State of California

Memorandum

To: Mr. Kyriacos C. Kyriacou
State Water Resources Control Board
Division of Water Rights
Post Office Box 2000
Sacramento, CA 95812-2000
Fax: (916) 341-5400

Date: November 6, 2002

Orig. signed by Robert W. Floerke

From : **Robert W. Floerke, Regional Manager**
Department of Fish and Game - Central Coast Region, Post Office Box 47, Yountville, California 94599

Subject: Response to Notice of Preparation of Draft Environmental Impact Report for Water Right Application 30166 by El Sur Ranch to Appropriate Water from Big Sur River Subterranean Stream, Monterey County

The Department of Fish and Game (DFG) has received the Notice of Preparation (NOP) for a Draft Environmental Impact Report (DEIR) for Water Right Application (WA) 30166, submitted by the El Sur Ranch, requesting an appropriation of 1,800 acre feet annually (afa) from the underflow of the Big Sur River, Monterey County. DFG has several concerns regarding the proposed appropriation and its effects on the environment, and requests that these concerns be addressed in the DEIR. As you are aware, DFG is both a Trustee and Responsible agency under the California Environmental Quality Act (CEQA). As such, we are responsible for providing input on projects that may have an effect on fish and wildlife resources.

WA 30166 seeks a permit to directly divert 1,800 afa from January 1 through December 31 of each year. The water would be diverted from the Big Sur River subterranean flow through wells in Andrew Molera State Park for the purpose of irrigation of 292 acres of pasture on the nearby El Sur Ranch. We have concerns regarding the effect that this diversion would have on the resources of the Big Sur River and its estuary, and on the adjacent riparian and upland habitats.

This proposed project may significantly affect the quantity and quality of water in the Big Sur River, including subterranean flows, and impact resources that are dependent on the riverine environment. In addition, place of use impacts on and adjacent to the 292 acres where the water is proposed to be discharged must be evaluated. The DEIR must include information from surveys that have been conducted to assess the presence of special status species and habitats, as well as addressing the potential for impacts to occur to these resources as a result of implementation of the proposed diversion and application of water as irrigation. In addition, analysis of the quantity and quality of water remaining in the stream after this proposed diversion as well as the other diversions within the watershed is critical in assessing the type and magnitude of impacts to sensitive resources.

A number of sensitive resources are either known or believed to occur in association with the riverine habitat of the Big Sur River including but not limited to:

1. Steelhead – South/Central California Coast ESU *(Oncorhynchus mykiss)*, listed as threatened under the Endangered Species Act (ESA) and a California species of special concern;

2. Tidewater goby *(Eucyclogobius newberryi)*, listed as endangered under the ESA and a California species of special concern;

3. California red-legged frog *(Rana aurora draytonii)*, listed as threatened under the ESA and a California species of special concern;

4. Coast range newt (*Taricha torosa torosa),* a California species of special concern;

5. Southwestern pond turtle *(Clemmys marmorata pallida)*, a California and Federal species of special concern;

6. Two-striped garter snake *(Thamnophis hammondii)*, a California species of special concern;

7. Pacific lamprey *(Lampetra tridentata)*, a species in decline; and

8. Central California Sycamore Alluvial Woodland, a rare and declining natural community of high inventory priority to DFG.

Surveys should be conducted at the appropriate time of year to determine if: 1) these resources occur on the project site, and 2) if the proposed project will have any impacts to these resources. Measures should be identified which would avoid or minimize all identified potential impacts to public trust resources.

Of particular concern to DFG is the information which will be needed to assess the effects that diversion of 1800 acre-feet (af) of water will have on the flows of the Big Sur River and the resources supported by those flows. The applicant submitted a report entitled *El Sur Ranch Hydrologic Investigation*, an analysis of the river prepared by Jones and Stokes Associates (JSA) in April 1999. This report was reviewed in October 2001, by the Department of Conservation's Division of Mines and Geology (DMG) through an interagency contract with DFG (see attached). DMG found a number of deficiencies with the JSA analysis. We request that the deficiencies identified by DMG be addressed.

A water availability analysis should be conducted to determine if this application, in addition to flows currently diverted from the Big Sur River, would significantly reduce the water available for public trust resources in the vicinity of the diversion. Such an analysis should include a water budget which would address water availability and water consumption in the watershed, and propose defensible flow reservations for the various trust resources dependent on the riverine environment. The water analysis should be stratified by five water year types (Wet, Above Normal, Median/Average, Below Normal/Dry and Critically Dry); and segregated base on 20 percent-40 percent-60 percent-80 percent exceedence flows. We

recommend that an Instream Flow Incremental Methodology (IFIM), or other fisheries flow analysis that is acceptable to DFG and the National Marine Fisheries Service, be conducted in order to define flows necessary to support public trust resources. Analysis should also address the effects the diversion has on water temperature, riparian health and canopy, salinity, and other water quality parameters which may be influenced by the diversion.

Discharge of 1800 acre-feet of water onto the upland environment can have a number of impacts, ranging from acceleration of seabluff retreat and coastal erosion, increased runoff that can lead to erosion and sedimentation, alteration of habitats, and decline of associated species. In the vicinity of the place of use for WA 30166, a number of sensitive resources are known or have the potential to occur, including but not limited to:

1. Smith's blue butterfly *(Euphilotes enoptes smithii)*, listed as endangered under the ESA;

2. Monarch butterfly *(Danaus plesippus)* wintering sites;

3. Black swift *(Cypseloides niger)*, a California species of special concern;

4. Little Sur manzanita *(Arcotostaphylos edmundsii),* of which the form found in the area *(parvifolia)* is listed as California rare;

5. Monterey paintbrush *(Castelleja latifolia)*;

6. Hutchinson's larkspur *(Delphinium hutchinsoniae)*;

7. Fragrant fritillary *(Fritellaria liliacea)*;

8. Dudley's lousewort *(Pedicularis dudleyi)*, listed as California Rare;

9. Adobe sanicle *(Sanicula maritima)*, listed as California rare;

10. Maple-leaved checkerbloom *(Sidalcea malachroides)*; and

11. Central Dune Scrub and California Oatgrass Grassland, sensitive natural communities of high inventory priority to DFG.

Surveys should be conducted at the appropriate time of year to determine if these resources occur on the place of use for the project site and, if so, what the impacts on these resources will be as a result of the proposed project. Other potential place of use impacts, such as accelerated bluff retreat, coastal erosion, or other erosion and sedimentation, should be identified and evaluated, and measures proposed to avoid or minimize all identified potential impacts. This should include identification of irrigation technology which would maximize water conservation, and/or other measures intended to reduce water demand.

While the NOP refers to the diversion of 1800 af for use on 292 acres, it does not provide information on the amount of water also diverted by the applicant under riparian claim for use on 90 acres of El Sur Ranch property. Any use of additional water under a riparian claim, above the 1800 af requested in WA 30166, should be disclosed to allow adequate assessment of the full potential impact of this project. Even if the total amount of water diverted is limited to the 1800 af requested, our agency believes that 6 af per acre is far in excess of that necessary for the proposed beneficial use of pasture irrigation and may constitute waste, unreasonable use, or unreasonable method of use balancing the proposed use against the potential significant impacts on this sensitive area. In addition, this amount may not be consistent with either the amount that the applicant has a legal right to use or the historic use of the wells in question. This latter issue should be addressed in order that the CEQA baseline for evaluation of impacts be appropriately established; we agree with SWRCB's initial determination that the baseline should be the pre-project condition in 1975, and we would be concerned if the unpermitted use of water would provide the only basis

for establishing a new baseline. Information needed to establish baseline use should include data such as parcel and water right conveyances, easements, well logs, water meters, or electrical bills demonstrating water use, or other information that would clarify historic use and basis for any riparian rights.

The DEIR needs to identify whether this request, in combination with other allocations from the Big Sur River, would be consistent with the *Big Sur River Protected Waterway Management Plan*, prepared in April 1986 by the County of Monterey. In addition, the diversion itself and the impacts on the place of use need to be evaluated for consistency with the Big Sur Local Coastal Plan; with the terms and conditions of any conservation easement placed over the El Sur Ranch lands; and terms and conditions which may have been placed at the time of conveyance of Department of Parks and Recreation (DPR) lands from Frances Molera to The Nature Conservancy and from The Nature Conservancy to DPR. DFG requests full disclosure of the location of all water use, including whether any portion of this will require an out-of-basin transfer. Significant additional impacts may result from such an action. The diversion needs to be evaluated for consistency with any Monterey County policy or other policies which may preclude or counsel against such transfers.

Thank you for the opportunity to identify information needed to adequately analyze the effects that the proposed project may have. Should you have any questions regarding our comments, please contact Deborah Hillyard, Staff Environmental Scientist, at (805) 772-4318; or Carl Wilcox, Habitat Conservation Manager, at (707) 944-5525.

Attachment

cc: See next page

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bcc: Harllee Branch, Office of General Counsel

e:: Hillyard, Urquhart, Wilcox, Hanson, Hill,
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State of California

Memorandum

To: Mr. Edward Anton
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Attention Kyriacos C. Kyriacou

Date: April 21, 2003

Copy, original signed by:

From : **Robert W. Floerke, Regional Manager**
Department of Fish and Game - Central Coast Region, Post Office Box 47, Yountville, California 94599

Subject: Comments on the Preparation of the Draft Environmental Impact Report for Water Right Application 30166 by El Sur Ranch to Appropriate Water from Big Sur River Subterranean Stream, Monterey County

The Department of Fish and Game (DFG), acting as both a Trustee and Responsible agency under the California Environmental Quality Act (CEQA), commented on the Notice of Preparation (NOP) for a Draft Environmental Impact Report (DEIR) for Water Right Application (WA) 30166. That WA, submitted by the El Sur Ranch, requests an appropriation of 1,800 acre-feet annually (afa) from the underflow of the Big Sur River for use on 292 acres of pasture on the El Sur Ranch in Monterey County. DFG listed several concerns in its comments regarding the effects of the proposed appropriation on the environment and requested that these concerns be addressed in the DEIR (see attached).

To evaluate the effects of the project on the quantity and quality of water in the Big Sur River and the aquatic and terrestrial resources affected by the project, DFG recommended that the DEIR include various new studies and review of previous studies. Our agency stated that it would be critical to analyze the quantity and quality of water remaining in the stream after this proposed diversion as well as other diversions within the watershed that were assessed. To that end, we requested that this analysis address the effects of the diversion on water quality parameters including temperature, salinity, dissolved oxygen and other parameters which may be

influenced by the diversion. We also expressed concerns about the deficiencies in the report entitled *El Sur Ranch Hydrologic Investigation*, an analysis of the river prepared by Jones and Stokes Associates (JSA) in April 1999 and requested that the deficiencies identified by DFG be addressed.

Within the past two weeks, DFG has had conversations with Mr. Kyriacos Kyriacou, the SWRCB contact for this project, and Mr. Rieger, a consultant working on the fisheries issues for the preparation of the DEIR. From those conversations, DFG became aware that the DEIR is scheduled for completion by May, 2003. Based only on the topics discussed during those conversations, DFG has the following concerns in regard to the DEIR.

First, except for a January 10, 2003 letter from the SWRCB to DFG requesting historical studies relevant to the Big Sur River fisheries, there has been no consultation or contact with our agency during the preparation of this DEIR. At no time has DFG been contacted concerning study plans or adequate mitigation measures for identified impacts. While such contact is not a CEQA requirement, per se, previous discussions with SWRCB provided for a coordination process during the CEQA review process to ensure that issues were adequately addressed during document preparation. DFG believes that inadequacies in some assessments for this project could be addressed through a consultation process. In particular, water quality parameters within the estuary appear to have been inadequately assessed, especially in light of our specific NOP recommendations and previous responses from the National Marine Fisheries Service (NMFS) and Janet Goldsmith, the applicant's attorney, on this topic.

Second, impacts to aquatic resources (as discussed with Mr. Rieger by phone), prompted both inter-agency and intra-agency discussion and concerns. Patricia Anderson, the DFG fisheries biologist assigned to this project, will be contacting Mr. Rieger to discuss some of these issues specific to fishery impacts. However, it again appears that some of these concerns would profit from pre-consultation with the appropriate agencies.

Third, and of particular concern, is the setting of the CEQA environmental baseline so as to mask the impacts of an ongoing illegal diversion and prevent an appropriate environmental assessment according to the intent of CEQA. It appears that the existing environment or baseline has been established based on current unauthorized diversions occurring at the project site that are in apparent violation of Section 1052 of the Water Code. This ongoing violation is not only being allowed to continue but is being used to set an artificial environmental baseline for the project during its CEQA review. In effect, using a baseline that includes the proposed diversions allows this project to be assessed in such a way as to avoid any impacts over those currently present and, as such, circumvents the intent of CEQA review to disclose the impacts of the project. In essence, the project can be said to have no impacts above the existing baseline. Section 15125 of the CEQA Guidelines states that existing environmental conditions at the time the Notice of Preparation (NOP) is published will "normally" constitute the baseline environmental conditions against which significant impact will be determined. This language, "normally," was inserted to guard against an artificial manipulation of the environmental baseline that would serve to circumvent a true impact analysis. Here, an ongoing illegal diversion is certainly not a "normal" situation, but one that calls for an adjustment of the baseline in order to accurately conduct the environmental review and satisfy the intent of CEQA. By studying historical data, DFG believes that the baseline can be set to simulate pre-project conditions.

Allowing illegal diversions to continue during the time between submission of a water right application and the time that environmental review commences, masks significant impacts and allows Section 1052 trespass. DFG's position is that illegal diversions must not be included in baseline environmental review and the illegal diversion should cease immediately.

In closing, DFG requests a site visit prior to the beginning of the DEIR comment period as well as the coordination of contacts and consultations through DFG's Yountville office to assure appropriate staff response. We hope that this memorandum will help clarify some of the shortcomings in both the CEQA process and the information being collected so that our agency can adequately analyze the effects of the proposed project. Should you have any questions regarding our comments, please contact Linda Hanson, Environmental Scientist, at (707) 944-5562; or Scott Wilson, Habitat Conservation Supervisor, at (707) 944-5584.

Attachment

cc: See next page

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bcc: Harllee Branch, Office of General Counsel
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State of California

M e m o r a n d u m

To: Ms. Victoria Whitney, Chief
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Date: July 9, 2004

Attention Mr. Kyriacos C. Kyriacou:

From: Robert W. Floerke, Regional Manager ***COPY - Original signed by Robert W. Floerke***
Department of Fish and Game - Central Coast Region, Post Office Box 47, Yountville, California 94599

Subject: Comments on the Interim Monitoring Plan Proposed for WA 30166 by El Sur Ranch to Appropriate Water from Big Sur River Subterranean Stream, Monterey County

Department of Fish and Game (DFG) personnel have received and reviewed the May 2004 El Sur Ranch Interim Monitoring Plan for Water Right Application (WA) #30166 (2004 Monitoring Plan) as submitted by the Source Group, Inc. This WA project seeks to divert 1,800 acre-feet per annum (afa) from the underflow of the Big Sur River from January 1 to December 31 of each year to irrigate 292 acres of pasture land. As stated in our response to the Notice of Preparation (NOP) for this project (attached), DFG has concerns regarding the effect of this diversion, and the others in the area, on the resources of the Big Sur River, its estuary, and on the adjacent riparian and upland habitats. DFG has previously provided comments (attached) on a report entitled *El Sur Ranch Hydrologic Investigation*, prepared by Jones and Stokes Associates. DFG continues to be concerned about the deficiencies and data gaps identified at that time and recommend that those concerns be appropriately addressed in the current hydrological studies.

The focus of this letter is to provide comments on our review of the portion of the 2004 Monitoring Plan dealing with the assessment of fishery habitat quality and availability. The stated objectives of the 2004 Monitoring Plan are: 1) to determine if seasonal changes occur within the lower Big Sur River and lagoon that would adversely affect habitat quality and availability during the summer and fall season, and 2) to assess the potential effects of the diversion operation on fishery habitat if changes in quality and availability of habitat are detected. Our comments and recommendations follow.

Stated Objective #1: to determine if seasonal changes occur within the lower Big Sur River and lagoon that affect fishery habitat.

On review, DFG found that the proposed study should provide sufficient additional information to allow changes in fishery habitat, both habitat quality and availability, to be assessed under a variety of natural seasonal flow conditions. However, we make the following recommendations for modifications to the study to ensure the appropriate future analysis of results:

- The monitoring report should include the specific temperature and dissolved oxygen (DO) data collected over the range of flows rather than utilizing a "stressful" threshold that may not be held in general agreement. However, any thresholds utilized in the analysis should be included in the report.

- The survey should be modified to include continuous DO monitoring at specific locations in addition to the proposed continuous temperature monitoring. The continuous DO monitoring locations should be located in areas subject to temporal change due to depth and/or aquatic vegetation.

Stated Objective #2: to assess the potential effects of the diversion operation on fishery habitat if changes in seasonal quality and availability of habitat are detected.

DFG recognizes that this *is* the primary objective of any monitoring plan designed to provide information concerning the potential impacts of a diversion. To accomplish this objective, the effects of pumping on habitat quality and availability should be clearly distinguishable from any effects caused by changes in the natural flow. Yet our review of this monitoring plan found that there is nothing proposed to allow for the impacts of pumping component to be adequately assessed. Instead there is a masking of potential impacts of pumping by allowing them to become an indistinguishable and difficult to quantify part of the "natural" flow conditions within the lower El Sur River.

The primary component of this portion of the monitoring endeavor should disclose the impacts of pumping as initially discussed in DFG comments to the NOP. To that end, the effects of pumping and any changes in pumping regime need to be addressed in a way that clearly distinguishes those activities from the changes that would naturally occur within the system. This parameter is

missing from the monitoring as proposed and as such the information collected will not provide conclusive results concerning the effects of pumping on habitat quality or availability.

- DFG recommends that relatively minor modifications be made to the 2004 Monitoring Plan to allow for sampling to occur during specific "pump on" and "pumps off" periods, with adequate time allowed for recovery in between these sampling events. Providing sampling during times when pumping activity is occurring and when it is not will allow the impacts of the pumping activity to be more easily discerned from the flow reductions that naturally occur during the summer and fall. As proposed, the study does not appear to allow for the inclusion of this essential component for analysis and the effects of pumping will be masked by natural seasonal variability and groundwater recovery with inconclusive results concerning the impacts of pumping the likely outcome. Study design should attempt to avoid masking of pumping impacts to provide the analysis required by the California Environmental Quality Act (CEQA) and requested in our response to the NOP.

- The pumping regimes to be tested (including the different pumping rates, pumping durations, and the recovery times between pumping tests) need to be clearly defined in the monitoring plan procedures and in the subsequent report.

- If none of the three proposed stage/flow transects are within the well field zone of influence, then DFG recommends that an additional transect within the zone of influence be added so that the effects of pumping on stage/flow can be adequately assessed. (Transect # 1 appears to be above the well zone, it was unclear if Transect # 2 is within this well zone or above it, and Transect # 3 is within the zone of tidal influence that will mask any pumping impacts.) As described, it appears that the three transects will likely yield inadequate information to determine the impacts of the well pumping on steelhead.

Acting as both a Trustee and Responsible agency under CEQA for this project, DFG is responsible for providing input during the environmental review of projects that have the potential to impact fish and wildlife resources. DFG has provided these recommendations and comments to allow for the modification of the Monitoring Plan prior to the low flow season so that it will specifically address the areas of concern stated in our original

NOP. It is expected that a revised Monitoring Plan will provide adequate information for the analysis needed to assess the type and magnitude of impacts to sensitive resources of the Big Sur River caused by this diversion, and others in the well field.

Finally, and of special concern in light of the sensitivity of resources potentially impacted by this study, the monitoring plan does not appear to provide for a cessation of pumping activities if adverse impacts to listed species are detected. During extremely low flow conditions, pumping restrictions have already been recommended for this project to help ensure that listed species are protected. However, based on the information presented in the 2004 Monitoring Plan, an increase in survey frequency will occur rather than the restriction on pumping recommended for low flow periods. Since increasing the frequency of surveys does nothing to avoid adverse impacts, it would be prudent to incorporate procedures for avoiding adverse impacts to listed species into the 2004 Monitoring Plan.

Thank you for the opportunity to identify information needed to adequately analyze the effects of the project. If you have questions regarding our comments, please contact Ms. Linda Hanson, Staff Environmental Scientist, at (707) 944-5562; or Mr. Carl Wilcox, Habitat Conservation Manager, at (707) 944-5525.

Attachments
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LH/pm

State of California

M e m o r a n d u m

To : Ms. Victoria A. Whitney, Chief
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Attention Mr. Paul Murphey
Via Fax: (916) 341-5400

Date: December 7, 2005

From : Robert W. Floerke, Regional Manager ***COPY – Original signed by Robert W. Floerke***
Department of Fish and Game - Central Coast Region, Post Office Box 47, Yountville, California 94599

Subject : Outstanding Issues Related to Water Right Application 30166 by El Sur Ranch to Divert Water from the Big Sur River, Monterey County

The Proposed Project

Water Application (WA) 30166, submitted by the El Sur Ranch, proposes to divert 1800 acre-feet of water per annum on a year-round basis. The diversion wells are located in Andrew Molera State Park and tap underflow from the Big Sur River not far upstream from the lagoon at the mouth. The State Water Resources Control Board (SWRCB) is the State lead agency for the California Environmental Quality Act (CEQA) review of the project and is currently preparing an Initial Study. Protests to this water right application have been filed by Department of Parks and Recreation (DPR), Department of Fish and Game (DFG), and California Sportfish Protection Alliance (CalSPA).

DFG's interest in this application is based on its status as trustee and responsible agency for fish and wildlife resources in California. As such, DFG has, in the past three years, reviewed and commented on various documents provided by the SWRCB. This memo summarizes the information we believe is needed to allow appropriate disclosure for this project, and summarizes that which has been requested but not yet provided.

Summary of Issues to be Addressed Based on DFG Responses to SWRCB Requests for Comments

November 6, 2002: DFG responded to the SWRCB Notice of Preparation (NOP) of an Environmental Impact Report (EIR) for the project and identified several areas for which additional information needed to be provided, in order to prepare the EIR, including:

1. The status of sensitive resources known to occur in the vicinity of the diversion, including seven sensitive species (three Federally listed) and one sensitive natural community.

2. Whether the proposed diversion would have significant impacts on the sensitive resources at the diversion site, and measures identified which would avoid or minimize impacts to public trust resources.

3. The status of sensitive resources potentially occurring at the place of use of the diverted water, including ten sensitive species (four State or Federally listed) and one sensitive natural community.

4. Potential impacts to the place of use from the application of 1,800 acre feet (af) of water, such as acceleration of seabluff retreat and coastal erosion, increased runoff that can lead to erosion and sedimentation, alteration of habitats, and decline of associated species.

5. Whether the proposed project would have significant impacts on the sensitive resources at the place of use, and measures identified which would avoid or minimize impacts to public trust resources.

Additionally, we requested specific information to address the effect that the proposed diversion would have on the flows of the Big Sur River; information on resources supported by those flows was also requested, including:

6. A water availability analysis, including a water budget which would address water availability and water consumption in the watershed, and propose defensible flow reservations for the various trust resources dependent on the riverine environment. The water analysis should be stratified by five water-year types (Wet, Above Normal, Median/Average, Below Normal/Dry and Critically Dry) and segregated base on 20 percent, 40 percent, 60 percent, 80 percent exceedence flows.

7. An Instream Flow Incremental Methodology (IFIM), or other fisheries flow analysis that is acceptable to DFG and the National Marine Fisheries Service, be conducted in order to define flows necessary to support public trust resources.

8. Analysis should also address the effects the diversion has on water temperature, riparian health and canopy, salinity, and other water quality parameters which may be influenced by the diversion.

Finally, this request for water diversion appears to be far in excess of that which is considered a beneficial use, potentially constituting waste (which is prohibited by California law); that the request was far in excess of the historic (and unpermitted) use of the wells; that the request is not consistent with the Department of Water Rights (DWR) published information regarding general water duties in California; and that the request may not be consistent with conservation easements and/or conveyance documents for the property. We asked that the SWRCB determine both the appropriate level of such a request and establish a baseline so that impacts of the proposed diversion could be evaluated. Toward this end, we requested information to establish historic use and baseline:

9. Information needed to establish baseline use should include data such as parcel and water right conveyances, easements, well logs, water meters, or electrical bills demonstrating water use, or other information that would clarify historic use and basis for any riparian rights.

10. Consistency with the terms and conditions of any conservation easement placed over the El Sur Ranch lands; and terms and conditions which may have been placed at the time of conveyance of DPR lands from Frances Molera to The Nature Conservancy and from The Nature Conservancy to DPR.

11. Full disclosure of the location of all water use, including whether any portion of this will require an out-of-basin transfer.

12. Identification of any portion of the proposed place of use which is subject to an existing riparian right.

As State lead agency, SWRCB is responsible for collecting the information needed to fully understand the potential impacts of the project, to both the place of diversion and the place of use. It is our understanding that you have, in turn, asked the applicant to supply this information. In partial response to SWRCB's request for information (to address 6, 7 & 8 above), the applicant proposed an Interim Monitoring Plan (Monitoring Plan) to collect information regarding flows, effects on flows of differing levels of diversion, and the effect of the diversion on quality and quantity of aquatic habitat.

July 9, 2004: In response to a request by SWRCB to review the Monitoring Plan proposed by El Sur Ranch, DFG identified several minor changes. It was expected that these minor revisions in the proposed Monitoring Plan would provide adequate information for the analysis needed to assess the type and magnitude of impacts to sensitive aquatic resources of the Big Sur River caused by this diversion and others in the well field. The revisions requested included:

- The effect of pumping on temperature and dissolved oxygen (DO) in the lagoon and other areas subject to temporal changes due to depth, aquatic vegetation, or proximity to the well field through the use of continuous temperature and DO monitoring.

- The effects of pumping on stage/flow, habitat quality, and habitat availability to be clearly distinguishable from any effects caused by changes in the natural flow. This was to be accomplished by sampling during specific "pump on" and "pumps off" periods, with adequate time allowed for recovery in between these sampling events.

- The effects of different pumping regimes (including different pumping rates, pumping durations, and the recovery times between pumping tests) on temperature, DO, flow, habitat quality and availability.

Although relatively minor, the requested revisions were not made. The results, presented in the technical reports described below, were not sufficient to determine the effects of diverting the proposed amount of water at the proposed diversions rates on the quantity and quality of aquatic habitat in the Big Sur River.

September 16, 2005: The SWRCB requested DFG, NOAA, DPR and CalSPA to review and comment on the technical reports provided by El Sur Ranch. Our comments were specific to the technical reports, though we did take the opportunity to inform the SWRCB that those reports were intended to be responsive to only 5 of the 12 areas of our original request for information (6, 7 & 8 and 9 & 12) and that there were other issues which had not yet been addressed. In summary, we commented that the technical reports were not entirely successful in addressing even that limited scope.

Comments and questions provided to SWRCB by DFG in our September 16, 2005 memo concerning the technical reports are technical in nature, asking for specific clarification of data collected and conclusions drawn from the data collected, on all three technical reports. We also referenced and attached the previous correspondence regarding the NOP, the Interim Monitoring Plan, and an internal memo from our Senior Engineering Geologist. Our comments are too numerous to summarize here, or to characterize them in general classes, other than to note that we reviewed and commented on all three technical reports. Our September 16, 2005 memorandum can be reviewed for the full text of our comments.

In addition, SWRCB was notified that DFG did not have the necessary expertise required to completely evaluate the technical data pertaining to Hydrogeology and Water Use in the Reports. Since these topics have the ability to affect the interpretation of the biological impacts, DFG is seeking outside expertise for additional review prior to providing final comments. Although an interagency contract request was submitted on October 4, 2005, we are still awaiting final contract approval to complete the expert review.

October 14, 2005: DFG also received an email from the applicant's consultant, Hunter-Ruiz, in response to a request via email on September 30, 2005, for some additional technical information related to our review of the Technical Report. Only partial information was provided and, in addition to the technical information requested in the September 16, 2005 letter and referred to above, the email response left the following issues unanswered:

- Request #1 for a discussion and interpretation of the effects of pumping on DO levels as was done for water level and temperature in Hydrogeological Section 3.4.8.2. Response did not provide the requested information. Data for DO from the same sources used for temperature and water level analysis is available (Appendix M, Page 1 of 1) to provide the requested discussion and interpretation.

- Request #2 for inclusion of water quality data collected on July 12, 2004 at stations 7, 8, 9, and 10 located nearest the well field. This could not be provided because field samplers could not find the sites identified by flagging and GPS.

- Request #3 for correlation between sampling data and whether pumps were on or off; in tabular form as well as discussion. We were only given a table showing pump condition. The data provided for September 30, 2005 is inconsistent with the data in the certified Technical Report and also with other tables received in the October 14, 2005 response. No discussion of the correlation was provided.

