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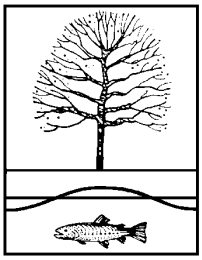


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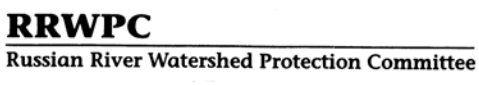
RRWPC
Russian River Watershed Protection Committee

August 30, 2010

Jeffrey Shu, State Water Resources Control Board
Division of Water Quality
P.O. Box 100
Sacramento, CA 95812-0100

VIA ELECTRONIC AND U.S. MAIL: jshu@waterboards.ca.gov

RE: **Notice of Public Solicitation of Water Quality Data and Information for 2012 California Integrated Report [Clean Water Act Sections 305(b) and 303(d)]**

Dear Mr. Shu:

The undersigned organizations have been active for many years on programs and issues affecting the quality and flow of the waters of the State. Our organizations have performed water monitoring and watershed surveys, and conducted outreach among a diverse group of citizens around California, to determine the most pressing issues for state waterway health. We welcome the opportunity to submit these comments in light of these significant and ongoing efforts.

We present in this letter two general themes of proposed listings. First, we highlight some examples of traditional "pollutant"-based "Category 5"[1] listings that are being proposed to you separately. This Category of listings has been the focus of the State Water Resources Control Board's (State Board) 303(d) list to date. We urge the State Board's careful attention to these and the other Category 5 listings proposed by the identified commenters as well as the undersigned organizations and others. The adoption of such proposed listings will help ensure clean, healthy waterways throughout the State.

Second, we highlight additional groups of listings that also identify impaired and threatened waters that should be listed under Category 4 (particularly 4C) or Category 5. Our analysis reveals three such groups that regularly impair designated beneficial uses but that have received inadequate attention in the state's 303(d) process to date. These are: altered natural flows in surface waters, groundwater contamination and excessive groundwater withdrawals that impact surface water health, and anthropogenic climate change-caused impacts to surface waters. Impaired and threatened waterways from these groups of listings must be included in the 2012 303(d) list to ensure compliance with the Clean Water Act, and to achieve full restoration of the health of the waters of the state.

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[1] Category references from U.S. EPA, "Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act" (July 29, 2005), available at: http://www.epa.gov/owow/tmdl/2006IRG/report/2006irg-report.pdf (2006 Guidance), and SWRCB, "Staff Report: 2010 Integrated Report Clean Water Act Sections 303(d) and 305(b)" (April 19, 2010) (2010 Integrated Report Staff Report), available at: http://www.waterboards.ca.gov/water_issues/programs/tmdl/2010state_ir_reports/2010ir0419.pdf.

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The State Water Board can and must ensure full compliance with Sections 303(d) and 305(b), and the 2006 Guidance, by listing these and other surface waters impaired by low flow caused by excessive groundwater withdrawals and pumping.[189]

V. THE STATE WATER BOARD MUST INCLUDE IN ITS 2012 303(D) LIST ANTHROPOGENIC CLIMATE CHANGE-DRIVEN SOURCES AND IMPAIRMENTS OF CALIFORNIA WATERWAYS.

Global climate change is altering the biological, chemical, and physical properties of California waterways. Projected impacts in California provide an added impetus for the State Water Board to take swift action on flows and groundwater, as described above. For example, California's total water demand is projected to increase by up to 12% or more between 2000 and 2050, and the impacts of climate change will greatly increase the number of areas where water demands will exceed supplies.[190]

Climate change will not only increase the number and severity of existing waterway impairments, it will also drive new sources and causes of impairments. Data and information in the California Climate Change Adaptation Strategy[191] and other analyses generated by the state[192] strongly suggest that climate change will have demonstrable impacts on beneficial uses of California waterways. The most immediate impairments, and those with the strongest causal connection to global climate change, are driven by four principal dynamics: oceanic and estuarine carbon absorption, sea level rise, air and water temperatures increases, and shifting precipitation patterns.

