INTRODUCTION

The City of San Buenaventura (City) has been required to conduct three inter-related special studies to meet NPDES permit requirements established for the Ventura Water Reclamation Facility (VWRF). The special studies are intended to provide information necessary to determine: 1) whether the VWRF tertiary treated flow discharged in the existing condition to the Wildlife/Polishing Ponds and then to the Santa Clara Estuary (SCRE) creates fuller realization of beneficial uses as necessary to confirm “enhancement” under the Bays and Estuaries Policy, and 2) whether alternative VWRF discharge scenarios might be achieved that improve and/or further optimize beneficial uses in the Santa Clara Estuary (SCRE) and its watershed.

Discharge scenarios evaluated include considerations such as additional recycling and reuse of tertiary treated flows, and/or discharging tertiary treated flows to new or additional treatment wetlands. Workplans for the special studies were developed with Stakeholder input and were submitted and approved by the Los Angeles Regional Water Quality Control Board (RWQCB) in September 2008.

The scope and schedule of the special studies included the following (collectively, the “Phase 1 Studies”):

- Estuary Subwatershed Study – Evaluates the physical and biological function of the SCRE affected by the discharge to confirm whether the discharge to the Wildlife/Polishing Ponds and then to the SCRE results in a fuller realization of beneficial uses, and to determine whether beneficial uses can be further optimized under different conditions such as a decreased discharge to the SCRE. The submission draft of this Study, titled “Final Synthesis Report” was provided to the Los Angeles Regional Water Quality Control Board (RWQCB or Regional Board) in March 2011. This Study synthesized information and results from the Year 1 Data Summary and Assessment and from data collected and analysis conducted during Year 2 in terms of ecosystem functioning under a range of flow scenarios to be accommodated by either treatment wetlands or reclaimed water recycling, as outlined in the other Phase 1 Studies below.

- Treatment Wetlands Feasibility Study – Evaluates the feasibility of implementing a constructed treatment wetland to further improve the water quality of the VWRF tertiary treated discharge by
reducing nutrients, copper, and other metals and constituents to further promote receiving water quality improvements. Submitted March 2010.

- Recycled Water Market Study – Evaluates and quantifies the feasibility of expanding the City’s existing reclaimed water system through evaluation of potential users within a five-mile radius of the VWRF (study area). Submitted March 2010.

In accordance with the approved Workplans, a series of six public workshops were held to present and discuss the scope, progress, status and findings the Phase 1 Studies, as well as underlying work products. The February 2, 2010 Stakeholder workshop (fourth public) workshop provided an opportunity for stakeholders to comment on the Year 1 findings, the Treatment Wetlands Feasibility Study, and the Recycled Water Study. On February 10, 2011, the sixth workshop was held to discuss the pre-submission draft of the Estuary Subwatershed Study. This workshop focused on a discussion of the discharge alternatives analysis. On March 7, 2011, the Estuary Subwatershed Study Report was submitted to the RWQCB.

In the interest of allowing for more stakeholder input, the RWQCB extended the comment period on the submission draft of the Estuary Subwatershed Study Report from March 7, 2011 to July 15, 2011. The RWQCB requested that the City submit by September 16, 2011 an amended version of the submission draft of the Estuary Subwatershed Study Report (the “Amended Final Report”). The RWQCB also suggested that the City hold an additional Stakeholder Workshop to discuss the comments and report. This workshop was held August 18, 2011. Notes from this workshop are posted on the City’s webpage (http://www.cityofventura.net/rivers). The Amended Final Report submission will address comments received during the additional comment period (set forth below), and will include a Memorandum of Recommendations for next steps based on the best scientific information available to date as result of the Phase 1 Studies and associated stakeholder comments.

The NPDES permit and the approved Workplans identified a second phase (“Phase 2 Studies”) needed to: (i) develop any additional information identified by the Phase 1 Studies as important for assuring protection of the sensitive wildlife and aquatic resources and habitats of the SCRE; and (ii) integrate the conclusions of all three of the Phase 1 Studies into a process for selection, design, environmental review, and, ultimately, in Phase 3, engineering, permitting and implementation of a preferred alternative or combination of alternatives to create a discharge regime that further optimizes beneficial uses of the SCRE.

COMMENTS RECEIVED ON THE MARCH 2011 ESTUARY SUBWATERSHED STUDY REPORT

As was the case with earlier comments received on the submission draft of the Estuary Subwatershed Study Report (dated March 7, 2011), many stakeholder comments identified additional data and analysis needs to determine an optimal discharge regime. Stakeholders also expressed concerns regarding potential risks of implementation of one or more of the identified alternatives. Prior to selection or implementation of a preferred alternative additional information needs not addressed in the current Estuary Subwatershed Study may be addressed as part of one or more Phase 2 studies. This will ensure the adoption of a VWRF discharge and/or diversion regime that further optimizes beneficial uses of the SCRE. In addition, the
Phase 2 Studies will set forth a plan for analyzing, evaluating, determining, permitting, and, ultimately, implementing the preferred combination of alternatives.

The comments on the March 2011 Final Synthesis Report are presented in the matrix below and organized by author in the order they appear in the original letters from which they were extracted. The original letters are attached to this memorandum.

**COMMENT RECEIVED BY RWQCB STAFF AT THE AUGUST 18, 2011 STAKEHOLDER WORKSHOP**

As discussed above, the meeting notes from the August 18, 2011 stakeholder workshop are posted on the City’s website. However, one comment at the August 18, 2011 workshop deserves some attention here to capture RWQCB staff discussion regarding what would constitute a finding of enhancement. To address this comment, we have added clarification on what is in the Amended Final Report about California Enclosed Bays and Estuaries Policy, information on past precedents, and how this affects the enhancement analysis presented in the Amended Final Report.

The comment made by Brandi Outwin of the LA RWQCB essentially questioned whether under the Enclosed Bays and Estuaries Policy the VWRF discharge would need to demonstrate improvement year-round for a finding of enhancement.

**Response:**

The comment appears to merge a technical issue and a legal issue, creating some confusion regarding the legal conclusion concerning “enhancement,” under the Enclosed Bays and Estuaries Policy. The two issues that the comment appears to merge are:

- from a technical perspective, it appears from the comment that the Regional Board would like to confirm the potential to adjust VWRF discharges seasonally to optimize beneficial uses; and
- from a legal perspective, the studies should demonstrate “enhancement” of beneficial uses.

In WQ 79-20, the State Board provided guidance regarding making a legal determination as to whether discharge to an enclosed bay or estuary is “treated and discharged in such a manner that it would enhance the quality of receiving waters above that which would occur in the absence of the discharge.” The State Board determined that discharge enhances the water quality under the Bays and Estuaries Policy if:

1. the treatment facility consistently and reliably achieves full secondary treatment, with disinfection and dechlorination;
2. the treatment facility consistently and reliably meets any NPDES permit effluent limits designed to protect designated beneficial uses of the receiving waters; and
3. the discharge either results in a new beneficial use or a “fuller realization” of an existing designated beneficial use of the receiving waters than would result in the absence of all point source discharges.
Under this guidance, so long as, on balance and taking into account any seasonal differences, one or more new beneficial uses are attained, or any beneficial use is more fully realized as compared to beneficial uses that would occur if there were no (zero) discharge, then there is enhancement. In considering whether any beneficial uses are attained or more fully realized as a result of a discharge, it is important to understand that some beneficial uses are themselves necessarily seasonal. For example, MIGR, SPWN, and often REC-1 and/or REC-2 will be realized, if at all, on a seasonal or episodic basis. Therefore, while a determination of enhancement considering realization of beneficial uses should take into account seasonal differences as they pertain to a discharge, it is also appropriate to take into account that a discharge may, on balance, result in fuller realization of beneficial uses, even if the beneficial use is not consistently improved in the same way or by the same amount during each and every season, or during each month or on each day of a particular study period.