- Request #4 for integration of data in Table 2-2 (El Sur Daily Pumping Rate) and Figure 3-45 (Spring Tide Effects on Electrical Conductivity in Old Well/New Well). This was only provided for the old well. Data is inconsistent with pumping information provided in response to Request #3 above.

- Request #5 for reconciliation of figures 3-47 and 3-48 as related to Source Group, Inc.'s saltwater intrusion model. DFG must wait until the outside consultant can review the response before verifying the information requested was received.

Status of Information Requests

In response to the NOP for this project, DFG requested information be provided on 12 topics, covering 3 basic areas of concern. The applicant then proposed a Monitoring Plan, intended to provide data partially responding to 3 of the 12 original items (6, 7 & 8) listed in the NOP comments. In response to a SWRCB request, DFG provided comments on that Monitoring Plan to further refine it to be more responsive to the concerns listed in the NOP comments. None of the modifications suggested were incorporated into the Monitoring Plan.

The applicant has now provided three technical reports, the first two reporting on aspects of the Monitoring Plan, and the third partially addressing two other items (9 and 12) identified in our NOP comments. After review of the technical reports, DFG provided detailed comments to the SWRCB concerning the information that still requires clarification and disclosure, with the caveat that final comments on these reports would be provided after a contract for outside expert review was approved. That contract is nearing approval, and we are reluctant to proceed with review and final comments until we have received the additional information requested in our September 16, 2005 letter and September 30, 2005 email. We would like clarification from you if it is your expectation that the applicant will be providing this information to you to allow review under our pending interagency contract.

In addition to the specific deficiencies identified above, we do not believe the information provided by the applicant is responsive to other points of our original comments provided to the SWRCB on November 6, 2002, in response to your NOP. We would like clarification from your agency whether you have the expectation that the applicant will be providing that information to you for your use in preparation of the EIR.

If you have questions or concerns, please contact Ms. Linda Hanson, Staff Environmental Scientist, at (707) 944-5562; or Mr. Carl Wilcox, Habitat Conservation Manager, at (707) 944-5525; or by writing to DFG at the above address.

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To: Linda Hanson December 16, 2005
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Subject: Review of Technical Reports in Support of Water Rights Application No.30166, El Sur Ranch, Monterey County, California, May 2005

Water Right Application No. 30166 seeks to extract ground water from underflow at the mouth of the Big Sur River. The point of diversion is two existing agricultural irrigation wells located in the flood plain northwest of the river within the Andrew Molera State Park. The El Sur Ranch (ESR) has submitted three technical documents in support of their Water Rights Application. These documents provide data and technical analyses assessing the environmental impacts from the ground water pumping on the lower reach of the Big Sur River. The two ESR agriculture wells are called the Old Well and the New Well. A third, smaller well, called the Navy Well, is operated by State Parks and Recreation Department, and pumps groundwater from the same aquifer. At the request of the Department of Fish and Game, Agreement No. P0530003, I have reviewed the three technical reports listed below. This letter presents my findings and opinions on the hydrologic, hydrogeologic and biologic data and environmental assessment presented in these reports.

Hydrologeologic Investigation and Conceptual Site Model Within the Lower Big Sur River, by The Source Group, Inc. (SGI), dated May 20, 2005

Assessment of Habitat Quality & Availability Within the Lower Big Sur River: April-October 2004, by Hanson Environmental, Inc. (HER), dated March 11, 2005

Reasonable Beneficial Use-Land Use Study for El Sur Ranch Irrigated Pastures, Water Rights Application #30166, by Natural Resources Consulting Engineers, Inc. (NRCE), dated May 18, 2005

Based on my review and analysis of these reports, I have the following conclusions and recommend that the Department of Fish and Game consider these issues in their evaluation of the Water Right Permit No.30166:

- Results and conclusions from the 2004 study period may not represent the potential impacts from the maximum permit extraction rate or total volume.

- The pumping of the ESR wells results in a reduction in the flows of the Big Sur River as extracted ground water is recharged from surface waters.

- The depletion of surface water flows due to ESR well pumping is spread along several hundreds of feet of river reach. While the loss at any one location may be small, the cumulative loss can exceed 90% of the well yield for prolonged periods of pumping.

- Losses from the river due to pumping extend beyond the period of pumping as the aquifer is recharged. For the highly conductive water table aquifer in the study area, this extended depletion period may extend for several days after cessation of pumping.

- Additional hydraulic data and analysis are needed to document the upwelling of ground water in the area of water quality stations 7, 8, and 9 to demonstrate its presence, rate of inflow and response to ESR pumping.

- Documentation of the methodology for collecting water quality data is needed to evaluate the impact of short-term variations on the report's conclusions.

- Additional documentation and discussion of the saltwater model setup is needed to evaluate the applicability of the model results in assessing potential pumping impacts from the ESR well field on the rate and extent of saline water intrusion.

Hydrogeologic Setting

The mouth of the Big Sur River flows through an alluvial filled valley within Andrew Molera State Park that is approximately 1,500 feet wide (SGI Figure 3-3). The alluvial fill consists mostly of permeable, recent-age sand and gravels (see SGI Section 3.3.2 and well logs in SGI Appendix B). Elevation and thickness of the alluvial aquifer varies (SGI Figures 3-8, 3-11 and 3-12). Thickness of the alluvium at the New Well is approximately 33 feet (Appendix B). The saturated thickness of the unconfined aquifer at the New Well during the pumped well test was approximately 24 feet (Appendix N). Thickness of the aquifer increases to the south towards the ocean (SGI Figure 3-8) within the ancestral canyon of Big Sur River (SGI Section 3.3.2). The contours of SGI Figure 3-8 show the base of the alluvial aquifer filling a canyon cut into Franciscan bedrock. At the present shoreline, the elevation of the base of the alluvial aquifer is approximately 100 feet below sea level. Contours of the base of the alluvial aquifer suggest that the ancient river

canyon extended inland with a northern branch trending towards the Old Well, and the main channel trending eastward beneath the central portion of the Creamery Meadow.

SGI Table 2-1 provides a summary of the well construction, and SGI Appendix B provides the well logs for recently constructed wells. Information on the design of the Old Well is minimal. The total depth of the Old Well is not available, although SGI Figure 3-8 shows the elevation of bedrock at approximately –27 feet mean sea level (msl), apparently based on geophysical data (SGI Figure 3-8). The well log of the New Well indicates a total alluvial depth of approximately 33 feet, with a screened interval between 14 and 32 feet below the ground surface (bgs). The well log for the Navy Well shows that total alluvial depth of approximately 38 feet, with a screened interval from 20 to 38 ft bgs.

Pumping well tests on the New Well conducted by Jones and Stokes in 1998 and re-evaluated by SGI for their 2005 report found that the transmissivity (T) of the unconfined aquifer ranges from approximately 53 to 71 square feet-per-minute, or 570,000 gpd/ft (gallons-per-day-per-foot) to 765,000 gpd/ft (SGI Appendix N). Hydraulic conductivity (K) for the alluvial aquifer was found to range from approximately 3,048 to 4,086 feet-per-day (ft/day), with an average value of 3623 ft/day (SGI Section 3.3.2). Alluvial materials filling the ancient river canyon below an elevation of negative 20 feet are identified as having large boulders and cobbles (SGI Section 3.3.2). The hydraulic conductivity of this lower boulder zone is estimated at 15,000 ft/day (SGI Sections 3.3.2 and 3.5.3). The alluvial aquifer is bounded by low permeability Franciscan bedrock and older terrace deposits (SGI Figure 3-3). Ground water flow in the Franciscan bedrock is interpreted to be an insignificant source of base flow (SGI Section 3.4.4). Contributions to base flow from ground water in the Older Terrace deposits are also minor, estimated at 463 acre-feet-per-year (ac-ft/yr) (SGI Section 3.44 and SGI Table 3-3). Hydraulic conductivity of the Older Terrace material is estimated at 100 ft/day (SGI Table 3-3), approximately 30 times lower than the alluvial aquifer.

The unconfined aquifer of the lower Big Sur River is in good hydraulic connection with the river channel (SGI Section 3.4.8). The 27-hour, 1150 gpm pumped well test of New Well by Jones and Stokes in 1998 found that the aquifer northwest of the river responded rapidly to pumping stresses. However, Jones and Stokes saw no effects from pumping in monitoring well JSA-05 located across the river from the well. The hydraulic gradient of the water table aquifer is approximately 0.002 during the times prior to and after pumping (SGI Section 3.3.3; Figures 3-14 ad 3-18). The estimated average ground water inflow to the Creamery Meadow area near cross-section A-A' (SGI Figure 3-10) is approximately 3.45 cubic-feet-per-second (cfs) (SGI Section 3.3.2). The estimated underflow in the study area ranges from 3.16 to 3.81 cfs (SGI Section 3.3.2).

The quality of ground water at the mouth of the Big Sur River is influenced by the presence of the ocean. The discharge from fresh-water aquifers to the ocean typically creates a salt-water interface where denser saline ocean water forms a landward thinning wedge below the fresh water (Fetter, 2001). Seawater intrusion into coastal fresh-water aquifers due to over-pumping of wells has been extensively studied (Fetter, 2001; Freeze

and Cherry, 1979; Cooper, H.H., Jr., and others, 1964). Tidal fluctuation can enlarge the width of the zone where fresh-water and saline-water mix (Fetter, 2001; Cooper, H.H., 1959).

The SGI report suggests that water quality and quantity in the Big Sur River adjacent to the study area is influenced by "upwelling" of ground water caused by a constriction of Franciscan bedrock near the mouth of the river (SGI Section 3.4.6.1). The width of the alluvial flood plain is approximately 800 feet (SGI Figure 3-8; Figure 3-12, cross-section D-D').

Ground Water Pumping Rates

The El Sur Ranch has extracted ground water from the lower Big Sur River since the 1950s (SGI Section1.0). The water is used to irrigate approximately 290 acres of pasture located on the terrace lands northwest of the wells (NRCE Figure 2-1 and SGI Figure 3-1). The Old Well has been pumping since 1950 and the New Well since 1975 (SCI Section 2.6.1). These two wells typically operate during the dry months, operating from late-April to mid-October during the 2004 study period of these three reports (Section 3.4.5). The volume of water pumped by each well is an estimate because neither well has a meter to measure total flow (SGI Section 3.4.5). Water Rights Application No. 30166 is requesting a water right for maximum annual diversion of 1,800 acre-feet (ac-ft) at a maximum rate of 5.84 cfs or 2,621 gallons-per-minute (gpm) (5.84 cfs * 7.48 gal/cu.ft. * 60 sec./min = 2,620.99 gpm).

During the 2004 DEIR study period, the Old Well pumped an average of 1.36 cfs (SGI Section 3.4.5) or approximately 610 gpm. The maximum pumping rate of the Old Well during the 2004 study period was 2.59 cfs (SGI Table 2-2) or 1,164 gpm. Pumping of the Old Well is controlled to prevent pump cavitation (SGI Section 3.4.3). The average pumping rate of the New Well during the 2004 study period was 1.86 cfs, or approximately 835 gpm, with a maximum rate of 3.57 cfs or approximately 1,600 gpm. During the 2004 study period, an estimated 1,136 ac-ft of ground water were pumped, approximately 63% of the 1,800 ac-ft requested in the permit. SGI reported that the average (mean) daily total extraction rate was 3.3 cfs (SGI Section 3.4.5). The daily pumping variation of these two wells during the 2004 study period is graphed in SGI Figure 3-30 and tabulated in SGI Table 2-2.

Based on the daily average pumping rates given in SGI Table 2-2, the combined pumping of the two wells equaled or exceeded the maximum (Application No. 30166) rate of 5.84 cfs, 2,620 gpm, on only three days during the 2004 DEIR study period, approximately 1.7% of the time (see SGI Figure 3-30). These three days all occurred within the first 10 days of pumping. Combined pumping rates exceeded 5 cfs, 2,240 gpm, only 13 % of the time, a total of 24 days, and only 30% of the daily pumping exceeded 4 cfs, or 52 days. A review of the statistics of these pumping data found that the pumping rates are skewed. The best estimate of data that are skewed is often the median value rather than the average. For the combined daily pumping of the ESR wells during the 2004 study period, the median rate was approximately 2.68 cfs, approximately 275 gpm less than the

average rate of 3.3 cfs reported by SGI. Although the pumping during the 2004 study period is said to be within the 90 percentile of pumping for years 1975 to 2004 (see abstract page iii), the 2004 median pumping rate of 2.68 cfs is only about 45 percent of the 5.84 cfs rate requested in the Application No. 30166. As will be discussed below, estimates of the impact of ground water pumping at variable rates on a stream can be made by assuming the "average" of the pumping rates occurs throughout the period of extraction. Although there were periods where the rate of pumping was near the maximum Application rate, 22 of the 24 total days greater than 5 cfs, approximately 92%, were before July 12, 2004 when the first pumping-period water quality data were collected.

Therefore, the impacts observed during the 2004 study period may not represent the impacts from the maximum extraction rate of 5.84 cfs requested in Application No. 30166. In addition, the total ground water extracted is only a portion of the 1,800 ac-ft maximum applied for in the permit application.

Impacts of Pumping on Steam Flow

Central to the assessment of impacts from the proposed water diversion is the question of whether pumping the two El Sur Ranch irrigation wells has an effect on the flow of the lower Big Sur River. The SGI report addresses this issue and summarizes their finding in Section 3.4.8.2. Evaluation of the effects of pumping on river flows was done primarily at Transect #2 which is approximately 300 feet from the ESR 10A/B/C cluster of monitoring wells.

An assessment of the effects of increasing the pumping from one well to two wells is shown in SGI Figure 3-35 which plots the water levels from mid-September to early October in 2004 at Velocity Transect #2 and ESR 10-B monitoring well. Figure 3-35 shows that the changes in water levels at each location differ substantially. The conclusion SGI draws from this data is that the increase in pumping has only a half-inch change in the surface water elevation of the stream (Section 3.4.8.2) a minor amount. A follow up comparison was made in mid-October 2004 when both wells were turned off (SGI Figure 3-36). Following cessation of pumping on October 16, 2004 there was no immediate rise in surface water elevation. The surface water elevation began to rise the following day approximately 5 inches higher by October 18th. A rain event on October 17th and 18th may have contributed to the increased flow. SGI apparently reached the conclusion that the change in surface water level after October 16th is due to runoff as they state that no noticeable effect on the surface water elevation was noted (SGI Section 3.4.8.2). I offer the following observations and analysis on the potential impacts of the ESR well pumping on flows in Big Sur River.

The impacts of a well pumping and unconfined aquifer adjacent to a hydraulically connected stream are well studied (Butler, and other, 2001; Chen and Shu, 2002; Chen Yin, 2004; Glover, 1959; Hantush, 1965; Hunt, 1999; Hunt and others, 2001; Jenkins, 1968, 1969; Nyholm and others, 2002; Sophocleous and others, 1995; and Zlotnik and others, 1999). The effects of ground water extraction on the stream are controlled by a

number of factors including the hydraulic characteristics of the aquifer and the stream bed, the distance between the stream and well(s), the width and depth of the stream and aquifer, distance from the well(s) to impermeable or recharge boundaries, and the orientation of the stream channel. Although these factors influence the well-stream interaction, several simplified analytical models have been successfully used in evaluating stream losses from pumping wells, particularly with longer periods of pumping as is the case with the ESR well field (Miller and Durnford, 2005; Pattle Delamore Partners Ltd., and Environment Canterbury, 2000). Even though the site conditions are not ideally matched, the SDF model can be applied to the ESR well field to provide insight into the interactions between the aquifer pumping and stream flow.

The simplified analytical model often used is known as the "SDF" or Jenkins' model (Miller and Durnford, 2005; Jenkins, 1968, 1969) based on a method originally proposed by Glover (1959). This analytical model uses a "stream depletion factor" or SDF which is a constant factor based on the hydraulic characteristics of the pumped aquifer and the distance to the well. In practice, a set of response curves is developed from which the percentage of the pumped well water depleted from the stream can be calculated for any given time after pumping starts (Miller and Durnford, 2005, Figure 1). In addition to stream depletion losses during pumping, the method can also calculate stream losses after cessation of pumping using the principle of superposition.

The results of applying the SDF method to the ESR well field finds that the stream should rapidly respond to the well pumping. After a day of pumping the New Well, the stream depletion rate is approximately 80% of the pumping rate. For the Old Well, the percentage is approximately 60% after a day. After 15 days the rate of stream loss is at or above 90% for both wells. After pumping stops, stream depletion continues creating a residual loss. For the New Well, stream losses occur for approximately one and a half days before the loss is reduced to below 10% of the pumping rate. For the Old Well, the residual depletion continues for 3 days before losses are below 10%. Jenkins (1968, 1969) showed that stream losses from variable pumping rates can be reasonably estimated by using the average rate of pumping. Miller and Durnford (2005) noted that when the rate of stream depletion approaches the rate of pumping, then approximately half of the accretion occurs within a length of stream centered on the well that is twice the closest stream-to-well distance. In the ESR well field, the average distance from the wells to the Big Sur River along the southeastern side of the flood plain is approximately 750 feet ([450 ft + 1000 ft]/2 = 725 ft). Twice this distance is approximately 1,500 feet. Transect#2 as well as water quality monitoring stations 7, 8, and 9 are within this distance. Along a reach length of 10 times the nearest distance approximately 87% of the stream depletion occurs.

The analysis of impacts of increasing pumping from one to two wells (SGI Section 3.4.8.2) noted that surface water levels decreased only a half-inch with increased pumping. This analysis does not fully evaluate the impacts of increased pumping. As the SDF model notes, loss of flow from a stream extends for some distance both upstream and downstream of the well. Unlike a direct surface water diversion where all flows are taken out at one location, stream depletion from pumping wells is cumulative. The

measurement of surface water levels changes at one station only reflects a very small portion of the total loss. Applying the SDF model in the case of the September 2004 change in ESR well pumping rates, the losses at Velocity Transect#2 would be less than one half gallon-per-minute, but over the 1,500 feet of stream nearest the wells the cumulative loss would be approximately 1.2 cfs. The evidence of this increase in stream loss can be found by comparing the hydraulic gradient between Transect #2 and ESR-10B before and after the increase in pumping. Before September 19th, the Old Well was pumping at 2.55 cfs (SGI Table 2-2). After the New Well began, the total rate of pumping was 4.81 or an increase of approximately 88%. Because the flow of ground water follows Darcy's law (Q = KiA) an increase in flow (Q) should result in a proportional increase in hydraulic gradient (i) assuming that the aquifer hydraulic conductivity (K) and saturated cross-sectional area (A) remain nearly constant. With increased pumping the hydraulic gradient increases approximately 50 percent (SGI Figure 3-36), which agrees with the SDF model that half of the stream loss occurs within 2 times the nearest distance.

The purpose of this discussion is to demonstrate that the data from the 2004 study period shows a reasonable match to theoretical SDF curves even though the hydrogeologic setting is not the ideal assumed for the theory. Therefore, these theoretical curves might be used to evaluate the potential impacts of pumping the El Sur Ranch wells on flows in the Big Sur River. This is especially true for the impacts of extracting for a prolonged period at the maximum permit diversion of 5.84 cfs. Based on the SDF curves, pumping of the two El Sur Ranch wells at the maximum proposed permit rate for longer than 5 days results in losses to the river of approximately 80% of the pumping rate or approximately 4.7 cfs, with approximately 50% (2.34 cfs) of that loss occurring along an approximate 1,500-foot section of the river between the wells and Creamery Meadow. Although the average stream loss rate would be approximately 1.56×10^{-3} cfs per linear-foot, or less than one gallon per minute, the cumulative loss may be significant during low flow periods. This amount of loss at a single point is so small that it is within accepted standard of error for stream flow measurement.

Impacts of Upwelling on Water Quality of Stream

Surface water quality measurements were made along the Big Sur River at 21 stations located along the river from the mouth to the State Park parking lot on the eastern side of Creamery Meadow (SGI Sections 3.4.6, Figure 2-2). Water quality monitoring for temperature, electrical conductivity (EC), and dissolved oxygen (DO) began in April 2004 and ended in October 2004. Results of the water quality monitoring are shown in SGI Figure 3-31 for temperature and HER Figures 25 to 64. An initial pre-pumping set of measurements for temperature and EC was done on April 18, 2004. The first measurements taken during pumping were done on July 12, 2004, 82 days after the pumping began (see SGI Figure 3-31, SGI Appendix M and HER Figures 25 to 64 for graphic results of measurements). As a result of the surface water quality monitoring, a portion of the river nearby the New Well was identified as having anomalously low temperature, EC, and DO values (SGI Section 3.4.6.1 and Figure 3-31). These lower values occurred mostly at water quality stations 7 and 8 and occasionally at station 9.

Water quality measurements were taken for ground water in the monitoring wells and the production wells beginning in July or August 2004 (see SGI Appendix M and values labeled on graphic SGI Figure 3-31 and HER Figures 35 to 44). SGI states that the cause of this anomalous water quality is the inflow of ground water to the river due to a narrowing of the width of the alluvial aquifer at the mouth of the river (SGI Section 3.4.6.1 and Figure 3-3). This "upwelling" or inflow of ground water to the river is thought to occur throughout the summer irrigation season regardless of the pumping conducted (SGI Section 4.0). I offer the following observations and analysis on the potential impacts of the ground water upwelling on the surface water quality in the lower Big Sur River.

The basis for the groundwater upwelling condition is two fold. First, the anomalous quality of the surface waters at stations 7, 8, and 9 have values nearer those of ground water than surface water suggesting a ground water source. Second, the narrowing of the alluvial aquifer width would reduce the ability of ground water to flow, and the principle of continuity would require the ground water level to rise, resulting in a discharge to the river. A review of the data in the SGI and HER reports suggests that additional evidence is needed to document the hydrogeologic condition for ground water upwelling and demonstrate that pumping has no effect on the condition.

ESR indicates that the water quality data show ground water upwelling in the area of stations 7, 8, and 9 appears to have occurred throughout the 2004 study period regardless of pumping (SGI Section 4.0). To support this conclusion they cite the water quality data taken in April 2004, prior to turning on the pumps, and on October 28, when both pumps were off. A review of the water quality graphs (HER Figures 25 to 64) does not seem to clearly support the discharge of ground water during the April 18 and October 28, 2004 sampling event. During periods of pumping, the ground water upwelling hypotheses is supported at stations 7, 8, and 9 by a marked drop in the values of temperature, EC, and DO. However, for the two pre- and post-pumping days, the measured water quality parameters at stations 7, 8, and 9 are not anomalous from the trend of the stations above and below; suggesting the upwelling is not occurring or the river flows overwhelm the rate of ground water inflow masking the effect. During the irrigation season, some level of pumping was occurring on all but two days (SGI Figure 3-30 and Table 2-2). Water quality data were collected on only one of the non-pumping days, September 30, 2004. However, ESR has indicated in an October 10, 2005 response to DFG's comments that pumping was occurring on this day and the report will be modified (see response 9-2). Thus, there is no water quality data to conclude support of the hypothesis that the upwelling occurs outside of the pumping period.

In regards to the water quality data, the issue of the short term variability of the data may be of greater significance than the lack of non-pumping data. HER Figure 70 shows the hourly water temperature measurement taken at the bottom of the river channel at sampling station CT-3 and similar graphs are presented in SGI Appendix H. HER Figures 35 to 44 show the temperature data for different sampling periods and are an enlargement of data shown of SGI Figure 3-31. Since HER sampling station CT-3 is near water quality station 7 (HER Figure 9), it can be assumed that the variability in the hourly

temperature similarly occurred to the station 7 data. HER Figure 79 shows that the CT-3 temperature typically fluctuates over a range of approximately 9^{o} F between April and August 2004. For example, the pre-pumping April 18th temperature is reported at 55.40^{o}F (HER Figure 35) which is near the lower limits of the hourly fluctuations on HER Figure 70. But during the same period, the upper limits of the hourly temperatures were approximately 64^{o}F. Thus, the timing of when a sample is taken can have a significant impact on the interpretation. A review of the temperature data for the other sampling periods suggests that the reported data are not consistently taken at the same place in the fluctuations. For example, on September 2 the temperature at station 7 is reported as 57.87 ^{o}F (HER Figure 40) which is near the upper end of the hourly fluctuations data on HER Figure 70. On September 15th the reported value is nearer the middle of the fluctuations, while on September 30th the reported value is again near the upper end. On October 15th the reported temperature of 56.57 ^{o}F is nearer to the middle of the temperature fluctuations, HER Figure 70. The SGI discussion of river water quality data (Section 3.4.6.1) does not indicate whether the data presented in Figure 3-31 is taken from a particular time interval or statistically derived, i.e., average daily value. With the high degree of at station variability and the lack of documentation on how data were collected and selected for presentation, the water quality data at this time cannot be considered definitive evidence of the ground water inflow or upwelling in the area of water quality stations 7, 8, and 9.

The second line of evidence for ground water upwelling is the narrowing of the alluvial valley at the mouth of the Big Sur River. Although the surface width of the alluvium narrows, the surface width is not the only factor to consider in evaluating the impact of this bedrock constriction. SGI Figure 3-8 shows that the base of the alluvial aquifer increases from an elevation of approximately -30 feet msl near stations 7 and 8 (cross-section B-B' on SGI Figure 3-11) to approximately -80 feet msl at cross-section D-D' (SGI Figure 3-12) and eventually to an elevation approximately –100 feet msl at the ocean. Thus, the thickness of the alluvium continues to increase as the ancient river channel deepens from the area of upwelling to the present day shoreline.

Although there is no site-specific data on the hydraulic conditions in the area of ground water upwelling, i.e., monitoring wells and river stage data, there is regional hydrogeologic data that suggest that upwelling may not occur during periods of non-pumping. The flow of ground water is governed by Darcy's law, Q = K* I* A, and all three variables have an impact of the rate and volume of ground water flow.

The narrowing of the width of the alluvial aquifer occurs at an area where the thickness of the aquifer is increasing. The area of the alluvial aquifer at cross-section D-D is approximately 34,000 square feet (sq-ft) close to the 31,000 sq-ft aquifer cross-sectional area estimated at eastern end of the study area at cross-section A-A' (SGI Table 3-2). The hydrogeologic model for the mouth of the Big Sur River has very coarse-grained alluvial aquifer material deposited below an elevation of –20 feet msl (SGI Sections 3.3.2 and 4.0). This basal coarse alluvium is thought to have a hydraulic conductivity of approximately 15,000 ft/day, as used in the salt water intrusion modeling, a value approximately 4 times that of the overlying aquifer, average value of 3,626 ft/day found

at the New Well (SGI Section 3.3.2). The ability of the alluvial aquifer to transmit water will be influenced by the higher hydraulic conductivity layer. Thus, even with a slight decrease in cross-sectional area, the rate of ground water flow in the aquifer at the mouth of the river may not be significantly lower if the hydraulic gradient is similar.

The hydraulic gradient during non-pumping conditions at the eastern edge of the study area, cross-section A-A' and in the area of ESR well field is approximately the same, 0.0026 versus 0.002, respectively (SGI Section 3.3.3 and Table 2-3). Influx of ground water at the eastern edge of the study area is estimated to average 3.45 cfs during the 2004 study period (SGI Section 3.3.2 and Table 2-3). No estimate was made of only the ground water outflow to the ocean is given (SGI Section 3.4.7.4). SGI Table 3-6B provides a combined runoff and underflow to the ocean of 16.7 cfs, but this was solved as part of the water balance. Ground water underflow in the alluvial aquifer is estimated to range from 3.16 to 3.81 cfs (SGI Section 3.3.2), but the non-pumping amount that reaches the ocean is not provided.

In order to document the nature of the ground water upwelling, additional water level data are needed on the river stage and ground water potentiometric head of both the southern and northern banks. In addition, an estimate of the actual seepage volume would be beneficial as this inflow volume is critical to evaluating the impacts of pumping.

Saltwater Intrusion Model

A density dependent flow and transport model was developed to evaluate the impacts of saline intrusion on the water quality of the El Sur Ranch wells (SGI Section 3.5.3). The model was a multilayer model, but used only two hydraulic conductivity values, 1,500 ft/day for the shallow alluvial and 15,000 ft/day for the deeper coarse-grained, boulder zone layer. Documentation for the model did not show the model extent of these two aquifer materials. The model did not simulate recharge or discharge to the river, but did simulate the upwelling ground water by increasing the pumping rate of the ESR wells by 50%. The model simulation period utilized the historic tidal fluctuations from June 15 to July 10, 2004. SGI concluded from the modeling that,

> *"… the high hydraulic conductivities associated with a boulder zone at depth in the alluvium, the high summer spring tides combined with pumping stresses and the density driven flow of a saltwater wedge are completely consistent with the interpretation that salinity impacts to the Navy and Old Wells are the result of subsurface saltwater intrusion and the movement of it accompanying diffusion front."* (SGI Section 3.5.4).

I offer the following observations and analysis on the saltwater model of the lower Big Sur River.