We respectfully request that the State Water Board ensure that the 303(d) list identifies climate change driven-impairments to waterway health, and consider including reference data and information contained herein in your pending "Guidance Document on Climate Change."[193] An initial identification of climate change-driven impairments is provided below as a starting point for the State Water Board's analysis of surface waters that should be included on the 2012 303(d) List as either threatened or impaired:

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[189] Excessive groundwater withdrawals can also cause groundwater levels to decline below sea level, causing seawater to intrude into fresh water aquifers. Saltwater intrusion into groundwater aquifers is likely to become a pressing threat in many watersheds as sea level rises. (*See* AMEC Earth & Environmental (2005) Santa Clara River Enhancement and Management Plan. 260 p. Prepared for the Ventura County Watershed Protection District and Los Angeles Department of Public Works, Santa Barbara, Riverside, San Diego, California.) This threat is described in more detail in the climate change section below.

[190] Natural Resources Defense Council, *Water Facts: Climate Change, Water, and Risk: Current Water Demands Are Not Sustainable,* p. 2 (July 2010) ("NRDC Climate & Water Risk"). Available at http://www.nrdc.org/global-Warming/watersustainability/.

[191] The California Climate Adaptation Strategy, released in December 2009, summarizes the best known science on climate change impacts in California and outlines possible solutions that can be implemented within and across state agencies to promote resiliency. California Natural Resources Agency, "2009 California Climate Adaptation Strategy: A Report to the Governor of the State of California in Response to Executive Order S-13-2006," (CA Climate Adaptation Strategy), available at www.climatechange.ca.gov/adaptation.

[192] *See* documents referenced in Section IV.A.

[193] *See* http://www.waterboards.ca.gov/water_issues/programs/climate/index.shtml#.

Ocean Acidification:
- decreased pH of oceanic and estuarine waters
- acidification impacts to nearshore coastal waters, bays and estuaries

Sea level rise:
- salinity intrusion into groundwaters hydrologically connected to surface waters
- salinity intrusion into estuaries, bays, and coastal rivers
- increased contaminant flows in waterways surrounding wastewater treatment plants and sewer outfalls
- habitat alterations

Air and water temperature increases:
- rivers, streams, and creeks: climate change-driven temperature listings
- decrease in dissolved oxygen
- loss of temperature-dependant beneficial uses (*e.g.* cold freshwater habitat)

Shifting precipitation patterns:
- decreased reservoir levels and spring-fall flows (increased water temperature, decreased dilution of pollutants)
- increase in winter flows, flooding, and runoff (increase in sedimentation and pollutant runoff)

These and other climate change-driven impacts are discussed in more detail below.

A. The State Must Use All Readily Available Data to Identify Climate Change-Driven Sources and Causes of Surface Waters Impairment.

As noted above, the State and Regional Water Boards must "actively solicit, assemble, and consider all readily available data and information," including information reported by local, state, and federal agencies.[194] Given the global and quickly-evolving nature of climate change, the State Water Board should also consider information from international bodies, such as the Water Quality Section of the Intergovernmental Panel on Climate Change's Assessment Report, which provides a useful overview of projected and already-occurring impacts to water quality. Additionally, local, state, and federal agencies have amassed a tremendous amount of regionally-scaled studies and analyses regarding climate change impacts to California water quality that have not yet been integrated into the State's biennial 303(d) (or 305(b)) data collection. In particular, there is a significant amount of modeling and data on how climate change will impact the water quality and water supply of the San Francisco-San Joaquin Delta that should be considered.