Importantly, the need to consider the absence of discharge in determining enhancement means that enhancement should be evaluated based on a comparison of discharge to a zero discharge scenario, including, in the case of Ventura, zero discharge to Wildlife/Polishing Ponds or the Estuary. By comparing current discharge to a true zero-discharge scenario, it is clear that there are several beneficial uses that are more fully realized year-round at the Wildlife/Polishing Ponds, and in the form of additional Estuary habitat for steelhead, tidewater goby, least tern, and other species. Nevertheless, the comment makes it clear that a better discussion of beneficial uses attained and/or more fully realized as compared to a zero discharge scenario is needed, and such discussion will be incorporated into the Amended Final Report. In addition, the comment makes it clear that we need to better distinguish between evaluating “enhancement” under the Enclosed Bays and Estuaries Policy, and determining how to improve chemical water quality, or habitat, or beneficial uses by adjusting the discharge regime (sometimes, confusingly referred to as “enhancing” beneficial use in the current submitted draft of the Estuary Subwatershed Study Report). The Amended Final Report will attempt to carefully distinguish between the two concepts.
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<td>1.2</td>
<td>NMFS (Penny Ruvelas, March 14, 2011)</td>
<td>The report states in Chapter 7 that adult and juvenile steelhead use the SCRE mainly as a migration corridor, and juvenile steelhead rear in the estuary only for short periods and do not use the estuary as summer rearing habitat. NMFS believes these conclusions are inaccurate and should be omitted.</td>
<td>Comment noted. Report Section 7.2.1.4 includes a discussion of steelhead use of the SCRE in summer/fall. Section 7.2.1.2 discusses the potential important role lagoons and estuaries play in steelhead rearing. Conclusions take into account over-summering by steelhead in the SCRE. No additional report changes made.</td>
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<td>1.3a</td>
<td>NMFS (Penny Ruvelas, March 14, 2011)</td>
<td>NMFS believes that there is significant uncertainty associated with the model used to predict the amount and extent of estuarine habitat available to steelhead under the three discharge scenarios. NMFS recommends that a broader discussion of the uncertainties associated with the model, and how they affect results, be provided.</td>
<td>Comment noted. Section 7.2.1.4 provides a clear basis for assessment of habitat suitability based upon depth. Although we recognize a number of habitat elements are included in steelhead critical habitat, other than water depth and quality, the majority of these elements are absent from the SCRE and also unaffected by VWRF discharge. Regarding the use of the water balance model to predict areas inundated to particular depths, Sections 4.2.3.1 and 11.2 include a discussion of uncertainty, and now Section 11.3 includes a discussion regarding the sensitivity of modeled SCRE stage to modest changes in bathymetry and mouth berm length. It should be noted that the wide range of hydrologic influences affecting SCRE habitat and ecosystem functioning result in uncertainty. However, this does not imply that the conclusions are not supported by substantial evidence, sound methodology, and rigorous analysis. It will be important to better address the uncertainties discussed in the comment and in Sections 4.2.3.1, 11.2 and 11.3 during Phase 2 Studies as necessary to identify a preferred discharge management alternative that optimizes beneficial uses in a manner that reasonably assures RWQCB, NMFS, USFWS and CDFG that no significant adverse impacts to the sensitive fish and wildlife occupying the SCRE and/or the Wildlife/Polishing Ponds will occur. Text additions made in Section 11.3.</td>
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<td>1.3b</td>
<td>NMFS (Penny Ruvelas, March 14, 2011)</td>
<td>NMFS also recommends that Figure 11-2, which estimates acreage of estuary habitat available to steelhead under the three discharge scenarios, includes error bars to display the range of uncertainty inherent in the model.</td>
<td>Comment noted. Given the duration of the monitoring period as well as the presence of several unmeasured components in the water balance, such as groundwater flow, it is not possible to provide representative error bars of this Figure (now Figure 11-3). Development of error bars would require uncertainty estimates regarding the range of suitable depths as well as all components of the water balance model, including inter-annual and seasonal changes in SCRE bathymetry, river, and groundwater flows. Understanding that these uncertainties should affect all scenarios evaluated, the curves are therefore intended to give a general sense of relative changes in habitat area with SCRE stage and VWRF discharge. A discussion on sensitivity of the model to variations in inputs was added to section 11.3 although figures were not modified to show error bars. As discussed more fully in the response to comment 1.3b, it will be important to better address the uncertainties discussed in the comment and in Sections 4.2.3.1, 11.2 and 11.3 during Phase 2 Studies.</td>
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<td>1.4a</td>
<td>NMFS (Penny Ruvelas, March 14, 2011)</td>
<td>The report lacks a clear assessment of the range of water depths available to steelhead within the SCRE under differing (e.g., open vs. closed) conditions, and does not describe the percentage of estuary area that are of a specific depth under differing conditions. NMFS recommends that the report include a detailed discussion of the relation between estuary stage, estuary area, and range of depths available to steelhead within the estuary.</td>
<td>Comment noted. Report revised. Figures 4-15 and 11-1 were modified to show average water depth as well as SCRE stage. New Figure 11.2 shows the area and depth for the identified alternatives. See discussion on comment 1.3a.</td>
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<td>1.4b</td>
<td>NMFS (Penny Ruvelas, March 14, 2011)</td>
<td>NMFS also recommends that the report include an analysis of how the amounts of deepwater habitat change relative to the overall estuary area under the three wastewater discharge scenarios.</td>
<td>Comment noted. Report revised. Figure 11-2 now shows the range of water depths associated with various SCRE stages.</td>
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<td>1.5</td>
<td>NMFS (Penny Ruvelas, March 14, 2011)</td>
<td>The report states in Chapter 9 that habitat conditions within the SCRE are “apparently not favorable for steelhead over-summering.” NMFS disagrees with this characterization because it appears to be based on past water quality data from grab samples restricted to a few locations within the estuary. Furthermore, the water quality data presented in the report clearly show that water quality parameters are within steelhead tolerances a majority of the time. Thus, NMFS recommends the conclusions in Chapter 9 that imply habitat conditions within the SCRE are not suitable for steelhead over-summer be omitted.</td>
<td>Comment noted. We agree that as steelhead are known to be in the SCRE during the closed mouth summer/fall period (as demonstrated in the September 2010 stranding); therefore the habitat and conditions are suitable at least in some portions of the SCRE during the summer/fall period. However, that is not to say that the water quality could not be improved to the benefit of the species. Temperature and dissolved oxygen (DO) conditions in the SCRE are suitable for much of the year, but since current DO monitoring, including continuous and grab sampling, suggests episodic hypoxia in some localized areas in the SCRE during dry weather closed-mouth condition, we believe the discussion is appropriate. Section 9.2.4.1 and other sections of the Report have been revised to include text regarding limitations affecting habitat suitability in some locations of the SCRE due to nutrient loading “…under some conditions due to algal impacts upon dissolved oxygen levels.”</td>
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<td>2.1a</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 7) …increased freshwater input into the estuary in the dry season increases the volume of water in the estuary, which increases the aquatic habitat area. This could potentially benefit steelhead, but the actual benefit is not easily determined because it is not clear that habitat is in any way limiting steelhead populations or growth in the estuary. <strong>Although the increase in wetted area at different estuary stages has been calculated, no analysis has been done to indicate whether the increased area was good quality habitat.</strong> As suggested above, it is possible that habitat simplification in the estuary has reduced the quality of SCRE for steelhead, and simply increasing the amount of low quality habitat (though, in the absence of an assessment of habitat quality we don’t know if the increased habitat is low or high quality) would have little benefit for steelhead. Thus this putative benefit, although asserted by the Synthesis Report, is uncertain.</td>
<td>Comment noted. Although Section 3.2 provides a thorough discussion of habitat simplification due to development of the surrounding watershed, the only effects of the VWRF discharge on SCRE habitat structure or complexity that are relatable to steelhead habitat quality are those related to water depth and quality. Sections 9.2.4 and 11 provide a discussion of aquatic habitat maintenance in the context of these factors. Minor report changes made.</td>
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<td>2.1b</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 7) The VWRF effects on water quality, especially increased nutrients and eutrophication and the consequent turbidity, would likely have a negative effect on steelhead (e.g., Kelley 2008)</td>
<td>Comment noted. Water quality in general and the effects of increased nutrients in the SCRE on algae, DO, and thus habitat suitability are extensively discussed in Sections 5, 7, 9, and 11. Water quality impacts to steelhead are discussed specifically in Sections 9.2.4.1 and 11.7. No report changes made.</td>
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<td>2.1c</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 7) There may also be negative effects on steelhead due to contaminant concentrations, both those that have been measured (e.g., copper) and emerging contaminants that generally are not measured.</td>
<td>Comment noted. Thresholds for olfactory impairment of steelhead due to dissolved copper in estuarine waters, or reliable methodologies for measuring emerging contaminants and for determining the effects of particular emerging contaminants are not well established. However, as appropriate and robust methodologies are developed, it is recognized that it may be possible and appropriate to develop information addressing these issues in Phase 2. No report changes made.</td>
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<td>2.1d</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 7 &amp; 8) What is certain, on the other hand, is that excessive breaching of the estuary during the dry season is detrimental to steelhead in the estuary. As with many southern California coastal wetlands, the SCRE historically was closed during most of the dry season (D. Jacobs and E. Stein, personal communication). The extra water introduced into the estuary during the dry season raises the level of the lagoon and increases the frequency of dry-season breaching. This certainly has a negative effect on steelhead residing in the lagoon at the time of breaching.</td>
<td>Comment noted. We concur that dry season flows into a closed estuary during can lead to the increased potential for mouth breaching due to multiple causal mechanisms (e.g., wave overwash at high tides, overtopping, or unauthorized third party activities). These issues are well discussed in Sections 4.1.5 and 11 of the report. However, it is likely that the SCRE was historically inundated during summer months. Data collected over the last 25 years suggests that the SCRE is currently closed during most (i.e., more than half of the time) of the dry season (July through November, see Figure 4-8) and it is apparent that no breaching has occurred in some summers, even with continuous VWRF discharge. In recent years, the summer/fall breaches that have occurred were attributed to unauthorized, third party action and not due to wave overwash or overtopping. Report changes have been made to clarify breaching mechanisms and their effects.</td>
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<td>2.2a</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pgs. 9 &amp; 10) Healthy populations of invertebrates in/around the coastal strand and healthy populations of estuarine fish in either the SCRE or McGrath lake could be sufficient but not necessary for a consistent population of plovers or terns in or around the SCRE. <strong>Both species nest around the terrestrial edges of the SCRE. As such, the health of both of these bird species are related to the dynamics of the VWRF, but only indirectly.</strong> While a healthy estuary would be a positive factor facilitating recovery of these birds, it is by no means necessary or even the greatest factor in their population dynamics. Ecological factors outside the SCRE and the influence of VWRF such as human disturbance and beach grooming (Lafferty 2001) appear to drive the dynamics of these populations. <strong>Hence, these are relatively equivocal indicator species relative to aquatic species directly influenced by SCRE dynamics such as steelhead and gobies.</strong></td>
<td>Agree. Although aquatic focal species were also included in the Final Study Plan, the selected species were provided by the RWQCB and are appropriate for the purposes of evaluating avian habitat use of the SCRE. Although examination of additional focal species may be considered under Phase 2 as and if necessary to safely establish a preferred discharge management alternative, as the commenter noted, selection of additional non-aquatic species will not strengthen the identified linkages of the VWRF to ecosystem functioning. No report changes made.</td>
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<td>2.2b</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 10) <strong>Owing to the indirect linkages between the proposed focal bird species and the functioning of the SCRE and VWRF discharge levels, we suggest two potential alternative candidate species. Both the Pacific lamprey (Lampetra tridentata) and the partially-armored threespine stickleback (Gasterosteus aculeatus microcephalus) are native fish species in the SCRE. While the Pacific lamprey has been in decline over the past several decades, it remains much more abundant in the Santa Clara River and Estuary than the nearly extirpated steelhead even though they share a similar anadromous life history (Chase 2001). The partially-armored threespine stickleback is second only to tidewater goby in SCRE resident fish abundance (Nautilis 2009). Both of these fish demonstrate an ecology that is likely much more impacted by habitat quality and quantity than either plovers or terns.</strong></td>
<td>Comment noted. Although these species are briefly discussed in Section 7.1.2, the high abundance noted in the comment suggests these species are less sensitive to current habitat conditions within the SCRE versus upstream conditions. For this reason, it is expected that scenarios benefitting local habitat conditions for the selected focal species would also benefit those proposed here. Although no detailed habitat assessment for these species has been added, additional discussion of resident SCRE species has been included in Section 11.</td>
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<td>2.3</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 12) The Synthesis Report recognizes the variability in the benthic invertebrate data due to environmental conditions (as well as variability in the data due to changes in sampling methods). In describing the recovery of benthic invertebrate populations after disturbance, the Synthesis Report reports that “[t]his provides further evidence that the SCRE BMI community is adapted to the harsh conditions found in this dynamic environment.” <strong>This is a tautological conclusion, since of course the organisms living in the SCRE are adapted to live in that environment.</strong> This idea that the organisms living the SCRE are adapted to a harsh environment seems to influence the Synthesis Report’s conclusions about the effects of the VWRF discharge. The Report concludes (p. 131) that “the weight of evidence to date indicates that the VWRF effluent is not adversely affecting BMI populations in the SCRE (ABC Laboratories 2009).” We do not agree with this conclusion. The absence of suitable undisturbed reference estuaries makes it difficult to draw conclusions about how the VWRF discharge might have affected the benthic invertebrate assemblage in the SCRE (see our Recommendations section below). However, as noted above, the discharge alters the estuary in ways that almost certainly would influence the invertebrates living there. Most significantly, more frequent breaching through the summer, especially repeated breaching events, would increase the physical stresses on the organisms living in the estuary and likely lead to reduced abundances and species richness, especially in the area closest to the mouth.</td>
<td>Comment noted. Although lack of suitable reference locations is a common issue to the evaluation of riverine and estuarine environments within urbanized settings, the cited ENTRIX (2002b) reviews BMI data from a number of Southern California estuaries and lagoons. Existing BMI data does not suggest large differences from nearby California estuaries and it is unlikely that the current frequency of breaching due to human intervention adversely affects the BMI species assemblage. Our review of the multiple years of BMI data analyzed in support of Sections 5.4, 5.5, and 7.1.1 does not suggest conditions for BMI themselves or as food resources for the identified focal species are impaired. Additionally, as discussed in comment 2.1d, we find the assertion of repeated summer breaching unsubstantiated by the historical data. As discussed in section 4.1.5 in the report and comment 2.1d, above, summer breaching in recent years was attributed to unauthorized third-party activities not related to wave overwash or overtopping, the potential for which may be increased due to SCRE water levels. Breaching dynamics are primarily driven by natural weather cycles of wet and dry periods, with the mouth remaining open longer during wet periods. For example, in summer 2011, following the wet weather of winter/spring 2011, the mouth did not close until late August due to the higher base flows. Changes have been made to distinguish between increased potential for breaching due to discharge and impacts due to unauthorized actions of third parties.</td>
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<td>2.4a</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 14) “it is clear the presence of abundant exotic species in the SCRE is likely detrimental to native species of concern such as the tidewater goby . . . and steelhead . . . . Any efforts to create environmental conditions less hospitable for such invaders [i.e., reducing VWRF flows to the SCRE during summer (dry) months] will ultimately benefit native flora and fauna throughout the SCRE and beyond.”</td>
<td>Agree. Intra-specific interactions are described in Section 7.1.3 and these arguments are consistent with the scenario evaluations of reduced VWRF discharge presented in Section 11.7. No report changes made.</td>
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<td>2.4b</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pgs. 14 &amp; 15) …Synthesis Report [i.e., the Estuary Subwatershed Study] implies that the discharge is compensating for reduced flow, and thus by implication is restoring a more natural cycle. For example many reports (e.g., 2002 BMI study, the Synthesis report) include a statement such as this: “…In part, the VWRF discharge compensates for upstream Water diversions and provides a water source during periods when the Estuary would otherwise be dry.” The first part of this excerpt is consistent with our understanding of the Santa Clara River and most other southern California rivers and estuaries. <strong>But the highlighted section implies the VWRF discharge is replacing water that would naturally be present in the lagoon if it weren’t for the upstream diversions.</strong> This may be true during spring, when flows in the River would be below their peak but not yet to the minimum. At this time, water diversions might significantly reduce the flow in the River, and the VWRF might be seen as replacing this water. <strong>But in summer, it would appear that there normally would be relatively little surface flow into the SCRE, with or without water diversions, so that the VWRF discharge would be an artificial supplement to the volume of water in the Estuary.</strong></td>
<td>Disagree. It is likely that flow regulation and groundwater extraction for agriculture in the Santa Clara River watershed have caused a decrease in dry season baseflow compared to pre-European settlement conditions. See Sections 4.1 and 9.2.1 for a detailed discussion on this topic. No report changes made.</td>
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<td>2.5</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 15) <strong>We do not find data supporting the contention that the SCRE would become unsuitable for steelhead, tidewater goby, or other resident species if the VWRF was not discharging into the Estuary.</strong> The estuary persisted without artificial water supplementation historically, as do many other seasonally open estuaries in southern and central California.</td>
<td>Partially Agree. Other than a discussion of periods of unsuitable DO conditions for some species in the introduction of Section 11 and in other sections as they relate to algal related DO fluctuations, the attributed assertion could not be found in the synthesis report. Nevertheless, we agree that the SCRE would persist under a 100% flow removal conditions, as discussed for the evaluation of Scenario 6 in Section 11.7 due to groundwater contributions that would cause the SCRE to fill. There would, however, be potential adverse effects on aquatic focal species in terms of a reduction in overall habitat area and depth as discussed in Chapter 11. These adverse effects would be more substantial in the absence of all discharge (i.e., the discharge scenario eliminating discharge to both the Wildlife/Polishing Ponds and the SCRE, as now discussed in Section 11 of the Final Amended Report).</td>
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<td>2.6</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 20) <strong>2009-2010 hydrologic conditions</strong> adequately characterizes typical system performance. We have some reservations with this given (as the authors note in section 11.2) the relatively wet conditions of 2009-2010 WY (although not as wet as the 2010-2011 WY is proving to be) and <strong>would have liked to have seen data from a range of years spanning comparatively dry years.</strong> Having said this, we believe that insight can still be gained even with models parameterized with only a subset of the natural range of physical conditions.</td>
<td>Comment noted. While the data collection period duration may not be ideal, we believe it is adequate to the task of determining whether the current VWRF discharge results in fuller realization of beneficial uses. Collection of additional data under the range of hydrologic conditions within the SCRE (wet, normal, and dry years) may be accomplished under the Phase 2 studies if and as necessary to safely establish a preferred discharge management alternative. No report changes made.</td>
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<td>2.7</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 20) <strong>Water Mass Balance Model</strong> (section 4.2) characterizes water quantity in the SCRE via essentially independent estimation of component inflows and outflows. <strong>The numerous assumptions used to generate each of these components necessitate great caution when interpreting the aggregate model outputs.</strong> This model appears particularly sensitive to predicted stage height, ground water pressure gradients/ inflow rates, and berm open/closed status. <strong>We have highlighted several concerns about these components/ assumptions previously.</strong> Alteration of the VWRF discharge rate is the primary forcing factor in future scenarios.</td>
<td>Comment noted. As discussed in the response to comments 1.3a and 1.3b, the water balance is adequate to evaluate the relative differences between alternatives. Sections 11.2 and 11.3 discuss the uncertainty in this analysis and the sensitivity analyses conducted. These uncertainties may be addressed during the Phase 2 studies if and as necessary to safely establish a preferred discharge management alternative. No report changes made.</td>
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<td>2.8a</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 20) Acute Nutrient Accumulation/Mass Balance Model (articulated in section 5.5) estimates Total Inorganic Nitrogen and Phosphate concentrations/mass loading to the SCRE. Similar to the above estimate of water quantity, this approach relies on assumptions about the various inputs and biological uptake/utilization rates. <strong>In particular we are concerned about the assumption that there are no biological “reactions” with regards to the nutrients in the system.</strong> This assumption can only hold if biological removal rates are low. In effect this says biological removal is not an issue by definition. This does not appear to be borne out by vetting of the overall ability of this model to predict extant conditions (see Figure 5-16). Comment noted. Although it is apparent the dynamics of algal-nitrogen uptake and release are not well represented in the equilibrium modeling approach used here, inclusion of factors related to algal growth and denitrification did not improve model performance. Although development of a more predictive water quality model could be accomplished at a higher sampling frequency, it is unlikely that the modeling conclusions would differ from those presented in the Amended Final Report. No report changes made.</td>
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<td>2.8b</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 20) <strong>In addition it is a bit unclear as to how the future condition parameters for Table 11-2 were set.</strong> For example, why does the VWRF pond groundwater flow rate increase across scenarios 4, 5, &amp; 6 (presumably due to an increase in hydraulic gradients as the overall water level decreases in the estuary and surrounding groundwater flows increase). This appears a key assumption as the model output predicts identical nutrient conditions/concentrations in Alternative 3, 5, and 6. Comment noted. Section 11.3 clearly states the process by which the variables used for modeling the discharge scenarios were developed. The groundwater flow rate increases with a decrease in VWRF discharge due to increased groundwater hydraulic gradients. Assumptions associated with developing estimates for this groundwater flow are given in Section 11.3. No report changes made.</td>
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<td>2.8c</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 20) <strong>Lastly, there is no clear link between nutrient concentration and habitat quality for the identified focal species other than general qualitative assertions</strong> that reduced nutrient concentrations should lead to less algal bloom or bloom-like conditions. Disagree. Whether nutrients are derived from the VWRF or other sources, it is clear that episodic algae blooms may result in periods of hypoxia in some localized areas in the SCRE. However, because of the relatively high nutrient levels in Santa Clara River upstream of the SRCE, there is no reason to expect that nutrient removals accompanying discharge reduction or removal scenarios would eliminate algal blooms and associated DO issues. As discussed in section 11.4 algal blooms are likely to occur under all potential discharge alternatives, however, a decreased frequency and duration is likely for alternatives with decreased nutrient loading from the VWRF (Alternatives 2, 3, 4, 5 and 6). No report changes made.</td>
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<td>2.9</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pgs. 20 &amp; 21) The models used to predict extant and potential future condition are deterministic. As such they paint a potentially misleading picture of those potential future condition of the SCRE; running this model again and again will merely produce the identical output and yield no measure of the error (or confidence we have in the reported output). <strong>Without such a measure of our confidence in the model result, decision makers may take away an assumption of certitude that does not exist.</strong> Emphasizing variance (between weeks, months, etc.) or incorporating some level of stochasticity would <strong>boost our confidence in this exercise.</strong> We recognize the challenges of such a more intense modeling effort, but numerous observations and data collected for this assessment point to the very dynamic nature of this coastal system. Indeed many of the key forcing factors within this system appear to be dictated by variation (e.g., breaching frequency) rather than the overall central tendency (e.g., average stage height) of the system. Modeling that central tendency is more expeditious but may not capture the key drivers of ecological functioning. For example, these models may predict a stage of height of say 10 feet after one month. Even if a brief breach then occurs, this model would predict another 10-foot elevation one month later and identical conditions to those of the previous month. The key determinant of the ecological functioning within that lagoon would be the breach event (the deviation if you will) and not the average condition.</td>
<td>Comment noted. While the dynamics of the larger Santa Clara River are well captured in the current conditions water balance (Figure 4-27), discerning the effect of incremental changes to VWRF discharge on top of these dynamic inputs is not possible. For this reason, the water balance inputs were modified to daily time series developed from long-term data. Figure 11-1 shows clearly the effect of VWRF discharge on SCRE stage, recognizing that year-to-year variations in river flows on a particular day as well as annual or shorter-term changes in berm and mouth conditions would produce different results from those shown in the report. As discussed in Section 4.1.5 breaching dynamics are largely influenced by natural wet and dry cycles and corresponding storm events that by nature are not predictable. Collection of additional data under the range of hydrologic conditions within the SCRE (wet, normal, and dry years) may be accomplished under the Phase 2 studies if and as necessary to safely establish a preferred discharge management alternative. No report changes made.</td>
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<td>2.10a</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 21) <strong>Stage height</strong> is the sole determinant of aquatic volume and in turn of the habitat quantity for focal species. As the authors point out, their approach depends entirely upon robust benthic topography, which has only been mapped to a high degree of accuracy twice in the last decade (2000, 2005). <strong>The assumption that the 2005 condition is an accurate predictor of topographies decades into the future is dubious.</strong> While a fine first pass, this approach is insufficient to characterize the overall quality of this aquatic habitat for our focal species. <strong>One example of the problem of this stage height-habitat area assumption can be found with the tidewater goby field surveys.</strong> Surveys conducted in the Spring of 2008 (see the Nautilus 2009 report) showed no effect of mouth breaching (<em>i.e.</em> different stage height) on tidewater goby abundance/incidence. If their habitat was so sensitive to stage height as implied by the core assumption of this model, we would expect goby abundance/incidence to decrease following a reduction in stage height. <strong>As such, using this single parameter as a predictor of goby habitat quality is flawed.</strong> While it is absolutely the case that gobies do require a minimum water level, other factors such as spatial refugia, prey availability, and predator abundance may well prove more accurate predictors of the adequacy of the SCRE as goby habitat. These were not assessed in this study.</td>
<td>Comment noted. Section 4.2.2.1 clearly states how the 2005 bathymetry was modified to reflect 2009 conditions and all associated assumptions and caveats and Figure 3-1 now shows the estimated 2009 SCRE extent and bathymetry. As for steelhead and other focal species, the assessment approach centers primarily upon habitat <em>quantity</em>, since the only habitat quality associations of the VWRF are related to receiving water quality. A discussion of the response to fabricated breaches, impacts by predator species adapted to current water quality conditions, as well as the potential loss of high flow refugia at the VWRF outfall channel is provided in Section 7.2.2 and Section 11.7. Collection of additional topographic/bathymetric data (<em>e.g.</em>, LiDAR) for current conditions or following future high flow events could be accomplished under the Phase 2 studies if and as necessary to safely establish a preferred discharge management alternative. Figure 3-1 updated.</td>
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<td>2.10b</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 21) A similar argument can be made for steelhead (see above). <strong>While higher stage results in greater aquatic habitat area, the additional habitat may not be of higher quality for steelhead or gobies</strong> (as acknowledge by the author).</td>
<td>Comment noted. As stated above, because of the frequency of high flow events in the Santa Clara River, SCRE habitat is highly simplified and lacks many structural attributes of riverine and estuarine locations elsewhere. That is, the majority of these features would be unaffected by any discharge scenario and changes in habitat “quality” are largely related to changes in water quantity and quality. Changes in water quantity and quality are well discussed in Sections 9.2.4 and 11.7. No report changes made.</td>
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<td>2.11</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pgs. 21 &amp; 22) Model only captures <strong>short-term dynamics</strong>. The authors are explicit in arguing that they designed this model to only address the situation in the 4-month, immediate aftermath period following a mouth closure. While we feel such a short-term approach is fine to compare the short-term dynamics of various management options, it is important to keep in mind that this ignores any longer-term shift in community dynamics. This weakness was recognized with regards to the potential expansion of tern and plover nesting (the authors felt the need to bring in longer term community dynamic estimates when they noted a lowered overall stage height such as under Alternative 6 would in all likelihood lead to only a temporary expansion of potential nesting area due to presumed vegetative encroachment in subsequent years), but not for putative salmon habitat. <strong>As their assumptions put a higher value on shallow/vegetated fringe regions of the marsh for focal fish species, their failure to consider possible longer-term dynamics (i.e., vegetation colonizing/redistributing to the periphery of new, lowered water levels under Alternatives 4-6) leads to an overly pessimistic estimate of the potential quantity of such habitat for fish rearing, etc.</strong> The authors could remedy this concern relatively easily by simply running additional simulations with a potentially redistributed vegetation polygon. This could at least help bound their results. Our concerns regarding the differences between habitat quality and quantity aside, we feel remaining cognizant of potential longer-term dynamics is always beneficial for managers/decision makers.</td>
<td>Comment noted. The supporting GIS analyses that provided the habitat area vs. stage relationships for focal fish species were driven primarily by the area meeting particular depth criteria. We find no reason to believe that changes in VWRF flows will fundamentally alter the vegetation distribution of higher stature vegetation that could provide structural cover for focal species, since this distribution is almost entirely controlled by scouring river flows during storm events and will therefore be unaffected by changes in VWRF flows (as discussed in Sections 3.2 and 9.2.1). With regards to rapidly colonizing, low stature vegetation, we believe our qualification of the longevity of short-term increases in open sand for snowy plover nesting are reasonable since it is likely that a similar vegetation distribution relative to average WSELs would likely occur. No report changes made.</td>
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<td>2.12</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 22) The Synthesis Report’s discharge-stage models predict or relatively little effect on focal species under scenarios 1, 2, and 3. McGrath State Beach would continue to flood under scenarios 1, 2, and 3. Effects upon focal species habitat begin to be felt under scenarios 4 and 5, although these effects are generally minimal according to the Report. Flooding of McGrath campground (and presumed recreational impairment) ceases under scenarios 4, 5, and 6. Scenario 6 would reduce potential steelhead habitat quantity by 70%, with that for other species moderately impacted or unimpacted. Unfortunately, we believe none of these model outcomes are of any utility to decision makers due to the caveats we have already mentioned and absence of any clear relationship between these predictions and the actual health of SCRE populations or functioning of the system.</td>
<td>Disagree. We believe that although many of the caveats identified in this review may be partially addressed through additional data collection during Phase 2, it is unlikely that these efforts will do more than point to the need to alter flows or include additional treatment, as concluded in the Study. We are confident in these conclusions based upon the current data collection effort but suggest that an adaptive approach be taken during the implementation phase of any preferred discharge management alternative. No report changes made.</td>
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<td>2.13a</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg 22 &amp; 23) …reductions in nutrient concentrations from the VWRF will tend to reduce the conditions leading to eutrophication, algal blooms, low DO, etc . . . This would represent an improvement in water quality to the background level of water entering the system from upstream/groundwater.</td>
<td>Agree. As discussed earlier, reduction in nutrients may reduce frequency and duration of algal blooms and localized areas of low DO, although these conditions will still occur due to relatively high background nutrient levels in the Santa Clara River. Section 11.4 and Table 11.2 present the anticipated water quality with improvements in nutrient removal from the VWRF. This is consistent with the discharge reduction/removal/treatment scenarios presented in Section 11.7. However, since steelhead and goby are present under current conditions, it is unclear whether habitat quality improvements anticipated under these scenarios due to water quality improvements outweigh habitat area reductions accompanying flow reduction alternatives. No report changes made.</td>
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<td>2.13b</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 23) At various points there are references made to potential long-term shifts in vegetation or other landscape elements should a given alternative be in place for an extended period of time (e.g. section 11-2) even though their modeling efforts do not encompass this possibility. While an important caveat, we are not particularly concerned with this eventuality. <strong>Even if Alternative 6 (complete cessation of VWRF input) were implemented, we believe the dynamic flows and scouring during the wet season are likely to prevent channels from choking with vegetative or sediment accumulation to the extent we would see a radical alternation of potential habitat for any focal species.</strong></td>
