A Publication of the Environmental Law Section of the State Bar of California
for Environmental, Natural Resources, Energy and Land Use Attorneys

Environmental Law NEWS

Vol. 22, No. 1 • Summer 2013

Editor's Note...

by Alexander "Sandy" Crockett

This jumbo issue of *Environmental Law News* is packed full of interesting articles from across a wide spectrum of environmental law. The issue opens with an article presenting a series of four commentaries on how California will need to adjust its approach to water management in order to adapt to the realities of climate change, which include major changes in the supply and timing of water flowing through the state's rivers and reservoirs. The second article provides an introduction to renewable energy development projects in Indian country, along with some observations on what needs to be done to promote worthy projects while protecting important Indian cultural resources. We then move on to a discussion of California's Low Carbon Fuel Standard and the legal challenges that have been brought against it, which are now pending before the Ninth Circuit and raise important constitutional issues that could have major ramifications for how California and other states approach greenhouse gas regulation. Next up is a retrospective on the highly successful Marine Life Protection Act Initiative, which was a groundbreaking collaborative planning process that brought together diverse stakeholders from throughout California's coastal regions to develop a new set of rules for the state's Marine Protected Areas. This is followed by a discussion of the recent emergence of complex multi-party toxic tort and property damage cases as a major area of litigation in California, with some practical insights into the issues that arise when litigating these cases. The final article discusses how to successfully use negotiation as a means of resolving environmental litigation, presenting the perspectives of four environmental practitioners with a great deal of negotiating experience representing diverse interests in environmental disputes, as well as those of an experienced mediation neutral.

The articles featured in this issue were developed primarily out of presentations from last fall's Environmental Law Conference at Yosemite®, and they showcase the wide range of the interesting and insightful topics that the Environmental Law Section presents at the conference each year.

Table of Contents

Environmental Law News Publications Committee

Chair: Alexander “Sandy” Crockett
Editors: Alexander "Sandy" Crockett, Chris O'Connell

Official Publication of the State Bar of California, Environmental Law Section. The statements and opinions herein are those of the contributors and not necessarily those of the State Bar of California, the Environmental Law Section, or any government body. Contributors are solely responsible for the content and accuracy of their articles.

If you would like to submit an article for publication or be a guest editor for a special topic issue, please submit a proposal to the Chair at ACrockett@baaqmd.gov.

If you are interested in advertising in *Environmental Law News*, please contact us at julie.martinez@calbar.ca.gov.

Section Website: http://environmental.calbar.ca.gov

Cry Me a Reservoir: Water Management and Climate Change Adaptation

by Roger B. Moore,* Katherine A. Spanos,† Robert Wilkinson, Ph.D.,‡ and Paul Stanton Kibel§

[Editor's Note: Adapting California's water management and delivery systems to account for anticipated climate change ranks among the century's foremost challenges. California law and policy are still evolving to address more than a decade of scholarship showing that climate change is likely to produce major changes in the supply and timing of water flowing through California's rivers and reservoirs, while compounding risks of flooding, declining water quality, and damage to protected species. Incorporating this information in environmental review, watershed management and hydropower licensing will test the resilience of California's infrastructure and its political institutions. This article, which is based on a panel discussion by the authors at the 2012 Environmental Law Conference at Yosemite®, presents four commentaries on water management and adaptation to climate change by four practitioners who work on these issues. Roger Moore begins with an overview of how California's historical approach to water management must change to respond to this new reality. Katherine Spanos then discusses Integrated Regional Water Management and how this modern approach to water resources planning can be used to incorporate climate change adaptation strategies. Robert Wilkinson follows with perspectives on how water and energy policy can be integrated to address climate change by developing cost-effective efficiency improvements that will save both water and energy, which will reduce greenhouse gas emissions and help adapt to a drier future. Paul Kibel then concludes the article with a commentary on potential legal mechanisms under CEQA, NEPA and the Endangered Species Act to ensure that water projects incorporate climate change adaptation strategies to protect coldwater fisheries and other resources that may be adversely affected by a warming world.]