More specifically, the State Water Board must examine and consider all readily available information that could inform 303(d) decisions related to climate change-driven impacts to California waterways, including but by no means limited to the following:

- Pertinent reports from the Department of Water Resources' (DWR) Integrated Regional Water Management Climate Change Document Clearinghouse.[195] This Clearinghouse

[194] *See* CA Listing Policy, Section 6.1.1 Definition of Readily Available Data and Information.
[195] A complete list of climate change publications written by DWR is available at http://www.water.ca.gov/climatechange/articles.cfm.

references dozens of pertinent reports that detail projected climate impacts to water quality, flow and species, including several recent DWR reports on how impaired water bodies and water quality will be impacted by climate change, including sea level rise;

- Analysis in the *California Water Plan Update 2009*[196] on how impaired water bodies and water quality will be impacted by climate change;
- Information from DWR's *Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water*[197] on waterways hydrologically connected to groundwater basins and on waterways vulnerable to sea level rise;
- Data and information in the Public Policy Institute of California's *Adapting Water Management to Climate Change*[198] on sea level rise and temperature impairments, as well as information on changes in the timing and amount of precipitation;
- Information regarding impairments stemming from salinity intrusion, inundation of wastewater treatment plants, and other impairments stemming from sea level rise in the Pacific Institute's *The Impacts of Sea-Level Rise on the California Coast*;[199]
- Ocean carbon data from NOAA's Pacific Marine Environmental Laboratory[200] and the U.S. Department of Energy's Carbon Dioxide Information Analysis Center;[201] and
- Data on changes in precipitation and temperature in the California Climate Tracker,[202] which is maintained by the Western Regional Climate Center, which would be extremely useful to identify related climate change-driven impairments as described below.

Information specific to the San Francisco-San Joaquin Delta includes, but is not limited to:

- Water quality monitoring data in the Central Valley Watershed Monitoring Directory, a joint effort by the San Francisco Estuary Institute (SFEI), the Central Valley Regional Water Quality Control Board Surface Water Ambient Monitoring Program (SWAMP) and the U.S. EPA;[203]
- Water quality and water supply studies from the CALFED Bay-Delta Program;[204] including the Delta Regional Ecosystem Restoration Implementation Plan models;[205]
- Reports and resources from the Water Quality, Supply and Reliability Workgroup of the California Partnership for the San Joaquin Valley;[206]

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[196] California Department of Water Resources (DWR), *California Water Plan Update 2009* (October 2009), available at http://www.waterplan.water.ca.gov/cwpu2009/index.cfm.
[197] DWR, *Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water* (October 2008), available at http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf.
[198] Public Policy Institute of California, *Adapting Water Management to Climate Change* (November 2008), available at http://www.ppic.org/content/pubs/report/R_1108JLR.pdf.
[199] California Climate Change Center, The Impacts of Sea-Level Rise on the California Coast ("Impacts of Sea Level Rise on CA"), May 2009, available at www.pacinst.org/reports/sea_level_rise/report.pdf.
[200] *See* Pacific Marine Environmental Laboratory homepage at http://www.pmel.noaa.gov/co2/OA/.
[201] Global Ocean Data Analysis Project, http://cdiac.ornl.gov/oceans/.
[202] *See* California Climate Tracker at http://www.wrcc.dri.edu/monitor/cal-mon/. Abatzoglou, J.T., K.T. Redmond, L.M. Edwards, "Classification of Regional Climate Variability in the State of California," *Journal of Applied Meteorology and Climatology*, 48, 1527-1541 (2009).
[203] Central Valley Watershed Monitoring Directory: http://www.centralvalleymonitoring.org/.
[204] CALFED Bay-Delta Program: http://www.science.calwater.ca.gov/science_index.html.
[205] Delta Regional Ecosystem Restoration Implementation Plan at http://www.science.calwater.ca.gov/drerip/drerip_index.html.
[206] California Partnership for the San Joaquin Valley Water Quality, Supply and Reliability Document Library http://www.sjvpartnership.org/wg_doc_lib.php?wg_id=10.

- The SWRCB's Final Report on Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem and studies supporting the recently-adopted Delta flow criteria;[207] and
- DFG biological opinions on Delta smelt and other endangered species.