The discussion of alluvial aquifer characteristics (SGI Section 3.3.2) states that the coarse-grained, boulder zone alluvium fills the ancient river channel at the mouth of the

river below a depth of –20 feet msl. The saltwater intrusion model assumed that this boulder zone extended along the "north valley wall" (SGI Section 3.3.2). The actual extent of this layer is not provided, but presumably it extends partially up the tributary drainage towards the Old Well. However, the –20 foot msl contour as shown on SGI Figure 3-8 extends much further inland, extending almost to the New Well and eastward well beneath the Creamery Meadow. In fact, it extends beneath the area of ground water upwelling near water quality stations 7 and 8. Because higher hydraulic conductivity layers can more easily transmit ground water, the results of modeling simulations are often dependant on placement. Additional information is needed on the extent of the high hydraulic conductivity to document the applicability of the simulation to the site conditions.

The setup of the saltwater model also reduced the hydraulic conductivity of the shallow alluvial aquifer to approximately half the value measured by the pumping well test of the New Well, 1,500 ft/day versus 3626 ft/day, respectively (SGI Sections 3.3.2 and 3.5.3). No reasoning was given for this reduction from the known value. As noted above, high hydraulic conductivity layers allow greater flow of ground water. A reduction in hydraulic conductivity would result in greater flows in the higher conductivity layers. Because the ESR wells are thought to be screened in the upper 30 feet of alluvial aquifer, a high percentage of the ground water extracted should come from the shallow zone. A reduction in the shallow zone hydraulic conductivity accompanied with an underlying zone of much higher hydraulic conductivity would likely result in higher rates of flow in the deeper zone. Additional information and discussion of the model setup is needed to justify the use of reduced hydraulic conductivity for the shallow alluvial aquifer.

The saltwater intrusion model did not simulate losses from the river due to recharge of the ground water. The loss of ground water due to upwelling was simulated by increasing the pumping rate of the ESR wells by 50% (SGI Section 3.5.3). The report doesn't provide any data to justify this upwelling rate, which is 2.65 cfs or approximately 1,200 gpm. Modeling of the upwelling ground water loss at the ESR wells instead of the eastern edge of the model would likely reduce the extent that the saltwater migrates towards Creamery Meadow. The model could simulate the upwelling losses at water quality station 7 and 8 using one or more shallow wells along the trace of the river at those locations. The proper placement and quantity of the upwelling losses is important to evaluate the potential for pumping of the New Well to draw in saline waters. As noted above, pumping rates in the Old Well are restricted to prevent the pump from cavitating, the actual restricted rate was not provided in the SGI report. However, if Application No. 30166's maximum rate of 5.84 cfs and 1,800 ac-ft/yr of diversion is granted, pumping of the New Well may allow for rates and durations not tested in the 2004 study period or yet simulated by the modeling effort.

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State of California

Memorandum

To : Ms. Victoria A. Whitney, Chief
Division of Water Rights
State Water Resources Control Board
Post Office Box 2000
Sacramento, CA 95812

Date: December 22, 2005

Attention Mr. Paul Murphey
Via Fax: (916) 341-5400

Original signed by

From : Robert W. Floerke, Regional Manager
Department of Fish and Game – Central Coast Region, Post Office Box 47, Yountville, California 94599

Subject : Geotechnical Review of the Technical Reports in Support of Water Rights Application 30166, El Sur Ranch, Monterey County, California, May 2005

The Proposed Project

Water Right Application 30166, submitted by the El Sur Ranch (ESR), proposes to divert 1800 acre-feet of water per annum on a year-round basis. The diversion wells are located in Andrew Molera State Park and tap underflow from the Big Sur River not far upstream from the lagoon at the mouth. The SWRCB is the state lead agency for the California Environmental Quality Act (CEQA) review of the project and is currently preparing an Initial Study. Protests to this water right application have been filed by Department of Parks and Recreation (DPR), Department of Fish and Game (DFG), and California Sportfish Protection Alliance (CalSPA).

DFG's interest in this application is based on its status as trustee and responsible agency for fish and wildlife resources in California. As such, DFG has, in the past 3 years, reviewed and commented on various documents provided by the State Water Resources Control Board (SWRCB). This memorandum 1) summarizes the findings of the geotechnical review completed for the Technical Reports and 2) provides information regarding the soils of the place-of-use of the proposed water allocation.

Geotechnical Review of Technical Reports

This Department contracted for expert review of "Technical Reports in Support of Water Rights Application 30166, El Sur Ranch, Monterey County California" (May 2005), a report prepared by the applicant's consultants. That review has now been completed, and the comments of our contracted reviewer, Mr. Kit Custis of the Department of Conservation are attached (Attachment 1). In addition, we are providing additional information from the "Soil Survey of Monterey County, California" (USDA Soil Conservation Service).

The conclusions of Mr. Custis' review have been summarized on the second page of his memorandum and are reiterated as follows:

- Results and conclusions from the 2004 study period may not represent the potential impacts from the maximum permit extraction rate or total volume.

- The pumping of the ESR wells results in a reduction in the flows of the Big Sur River as extracted ground water is recharged from surface waters.

- The depletion of surface water flows due to ESR well pumping is spread along several hundreds of feet of river reach. While the loss at any one location may be small, the cumulative loss can exceed 90% of the well yield for prolonged periods of pumping.

- Losses from the river due to pumping extend beyond the period of pumping as the aquifer is recharged. For the highly conductive water table aquifer in the study area, this extended depletion period may extend for several days after cessation of pumping.

- Additional hydraulic data and analysis are needed to document the upwelling of ground water in the area of water quality stations 7, 8, and 9 to demonstrate its presence, rate of inflow and response to ESR pumping.

- Documentation of the methodology for collecting water quality data is needed to evaluate the impact of short-term variations on the report's conclusions.

- Additional documentation and discussion of the saltwater model setup is needed to evaluate the applicability of the model results in assessing potential pumping impacts from the ESR well field on the rate and extent of saline water intrusion.

Santa Ynez Soil Series

Approximately 85% of the pasture proposed as the place-of-use, with a request for an appropriation that results in the use of 6 feet of water per acre per year, is mapped as Santa Ynez soil series. Based on information in the "Soil Survey of Monterey County" (see Attachment 2), this soil type typically has a clay layer 18 to 30 inches below the surface, rendering this soil type as having low permeability. It is questionable as to how the applicant can apply the requested quantity of water to this site without it resulting in prolonged soil saturation.

Status of Information Requests

In response to the NOP for this project, DFG requested information be provided on twelve topics, covering three basic areas of concern. The applicant then proposed a Monitoring Plan, intended to provide data responding to three of the twelve original topics (6, 7 and 8) listed in the NOP comments. In response to a

SWRCB request, DFG provided comments on that Monitoring Plan to further refine it to be more responsive to the concerns listed in the NOP comments. None of the modifications suggested were incorporated into the Monitoring Plan.

The applicant has now provided three Technical Reports, the first two reporting on aspects of the Monitoring Plan, and the third partially addressing two other topics (9 and 12) identified in our NOP comments. After review of the Technical Reports, DFG provided detailed comments to the SWRCB concerning the information that still requires clarification and disclosure, with the caveat that final comments would be provided after a contract for outside expert review was approved. The applicant responded to our preliminary comments on October 10, 2005, largely defending the scope and accuracy of the information presented in the Technical Reports and providing very little new information. We have now completed our geotechnical review of the Technical Reports, including the information provided in the applicant's October 10, 2005, "Responses to DFG Comments." Our additional review requests clarification regarding the previously supplied information, and questions the conclusions drawn from the data collected (see Attachment 1). Again, we would like clarification from you if it is your expectation that the applicant will be providing any additional information to you.

In addition to the specific deficiencies identified above, we do not believe the information provided by the applicant is responsive to our original comments provided to the SWRCB on November 6, 2002, in response to your NOP, identifying 12 general areas of information which would be needed to adequately identify and analyze the impacts of the proposed project. Again, we would like clarification from your agency whether you have the expectation that the applicant will be providing that information to you for your use in preparation of the EIR, or whether the EIR consultant will be developing the additional information.

If you have any questions or concerns, please contact Ms. Linda Hanson, Staff Environmental Scientist, at (707) 944-5562; or Mr. Carl Wilcox, Habitat Conservation Manager, at (707) 944-5525; or by writing to DFG at the above address.

Attachments

cc: See Next Page

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DH/LH/kg

To: Linda Hanson
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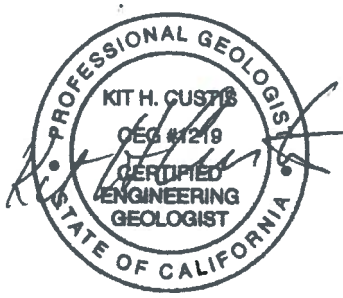
June 28, 2006



From: Kit H. Custis PG3942, CEG1219, CHG254
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Subject: Comments on June 2006 Notice of Preparation and Initial Study for El Sur Ranch Water Rights Application No. 30166, Monterey County, California

Water Right Application No. 30166 seeks to extract ground water from underflow at the mouth of the Big Sur River. The point of diversion is two existing agricultural irrigation wells located in the flood plain northwest of the river within the Andrew Molera State Park. The El Sur Ranch (ESR) submittal included three technical documents dated May 2005 in support of their Water Rights Application. These documents provide the environmental data and technical analyses for the June 2006 Notice of Preparation (NOP) and Initial Study (IS) prepared by EIP Associates for the State Water Resources Control Board. The two ESR agriculture wells are called the Old Well and the New Well. A third smaller well, called the Navy well, is operated by State Parks and Recreation Department.

At the request of the Department of Fish and Game, Agreement No. P0530003, I have reviewed the three technical reports and the Initial Study. This letter presents my findings and opinions on the technical data and Initial Study and makes recommendations in section 9 for additional hydrologic, hydrogeologic and environmental assessment and filling of data gaps that would help quantify the potential impacts from the proposed water diversion. The recommendations for additional study are based on the data, analysis and conclusions provided in the ESR technical submittals. The amount and complexity of the recommendations are in part due to both the complexity of the project site and to the applicant's reliance on ground water upwelling as mitigation for potential pumping impacts.

Summary of Comments

1. Hydraulic constriction of the alluvial aquifer at the ocean does not appear to be present due to the high hydraulic conductivity zone below an elevation of –20 feet below mean sea level (msl) which makes up for the reduction in aquifer cross-sectional area.

2. The influence of saltwater intrusion on upwelling of ground water at the "cold pool" needs to be quantified.

3. Data are needed on the elevation of surface water and ground water in the river reach adjacent to the pumping wells to measure the hydraulic gradient between the river and aquifer in order to calculate the quantity of ground water inflow and outflow, and to establish the location of the transition from the losing to gaining reach.

4. Calibration is needed of the relationship between water quality parameters, temperature, dissolved oxygen and electrical conductivity, and ground water flow direction and quantity before they can be used as indicators of impact.

5. Additional data and analysis are needed to explain the variation in water temperature observed during the 2004 pumping season.

6. The water balance for the study area needs to be revised to reflect pumping levels requested in the water rights application and to provide more information on the known inflows and outflows to reduce the high percentage of unknowns.

In reviewing the documents provided, a key hypothesis of the hydrogeologic setting at the ESR well field is that "upwelling" ground water at the "cold pool" that lies between water quality transects #7 and #9 demonstrates that the river is not losing flow due to pumping, and that there is sufficient inflow of cooler ground water to the river to mitigate the impacts from pumping. Pumping may even benefit surface water quality by capturing ground water low in dissolved oxygen, thereby preventing it from reaching the river. This upwelling is the result of the constriction of the river valley at the ocean which reduces ground water outflow to a rate that is less than at the middle of the alluvial valley causing ground water to rise to the surface. Because this constriction is a physical barrier to groundwater flow, the upwelling occurs throughout the irrigation season regardless of the level of pumping. The applicant assumed for the salt water intrusion model that the upwelling may be as high as half the pumping rate, approximately 1,200 gpm (gallons per minute) or 2.67 cfs (cubic feet per second). The applicant reasons that the upwelling has to stop before the pumping can cause an impact to the river, i.e., deplete the river, apparently because as long as the river is gaining it can't be losing. This letter will discuss several issues related to the data supporting the upwelling hypothesis and make recommendations for additional study to quantify the effects of upwelling on river quality and flow rates.

1. The Initial Study appears to accept the upwelling ground water hypothesis and relies on it throughout the evaluation of environmental impacts. For example, on pages 5-14 and 5-15, the discussion of potential impacts to biological resources from groundwater pumping lists impacts on the riparian resources from a reduction of underflow and groundwater levels and potential changes in salinity caused by increased saltwater intrusion. The Initial Study does not however list as a potential impact to biological resources the possibility for a reduction in the flow of the Big Sur River as the result of pumping ground water. A potential for impacts to surface water from ground water pumping does exist for reasons discussed below and should be addressed as a potential environmental impact.

2. The May 2005 hydrogeologic report by The Source Group, Inc. (SGI) discusses the hydrogeologic setting and the constriction of the aquifer in sections 3.3 and

5.1. The report states on page 5-2 that the reduction in the aquifer width between the Franciscan bedrock from 1,600 to 700 feet results in a pinching of the aquifer. While the width of the alluvial valley in the project area does lessen at the ocean, the flow of ground water is the result of the aquifer's transmissivity, not just width at the top of the aquifer. The ability of an aquifer to transmit water can be calculated by the product of the hydraulic conductivity and the cross-sectional area, the k*A portion of Darcy's Law, Q = k*i*A.

The change in the aquifer cross-section between the wider part of the aquifer and the ocean can be measured using the geologic cross-sections B-B' on Figure 3-11 and D-D' on Figure 3-12. Measurement of the cross-sectional area needs to separate the aquifer area above minus 20 feet below msl from that below because of the difference in hydraulic conductivity (see discussion on SGI page 3-10). The hydraulic conductivity of the shallow aquifer (above minus 20 feet below msl) can be taken from the pump test data that resulted in an average value of 3,623 feet/day (SGI page 3-9), although a value of 1,500 feet/day was used for the saltwater intrusion modeling effort (see SGI page 3-33). The deeper aquifer (below minus 20 feet below msl) is thought to be much coarser grained to bouldery with a hydraulic conductivity ranging from 10,000 to 100,000 feet/day (see SGI page 3-10). A hydraulic conductivity of 15,000 feet/day was used for the saltwater intrusion modeling effort (see SGI page 3-33).

Based on these two geologic cross-sections and the stated hydraulic conductivities, I did not find that the alluvial aquifer is constricted at the ocean, rather it appears to be more transmissive at the ocean than at the mid-section of the alluvial valley by approximately 20 to 75%, depending on an assumption on the inland extent of the deeper, high conductivity layer. The SGI report also attributes the rise in ground water at the ocean to the presence of the saltwater wedge. While this may have an effect, the inland extent of the saltwater wedge is not fixed, but varies based the elevation of surface water, tidal influences and to a significant extent on the rate of pumping, particularly at the Old Well (see SGI section 3.5.2).

Thus, the Initial Study's findings under the Hydrology Section 8b, starting on page 5-30, include: (1) the magnitude of any pumping withdrawals are exceeded by the influx of ground water recharging or upwelling into the river; and (2) water quality changes in the river near Creamery Meadow are naturally occurring and unrelated to pumping. These two findings may not be valid because they rely on the aquifer constriction to drive the "natural" upwelling ground water. Without the constriction of the aquifer at the ocean, the cause(s) of any groundwater inflow or upwelling and the changes in surface water quality are an open question. The lack of a constriction may result in the pumping rates and timing, as well as location of the wells, becoming the most significant parameters in determining the movement of ground water, the amount and timing of saltwater intrusion, and the resulting impacts to river flows. Without the constriction of the aquifer at the ocean, the monitoring mitigation measures mentioned in the Initial Study may differ substantially from those now being considered.

3. The Initial Study appears to agree with the 2005 SGI report's conclusion that water quality parameters can be used to measure hydraulic conditions between the river and aquifer. Specifically, the direction of change in water quality parameters, namely, temperature, dissolved oxygen, and electrical conductivity indicates the direction and quantity of water flow. This assumption becomes critically important in the discussion of the "cold pool" and its significance. However, the reliance on this assumption requires calibration of the relationship(s) between water chemistry, and ground water and surface water hydraulics which has not yet been done. In fact, there are no hydraulic gradient or flow data in the area of the "cold pool" to document the direction(s) or volume of water flow, either across or along the river channel. Recommendations are provided below in section 9 for additional data needed to demonstrate that water quality parameters can be used as a measure of water flow direction and quantity.

4. It is known that the pumping of a well in an unconfined aquifer lowers the water table around the well, creating a cone of depression that decreases in depth radially outward. The water table depressions created around the ESR irrigation wells must eventually intercept the river. The river and ground water are said to be in good hydraulic connection (see SGI sections 3.4.8.1, 4.0, and 5.2). The aquifer and the stream bed are coarse-grained with high hydraulic conductivity (see SGI section 3.3.2). No continuous low permeability layer has developed in the riverbed (see SGI section 4.0). The river can be a recharge boundary and lose water to the aquifer during pumping (see SGI section 5.2). Evidence of the recharge boundary can be found in the pumping test of the New Well, where no pumping related effects, i.e., drawdown, were observed in monitoring well JSA-05 located on the opposite side of the river (see SGI section 5.2). However, the river as a recharge boundary conflicts with the inflow of ground water that's needed to create the "cold pool." Resolving the apparent conflict of the river acting as a source of recharge to the aquifer during pumping while at the same time receiving inflow from upwelling is important to understanding the potential impacts from pumping and for selection of the appropriate monitoring requirements. The SGI report does provide some data on the hydrogeologic and hydraulic setting of the river and wells that may provide insight as to the location and nature of the losing-to-gaining transition as discussed below.

    a. The 2005 SGI report (section 3.4.6.3) identifies the reach of the Big Sur River between velocity transect #1 (VT#1) and velocity transect #2 (VT#2) as being a recharging or losing reach where higher temperature surface water infiltrates and was eventually seen as warm ground water in the monitoring wells ESR-10A, B, and C as well as ESR-02 and ESR-03 (see SGI section 3.4.6.3). As noted above, the "cold pool" was identified as a gaining reach where cooler ground water is thought to flow into the river generally between water quality stations #7 and #8, and sometimeS as far upstream as station #9. The SGI report does not provide any information on where upstream of VT#2 the infiltration occurs, or what happens downstream of VT#2 before reaching the gaining "cold pool" reach. If the river changes from a losing to a gaining reach, there must be a point or section of channel where this transition occurs and an associated physical reason for this reversal in hydraulic gradient. The SGI report

does not discuss the nature of this transition, what causes it, or whether it is stationary or moves as the result of changes in pumping rates, pumping times, river flow, tides, etc. Additional information is needed on the location and orientation of this transition zone in order to determine the appropriate monitoring locations and times.

b. The available information on the hydraulic gradient between the river and the aquifer comes from the river elevations measured at the stilling well installed near VT#2 (see SGI Figure 1-3), and water levels measured in the ESR-10 wells located in a southwesterly direction about 300 feet from the New Well (see SGI Figure 2-2). The direction of hydraulic gradient between the stilling well and ESR-10 wells was always away from river towards the pumping wells (see attached Figures 1 and 2). Similarly, the direction of hydraulic gradient between the stilling well and the more distant monitoring wells ESR-02 and ESR-03 located approximately 750 to 800 feet from the river was also always sloping from the river towards the pumping wells. This suggests that the losing reach of the Big Sur River extends at least into the area of the stilling well near VT#2. Additional information is needed to determine how far upstream and downstream the losing reach extends.

c. In order for the river to transition from a losing reach at VT#2 to a gaining reach by water quality station #9, the direction of the hydraulic gradient must reverse and a groundwater divide or boundary must develop where the direction of hydraulic gradient changes from flowing towards the river to flowing away towards the pumping wells. This groundwater divide must lie either between the river and the pumping wells or possibly beneath the river. The divide would also likely connect with the point of transition from losing to gaining river between water quality station #9 and VT#2, as discussed above. To create this groundwater divide, either the elevation of the water table between the river and the wells must rise above the river water surface, the surface water elevation drop below the water table, or a combination of both. Unfortunately, no data are available on the elevation of either surface water or ground water between VT#2 and water quality station #7, the downstream end of the "cold pool" to help determine where and by how much the hydraulic gradient between the river and ground water changes. In addition, there are no flow data for the river downstream of VT#2 to measure river flow gains or losses except the VT#3 gage at the ocean, which was not available during closure of the lagoon. Hydraulic gradient and flow data are needed from the area of groundwater upwelling to the losing reach at VT#2 to determine the nature of the transition. Additionally, a longitudinal profile of the river should be developed to help determine whether changes in the grade of the channel bottom are causing any changes in hydraulic gradient. Specific recommendations for additional data are given below in section 9.

d. In order for the river to be a continuously gaining reach at the "cold pool," the water table elevation for at least a portion of the Creamery Meadow area south of the river must be higher than the surface water between

stations #7 to #9. Again, there are no data to document the elevation of the water table in Creamery Meadow relative to the adjacent river. Piezometers are needed in Creamery Meadow adjacent to the "cold pool" reach of the river and possibly further upstream to the area of VT#2 to document the direction and gradient of groundwater flow. Consideration should be given to making these piezometers so that water quality samples can be obtained to document upgradient groundwater quality.

e. Although there is no water elevation data in the vicinity of the "cold pool," one sampling event at water quality station #8 might provide some information on the complexity of ground water flow in the reach. On September 15, 2004, the water quality sampling event at station #8 consisted of two samples at different water depths for each of the three sampling sites, #8-L, #8-M and #8-R. The results of that sampling event are given in the following table.

September 15, 2004 Temperature, Dissolved Oxygen, and Electrical Conductivity at Water Quality Station #8

Station ID	Date	Time	Temp °C	Temp °F*	Conductivity µS/cm	DO mg/L	Sample Depth, ft
#8-L	15-Sept.	16:45	15.15	59.27	247	6.15	3.8
#8-L	15-Sept.	16:50	13.21	55.78	234	3.45	4.5
#8-M	15-Sept.	16:50	13.50	56.30	239	4.87	3.5
#8-M	15-Sept.	16:45	14.20	57.56	237	5.84	4.3
#8-R	15-Sept.	16:50	13.15	55.67	232	4.50	3.8
#8-R	15-Sept.	16:45	14.30	57.74	241	5.57	4.0

* Converted from °C

At the left sampling point, #8-L, located on the Creamery Meadow side of the river, there was an upward increase in temperature with a decrease in sampling depth which suggests upward movement of cooler waters, which agrees with the "upwelling" hypothesis. For the middle and right side sampling stations, #8-M and #8-R, the direction of water quality change reverses. There is a downward increase in temperature and dissolved oxygen. If the water quality change by itself is an indicator of water flow direction, the data from this sampling event suggest water flows into the river on the Creamery Meadow side and out on the middle and right, pumping well side. Although, this is the only sampling event and sampling station where two depths were sampled at the same time, it demonstrates the importance of the location and depth that a sample is taken, and reinforces the need for specific water elevation information during water quality sampling events to document the direction and amount of hydraulic gradient between the river and ground water.

5. The Initial Study's Hydrology and Water Quality section on page 5-30 states that, "the ability to measurably affect river stage remains inconclusive, yet there was no noticeable effect on surface water elevations when the pumps were turned off for the season in 2004." This statement appears to ignore the documented change

in surface water and groundwater levels as the result of increasing the pumping from one to two wells as discussed in SGI section 3.4.8.1 and as shown in SGI Figure 3-35. SGI Figure 3-35 shows the water levels dropping from mid-September to early October in 2004 at the stilling well in the river adjacent to VT #2 and in monitoring well ESR 10-B. The SGI report noted that the surface water level dropped approximately ½ inch and the ground water in the well dropped approximately 1 foot as a result of increased pumping. While this may not appear to be much of a physical change to the river, it is a significant change in hydraulic gradient between the river and well. The change in hydraulic gradient is a measure of the significance of increase, or decrease, in pumping because ground water flow is governed by Darcy's Law ($Q = k*i*A$). Assuming the hydraulic conductivity (k) and cross-sectional area (A) are not significantly changed, then the change in hydraulic gradient (i) quantifies the change and level of impact. As the Initial Study noted, ground water losses or gains to a river do not generally occur at a single point, but are spread along the river reach. Thus, the total change in flow can't be measured at a single point but must be measured between at least two points placed on either side of the impacted reach. By the statement of "no noticeable impact," the Initial Study appears to expect that the impacts from pumping the wells will be similar to a diversion into a pipe or canal, all occurring at one point on the river. The following discusses the significance of the hydraulic changes measured when the pumping rates varied.

a. The volume change from ½-inch rise or fall in surface water level at VT#2 where the average depth was less than 2 feet all pumping season is not insignificant. From the velocity profile calculation sheets in Appendix L, the average velocity at VT#2 is at least 0.10 feet per second (ft/sec), and the top width of the channel is approximately 20 to 24 feet (wetting perimeter – channel bank depths). Assuming that the surface velocity is equal to the average (generally it is considered slightly greater) and using the relationship Quantity = Velocity * Area, then ½-inch of flow is:

   $Q = 0.1$ ft/sec. * (½ / 12)ft * 20 ft = 0.083 cfs = 0.623 gal/sec ~ 37gpm
   $Q = 0.1$ ft/sec. * (½ / 12)ft * 24 ft = 0.1 cfs = 0.748 gal/sec ~ 45gpm

   A loss at this rate over a river length of 100 feet would cumulatively be 8 to 10 cfs, which clearly is not the case here. The point is, however, that ½-inch of change in surface water level while seemingly a minor change in elevation, is not an insignificant change in rate of flow, particularly when the change accumulates along a reach during a period low flow.

b. As noted above, the SGI report acknowledges that the river between VT#1 and VT#2 is a losing reach. The change in water levels at the stilling well and the increase in groundwater gradient that resulted from the increased pumping rate document that river losses from pumping can extend downstream to at least VT#2. Before September 19th, the Old Well was pumping at 2.55 cfs (see SGI Table 2-2). After the New Well began pumping, the combined rate of pumping was approximately 4.8 cfs, an increase of approximately 88%. Because the flow of ground water follows Darcy's Law, a change in groundwater flow is proportional to the change

in hydraulic gradient. With an almost doubling of the pumping rate, the hydraulic gradient between VT#2 and ESR 10-B increased approximate 50 percent (SGI Figure 3-36). This increase in gradient agrees with the analysis by Miller and Durnford (2005) that when the rate of stream depletion approaches the rate of pumping, then approximately half of the seepage occurs within a reach of stream centered on the well, the length of which is twice the closest stream-to-well distance. For the study area, the river's closest point to the New Well is approximately 500 feet away (see SGI Figure 2-2) and VT#2 is approximately the same distance upstream. Therefore, with the 88% increase in pumping rate, the hydraulic gradient of ground water increased by approximately 50%, which suggests an increase in seepage losses from the river of approximately 50%.

c. A second opportunity to evaluate the impacts of pumping on river flow was made by using data from mid-October 2004 when both wells were turned off (see SGI Figure 3-36). Following cessation of pumping on October 16, 2004, there was no immediate rise in surface water elevation at the stilling well near VT#2. In fact, an analysis of the daily average elevation at the stilling well indicates that it dropped approximately ½ inch from October 15th to October 16th (see the ESR technical reports data). The surface water elevation began to rise the following day likely in response to the rain event on October 17th and 18th. If pumping ceased, why did the surface water level drop?

   Jenkins (1968) provides an explanation to this apparent inconsistency. River losses from pumping do not stop immediately when pumping stops; there is residual depletion. In fact, for certain hydrogeologic settings, the amount of water lost from a river after cessation of pumping can exceed the losses during pumping. Thus, the continued drop in surface water level is not inconsistent with known residual depletion and suggests that the river was still a losing reach. The rise in river stage due to the rain event eventually obscured the effects of stopping the pumping.