<td>Partially agree. While we agree that the flood frequency of the SCRE under any discharge scenario will likely scour vegetation encroaching into the floodway, we disagree with the comment. Vegetation in the vicinity of the VWRF discharge channel appears to have survived the last two high flow events. Although it is more likely that the loss of high flow refuge to tidewater goby due to vegetation encroachment in the outfall area would occur under Scenario 6 (elimination of VWRF discharge to the SCRE), we believe that vegetation in other areas of the SCRE may provide this function. No report changes made.</td>
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<td>2.14</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 23) These 4-month long scenarios generally are at or near (within ~1 foot) their equilibrium conditions within 1 to 1.5 months of the onset of the model. The general assessment of each given scenario is therefore driven by those dominant equilibrium or near equilibrium conditions. This ignores the fact that during the summer months, the mouth has remained open approximately 2/3 of the time from the mid-1980s to late 1990s or 1/3 of the time over the past decade (see Figure 4-9). <strong>We understand the value of a standardized model with which to compare alternative scenarios. However the propensity to breach is not expressed at all in this exercise.</strong> This is a key driver if of ecological functioning of the system and of habitat quality and quantity for our focal species in the SCRE. Even assuming the relatively infrequent summer breaching rate of recent years (30% or less of the time) paints a very different picture of the quantity/duration of habitat available to the focal species. We therefore cannot express how problematic excluded breaching from this scenario comparison exercise is. <strong>As we believe breaching is the most important feature of the SCRE from an ecological impact perspective and the greatest impact from the VWRF discharge in particular, any interpretation of these scenario models is limited.</strong></td>
<td>Disagree. The modeling does explicitly include the propensity for the mouth to breach. The modeling was concerned with SCRE stage during closed mouth, dry season conditions (i.e., period when the VWRF is the dominant inflow). Based on available information, we assumed that increased potential for breaching due to wave overwash or overtopping would occur at stages above 9.5 ft NAVD88 with overtopping of the mouth berm occurring when the SCRE stage is at or above 11 ft NAVD88 (see Figure 4-15) Our modeling exercise for a hypothetical, idealized future SCRE stage showed that the stage remained below the 11 ft NAVD88 ‘overtopping stage’ for all six scenarios. Text revisions made in Section 11.3.</td>
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<td>2.15</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 23) One potentially cost effective approach to improve our understanding of the proposed alternatives is to build upon the considerable effort that went into this existing model. <strong>We suggest adding breaching events and explicit measures of habitat quality to this model. This could potentially be done via an integration of the nutrient and stage height elements.</strong> The Bight ’08 estuary dataset complied by the Southern California Coastal Water Research Project may be particularly helpful in this regard. While not directly elucidating nutrient-fish relationships, this yearlong effort attempted to relate nutrient concentrations to DO and algal bloom events. Such an exercise which attempted to explicitly get at habitat/water quality from this initial model framework would greatly improve decision makers’ ability to distinguish between potential alternative scenarios.</td>
<td>Comment noted. See response to Comments 2.3 and 2.14 regarding linking breaching to VWRF operations. As stated in other comments regarding habitat quality and detailed in the report, the majority of structural habitat elements associated with fish habitat “quality” are absent from the SCRE due to the frequency of flood scour events. Although additional stage and water quality data collection over an extended monitoring period may allow the development of such measures as part of the Phase 2 studies, we do not believe that the resulting conclusions would differ from those presented in the Estuary Subwatershed Study Report regarding nutrients, algae, DO and fish habitat. No report changes made.</td>
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<td>2.16a</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 24) Much effort in both this report and the monitoring efforts that have led up to this report have focused on elucidating SCRE habitat quantity or traditional water quality parameters within the SCRE. This was an appropriate starting point. With this foundational work in place, <strong>we would like to see the data collection efforts mature to focus more intently upon issues of habitat quality.</strong> This includes a better understanding of the productivity rate of prey items for focal species, growth rate studies of focal species, and a better understanding of community assemblages across a range of SCRE sites and comparable reference sites (see below).</td>
<td>Comment noted. As stated in responses to previous comments, nearly all issues of habitat quality affected by the VWRF relate to potential changes in water quality under one or more of the identified discharge scenarios. Although inclusion of growth studies and assessment of community assemblages may be considered under Phase 2 if and as necessary to safely establish a preferred discharge management alternative, the lack of suitable estuarine reference sites will ultimately result in poor comparability of results and an inability to provide meaningful predictions of these measures of ecosystem functioning under future alternative scenarios. No report changes made.</td>
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<td>2.16b</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 24) <strong>We also suggest a greater emphasis be given to ecotoxicological studies</strong>, particularly sub-lethal chronic and acute studies on focal species (goby or goby models and smolt steelhead or steelhead models) that have received so much attention in this work leading up to this Synthesis Report. Nutrient, heavy metal, organic and emerging contaminant studies on aquatic species would greatly improve our ability to ascertain the actual value of the habitat quantity. <strong>Comment noted. A range of toxicity studies have been previously undertaken by the City as reported in the submitted Estuary Subwatershed Study. However, as and when methodologies are developed for more robust evaluation of sublethal effects of the identified contaminants, it is recognized that information addressing these issues may be appropriate to develop in Phase 2 studies if and as necessary to safely establish a preferred discharge management alternative. No report changes made.</strong></td>
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<td>2.17</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 24) <strong>Our ability to better interpret VWRF-associated impacts and benefits would improve with a more rigorous assessment of the ecotoxicology of various factors upon SCRE organisms. We suggest a series of acute and chronic toxicity tests with EPA approved organisms.</strong> Ideally organisms would include species of concern but also other organisms that represent a range life histories and interactions with the environment, developmental periods/ages, and that span a range of sensitivities. We suggest both vertebrate and invertebrate EPA-approved Whole Effluent Toxicity (so-called WET) model organisms. Rainbow trout (<em>Oncorhynchus mykiss</em>), fathead minnow (<em>Pimephales promelas</em>), and topsmelt (<em>Atherinops afinis</em>) could provide good estimates of the range of fish feeding guilds and are relatively robust estuarine organisms that occur in SCRE. Water fleas (<em>Daphnia</em> sp.) and mysid shrimp (<em>Mysidopsis bahia</em>) would characterize the sensitivity of short-lived invertebrates who may be relatively more susceptible to both acute and chronic impacts from pollutants. We note that fathead minnow, topsmelt, and mysid (and a <em>Daphnia</em> analog) were used during water and sediment toxicity tests conducted in the SCRE from 2003-2004 (<em>Nautilus</em> 2005). We suggest building upon this good previous work, however emphasize focal species models and emphasize the more freshwater/brackish suite of models (<em>Nautilus</em> 2005 emphasized marine models). Acute and chronic bioassays for both lethal and sublethal Comment noted. See response to Comment 2.16b. Data summaries from the City’s ongoing and extensive toxicity testing are provided in the report. There is no indication of water quality impairments for toxicity under current conditions. However, it is recognized that information addressing these issues may be developed in Phase 2 studies if and as necessary to safely establish a preferred discharge management alternative. No report changes made.</td>
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<td>2.18</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 24) <strong>Additionally any attempts to characterize emerging contaminants commonly derived from municipal, agricultural, and industrial wastewater such as endocrine disruptors, cosmetics, and fire retardants would be a positive step.</strong> We appreciate that concentrations of such compounds are often at the ppb level, at or near existing detection limits, and that few if any standard monitoring methods have emerged. Nevertheless, such a dataset will go a long way towards helping us understand some of the more subtle impacts of VWRF upon potential habitat quality.</td>
<td>Comment noted. Comments regarding the role of emerging contaminants were discussed in previous responses to comments. However, as and when methodologies are developed for more reliable assessment of sublethal effects and emerging contaminants, it is recognized that information addressing these issues may be developed in Phase 2. No report changes made.</td>
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<td>2.19</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 25) <strong>Perhaps the greatest challenge to rendering a robust judgment upon the health of the SCRE is the lack of an appropriate reference system or systems.</strong> At some level (coastal river or coastal estuary), we have many sites with which to compare the SCRE. At such a gross level, we can relatively confidently answer some basic questions such as are there/should we expect there to be steelhead in the SCRE? At this gross level of assessment, nearby sites are acceptable reference sites or historic data can be gathered to determine the historic condition of the SCRE. <strong>Unfortunately, for many of the more focused and therefore diagnostic metrics discussed in this report, such gross comparisons are not appropriate.</strong> In particular the conditions that derive from the seasonal closure of the river mouth are a challenge. We know of no good extant system that mimics the open-closed nature of this coastal lagoon system that is itself relatively undisturbed. While we may have some suppositions based on our own experiences, there is simply no obvious, objective yardstick with which to compare many of these more detailed metrics discussed herein: infaunal density, ichtyofauna compositional diversity measures, etc. For</td>
<td>Partially Agree. We agree with all of the limitations discussed. However, although a longer term dataset and additional lines of analysis will always provide additional insights, we believe that the developed models and comparisons to other systems provide a reasonable basis for informing estuary management decisions. With the exception of the predicted changes in water quality and inundated area, we believe the highly simplified habitat within the SCRE resulting from the hydrology of the larger Santa Clara River watershed will be largely unaffected by selection of a particular discharge alternatives. That said, further for identification of a preferred discharge management alternative could be accomplished as part of the Phase 2 studies. No report changes made.</td>
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<td>example, in previous reports wherein an effort was made to compare benthic macroinvertebrates within the SCRE to those within other systems in the Southern California Bight, the vast majority of these putative reference sites were fully tidal and so not comparable (even if identical sampling methodologies had been used). <strong>In short, the lack of a robust, regional assessment framework is clearly felt.</strong> Nevertheless the authors lack of monitoring at a range of reference sites and the short temporal duration of the vast majority of their sampling efforts (we note that discharges in the SCRE began in 1958 and California’s inaugural Enclosed Bay and Estuaries Discharge Policy in place since 1974) makes interpreting current performance an equivocal task.</td>
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<td>2.20</td>
<td>Ventura CoastKeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 25) Given both the shortcomings of the scope and duration of the sampling efforts to date, the lack of obvious reference sites for the SCRE, and limitations of the models utilized, <strong>we propose a manipulative experiment to better interpret the current conditions and at least some of the alternative management scenarios.</strong> We propose a 3- to 6-month experiment wherein effluent from the VWRF is removed, reclaimed or piped directly offshore via a temporary pipeline akin to the temporary dredging pipeline routinely deployed adjacent to the SCRE for dredging operations in Ventura Harbor. As we lack an adequate model system, such a temporarily cutoff VWRF discharge from the estuary proper would go a tremendous way towards estimating salinity levels, stage height, infaunal responses, etc. in a VWRF-free scenario. While there are various shortcomings and risks with such a manipulative approach, we would be on much more solid footing with regards to predicting alternative scenarios. It would directly allow the testing of Alternative 1 and Alternative 6 (and a partial diversion would allow us to evaluate the hydrological components of Alternative 4 &amp;</td>
<td>Comment noted. Although the specific management actions for the SCRE could range from No Action to Complete removal, we agree that any management decisions should be adopted in an experimental adaptive management framework over time with appropriate monitoring to address potential risks to SCRE beneficial uses. However, as discussed at the August 18, 2011 stakeholder workshop, the permitting required for a temporary discharge to the Harbor or the Ocean would be extremely difficult to obtain, and it is likely to be infeasible to conduct such a short-term experiment during Phase 2. No report changes made</td>
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<td>while giving important insight into the other alternatives. Even a short-term experiment may elucidate much of what currently remains unknown or untested.</td>
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<td>2.21</td>
<td>Ventura Coastkeepers (EXPERTS, June 14, 2011)</td>
<td>(Pg. 26) In summary we feel the Santa Clara River subwatershed studies do not afford enough ecologically-relevant information to say that VWRF discharges into the SCRE are necessarily a net benefit to the system. There are likely to be improvements to the ecological and recreational values with reduced quantities of water and nutrients discharged into the system, but the nature and extent of these benefits are unclear given the information and data provided to date. The summary report is a definite improvement in the effort to better understand the SCRE system and the effect that the VWRF has upon it, but does not provide adequate information to make a fully informed decision as to the current effect of VWRF discharge on SCRE organisms and their ecosystem.</td>
<td>Disagree. We agree that the dynamic nature of the SCRE ecosystem limits the applicability of the short-term data collected to date to represent the full range of potential conditions in the future. Nevertheless, based upon the results collected to date, maintenance of current habitat area provides benefit to the identified focal species and potential improvements from removal of nutrients will provide further benefits. Development and optimization of a preferred discharge management alternative, including treatment wetlands for nutrient reduction, or potential increases in the use of recycled water is anticipated as part of the Phase 2 studies and would likely include an adaptive management framework to further validate various hypotheses regarding future habitat conditions as well as other beneficial uses. No report changes made.</td>
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<td>3.1</td>
<td>Ventura Audubon Society (Reed Smith, July 5, 2011)</td>
<td>Figure 11-4 which shows modeled Western Snowy Plover and California Least Tern nesting habitat areas for each alternative: This discussion doesn’t give the decision makers any useful information as currently the available habitat for nesting for both species is underutilized. The main factor for Least Tern nesting success is the availability of nearby foraging habitat. If forage fish are available the terns will use nearby sandy areas outside of the estuary for nesting.</td>
<td>Disagree. We agree that the changes in Least tern nesting are unaffected by various discharge scenarios, but believe that current Figures 11-5 and 11-6 provide a useful means of illustrating relative changes in habitat during low-flow, closed-mouth conditions for the three discharge alternatives. In addition to current Figure 8-4, Figure 11-6 provides an estimate of variations in open water habitat for foraging of least tern. Since smaller fish generally use shallow-water margin habitat, potential water quality improvements under one or more scenarios will likely not increase the relative abundance of prey species for least tern and we have modeled the future forage habitat solely as a function of wetted area. No report changes made.</td>
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<td>3.2</td>
<td>Ventura Audubon Society (Reed Smith, July 5, 2011)</td>
<td>Page 2 correctly identifies the VWRF discharge as providing 90% of the flow during the March through September period when plovers and terns are nesting. Given this we do not understand how the report reaches the conclusion that elimination of the discharge will result in no decrease in foraging area for Least Terns. (See Figure 11-5 and page 207)</td>
<td>Comment noted. The removal of VWRF discharge would result in more gradient-driven groundwater flow into the SCRE when the SCRE is empty. The modeling suggests that during dry conditions when the SCRE mouth closes, groundwater will fill the SCRE to an average depth that would be suitable for Tern foraging as shown in Figure 11.6. That is, elimination of the VWRF discharge would result in only minor decreases in Least Tern foraging area. No report changes made.</td>
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<td>3.3</td>
<td>Ventura Audubon Society (Reed Smith, July 5, 2011)</td>
<td>Page 195 shows essentially the same groundwater flow from the VWRF pond even though the report admits that implementation of Alternative 6 will likely result in the elimination of the ponds.</td>
<td>Disagree. We state that this alternative may result in the elimination of discharge from the ponds to the SCRE, but the ponds themselves would remain. For this reason, gradient driven groundwater flow to SCRE by percolation from the ponds remains as a modeling assumption and therefore some subsurface flow from the ponds would continue, as long as VWRF is still sent to the ponds. We have added an additional Alternative (6A) to reflect complete elimination of the Wildlife/Polishing Ponds which shows a minor decrease in groundwater flow arriving to the SCRE from the Ponds as well as a slight decrease (0.3 ft) in equilibrium SCRE stage. However, as discussed in the Amended Final Report, the City is not considering Alternative 6A for possible implementation due to significant adverse impacts on existing beneficial uses of the ponds. In light of Comment 5.0 below, and the comments by the Regional Board at the August 18 Workshop discussed above, discussion of Alternative 6A has been added to Section 11 for the limited purpose of analyzing realization of beneficial uses with VWRF discharge as compared to a zero discharge scenario, solely for the purposes of supporting a determination regarding “enhancement.”</td>
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<td>3.4</td>
<td>Ventura Audubon Society (Reed Smith, July 5, 2011)</td>
<td>Using the estimates the reports provides in Table 11-1 one can derive net water flows in the estuary by summing the inflows and outflows. The current condition is shown as a positive 1.8 MGD. The report shows that eliminating the discharge will result in a flow of 0.7 MGD. We do not believe that lowering the flow in the estuary by more than half will not change the area available for tern foraging.</td>
<td>Comment noted. See response to Comment 3.2 and 3.3. Although we agree that flow reductions will reduce foraging area to some degree, the largest changes in inundated area suitable for forage species occurs at SCRE stages below approximately 7.5 ft NGVD. Because none of the discharge alternatives, including complete removal, would result in SCRE water levels below this level, predicted changes in forage area are considered relatively minor. No report changes made.</td>
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<td>3.5</td>
<td>Ventura Audubon Society (Reed Smith, July 5, 2011)</td>
<td>There are two very suspect values in Table 11-1. The first is the contribution from the VWRF ponds and this will likely be eliminated with Alternative 6. The contribution from the Northbank groundwater is suspect as NO DATA exists for the flow values given. If you subtract the groundwater flows from these sources in Alternative 6 the new flow in the estuary is a minus 2.6 MGD. This would dry up the estuary.</td>
<td>Comment noted. As stated above, we assumed that the VWRF ponds would remain for Alternative 6 and discuss contributions to the SCRE if they were removed (see Sections 11.3 and 11.7). As stated in response to Comment 3.3, above, we have now added an additional sub alternative in Section 11 (Alternative 6A), which reflects the potential for reduced groundwater flow due to no contribution from the Wildlife/Polishing Ponds. The SCRE does not dry up in this scenario, although the SCRE stage does decrease slightly (0.3 ft or 7.7 NAVD88). Also, it is true that the North Bank groundwater discharge was derived from a SCRE stage-groundwater flow relationship developed for a ‘wet’ year (as described in Section 4.3 of the report). However, it is not realistic to assume that the North Bank groundwater contribution would be zero. Anecdotal evidence suggests that the surface Semi-perched aquifer retains agricultural irrigation water (see Section 4.1.4 of the report) and therefore contributes groundwater flow to the SCRE when the SCRE is empty.</td>
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<td>3.6</td>
<td>Ventura Audubon Society (Reed Smith, July 5, 2011)</td>
<td>I’ve attached a photo of the estuary taken on June 24, 2011. It represents the estuary in a dry condition. It is essentially a view of how the estuary would look if the VWRF discharge is eliminated. On that date the discharge was flowing directly to the ocean through the river mouth that is open. The river mouth was being kept open by unusually high flows from the Santa Clara River. The Victoria Avenue stream gauge showed a flow of 68 cfs, twice the normal flow at this time of year. So far this year there have only been 6 Least Tern nests on the south side of the river, adjacent to the estuary and none on the north side. (There are more Least Tern nests further south adjacent to McGrath Lake and the lake is being used for foraging)</td>
<td>Comment noted. This is an informative photograph of the SCRE during low-flow, open-mouth conditions when surface water moves in and out of the SCRE with the tide. However, when the SCRE mouth closes, the SCRE immediately begins to fill in with VWRF discharge, surface water discharge, and groundwater discharge. If VWRF discharge is eliminated, it will still fill in with surface water and groundwater during closed-mouth conditions. No report changes made.</td>
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<td>3.7</td>
<td>Ventura Audubon Society (Reed Smith, July 5, 2011)</td>
<td>Page 200 discusses the use of the discharge channel for a refuge for Tidewater gobys during high river flow times. The report says it is likely that other low velocity areas would be available if the discharge is eliminated. We are quite familiar with the estuary and no other low flow areas exist. Elimination of the discharge channel will mean gobys will have no safe areas during high river flows.</td>
<td>Disagree. Although we agree that no other off-channel habitat exists and high flow refuge for tidewater goby would be limited to emergent macrophyte stands along the SCRE margins, we believe that tidewater goby will move upstream and into low velocity zones within the emergent macrophytes along the margins of the SCRE. No report changes made.</td>
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<td>3.8</td>
<td>Ventura Audubon Society (Reed Smith, July 5, 2011)</td>
<td>The report focused on two bird species, yet 116 species were observed during the required bird surveys. Eighteen sensitive species have been recorded at the estuary. In deciding if the discharge is an enhancement consideration of all the life the estuary and wildlife ponds supports must be considered.</td>
<td>Comment noted. We agree that the SCRE and larger Santa Clara River watershed support a large avian species assemblage. Although assessment of a broader focal species assemblage could be accomplished under the Phase 2 studies, we do not believe the resulting conclusions regarding the potential for improvement to beneficial uses through development of a preferred discharge management alternative would differ greatly from those developed here. However, for purposes of assessing realization of beneficial uses as necessary to confirm enhancement, the degree to which discharge supports the presence of other avian species using the receiving waters of the SCRE (including the Wildlife/Polishing Ponds and the SCRE) is relevant and such an assessment has now been incorporated into a discussion of Alternative 6A in Section 11 of the Final Amended Report.</td>
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<td>4.1</td>
<td>California Department of Parks and Recreation (Richard Rozzelle, July 14, 2011)</td>
<td>We feel that the authors of the study did not properly weight the role that increased surface water elevation has in the likelihood of an unseasonable breach occurring at the estuary nor did they properly discuss the profound effects such an event has on habitat type, quality, quantity, or sustainability for each of the focal species</td>
<td>Comment unclear. If the commenter means that there was no discussion of the potential impacts on focal species, then we disagree (see Sections 7.2.1 and 7.2.2). If the commenter means that the analysis is flawed, we cannot respond without knowing what “weight” the commenter thinks should have been placed on the information. Although the role of human intervention on unseasonal breaches has been discussed, VWRF operations do not cause unauthorized third party actions. Nevertheless, the report does suggest that reduced flows may reduce the potential for occurrences of breach events caused by wave overwash or overtopping. There is evidence that the unseasonal breaches in recent years have been the unfortunate result of the unauthorized actions of unknown third parties, and the report has been clarified in this matter. No other report changes made.</td>
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<td>4.2</td>
<td>California Department of Parks and Recreation (Richard Rozzelle, July 14, 2011)</td>
<td>One might reasonably conclude that a lagoon mouth that seals earlier in the dry season would then allow for a greater time period of beach berm building to occur before the next wet season commences. The net result would be a more robust berm across the mouth of the estuary less prone to unseasonable breach events. A significant reduction in WRF discharge volumes during the dry season would help facilitate this scenario. It is also easy to picture that if the SCRE water surface elevation during a typical closed condition were lower than the current condition that hydraulic head pressure acting on the beach berm would lessen. Again, the berm would present a more robust barrier against unseasonable breaching than it does currently.</td>
<td>Comment noted. We agree that the stability of the mouth berm is related to the volume of sediment comprising the mouth berm, and that the longer the berm is closed, the more off-shore sediment is deposited on the berm. Therefore, we also agree that the stability of the mouth berm increases in the weeks and months following a breach event. As discussed in comment 2.3, natural episodes of wet periods have the greatest impact on breaching and extended periods of open mouth conditions due to increased base river flows. No report changes made.</td>
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<td>4.3</td>
<td>California Department of Parks and Recreation (Richard Rozzelle, July 14, 2011)</td>
<td>The authors of the report do an adequate job of describing the life history of this species and in characterizing the available goby habitat under the various alternatives. However, they fail to thoroughly discuss how unseasonable breaching affects the dispersal strategy for this species…. If tidewater gobys that are swept out of the SCRE after a breach are going to have any chance to enter and colonize at a down current estuarine system, then that estuary too must be open to the marine environment.</td>
<td>Comment noted. While we agree that goby dispersal is part of the normal flood-related breach events in the SCRE and other lagoon type estuaries along the Pacific coast, we disagree that unseasonal breaches are directly related to VWRF operations. Nevertheless, the potential for reduced likelihood of unseasonal breaches due to wave overwash or overtopping under one or more alternatives, including flow reductions, is discussed in Section 11.7. No report changes made.</td>
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<td>4.4</td>
<td>California Department of Parks and Recreation (Richard Rozzelle, July 14, 2011)</td>
<td>…it is likely that short term goby survivorship in the marine environment is increased by an ephemeral decrease in salinity in the near shore environment caused by multiple torrential freshwater river inputs. So if the torrential river flows are not present and the neighboring estuary is closed to the marine environment, then it is easy to conclude that an unseasonable breach of the SCRE is detrimental to tidewater goby dispersal strategy.</td>
<td>Comment noted. See response to Comment 4.3.</td>
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<td>4.5</td>
<td>California Department of Parks and Recreation (Richard Rozzelle, July 14, 2011)</td>
<td>The Southern steelhead is also adversely affected by unseasonable berm breaching. At least 7 dead smolts were collected after the last such event in September, 2010. These strandings occurred near the back of the estuary indicating that these fish were not attempting to exit the lagoon when presented the opportunity, but rather instinctually tried to remain upstream only to end up as fish out of water…. Although we may not know enough about steelhead behavior to at this time to say with certainty what caused this reaction, on[e] possibility is that normal cues present during a storm driven breach event simply were not available to these fish and thus the instinct to swim out to sea when berm breached was not activated. Two potential missing cues are an increase in estuary depth and a decrease in estuary salinity as a precursor to breaching.</td>
<td>Comment noted. This fish stranding is discussed in section 7.2.1.4 of the report. Although additional investigation of factors affecting smoltification in the SCRE may be undertaken as part of Phase 2, based upon our reviews, the factors controlling smoltification and out-migration of lagoon systems are not well understood. As discussed earlier, this event was caused by the unauthorized actions of one or more third-parties that is being investigated by resource agencies. This was not a natural event caused by SCRE water levels or wave overwash. No report changes made.</td>
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<td>4.6</td>
<td>California Department of Parks and Recreation (Richard Rozzelle, July 14, 2011)</td>
<td>It is easy to see how an unseasonable breach of the SCRE during the California least tern nesting season could significantly decrease the abundance of local baitfish and thus negatively affect California least tern nest fledging success rates.</td>
<td>Comment noted. Although the change in water surface area might be expected to result in the identified effect, we disagree that unseasonal breaches are directly related to VWRF operations. Nevertheless, the reduced potential for unseasonal breaching due to several causal mechanisms under one or more alternatives including flow reductions are provided in Section 11.</td>
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<td>4.7</td>
<td>California Department of Parks and Recreation (Richard Rozzelle, July 14, 2011)</td>
<td>Western snowy plovers suffer the greatest from nest loss caused by artificially increased water surface levels in the lagoon during the dry season. The nesting season for these birds begins in early spring and continues until the end of summer. Occasionally, nest scrapes are located near the estuary or on the back side of the developing berm at or below 10 ft. NAVD88. These nests are in jeopardy of being flooded if the berm seals and the lagoon fills up to its current equilibrium state. In fact, DPR biologists have documented at least 5 Western snowy plover nests that met this exact fate within the last eight breeding seasons.</td>
<td>Comment noted. Although the majority of nesting appears to be located along McGrath State Beach, the report does show that Western snowy plover habitat area is the lowest for the alternatives that include VWRF discharge (see current Figure 11-5). No report changes made.</td>
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<td>4.8</td>
<td>California Department of Parks and Recreation (Richard Rozzelle, July 14, 2011)</td>
<td>It is quite obvious that if there were less water entering the SCRE in the summer months from VWRF discharges that more stable foraging resources would be available for nesting least terns and less nesting areas for Western snowy plovers would be prone to flooding.</td>
<td>Comment noted. See response to Comment 4.7.</td>
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<td>4.9</td>
<td>California Department of Parks and Recreation (Richard Rozzelle, July 14, 2011)</td>
<td>The authors argue that stage height dictates the amount of available habitat in the SCRE for certain keystone species and that increased habitat constitutes a beneficial enhancement for these species. This assumption is oversimplified because it fails to consider interspecies dynamics, in particular predator and prey relationships. Many nonnative species that compete with desired native species would likely also benefit from increased habitat size.</td>
<td>Disagree. Although the report analyzes the identified focal (“keystone”) species, the fish community composition including non-native predatory species adapted to freshwater conditions is detailed in Section 6.2.3 of the report and the impacts of breaching as well as flow volume reductions upon non-native species under various scenarios are discussed in Section 11.7. No report changes made.</td>
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<td>4.10</td>
<td>California Department of Parks and Recreation (Richard Rozzelle, July 14, 2011)</td>
<td>Discharge into the estuary is a clear disruption to the natural hydrology of the estuary and surrounding perched sub watershed. It is our experience that deviations from natural regimes generally favor exotic species invasions to the detriment of native species.</td>
<td>Comment noted. While we agree that a number of non-native fresh water fish have been introduced to the SCRE, but given the large amounts of freshwater arriving to the SCRE from groundwater sources, we do not believe that a complete shift to a “native” species assemblage would occur under flow reduction or removal scenarios. For this reason, the inter-specific interactions of these fish will likely occur under all scenarios evaluated. No report changes made.</td>
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<td>4.11</td>
<td>California Department of Parks and Recreation (Richard Rozzelle, July 14, 2011)</td>
<td>The relationship between estuary stage height and either partial or total closure of the McGrath State Beach campground is also well documented. We feel that these closures would be drastically reduced or eliminated entirely if the surface and groundwater discharge of effluent into the estuary was significantly decreased.</td>
<td>Agree. This is discussed in the report in Section 11.</td>
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<td>4.12</td>
<td>California Department of Parks and Recreation (Richard Rozzelle, July 14, 2011)</td>
<td>If there were no summertime surface discharge from VWRF or seepage from the treatment ponds, then the source for the water in the estuary during the dry season would consist primarily of local groundwater inputs.</td>
<td>Partially agree. In addition to local groundwater contributions, significant dry weather flows from upstream will also arrive as hyporheic flows along the Santa Clara River channel bed. No report changes made.</td>
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<td>4.13</td>
<td>California Department of Parks and Recreation (Richard Rozzelle, July 14, 2011)</td>
<td>…we feel the best option for the overall health of the ecosystem is one that reduces dry weather discharges and nutrient loading into the estuary…. We recommend a modified version of alternative 5 that would also strive to significantly reduce nutrient laden groundwater seepage from the wetland pond, possibly through the installation of an impervious clay liner.</td>
<td>Comment noted. Development and optimization of a preferred alternative, including treatment wetlands, or potential increases in the use of recycled water for nutrient reduction is anticipated as part of the Phase 2 studies. No report changes made.</td>
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<td>5.0</td>
<td>LA Regional Water Quality Control Board (Brandi Outwin, paraphrased oral comment at August 18, 2011 Stakeholder Workshop)</td>
<td>Looking at the Enclosed Bays and Estuaries Policy - if we continue to allow the discharge then we have say it improves the estuary. We are going to have to make an argument for year-round improvement to comply with the Enclosed Bays and Estuaries Policy. I do not believe it distinguish between seasons, but need to go back and review this issue.</td>
<td>See body of memorandum above for more thorough response. Under the guidance the Enclosed Bays and Estuaries Policy, so long as, on balance and taking into account any seasonal differences, one or more beneficial uses are attained, or any beneficial use is more fully realized as compared to beneficial uses that would occur if there were no (zero) discharge, then there is enhancement. In considering whether any beneficial uses are attained or more fully realized as a result of a discharge, it is important to understand that some beneficial uses are themselves necessarily seasonal. For example, MIGR, SPWN, and often REC-1 and/or REC-2 will be realized, if at all, on a seasonal or episodic basis. The report has been clarified to address this issue.</td>
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Dan Pfeifer, Wastewater Utility Manager
City of Ventura
Ventura Water Reclamation Facility
P.O. Box 99
Ventura, California 93002