The State Water Board should solicit, assemble and consider all readily available data relating to climate change-driven impairments for the 2012 303(d) List, with a particular focus on developing appropriate 303(d) listings for which a large amount of data currently exists, such as for ocean acidification impairments and climate change-driven Delta waterway impairments. The Board should also use and consider data regarding potential sources and causes of impairment cased by climate change-driven sea level rise, warming and shifting precipitation. Finally, the Board should augment its "Climate Change and Water Resources" website with data and information regarding the aforementioned climate change-driven impairments.[208]

B. The State Water Board Must Take Immediate Action to Ensure That the 2012 303(d) List Reflects Data on Climate Change-Driven Impairments Related to Ocean Acidification.

There is a significant amount of data and information currently available with requisite specificity for assessing which waterways are impaired by ocean acidification for the 2012 303(d) List. The State must collect data regarding the pH of bays, estuaries, the ocean, near-coastal areas, and coastal shorelines, and list waterways impaired or threatened by ocean acidification. The State Board must take action to ensure that the 2012 303(d) List contains pertinent data and lists impaired waterways as appropriate. If the State declines to do so, it must submit a "rationale" for not doing so, as required by the Clean Water Act, though we urge the State to implement its responsibilities and authorities fully in ensuring comprehensive listings.

Ocean acidification, a decrease in ocean pH fueled by the ocean's absorption of carbon dioxide, threatens the seawater quality of California's bays and estuaries. The ocean absorbs about half of all anthropogenic carbon dioxide emissions, an estimated 22 million tons of carbon dioxide (CO_2) every day.[209] When CO_2 dissolves in seawater it forms carbonic acid, which decreases ocean pH and causes "ocean acidification."[210] Global average surface pH has already decreased by approximately 0.1 units, and is expected to decrease by another 0.3-0.4 units by the end of the century, depending on future levels of atmospheric carbon dioxide.[211]

The latest science indicates that ocean acidification impacts to the seawater quality of California bays, estuaries and near coastal areas may already be occurring, and are projected to

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[207] http://www.swrcb.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/
[208] *See* http://www.waterboards.ca.gov/water_issues/programs/climate/index.shtml.
[209] Feely, R. A., C. L. Sabine, K. Lee, W. Berelson, J. Kleypas, V. J. Fabry, and F. J. Millero. "Impact of anthropogenic CO2 on the CaCO3 system in the oceans," *Science* 305:362-366 (2004).
[210] Orr, J.C. *et al*. "Research Priorities for Understanding Ocean Acidification," *Oceanography*, 22(4): 182 (2009).
[211] Hauri, Claudine, Gruber, N, Lachkar, Z., Plattner, G. Abstract. "Accelerated acidification in eastern boundary current systems," Goldschmidt Conference Abstracts (2009); citing Orr, J.C., V.J. Fabry, O. Aumont, L. Bopp, S.C. Doney, R.A. Feely, A. Gnanadesikan, N. Gruber, A. Ishida, F. Joos, et al, "Anthropogenic ocean acidification over the twenty-first century and its impact on calcifying organisms," 437 *Nature* 681-86 (2005), http://www.nature.com/nature/journal/v437/n7059/full/nature04095.html.

accelerate.[212] In 2008, scientists discovered high levels of acidified ocean water within 20 miles of the Pacific Coast.[213] Given that atmospheric levels of carbon dioxide have increased drastically in the last half century, and are likely to increase further, such acidification trends are projected to increase, a trend that should be considered in projecting "threatened" waterways in particular.[214] Natural upwelling in nearshore waters, coupled with oceanic uptake of anthropogenic CO_2, mean that "ocean acidification has already decreased mean surface water pH in the California Current System to a level that was not expected to happen for open-ocean surface waters for several decades."[215] Projections indicate that the Humboldt Current System, another eastern boundary upwelling system that impacts ocean waters off of California, may be subject to the same conditions.[216]