6. Periodic water quality sampling of the river was undertaken during the 2004 pumping season along the river at twenty-one sampling sites, while continuous sampling of river temperature was done at five temperature logger sites (see SGI Figure 2-2 for sampling locations). Two continuous recording temperature loggers, numbered 3 and 4, were placed in the section of river between water quality stations #12 and #6, temp-logger #3 at water quality station #7R, and temp-logger #4 at water quality station #11R. Temp-loggers #4 is in an apparent losing reach and temp-logger #3 is in an apparent gaining reach, the "cold pool." Figure 3 (attached) shows the continuous data from the upstream, bottom temp-logger #4 in red, with the downstream "cold pool," bottom temp-logger #3 values superimposed in grey. Point symbols indicate the measurements taken at adjacent water quality stations. Figure 4 shows the temperature logger data as a 24-point running average; most samples were taken hourly. These graphs show that temperatures at the two locations do not differ significantly from the beginning of the record on April 18th to approximately July 16th when a difference of 2 °F to 4 °F occurs for highest temperatures only. On August 26th , the lagoon closes and

the temperature differences increase for both high and low temperatures. Between September 2nd and the 20th, there is a gradual drop in the temperature at the upstream temp-logger #4. By mid-October, near the end of the record, the temperature range and variations are again similar at the two locations. Even though these temperature data were taken from the right side of the channel, the pumping well side, the data show that the differences between the hotter upstream reach and the "cold pool" were not uniform throughout the irrigation season. The questions then are why is there a variation, how consistent is the upwelling, and what impact might this have on the proposed mitigation monitoring program. The following is a discussion of the 2004 irrigation season temperature data taken by the two continuous temperature loggers, and at the adjacent water quality stations.

a. From the beginning of data collection on April 18th, through July 16th, the river bottom temperatures at the two temperature stations appear to be similar. This may be due in part to the higher flow rates during this period of time. Following the initial measurements on April 18th, no water quality transect sampling was reported from stations #7 through #10 until July 23rd, 96 days later. Thus, the available data do not appear to document the "cold pool" effect of ground water upwelling during the first half of the 178-day 2004 irrigation season.

b. The hypothesized upwelling is in part thought to be caused by the presence of a saltwater wedge, and high spring tides are thought to be a significant factor in the landward movement of the saltwater wedge (see SGI section 3.5.2). The saltwater modeling effort simulated the high spring tides from June 15 to July 10 (see SGI section 3.5.3). No water quality data were collected from the "cold pool" reach during the period of highest tides. The July 12th transect sampling skipped water quality stations #7 through #10, as well as several others. In the period when saltwater intrusion is thought to have had the greatest influence on upwelling, there are no data to document the effect in the "cold pool."

c. The period of measurable temperature difference between the temperature loggers begins on July 16th when the higher temperatures start to differ. This time corresponds with the beginning of the period of lowest flow in the river as measured at the USGS gage (see SGI Figures 3-26 and 3-27). The high temperature difference continues until August 26th when a sand bar closes the lagoon's surface water outlet to the sea.

d. On August 26, 2004, when a sand bar closes the river's outlet, the lagoon surface water level starts rising from approximately 5.2 feet above msl and reaches 8.5 feet above msl by mid-September (see SGI Figure 3-43 and section 3.4.8.3). By the end of September, the lagoon surface drops to approximately 6.75 feet above msl. Groundwater levels in monitoring wells also go up approximately 1.5 feet to 2.0 feet by the start of September (see SGI Figure 3-44 and section 3.4.8.3). By mid-September, groundwater levels drop back to below approximately 6.25 feet above msl. The attached Figure 5 shows the changes in groundwater levels at monitoring well ESR-02 which is representative of the effects of the

lagoon closure over a longer period than shown in SGI Figure 3-44. The rise in river stage with the closure of the lagoon may have extended upstream into the reach of the "cold pool" (see SGI Figures 3-28 and 3-29 for a comparison of lagoon water levels). The evidence for this can be found in the sampling depths of the water quality stations.

e. The March 11, 2005 Hanson Environmental, Inc.'s Biology report states in Section 3.3 that water quality samples were taken mid-way in the water profile. Thus, the depth of each sample can be used as a general index of the total depth at each transect location during each sampling event. A review of the sampling depths finds similarities to the lagoon data, in that the sampling depths at water quality stations #6 to #9 increase after the lagoon closure. The average sampling depth across each transect increases typically from approximately 1.0 to 1.5 feet (see summary table below). This corresponds to an increase in total water depth of 2 to 3 feet, assuming the mid-column sampling criteria. The cause of this rise does not appear to be an increase in surface water flow from upstream, as discussed below. If the river rise is the result of an increase in ground water discharge at the 'cold pool," the discharge would have to be very significant to cause this amount of sustained change.

Range of Sampling Depth Before and After Lagoon Closure

Transect	Aug. 19 Depth, ft	Sept. 2 Depth, ft	Difference, Min-Max
#6	0.40 – 0.90	2.00 – 3.20	2.10 – 2.50
#7	2.25 – 3.50	3.70 – 4.50	0.05 – 1.95
#8	2.10 – 2.70	3.30 –3.90	0.65 – 1.70
#9	1.70 – 3.75	3.80 – 5.20	0.10 – 1.45
#10	1.60 –3.10	1.80 – 3.25	0.15 – 0.60
#11	2.50 – 3.00	2.50 – 3.50	-0.20 – 1.00
#12	0.40 – 0.85	0.70 – 1.15	0.15 – 0.60

f. The differences in sampling depth do not appear to correspond to an increase in surface water flow as measured upstream at VT#2 (see SGI Table 3-1). On August 19th, the flows at VT#2 ranged from 5.90 to 6.97 cfs with sampling depths at water quality station #8 ranging from 2.10 to 2.70 feet. On September 2nd, the stream flows measured at VT#2 were higher at 7.28 to 10.26 cfs with the sampling depths at water quality station #8 ranging from 3.3 to 3.9 feet, showing an increase sampling depth with increased flows. However, on September 15th and 16th, VT#2 surface flows are reduced, ranging from 6.18 to 5.96 cfs, respectively, with sampling depths at water quality station #8 at 3.5 to 4.5 feet, slightly higher than on September 2nd and much higher than on August 19th when surface flows were at a similar rate. On October 28, after the river mouth has opened to the ocean, the measured surface water flow at VT#2 is approximately 46 cfs and the sampling depths at water quality station #8 range from 2.7 to 3.2 feet the following day, October 29th, showing shallower conditions than on September 2nd and September 15th and 16th.

Clearly, the greater water quality sampling depths at station #8 after closure of the lagoon on August 26th do not have a linear correlation with the total rate of surface water flow as measured at VT#2 suggesting some change in channel hydraulics or inconsistencies at the sampling locations. A possible reason for this lack of correlation between flow rate and water depth at station #8 is that the rising lagoon waters extended upstream creating a backwater effect in the area of the "cold pool" area, which likely widened the channel surface, creating the non-linear relationship between stage and flow before and after lagoon closure.[1]

g. The temperature values plotted for station #6 to #12 on SGI Figure 3-31, River Temperature Profiles, are generally taken from the left sampling point at water quality station #8, except on April 18 and October 29. Those for the other water quality stations were taken from the middle sampling point. The range of temperatures across stations #7, #8 and occasionally #9 is generally greater than at the other transects. The attached Table 1 shows temperature differences of water quality stations #6 to #12 for each reported sampling event in 2004. Data plotted on SGI Figure 3-31 are shown with red highlights. The question arises as to why the sampling points for the "cold pool" were taken from the bank opposite the pumping wells, likely the greatest area of upwelling, while the upstream samples were taken from the middle of the reach?

7. The lower section of the Big Sur River is a dynamic environment. The rates of surface water flows, precipitation, natural vegetation and crop evapotranspiration, and to some extent groundwater underflow vary throughout the year. The water balance for the pumping area is discussed in SGI section 3.4.7 and its subsections starting on page 3-22, and in Tables 3-6A and B. The water balance assumes for outflow that the surface water and groundwater underflow are a single system, which is generally correct, except that the timing and locations of inflows and outflows for each can have a significant impact on the local availability of water, which is a critical condition for some plants and wildlife. Although the water right being applied for requires a 30-day running average, the SGI water balance for the study area, Table 3-6B, does not provide analysis on a short term basis, e.g., monthly, but instead gives an annual and a 2004 season water balance. The combining of surface flow and underflow for the outflow balance misses the issue that the availability of surface flow is at times critical to sustaining the resource. The following is a discussion of the water balance.

a. In calculating the water balance for the study area, the surface water runoff and groundwater underflow were kept separate as inflow, but combined as outflow. In the outflow portion of the 2004 season water balance, the combined outflow to the ocean of runoff and underflow was considered an unknown. The value was "solved for" by calculating the difference between the inflow and outflow and setting the imbalance equal to the combined outflow of runoff and underflow to the ocean. This

[1] Compare SGI Figures 3-28 and 3-29 for effects on lagoon water surface width, from pre- to post-lagoon closure.

combined outflow of runoff and underflow to the ocean made up approximately 83% of the total outflow for the 2004 season study area water balance. Because such a large percentage of the outflow is unknown, it creates concerns about the accuracy of the estimate and introduces the issue of measurement error. That is, if 80% of the flow can't be measured, how accurate is the estimate? It would be a more useful water balance if what is known about the runoff and underflow draining to the ocean is included and what is not known is calculated. This would give a measure of not only the inflow and outflow, but also the accuracy of the measurement.

b. In the annual water balance calculations for the study area (Table 3-6B), the combined runoff and underflow to the ocean was given as a known value taken from the total watershed discharge water balance presented in Table 3-6A. In the calculation of the total watershed water balance, this discharge to the ocean was taken from the Lower Big Sur watershed water balance, where it was an unknown and "solved for." Thus, an unknown at the watershed scale become a known at the scale of the study area. This appears to create a fact out of a previously unknown. As noted above, establishing what is accurately known and identifying what is still unknown is probably a better use of the water balance exercise because it will point to where more data should be collected.

c. In the annual study area water balance (Table 3-6B), the unknown that was "solved for" was the surface water inflow at cross-section A-A', which represents approximately 94% of the inflow. However, this value was previously estimated in Table 3-4 using an assumption that it has a relationship to the upstream USGS gage. The "solved for" value of 82,271 ac.-ft. (116.64cfs) in the study area's annual water balance is higher than the value that would result from summing the monthly values in Table 3-4, 77,851 ac.-ft. (107.53cfs). It is unclear why the surface water inflow at section A-A' was considered an unknown for the annual study area water balance and why the calculated result exceeds that estimated elsewhere. Again, the inconsistency of the water balance reduces its accuracy and questions its utility.

d. In the annual study area water balance (Table 3-6B), the annual value for pumping was 977 ac.-ft. This value is much less than the quantity requested in the water right application, a maximum of 1,615 ac.-ft., with a 20-year rolling average not to exceed 1,200 ac.-ft. The note in the table states that it is the average pumping rate for 1975 to 2004 with the addition of the Navy well's pumping. While this would be of interest in establishing the baseline water usage, there is no analysis of future use which is the subject of the environmental review. An additional water balance using the permit requested pump rate is needed.

e. In the 2004 season study area water balance (Table 3-6B), rainfall of 7.59 inches is assumed over a one-square-mile area producing 405 ac.-ft of inflow. Based on the ratio of cfs to acre-feet for the terrace subsurface

inflow line item, the 405 acre-feet of rainfall appears to represent approximately 1.15 cfs. This rate is approximately 20% of the peak pumping rate requested in the water right application, a maximum 30-day average of 5.34 cfs and a maximum instantaneous rate of 5.84 cfs. However, most of this precipitation fell after mid-October (see SGI Appendix G) and was essentially never available during the 2004 pumping season which ended before mid-October (see SGI Table 2-2). In addition, the period for the surface water inflow at section A-A' was stated as July to September. The inclusion of precipitation that fell outside of the pumping season adds more inflow than was actually available. The water balance should be revised.

Based on the above discussion, the SGI water balance for the study area does not appear to provide a sufficiently accurate estimate to allow for use in measuring potential impacts from pumping on surface water flows or to measure the available waters. The water balance analysis for the study area should be done on a shorter time interval, no longer than monthly, because when less water is available in summer, more water is needed, and the water right being sought is in part based on a 30-day running average. The water balance and availability analysis should demonstrate that the requested 30-day average can be sustained. The analysis should also keep separate the surface water and groundwater flows to demonstrate how much of each is available. Because much of the outflow to the ocean is difficult to measure and subsequently has a high standard of error, it would be a more useful if the water balance documents what is known and then calculates the level of the unknown or error in the measurement. A water balance analysis where 80% or more of the data are unknown is not reliable. The balance should present data and calculations using both rate and volume, because the water right seeks diversion using both measures. The balances should be estimated for not only the average water year, but also for low flow years to establish minimum by-pass flow requirements and associated triggers.

8. A source of groundwater inflow to the river that was not discussed in the applicant's technical documents is bank storage. The rise in surface water flow during winter and spring months will raise the river stage and, with a sufficiently long duration, surface water will infiltrate the adjacent alluvium, temporarily storing ground water as bank storage (Freeze and Cherry, 1979). The rate of infiltration is dependent on the hydraulic conductivity of the stream bed and surrounding aquifer. The high hydraulic conductivity values of the Creamery Meadow area should allow for rapid saturation of the aquifer. In fact, the annual water balance for the study area (Table 3-6B) assumed an increase in underflow at sections A-A' of 0.55 cfs in winter months. This increase requires an approximate 5-foot rise in the groundwater level during winter months at section A-A', which likely extends downstream throughout the study area. With a drop in river stage during the spring and summer, the stored ground water will discharge back into the river, delivering baseflow. The rate of groundwater discharge decays over time as the gradient between the river and the water table falls (Glover, 1964). The volume of available bank storage is limited in the project area because the alluvial valley is bounded by low permeability bedrock (see SGI section 3.4.4). If all of the approximately 200-acre alluvial plain of the valley

surrounding the ESR wells is saturated for an additional 5 feet, then approximately 250 acre-feet of bank storage would be produced annually. The potential for ground water inflows to the river being derived from bank storage has not been discussed or eliminated as a source in the technical documents submitted by ESR. Given that the aquifer constriction is questionable and the influence of saltwater intrusion on upwelling is not yet quantified, as discussed above, bank storage should be considered as a potential source of summer inflow to the river, although the quantity is likely to be much less than the 1,200 gpm assumed in the SGI report (see SGI section 3.5.3).

9. Based on the discussions given above, there are several data gaps in the hydrogeologic and hydrology data for the study site that should be collected and analyzed in order to determine the available waters, quantify the gains and losses to the river from various pumping rates, and to assist in selection of type, location, and timing for monitoring water quality, quantity, flow rate, and elevation data. The following are my recommendations for additional data needs.

    a. **Lack of ground water and surface water hydraulic head data along the river on both sides.** This is especially critical between stations #6 to #12 and within the areas not under pumping influence, e.g., Creamery Meadow, to document water level differences within and outside the area of upwelling, to obtain background groundwater quality parameters, and to delineate the transition from a losing to a gaining river. Upstream of VT#2 where surface water is said to be infiltrating, hydraulic head data are needed to document flow direction. Without data on the water levels, surface and ground water, the validity of the chemistry signature of the upwelling ground water hypothesis can't be validated.

    Piezometers are needed in Creamery Meadow adjacent to the "cold pool" reach of the river and possibly further upstream to the area of VT#2 to document the elevation and gradient of groundwater flow. Data from these piezometers should be tied to surface water elevations in the adjacent river. Consideration should be given to making these piezometers so that water quality samples can be obtained to document upgradient ground water quality.

    b. **Lack of hydraulic conductivity data on the stream bed.** There is no information on whether the channel bed develops a clogging layer of fine materials, as asserted in the applicant's response to my previous comments. The text of the hydrogeology report suggests otherwise. If there is a large percentage of the channel bed covered with a fine-grained layer, then the clogging will reduce the rate of groundwater movement **into or out of** the channel. Variation in this clogging will also result in a variation in the impacts on the river. If fine sediments are commonly found covering the stream bed, then documentation is needed because it might affect where and when monitoring is done. Hydraulic conductivity data are needed for the channel bed. The number and location of measurements should adequately document the channel variability.

c. **Estimate the quantity of ground water upwelling into the river.** The presence of upwelling ground water in the reach of the river adjacent to the pumping wells is said to be an indicator of no surface water losses and is apparently thought to supply sufficient water to mitigate impacts of ground water pumping. However, none of the technical documents submitted provide a measured estimate of the rate or volume of upwelling ground water. The saltwater intrusion modeling effort assumed an upwelling inflow of 50 percent of the pumping, approximately 1,200 gpm, but this value was not measured or validated. The hydraulic gradient data combined with stream bed permeability data can be used to estimate the quantity and volume of inflowing or outflowing ground water.

d. **Estimation of influence of saltwater influx on upwelling ground water.** The cause(s) of the upwelling ground water in the reach of the river adjacent to the pumping wells still needs to be determined. As discussed above, the aquifer constriction appears to be unlikely, and the influence of the saltwater intrusion on upwelling is not adequately quantified. In addition, if the cause of the upwelling ground water is largely due to saltwater intrusion, then the rate and timing of the pumping of ground water is linked. Control of the pumping schedule might determine the rate and timing of upwelling. Data are needed to demonstrate the influence of saltwater intrusion on upwelling and to quantify the effects of pumping on upwelling.

e. **Water level and water quality data are lacking for ground water outside of the pumping well field.** The upwelling hypothesis is based an assumption that water chemistry changes and differences along the channel are caused primarily by inflows of ground water to the stream, but the background quality of ground water is assumed. Data are needed on the quality of background ground water to determine the extent of aquifer and surface water mixing and to track the migration direction and rate of surface water and ground water movement.

f. **Data are needed on the changes in surface water flow rates from water quality stations #6 to #12.** Stream flow data are needed in this critical reach to document the rate and timing of ground water inflow or loss. The value of inflow assumed for the salt water intrusion model between June 15th and July 10th was approximately 2.67 cfs (1,200 gpm) or 50% of the pumping rate (see SGI pages 3-33 and 3-34). However, the hydrogeology report fails to provide data and calculations on how this inflow rate was measured, estimated, or validated. Flow measurements at VT#2, near water quality station #10, do not have a downstream counterpoint of measurement to document rates of groundwater inflow in this most critical section of the reach, before water quality station #6. The velocity transect VT#3 at the mouth of the river failed when the lagoon closed and was not available during the time of greatest temperature variability. In addition, VT#3 was not hydraulically a good measuring point because of the upstream lagoon's non-linear storage characteristics

and the downstream variability in elevation of discharge at the ocean, which causes variations in surface water gradient.

g. **A longitudinal profile of the river channel.** Data are needed to document the relationship between ground water and surface water levels and the channel bottom. The hydrogeology report indicates that upstream of VT#2 the river is a losing reach and a gaining reach downstream of water quality station #9. Is this the result of a change in elevation of the river bottom? If so, is this caused by the change in direction of the channel from down the valley axis to across the valley, or is there a geologic barrier? It is important to know whether there is a natural change in channel gradient or a geologic barrier in the transition zone between the losing and gaining portions of the river.

h. **Review of historic aerial photos and topographic maps.** Figure 9-1 of the May 18, 2005 NRCE water use report shows the study area in 1929. A comparison of the 1929 river configuration to that of today (see attached Figure 6) clearly shows that today's sinuous channel next to the pumping wells was instead rather linear and a somewhat braided reach. This change in channel morphology may be an important feature in determining where to monitor, and may help explain the movement of ground water because the main channel of a river is often coarser grained than bank deposits and becomes a preferred flow path. Historic photos, aerial or ground based, would be a valuable source to document historic changes in channel morphology. Knowledge of any changes in the channel is critical in interpreting the existing data and in selecting monitoring points for the water rights permit. An effort should be make to collect and analyse these.

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Table 1
El Sur Ranch
Station #6 to #12 Temperature Differences of Plotted Data

18-Apr-04

L	M	R	Average	Range	Plotted - Ave	Plotted oF		Temp. Difference Going Upstream					
								6	7	8	9	10	11
55.76	55.58	55.58	55.64	0.18	-0.06	55.58	6	-	-	-	-	-	-
55.40	55.40	55.76	55.52	0.36	-0.12	55.40	7	-0.18	-	-	-	-	-
54.50	55.40	55.22	55.04	0.90	0.36	55.40	8	-0.18	0.00	-	-	-	-
55.04	55.04	55.04	55.04	0.00	0.00	55.04	9	-0.54	-0.36	-0.36	-	-	-
55.04	55.04	55.04	55.04	0.00	0.00	55.04	10	-0.54	-0.36	-0.36	0.00	-	-
54.86	54.86	55.04	54.92	0.18	-0.06	54.86	11	-0.72	-0.54	-0.54	-0.18	-0.18	-
54.68	54.68	54.68	54.68	0.00	0.00	54.68	12	-0.90	-0.72	-0.72	-0.36	-0.36	-0.18

23-Jul-04

L	M	R	Average	Range	Plotted - Ave	Plotted oF		Temp. Difference Going Upstream					
								6	7	8	9	10	11
66.72	66.97	67.33	67.01	0.61	-0.04	66.97	6	-	-	-	-	-	-
-	-	-	-	-	-	-	7	-	-	-	-	-	-
58.10	66.63	67.23	63.99	9.13	-5.89	58.10	8	-8.87	-	-	-	-	-
66.24	68.54	68.79	67.86	2.55	0.68	68.54	9	1.57	-	10.44	-	-	-
68.97	68.94	68.63	68.85	0.34	0.09	68.94	10	1.97	-	10.84	0.40	-	-
68.29	68.34	68.31	68.31	0.05	0.03	68.34	11	1.37	-	10.24	-0.20	-0.60	-
68.34	68.52	68.41	68.42	0.18	0.10	68.52	12	1.55	-	10.42	-0.02	-	0.18

6-Aug-04

L	M	R	Average	Range	Plotted - Ave	Plotted oF		Temp. Difference Going Upstream					
								6	7	8	9	10	11
63.37	62.04	62.06	62.49	1.33	-0.45	62.04	6	-	-	-	-	-	-
59.65	60.73	61.11	60.50	1.46	0.23	60.73	7	-1.31	-	-	-	-	-
60.35	61.72	61.65	61.24	1.37	-0.89	60.35	8	-1.69	-0.38	-	-	-	-
62.08	62.13	62.35	62.19	0.27	-0.06	62.13	9	0.09	1.40	1.78	-	-	-
61.79	61.70	61.79	61.76	0.09	-0.06	61.70	10	-0.34	0.97	1.35	-0.43	-	-
61.09	61.09	61.14	61.11	0.05	-0.02	61.09	11	-0.95	0.36	0.74	-1.04	-0.61	-
62.20	62.31	62.19	62.23	0.12	0.08	62.31	12	0.27	1.58	1.96	0.18	0.61	1.22

Red highlight values plotted on Figure 3-31

Table 1, cont'd

19-Aug-04

L	M	R	Average	Range	Plotted - Ave	Plotted oF		Temp. Difference Going Upstream					
								6	*7*	*8*	*9*	*10*	*11*
62.42	61.86	61.95	62.08	0.56	-0.22	61.86	*6*	-	-	-	-	-	-
59.74	60.78	61.84	60.79	2.10	-0.01	60.78	*7*	-1.08	-	-	-	-	-
58.10	60.87	59.90	58.74	4.79	-2.66	-	*8*	-	-	-	-	-	-
56.08	-	-	-	-	-	56.08	*8*	-5.78	-4.70	-	-	-	-
63.25	63.28	63.30	63.28	0.05	0.00	63.28	*9*	1.42	2.50	7.20	-	-	-
63.19	63.03	62.92	63.05	0.27	-0.02	63.03	*10*	1.17	2.25	6.95	-0.25	-	-
62.58	62.60	62.60	62.59	0.02	0.01	62.60	*11*	0.74	1.82	6.52	-0.68	-0.43	-
63.50	63.66	63.46	63.54	0.20	0.12	63.66	*12*	1.80	2.88	7.58	0.38	0.63	1.06

2-Sep-04

L	M	R	Average	Range	Plotted - Ave	Plotted oF		Temp. Difference Going Upstream					
								6	*7*	*8*	*9*	*10*	*11*
64.00	64.04	64.11	64.05	0.11	-0.01	64.04	*6*	-	-	-	-	-	-
60.04	57.87	58.53	58.81	2.17	-0.94	57.87	*7*	-6.17	-	-	-	-	-
56.03	57.54	57.56	57.04	1.53	-1.01	56.03	*8*	-8.01	-1.84	-	-	-	-
64.40	59.45	57.96	60.60	6.44	-1.15	59.45	*9*	-4.59	1.58	3.42	-	-	-
67.03	66.94	66.92	66.96	0.11	-0.02	66.94	*10*	2.90	9.07	10.91	7.49	-	-
67.46	67.33	67.19	67.33	0.27	0.00	67.33	*11*	3.29	9.46	11.30	7.88	0.39	-
67.73	67.95	67.77	67.82	0.22	0.13	67.95	*12*	3.91	10.08	11.92	8.50	1.01	0.62

15-Sep-04

L	M	R	Average	Range	Plotted - Ave	Plotted oF		Temp. Difference Going Upstream					
								6	*7*	*8*	*9*	*10*	*11*
63.09	63.79	64.53	63.80	1.44	-0.01	63.79	*6*	-	-	-	-	-	-
-	57.74	60.26	59.00	2.52	-1.26	57.74	*7*	-6.05	-	-	-	-	-
59.27	57.56	57.74	58.19	1.71	-2.41	55.78	*8*	-	-	-	-	-	-
55.78	56.30	55.67	55.92	0.63	-0.14	55.78	*8*	-8.01	-1.96	-			
64.06	62.47	62.22	62.92	1.84	-0.45	62.47	*9*	-1.32	6.69	6.69	-	-	-
65.77	65.73	65.73	65.74	0.04	-0.01	65.73	*10*	1.94	9.95	9.95	0.00	-	-
65.62	65.61	65.62	65.62	0.01	-0.01	65.61	*11*	1.82	9.83	9.83	-0.12	0.00	-
65.28	65.28	65.26	65.27	0.02	0.01	65.28	*12*	1.49	9.50	9.50	-0.45	-0.33	-0.33

Table 1, cont'd

30-Sep-04

L	M	R	Average	Range	Plotted - Ave	Plotted oF		Temp. Difference Going Upstream					
								6	7	8	9	10	11
59.81	60.15	60.76	60.24	0.95	-0.09	60.15	6	-	-	-	-	-	-
57.31	59.22	58.89	58.47	1.91	0.75	59.22	7	-0.93	-	-	-	-	-
56.75	58.10	58.39	57.75	1.64	-1.00	56.75	8	-3.40	-2.47	-	-	-	-
60.48	60.42	60.24	60.38	0.24	0.04	60.42	9	0.27	1.20	3.67	-	-	-
60.40	60.40	60.39	60.40	0.01	0.00	60.40	10	0.25	1.18	3.65	-0.02	-	-
60.42	60.44	60.42	60.43	0.02	0.01	60.44	11	0.29	1.22	3.69	0.02	0.04	-
60.51	60.53	60.51	60.52	0.02	0.01	60.53	12	0.38	1.31	3.78	0.11	0.13	0.09

15-Oct-04

L	M	R	Average	Range	Plotted - Ave	Plotted oF		Temp. Difference Going Upstream					
								6	7	8	9	10	11
56.53	56.57	56.55	56.55	0.04	0.02	56.57	6	-	-	-	-	-	-
56.19	56.57	56.68	56.48	0.49	0.09	56.57	7	0.00	-	-	-	-	-
55.72	56.68	56.68	56.36	0.96	-0.64	55.72	8	-0.85	-0.85	-	-	-	-
56.97	56.82	56.77	56.85	0.20	-0.03	56.82	9	0.25	0.25	1.10	-	-	-
56.55	56.52	56.52	56.53	0.03	-0.01	56.52	10	-0.05	-0.05	0.80	-0.30	-	-
56.39	56.39	56.37	56.38	0.02	0.01	56.39	11	-0.18	-0.18	0.67	-0.43	-0.13	-
56.39	56.43	56.48	56.43	0.09	0.00	56.43	12	-0.14	-0.14	0.71	-0.39	-0.09	0.04

29-Oct-04

L	M	R	Average	Range	Plotted - Ave	Plotted oF		Temp. Difference Going Upstream					
								6	7	8	9	10	11
-	-	-	-	-	-	-	6	-	-	-	-	-	-
51.69	51.46	51.51	51.55	0.23	-0.09	51.46	7	-	-	-	-	-	-
51.69	51.55	51.49	51.58	0.20	-0.03	51.55	8	-	0.09	-	-	-	-
51.37	51.33	51.35	51.35	0.04	-0.02	51.33	9	-	-0.13	-0.22	-	-	-
51.26	51.28	51.33	51.29	0.07	-0.01	51.28	10	-	-0.18	-0.27	-0.05	-	-
51.21	51.21	51.21	51.21	0.00	0.00	51.21	11	-	-0.25	-0.34	-0.12	-0.07	-
-	-	-	-	-	-	-	12	-	-	-	-	-	-