Dear Mr. Pfeifer:

NOAA’s National Marine Fisheries Service (NMFS) has reviewed the City of Ventura’s (City) February 2011 Draft Synthesis Report: Subwatershed Study of the Santa Clara River Estuary (SCRE), Ventura County, California (Report). The draft Report outlines the results of a series of studies required by the Los Angeles Regional Water Quality Control Board (Board) for the City's National Pollutant Discharge Elimination System (NPDES) Permit No. CA0053651. The studies are intended to assist the Board in determining whether discharge of the City’s treated wastewater into the SCRE provides habitat enhancement as defined by the Board’s Enclosed Bays and Estuaries Policy. The draft Report is of concern to NMFS because the Santa Clara River is within the endangered Southern California Distinct Population Segment (DPS) of steelhead (*Oncorhynchus mykiss*), and is critical habitat for this species. At a meeting of February 10, 2011, to discuss the results of the draft Report, the City requested written comments from agencies and stakeholders with the intention of incorporating comments into the final Report. To this end, NMFS is offering the following comments on the draft Report, with the intention of providing additional comments to the City and the Board on the final Report when it becomes available.

- The Southern California DPS of steelhead is listed as “endangered” under the U.S. Endangered Species Act (ESA). The draft Report incorrectly states on page 130 that the DPS is listed as “threatened”. This inaccuracy needs to be corrected in the final Report.

- The draft Report states in chapter 7 (Pages 128, 130, and 132) that adult and juvenile steelhead use the SCRE mainly as a migration corridor, and juvenile steelhead rear in the estuary only for short periods and do not use the estuary as summer-rearing habitat. NMFS believes these conclusions are not accurate and should be omitted from the final Report for several reasons. First, the conclusions are based, in part, on a single study of steelhead smolt residence times within the SCRE performed by Dr. Elise Kelley in 2008, which showed that
smolts left the estuary after a few days. The findings of Dr. Kelley’s study may be an artifact of anthropogenic activities that have altered the natural characteristics and conditions of the estuary and therefore its functional capacity for steelhead. Additionally, because it is known that steelhead smolts normally use estuaries for acclimation to an ocean-based life stage and emigrate to the ocean after a short period of time, it is inappropriate to conclude from this study that juvenile steelhead do not use the SCRE for extended over-summer rearing. Secondly, recent studies (e.g., Bond et al. 2008) have shown that juvenile steelhead rear in estuaries for extended periods during the summer, and more research is needed in the SCRE to understand juvenile steelhead rearing dynamics during the summer. Lastly, the SCRE breaching event of September 2010 clearly indicated that juvenile steelhead have been rearing in the estuary during the summer.

- NMFS believes that there is significant uncertainty associated with the model used to predict the amount and extent of estuarine habitat available to steelhead under the three wastewater discharge scenarios analyzed in the draft Report. While the draft Report does contain some discussion of uncertainties inherent in the model, NMFS recommends that a broader discussion of the uncertainties associated with the model, and how they affect the results, is provided in the final Report. NMFS also recommends that Figure 11-2, which estimates acreage of estuary habitat available to steelhead under the three discharge scenarios, includes error bars to display the range of uncertainty inherent to the model.

- The draft Report lacks a clear assessment of the range of water depths available to steelhead within the SCRE under differing (e.g., open vs. closed) estuary conditions, and does not describe the percentages of estuary area that are of specific depth under differing conditions. NMFS recommends that the final Report includes a detailed discussion of the relation between estuary stage, estuary area, and the range of depths available to steelhead within the estuary. NMFS also recommends that the final Report includes an analysis of how the amounts of deepwater habitat change relative to overall estuary area under the three wastewater discharge scenarios.

- The draft Report states in chapter 9 that habitat conditions within the SCRE are “apparently not favorable for steelhead over-summering” (Page 161). NMFS disagrees with this characterization of the estuary because it appears to be based on past water quality data from grab samples restricted to a few locations within the estuary. Thus, the data are inadequate to determine the suitability of habitat for steelhead within all areas of the estuary over time and space, or under a future condition where the wastewater discharged into the SCRE is of higher quality than it is presently (e.g., discharge alternatives 2, 3, and 5). Furthermore, the water quality data presented in the draft Report clearly show that water quality parameters (e.g., temperature and dissolved oxygen) at different locations in the estuary are within steelhead tolerances a majority of the time. Thus, NMFS recommends the conclusions in chapter 9 that imply habitat conditions within the SCRE are not suitable for steelhead over-summering are omitted from the final Report.

NMFS understands that after the City’s consultant produces the final Report, it will be given to the Board to assist them in making a determination regarding the renewal of the City’s NPDES Permit. NMFS requests that prior to its renewal, the Board allows for agency review and
comment on the City’s NPDES Permit, as provided for in the Memorandum of Agreement between the Environmental Protection Agency, Fish and Wildlife Service and National Marine Fisheries Service regarding enhanced coordination under the Clean Water Act and Endangered Species Act; Notice (66 FR 11202; February 22, 2001).

NMFS appreciates the opportunity to review and provide comments to the City on the draft Report. Please contact Stan Glowacki at (562) 980-4061 or via email at Stan.Glowacki@noaa.gov if you have any questions concerning this letter, or if you require additional information.

Sincerely,

[Signature]

Penny Ruvelas
Southern California Supervisor
for Protected Resources Division

cc: Samuel Unger, Regional Water Quality Control Board
    Michael Lyons, Regional Water Quality Control Board
    Gerhardt Hubner, Watershed Protection District
    Karen Waln, City of Ventura
    Mary Larson, CDFG
    Chris Dellith, USFWS
    Copy to File 151422SWR2011PR00520

Citations:

June 14, 2011

VIA E-MAIL

City of Ventura
Attn: Mr. Rick Raives
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Re: Independent Expert Review of the City of Ventura’s Estuary Special Studies and the environmental effects of Ventura’s TTF Discharge to the Estuary

Wishtoyo Foundation’s Ventura Coastkeeper Program (“VCK”) retained independent objective experts Dr. Richard Ambrose\(^1\) and Dr. Sean Anderson\(^2\) to conduct an independent expert review of the City of Ventura’s Estuary Special Studies and the environmental effects of the City’s Tertiary Treated Flow discharge to the Estuary (“Independent Expert Review”) to provide stakeholders with an independent expert evaluation of the affect of the City’s water treatment operation on the Santa Clara River Estuary’s water quality and aquatic life.

Dr. Richard Ambrose’s and Dr. Sean Anderson’s Independent Expert Review attached to this introductory letter consists of their objective scientific analysis and review of the environmental effects of the City’s Tertiary Treated Flow discharge to the Estuary, and of the findings, methodology, analysis, and management recommendations in the “City of Ventura special studies: Estuary Subwatershed Study assessment of the physical and biological condition of the Santa Clara River Estuary, Ventura County, California. Final Synthesis Report. Prepared by Stillwater Sciences, Berkeley, California for City of Ventura, California, March 2011.”