There is precedent both for listing waterways impaired or threatened by atmospheric sources of pollution and for listing waterways impaired for pH. U.S. EPA maintains a list of waterways impaired for pH under the 303(d) program, with more than 3,500 waterbodies so listed as of May 2010.[217] Section 303(d) of the Clean Water Act also has been interpreted by both U.S. EPA and states to cover waterways impaired by atmospheric sources of pollution (such as carbon deposits). Specifically, in March 2007, EPA issued information on listing waters impaired by mercury from atmospheric sources under Section 303(d) of the Clean Water Act.[218] Subsequent to EPA's action, in October 2007, a group of Northeast states established the Northeast Regional Mercury TMDL, a regional cleanup plan to reduce mercury entering the states' watershed from a range of pollution sources, including atmospheric deposition of mercury.[219]

In response to legal action from the Center for Biological Diversity directly on the issue of climate change, the U.S. EPA solicited public comment on how to address listing of waters as threatened or impaired for ocean acidification under the 303(d) program.[220] California need not wait for EPA's issuance of guidance on listing waters impaired by ocean acidification. The State should immediately assemble and consider all readily available evidence regarding waters impaired by ocean acidification and list waters accordingly.

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[212] Byrne, R. H., S. Mecking, R. A. Feely, and X. Liu (2010), "Direct observations of basin-wide acidification of the North Pacific Ocean," 37 *Geophys. Res. Lett.* (2010), L02601, doi:10.1029/2009GL040999, http://www.agu.org/journals/ABS/2010/2009GL040999.shtml.

[213] Feely, R. A., C. L. Sabine, J. M. Hernandez-Ayon, D. Ianson, and B. Hales, "Evidence for upwelling of corrosive "acidified" water onto the continental shelf," *Science* 320:1490-1492 (2008), http://www.sciencemag.org/cgi/content/abstract/sci;320/5882/1490. *See also* Hauri *et al*. at p. 66.

[214] *Id. See also* http://www.sciencedaily.com/releases/2008/05/080522181511.htm.

[215] Hauri *et al*. at p. 69.

[216] *Id.*

[217] *See* Environmental Protection Agency Watershed Assessment, Tracking & Environmental Results webpage, Specific State Causes of Impairment That Make up the National pH/Acidity/Caustic Conditions Cause of Impairment, available at: http://iaspub.epa.gov/tmdl_waters10/attains_nation_cy.cause_detail_303d?p_cause_group_id=1188.

[218] Hooks, Craig, EPA Office of Wetlands, Oceans, and Watersheds, "Memorandum: Listing Waters Impaired by Atmospheric Mercury Under Clean Water Act Section 303(d): Voluntary Subcategory 5m for States with Comprehensive Reduction Programs" (March 8, 2007).

[219] New England Interstate Water Pollution Control Commission, "Northeast Regional Mercury Total Maximum Daily Load," p. 32 (October 24, 2007), available at http://www.neiwpcc.org/mercury/mercurytmdl.asp.

[220] *See* EPA's Federal Register Notice at http://www.epa.gov/owowwtr1/tmdl/oceanfrMarch_2010/.

C. The State Water Board Must Use and Consider Data on Sea Level Rise, Warming, and Precipitation Changes That Cause or Are Potential Sources of Impairments.

Projections of climate change-driven sea level rise, increased temperature, and shifting precipitation patterns will continue to have a major impact on California's water quality. The water quality impacts of climate change-driven sea level rise will be felt throughout California. In particular, a change in sea level will substantially alter San Francisco Bay-Delta conditions, where water surface elevations and associated fluctuations drive Bay-Delta hydrodynamics, which in turn dictate the location and nature of physical habitat and the quantity and quality of water.[221] Even under modest sea level rise and climate warming projections, an increase in the frequency, duration, and magnitude of water level extremes is expected in the Delta, to the detriment of numerous waterway beneficial uses.[222]

As for ocean acidification, we respectfully request that the State Water Board review and assess whether water bodies are impaired or threatened by climate change and also to list climate change as a potential source of impairment, where appropriate, on the 2012 303(d) List.[223] As outlined at the beginning of this section, we bring the following impairments to the Board's attention, although review of climate change impairments should by no means be limited to the impairments described below.