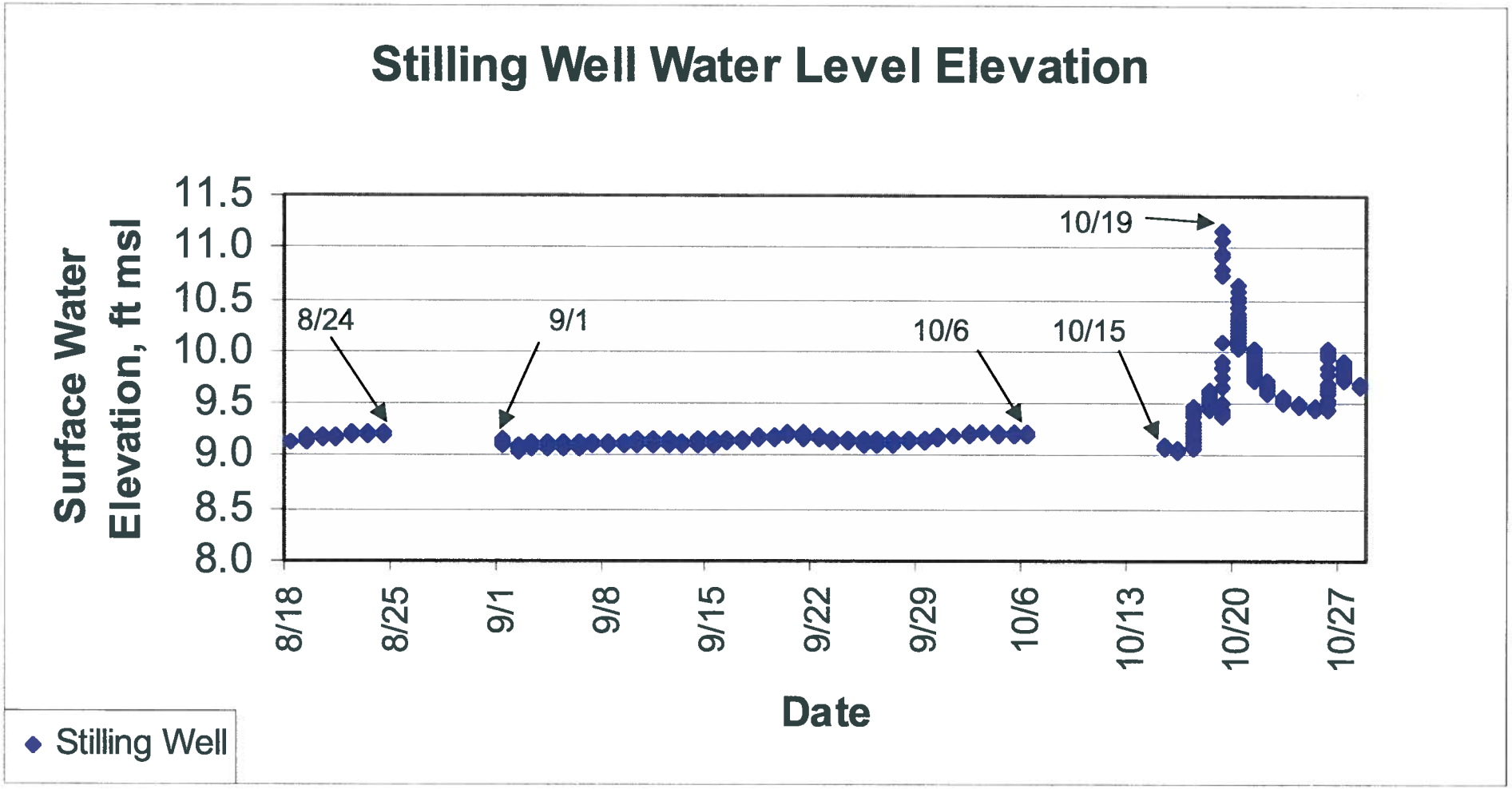

Stilling Well Water Level Elevation
Surface Water Elevation, ft msl
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
8/24
9/1
10/6
10/15
10/19
8/18
8/25
9/1
9/8
9/15
9/22
9/29
10/6
10/13
10/20
10/27
Date
Stilling Well

Figure 1

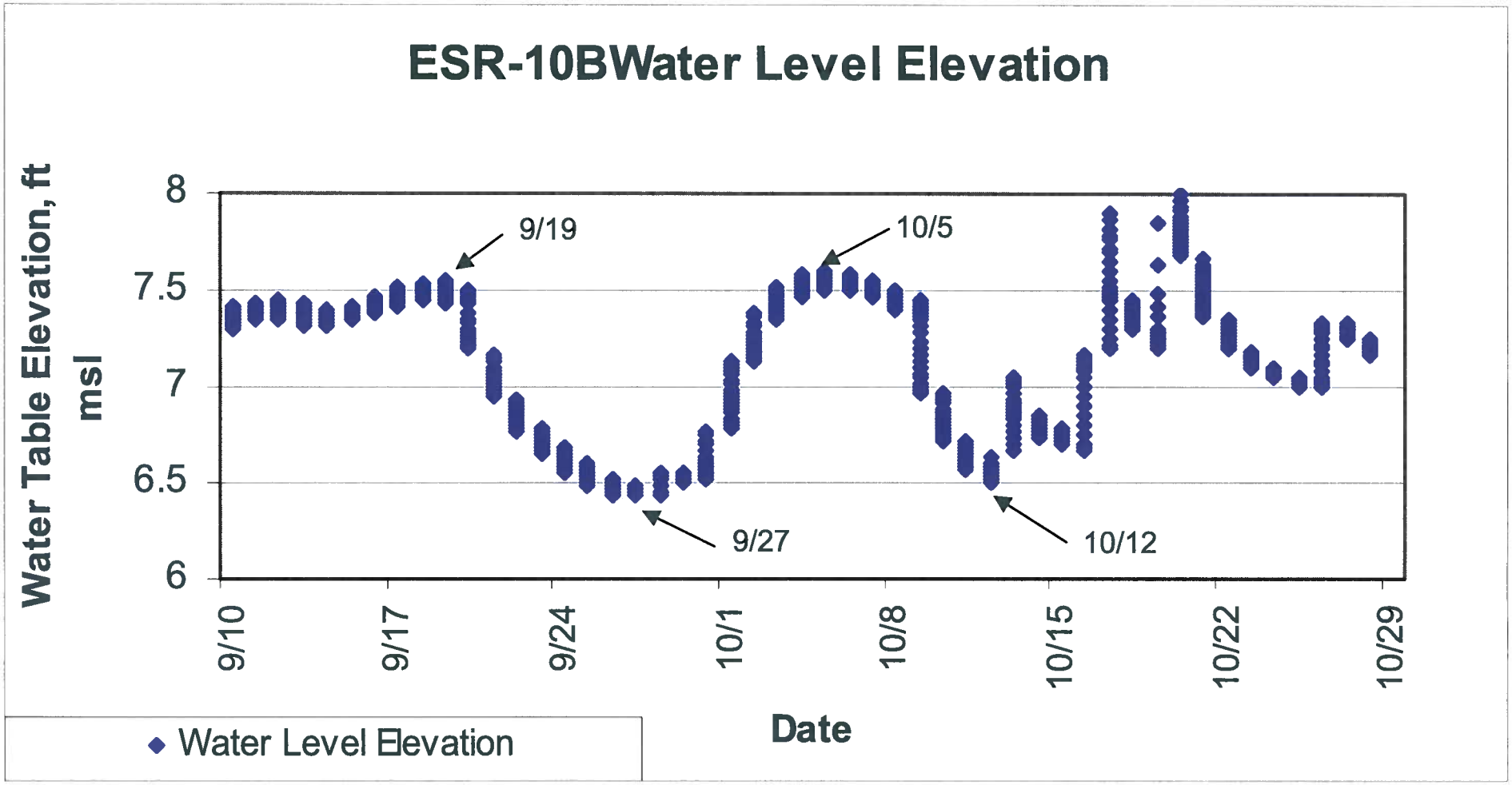

ESR-10BWater Level Elevation
Water Table Elevation, ft msl
8
7.5
7
6.5
6
9/19
10/5
9/27
10/12
9/10
9/17
9/24
10/1
10/8
10/15
10/22
10/29
Date
Water Level Elevation

Figure 2

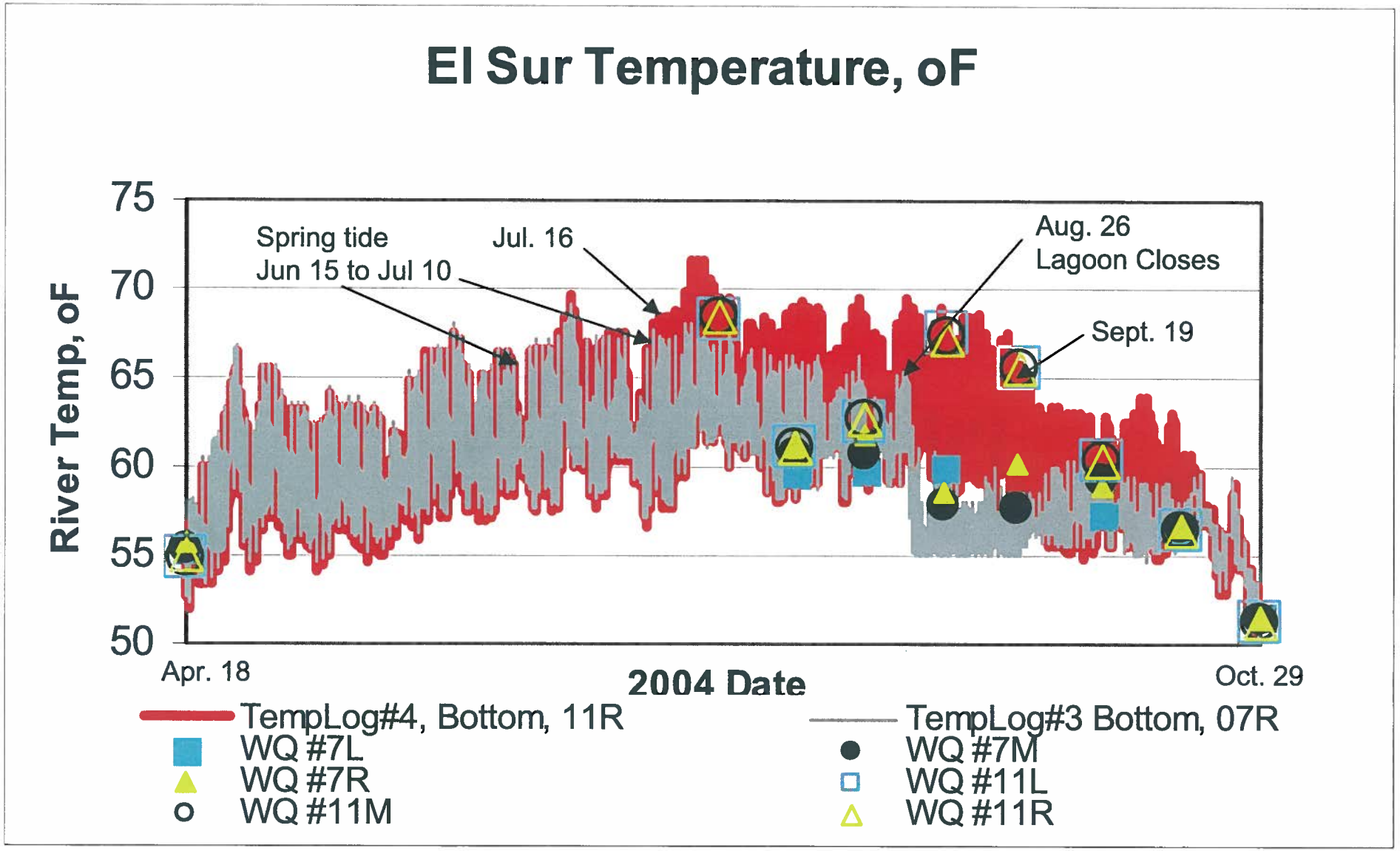
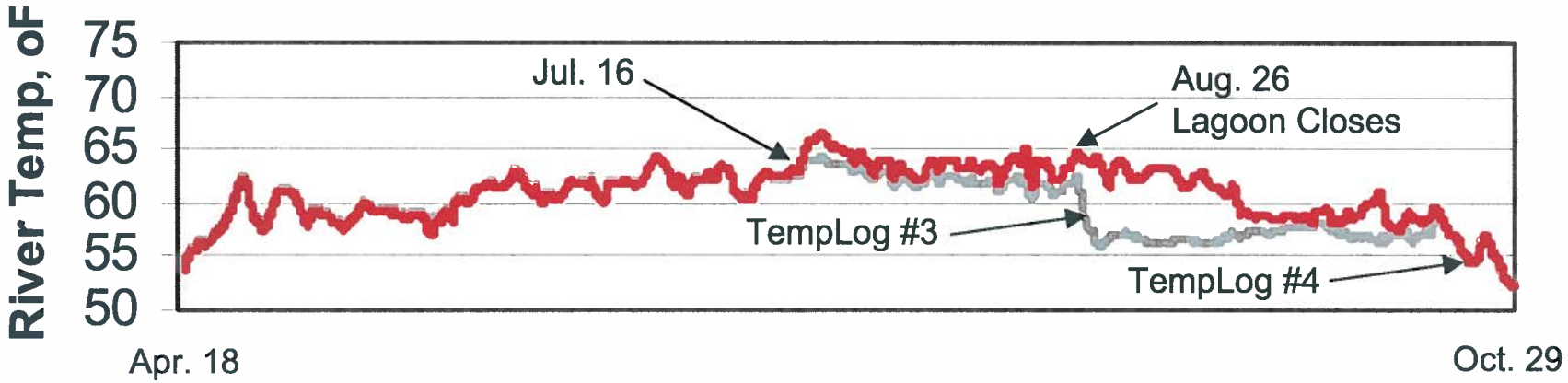

El Sur Temperature, oF
River Temp, oF
75
70
65
60
55
50
Spring tide
Jun 15 to Jul 10
Jul. 16
Aug. 26
Lagoon Closes
Sept. 19
Apr. 18
2004 Date
Oct. 29
TempLog#4, Bottom, 11R
TempLog#3 Bottom, 07R
WQ #7L
WQ #7R
WQ #11M
WQ #7M
WQ #11L
WQ #11R

Figure 3

El Sur Temperature, °F
24-Pt Running Average



2004 Date

Figure 4

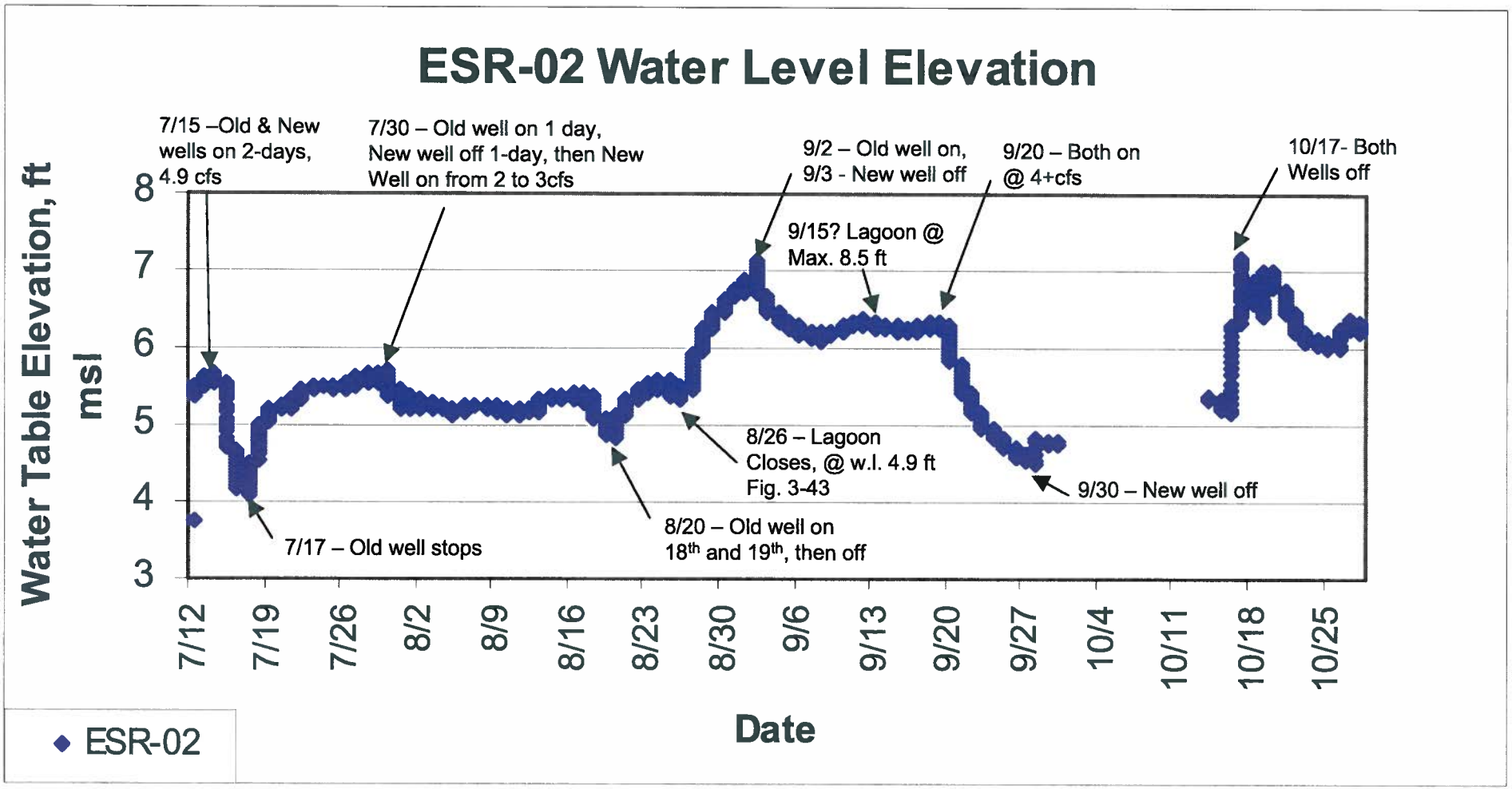
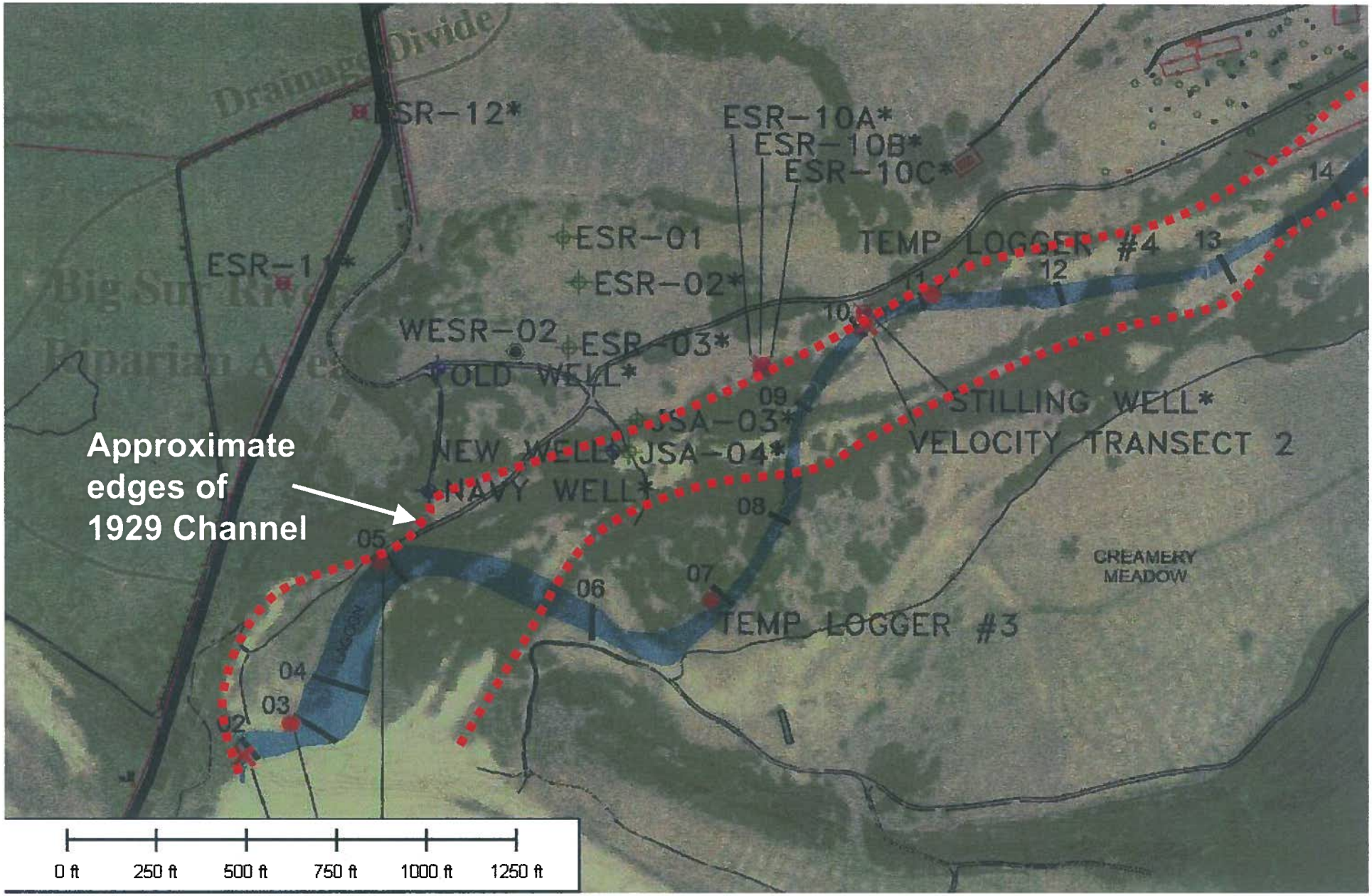

ESR-02 Water Level Elevation
7/15 –Old & New wells on 2-days, 4.9 cfs
7/30 – Old well on 1 day, New well off 1-day, then New Well on from 2 to 3cfs
9/2 – Old well on, 9/3 - New well off
9/20 – Both on @ 4+cfs
10/17- Both Wells off
9/15? Lagoon @ Max. 8.5 ft
8/26 – Lagoon Closes, @ w.l. 4.9 ft Fig. 3-43
9/30 – New well off
7/17 – Old well stops
8/20 – Old well on 18th and 19th, then off
Water Table Elevation, ft msl
8
7
6
5
4
3
7/12
7/19
7/26
8/2
8/9
8/16
8/23
8/30
9/6
9/13
9/20
9/27
10/4
10/11
10/18
10/25
Date
ESR-02

Figure 5



El Sur Ranch wells, closeup of 2004 channel overlayed on to 1929 image

Figure 6

State of California

M e m o r a n d u m

To: Ms. Victoria Whitney, Chief
State Water Resources Control Board
Division of Water Rights
Post Office Box 2000
Sacramento, CA 95812

Attention Mr. Paul Murphey
Project Manager

Date: June 30, 2006

From: Robert W. Floerke, Regional Manager ***COPY – Original signed by Cindy Catalano for***
Department of Fish and Game - Central Coast Region, Post Office Box 47, Yountville, California 94599

Subject: Water Right Application No. 30166, El Sur Ranch, Monterey County - Notice of Preparation, Draft Environmental Impact Report (DEIR), SCH# 2006061011

Department of Fish and Game (DFG) has reviewed the Initial Study (IS) prepared by the State Water Resources Control Board (SWRCB) regarding Water Right Application (WA) No. 30166 for the El Sur Ranch (ESR), Monterey County, California. DFG is a Trustee Agency and potentially a Responsible Agency pursuant to CEQA, and as such, we offer the following comments on the proposed project as it relates to fish and wildlife resources of interest to DFG.

The project proposes to divert on a year-round basis, with a maximum direct diversion quantity of 1,615 acre-feet per annum (afa), with a twenty-year rolling average not to exceed 1,200 afa, from two wells near the mouth of the Big Sur River for irrigating 267 acres of pasture land out of a 292-acre place of use. The rate of diversion is proposed as a maximum instantaneous rate of 5.84 cubic-feet per second (cfs) with a running 30 day diversion average rate of 5.34 cfs

DFG has already provided comments, dated November 6, 2002, to the SWRCB regarding the issuance of a previous Notice of Preparation (NOP) for this project application (attached). The previous project was substantially the same (proposing instead to divert 1,800 afa for the irrigation of 292 acres of land as the currently proposed project. Therefore, our concerns remain the same and our previous comments are incorporated by reference.

In addition to concerns which we expressed in response to the previous NOP, as summarized below in Section 1, we have additional concerns based on review of the IS which was released with this NOP. First, the project description as provided in the IS does not entirely address the scope of the proposed project. Second, we are very concerned that the SWRCB has utilized assumptions contained in the ESR 2005 Technical Reports submitted by the applicant, rather than conclusions supported by data, to assess impacts and to support potential mitigation measures in the IS. DFG has provided recommendations for information needed to fully understand the impacts of the

proposed diversion and to identify appropriate and meaningful mitigation measures. Third, we remain concerned about the CEQA baseline which the SWRCB has assumed for this project as stated in the IS. Detailed comments can be found in Section 2 below.

Section 1: Summary of Previously Stated Concerns

As a result of issuance of a NOP in 2002, DFG provided a detailed response identifying our concerns regarding the proposed project and information needed to adequately assess impacts and identify appropriate mitigation measures. We have attached our previous letter to the SWRCB, dated November 6, 2002.

In May 2004, ESR proposed to conduct an "Interim Monitoring Plan" to study instream impacts from the diversion. At that time, SWRCB requested DFG to review the plan and to provide comments on whether the proposed study would provide the information necessary to adequately assess the instream effects of pumping on the Big Sur River. DFG provided comments to the SWRCB in a memo dated July 9, 2006, requesting specific modifications to the plan; the study moved forward without the requested modifications resulting in significant and predicted data gaps. The completed fisheries study, provided by the applicant in May 2005, and referred to as the biological section of the ESR 2005 Technical Reports, was deficient in information needed to fully identify potential effects of pumping on instream conditions.

DFG provided comments to the SWRCB regarding all three sections of the ESR 2005 Technical Reports in a memo dated September 16, 2005 (attached). DFG also contracted for additional technical review of the hydrogeologic section and when those comments were provided to DFG in a memo dated December 16, 2005, we transmitted them to the SWRCB on December 22, 2005, with a summary memo.

We have attached the five referenced memos and request that these previous comments also be incorporated into this response to the current NOP. In addition, we would like to reiterate the previously identified twelve areas of interest that should be addressed as part of an EIR for the proposed project. Briefly, those are:

1. The status of sensitive resources known to occur in the vicinity of the diversion, including seven sensitive species (three Federally listed) and one sensitive natural community.

2. Whether the proposed diversion would have significant impacts on the sensitive resources at the diversion site, and measures identified which would avoid or minimize impacts to public trust resources.

3. The status of sensitive resources potentially occurring at the place of use of the diverted water, including ten sensitive species (four State or Federally listed) and one sensitive natural community.

4. Potential impacts to the place of use from the application of 1,615 af of water, such as acceleration of seabluff retreat and coastal erosion, increased runoff that can lead to erosion and sedimentation, alteration of habitats, and decline of associated species.

5. Whether the proposed project would have significant impacts on the sensitive resources at the place of use, and measures identified which would avoid or minimize impacts to public trust resources.

Additionally, we requested specific information to address the effect that the proposed diversion would have on the flows of the Big Sur River, and resources supported by those flows, including:

6. A water availability analysis, including a water budget which would address water availability and water consumption in the watershed, and propose defensible flow reservations for the various trust resources dependent on the riverine environment. The water analysis should be stratified by five water year types (Wet, Above Normal, Median/Average, Below Normal/Dry and Critically Dry); and segregated base on 20 percent-40 percent-60 percent-80 percent exceedence flows.

7. A fisheries flow analysis, acceptable to DFG and the National Marine Fisheries Service, to be conducted in order to define flows necessary to support public trust resources.

8. Analysis addressing the effects the diversion has on water temperature, riparian health and canopy, salinity, and other water quality parameters which may be influenced by the diversion.

In addition, this request for water diversion appears to be far in excess of that which is considered a beneficial use, potentially constituting waste (which is prohibited by California law); that the request was far in excess of the historic (and unpermitted) use of the wells; and that the request may not be consistent with Conservation Easements and/or conveyance documents for the property. We asked that the SWRCB determine both the appropriate level of such a request and establish a baseline so that impacts of the proposed diversion could be evaluated. Toward this end, we requested information to establish historic use and baseline:

9. Information needed to establish baseline use should include data such as parcel and water right conveyances, easements, well logs, water meters, or electrical bills demonstrating water use, or other information that would clarify historic use and basis for any riparian rights.

10. Consistency with the terms and conditions of any conservation easement placed over the ESR lands; and terms and conditions which may have been placed at the

time of conveyance of Department of Parks and Recreation (DPR) lands from Frances Molera to The Nature Conservancy and from The Nature Conservancy to DPR.

11. Full disclosure of the location of all water use, including whether any portion of this will require an out-of-basin transfer.

12. Identification of any portion of the proposed place of use which is subject to an existing riparian right.

We believe the twelve areas to be pertinent to the currently proposed project, and request that these issues be addressed in the DEIR.

After review of the ESR Technical Reports provided by the applicant, we believe them to be only partially responsive to 5 of the 12 areas of interest we have identified. The ESR Technical Reports include significant data gaps and we believe that some of the conclusions presented in the ESR Reports are not supported by data. We also do not believe that a previous submittal by the applicant, a 1999 report by Jones & Stokes Associates, can be relied upon to support impact analysis and/or identification of appropriate mitigation measures for this project. Comments related to DFG review of these documents are attached.