Please feel free to contact us with any questions.

Sincerely,

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Background

The Santa Clara River Estuary (SCRE) is a seasonally closed estuary. In general, the estuary opens during the wet season when high river flow and ocean waves breach the sand barrier, and then closes in spring when river flow is reduced and ocean waves rebuild the sand barrier. The alternating open and closed conditions of the estuary are essential characteristics for the ecology of the SCRE ecosystem.

The natural breaching regime for the estuary is not known (although there is currently a study of the historical ecology of the Santa Clara River that will provide important information about this and related dynamics via the Historical Ecology of Southern California Wetlands under the umbrella of the Southern California Coastal Water Resource Project). In particular, the amount of water (both surface and subsurface) delivered to the estuary during the dry season is not well quantified. This is a critical aspect of the hydrology because it determines the volume of water in the estuary when it is closed, its salinity, and whether it would breach over the summer. As noted below, all of these aspects of the estuary have important consequences for the species living in it.

The extent and nature of the SCRE has changed substantially over the past 150 years, although the location of the river’s mouth has varied little (Figure 1). In the mid-1800s,
more than half of the SCRE consisted of open water, with approximately one quarter each of salt flat and vegetated wetland habitats (Grossinger et al. 2011). Compared to the estuaries of other large South Coast rivers, the SCRE had relatively little estuarine habitat, with a large area of willow-cottonwood riparian forests (Grossinger et al. 2011). Figure 6-1 of the Synthesis report provides a nice comparison of vegetation in 1855 compared to 2009. The total area mapped from the 1855 T-sheet is 989 acres, with 118 acres of open water, 168 acres of salt flat/playa, 313 acres of woody riparian forest, 48 acres of vegetated wetland, and the rest beach, bluff, dune, and upland habitats. The area was apparently more extensive in the past. Aggregate extent was slightly more expansive historically (an 8% reduction in aggregate wetland; see Table 6-1) with some landscape types changing greatly such as an apparent 70% (Stillwater Sciences 2007) to 91% (Nautilus Environmental 2005) reduction in riparian extent since the mid 19th century. The 2009 vegetation mapping effort reported 126 acres of open water, 225 acres of riparian forest, 75 acres of vegetated marsh (70 acres of freshwater marsh and 5 acres of salt marsh). The area of open water is remarkably similar between the 1855 and 2009 mapping efforts, although it is not clear how representative the 1855 “snapshot” is of general conditions around that time. The salt flat/playa from the 1855 topographic sheet (so-called “T-sheet”) is interpreted by Stillwater Sciences (2011) to be recently scoured, unvegetated floodplain.

Development in the watershed has changed the quantity and timing of water delivered to the estuary (as well as the quality of that water). There likely have also been changes in the groundwater around the estuary. The two major disturbances to the natural hydrologic regime have been the diversion of water from the watershed (most prominently at the upstream Freeman Diversion) and the discharge of treated wastewater into the estuary from the Ventura Water Reclamation Facility (VWRF).

For this report, we focus on how the VWRF has altered the SCRE hydrology and ecology, and the consequences of this alteration for the species living in the estuary, particularly steelhead and tidewater goby. On the face of it, it could be considered that the addition of treated wastewater balances the loss of water from the upstream diversions. Of course, it is not this simple. Under natural conditions, the Santa Clara River would deliver a high volume of freshwater to the estuary in the wet season, tapering to a low volume, and perhaps to no water, during various periods of the dry season. Depending on the inflow of freshwater from groundwater and a host of other factors (see Salinity section below), the salinity of the estuary might increase during the dry season due to evaporation of the water in the estuary, but we have not seen evidence that the estuary ever became hypersaline as other coastal wetlands in southern California are reported to have become. Under current conditions, the basic pattern of water delivery from the Santa Clara River slows or ceases during the dry season. However, the VWRF discharges a fairly constant amount of water into the estuary year-round. Thus, there is a substantial amount of low-salinity water flowing into the lagoon during the dry season. This maintains the estuary water at a low salinity when the sand barrier closes. It also increases the volume of water in the estuary above what it would otherwise be. While the introduction of a large enough volume of water can shift the average water quality within a circumscribed area, that increased volume may also alter the distribution of the aquatic community itself. There are at least two such consequences of such and
increased volume with important ecological implications: (1) the lagoon is more likely to breach during the summer and fall, and (2) there is a larger flooded area in the estuary than we would expect given the extant upstream water diversions.

Breaching due to excessive freshwater inflow can result in high mortalities of native fish and macroinvertebrate species. Comment on September 2010 breach that killed seven steelhead and thousands of tidewater gobies (ENTRIX 2010).

Many factors influence the frequency of berm breaching. Stillwater Sciences (2011), comparing the SCRE mouth berm in the 1855 T-sheet and aerial photographs from the past 80 years, concluded that the mouth berm length decreased by hundreds of meters since development began. They suggest that this indicates the SCRE historically had a higher berm seepage rate and therefore likely breached less frequently during low-flow conditions in both drier months (periods of low river and groundwater discharge) and wetter months (baseflow conditions after storms but elevated groundwater discharge rates to the SCRE).
Breaching due to excessive freshwater inflow can result in high mortalities of native fish species. Comment on September 2010 breach that killed seven steelhead and thousands of tidewater gobies (ENTRIX 2010).

**Organismal Ecology**

The SCRE provides important habitat for a variety of fish, invertebrates, birds and plants. However, particular attention has been focused on two endangered fish species, southern California steelhead and tidewater goby. We concentrate on these species because, as aquatic species, they feel the biggest influence of the VWRF.

**Southern California Steelhead**

Steelhead is the anadromous form of the species *Onchorynchus mykiss* (the non-anadromous form being the rainbow trout). The annual steelhead runs in southern California have declined from 32,000-46,000 returning adults historically to less than 500 returning adults today (Good et al. 2005). Many factors have contributed to this decline, including urbanization, dams and other barriers, stream habitat loss, estuarine habitat loss, species interactions, hatcheries, drought and climate change, and wildfire (Moyle et al. 2008).

Historically, the Santa Clara River supported an important steelhead population, with perhaps one of the largest steelhead runs in southern California (Moore 1980, Bowers 2008, Kentosh 2008). Populations appear to have numbered in the thousands, even after stocking of the anadromous form switched to stocking of resident rainbow trout in the 1930s (Bowers 2008, Kentosh 2008). However, changes in the watershed during the mid 1900s, including the construction of dams and other barriers to migration, dramatically reduced the steelhead run (Stoecker and Kelley 2005). Spawning fish returning from the sea documented in recent years in the Santa Clara River number in the dozens at best. The 2009 monitoring of fish passing the Freeman Diversion recorded only 162 steelheads in total, 160 of which were smolts from above the diversion heading downstream towards the estuary (Howard and Gray 2009).

Estuaries are key habitats for steelhead because they are used by both immigrating adults and emigrating juveniles moving between the marine and freshwater environments. Estuaries can be important habitats for young steelhead to feed before moving to the ocean. Few studies of steelhead use of estuaries have been conducted in southern California, but their importance can be inferred from studies elsewhere. Smith (1990) and others (e.g., Atkinson 2010) have made extensive observations in central California. These studies have demonstrated the potential for rapid growth of young steelhead in estuaries when food is abundant and water quality (especially oxygen, but often mediated by salinity distributions) is appropriate. Hayes *et al.* (2008) found that the majority of steelhead in Scott Creek (Santa Cruz County) reaching typical ocean entry sizes (150–250 mm FL; age 0.8–3.0 years) were estuary–lagoon reared, which indicates a disproportionate contribution of this habitat type to survival of Scott Creek steelhead. Estuarine growth rates were among the fastest reported for wild steelhead in the literature (1–2% per day). Steelhead that rear in lagoons also smolt at an earlier age than most
stream fish (Smith 1990, Cannata 1998, Bond 2006, Hayes et al. 2008). In fish, survival is often related to size, and larger steelhead smolts likely have higher survival rates in the ocean than smaller smolts (Ward et al. 1989, Smith 1990, Tipping 1997, Bond 2006). Bond (2006) found that 85% of the returning adult steelhead in the Scott Creek watershed in Santa Cruz County had reared in the estuary as age 0+ or 1+ of despite the fact that these individuals comprised only 8%-48% of the juvenile steelhead production in that watershed. Thus, steelhead using estuaries typically grow faster, smolt at an earlier age, and survive in the ocean better than fish reared in streams.

In addition to the growth and consequent survival advantages from rearing in estuaries, estuaries provide a transition zone that allows salmonids to adapt gradually to changes from freshwater to the marine environment and vice versa (Healey 1982). Juvenile salmonids that were deprived of an estuary residence suffered from higher physiological stress during saltwater entrance than those that had longer estuary residence times (MacDonald et al. 1988).

Water temperatures in southern California rivers and estuaries are generally higher than the “preferred” range for steelhead (often determined in more northerly latitudes), but the fact that southern California populations flourished here historically demonstrates the local genotypes are able to withstand higher temperatures than fish from more northerly populations. Growth of Ventura County steelhead juveniles appears more rapid than the growth rates of those more northerly steelhead populations (e.g., Moore 1980, Busby et al. 1996, McEwan and Jackson 1996) and may give them an increased thermal tolerance relative to steelhead that evolved in more northerly climes, however we have little life history information or experimental manipulations for steelhead in southern California.

Moyle et al. (2008) indicate that juvenile southern steelhead may spend less time in freshwater than northern steelhead because southern California streams often have inhospitable conditions (low flows and warm temperatures). Thus, southern steelhead may migrate to the ocean or have greater dependence on coastal lagoons during their first year compared to other stream-oriented northern steelhead populations. However, there is little information about steelhead use of estuaries in southern California.

Little is known about current steelhead use of the SCRE. In a one-year study, Kelley (2008) tagged and released 81 smolts on the Santa Clara River, 48 of which (59%) survived the migration to the ocean. Kelley found that smolts spend only a few days at most before moving to the ocean when the estuary was open to the ocean. Kelley identified the major potential problems for smolts as high turbidity, high water temperatures, insufficient cover to hide from predators, and resident populations of avian predators, most of which have been exacerbated by anthropogenic changes to the SCRE. Kelley’s study included only one season of data and focused on smolts, so it provides a limited view of steelhead use of the SCRE (Kelley 2011). In addition, Kelley did not tag smolts smaller than 150 mm, 51 of which fish were captured but not tagged (Table 2 in Kelley 2008), presumably because they were smaller than 150 mm. Thus, the behavior of small smolts in SCRE is not known, but it is possible that they may have had longer residence in the estuary, possibly spending the summer in the estuary to grow to a larger...
size. This would be consistent with one of the steelhead life history pathways proposed by Hayes et al. (2008) for Scott Creek steelhead in central California.

Observations of steelhead after the breach on September 17, 2010 indicate that steelhead smolts can reside for an extended time in the SCRE and grow substantially during that time. Seven dead *Oncorhynchus mykiss* were collected, ranging in size from 227 to 310 mm standard length. After observing the steelhead killed in the summer 2010 breach, ENTRIX (2010) noted that “[t]he relatively large size and robust condition of these fish (Photos 2-4) indicate they were doing relatively well in or near the estuary and that adequate conditions existed for them in at least part of the local habitat.”

For central California estuaries, Smith (1990) reported good steelhead growth and survival when the lagoons were open to the ocean and when the berm was closed and the lagoon was largely fresh water. If the sand barrier was closed but there was salinity stratification, the salt lens could cause higher temperatures on the bottom of the lagoon and low dissolved oxygen concentrations, which led to low steelhead growth. Smith (1990) also found that frequent or artificial breaching of the sand berm could cause poor steelhead growth because it maintained salinity stratification and warm temperatures. Similar studies have not been conducted at SCRE or other southern California estuaries. However, Kelley (2008) did not find salinity stratification and associated low dissolved oxygen concentrations in the SCRE during her study. In compiling water quality data from many different sources, the Synthesis report states that only the upper and lower outfall locations exhibited any signs of density stratification in some sampling events due to freshwater flows from the VWRF (Stillwater Sciences 2011, page 81).

Steelhead in estuaries feed on invertebrate species. Robinson (1993) has reported the changes in benthic and epibenthic invertebrates in Pescadero Lagoon, a seasonally open lagoon in central California, as the lagoon changed from an open to closed condition. Although the invertebrate assemblage changed from marine to euryhaline and freshwater species, the invertebrate assemblage in Pescadero Lagoon had previously been shown to support good steelhead growth (Smith 1990). Martin (1995) found that steelhead in Pescadero Lagoon, studied at the same time as Robinson (1993) and Smith (1990), changed their diet as the lagoon condition changed from open to closed. When the lagoon mouth was open, steelhead fed mainly on gammarid amphipods, shrimp and isopods. After the lagoon closed, steelhead ate mainly freshwater-dependent dragonfly nymphs, mayfly nymphs and midges. Martin concluded that steelhead food was abundant throughout the lagoon when it was open to the ocean, but was most available where there was fresh water with abundant pondweed. Robinson’s results are similar in some ways to what has been found in the SCRE. Monitoring at SCRE since 1997 indicated that the benthic invertebrate assemblage was composed of freshwater or estuarine species, and tended to be dominated by three or four tolerant species, and varied seasonally and among years (Stillwater Sciences 2011). The species found at SCRE include some of the taxa reported in the diet of steelhead from central California, though not shrimp, isopods, dragonfly nymphs or mayfly nymphs. In comparison to Pescadero Lagoon, salinity in the SCRE does not get as high, so the invertebrate assemblage is never dominated by marine taxa. In addition, invertebrate abundances are sometimes low; for example, the abundance of invertebrates in October 2009 was very low at
stations sampled by ABC Laboratories (2010) and restricted to only a few freshwater taxa, primarily oligochaetes and chironomids. During these times, food might be limiting for steelhead growth.

Although the hydrology of the SCRE system has clearly been altered by human activities, the natural habitats of the estuary have also changed substantially. Stillwater Sciences (2011, Section 9.1.2) reports:

“Historically, the floodplain of the lower Santa Clara River contained a dense riparian zone with marshy areas that were regularly re-connected with in-channel habitats at higher flows. Prior to the establishment of levees in the lower river in the 1900s, meander and migration processes regularly eroded channel banks causing a retreat of floodplain habitat on the outside of meander bends, depositing fresh sediment and forming new floodplain habitat on the inside of meander bends. Under idealized conditions, this process of erosion on the outside of meander bends maintains scour pools and causes tree recruitment into the river, which provides cover and other habitat functions for fish and other aquatic organisms. Interruption of these processes has resulted in greatly simplified habitat structure with limited available cover resident fish species.”

Little is known about how steelhead use different habitats in estuaries, and this is especially true in southern California. We do know that protection from predators, both aquatic and bird predators, is important (Kelley 2008). A refuge from undesirable physical conditions, which might include deep water, is also likely to be important. It is possible that the habitat simplification at SCRE has reduced the quality of the estuary for steelhead. This might provide some restoration opportunities, but more needs to be known about steelhead habitat use.

The VWRF discharge into the SCRE directly affects the quality and quantity of water in the estuary. The VWRF effects on water quality, especially increased nutrients and eutrophication and the consequent turbidity, would likely have a negative effect on steelhead (e.g., Kelley 2008). There may also be negative effects on steelhead due to contaminant concentrations, both those that have been measured (e.g., copper) and emerging contaminants that generally are not measured. The VWRF effects on water quantity are varied. On the one hand, increased freshwater input into the estuary in the dry season increases the volume of water in the estuary, which increases the aquatic habitat area. This could potentially benefit steelhead, but the actual benefit is not easily determined because it is not clear that habitat is in any way limiting steelhead populations or growth in the estuary. Although the increase in wetted area at different estuary stages has been calculated, no analysis has been done to indicate whether the increased area was good quality habitat. As suggested above, it is possible that habitat simplification in the estuary has reduced the quality of SCRE for steelhead, and simply increasing the amount of low quality habitat (though, in the absence of an assessment of habitat quality we don’t know if the increased habitat is low or high quality) would have little benefit for steelhead. Thus this putative benefit, although asserted by the Synthesis Report, is uncertain. What is certain, on the other hand, is that excessive breaching of the estuary
during the dry season is detrimental to steelhead in the estuary. As with many southern California coastal wetlands, the SCRE historically was closed during most of the dry season (D. Jacobs and E. Stein, personal communication). The extra water introduced into the estuary during the dry season raises the level of the lagoon and increases the frequency of dry-season breaching. This certainly has a negative effect on steelhead residing in the lagoon at the time of breaching.

**Tidewater goby**

The tidewater goby is a small benthic fish that occurs in estuaries in California. It is typically an annual species that is restricted to estuaries (although adults and larvae may spend a short time in the marine environment during dispersal, especially following floods; Swift *et al*. 1989, Lafferty *et al*. 1999b). Tidewater gobies prefer brackish water, typically less than 12 ppt although they tolerate a wide salinity range (0 to 54 ppt; Worcester and Lea 1996). Reproduction typically occurs year-round although distinct peaks in spawning, often in early spring and late summer, do occur (Swenson 1999, Ambrose and Meffert 1994). Most of the estuaries where tidewater gobies occur are closed seasonally to the ocean.

The tidewater goby is a federally listed endangered species. Principal threats to the tidewater goby include loss and modification of habitat, water diversions, predatory and competitive introduced fish species, habitat channelization, and degraded water quality (USFWS 2005).

Although the tidewater goby was listed as an endangered species, its listing was based on its extirpation from many of its historic locations. Where there is suitable habitat, the tidewater goby is often numerous; it is frequently the most abundant fish species in many of the lagoons and estuaries where it occurs (Lafferty *et al*. 1999a).

Male tidewater gobies begin digging breeding burrows in relatively unconsolidated, clean, coarse sand in April or May, after lagoons close to the ocean (Swift *et al*. 1989; Swenson 1995).

Tidewater gobies feed mainly on small animals, usually mysid shrimp, gamarid amphipods, ostracods, and aquatic insects, especially chironomid midge larvae (Swift *et al*. 1989; Swenson 1995; Moyle 2002). Many of these species have been recorded in the SCRE (ENTRIX 2003, Kelley 2008, ABC Laboratories 2008, 2010).

Because tidewater gobies prefer brackish water, changes to an estuary that limit or reduce brackish water habitats have an adverse effect on tidewater goby populations. In southern California, a common impact is the frequent breaching of the sand barrier separating a lagoon from the ocean. According to the U.S. Fish and Wildlife Service, in their tidewater goby recovery plan:

A trend in southern California is for more water to be available all year in streams that receive municipal waste discharges. Today many streams (e.g., Santa Ynez River and Malibu Creek) are flowing with much more water in the dry season than probably occurred historically. This water is high in nutrients that contribute
to enrichment of lagoon water and the associated decreases in dissolved oxygen. This extra water can cause the lagoon to rise and increase the frequency of breaching experienced under natural conditions, causing erratic fluctuations in water level. These erratic fluctuations result in decreases in habitat that increase chances of predation and leave spawning burrows exposed to the air. The sudden draining of a lagoon in late spring or summer also can allow marine water to dominate the lagoon for months until winter rains return (Swift et al. 1989).