1. Sea Level Rise

Climate change is projected to result in sea level rise in California of 16 inches by 2050 and 55 inches by the end of the century.[224] In the Bay Area, 180,000 acres of shoreline are vulnerable to flooding by 2050, putting 21 wastewater treatment plants at risk of inundation.[225] Sea level rise also will substantially impair California's waterways by causing saltwater intrusion into estuaries and hydrologically connected groundwaters, inundating or eroding habitats, altering species composition, changing freshwater inflow, and impairing water quality.

a. Saltwater intrusion of hydrologically connected groundwaters.

Saltwater intrusion into aquifers is a man-made problem in many places in California, resulting from over-pumping and excessive withdrawals from groundwater aquifers.[226] Pumping coastal aquifers in excess of natural recharge rates draws down the surface of the aquifer, allowing surface water to move inland into a freshwater aquifer and contaminate it with salts.[227] When the ocean has a higher water elevation, it causes the saltwater wedge to intrude further

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[221] CALFED Bay-Delta Program Independent Science Board, Memorandum: *Sea Level Rise and Delta Planning* (September 6, 2007).
[222] *Id*. at 2.
[223] *See* discussion in Section III. above regarding "causes" versus "sources" of impairment.
[224] California Climate Change Center, "Climate Change Scenarios and Sea Level Rise Estimates for the California 2008 Climate Change Scenarios Assessment (Draft Paper)," available at www.energy.ca.gov/2009publications/CEC-500-2009-014/CEC-500-2009-014-D.PDF.
[225] *Id*.
[226] *Impacts of Sea Level Rise on CA* at 80.
[227] *Id.*

inland.[228] Seawater intrusion is already problematic in California's coastal aquifers throughout Central and Southern California, including the Pajaro and Salinas Valleys and aquifers in Orange and Los Angeles Counties. Groundwater supplies in the Santa Clara Subbasin are also vulnerable to salinity intrusion.[229]

Overdraft and saltwater intrusion into groundwater aquifers will be accelerated and made worse by sea level rise. Where these groundwater aquifers are hydrologically connected to surface waters, and thus affect the water quality of those surface waters, the State Water Board should list climate change/sea level rise as a source or cause of impairment so that appropriate remedial action can be taken.

b. Salinity intrusion into estuaries

Sea-level rise and changes in the intensity of storm events will impact low-lying coastal areas and result in the loss or inundation of coastal wetlands and dune habitat, resulting in salt water intrusion and loss of freshwater habitat for fish and wildlife.[230] Changes in salinity from reduced freshwater inflow will affect fish, wildlife and other aquatic organisms in intertidal and subtidal habitats. Increasing rates of saltwater intrusion into groundwater that impacts the beneficial uses of connected surface waters will need to be addressed in water quality management decisions, including the 303(d) List.[231]

c. Increased contamination from inundation of wastewater treatment facilities and sewer outfalls.

A recent Pacific Institute study found that a 1.4 meter sea level rise makes 28 wastewater treatment plants vulnerable to inundation: 21 plants around the San Francisco Bay and 7 other plants on the Pacific coast.[232] The combined capacity of these plants is 530 million gallons per day.[233] Some wastewater treatment plants are preparing for projected inundation,[234] but many more are not taking any action. Inundation from sea level rise, as well as an increased number of extreme weather events, could damage pumps and other treatment plant equipment and interfere with discharges from outfalls sited on coast and bay shorelines.[235] This will lead to an increased

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[228] *Id.*
[229] Santa Clara Valley Water District, "Groundwater Quality Report," p. 19 (2008) ("Saltwater intrusion of the Santa Clara Subbasin shallow aquifer zone adjacent to the southern shore of the San Francisco Bay has been studied and monitored for many years by the District. Although the contamination has been somewhat widespread in the shallow aquifer zone, fortunately, the lower aquifer has not been affected significantly.")
[230] *CA Climate Adaptation Strategy* at 73.
[231] *Id.* at 70.
[232] *Impacts of Sea Level Rise on CA* at 62-63, *see* Figure 24: Wastewater treatment plants on the Pacific coast vulnerable to a 100-year flood with a 1.4m sea-level rise.
[233] *Id.* at 63.
[234] In 2009, the City of Morro Bay commissioned a *Wastewater Treatment Plant Flood Hazard Analysis* and concluded that the existing wastewater treatment plant (WWTP) was subject to inundation from the Morro Creek watershed. The City recommended that the new site for a WWTP be developed with the placement of engineered fill to raise the new site above the 100-year flood elevation. *See* City of Morro Bay and Cayucos Sanitary District Wastewater Treatment Plant Upgrade Project, Facility Master Plan Draft Amendment No. 2, p. 12 (July 2010).
[235] *Id.* at 63.