Section 2: Comments Based on Review of the IS Released with the NOP

Comments Concerning the Project Description

The diversion proposed for this project may significantly affect the quantity and quality of water in the Big Sur River, including subterranean flows, and impact resources that are dependent on the riverine environment. In addition, place of use impacts on, and adjacent to, the lands being flood irrigated must be evaluated. To allow this to occur there first must be an adequate project description. The project has been revised but the description and environmental setting in the IS does not provided a clear description of the activities proposed to allow adequate information to be used in our review. DFG requests that the following information be included in the DEIR:

Without a clear description of where water is being applied, it is impossible to assess potential impacts to the irrigated pasture land, Swiss Gulch, the unnamed tributary, and other areas that may be disclosed to be sensitive. DFG requests full disclosure of the location of all water use and suggests that inclusion of a map providing the following information would help clarify the text description.

- The total acreage of the parcel(s) within the project area.

- The acreage of land being flood irrigated within each pasture block . (It is assumed that it is less than the total acreage of the parcels. However, the map provided in the

IS appears to show the entire parcel(s) as the place of use for flood irrigation including watercourses, riparian areas and dunes. If this is the case, then additional biological impacts associated with flood irrigation of these areas would need to be disclosed. If they are not intended for irrigation, the size of the Place of Use should be adjusted accordingly.)

- The acreage of land within the land parcel(s) that is not being flood irrigated (for example the acreage of: 1) The Swiss Gulch watershed; 2) the watershed of the unnamed tributary to the Pacific Ocean; 3) the tailwater pond; 4) the sea bluff and sand dune area; and 5) the berms between the pastures).

- A clear delineation of the acreage of lands receiving water under the riparian claim and lands which will receive water under this water application. The SWRCB previously determined that the riparian area within the land parcel(s) was 90 acres but the revised application has reduced the area to 25 acres. Clear mapping which identifies pertinent watershed boundaries will clarify this discrepancy.

The project described should be the whole of the action. In this case, water to serve riparian lands, while not subject to the water right application, is being diverted to serve the place of use from the same set of wells. Disclosure of all water to be diverted from the wells is necessary to allow adequate assessment of the full potential impacts of this project.

The project description discloses that water used to flood irrigate the upper border strips flows to lower ones, but it does not disclose where the water from the lower border strips flows. The DEIR should disclose how and where the tailwater discharges from the site. The IS also does not disclose sufficient information about the existing tailwater pond. This pond and how it functions should be fully described. This allows disclosure of any impacts to water quality or to the cliffs due to release of tailwater from that pond. This disclosure is necessary to understand and assess any potential erosion problems and determine appropriate erosion control measures.

The IS discloses that the pastures are annually fertilized but did not elaborate on how this was done, what types of chemicals were used, and what methods were used to ensure that these chemicals are not being discharged in tailwater to waters of the State. This information should be included in the DEIR.

The ESR project wells are clearly described, but the IS states that the New Well was not intended to significantly increase pumping, water use, or to be used to irrigate lands in addition to the Place of Use. However, there is no information provided that the “old well” once pumped at the combined rate of the both wells (as described on Page 2-7 of the IS). As presented, it appears that the use of both wells at maximum capacity now exceeds the historical pumping rate and that the use of the “new well” now allows pumping during the lowest flow season when salt water intrusion would have curtailed pumping at the old well.

If there is to be a claim that these two wells have not increased the pumping/water use or extended the season of pumping, the validation of those claims needs to be included in the DEIR (see also our comments below on CEQA baseline).

In addition, the historical (and current) use of water is limited to the period of April 15 to October 15; a request to divert out of the river year-round constitutes a new period of use (October 16 to April 14) with its own set of potential impacts. Winter drought exacerbated by diversion has the potential for numerous adverse effects. In a dry year, diversion during the period of October to April can be detrimental to fish passage; it is also the season for root growth for many plants in this system. The DEIR should address impacts of a project which would divert year-round, addressing the season of diversion in conjunction with quantity of diversion. Winter diversions should not be considered a less than significant impact unless data supports that conclusion.

The IS mentions but does not adequately describe the other wells in the well field. If information regarding these wells are to be used in further analysis or discussions within the DEIR, which we recommend, then their characteristics also need to be included in the Project Description. The effects of pumping from all wells should be included in a discussion of cumulative effects.

Comments Concerning Information to be Collected for the DEIR

General Comments

We recommend that the SWRCB; 1) Identify information needed to support the impact analysis and identification of appropriate mitigation measures; 2) identify information gaps; and 3) then collect or contract to collect the information needed. We are very concerned that the SWRCB retain control over the type and scope of information needed, in consultation with the applicant, the trustee and responsible agencies, and in consideration of public input. We are concerned that information which has been previously provided directly by the applicant may not meet the needs of the CEQA process. This results in delays that benefit neither the applicant nor the permitting process.

Our previous experience with the “Interim Monitoring Plan” indicates that recommended information was not collected by the applicant, in spite of review and comment by DFG as to how the work plan could be revised to meet our needs. Instead, considerable time and effort was spent by the applicant on a study which had predictable data gaps and which addressed issues which were outside the proposed and reviewed scope of work. We are very concerned that the SWRCB has utilized unsupported assumptions contained in the ESR Technical Reports for impact assessment, as well as to formulate potential mitigation measures. This only serves to obfuscate the issues and delay the process.

Comments on Hydrogeolgical Issues

We have provided an analysis of the utility of the ESR hydrogeological information, as well as recommendations for additional specific information that we believe are necessary to quantify potential impacts from the proposed water diversion, in the attached memo from Mr. Kit Custis, June 28, 2006. We recommend that the SWRCB provide the necessary oversight, with the input of the Trustee and Responsible agencies, to insure that the scope of work and data collected will meet our collective needs and expedite completion of the CEQA process.

In summary, Mr. Custis' memo identifies gaps in the hydrogeologic and hydrology data, and recommends specific information be collected and analyzed in order to determine impacts, the available waters, and to assist in selection of type, location and timing for monitoring water quality, quantity and flow data. The specific recommendations are related to the need for: 1) Ground water and surface water hydraulic head data along both sides of the river; 2) hydraulic conductivity data on the streambed; 3) information concerning the quantity of ground water upwelling into the river; 4) the influence of saltwater influx on upwelling ground water; 5) water level and water quality data for ground water outside the pumping well field; 6) data on the changes in surface water flow rates from water quality stations #6 to #12; 7) a longitudinal profile of the river channel; and 8) a review of historic aerial photos and topographic maps to assess changes in channel morphology and its relationship to the movement of groundwater. Please see the attached memo, dated June 28, 2006, for more detail.

Comments on Water Availability Analysis

Water Code requires that water be available for diversion. However, a comparison of water to be diverted to water available on a mean annual basis is an insufficient approach for the analysis required to provide protection of the public trust. Diversion for crop irrigation is likely to be highest when the stream flows are lowest. Therefore, the analysis must address seasonal water availability and water consumption in the watershed, and include defensible seasonal flow reservations (protective bypass flows) for the various trust resources dependent on the riverine environment.

DFG recommends that this analysis be done at least at the monthly level. An adequate analysis must consider both seasonal and year-type variation so any water analysis should also be linked to water-year type variation. DFG recommends that the information be stratified by five water year types (Wet, Above Normal, Median/Average, Below Normal/Dry and Critically Dry); and segregated base on 20 percent-40 percent-60 percent-80 percent exceedence flows.

Comments on the General Information Related to Water Flow Requirements

The seasonal flow reservations (protective bypass flows) should assure that both water quality and quantity to support sensitive life stages of aquatic resources are being bypassed. This can be accomplished with a fisheries flow analysis that is acceptable to

DFG and the National Marine Fisheries Service. It should be conducted to define flows necessary to provide passage, maintain habitat, and protect water quality during the entire diversion season (which has been requested to be altered from a historic April to October regime to a year-round diversion).

It appears from our review that the IS has repeated the assumption of the ESR Technical Reports that pumping has no affect on instream flows or water quality regardless of the pumping rate or natural flow condition. There is no data provided to support that conclusion. DFG has previously recommended that the effects of pumping and changes in those effects due to different pumping regimes (including having the pump off for a period that allows recovery) be addressed in a way that clearly distinguishes conditions due to pumping from those that naturally occur. Those comments can be found in correspondence provided to the SWRCB dated July 9, 2004, and September 16, 2005 (attached). They are incorporated by reference into this letter and are summarized below.

Comments Related to Impacts to Passage

The IS states that the ESR 2005 study "implied continuous habitat connectivity where no physical disruption in migration would have occurred." A stream can exhibit shallow connectivity without providing passage. Not enough information was provided in the ESR Report to support a claim that passage could occur during the summer rearing period nor did the Report make that assertion directly. Additional data will need to be provided to address this issue.

Additionally, diversion during the winter months should not be considered a de minimus impact since winter diversion for crop irrigation are likely linked to periods of low rainfall and corresponding low flow levels in the river. Low flows in the winter can affect species ability to migrate and any impacts must be disclosed and mitigated.

Comments Related to Impacts to Water Quality

Analysis should also address the effects of this diversion on water temperature, dissolved oxygen (DO), riparian health and canopy, salinity, and other water quality parameters which may be influenced by the diversion. An appropriate analysis of the quantity and quality of water remaining in the stream (as surface flow) after the proposed diversions (under both riparian and appropriative rights) is critical in assessing the type and magnitude of impacts to sensitive resources.

Additionally, the IS repeats the Technical Reports' claims that reduced dissolved oxygen levels appear to be unrelated to the project. Data was only collected when the pumps were operating so there is no data to support this claim or the additional claim that pumping actually reduces low levels of DO and improves water quality. Continuous DO monitoring and data collection during various pumping regimes is needed to support such claims and its collection was recommended to fill this data gap in our previous communications with ESR and the SWRCB.

Comments Related to the Impacts to Available Habitat.

Impacts of pumping on the availability of aquatic habitat have not yet been addressed. While a small change in stage height was reported during the 2004 study, an assessment of impacts to flows and, in turn, on available aquatic habitat is not available. Biological sample is reported to have only occurred when the pump was operational allowing no comparison between natural flow conditions and pumping periods. Data needs to be collected, analyzed and made available concerning impacts of pumping as compared with the natural condition to adequately assess pumping impacts to flow, availability of habitat at the stream margin, and water quality.

Comments Related to the Impacts due to the Excessive Application of Water

Department of Water Resources has compiled information intended for planning and determining irrigation efficiencies for various crops in different hydrographic areas. A clear project description, including the acerage that will actually be irrigated, will provide a basis for comparison of the requested water use of this project to that being used in other similar projects in the same hydrographic areas. This information should be made available in the DEIR.

Our agency continues to maintain that even the estimated six af per acre is far in excess of that necessary for the proposed beneficial use of pasture irrigation and may constitute waste, unreasonable use, or unreasonable method of use. This has the potentially to be particularly egregious in the winter if irrigation were to be applied as suggested with a year-round request for diversion. Excessive application has the potential for a range of adverse biological effects. These potentially significant effects result from the fact that: 1) Irrigation water applied under appropriative rights for this project moves diverted water out of the basin (since excess tail water flows to the ocean or into other watercourses), which does not allow excess water to flow back to the Big Sur River to support resources there; and 2) excess water application and the resulting run off threatens adverse water quality and erosional impacts to the seas cliffs and watercourses within, and outside, the project area where tailwater is being released.

Although the IS proposed erosion control measures to mitigate for any excessive runoff of tail water, DFG recommends avoiding this impact by requiring the application of the appropriate amount of water as the superior mitigation in terms of resource protection.

Comments Concerning the CEQA Baseline

The IS details the information that the SWRCB used to determine the CEQA baseline for this project, which is “the point above which the project’s contributory impacts are evaluated.” We are concerned about several aspects of the determination of the baseline, but in particular, we are very concerned that the SWRCB has used a period of unpermitted use to set the baseline. The New Well was constructed and put into use without either a permit or review under CEQA, after dates which are used to define an

"ongoing project" exempt from CEQA (PRC 21169; CEQA Guidelines 15261). Failure to get a water right further excludes the new well as an exempted project since they must be "otherwise legal and valid" (PRC 21169). The new well served to increase the amount of water diverted over and above that of the old well, which could be regarded as "pre-CEQA," but nonetheless, was still operating without a valid water right.

As stated in the IS, the period selected for establishing the pumping baseline does not capture the years of lowest water use. As such, it sets a higher baseline, decreasing the level of impacts which are being evaluated, as well as the level of impacts which would need to be mitigated to protect public trust.

In addition, the historical use of water is during the period of April 15 to October 15; a request to divert out of the river year-round constitutes a new period of use (October 16 to April 14). We believe that the season of use is also pertinent to designation of the baseline, in addition to the overall volume of water, and both should be analyzed regarding impacts which have the potential to occur with year-round diversion.

DFG has provided the SWRCB with specific comments regarding informational needs in previous correspondence; we suggest that these and other documents pertinent to this project's impacts be made available for public review on the SWRCB website.

Thank you for the opportunity to provide you with our concerns regarding this project. Should you have questions regarding our comments, please contact Ms. Linda Hanson, Staff Environmental Scientist, at (707) 944-5562; or Ms. Deborah Hillyard, Staff Environmental Scientist, at (805) 772-4318.

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e⊠: w/Custis Memorandum only
Hillyard, Urquhart, Wilcox, Hanson, Hill, – CCR
Robert Titus, Headquarters

LH/DH/pm

Attachments:

- Memo to DFG from Mr. Kit Custis, June 28, 2006
- Memo to SWRCB from DFG, December 22, 2005
- Memo to DFG from Mr. Kit Custis, December 16, 2005
- Memo to SWRCB from DFG, September 16, 2005
- Memo to SWRCB from DFG, July 9, 2004
- Memo to SWRCB from DFG, April 21, 2003
- Memo to SWRCB from DFG, November 6, 2002

State of California
Department of Fish and Game

Flex your POWER

Memorandum

To: Victoria Whitney, Chief
Division of Water Rights
State Water Resources Control Board
Post Office Box 2000
Sacramento, California 95812-2000

Date: November 15, 2007

Attention: Paul Murphey, Project Manager

From: W. E. Loudermilk, Regional Manager WEL
Department of Fish and Game – Central Region

Subject: Response to the State Water Resources Control Board Request for Review of and Comments on the Technical Memorandum "Draft CEQA Project Description and Baseline Discussion for Possible Use in the Upcoming EIR for Water Right Application A030166," dated August 24, 2007

Staff of the Department of Fish and Game (Department) have reviewed the Technical Memorandum "Draft CEQA Project Description and Baseline Discussion for Possible Use in the Upcoming EIR for Water Right Application A030166," dated August 24, 2007. The Technical Memorandum (Tech Memo) was provided to the Department via email from the State Water Resources Control Board (SWRCB) on September 11, 2007. The header on the Tech Memo indicates that it was prepared by the SWRCB Environmental Impact Report (EIR) consultants, PBS&J/EIP. It is self-described as likely to be used in a Draft EIR under preparation associated with a pending appropriative Right Application. We appreciate this opportunity to provide this early input on your CEQA compliance associated with the Big Sur River.

We offer early input on 1) the organization of the Tech Memo, as it relates to the development of a Draft EIR; 2) the content of the Tech Memo, as it relates to a Draft EIR; and 3) the use of information to support the content of the Tech Memo, particularly as it relates to use of information in the Tech Memo for development of key portions of a Draft EIR. In addition, 4) we have difficulty with the rationale for the CEQA baseline proposed by the SWRCB in this Tech Memo, and offer suggestions for an alternate basis for a CEQA baseline and/or approach to better address public trust resource with modifications of the natural flow. We also provide 5) a discussion of reasonable use; and input on 6) the need for other permits. We are also including comments related to 7) the need for additional studies and 8) project alternatives, as requested by the SWRCB at our meeting with the California Department of Parks and Recreation (DPR) on September 18, 2007.

Additionally, SWRCB staff met with our hydrogeological consultant, Kit Custis, on October 31, 2007. Comments he provided at that meeting are not included in this memorandum due to the timing of that meeting, but please consider his input as a component of the Department's early input.

Again, thank you for this opportunity to provide early input in the form of comments on the Tech Memo. I have recently designated Julie Means, Senior Environmental Scientist, as our liaison regarding this water right process. She can be reached at (559) 243-4107, extension 240. In recognition of our recent reorganization, it would be most helpful to you, the applicant and the Department if all formal coordination and correspondence on this Water Right application from this date forward be directed through Ms. Means in our Fresno office. She will help assure the internal coordination with appropriate technical staff and serve as Department staff liaison as you proceed with your process on this important application on the Big Sur River.

Attachment

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Ms. Julie Means, R4
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Ms. Patricia Anderson, R4
Ms. Deborah Hillyard, R4

Department of Fish & Game (Department) early input on Technical Memorandum "Draft CEQA Project Description and Baseline Discussion for Possible Use in the Upcoming EIR for Water Right Application A030166", dated August 24, 2007, and provided to the Department via email from the State Water Resources Control Board (SWRCB) on September 11, 2007. The Tech Memo was prepared by the SWRCB EIR consultants, PBS&J/EIP and is self-described as likely to be used in the Draft EIR under preparation

1. Memo Organization

The Tech Memo could be significantly improved, and provide better support for the EIR, if it were modestly reorganized. As drafted, the overall organization of this tech memo may unintentionally confuse or mislead a reader. Suppositions, assumptions, or conclusions in dispute should not be included in the Project Description. Instead it should focus on clearly describing the project proposed, including the place of use, purpose of use, and points of diversion rather than including analysis of potential impacts. Also all references to the water source should be described as subterranean flow ("underflow") rather than groundwater.

Overall, we suggest the document structure may be more useful if it includes the "Introduction and Project Overview" including Table X-1, immediately followed by the "California Water Rights and Water Right Process"; and then the "Project Description" and "Project Objectives", currently found on page X-14 of the Tech Memo. The sections on "Project Site and Environmental Setting", "Project Location", "Place of Use" and "Points of Diversion" could follow logically as elaborations on the project description. The "Place of Use" description on page X-15 appears to be redundant with portions of the "Place of Use" on page X-4; the two could perhaps be combined and edited for content.

The Section on "Project Background" could include everything in that section beginning on page X-8, through the end of "Previous Technical Studies" ending mid-page X-14. The four paragraphs on page X-9 appear to be the "El Sur Ranch Well History" (rather than Water History) and the remainder of that section, including all of page X-10 and the first partial paragraph of page X-11 could be labeled as "Complaint History".

The Sections which currently begin on pages X-16 and extending through the first half of page X-24, titled "Assumptions Used to Develop Numerical Diversion and Rate Limits"; as well as "Irrigation Operating Practices and Historical Diversions" from page X-8, and the accompanying Table X-2, on page X-7; and portions of the "Land Use" section on page X-8, appear to be information provided by the applicant in support of their requested appropriation. We believe these should be removed from the project description. If used elsewhere in the document they should be renamed, perhaps with the title of "Rationale Provided in the Application to Support Requested Diversion;" and

the introductory paragraph should clearly define the source information. Further, it is unclear to us if inherent assumptions have been made and/or will be utilized by the SWRCB in evaluating the proposed project and/or to support your CEQA analysis. It is not clear how this section would be of use in the upcoming Draft EIR. See our specific comments below, regarding the content of these sections, to better understand the reasons why we believe that the SWRCB would be better served by more fully developing and clarifying your assumptions to evaluate the proposed project.

The final section could be the "CEQA Project Baseline and the Proposed Diversions"; see below for our discussion of the content of that section.

2. Specific Comments on the Project Description and Background

The Introduction states: "*Also included in this chapter is information from technical investigations that were prepared to identify project baseline conditions and to support the appropriation requested in the water right application.*" We would like to clarify that studies that are summarized in the Tech Memo, primarily in the sections titled "Previous Technical Studies" and "Assumptions Used to Develop Numerical Diversion and Rate Limits" were not designed to identify project baseline; and, in our view, do not adequately define project baseline conditions. As stated in the "Previous Technical Studies" section of the Tech Memo, the studies were implemented by the El Sur Ranch to examine the various issues central to the Protests. DFG has provided comments directly to ESR and the SWRCB that question the stated conclusions of these studies based on the data collected. We encourage resolution of these issues preceding the definition of CEQA project baseline to avoid challenges later.

Throughout the Project Description, the Tech Memo states that the Ranch "...*seeks to continue existing, historic (sic) direct diversions from the subterranean flow of the lower Big Sur River...*"; "*the applicant would like to ensure the "...continuation of historic (sic) land uses...*"; and that the objective of the proposed project is to "*...authorize the historical use of water on the El Sur Ranch...*". Referring to the request as a continuation of an historical use is misleading in several ways. First, the application proposes to divert water year-round, and the historical use is primarily April through October. Second, the application asks to divert up to 1,615 acre feet per year, with a "20-year rolling average" of 1,200 acre feet per year; yet the historical diversion average was 857 or 937 acre feet per year, depending on whether a 20- or 30-year average is utilized. As a result, the project description and subsequent analyses in the Draft EIR should delete references to the application as a request for "historical" use. It should articulate the amounts and timing of historical uses being requested to be redefined and authorize, as Appropriative, and define the additional use as such.

Typically, the "Project Description" portion of a CEQA document is a short summary of the request that the applicant has made. Table X-1 summarizes their request, and should be labeled as "Summary of Diversion Limits, Rates, and Operating Practices for

El Sur Ranch ***Proposed Under*** Water Right Application A030166" (emphasis added). The remainder of the project description should be edited to clearly indicate that the proposed elements are part of the applicant's request. It would be preferable to remove the discussion of rationale for the requested amounts from this section, and if relocated elsewhere, to include with it a clarification of alternative beneficial water duty assessment made by the Department of Water Resources for this type of water use in this area so that adequate comparisons can be made.

The "Project Location" should include more information about the El Sur Ranch (ESR), which is incorrectly characterized as consisting of 292 acres. A clear distinction between the Project location and place of use is important. The Ranch is in actuality thousands of acres (elsewhere identified as "the largest of the remaining working cattle ranches that once existed on the coast between San Simeon and Monterey"); and includes portions of the watersheds of both the Little Sur and Big Sur Rivers. The second paragraph in the "Project Location" should be expanded to summarize information on the "Place of Use" (POU), and should be included in the section on the "Project Site and Environmental Setting", rather than its current location.

The POU should more clearly be identified as the actual location and number of acres which are to be irrigated under the appropriative right requested, which does not include the 25 acres attributed to that acreage subject to a riparian right. The 25 acres that are to be irrigated under riparian claim should be characterized as irrigated "subject to a riparian right" so as not to confuse that portion of the irrigated fields with those portions of the "Points of Diversion" (POD) and POU which consist of riparian vegetation. The effects of diversions for irrigation of acreage under riparian claim should be considered cumulatively with the effects of diversion made subject to the proposed appropriative right, and the description of the POU for the appropriative right should not include lands to be irrigated under the riparian claim unless a rationale is included for its inclusion. In addition, it should be clearly stated that the 267 acres (or the number of acres that the POU that the SWRCB determines would actually be irrigated by the requested appropriation) does not include Swiss Canyon, the tailwater pond, the dunes, or any other such features not requiring irrigation as may be generally between Highway 1, the Pacific Ocean, an unnamed creek and Andrew Molera State Park, the location described in the Tech Memo. A list of the acreage of each pasture unit, accompanied by a pasture map, should be included for clarity. The expectation is that the acreage described as the POU in the CEQA document will include only those acres that will require irrigation even though adjoining lands may need to be analyzed for impacts of the project.

The "Points of Diversion" should, in addition to the maximum pump rates in cubic feet per second for each well, include information on the "Old Well" to clarify that it was re-drilled in a separate, but nearby, location; the date of construction of the new "Old Well", and that there are currently two pump houses and associated equipment at the "Old Well" site. Due to the recent drilling of the new "Old Well," it is likely that a well drilling

report exists for that well, and should be provided by the applicant so that information regarding that well may be included in the EIR. Additionally, it should be clarified that the New Well is currently located approximately 400 feet from the river, but this has not always been the case based on photographic records. Impacts of a shift in the river meander that may move the river closer or father away from the well may need to be evaluated elsewhere in the document.

The project description, including the subsequent detailed sections on the POD and POU, should include information regarding the vegetation and soils of both the POD and the POU. In particular, sensitive natural communities which have the potential to be affected by the project should be described and summarized; and soil characteristics which would influence the particulars of potential impacts associated with either the POD or the POU should be discussed.

In the section titled "El Sur Ranch Irrigation System Operation", we recommend three changes. First, there should be clarification of how and where the tailwater drains into Swiss Canyon to allow analysis of impacts in the document. Second, the time of construction and the size (in acre feet) of the existing unpermitted tailwater pond and the size of its outlet structures needs to be stated. Third, this section should address the need for permits for the tailwater pond; e.g. water right permit for storage; possibly an NPDES permit for water quality; and a Coastal Development Permit for construction. Finally, at the end of the third paragraph on page X-6, there is a statement which attributes increased salinity in the vicinity of the "New Well" to Spring tides; we believe this is unsubstantiated, and should not be included in the project description. Salinity is a potential environmental effect that will need to be analyzed by the Draft EIR; information regarding sources of salinity should be thoroughly evaluated in order to better inform the EIR.

The "El Sur Ranch Water (Well) History" should clarify the names, dates, and pumping capacity of the various wells which the history chronicles. There is no mention, as stated above, of the new "Old Well", and detailed information regarding the dates and pertinent information regarding the construction of the new "Old Well" should be provided. Of the group of new wells, it appears that the first well constructed (in 1972) was to serve Andrew Molera State Park, not ESR; and that the

well which is now referred to as the "New Well", was constructed specifically for the ESR, but not completed until 1975. That is not consistent with other sections of the Tech Memo which indicate that access was not granted by the California Department of Parks and Recreation (DPR) until 1977, and that the New Well did not begin pumping until 1984. The piping that connects one or both wells to the ESR irrigation system was recently replaced, and the dates of that construction as well as details of the construction should be disclosed. There is mention of a temporary permit issued in

1972 by DPR, but no specific date is provided; and it appears that access to the site for the purpose of completing the wells was not granted until after 1977, again, no specific date is supplied.

The section on pages X-10 and the first portion of X-11 describe the complaint filed by DPR, and the resolution of that complaint by the SWRCB. The section indicates that the SWRCB concluded that the riparian right to underflow was limited to 90 acres; and that the El Sur Ranch has subsequently asserted that their riparian right is "*...25 acres, not the 90 acres as identified by the State Water Board*". This disparity should be resolved and the issue clarified with appropriate maps, as review of the topography of the POU would suggest that 90 acres is a more realistic figure for ESR lands within the watershed.

The section titled "Water Right Application and Protests" provides a history of the application and the various Protests, including restated information on the riparian right. The description of the application should note, for each portion of the request, that the proposed maximum pumping rates are just that, "proposed". The document could acknowledge that the actual maximum annual diversion in acre feet per annum (afa), the 20-year rolling average, the maximum instantaneous rate of diversion in cubic feet per second (cfs) and/or limits on a 30-day running average for the diversion rate, as well as seasonal and monthly diversion limits, are all conditions which the SWRCB will consider and may require as conditions to protect public trust resources, and to minimize impacts. In addition, we recommend that as the SWRCB move forward scoping and developing the EIR mitigation measures, that it consider, in consultation with the resource agencies, limits on pumping during critically dry periods, which is not now part of the application; and bypass flow standards and the measurement site(s) and monitoring protocols necessary to maintain flows and water quality in the Big Sur River to protect resources throughout the year and variations of annual hydrology.

Also included in the section titled "Water Right Application and Protests" is the statement: "*Additional information, including the assumptions used to develop these limits, is provided below, as well as information regarding the establishment of the baseline condition against which the proposed diversions are analyzed in this EIR to determine whether significant impacts would occur.*" This statement does not clearly state that the assumptions which have been used to develop the ***proposed*** limits are assumptions provided by the applicant in support of the suggested limits. It also implies that the establishment of the baseline condition is also predicated upon the same information provided by the applicant. We encourage the SWRCB, as the lead CEQA Agency, to independently gather and objectively evaluate all the information available, and to do independent data gathering when needed; to support not only the determination of the CEQA baseline, but also the type, scope and significance of potential impacts of the proposed diversion. Please see our comments below regarding these issues.

The section on the "Water Availability Analysis" (WAA) does not indicate the source of the WAA which has been prepared and is referenced in that section. In addition, the section references information provided by the applicant (generally referred to as "Previous Technical Studies" and addressed in the following section of the Tech Memo), and specifically mentions that the studies "*...showed that the river flow below the POD exceeds that upstream of the POD...*" and that data "*...support a conclusion that water is available for the subterranean diversions sought by the Application...*". These statements, presented as fact based on information provided by the applicant, have been specifically reviewed and called into question by the Department. Comments were provided to the SWRCB by both Departmental Staff and our hydro geological consultant to avoid contention later. We encourage the SWRCB to review this issue independently and exercise independent judgment in this area. The Department remains concerned about the incorrect assumptions provided by the applicant. We recommend that the SWRCB Tech Memo describe that there are known reaches within the potential impact zone of the river where the flow is not higher than the flows above the proposed diversions. These are the areas with the highest probability of impact to public trust resources, not the specific locations where gaining river reaches mask influences elsewhere. The second conclusion is based on analyzing flows and diversions only on a yearly basis where high winter flows mask the impacts of diverting at an instantaneous rate that represents a high percentage of flow during low flow months or periods.