The sudden breaching of a lagoon is a particular risk to tidewater gobies because of their association with shallow water burrows. When the lagoon water level is high, the gobies build their burrows in the expanded habitat. Unlike a free-swimming fish that can simply move with the changing water level (although even these species are stranded when a lagoon is breached), tidewater gobies cannot relocate their burrows in response to the rapidly declining water level, and thus they are stranded, in addition to being washed out into the ocean. Both outcomes were well documented in the aftermath of a berm breach in September 2010 (Cardno ENTRIX 2010). Mass standings/mortalities of thousands of tidewater gobies occurred across the suddenly-dry shallows of the lagoon. In addition, hundreds of dead/dying gobies were scattered across the oceanward beach, attesting to a significant proportion of the SCRE population being flushed out to sea.

**Birds**

Pacific coast populations of western snowy plovers (*Charadrius alexandrinus nivosus*) are listed as federally endangered due to declining populations over the previous several decades. Plovers feed primarily on small invertebrates along sandy beaches, mudflats, and salt pannes from the low intertidal to well above the high tide line (FWS 2007). Less frequently they may pick invertebrates from coastal strand or wetland plants and have even been reported to flycatch in southern California (Fancher, et al. 1998). Their inclusion here as an identified indicator species appears primarily related to their potential reliance upon forage sources within the SCRE.

California least terns (*Sterna antillarum browni*) are a federally and state listed endangered species declining for reasons identical to western snowy plovers: disturbance of their beach nesting habitat by coastal development and recreational activities (FWS 2006). Terns hunt small fish, most commonly in coastal estuaries, lagoons, and lakes. This potential foodchain support therefore motivated their inclusion in this study as an indicator species.

Healthy populations of invertebrates in/around the coastal strand and healthy populations of estuarine fish in either the SCRE or McGrath lake could be sufficient but not necessary for a consistent population of plovers or terns in or around the SCRE. Both species nest around the terrestrial edges of the SCRE. As such, the health of both of these bird species are related to the dynamics of the VWRF, but only indirectly. While a healthy estuary would be a positive factor facilitating recovery of these birds, it is by no means necessary or even the greatest factor in their population dynamics. Ecological factors outside the SCRE and the influence of VWRF such as human disturbance and beach grooming (Lafferty 2001) appear to drive the dynamics of these populations. Hence,
these are relatively equivocal indicator species relative to aquatic species directly influenced by SCRE dynamics such as steelhead and gobies.

Other Potential Aquatic Focal Species: Lampreys and Sticklebacks

Owing to the indirect linkages between the proposed focal bird species and the functioning of the SCRE and VWRF discharge levels, we suggest two potential alternative candidate species. Both the Pacific lamprey (*Lampetra tridentata*) and the partially- armored threespine stickleback (*Gasterosteus aculeatus microcephalus*) are native fish species in the SCRE. While the Pacific lamprey has been in decline over the past several decades, it remains much more abundant in the Santa Clara River and Estuary than the nearly extirpated steelhead even though they share a similar anadromous life history (Chase 2001). The partially- armored threespine stickleback is second only to tidewater goby in SCRE resident fish abundance (Nautilis 2009). Both of these fish demonstrate an ecology that is likely much more impacted by habitat quality and quantity than either plovers or terns.

Invertebrates

The invertebrate assemblage of the SCRE reflects the dynamic nature of the estuary, with a marine influence when the mouth is open, a transition through brackish conditions starting after the mouth closes, and freshwater conditions during much of the dry season. Superimposed on this natural seasonal dynamic is the relatively constant inflow of water from the VWRF; although the discharged volume is relatively constant, its influence varies seasonally, with the greatest effect during periods (*i.e.* the dry season) when surface inflows from the Santa Clara River have historically been very low or nonexistent. As such, VWRF flows act to reduce the seasonal contrasts that SCRE invertebrate communities have experienced and evolved with for millennia.

Typical estuarine communities are well represented by crustaceans, molluscs (bivalves and gastropods), and polychaetes (Kennish 1986). Anthozoans, Hydrozoans, and Echinoderms are also often present. The presence of gastropods, bivalves, Polychaeta, Crustacea, and Echinodermata in many estuaries reflects the typical estuarine communities described by Kennish (1986). In contrast, the lack of bivalves, low numbers of Polychaeta and Echinodermata, as well as the large presence of Ostracods, set the benthic community of the SCRE apart from the benthic communities of many other estuaries. This difference is driven various factors including the seasonality of the mouth opening at SCRE, which leads to greater variability in physical conditions through the year, and generally lower salinity (which reduces or eliminates more marine taxa such as Echinoderms and bivalves that cannot tolerate low salinity).

Little is known about the benthic invertebrate community in a relatively undisturbed, seasonally open lagoon in southern California. Although there have been studies of invertebrates in SCRE (*e.g.*, ENTRIX 2003, Kelley 2008, ABC Laboratories 2008, 2010) and other seasonally open lagoons in southern California (*e.g.*, Malibu Lagoon, Ambrose *et al*. 1995), these lagoons have been substantially modified by human activities (including the discharge of treated wastewater). Robinson (1993) has reported the
changes in benthic and epibenthic invertebrates in Pescadero Lagoon, a seasonally open lagoon in central California, as the lagoon changed from an open to closed condition.

The invertebrate assemblage changed from marine to euryhaline and freshwater species. Robinson’s results are similar in some ways to what has been found in the SCRE. Monitoring at SCRE since 1997 indicated that the benthic invertebrate assemblage was composed of freshwater or estuarine species, and tended to be dominated by three or four tolerant species, and varied seasonally and among years. In particular, species of midge larvae (Diptera: Chironomidae), oligochaete worms, copepods, ostracods, and amphipods have tended to dominate during the 1997–2008 monitoring period (Stillwater Sciences 2011). In comparison to Pescadero Lagoon, salinity in the SCRE does not get as high, so the invertebrate assemblage is never dominated by marine taxa. In addition, invertebrate abundances are sometimes low; for example, the abundance of invertebrates in October 2009 was very low at stations sampled by ABC Laboratories (2010) and restricted to only a few freshwater taxa, primarily oligochaetes and chironomids.

The VWRF discharge into the SCRE alters the estuary chemistry and lagoon mouth dynamics, and these changes undoubtedly affect the invertebrate assemblage in the SCRE. It is difficult to assess these changes quantitatively because of the lack of appropriate reference data (see our Recommendations section below), but some qualitative effects can be inferred. It is also important to keep in mind that the VWRF discharge is only one anthropogenic influence on the SCRE; berm breaching, changes in water quantity, and especially water quality in the Santa Clara River inflow undoubtedly also affect invertebrates in the estuary.

One physical effect of the VWRF discharge likely to impact the SCRE invertebrate community is altered salinity within the estuary. Compared to some other seasonally open estuaries, the salinity in the SCRE stays relatively low even when the mouth is open. For example, instead of full seawater salinity, such as reported for Malibu Lagoon (Ambrose et al. 1995) and central California lagoons (Smith 1990), the SCRE salinity currently reaches only 15-16 ppt near the mouth (Stillwater Sciences 2011). When Santa Clara River flow is high, the VWRF discharge would have little influence on SCRE salinity, but the discharge might keep the salinity lower than it would be otherwise when the SCR flow is low but the mouth still open. The VWRF discharge has a great influence once the sand barrier has closed the mouth. Because of the extra freshwater input, the salinity of the estuary will freshen up faster than it would in the absence of the VWRF discharge. In addition, salinity might be lower in the summer than it would otherwise be. Summertime salinity is a balance of evaporation and freshwater inflow (see our Salinity section below). This balance changes from year to year. In the absence of historic measurements, we don’t really know what the conditions were like at SCRE, but likely salinity was often higher. All of these effects of the VWRF discharge would lead to an invertebrate assemblage more dominated by freshwater taxa than would otherwise be the case.

Perhaps more importantly, by adding water to the SCRE when the estuary mouth is closed, the VWRF discharge increases the frequency of breaching. Breaching leads to rapid change in the physical conditions of the lagoon, from freshwater to brackish in just
a matter of hours. Some species cannot tolerate such rapid changes in salinity. Moreover, if there are repeated breaching and rebuilding of the sand barrier, there is never an extended period for either brackish or freshwater invertebrate assemblages to develop; as a consequence, an assemblage of low species richness and low abundance would be expected. These changes will be most stressful near the ocean, where fewer species would be expected to flourish. In fact, these assemblage characteristics do sometimes occur in the SCRE (ABC Laboratories 2010).

The Synthesis Report recognizes the variability in the benthic invertebrate data due to environmental conditions (as well as variability in the data due to changes in sampling methods). In describing the recovery of benthic invertebrate populations after disturbance, the Synthesis Report reports that “[t]his provides further evidence that the SCRE BMI community is adapted to the harsh conditions found in this dynamic environment.” This is a tautological conclusion, since of course the organisms living in the SCRE are adapted to live in that environment. This idea that the organisms living the SCRE are adapted to a harsh environment seems to influence the Synthesis Report’s conclusions about the effects of the VWRF discharge. The Report concludes (p. 131) that “the weight of evidence to date indicates that the VWRF effluent is not adversely affecting BMI populations in the SCRE (ABC Laboratories 2009).” We do not agree with this conclusion. The absence of suitable undisturbed reference estuaries makes it difficult to draw conclusions about how the VWRF discharge might have affected the benthic invertebrate assemblage in the SCRE (see our Recommendations section below). However, as noted above, the discharge alters the estuary in ways that almost certainly would influence the invertebrates living there. Most significantly, more frequent breaching through the summer, especially repeated breaching events, would increase the physical stresses on the organisms living in the estuary and likely lead to reduced abundances and species richness, especially in the area closest to the mouth.

**Invasive Species**

Over the past century our development and alteration of riparian/estuarine systems in southern California has tended to ameliorate annual variation in water quality and quantity. This tendency to reduce contrasts between seasons (i.e., winter vs. summer; Ambrose, *et al.* 1995) has generally benefitted aggressive non-native, invasive species (NIS). Previously, more extreme abiotic conditions (often occurring during the summer, dry season) acted as something of a barrier to the establishment of such non-indigenous animals. As we have removed these potentially stressful conditions (e.g., prevented extreme salinity, stabilized temperature, moderated pH, *etc.*) with more consistent year-round flows into our estuaries, native species whose estuarine abundance owes much to their ability to tolerate those stressful physical conditions (Mitsch and Gosselink 2000) have lost important ecological advantages. In the case of the SCRE, numerous NIS now compose the aquatic fauna. Consistent surface water inputs from the VWRF into the estuary have likely aided in the establishment/maintenance of at least some NIS, although the specific contribution of the VWRF input relative to numerous other anthropogenic impacts is unstudied. Potential impacts from NIS include reduced growth, reproductive output, and abundance of native individuals, an increased probability of native population extinction, and depressed ecological functioning of the community as a whole.
Introduced species commonly encountered during aquatic SCRE surveys (ENTIRX Inc. 2009, Nautilus Environmental 2009, Cardno ENTRIX 2010) include: carp (Cyprinus carpio), Arroyo chub (Gila orcutti), prickly sculpin (Cottus asper), fathead minnow (Pimephales promelas), mosquitofish (Gambusia affinis), green sunfish (Lepomis cyanellus), Mississippi silverside (Menidia audens), prickly sculpin (Cottus asper), Louisiana crayfish (Procambarus clarkii), and African clawed frog (Xaenopus laevis). Less abundant non-natives encountered in the SCRE include suckers (Catostomus santanae, C. fumeiventris, and their hybrids) and yellowfin goby (Acanthogobius flavimanus). Note that the Arroyo chub and suckers are both native to our coastal southern California region and species of concern in our state. While they were introduced into the Santa Clara watershed, their presence is probably a beneficial one from the overall regional perspective as their presence in the Santa Clara in effect minimizes the probability of their global extirpation. Most of these NIS are either direct or indirect competitors with native SCRE fish and amphibians or predators upon larval or adult SCRE fish, amphibians, or invertebrates.

Reductions in the quantity of VWRF discharge released into the summertime SCRE will have the effect of reducing the propensity of the berm to breach and foster longer dry season closed-mouth conditions that tend to establish a clear seasonal difference in SCRE abiotic conditions. Additionally, many of the predatory NIS fish such as carp and green sunfish refuge in the deeper water main channels out of range of avian predators. Reduced VWRF discharges that reduce overall stage height of the lagoon will tend to eliminate these refugia for these exotics. Steelhead and tidewater goby may also refuge in these deeperwater reaches, but the steelhead also frequently occupy vegetated shallower reaches and tidewater goby utilize waters generally shallower than 1 to 1.5 m. The apparent disproportional use of deepwater habitats by some NIS was illustrated by the berm breach on September 16, 2010 assessed the following morning by the Cardno Entrix team (2010). Thousands of native tidewater goby (all size classes), many hundreds of juvenile green sunfish, and many hundreds fathead minnow (all size classes) mortalities were common across the then-exposed mudflats of the drained lagoon. Far fewer suckers, prickly sculpin, adult green sunfish or carp were stranded. The Cardno Entrix team observed hundreds of living adult carp and “hundreds if not thousands” of living African clawed frogs (juvenile and adult) in the deeper reaches of the SCRE during their surveys.

We do not suspect the SCRE would commonly become hypersaline during the summer season in the absence of VWRF discharge (see our above discussion on salinity) as occurs in some other southern California estuaries, but we do presume a variety of factors would combine to create the salinity conditions of a VWRF-free SCRE. It is well within the range of possibilities that the SCRE would be brackish during summer months. This could at times be enough to reduce the abundance of some NIS. For example, both carp and African clawed frogs are sensitive to brackish water. Clawed frogs show decreased performance with salinities as low as 8-9 ppt (Munsey 1972) but some may be able to tolerate upwards of 20 ppt water for at least limited periods (Wells 2007). Carp can tolerate water up to 12-15 ppt (Kasim 1983). Conspicuous living carp seen during those Cardno ENTRIX surveys (2010) had migrated riverward (the largest concentration were proximate to the Harbor Boulevard Bridge), with individuals in the brackish waters
created by the sudden seawater intrusion showing increased mortality as the day
progressed.

Whatever the vector of introduction or factors leading to their expansion, it is clear the
presence of abundant exotic species in the SCRE is likely detrimental to native species of
concern such as tidewater goby (Lafferty, et al. 1999a) and steelhead (Kelley 2004). Any
efforts to create environmental conditions less hospitable for such invaders will
ultimately benefit native flora and fauna throughout the SCRE and beyond.

We note that our discussion of invasive species has only examined the aquatic fauna of
the SCRE. To be sure, numerous invasive plants and algae exist throughout this and all
southern California estuaries. The most problematic of these plants, Giant Cane (Arundo
donax) and Tamarisk (Tamarix spp.), are a major threat to native diversity, hydrologic
functioning, fire management, and recreational use (e.g., VCRCD 2006) of our estuaries
and riparian corridors. However, their spread and maintenance is largely driven by
upstream forces and not particularly influenced by the dynamics of the estuary proper.
Hence our motivation to de-emphasize the invasive SCRE flora in our discussion.

Hydrology

Water quantity

There is not enough information about the natural hydrologic cycle of the SCRE to know
with confidence how the VWRF discharge has, in concert with other hydrological
changes to the Santa Clara River system, changed it.

However, Synthesis Report implies that the discharge is compensating for reduced flow,
and thus by implication is restoring a more natural cycle. For example many reports
(e.g., 2002 BMI study, the Synthesis report) include a statement such as this:

“The natural hydrology of the Santa Clara River and estuary is typical of
costal Southern California watersheds, which normally have very low, dry-
season flows and large storm driven peak flows that dissipate rapidly. The
natural hydrology of the Santa Clara River, though, has been greatly altered
by upstream diversions and irrigation. In contrast, the VWRF outfall
constantly discharges tertiary treated wastewater into the Estuary. Flow
from the Santa Clara River typically does not reach the Estuary during much
of the year due to agricultural and municipal water diversions. In part, the
VWRF discharge compensates for upstream water diversions and provides a
water source during periods when the Estuary would otherwise be dry. In turn,
this continuous water source provides habitat for a wide array of aquatic
organisms, waterbirds, and other vertebrates in the Estuary.” (Synthesis
report 2002, emphasis added)

The first part of this excerpt is consistent with our understanding of the Santa Clara River
and most other southern California rivers and estuaries. But the highlighted section
implies the VWRF discharge is replacing water that would naturally be present in the
lagoon if it weren’t for the upstream diversions. This may be true during spring, when flows in the River would be below their peak but not yet to the minimum. At this time, water diversions might significantly reduce the flow in the River, and the VWRF might be seen as replacing this water. But in summer, it would appear that there normally would be relatively little surface flow into the SCRE, with or without water diversions, so that the VWRF discharge would be an artificial supplement to the volume of water in the Estuary.

Despite the implication of the passage quoted above, even the Synthesis Report’s authors recognize that the VWRF discharge is an artificial supplement to the Estuary in the summer. For example, page 45 of the Synthesis Report includes a graph (Figure 4-6) showing the monthly average discharge volumes for the Santa Clara River and the VWRF, and the statement: “This combined flow results in a summer and fall surface water flow into the SCRE that is likely greater than would be expected from an unregulated southern California river during closed-mouth conditions (ESA 2003).”

We do not find data supporting the contention that the SCRE would become unsuitable for steelhead, tidewater goby, or other resident species if the VWRF was not discharging into the Estuary. The estuary persisted without artificial water supplementation historically, as do many other seasonally open estuaries in southern and central California.

One important consequence of the VWRF discharge into the SCRE is increased frequency of breaching. Although breaching is influenced by a complex mixture of fluvial and marine processes and breaching timing and frequency varies from year to year (see Smith 1990), many coastal wetlands in southern California naturally remained closed from the end of the wet season in February or March through the end of the dry season in November or so (Dave Jacobs, personal communication). Increasing the volume of water stored in an estuary through artificial supplementation can dramatically increase the number of times an estuary breaches in summer.

Summer-time breaching can have dramatic negative effects on both of the target species considered in this report. The effects of summer-time breaching is well illustrated by the breach in summer 2010, which was well documented by the fish survey that was scheduled for the next day (ENTRIX 2010). Thousands of tidewater gobies were stranded and killed when the lagoon drained rapidly and seven large juvenile steelhead were documented to have died.

Although the adverse effects of summer-time breaching are clear and well understood, various arguments have been made that the extra water in the summer time provides some ecological benefits to the SCRE. The main argument is that the extra water, by raising the water elevation in the lagoon, results in more habitat for steelhead and tidewater goby.

Note: http://www.venturariver.org/2010/09/estuary-breach-kills-fish.html reports “Two separate federal agencies are charged with stewarding the fish - NOAA Fisheries for the steelhead trout, and Fish and Wildlife Service over the tidewater goby. Past decisions
have been based upon the need for continued water for the tidewater goby, based upon the fear that reduced flows from the wastewater plant would limit habitat in the estuary. And although steelhead often struggle to get downstream with limited flows past migration barriers, studies have revealed that steelhead rely upon the estuary in order to grow to a size which ensures their survival once they enter the ocean."

**Water quality**

Although the timing and quantity of water delivered to the SCRE has clear ecological consequences for steelhead, tidewater goby, and other species living in the Estuary, the quality of water is also important.

**Salinity**

Salinity levels have major ramifications for the distribution and abundance of many organisms found throughout the SCRE. As with many other SCRE parameters, understanding the historic and current salinity fluctuations is key to evaluating the impact any VWRF discharge might be having upon estuarine organisms. Pre-VWRF discharge (pre-1958) water quality data is non-existent and all modern Estuary sampling is confounded by the contiguous VWRF discharges. While we can infer previous general salinity levels from detailed historic ecology studies of the SCRE (now underway) or from our contemporary understanding of analogous, seasonally open systems, we are often left to rely upon models to predict the specific “undisturbed” salinity condition of the SCRE in the critical summer dry season that is so central to the focus of much of this Report.