number of untreated and partially treated sewage discharges and increased contamination and impairment of proximate waterways.

Discharges from sewage treatment plants already impair waterbodies throughout California. Pathogen impairments, which are linked to discharges from wastewater treatment plants among other sources, represent the second highest number of impairments for California waterways.[236] High concentrations of bacteria such as fecal coliform and E. coli raise the risk of waterborne diseases and starve fish of the oxygen they require, destroying several beneficial uses for affected waterbodies.

d. Sea level rise-caused habitat alterations

EPA records show 699 waterbody-segments listed nationwide as impaired due to "habitat alteration." This habitat alteration impairment group captures numerous impacts to waterways, including but not limited to alterations to wetland habitats, habitat barriers, degraded habitat and other forms of habitat alterations. Projected sea level rise similarly could result in a large number of habitat alteration impairments, both directly from sea level rise alteration to coastal wetland and other habitats, and indirectly by prompting construction of hard structures on the coastline such as seawalls and levees.

For example, according to the report *Impacts of Sea Level Rise on the California Coast* rising seas threaten to substantially modify or destroy wetland habitats.[237] More specifically:

> Vast areas of wetlands and other natural ecosystems are vulnerable to sea level rise. An estimated 550 square miles, or 350,000 acres, of wetlands exist along the California coast, but additional work is needed to evaluate the extent to which these wetlands would be destroyed, degraded, or modified over time. A sea level rise of 1.4 m would flood approximately 150 square miles of land immediately adjacent to current wetlands, potentially creating new wetland habitat if those lands are protected from further development."[238]

2. Air and water temperature increases

a. Warming of streams and rivers

New research shows that water temperatures are increasing in many streams and rivers throughout the United States,[239] with less water available for ecosystem flow and temperature needs in spring and summer.[240] In many low- and middle-elevation streams today, summer temperatures often approach the upper tolerance limits for salmon and trout; higher air and water

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[236] http://iaspub.epa.gov/waters10/state_rept.control?p_state=CA&p_cycle=.
[237] *Impacts of Sea Level Rise on CA* at 27.
[238] *Id.* at 17.
[239] Kaushal et al., "Rising stream and river temperatures in the United States," *Frontiers in Ecology and the Environment*, 2010; 100323112848094 DOI: 10.1890/090037; University of Maryland Center for Environmental Science, "Rising water temperatures found in US streams and rivers" (April 7, 2010), available at: http://www.sciencedaily.com/releases/2010/04/100406101444.htm.
[240] *CA Climate Adaptation Strategy* at 80.

temperatures will exacerbate this problem.[241] Thus, climate change might require dedication of more water, especially cold water stored behind reservoirs, to simply maintain existing fish habitat.[242] The 303(d) List should reflect instances where scientific evidence suggests that climate change is a cause or source of temperature impairments. Doing so would ensure that appropriate mitigating and prevention measures can be taken.

b. Decrease in dissolved oxygen

An inverse correlation between water temperature and the amount of dissolved oxygen in a waterbody is well-known and understood by water quality managers. Many California waterbodies that are impaired for temperature are also impaired because of low dissolved oxygen. Where waterbodies experience unnaturally high temperatures, the amount of dissolved oxygen can drop to levels that negatively impact water quality and aquatic species. Studies suggest that climate change-driven warming of streams, rivers, and other waterways could similarly decrease dissolved oxygen levels.[243] This is a phenomena the State Water Board must track and address in its 303(d) list, as appropriate.