The section on "Previous Technical Studies" lists a number of studies which were done by the applicant's consultants, and repeats, as fact, conclusions which were reached in some of those studies without supporting data, (such as "*...well pumping by the Ranch does not significantly affect river flow or stage...*"; or "*...a river flow of 5.3 cfs at the upstream USGS river gauge as a supportable measure of flow when considering future monitoring and management requirements to maintain river flows...*"; or "*...the flood irrigation method and system for the Ranch is efficient and appropriate for the site...*"). This section also asserts that the information collected by the applicant in 2007 "*...supports the conclusions presented in the 2005 (sic), and will be incorporated as part of the analysis contained in this EIR.*" Given that the 2007 studies have not been concluded, reported, or reviewed, we believe it premature for the SWRCB Tech Memo to assert conclusions reached in 2005 when the remaining information is as yet incomplete.

This section (as well as the extensive section on "Assumptions") does not mention, or consider, extensive review and comments that the Department previously provided to the SWRCB and the applicant (on Technical Studies). Prior comments by the Department express concern that aspects of the Technical Studies put forward by the applicant are flawed, and include conclusions that are not supported by the data. It is appropriate to depict conditions at the site in the EIR using all pertinent information, including instances where opinion differs. We recommend that the SWRCB include

only factual information, and not conclusions based on disputed studies in the CEQA project description, and that if disputed studies are to be utilized in other sections of the EIR that they are balanced by the whole of the information made available to the SWRCB.

The remainder of the Tech Memo, up to the section on the CEQA baseline, summarizes information provided by the applicant in support of their application. The information is intended to support the requested diversion and includes suggested limits on diversions using several different time periods and pumping caps. The specifics are too general to be helpful and do not appear to be internally consistent, and do not appear to be supported by fact or data. We recommend that the SWRCB not utilize this text in the project description. Instead, we encourage that other pertinent information be utilized in the impact analysis section such that the whole body of information and opinion are disclosed as part of the public process.

3. Use of Applicant's Information in the Memo and as Proposed for the Draft EIR

The information which has been provided by the applicant thus far may be problematic if included in the Draft EIR. Some studies have been conducted without including recommendations made by the Department and NOAA. The result thus far is that we cannot determine whether, or to what degree, the proposed level of diversion would have impacts on public trust resources. The conclusions reached in the reports are, in some cases, not supported by the data collected. The Department has provided numerous written reviews of the materials referenced in the Technical Memo. These reviews have been provided to the applicant as well as to the SWRCB. However, we see no reference or recognition of the Department's recommendations or peer review on the submitted information. Additionally, our technical advice on the potential impacts of the proposed project to pubic trust resources appears to have been ignored. For example, studies conducted by applicant's consultants in 2006 were to be based on specific targeted data collection that was developed in consultation with the Department, its hydro geological consultant, and National Marine Fisheries Service (NOAA). The proposed data collection and goals of the study plans were formalized in correspondence between ESR and the Department with copies to the SWRCB, DPR, and the Resources Agency. The resulting studies did not provide all of the data components. The approved study plans were to be included to support conclusions to be drawn. Yet, it appears that unsupported conclusions are tendered as established fact in the Tech Memo.

It is not clear to what extent the SWRCB will be utilizing the information provided by the applicant to inform and support analysis of potential impacts and the significance of those impacts in the CEQA document. We encourage you to independently determine the scope of work still required; to conduct studies, or have studies conducted under the direct supervision of the SWRCB; and to evaluate information collected, as necessary for the evaluation of impacts from the proposed project, and not rely solely on

conclusions provided by the applicant. This would include evaluation of the applicant's information, as well as the review/comments provided by this Department and other trustee agencies. We recommend that only factual information be included in the project description and that if disputed studies are to be utilized in other sections of the EIR that they be balanced by the whole of the information made available to the SWRCB and that any conclusions be based on the independent analysis of the data by the SWRCB.

4. Determination of CEQA Baseline and Public Trust Protection

We encourage the SWRCB to give careful consideration to the selection of the baseline description in this CEQA document. Ongoing activities may properly be considered under CEQA as part of the existing environmental baseline by the lead agency, yet should not result in understating the environmental impacts associated with legal historical diversions. The SWRCB normally grants water rights under Porter-Cologne and the public trust doctrine with mitigation terms and conditions necessary to protect trust resources that are/may be impacted. We view this as separate from the project-related impacts you may identify in the CEQA context, which may rely on current case law governing the selection of environmental baseline, and ongoing unauthorized activities. The SWRCB has not clarified how it plans to meet its public trust responsibilities but the Department expects the SWRCB to include adequate analysis of the adverse impacts for the entirety of the project in their EIR document, regardless of the baseline chosen, to ensure that resources are protected. The Introduction in the Tech Memo states that the SWRCB "*...must consider the relative benefit to be derived from all beneficial uses of water concerned, including the preservation and enhancement of fish and wildlife, and uses protected in a relevant water quality control plan*". It is not clear how the relative benefits of protecting the public trust resources will be considered in the Draft EIR. This objective is not clearly spelled out, nor is there specific mention of elements of such preservation and enhancement in the Tech Memo. We encourage the SWRCB to revise the Tech Memo to clarify how it intends to meet its public trust responsibilities which require that analysis be completed prior to the SWRCB exercising its permitting authority. Regardless, we encourage the SWRCB to avoid selection of a CEQA baseline that minimize or eliminate the impacts of the proposed project on these resources.

The proposed CEQA baseline in the Tech Memo seems to advocate the establishment of new baseline metrics that include averages, rolling averages, and seasonal and monthly "caps" which may be irrelevant to assessing impacts of the project. The adoption of multiple baseline metrics, with their focus on long-term changes, may confuse rather than disclose to readers the potential project-related environmental impacts in the CEQA. For example, proposing analysis of the impacts resulting from changes to a 20-year rolling average baseline can mask the potential impacts to instream resources, because it is not addressing impacts at a scale appropriate to discern site specific- or reach specific impacts on shorter time frames. In its worst case,

rolling average diversions over a 20-year period can be made to comply with the constraints imposed by a 20-year rolling average period while still allowing significant adverse impacts to resources due to complete or nearly complete dewatering for various time intervals. The Department has repeatedly provided guidance arguing against the use of averages for analysis of impacts, since this level of analysis simply masks the instantaneous impacts. The instantaneous and longer duration issues are essential components to analyzing impacts to resources and providing specific terms or conditions on Appropriative Water Rights that will protect public trust resources.

To justify the baselines, the Tech Memo includes rationale including, "*(t)ypically, the baseline condition represents the physical environmental conditions as they exist at the time the notice of preparation (NOP) is published (Cal. Code Regs., tit. 14 Section 15125, subd.(a)). However, as the proposed project essentially represents the conditions present at the time of the NOP, the State Water Board considered other options for considering the potential environmental effects of the proposed projects.*" As stated previously, the Department disagrees that the proposed project "essentially represents the conditions present at the time of the NOP" relative to the amounts, rates or the seasons of diversion.

We encourage you to carefully consider development of a CEQA baseline premised upon legal diversions. It is conceivable that a baseline condition which is limited to riparian claims would be considered as the baseline condition described in your CEQA document. The existing conditions and the "no project" alternative would be based on the legal diversions, and result in no diversion above that which is authorized under a riparian right[1]. Cumulatively, we suggest that there are other potential dates and actions which should be carefully considered when setting the CEQA baseline consistent with the results of a "no project" alternative. The period of 1985 to 2004 may be inappropriate unless the limited legal diversions are properly included in your determinations.

5. Reasonable Use

It is not clear how the information provided in the Tech Memo will be utilized to determine reasonable use, defined in the Tech Memo as "*...the amount required to supplement the water naturally provided by precipitation and other climatic factors should reasonably match the requirements of that use so that the water is not wasted*". The Tech Memo does not clearly identify what standards or metrics would be utilized to determine "reasonable use" or how the project could be evaluated and alternatives developed, to provide reasonable use limitations. Thus far, information provided by the applicant on the proposed diversions, the purpose of use, seasons of use, place of use,

[1] In 1992 the SWRCB determined that the applicant's right to divert was limited to a riparian claim for the irrigation of 90 acres of riparian pastureland, with a corresponding total diversion limit of 270 acre feet per annum (afa). The amount of riparian land has been adjusted to 25 acres which would correspondingly reduce the amount of riparian diversion to 75 afa.

and the proposed irrigation method for pasture land, does not appear to characterize a reasonable use of the water requested for appropriation.

The previous SWRCB finding concerning the quantity of water available under the riparian claim made it clear that a standard yearly diversion total of 3.0 acre feet (af) of water per acre of irrigated land is considered a reasonable beneficial use for the riparian portion of the ranch. Currently, the Appropriative Water Right application requests a total maximum annual diversion of 1,615 af for application on the additional (non-riparian) 267-acre POU. This amounts to placing in excess of 6 af of water on each acre of pasture not subject to a riparian claim each year, or twice the reasonable amount previously considered reasonable for the riparian use by the SWRCB. The proposed maximum annual usage of 1,615 af also exceeds what has historically been utilized on the ranch on a year-by-year basis (Table X-2) during every year (and water year type) in the past 30 years (except 1984 when pump tests expanded the water used in that year). In fact, analysis of Table-2 shows that in the past 20 years the water duty on the ranch never exceeded 3.9 af per acre in any year and was more commonly well less than 3.0 af per acre per year. This is reflective of a limited season of water diversions for irrigation that differs from the longer season currently requested/proposed. Up to this point, diversions have been very limited (with no diversion occurring in most years) during the months of November through March or April. In fact, in the past 20 years the total diversions during the months of November through March have never exceeded a total diversion of 76 af during all of those months in any year. The proposed increase in diversion during the wetter period should be considered in establishing reasonable use in much the same way the applicants have proposed limitations reasonable use in the dry season from July 1 and October 31. It is inappropriate to assume that increased diversions during the wet season months will have no adverse effects based on the instream flows during those months that will vary by precipitation and water year type.

The Tech Memo includes some inconsistencies. Table X-4 lists estimated irrigation requirements, rather than the actual diversions made to support the ranch historically. The estimate of proposed "requirements" in Table X-4 exceeds the actual usage for every year of record except three: the drought year of 1977; 1982; and 1984 when actual pumping was not related to demand. Some requested amounts in the water application even exceed the estimated amounts in Table X-4 for time periods without precipitation. For example, the maximum amounted requested in the water application for the period of July through October is 735 af. This exceeds the projection in Table X-4 that identifies only 700 af for use *in years with no precipitation* and Table X-2 indicates that historical diversions to support the ranch from July through October was limited to 540 af or 585 af, depending on if a 20- or 30-year average is utilized.

One valid approach to establishing "beneficial use" under this Application, is to assume that the reasonable water use for the riparian right, as determined by the SWRCB in 1992, is consistent with reasonable use applied over the remaining acres of the POU.

In the case of the ESR, the right to water for 90 acres results in the corresponding total diversion of 270 af, or 3 af per acre per year. That would translate to 801 acre feet per year for all of the proposed 267 acres of irrigated pasture (with corresponding adjustment of this amount if less than 267 acres are to be irrigated).

Finally, there appears to be little or no conservation practices proposed for the ranch that would reduce its overall water needs. Rationale for not implementing or seriously considering alternative irrigation methods to replace flood irrigation with other methods claimed that current practices were "...*to help maintain natural view of the coastline*..." and that "...*regulatory prohibitions of natural landform alternation*..." were barriers to the utilization of other methods. Conservation that would initiate and utilize recovered tailwater for irrigation to reduce the need to divert is also dismissed because it "...*may be limited due to regulatory, environmental and construction constraints*..."). It is unclear which existing regulations this statement references or what the logic is for this statement. For example, switching to another method of irrigation would be unlikely to trigger the need for permits, unless grading/sloping the land were involved. Such a switch could hardly be characterized as alteration of natural landforms, or interfering with the natural view of the coastline. Additionally, decisions regarding land uses often require the balancing of competing resource needs. The increased efficiency of another irrigation technology, which would result in water conservation such that public trust resources would benefit, would likely get approval unless the proposal resulted in some as yet undefined impact.

6. Need for Other Permits

The Tech Memo overlooks some of the regulatory framework of the proposed project, including compliance with the State and Federal Endangered Species Acts; the California Coastal Act; and consistency with the Big Sur Local Coastal Plan, and the Big Sur River Protected Waterway Management Plan, both of which were prepared by the County of Monterey. The diversion also needs to be evaluated for consistency with any Monterey County policy and other policies which involved out-of-basin water transfers.

The proposed project has the potential to impact at least two Federally listed wildlife species, the California red-legged frog; and steelhead, in particular the South/Central California Coast ESU. Take of these species is prohibited, unless a take authorization has been issued by the administering agency, the U.S. Fish and Wildlife Service, in the case of California red-legged frog; and the National Oceanic and Atmospheric Administration, for steelhead. Other listed species may also be affected, and the need for permits would be evaluated after appropriate surveys have been conducted and impact analyses completed.

The installation of two wells, as well as replacement of hundreds of feet of pipeline would likely need Coastal Development Permits. The dates of previous construction

would likely determine if any of their activities were "grandfathered" as to permits. In addition, diversion of surface flow from the Big Sur River may need a Streambed Alteration Agreement pursuant to Section 1600 et. seq. of the Fish and Game Code.

7. Additional Study Needs

The Department has clarified the surveys and studies which in our view are needed to inform the process and provide adequate disclosure. Our input included accepted protocols and data to be collected,. This input was provided in previous communications with the SWRCB. We have also provided comments on the data gaps in studies that have been performed to date, including those completed in 2006. Some information requested and agreed to at the time of study plan approval has not been provided. If the SWRCB requires additional information or a summary, the Department can provide it upon request.

We reiterate our previous and still pertinent request for Instream Flow Incremental Methodology (IFIM) and information necessary to define protective bypass flows for this project. In its 2002 NOP response, the Department recommended that the SWRCB utilize IFIM, or equivalent, to develop information which could be used to determine in-stream flows necessary to protect the differing life stages of steelhead, in a variety of water years. To date, these types of important instream flow studies have not been completed.

Most recently, in an effort to expedite protective instream flow information gathering for the EIR, a 2006 study plan was developed to gather data by using the "Thompson" methodology to assess fish passage. The data provided to the Department for review included only the depth component of that methodology, which is meaningless without the complementary and equally important velocity component. Recent communication from the applicant's representatives has clarified that they do not believe velocity information is needed, although the acceptable sampling methodology was clearly presented in the circulated and agreed to study plan. The Department is evaluating its options regarding the independent development of instream flow recommendations.

8. Developing Alternatives for the EIR

The SWRCB also requested comments from the Department on project alternatives for inclusion in the EIR. While the Department cannot provide a full set of appropriate alternatives, it does make the following suggestions for the SWRCB to consider as it develops the project alternatives for inclusion in the EIR.

- Include in both the project proposed, and all alternatives, full disclosure of the acres of land to that will actually be irrigated as pasture (this would eliminate from the proposed place of use the acreage of Swiss Canyon, the coastal bluffs, the tailwater pond, etc) under both the requested appropriative rights and the

riparian claim. This will clarify for disclosure and analysis the total acre feet of water that will be applied to each acre of irrigated land and allow comparison with water duty information typically provided by other sources in acre feet per annum (afa) per acre irrigated.

- Include analysis of restricting water use during the wetter months of the year with adequate resource-protective terms in place year round. This analysis, in addition to protecting most of the migration season for steelhead in the reach of the Big Sur River affected by the pumping (which to this point is an unanalyzed impact), will allow the first project objective listed on page X-14 of the Tech Memo to be met and provide irrigation to ESR during the periods it has indicated, and is supported by historic records, as the priority periods for use for cattle production.

- Ensure that diversion requested is limited to the beneficial use proposed on the POU being analyzed. This may require restrictions under the water right for wet or very wet years when water use on the pasture would be satisfied by the natural conditions and/or additional water use would adversely impact Swiss Canyon, the coastal bluffs, or adjoining DPR lands. It may also limit additional diversions (beyond riparian) in drier periods and years to protect public trust resources.

- Limit the beneficial use of water to a **maximum** of 3 af per irrigated acre, with adequate resource protection bypass terms in place, particularly in dry or critically dry years. This amount is reflective of the DWR recommendations for diversion to meet the water duty for irrigated pasture, and exceeds limitations for uncultivated land set by the water code. In addition, this is consistent with the 3 af per acre for the previous SWRCB resolution of the quantity of the riparian claim for the ranch, and would eliminate the discrepancy between the 3 af per acre as an appropriate beneficial use for the ranch's lands subject to a riparian right and the higher than 6 af for each acre of those lands on the ranch which are not subject to a riparian claim.

- Clearly disclose the current level of efficiency of water use at the POU, as well as analyzing the reduced need for diversion based more modern operations, including but not limited to a more efficient irrigation system, reclamation and reuse of tail water, and a more modern system to determine when irrigation is needed (such as CIMIS, the California Irrigation Management Information System.)

- Analyze the financial impacts of importing feed rather than relying on direct diversion from the Big Sur River, especially in critical dry years or during critically dry periods when flow are not available for diversion because of public trust considerations.

- Clearly analyze the impact of the application of irrigation water, in the context of the specific soils that comprise the POU, especially with regard to soil properties, soil water capacities, and the water needed for leaching and irrigation.

State of California
Department of Fish and Game

Flex your POWER

Memorandum

Date: August 12, 2008

To: Vicky Whitney
Deputy Director, Division Water Rights
State Water Resources Control Board

From: Carl Wilcox
Chief, Water Branch
California Department of Fish and Game

Subject: Priority Streams List for Instream Flow Assessment Prepared by the Department of Fish and Game Pursuant to Public Resources Code (PRC) Section 10004.

The Department of Fish and Game (DFG) developed the attached list of 22 priority streams or watercourses for future instream flow work pursuant to Public Resources Code (PRC) 10004. This list was compiled and ranked based on input from Regional DFG staff, staff from the State Water Board, U.S. Fish and Wildlife Service (USFWS), and the National Marine Fisheries Service (NMFS). In developing the ranking, staff considered criteria such as 1) presence of anadromous species; 2) likelihood that DFG flow recommendations would provide a high level of improvement; 3) availability of recent flow studies or other relevant data; and 4) the possibility of partners/willing landowners.

Should you have any questions or comments, please contact me at (916) 445-1231 or Robert Holmes, Instream Flow Coordinator, Water Branch, at (916) 324-0838.

Attachment

cc: Craig Wilson
Nancee Murray

Priority Streams List for Instream Flow Assessment Prepared by the Department of Fish and Game Pursuant to Public Resources Code (PRC) Section 10004. August 8, 2008.

Rank	Stream or Watercourse	DFG Region and County
1	Butte Creek	2 Butte
2	Tuolumne River (below La Grange Dam)	4 Stanislaus
3	San Gregorio Creek (lower)	3 San Mateo
4	North Fork of Navarro River	1 Mendocino
5	Big Sur River	4 Monterey
6	Santa Maria River	5 Santa Barbara
7	Redwood Creek (tributary to Maacama)	3 Sonoma
8	Bear River (below Camp Far West)	2 Placer and Nevada
9	Shasta River	1 Siskiyou
10	Carmel River	4 Monterey
11	Santa Margarita River	6 Riverside
12	Merced River (below Crocker-Huffman Dam)	4 Merced
13	Redwood Creek (tributary to Napa)	3 Napa
14	Scott River	1 Siskiyou
15	Mattole River (near Whitethorn)	1 Humboldt
16	Dry Creek (tributary to Napa River)	3 Napa
17	Deer Creek (tributary to Yuba River)	2 Nevada
18	Mojave River	6 Riverside
19	Carpinteria Creek	5 Santa Barbara
20	Santa Ana River	6 Riverside, San Bernardino
21	Middle Fork Feather River	2 Plumas
22	Dos Pueblos Creek	5 Santa Barbara

CALIFORNIA DEPARTMENT OF FISH AND GAME

INSTREAM FLOW PROGRAM

STUDY PLAN:
HABITAT AND INSTREAM FLOW RELATIONSHIPS FOR STEELHEAD IN THE BIG SUR RIVER, MONTEREY COUNTY

June 2009

Preface

This study plan document outlines the approach and methods that will be used by the California Department of Fish and Game (Department) to conduct an instream flow study on the Big Sur River, Monterey County. The Department intends to use existing staff resources from the Water Branch, Fisheries Branch, Engineering Branch, the Bay Delta Region, and the Central Region to conduct this study. In addition, the Department intends to use a grant award of $100,000.00 from the Ocean Protection Council (OPC) to fund the Pacific States Marine Fisheries Commission (PSMFC) to conduct the habitat suitability criteria development portion of this study. The Big Sur River flow study reflects part of the activities that the Department plans to begin work on in 2009 as part of its responsibility to implement Public Resources Code (PRC) sections 10000-10005 through the Department's Instream Flow Program.

The primary objective of the Department's Instream Flow Program is to develop scientific information on the relationships between flow and available stream habitats to determine what flows are needed to maintain healthy conditions for fish and wildlife. Relationships between flow and habitat will be developed on the selected streams for each species' critical lifestage need, including spawning, rearing and migration. The Department has interest in assuring that water flows within streams are maintained at levels which are adequate for long-term protection, maintenance and proper stewardship of those resources.

For more information or questions about this study plan please contact:

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Approvals

Chuck Armor
Regional Manager, Bay Delta Region

_____ Date_____

George Heise
Program Lead, Fisheries Engineering Program

_____ Date_____

Neil Manji
Branch Chief, Fisheries Branch

_____ Date_____

Jeffrey Single
Regional Manager, Central Region

_____ Date_____

Carl Wilcox
Branch Chief, Water Branch

_____ Date_____

Table of Contents

Background

South-Central California Coast Steelhead populations have declined from annual runs totaling 25,000 spawning adults to less than 500 (NMFS, http://swr.nmfs.noaa.gov/recovery/Steelhead_SCCS.htm). Consequently, the south-central DPS (Distinct Population Segment) of California steelhead (hereinafter south-central steelhead, anadromous form of rainbow trout *Oncorhynchus mykiss*) was listed as threatened in 1997 and reaffirmed in 2006 (NMFS 1997; NMFS 2006). All of the four largest watersheds (Pajaro, Salinas, Nacimiento/Arroyo Seco, and Carmel Rivers) have experienced declines in run sizes of 90% or more. Present population trends in many other individual watersheds remains unknown.

The Big Sur River is among the larger watershed drainages south of San Francisco Bay currently supporting south-central steelhead (Titus et al., *In Prep*). The Big Sur River originates in the steep canyons of the Ventana Wilderness, and flows northwest through two state parks (Pfeiffer Big Sur and Andrew Molera), and a lagoon, before emptying into the Pacific Ocean. Coastal estuaries are an important part of the life cycle of steelhead trout (Bond, 2006). Currently, only the lower 7.5 miles of the river are accessible to south-central steelhead, with upstream fish migration blocked either by a partial or complete bedrock barrier depending on streamflow conditions.

Although the Big Sur River appears to be in a relatively pristine state containing one of the last strongholds of quality steelhead habitat on California's south coast, this habitat is at risk from pending water diversion applications requesting a large portion of available flow, existing permitted diversions, illegal unpermitted diversions, and dewatering. Such water management activities pose additional risk to south-coast steelhead populations in the Big Sur River (Monterey County, 1986). Subsequently, the Big Sur River has been identified as one of the Department's priority streams in 2008 for future instream flow assessments due to its' high resource value, presence of south-central steelhead, and increasing water rights pressure.

Project Organization

The Department intends to use existing staff resources from the Water Branch, Fisheries Branch, Engineering Branch, and the Central Region to conduct this study. Department staff from the Bay-Delta Region will be coordinating the stream survey portion of the study. Staff from the Water Branch will serve as the overall project coordinator. The Department also intends to use a grant award of $100,000.00 from the Ocean Protection Council (OPC) to fund the Pacific States Marine Fisheries Commission (PSMFC) to conduct the habitat suitability criteria development portion of this study. Table 1 outlines the responsibilities of Department staff in the Big Sur River flow study.

Table 1. Responsibilities of Department Staff in Big Sur River Flow Study.

RESPONSIBILITIES		DEPARTMENT STAFF (Branch/Region)
Project Coordinator/Study Plan		Robert Holmes (Water)
PSMFC Contract/Project Manager		Robert Holmes (Water)
Study Design and Approach		Robert Holmes (Water), Bob Hughes (Engineering), Rob Titus (Fisheries)
Surface Water/Ground Water Interface		Kit Custis (Engineering)
Field Data Collection[1]	Reconnaissance, study site and transect selection	Patricia Anderson (Central), Kit Custis (Engineering), Deborah Hillyard (Central), Robert Holmes (Water), Bob Hughes (Engineering), Rob Titus (Fisheries)
	Stream Surveys (Habitat mapping, weekly stream flows, continuous temperature Monitoring)	Jennifer Nelson (Bay Delta)
	Habitat Suitability Criteria development/ Estuary Assessment	Robert Holmes (Water)[2]
	Hydraulic and Structural Data	Robert Holmes (Water), Bob Hughes (Engineering), Rob Titus (Fisheries)
Hydraulic Model Construction and Calibration[3]		Robert Holmes (Water) Bob Hughes (Engineering)
Quality Assurance/Quality Control		Robert Holmes (Water), Bob Hughes (Engineering), Jennifer Nelson (Bay Delta), Rob Titus (Fisheries)
Data Management and Reporting		Robert Holmes (Water), Bob Hughes (Engineering), Jennifer Nelson (Bay Delta), Rob Titus (Fisheries)

[1] The US Fish and Wildlife Service (USFWS) will be assisting the Department in form of a two-dimensional (2D) stream flow model training effort, including 2D field data collection.
[2] Manage contract, provide field work assistance and project oversight to Pacific States Marine Fisheries Commission (PSMFC) staff to develop habitat suitability criteria for rearing steelhead in the Big Sur River and conduct estuary assessment.
[3] The USFWS is responsible for construction and calibration of the 2D model component of the study.

Problem Statement

The PRC mandates the Department to develop stream flow requirements for the long-term protection, maintenance and proper stewardship of fish and wildlife resources. Pursuant to the PRC, the Department needs to conduct field studies to identify stream flow requirements for the protection of south-central steelhead in the Big Sur River.

Goals and Objectives

The overall goal of this project is to quantify or characterize south-central steelhead habitat as a function of flow in the Big Sur River using modeling, hydrologic, and empirical methods. Development of habitat and flow relationships will allow the Department to identify flow requirements needed to protect south-central steelhead in the Big Sur River.

The objectives of this project include:

1) Estimate the habitat index versus flow relationships using a one-dimensional (1D) and/or a two-dimensional (2-D) hydraulic and habitat model.
2) Use habitat index versus flow relationships to develop habitat duration or time series analysis of south-central steelhead habitat in the Big Sur River over time under alternative flow scenarios.
3) Develop habitat suitability criteria that reflect south-central steelhead behavior and habitat sensitivity in the Big Sur River.
4) Develop habitat and flow relationships for two distinct south-central steelhead life stages in the Big Sur River including: adult upstream migration passage and juvenile rearing.
5) Investigate the relationship between Big Sur River south-central juvenile steelhead data and hydraulic and habitat modeling.

General Approach

The relationship between flow and habitat availability will be developed using a 1D Physical Habitat Simulation (PHABSIM) and/or a River2D 2-D hydraulic and habitat model (Steffler and Blackburn, 2001; Gard, 2006). Data collection procedures are outlined in Bovee (1997), Bovee et al., (1998), and Milhous et al., (1984). The approach will be to collect hydraulic and physical modeling data at study sites representing steelhead mesohabitat types (e.g., pools, runs, riffles, glides) to identify habitat availability in each reach. Representative study sites will be identified by: 1) classifying habitat types within the study reach to identify dominant and critical habitat types using Flosi et al., (1998), 2) select habitat types to represent the dominant and critical types, and 3) identify and establish study site locations in each reach using a combination of targeted and randomly selected sites to collect the required hydraulic and geomorphic data.

Unimpaired annual flow time series and exceedance hydrograph information for the period of record will be developed and evaluated and used to select target flow for hydrological data collection. Hydrological data will be collected at each study site at three distinct flows. Study site data will be collected and then entered into the PHABSIM and/or the River2D model by habitat type, calibrated, and modeled to identify flow versus habitat relationships for each habitat type. The model results will then be weighted to represent the proportion of the represented habitat

type within the study reach, and then combined to identify flow and habitat relationships for the study reach. Adult south-central steelhead passage at targeted critical riffles will also be evaluated individually using a minimum depth of 0.8 to 1 ft. using the PHABSIM and/or the River2D model.

For 2-D sites, a 1-D PHABSIM transect will be placed at the upstream and downstream end of each study site. Water surface elevations at the downstream end of the site, along with bed topography and bed roughness, will be used to develop stage/discharge relationships as part of the 2-D model. The amount of physical habitat present at a site will be predicted using the substrate composition and cover at each site, along with the predicted depths and velocities predicted by the 2-D model.