The most recent SCRE geomorphology data (1-m resolution LiDAR surveys conducted by both Ventura County and the United Stages Geologic Survey in 2005) analyzed and reported in the Synthesis Report (Stillwater Sciences 2011) combined with other data collected and analyzed (*i.e.* NOAA Santa Barbara Tide Station 9411340 data) therein suggests that seawater enters the estuary primarily when the berm is breached and overall SCRE stage height is low. So salinity levels in the Estuary during open conditions (typically the wet period of the year) are only somewhat influenced by the VWRF discharge, with particular salinity levels fluctuating over the course of any given day as tidal forcing and river flushing alternate to allow a marine lens to migrate in and out of the Estuary. When the Estuary mouth is closed, relatively little saltwater appears to percolate through the sandy barrier across that SCRE mouth (although direct measurements are lacking to confirm this prediction). This owes to the fact the minimum estuary bed elevation is 3 feet (NAVD88) and the Mean Tide Level is only 2.71 feet (NAVD88). More than 80% of the estuary bed is higher than the 5.3 feet (NAVD88) equivalent to Mean Higher High Water (Stillwater Sciences 2011). Our independent analyses of the Santa Barbara Tide Station data shows tides exceed 3 feet (NAVB88) 46% of the time, exceed 4.5 feet (NAVD88) only 16% of the time, and exceed 6 feet (NAVD88) less than 2% of the time (these values hold for both the year as a whole and for the summer seasonal tides in isolation). If we assume Stillwater’s monitoring was adequate to correctly characterize the groundwater gradients, McGrath Lake typically creates a net inflow of subsurface water into SCRE when the SCRE stage height is less
than 5.3 to 6.3 feet (NAVD88) during the summer (Stillwater Sciences 2011). We therefore concur with the Synthesis Report’s estimate that if we were to cease VWRF input into the SCRE during the dry summer months (when the SCRE experiences little or no surface riverine flows), the SCRE stage height would likely hover around 8 feet (NAVD88) in elevation. Assuming no rains or other surface inflows, the primary forcing function for those summertime inputs into the SCRE would be the rate of evaporation within the Estuary. As water elevation is drawn down, fresh, groundwater subsurface flows would tend to replace that volume lost to evaporation. The resulting summertime salinity of the Estuary would therefore be heavily dependent upon the volume of seawater retained within the SCRE at the moment the berm reforms across the mouth and ceases direct tidal exchange with the sea. Should the berm form rapidly and retain a large volume of seawater, we expect a relatively saline and perhaps even hypersaline lagoon as water evaporates and salts are concentrated into a lower stage/smaller volume lagoon. Should the berm form slowly and retain a comparatively small volume of seawater, we expect a fresher, slightly brackish lagoon. Given these caveats, we estimate that a VWRF-free summertime SCRE would probably more often than not tend towards brackish but likely experience elevated water temperatures.

Even if we are presented with a relatively stable fresh or brackish Estuary overall during closed-mouth summertime conditions, we could still potentially get sections of the Estuary that are more saline than other sections and hence influence organismal distribution within the lagoon itself. As with the system overall, a variety of factors come into play to determine that distribution of salinity across the lagoon. The extremes are represented by a completely (vertically and horizontally) homogenized state or a highly stratified state. The primary factors that come into play here are frequency and speed of surface winds blowing across the lagoon’s surface, the amount of water restricted to very shallow depths (generally around the lagoon’s perimeter), location relative to the primary percolation/subsurface inflow points in the lagoon (i.e. segments closest to McGrath Lake), and the amount of hydrogeomorphic partitioning (side channels, vegetation) that acts to increase hydrologic roughness and minimize mixing.

Evidence for wind-induced mixing of the SCRE is equivocal and data collected for this current Subwatershed study confirm stratification of DO, salinity, etc. is common (Stillwater Sciences 2011). Consistent stratification in small, central Californian estuaries has been implicated in slower growth of estuary-dependent animals such as steelhead (Smith 1990). However, should wind-induced mixing occur, that would tend to homogenize the SCRE as a whole, moderating any temperature increases and keeping the overall salinity levels in shallow reaches and vegetation-rich back channels lower than in a putative stratified condition.

This complex mix of marine and freshwater fluxes, geomorphology, and physical processes emphasizes the dynamic nature of this overall system and the importance of variable “initial” conditions at the onset of mouth closure and of stochastic events even were the VWRF to discharge nothing into the SCRE.
Nutrients

The Synthesis Report states that:

Under current conditions, water quality regulation in the SCRE is directly impacted by excess nutrients arriving from the VWRF. The elevated nutrient levels in the VWRF outfall channel relative to other locations in the SCRE combined with the elevated trophic state index values suggest the SCRE is currently eutrophic. Although recent scour events may influence the relative amounts of rooted submerged aquatic vegetation (SAV), the lack of SAV has also been linked with nutrient enrichment in estuaries (e.g., Orth and Moore 1983).

The eutrophication of the SCRE has consequences for most species using the estuary. In particular, steelhead may be adversely affected by the low Dissolved Oxygen that occurs at times in some places of the estuary, most notably in the reaches proximate to the VWRF discharge during the warm summer months in pre-dawn hours where respiring algal biomass robs the water column of oxygen (see Figure 5-6). As noted by the Synthesis Report (p. 166), “the VWRF discharge may be directly linked to periods of low DO levels due to algal growth.” Controlling nutrient inputs is an increasingly important goal across our region and key to a healthy estuary.

Dissolved Oxygen

Dissolved oxygen (as noted in the previous section) is a seasonal problem in the SCRE. Low oxygen conditions in the SCRE are primarily associated with nutrient enrichment, and algal blooms. As such the most common management action is to reduce nutrient inflows as already discussed. It is important to note, however, that low oxygen conditions may manifest in the absence of eutrophication, if waters are significantly stratified for extended periods of time. When a large biomass of vegetation, protists, or sessile animals are held within such a stagnant body of water, normal respiration may be enough to rob the water segment of available oxygen and create dangerously low DO. Their solution to such stress is to induce water column mixing, thereby allowing exchange with oxygen-rich surface waters. Widespread, persistent stratification in the SCRE to the point of routinely suppressing DO is uncommon in the SCRE.

Temperature

Temperature typically ranges over 10°C (from a wintertime low around 13°C to a summertime high of 25°C; Stillwater Sciences 2011) over the course of the year in the central SCRE. While we have measured temperatures ranging to greater extremes in the shallow water perimeter reaches of the SCRE (Anderson unpublished data), temperatures are roughly similar to those of other southern California estuaries and not of particular management concern at this point. Typical temperature ranges are within those identified for steelhead and tidewater goby.
**Anthropogenic Pollutants: Heavy Metals, Pesticides, and Emerging Contaminants**

Various human created, modified, or distributed compounds from numerous sources can be found throughout the SCRE. State Water Board policy (LARWQCB 1994) requires toxicity tests and for water bodies to achieve the somewhat illusory “no acute toxicity” standard. Problematic identified contaminants to date include copper, nickel, lead, zinc which have all exceeded the US EPA (2000) California Toxics Rule (CTR) criteria for these metals (Stillwater Sciences 2010). It is worth noting that ammonia levels were periodically above toxicity criteria established under that same policy (Section 5.2.1, of LARWCB 1994). Regional Water Quality Control Board mandated toxicity tests included acute (Lethal Concentration or LC50) toxicity for fathead minnow (*Pimephales promelas*), and chronic toxicity tests for growth, reproduction, or survival. Model organisms included fathead minnow, a freshwater green alga (*Selenastrum capricornutum*), and daphnia (*Ceriodaphnia dubia*).

While all of these metals are potentially problematic to aquatic organisms (particularly developing individuals), copper has received the bulk of the attention from the perspective of our focal species. A decade ago, attention was raised when copper exceedances were identified in about 10% of the samples collected over the course of a year (ENTRIX 2002). Copper, lead, and nickel continue to violate identified monthly NPDES targets, although copper (and other metals for that matter) may well be entering the SCRE from upstream, open ocean or non-point sources (VWRF NDPS Monthly Reports 2008-2011, Stillwater Sciences 2011). Whatever the source, copper has the potential to impact salmonid olfaction and food chain support at concentrations as low as 0.59-2.1 ppb and behavior or growth at concentrations as low as 0.75-2.5 ppb (Baldwin, *et al.* 2003, Hecht, *et al.* 2007 and references therein). These sublethal impacts can manifest as recruitment failure, difficulty foraging, or other consequences. It should be noted that the detection limit for the EPA approved method used to measure copper in the SCRE and VWRF discharge (2 ppb) is above the lower end of these sublethal effects concentrations. From 1999 to 2004 Copper in the SCRE ranged from 0.5 to more than 140 ppb (ENTRIX 2002, Nautilus 2005). Data over the past 5 years shows copper now typically ranges from 2-20 ppb in the SCRE water column.

**Proposed Alternatives**

**General Concerns of Proposed Alternative Modeling Approach**

Interpreting alternatives is complicated by the poor characterization of current conditions of the extant system. The Summary Report authors have indeed done much work to model the effects of various candidate future manipulations. As with all such efforts, the key to this model’s utility lies within the assumptions made. As such we would first like to explore some of the important caveats and assumptions associated with their modeling efforts:

1) For simplification purposes, all alternatives explore conditions within the relatively dry time of the year (late Spring through Summer) only.
Relatively wet periods of the year are often characterized by constant or at least frequent open-mouth conditions and the dwarfing of VWRF releases by main stem Santa Clara River flows. We find these assumptions and general focus on dry season conditions reasonable.

2) **2009-2010 hydrologic conditions** adequately characterizes typical system performance. We have some reservations with this given (as the authors note in section 11.2) the relatively wet conditions of 2009-2010 WY (although not as wet as the 2010-2011 WY is proving to be) and would have liked to have seen data from a range of years spanning comparatively dry years. Having said this, we believe that insight can still be gained even with models parameterized with only a subset of the natural range of physical conditions.

3) **Water Mass Balance Model** (articulated in section 4.2) characterizes water quantity in the SCRE via essentially independent estimation of component inflows and outflows. The numerous assumptions used to generate each of these components necessitate great caution when interpreting the aggregate model outputs. This model appears particularly sensitive to predicted stage height, ground water pressure gradients/inflow rates, and berm open/closed status. We have highlighted several concerns about these components/assumptions previously. Alteration of the VWRF discharge rate is the primary forcing factor in future scenarios.

4) Acute **Nutrient Accumulation/Mass Balance Model** (articulated in section 5.5) estimates Total Inorganic Nitrogen and Phosphate concentrations/mass loading to the SCRE. Similar to the above estimate of water quantity, this approach relies on assumptions about the various inputs and biological uptake/utilization rates. In particular we are concerned about the assumption that there are no biological “reactions” with regards to the nutrients in the system. This assumption can only hold if biological removal rates are low. In effect this says biological removal is not an issue by definition. This does not appear to be borne out by vetting of the overall ability of this model to predict extant conditions (see Figure 5-16). In addition it is a bit unclear as to how the future condition parameters for Table 11-2 were set. For example, why does the VWRF pond groundwater flow rate increase across scenarios 4, 5, & 6 (presumably due to an increase in hydraulic gradients as the overall water level decreases in the estuary and surrounding groundwater flows increase). This appears a key assumption as the model output predicts identical nutrient conditions/concentrations in Alternative 3, 5, and 6. Lastly, there is no clear link between nutrient concentration and habitat quality for the identified focal species other than general qualitative assertions that reduced nutrient concentrations should lead to less algal bloom or bloom-like conditions.

5) **Deterministic Models.** The models used to predict extant and potential future condition are deterministic. As such they paint a potentially misleading picture of those potential future condition of the SCRE; running this model again and again will merely produce the identical output and yield no measure
of the error (or confidence we have in the reported output). Without such a measure of our confidence in the model result, decision makers may take away an assumption of certitude that does not exist. Emphasizing variance (between weeks, months, etc.) or incorporating some level of stochasticity would boost our confidence in this exercise. We recognize the challenges of such a more intense modeling effort, but numerous observations and data collected for this assessment point to the very dynamic nature of this coastal system. Indeed many of the key forcing factors within this system appear to be dictated by variation (e.g., breaching frequency) rather than the overall central tendency (e.g., average stage height) of the system. Modeling that central tendency is more expeditious but may not capture the key drivers of ecological functioning. For example, these models may predict a stage of height of say 10 feet after one month. Even if a brief breach then occurs, this model would predict another 10 foot elevation one month later and identical conditions to those of the previous month. The key determinant of the ecological functioning within that lagoon would be the breach event (the deviation if you will) and not the average condition.

6) **Stage height** is the sole determinant of aquatic volume and in turn of the habitat quantity for focal species. As the authors point out, their approach depends entirely upon robust benthic topography, which has only been mapped to a high degree of accuracy twice in the last decade (2000, 2005). The assumption that the 2005 condition is an accurate predictor of topographies decades into the future is dubious. While a fine first pass, this approach is insufficient to characterize the overall quality of this aquatic habitat for our focal species. One example of the problem of this stage height-habitat area assumption can be found with the tidewater goby field surveys. Surveys conducted in the Spring of 2008 (see the Nautilis 2009 report) showed no effect of mouth breaching (i.e. different stage height) on tidewater goby abundance/incidence. If their habitat was so sensitive to stage height as implied by the core assumption of this model, we would expect goby abundance/incidence to decrease following a reduction in stage height. As such, using this single parameter as a predictor of goby habitat quality is flawed. While it is absolutely the case that gobies do require a minimum water level, other factors such as spatial refugia, prey availability, and predator abundance may well prove more accurate predictors of the adequacy of the SCRE as goby habitat. These were not assessed in this study. A similar argument can be made for steelhead (see above). While higher stage results in greater aquatic habitat area, the additional habitat may not be of higher quality for steelhead or gobies (as acknowledge by the author).

7) Model only captures short-term dynamics. The authors are explicit in arguing that they designed this model to only address the situation in the 4-month, immediate aftermath period following a mouth closure. While we feel such a short-term approach is fine to compare the short-term dynamics of various management options, it is important to keep in mind that this ignores any longer-term shift in community dynamics. This weakness was recognized
with regards to the potential expansion of tern and plover nesting (the authors felt the need to bring in longer term community dynamic estimates when they noted a lowered overall stage height such as under Alternative 6 would in all likelihood lead to only a temporary expansion of potential nesting area due to presumed vegetative encroachment in subsequent years), but not for putative salmon habitat. As their assumptions put a higher value on shallow/vegetated fringe regions of the marsh for focal fish species, their failure to consider possible longer-term dynamics (i.e., vegetation colonizing/redistributing to the periphery of new, lowered water levels under Alternatives 4-6) leads to an overly pessimistic estimate of the potential quantity of such habitat for fish rearing, etc. The authors could remedy this concern relatively easily by simply running additional simulations with a potentially redistributed vegetation polygon. This could at least help bound their results. Our concerns regarding the differences between habitat quality and quantity aside, we feel remaining cognizant of potential longer-term dynamics is always beneficial for managers/decision makers.

**Interpretation of Alternative Scenarios**

The discharge-stage height and discharge-nutrient concentration models predict improvements for most organisms with reduced water quantity and nutrient discharges into the SCRE from the VWRF. The stage-height model predicts specific conditions, while the nutrient models predict general conditions lacking specific predictions upon species performance. Given the lack of predictive power of the nutrient model, the alternatives can be generally aggregated based on the discharge-stage model; continued discharge grouping (Alternative 1, 2, 3), 30% reduction is discharge group (Alternative 4, 5), and the no discharge group (Alternative 6). The authors’ interpretation largely follow these groupings.

The Synthesis Report’s discharge-stage models predict or relatively little effect on focal species under scenarios 1, 2, and 3. McGrath State Beach would continue to flood under scenarios 1, 2, and 3. Effects upon focal species habitat begin to be felt under scenarios 4 and 5, although these effects are generally minimal according to the Report. Flooding of McGrath campground (and presumed recreational impairment) ceases under scenarios 4, 5, and 6. Scenario 6 would reduce potential steelhead habitat quantity by 70%, with that for other species moderately impacted or unimpacted. Unfortunately we believe none of these model outcomes are of any utility to decision makers due to the caveats we have already mentioned and absence of any clear relationship between these predictions and the actual health of SCRE populations or functioning of the system.

The authors are correct in their assertions that reduced VWRF discharges will likely decrease the freshening of the estuary and so make the SCRE generally less hospitable to invasive aquatic species that compete or prey upon our focal species. This is recognized as an improvement in ecological functioning. Similarly reductions in nutrient concentration from the VWRF will tend to reduce the conditions leading to eutrophication, algal blooms, low DO, etc. (although the expected magnitude of that
improvement is unknown). This would represent an improvement in water quality to the background level of the water entering the system from upstream/groundwater.

The authors are correct in noting that their model only attempts to predict the acute condition of the SCRE given various alternatives. At various points there are references made to potential long-term shifts in vegetation or other landscape elements should a given alternative be in place for an extended period of time (e.g. section 11-2) even though their modeling efforts do not encompass this possibility. While an important caveat, we are not particularly concerned with this eventuality. Even if Alternative 6 (complete cessation of VWRF input) were implemented, we believe the dynamic flows and scouring during the wet season are likely to prevent channels from choking with vegetative or sediment accumulation to the extent we would see a radical alternation of potential habitat for any focal species.

These 4-month long scenarios generally are at or near (within ~1 foot) their equilibrium conditions within 1 to 1.5 months of the onset of the model. The general assessment of each given scenario is therefore driven by those dominant equilibrium or near equilibrium conditions. This ignores the fact that during the summer months, the mouth has remained open approximately 2/3 of the time from the mid-1980s to late 1990s or 1/3 of the time over the past decade (see Figure 4-9). We understand the value of a standardized model with which to compare alternative scenarios. However the propensity to breach is not expressed at all in this exercise. This is a key driver of ecological functioning of the system and of habitat quality and quantity for our focal species in the SCRE. Even assuming the relatively infrequent summer breaching rate of recent years (30% or less of the time) paints a very different picture of the quantity/duration of habitat available to the focal species. We therefore cannot express how problematic excluded breaching from this scenario comparison exercise is. As we believe breaching is the most important feature of the SCRE from an ecological impact perspective and the greatest impact from the VWRF discharge in particular, any interpretation of these scenario models is limited.

**Recommendations**

**Model Improvements**

We have noted several concerns with the modeling effort, but improvements do not necessarily require starting over from scratch. One potentially cost effective approach to improve our understanding of the proposed alternatives is to build upon the considerable effort that went into this existing model. We suggest adding breaching events and explicit measures of habitat quality to this model. This could potentially be done via an integration of the nutrient and stage height elements. The Bight ’08 estuary dataset complied by the Southern California Coastal Water Research Project may be particularly helpful in this regard. While not directly elucidating nutrient-fish relationships, this year-long effort attempted to relate nutrient concentrations to DO and algal bloom events. Such an exercise which attempted to explicitly get at habitat/water quality from this initial model framework would greatly improve decision makers’ ability to distinguish between potential alternative scenarios.