3. Shifting precipitation patterns

Observational records and climate projections provide abundant evidence that freshwater resources are vulnerable and have the potential to be strongly impacted by climate change.[244] The decrease in precipitation and increase in potential evapotranspiration will have a significant affect on California's "available precipitation," which means water falling as rain or snow.[245] Projections suggest that precipitation will decline five inches per year by 2050 in California.[246] The Department of Water Resources projects that the Sierra Nevada snowpack may be reduced from its mid-20th century average by 25 to 40 percent by 2050.[247]

a. Longer low flow conditions

Climate change should be specifically identified as the source of low flow conditions where data so indicate. For example, projected declines in summer stream flows may impair Delta waterways through low-flow conditions and higher stream water temperatures.[248] As freshwater inputs decrease, Delta water quality may also be degraded as saltwater intrudes further upstream from the Pacific Ocean.[249] Salinity intrusion, low-flow conditions and higher

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[241] *Id.*
[242] *Id.*
[243] *See* IPCC Assessment Report, Working Group II: "Impacts, Adaptation and Vulnerability," Section 4.3.10 available at http://www.ipcc.ch/ipccreports/tar/wg2/index.php?idp=173.; B. A. Cox and P. G. Whitehead, "Impacts of climate change scenarios on dissolved oxygen in the River Thames, UK, Hydrology Research," 40(2-3): 138–152 © IWA Publishing 2009 doi:10.2166/nh.2009.096.
[244] Climate Change and Water: Intergovernmental Panel on Climate Change Technical Report VI – June 2008, available at: http://www.ipcc.ch/publications_and_data/publications_and_data_technical_papers_climate_change_and_water.htm.
[245] *NRDC Climate & Water Risk* at 2.
[246] *Id.*
[247] CA Climate Adaptation Strategy at 82.
[248] *Id.* at 86.
[249] *Id.*

stream water temperatures are all sources and causes of waterway impairment that could and should be addressed under the State Water Board's 2012 303(d) process.

The California Natural Resources Agency made an initial determination that mitigating these impacts requires more freshwater releases from upstream reservoirs.[250] The State Water Board should work with the Central Valley Regional Water Quality Control Board to examine data on climate change-driven impairments of Delta waterways and tributaries so that impaired waterways can be correctly identified and appropriate mitigating actions can be implemented to restore waterway health.

b. Increased contamination from stormwater runoff

Many models project higher contaminant concentrations in waterways as less frequent but more intense rainfall patterns change water quality.[251] An increased number and severity of extreme weather events and storm surges are also predicted. These climate change-driven phenomena will increase runoff and flooding, thus exacerbating levels of storm water pollution and sediment runoff.

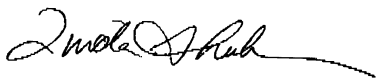
* * *

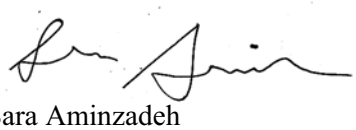
Thank you for the opportunity to provide this information in support of a comprehensive 2012 Section 303(d) list that meets the mandates of the Clean Water Act. California's 303(s) list cannot be limited to "traditional" Category 5 listings. To comply with the Act, and to help lead the state to achieving its goals of clean waters with healthy flows and biodiverse aquatic ecosystem, the 2012 303(d) list must also include waterways impaired or threatened by: altered natural flows in surface waters, groundwater contamination and excessive groundwater withdrawals that impact surface water health, and anthropogenic climate change-caused impacts to surface waters. The data and information contained and referenced in this letter, as well as extensive other databases and peer-reviewed reports that are readily available to the State and Regional Water Boards, should provide more than adequate support for the listing of numerous waterways that are impaired and threatened and that therefore require the state's attention under the Clean Water Act and Porter-Cologne.

If you have any questions, please do not hesitate to contact us.

[250] *Id.*
[251] *CA Climate Adaptation Strategy* at 82.

Sincerely,





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