Study Reaches

In 1994 the Department initiated a validation program of the 1-D PHABSIM model developed by Bovee (1982) in the Big Sur River and Juan Higuera Creek, a significant tributary (Titus, 1994). Data collected included 1-D transect placement and hydraulic variable measurements in conjunction with juvenile steelhead/rainbow trout abundance. The current project intends to reassess the study reaches that the Department identified and assessed in 1994 using a 1-D and/or a 2-D model. The Department has traditionally used the 1-D PHABSIM model for instream flow assessments in California streams and rivers throughout the 1980's and 1990's. However, the 2-D model may be able to model the depths and velocities over a range of flows more accurately than the 1-D model (Gard, 2009; Ghanem et al., 1996; Leclerc et al., 1995). The 2-D model also avoids problems of transect placement, since data are collected uniformly across the entire site. The 2-D model may therefore be particularly applicable for use on the Big Sur River, where many low gradient riffle habitats have been reported at lengths of 25 - 40 meters (Titus, 1994), and it will be necessary to evaluate contiguous depths and velocities throughout such sites to identify appropriate adult south-central steelhead passage flows and velocities.

With an objective of evaluating and comparing the physical habitat characteristics of several stream reaches, the 1994 Department reach designations would be replicated with the addition of a lagoon reach. The reaches represent homologous stream segments based upon gradient, geomorphology, hydrology, riparian zone types, flow accretion, diversion influence, and channel metrics (Figure 1). Assessment reaches would be:

- Lagoon Reach – from tail of lagoon to head of lagoon/river mouth.
- Lower Molera Reach – from tail of lagoon to upstream radius of well pumping zone of influence in lower Andrew Molera State Park.
- Molera Reach – Lower Andrew Molera State Park to upstream boundary of Park.
- Campground Reach – from upstream boundary of Andrew Molera State Park to the bottom of the gorge in the upper campground area of Pfeiffer Big Sur State Park
- Juan Higuera Creek Reach – from Big Sur confluence to upstream limit of steelhead migration

Figure 1. Map of Big Sur River showing flow study reaches.

Generally, the number of 1D transects placed within each mesohabitat of each reach will be proportional to the percentage of mesohabitat type in the reach, and will meet recently published conclusions concerning minimum PHABSIM transect needs (Payne et al., 2004; Gard, 2005).

Stream Surveys and Habitat Mapping

Stream surveys will be conducted by Department staff from the Bay Delta Region. The survey work is in response to recent wildfires and is funded through a Steelhead Report Card grant. The survey work includes habitat mapping, weekly stream flow measurements, continuous temperature monitoring, and fish population work in the anadromous zones of the Big Sur River. Department staff anticipates using the level four habitat mapping portion of the survey work as described in the *California Salmonid Stream Restoration Manual* (Flosi et al., 1998) to facilitate site selection within each reach for the flow study. The habitat classification is based on channel morphology, gradient, substrate composition, and hydraulic characteristics. Habitats will be generally classified as riffle, run, glide, or pool. Review of historical habitat classification done by Snider in 1989 (unpublished data) suggests that pools may be further classified into lateral scour pools and main channel pools in the anadromous zone of the Big Sur River. Other habitat types may be further identified and classified based upon the future habitat mapping to be conducted as planned in Summer 2009. An alternative habitat mapping approach may be used, such as outlined in Snider et al., (1992), if conditions warrant such use.

Target Fish Species and Life Stages

The species and lifestages that will be used for 1-D PHABSIM and/or River 2D modeling are based upon management importance and/or sensitivity to water withdrawal operations. Life stage periodicity and target life stages for south-central steelhead are shown in Table 2 and Table 3, respectively.

Table 2. Life stage periodicity for south-central steelhead in the Big Sur River, Monterey County.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Adult Migration[1]												
Spawning												
Egg Incubation												
Emergence/Fry												
Juvenile Rearing												
Smolt Emigration												

[1]Dependent upon sand bar breaching.

Table 3. Target species and life stages for 1D PHABSIM model and/or River2D model.

Species	Lifestages	Location
South-central steelhead, anadromous form of rainbow trout *Oncorhynchus mykiss*	adult migration juvenile rearing	All reaches[4]

Selection and Location of Study Sites

Representative habitat types will be both targeted and selected randomly in each reach to represent the study reaches for development of flow habitat relationships at each study site. The number of study sites in a given reach will be dependent upon the number and types of dominant and critical habitat types within each reach. Generally, the number of study sites selected in each reach will proportionally reflect dominant and critical mesohabitat type in the reach.

Study sites for rearing will be randomly selected to ensure unbiased selection of the study sites. The upstream and downstream end of each rearing study site will be selected to correspond to the upstream and downstream ends of the mesohabitat units selected.

Hydraulic and Structural Data Collection

Hydraulic and structural parameters will be measured using a combination of standard techniques of the U.S. Fish and Wildlife Service (USFWS) methodology (Trihey and Wegner, 1981; Bovee, 1982; Bovee, 1997; Bovee et al., 1998). The data collected at the upstream and downstream transects at each site will include: 1) Water Surface Elevations (WSELs); 2) wetted streambed elevations; 3) dry ground elevations to points above bankfull discharge ; 4) mean water column velocities measured at the points where bed elevations were taken; and 5) substrate and cover classification at these same locations (Appendix 1 and 2) and also where dry ground elevations were surveyed. If there is a hydraulic control downstream of a given transect, the stage of zero flow in the thalweg downstream of that transect will be surveyed in using differential leveling.

Data collected between the upstream and downstream transects at a site will include: bed elevation; horizontal location; substrate composition; and cover. The bed topography data are planned to be collected with a total station. Data will be collected at least up to the location of the water's edge at the highest flow to be simulated. Bed topography data will be collected at a higher density of points in areas with rapidly varying topography and patchy substrate and cover, and lower densities of points in areas with more uniform topography, substrate and cover. Bed topography and substrate data will be collected at a low flow. Only water surface elevations at the upstream and downstream ends of the sites, flow, and edge velocities will be needed at moderate and high flows. The horizontal locations of the transect headpins and tailpins are

[4] The PHABSIM and River2D models will not be used for Lagoon reach. Lagoon reach assessment will include: bathymetric mapping (using semi-permanent transects) to track changes in water volume, fish surveys using visual observation and seining to assess presence/absence of south-central steelhead, and monitoring of water quality conditions (temperature, dissolved oxygen, conductivity) to assess estuary habitat suitability.

planned to be determined with the total station so that the topography for the transects can be incorporated into the bed topography of the sites. Topography data will be collected at a distance of one channel-width upstream of the upstream transect to improve the accuracy of the flow distribution at the upstream end of the sites.

At least 50 velocity measurements determined by the total station will be collected (in addition to the velocities measured at the upstream and downstream transects) to validate the hydraulic predictions of the 2-D model. The locations of these velocity measurements will be distributed throughout the site. The flow present during validation velocity data collection will be determined from gage readings, if the proposed gage in Andrew Molera State Park is available. If the proposed gage is not available, the flow present during validation velocity data collection will be measured.

Target Calibration Flows

Target calibration flows will be selected to allow for development of an adequate stage/discharge relationship in the PHABSIM and/or River2D model. The flows targeted for data collection will be measured at a proposed gage to be located in lower Andrew Molera State Park and the current United States Geological Survey (USGS) stream gauge # 11143000. The proposed gage would be funded through a potential grant from the Department Fisheries Restoration Grant Program and would ideally be in place by Summer/Fall 2009. Mean daily flows and the percent exceedence flows for the Big Sur River at station 11143000 are presented in Figures 2 and 3, respectively. Preliminary target calibration flows are presented in Table 4.

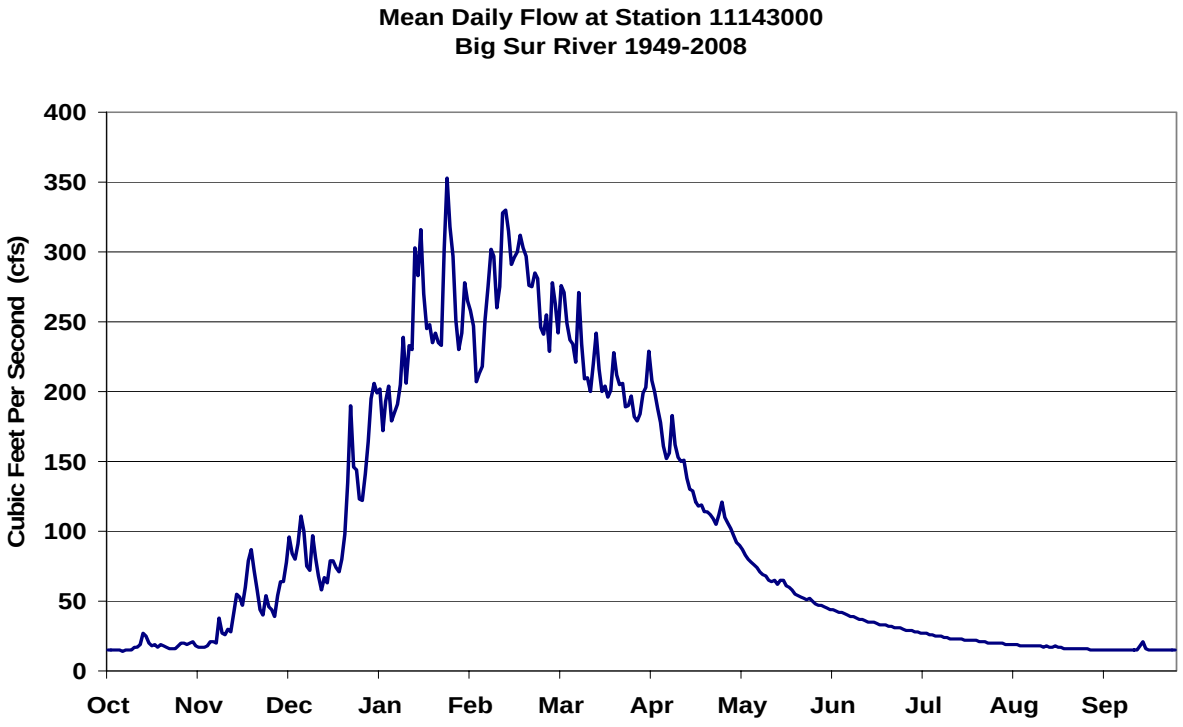

Figure 2. Mean daily flow at USGS Station 1143000, Big Sur River, 1949-2008 (n = 11,150).

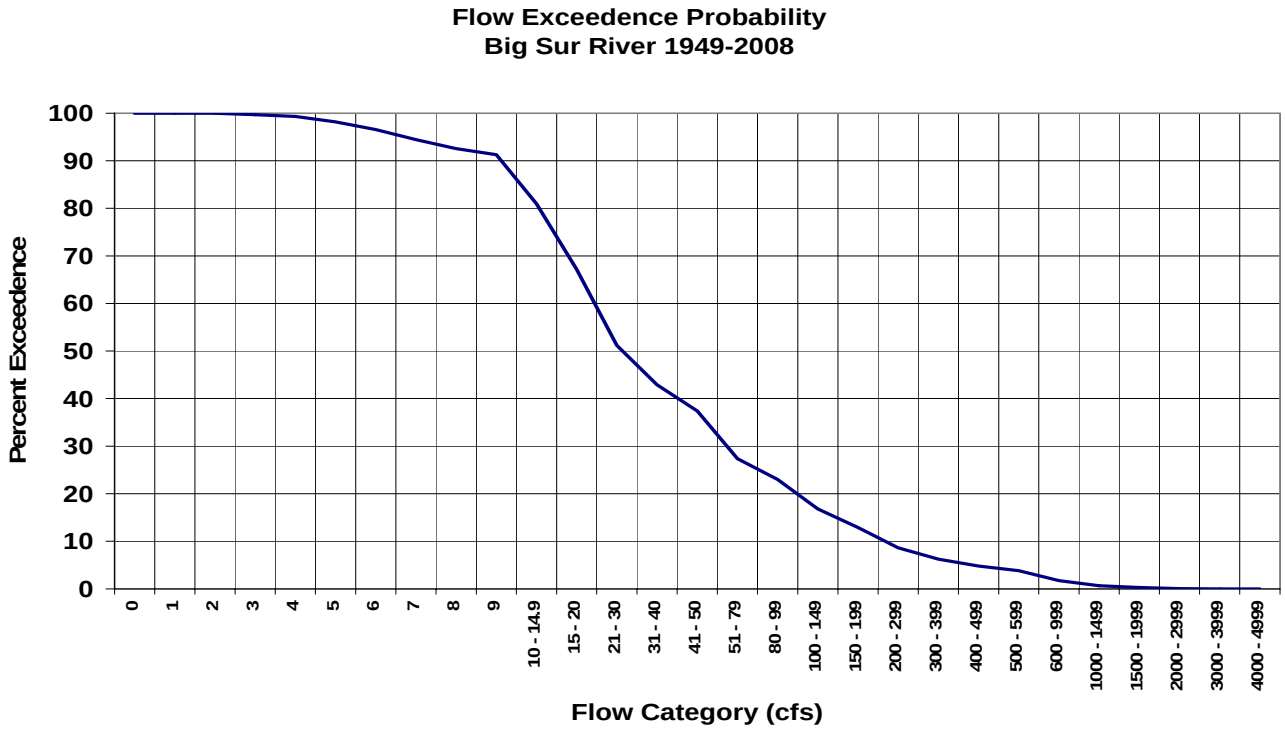

Figure 3. Flow exceedance probability, Big Sur River, 1949-2008. Data from USGS 11430000 (n = 11,150).

Table 4. Target calibration flows by PHABSIM and/or River2D reach[6].

PHABSIM or River2D Reach	20% Exceedance (cfs)	80% Exceedance (cfs)	Target Calibration Flow		
			Low (cfs)	Middle (cfs)	High (cfs)
Lower Molera Reach	80 - 100	10 - 15	5 - 10	45 - 55	80 - 100
Molera Reach					
Campground Reach					

Habitat Suitability Criteria (HSC) Development

Accurate representation of habitat index-discharge results requires linking stream channel hydraulics over a range of flows with known habitat suitability criteria (HSC) for the target species and life stages. For the HSC component of this project, the target species and life stages would be south-coast steelhead fry (0+) and juveniles (1+). The spawning life stage is

[6] Exceedence flows calculated using USGS station 11143000 data.

not proposed for HSC development. Even though appropriate HSC are a critical element of 1-D and 2-D flow studies, no HSC have been developed for coastal California steelhead rearing life stages.

Creation of suitable HSC requires a minimum sample size of fish observations (typically greater than 150 per a lifestage, mesohabitat category, and microhabitat component) made under a rigorous study plan that accounts for the influence of habitat availability on observed habitat use. Preparation of a detailed site-specific study plan incorporating these elements would be the first task of this study component by PSMFC staff. The HSC will be developed using water depth, velocity, cover, and adjacent velocity. General guidelines for HSC development are contained in Bovee, 1986; Bovee and Zuboy, 1988; and CDFG, 2006.

1-D Hydraulic Model Construction and Calibration

The current project will include habitat predictions using the 1-D PHABSIM model and/or the River2D model at study sites within the Big Sur River. For 1-D modeling the Department intends to use a commercial version of PHABSIM known as the Riverine Habitat Simulation (RHABSIM). Hydraulic modeling procedures appropriate to the study site and level of data collection will be used for modeling water surface elevations and velocities across each cross section. For water surface elevations, these procedures include: the development of stage-discharge rating curves using log-log regression (IFG4), Manning's formula (MANSQ), and/or step backwater models (WSP, HecRas); direct comparison of results; and selection of the most appropriate and accurate method. If, for example, rating curves using log-log and MANSQ are nearly identical, then log-log will be used to easily allow changes in simulated flows. But, if the two methods diverge and the transect is a riffle or run, then MANSQ will be selected for flow simulation. Water velocities will be simulated using the Manning's n method of velocity distribution across all transects, with calibrations generally consisting of correction of over- or under-simulated velocities at individual sample points (i.e. velocity adjustment factors or VAFs). Data file construction, calibration, simulation, reporting, review, and consultation will follow standard procedures and guidelines.

Habitat modeling will be conducted using an approach consistent with the Instream Flow Incremental Methodology (IFIM) approach (Bovee et al., 1998). Mesohabitat types will be weighted and combined to develop a representation of hydraulic characteristics and fish habitat suitability for the PHABSIM reach. Mesohabitat weighting will be based on the relative proportion of each of the modeled mesohabitats within the PHABSIM reach, as described above.

2-D Hydraulic Model Construction and Calibration

The topographic data described above will be combined with the bed topography from the upstream and downstream transects to create the initial bed file. See Appendix 1 and Appendix 2 for the substrate and cover codes, respectively. The bed file contains the horizontal location, bed elevation and initial bed roughness value for each point. The initial bed roughness values

will be determined from the substrate and cover data using the values in Appendix 3. If the topography data collected upstream of the upstream transect does not extend at least 1 channel width upstream of the top of the site, a one-channel-width artificial extension will be added upstream of the measured topography data to enable the flow to be distributed by the model when it reaches the study area, thus minimizing boundary conditions influencing the flow distribution at the upstream transect and within the study site. A utility program, R2D_BED (Steffler 2002), will be used to define the study area boundary and to refine the raw topographical data triangulated irregular network (TIN) by defining breaklines[7] going up the channel along features such as thalwegs, tops of bars and bottoms of banks.

Breaklines will also be added along lines of constant elevation. An additional utility program, R2D_MESH (Waddle and Steffler 2002), will be used to define the inflow and outflow boundaries and create the finite element computational mesh for the River2D model. R2D_MESH uses the final bed file as an input. Mesh breaklines[8] will be defined which coincided with the final bed file breaklines. Additional mesh breaklines will then be added between the initial mesh breaklines, and then additional nodes will be added as needed to improve the fit between the mesh and the final bed file and to improve the quality of the mesh, as measured by the Quality Index (QI) value. The computational mesh will be run to steady state at the highest flow to be simulated (approximately 200 to 250 cfs), and the water surface elevations (WSELs) predicted by River2D at the upstream end of the site will be compared to the WSELs predicted by PHABSIM at the upstream transect.

In cases where the simulated WSELs at the highest simulation flow varies across the channel by more than 0.1 foot, the highest measured flow within the range of simulated flows will be used for River2D calibration. The bed roughnesses of the computational mesh elements will then be modified by multiplying by a constant bed roughness multiplier (BR Mult) until the WSELs predicted by River2D at the upstream end of the site matched the WSELs predicted by PHABSIM at the top transect. The minimum groundwater depth will be adjusted to a value of 0.05 to increase the stability of the model. The values of all other River2D hydraulic parameters will be left at their default values (upwinding coefficient = 0.5, groundwater transmissivity = 0.1, groundwater storativity = 1, and eddy viscosity parameters $\varepsilon_1 = 0.01$, $\varepsilon_2 = 0.5$ and $\varepsilon_3 = 0.1$).

Velocities predicted by River2D will be compared with measured velocities to determine the accuracy of the model's predictions of mean water column velocities. After the River2D model is calibrated, the flow and downstream WSEL in the calibrated cdg file will be changed to simulate the hydraulics of the site at 30 simulation flows, ranging from approximately 3 to 4 cfs to approximately 200 to 250 cfs. The cdg file for each flow contains the WSEL predicted by PHABSIM at the downstream transect at that flow. Each cdg file will be run in River2D to steady state.

[7] Breaklines are a feature of the R2D_Bed program which force the TIN of the bed nodes to linearly interpolate bed elevation and bed roughness values between the nodes on each breakline and force the TIN to fall on the breaklines (Steffler 2002).

[8] Mesh breaklines are a feature of the R2D_MESH program which force edges of the computation mesh elements to fall on the mesh breaklines and force the TIN of the computational mesh to linearly interpolate the bed elevation and bed roughness values of mesh nodes between the nodes at the end of each breakline segment (Waddle and Steffler 2002). A better fit between the bed and mesh TINs is achieved by having the mesh and bed breaklines coincide.

Habitat modeling will be conducted using an approach consistent with the Instream Flow Incremental Methodology (IFIM) approach (Bovee et al., 1998). Mesohabitat types will be weighted and combined to develop a representation of hydraulic characteristics and fish habitat suitability for the River2D reach. Mesohabitat weighting will be based on the relative proportion of each of the modeled mesohabitats within the River2D reach, as described above.

Quality Assurance/Quality Control (QA/QC)

Water Surface Elevations (WSELs) will be measured to the nearest 0.01 foot at a minimum of three significantly different stream discharges using standard surveying techniques (differential leveling). Wetted streambed elevations will be determined by subtracting the measured depth from the surveyed WSEL at a measured flow. Dry ground elevations to points above bankfull discharge will be surveyed to the nearest 0.1 foot. WSELs will be measured along both banks and in the middle of each transect if conditions allow. Otherwise, the WSELs will be measured along both banks. If the WSELs measured for a transect are within 0.1 foot of each other, the WSELs at each transect will be derived by averaging the two to three values. If the WSEL differ by greater than 0.1 foot, the WSEL for the transect will be selected based on which side of the transect was considered most representative of the flow conditions. The range of flows to be simulated should go up to the mean unimpaired flow in the highest flow month. Water surface elevations will be collected at a minimum of three relatively evenly spaced calibration flows, spanning approximately an order of magnitude. The calibration flows will be selected so that the lowest simulated flow is no less than 0.4 of the lowest calibration flow and the highest simulated flow is at most 2.5 times the highest calibration flow.

For bed topography data collected with the total station, the accuracy of the bed elevations will be 0.1 foot, while the accuracy of the horizontal locations will be at least 1.0 foot. Velocities will be measured to the nearest 0.01 ft/s at 0.6 of the depth for 20 seconds using either a Price AA or a Marsh-McBirney velocity meter.

For the computational mesh, QI value of at least 0.2 is considered acceptable (Waddle and Steffler 2002). For River2D, a stable solution will generally have a solution change (Sol Δ) of less than 0.00001 and a net flow (Net Q) of less than 1% (Steffler and Blackburn 2002). In addition, solutions for low gradient streams will usually have a maximum Froude Number (Max F) of less than one. Calibration is considered to have been achieved when the WSELs predicted by River2D at the upstream transect is within 0.1 foot of the WSEL predicted by PHABSIM. BR Mult values should lie within the range of 0.3 to 3.0. The criterion used to determine whether the model is validated will be whether the correlation between measured and simulated velocities is greater than 0.6. The model would be in question if the simulated velocities deviated from the measured velocities to the extent that the correlation between measured and simulated velocities fall below 0.6. For simulation flows, again, a stable solution will generally have a Sol Δ of less than 0.00001 and a Net Q of less than 1%. In addition, solutions should usually have a Max F of less than one.

Biovalidation

Habitat suitability criteria (HSC) curves are used to translate hydraulic and structural elements of rivers in combined suitability indices (CSI), which are calculated as the product of depth, velocity, adjacent velocity, and substrate suitability's for fry and juvenile rearing. South-central steelhead juvenile rearing CSI will be calculated using HSC developed through the current project as part of a biovalidation process. Biovalidation will be conducted at the microhabitat scale ($1ft^2$ grid) to determine if the combined suitability of occupied locations is greater than the combined suitability of unoccupied locations. These data are needed to verify the accuracy of the model's predictions regarding habitat availability and use.

Data Management and Reporting

Field data will be collected by Department staff from the Engineering, Fisheries, and Water Branches. All data generated by this project will be maintained in both field log books and electronic spreadsheet format. A final technical report will be prepared by Water Branch staff, with assistance from the Engineering and Fisheries Branches staff.

Target Audience and Management Decisions

The Department has interest in assuring that water flows within streams are maintained at levels which are adequate for long-term protection, maintenance and proper stewardship of fish and wildlife resources. Using data generated from the flow study outlined herein, the Department intends to develop stream flow recommendations for the Big Sur River. The Department also intends to transmit those stream flow recommendations to the State Water Resources Control Board (Water Board) for consideration by the Water Board as set forth in 1257.5 of the Water Code. Submission of such flow recommendations to the Water Board complies with Public Resources Code Section 10000-10005.

Coordination and Review Strategy

To the extent possible, entities or stakeholders which might have an interest in the results and interpretation of habitat index modeling will be involved in study scoping and implementation.

To promote coordination this study plan will be distributed for review and comments among interested Department staff, other interested agencies such as the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS), other interested groups and/or scientists. The project coordinator will facilitate and coordinate this review and addressing comments.

It is anticipated that the instream flow project will be coordinated and leveraged with planned survey work on the Big Sur River by the Bay Delta Region (Department of Fish and Game Region 3) staff. The survey work will likely include habitat mapping, weekly stream flow

assessments, continuous temperature monitoring, and fish population studies. The Habitat Suitability Criteria (HSC) development portion of the current study will also include development of study plan that will be developed by the Pacific State Marine Fisheries Commission (PSMFC) staff.

Products

A final project report will be prepared that will include the results of the 1-D and 2-D analyses including the habitat suitability development task. Study products will include: a) a summary of field methods, data analysis, and results; b) all PHABSIM and River2D data on CD; and c) spreadsheet based interactive analytical tools. Habitat suitability criteria (HSC) study products will include a study plan, and a final south-central rearing steelhead HSC report outlining the methods, results, and discussion.

Field Methods Summary

Field methods for each reach will be summarized to include but not be limited to the following:

- Maps showing study site locations
- Photographs of study sites at calibration flows
- Date and discharge of calibration flows
- Description of any deviations from the study plan

Data Analysis Summary

Data analysis for each reach will be summarized to include but not be limited to the following:

- Hydraulic calibration report (detailed modeling procedures and model performance)
- Habitat modeling report (target species, and HSC used)
- Habitat Duration Analysis (species/life stage periodicity, hydrologic data sources, index, benchmark, and metrics applied)
- Description of any deviations from the study plan

Results Summary

Results for each reach will be summarized to include but not be limited to the following:

- Graphic and tabular results of Weighted Useable Area vs. flow
- Habitat modeling report (target species and HSC used)
- Habitat Duration Analysis (species/life stage periodicity, hydrologic data sources, index, and metrics applied)
- Description of any deviations from the study plan

Results Summary – Passage at Targeted Critical Riffles

Results for each passage assessment at critical riffles will be summarized to include but not be limited to the following:

- Graphic and tabular results of the relationship between flow and depth, velocity, and width criteria
- The analysis will include the use of a minimum depth of 0.8 to 1 ft. at critical riffles
- Description of any deviations from the study plan

Project Schedule[9]

ACTIVITY	DATE
Study Plan	June 2009
Stream Surveys	July – August 2009
Reconnaissance, Study Site and Transect Selection	August - September 2009
Habitat Suitability Criteria Development	September 2009 – August 2010
Hydraulic and Structural Data Collection	September 2009 – August 2010
Hydraulic Model Construction and Calibration	September 2010 – December 2010
Final Project Report	June 2011

[9] The Torri fire of 2008 burned approximately 85 percent of the Big Sur watershed. Post-fire related instream habitat impacts, such as increases in sediment or fines load and/or substrate embeddedness due to altered hydrologic patterns and unstable slopes will be evaluated. If it is determined that the watershed is not in equilibrium, or appears in a degraded state, due to fire-related increased sediment or fines, some elements of this study may be postponed.

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Appendix 1. Substrate codes, descriptors and particle sizes.

Code	Type	Particle Size (inches)
0.1	Sand/Silt	< 0.1
1	Small Gravel	0.1 – 1
1.2	Medium Gravel	1 – 2
1.3	Medium/Large Gravel	1 – 3
2.3	Large Gravel	2 – 3
2.4	Gravel/Cobble	2 – 4
3.4	Small Cobble	3 – 4
3.5	Small Cobble	3 – 5
4.6	Medium Cobble	4 – 6
6.8	Large Cobble	6 – 8
8	Large Cobble	8 – 10
9	Boulder/Bedrock	> 12
10	Large Cobble	10 – 12

Appendix 2. Cover coding system.

Cover Category	Cover Code
No cover	0
Cobble	1
Boulder	2
Fine woody vegetation (< 1" diameter)	3
Fine woody vegetation + overhead	3.7
Branches	4
Branches + overhead	4.7
Log (> 1' diameter)	5
Log + overhead	5.7
Overhead cover (> 2' above substrate)	7
Undercut bank	8
Aquatic vegetation	9
Aquatic vegetation + overhead	9.7
Rip-rap	10

Appendix 3. Initial bed roughness values.

Substrate Code	Bed Roughness (m)	Cover Code	Bed Roughness (m)
0.1	0.05	0.1	0
1	0.1	1	0
1.2	0.2	2	0
1.3	0.25	3	0.11
2.3	0.3	3.7	0.2
2.4	0.4	4	0.62
3.4	0.45	4.7	0.96
3.5	0.5	5	1.93
4.6	0.65	5.7	2.59
6.8	0.9	7	0.28
8	1.25	8	2.97
9	0.05	9	0.29
10	1.4	9.7	0.57
		10	3.05