**Habitat Quality and Ecotoxicological Studies**

Much effort in both this report and the monitoring efforts that have led up to this report have focused on elucidating SCRE habitat quantity or traditional water quality parameters within the SCRE. This was an appropriate starting point. With this foundational work in place, we would like to see the data collection efforts mature to focus more intently upon issues of habitat quality. This includes a better understanding of the productivity rate of prey items for focal species, growth rate studies of focal species, and a better understanding of community assemblages across a range of SCRE sites and comparable reference sites (see below). We also suggest a greater emphasis be given to ecotoxicological studies, particularly sub-lethal chronic and acute studies on focal species (goby or goby models and smolt steelhead or steelhead models) that have received so much attention in this work leading up to this Synthesis Report. Nutrient, heavy metal, organic, and emerging contaminant studies on aquatic species would greatly improve our ability to ascertain the actual value of the habitat quantity.

Our ability to better interpret VWRF-associated impacts and benefits would improve with a more rigorous assessment of the ecotoxicology of various factors upon SCRE organisms. We suggest a series of acute and chronic toxicity tests with EPA approved organisms. Ideally organisms would include species of concern but also other organisms that represent a range life histories and interactions with the environment, developmental periods/ages, and that span a range of sensitivities. We suggest both vertebrate and invertebrate EPA-approved Whole Effluent Toxicity (so-called WET) model organisms. Rainbow trout (*Oncorhynchus mykiss*), fathead minnow (*Pimephales promelas*), and topsmelt (*Atherinopsis afinis*) could provide good estimates of the range of fish feeding guilds and are relatively robust estuarine organisms that occur in SCRE. Water fleas (*Daphnia* sp.) and mysid shrimp (*Mysidopsis bahia*) would characterize the sensitivity of short-lived invertebrates who may be relatively more susceptible to both acute and chronic impacts from pollutants. We note that fathead minnow, topsmelt, and mysid (and a *Daphnia* analog) were used during water and sediment toxicity tests conducted in the SCRE from 2003-2004 (Nautilus 2005). We suggest building upon this good previous work, however emphasize focal species models and emphasize the more freshwater/brackish suite of models (Nautilus 2005 emphasized marine models). Acute and chronic bioassays for both lethal and sublethal endpoints are well established (see US EPA 2002 and the US EPA’s Manual clearing house at http://water.epa.gov/scitech/methods/cwa/wet/index.cfm).

Additionally any attempts to characterize emerging contaminants commonly derived from municipal, agricultural, and industrial wastewater such as endocrine disruptors, cosmetics, and fire retardants would be a positive step. We appreciate that concentrations of such compounds are often at the ppb level, at or near existing detection limits, and that few if any standard monitoring methods have emerged. Nevertheless, such a dataset will go a long way towards helping us understand some of the more subtle impacts of VWRF upon potential habitat quality.
Lack of Adequate Reference Sites for the Santa Clara River Estuary

Perhaps the greatest challenge to rendering a robust judgment upon the health of the SCRE is the lack of an appropriate reference system or systems. At some level (coastal river or coastal estuary), we have many sites with which to compare the SCRE. At such a gross level, we can relatively confidently answer some basic questions such as are there/should we expect there to be steelhead in the SCRE? At this gross level of assessment, nearby sites are acceptable reference sites or historic data can be gathered to determine the historic condition of the SCRE. Unfortunately, for many of the more focused and therefore diagnostic metrics discussed in this report, such gross comparisons are not appropriate. In particular the conditions that derive from the seasonal closure of the river mouth are a challenge. We know of no good extant system that mimics the open-closed nature of this coastal lagoon system that is itself relatively undisturbed. While we may have some suppositions based on our own experiences, there is simply no obvious, objective yardstick with which to compare many of these more detailed metrics discussed herein: infaunal density, ichthyofauna compositional diversity measures, etc.

For example, in previous reports wherein an effort was made to compare benthic macroinvertebrates within the SCRE to those within other systems in the Southern California Bight, the vast majority of these putative reference sites were fully tidal and so not comparable (even if identical sampling methodologies had been used). In short, the lack of a robust, regional assessment framework is clearly felt. Nevertheless the authors lack of monitoring at a range of reference sites and the short temporal duration of the vast majority of their sampling efforts (we note that discharges in the SCRE began in 1958 and California’s inaugural Enclosed Bay and Estuaries Discharge Policy in place since 1974) makes interpreting current performance an equivocal task.

Hydrology Experiments

Given both the shortcomings of the scope and duration of the sampling efforts to date, the lack of obvious reference sites for the SCRE, and limitations of the models utilized, we propose a manipulative experiment to better interpret the current conditions and at least some of the alternative management scenarios. We propose a 3- to 6-month experiment wherein effluent from the VWRF is removed, reclaimed or piped directly offshore via a temporary pipeline akin to the temporary dredging pipeline routinely deployed adjacent to the SCRE for dredging operations in Ventura Harbor. As we lack an adequate model system, such a temporarily cutoff VWRF discharge from the estuary proper would go a tremendous way towards estimating salinity levels, stage height, infaunal responses, etc. in a VWRF-free scenario. While there are various shortcomings and risks with such a manipulative approach, we would be on much more solid footing with regards to predicting alternative scenarios. It would directly allow the testing of Alternative 1 and Alternative 6 (and a partial diversion would allow us to evaluate the hydrological components of Alternative 4 & 5) while giving important insight into the other alternatives. Even a short-term experiment may elucidate much of what currently remains unknown or untested.
Conclusions

In summary we feel the Santa Clara River subwatershed studies do not afford enough ecologically-relevant information to say that VWRF discharges into the SCRE are necessarily a net benefit to the system. There are likely to be improvements to the ecological and recreational values with reduced quantities of water and nutrients discharged into the system, but the nature and extent of these benefits are unclear given the information and data provided to date. The summary report is a definite improvement in the effort to better understand the SCRE system and the effect that the VWRF has upon it, but does not provide adequate information to make a fully informed decision as to the current effect of VWRF discharge on SCRE organisms and their ecosystem.

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Kelley, E. 2011. Letter to Karen Wain, Public Works Department of the City of San Buenaventura, regarding the Final Synthesis Report, City of Ventura Special Studies, Estuary Subwatershed Study Assessment of the Physical and Biological Condition of the Santa Clara River Estuary, Ventura County, California, by Stillwater Sciences.


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Santa Clara River Estuary, Ventura County, California. Report to the City of Buenaventura.


July 5, 2011

Karen Waln
City of Ventura
Environmental and Water Resources Division

Dear Ms. Waln,

This letter constitutes Ventura Audubon’s comments on the Final Synthesis Report on the Santa Clara River Estuary study discussing the alternatives for the discharge from your water treatment plant.

Figure 11-4 which shows modeled Western Snowy Plover and California Least Tern nesting habitat areas for each alternative: This discussion doesn’t give the decision makers any useful information as currently the available habitat for nesting for both species is underutilized. The main factor for Least Tern nesting success is the availability of nearby foraging habitat. If forage fish are available the terns will use nearby sandy areas outside of the estuary for nesting.

Page 2 correctly identifies the VWRF discharge as providing 90% of the flow during the March through September period when plovers and terns are nesting. Given this we do not understand how the report reaches the conclusion that elimination of the discharge will result in no decrease in foraging area for Least Terns. (See Figure 11-5 and page 207)

Page 195 shows essentially the same groundwater flow from the VWRF pond even though the report admits that implementation of Alternative 6 will likely result in the elimination of the ponds.

Using the estimates the reports provides in Table 11-1 one can derive net water flows in the estuary by summing the inflows and outflows. The current condition is shown as a positive 1.8 MGD. The report shows that eliminating the discharge will result in a flow of 0.7 MGD. We do not believe that lowering the flow in the estuary by more than half will not change the area available for tern foraging.

There are two very suspect values in Table 11-1. The first is the contribution from the VWRF ponds and this will likely be eliminated with Alternative 6. The contribution from the Northbank groundwater is suspect as NO DATA exists for
the flow values given. If you subtract the groundwater flows from these sources in Alternative 6 the new flow in the estuary is a minus 2.6 MGD. This would dry up the estuary.

I’ve attached a photo of the estuary taken on June 24, 2011. It represents the estuary in a dry condition. It is essentially a view of how the estuary would look if the VWRF discharge is eliminated. On that date the discharge was flowing directly to the ocean through the river mouth that is open. The river mouth was being kept open by unusually high flows from the Santa Clara River. The Victoria Avenue stream gauge showed a flow of 68 cfs, twice the normal flow at this time of year. So far this year there have only been 6 Least Tern nests on the south side of the river, adjacent to the estuary and none on the north side. (There are more Least Tern nests further south adjacent to McGrath Lake and the lake is being used for foraging.)

Page 200 discusses the use of the discharge channel for a refuge for Tidewater gobys during high river flow times. The report says it is likely that other low velocity areas would be available if the discharge is eliminated. We are quite familiar with the estuary and no other low flow areas exist. Elimination of the discharge channel will mean gobys will have no safe areas during high river flows.

The report focused on two bird species, yet 116 species were observed during the required bird surveys. Eighteen sensitive species have been recorded at the estuary. In deciding if the discharge is an enhancement consideration of all the life the estuary and wildlife ponds supports must be considered.

We believe that the synthesis report is flawed because of the above listed concerns. We support Alternative 3 with the treatment plant upgrades and enhanced denitrification using a treatment wetland.

Reed Smith, Science Chair

Attachment: Photo of estuary taken June 24, 2011
July 14, 2011

City of Ventura
Attn: Karen Waln
501 Poli Street
Ventura, CA 93002-0099
Email: kwaln@cityofventura.net

Dear Ms. Waln:

Thank you for the opportunity to submit formal comments in regards to the Santa Clara River Estuary (SCRE) Special Studies. As you know the California Department of Parks and Recreation (DPR) is the principle landowner and steward of the unique natural, cultural, historical, and recreational resources of the Santa Clara River estuary, adjacent campground, beach, and dune areas. We therefore are arguably affected by Ventura Wastewater Reclamation Facility (VWRF) discharges greater than any other stakeholder in the region. Both the quantity and quality of this effluent can have significant impacts on State Park resources. Dry weather discharge volumes artificially increase stage level and the likelihood of a summer berm breach event. Artificially increased water surface elevations and breach events have the potential to strand both Steelhead and tidewater Goby, reduce available forage area for California least terns, and destroy Western snowy plover nests that occasionally are established on the estuary side of the berm at or below 10ft. NAVD88.

According to the study, the VWRF discharge currently accounts for the vast majority of summertime freshwater input into the estuary and therefore is the driving factor in establishing water surface elevations of the SCRE during this time of year. We feel that the authors of the study did not properly weight the role that increased surface water elevation has in the likelihood of an unseasonable breach occurring at the estuary nor did they properly discuss the profound effects such an event has on habitat type, quality, quantity, or sustainability for each of the focal species. Please allow us to provide that analysis for you in the form of this comment letter.

First it is useful consider the dynamics of beach berm building across the mouth of the SCRE on McGrath State Beach. After the rainy season, flows in the Santa Clara River reside to the point where surface connectivity to the estuary is lost. During this time of decreasing flows, the river mouth tends to meander southward and the sand berm begins to form on the north side of the outlet. This pattern is consistent with littoral sand movement driven by local coastal ocean currents. Eventually, the mouth becomes
completely plugged with sand in this beach building process. For the rest of the dry summer season the berm building process continues until either heavy winter surf begins eroding the beach berm, storm driven river flows punch through the berm, or an unnatural breach occurs. This seasonal variation in beach sand deposition is important to consider. One might reasonably conclude that a lagoon mouth that seals earlier in the dry season would then allow for a greater time period of beach berm building to occur before the next wet season commences. The net result would be a more robust berm across the mouth of the estuary less prone to unseasonable breach events. A significant reduction in VWRF discharge volumes during the dry season would help facilitate this scenario. It is also easy to picture that if the SCRE water surface elevation during a typical closed condition were lower than the current condition that hydraulic head pressure acting on the beach berm would lessen. Again, the berm would present a more robust barrier against unseasonable breaching than it does currently.

With these dynamics of berm building in mind, consider the effects that VWRF surface discharges and groundwater seepage from treatment ponds has on this process and how this alteration from a natural regime affects the focal species in this study. First consider the tidewater goby. The authors of the report do an adequate job of describing the life history of this species and in characterizing the available goby habitat under the various alternatives. However, they fail to thoroughly discuss how unseasonable breaching affects the dispersal strategy for this species. Under the most natural scenario, the estuary breaches as a result of regional storm patterns that can affect multiple coastal watersheds in a concerted effort. These regional storms often allow multiple estuaries in an area to be open to the marine environment at the same time. The natural dispersal strategy of the tidewater goby hinges entirely on this phenomenon. If tidewater gobys that are swept out of the SCRE after a breach are going to have any chance to enter and colonize at a down current estuarine system, then that estuary too must be open to the marine environment. Furthermore, it is likely that short term goby survivorship in the marine environment is increased by an ephemeral decrease in salinity in the near shore environment caused by multiple torrential freshwater river inputs. So if the torrential river flows are not present and the neighboring estuary is closed to the marine environment, then it is easy to conclude that an unseasonable breach of the SCRE is detrimental to tidewater goby dispersal strategy.

The Southern steelhead is also adversely affected by unseasonable berm breaching. At least 7 dead smolts were collected after the last such event in September, 2010. These strandings occurred near the back of the estuary indicating that these fish were not attempting to exit the lagoon when presented the opportunity, but rather instinctually tried to remain upstream only to end up as fish out of water. These trout presumably would have been large enough to survive in the marine environment so one must then ask the question why they remained within the lagoon. Although we may not know enough about steelhead behavior to at this time to say with certainty what caused this reaction, on possibility is that normal cues present during a storm driven breach event simply were not available to these fish and thus the instinct to swim out to sea when berm breached was not activated. Two potential missing cues are an increase in estuary depth and a decrease in estuary salinity as a precursor to breaching.
According to the authors of this study each of the six proposed alternatives has little to no effect on the amount of available habitat for either California least terns or Western snowy plovers. We disagree with this oversimplified picture and propose that once again the artificially raised water surface levels and the accompanying increased likelihood of unseasonable breaching is detrimental to both avian species but for distinctly separate reasons. To correctly qualify the effects unseasonable breaching has on California least terns it is appropriate to focus on available forage habitat rather than available habitat for other nesting activities. It is well documented that least tern colonies are established near bodies of water where abundant bait fish can be found. Typically a nesting colony develops near the SCRE every year due in large part to the abundance of baitfish it holds. It is easy to see how an unseasonable breach of the SCRE during the California least tern nesting season could significantly decrease the abundance of local baitfish and thus negatively affect California least tern nest fledging success rates. Western snowy plovers suffer the greatest from nest loss caused by artificially increased water surface levels in the lagoon during the dry season. The nesting season for these birds begins in early spring and continues until the end of summer. Occasionally, nest scrapes are located near the estuary or on the back side of the developing berm at or below 10 ft. NAVD88. These nests are in jeopardy of being flooded if the berm seals and the lagoon fills up to its current equilibrium state. In fact, DPR biologists have documented at least 5 Western snowy plover nests that met this exact fate within the last eight breeding seasons. It is quite obvious that if there were less water entering the SCRE in the summer months from VWRF discharges that more stable foraging resources would be available for nesting least terns and less nesting areas for Western snowy plovers would be prone to flooding.

The authors argue that stage height dictates the amount of available habitat in the SCRE for certain keystone species and that increased habitat constitutes a beneficial enhancement for these species. This assumption is oversimplified because it fails to consider interspecies dynamics, in particular predator and prey relationships. Many nonnative species that compete with desired native species would likely also benefit from increased habitat size. Discharge into the estuary is a clear disruption to the natural hydrology of the estuary and surrounding perched sub watershed. It is our experience that deviations from natural regimes generally favor exotic species invasions to the detriment of native species.

The relationship between estuary stage height and either partial or total closure of the McGrath State Beach campground is also well documented. We feel that these closures would be drastically reduced or eliminated entirely if the surface and groundwater discharge of effluent into the estuary was significantly decreased. Two major considerations in the decision to place McGrath State Beach on the statewide park closure list are the increased maintenance costs at the unit associated with flooding of park infrastructure and the loss of revenue that occurs during periods of flood induced closure.

The overall effects of nutrients contributed to the system from the wastewater treatment plant are also underestimated in the report. Surface flow in the Santa Clara River consistently measures around 6 mg N/L total dissolved nitrogen and is the driving force of overall Nitrogen loading in the estuary during the wet season since river flows are
much greater than VWRF discharge and groundwater flows during this time and the lagoon berm is typically open. In contrast, during the summer the Santa Clara R. normally goes dry and does not connect to the estuary during the typical closed condition. Currently major water inputs during dry months are treatment pond seepage, VWRF discharged surface water, and other groundwater sources. Surface discharge from VWRF and seepage from the treatment ponds is currently 14 mg N/L with projected number of 10 mg N/L after plant upgrades. The groundwater from the south side of the estuary was measured at only 1 mg N/L nitrogen during this study. If there were no summertime surface discharge from VWRF or seepage from the treatment ponds, then the source for the water in the estuary during the dry season would consist primarily of local groundwater inputs. Under this scenario the estuarine system would have a relatively stable wet weather nitrogen level of 6 mg N/L provided by river flows. As the dry season developed the estuary would eventually lose this surface connection to upper reaches of the Santa Clara R. at which point additional ground water input at 1 mg N/L would dilute the nitrogen levels in the estuary even further. Currently, phosphorus is considered the limiting nutrient in the SCRE. It would be interesting to see if a drastic reduction in nitrogen inputs as described above could possibly change this equation enough to make nitrogen the limiting nutrient in the SCRE instead. If so, this could lead to better overall dry weather water quality by suppressing excessive algal growth and reducing the frequency low dissolved oxygen events that have been documented as the cause of previous fish die offs in the SCRE.

Given the vast ecological improvements that could be achieved through minimizing unseasonable breaching and reducing nutrient loading by minimizing treatment pond groundwater seepage and surface discharges from the VWRF, we feel the best option for the overall health of the ecosystem is one that reduces dry weather discharges and nutrient loading into the estuary. We have included a modified version of Table 11-3 labeled Table 11-3(Alt) that includes analysis on how unseasonal berm breach events might be affected by each alternative. This modified table shows that scenarios 1, 2, and 3 have no effect summer time berm breaching, whereas scenarios 4 and 5 show some improvement over current conditions, and scenario 6 shows the greatest improvement. We recommend a modified version of alternative 5 that would also strive to significantly reduce nutrient laden groundwater seepage from the wetland pond, possibly through the installation of an impervious clay liner. We feel that option 5 with this modification will provide for the best quality habitat for the focal species in this study while also providing for enhanced recreation activities through a reduction of flooding events that cause closures at McGrath State Beach. Again, thank you for the opportunity to comment on the Santa Clara River Estuary Special Studies.

Sincerely,

[Signature]

Richard Rozzelle
District Superintendent
Table 11-3(Alt). Qualitative comparison of focal species' habitat conditions and recreational opportunities to the 'No Action' alternative.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Focal species habitat</th>
<th>Habitat area</th>
<th>Water quality</th>
<th>Recreational</th>
<th>Likelihood of sand berm remaining intact for duration of dry season</th>
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<td>Steelhead</td>
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<td>Tern foraging</td>
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Note: = indicates no change, ↑ indicates improved conditions, ↓ indicates reduced habitat availability or quality