CLIMATE GHOSTS OF PAST, PRESENT AND FUTURE

By Roger B. Moore

Roger B. Moore

"The future of the West hinges on whether it can defend itself against itself."[1]
Bernard DeVoto

The Ghost of Climate Past

At the Los Angeles Aqueduct's opening ceremony on November 15, 1913, William Mulholland exclaimed of the aqueduct's new water supply: "There it is…Take it!" This succinct charge, which captured the brash optimism of twentieth-century water management, followed torrents of purple prose celebrating the arrival of clear water from the distant "snow-capped peaks" of the Sierra Nevada.[2]

To put it mildly, the times have changed. In the new century, California's major sources of water have been stretched beyond their physical limitations, their legal limits for long-term extraction, or both.[3] Climate change is shrinking the Sierra Nevada's snowpack and threatening to replace Mulholland's famous phrase with a modern chorus of "Who took it, and where did it go?" Navigating through previously uncharted areas of science, law and policy to adapt to climate change will require "an unprecedented level of cooperation and leadership," as the Natural Resources Agency noted in its *California Climate Change Adaptation Strategy*.[4]

For California's water managers and users—in short, for virtually all its living things—the need for this adaptation has arrived. Climate change is already occurring rapidly in California. The state is growing warmer, with less water; sea levels have risen; and the percentage of annual runoff during spring snowmelts has decreased in many major river systems, especially in the second half of the twentieth century.[5] To adapt to these changes, California must confront, and change, the way it has historically viewed its water supply.

Life After the "Death of Stationarity"

Planning for the new century demands an assessment of future conditions that includes both climate and hydrology. However, a lingering ghost from the twentieth century—the principle of "stationarity"—continues to complicate the relationship between water and development. During the twentieth century, Californians built cities, farms, and the state's major water delivery systems with little concern that during their lifetimes or the expected life of their projects, a changing climate might undermine the assumptions on which they were built. This principle of stationarity guiding earlier generations of water management and project planning posited that the historic range of hydrology (i.e., the water historically available in a defined range of past years) could serve as a reliable guide to forecast the water available in the future.

Modern climate science has undermined this assumption, however, and leading researchers have declared the "death of stationarity."[6] Even if aggressive mitigation is implemented to reduce greenhouse gas emissions, stationarity "cannot be revived."[7] Due to the collapse of the stationarity assumption, infrastructure and water management decisions based upon even the widest range of twentieth-century hydrologic conditions will inaccurately disclose, and fail to accurately test, project performance over the coming decades.

California Confronts Its Climate Ghost

Overcoming stationary planning is a global imperative with strong applications to California, whose ability to serve urban, agricultural and instream water uses depends upon accurate forecasting of conditions that are highly susceptible to climate warming, such as the timing and amount of runoff from the Sierra Nevada mountains, the flow and temperature of river water, and changes in sea levels and salinity.[8]

Leading scientists have recognized this necessity for a number of years, noting that successful adaptation will require planning for a future in which "today's extremes could become tomorrow's norms."[9] There is, however, a "growing disparity between regulatory accord and hydrologic reality," as key regulatory benchmarks have been, and sometimes still are, premised on a distribution of water-year types (from wet to critically dry) that climate change is quickly altering[10] To meaningfully address climate change, adaptation law cannot simply assume the preservation of the status quo, because the resource assumptions behind existing conditions will foreseeably disappear within the time frame of certain projects.[11]

The California Department of Water Resources (DWR) has begun to confront this reality as well, recognizing that "due to climate change, the hydrology of the past is no longer a reliable guide to the future."[12] As noted in a research report included in DWR's 2005 California Water Plan Update, "[a]ny financial investment in infrastructure would be poorly spent if it does not accommodate for altered hydrology under climate change. Moreover, there is the risk that such infrastructure would fail to protect the public against the hazards of more severe flood events or water supply shortages under climate change."[13]

The courts have similarly recognized that stationarity can no longer form a sound foundation for water projections. For example, two decisions by Judge Oliver Wanger in the United States District Court for the Eastern District of California—*Natural Resources Defense Council v. Kempthorne* and *Pacific Coast Federation of Fishermen's Association v. Gutierrez*—rejected reliance on the twentieth-century hydrologic record in biological opinions addressing the impacts of the Central Valley Project and State Water Project on fish habitat. As discussed in more detail in Professor Kibel's commentary, *infra*, Judge Wanger found that "[t]he best scientific data available today establishes that global climate change is occurring and will affect western hydrology."[14] On this basis, Judge Wanger concluded that the biological opinions' use of past history as the basis for future projections—and the failure even to attempt to assess the consequences of climate change for water resources—was arbitrary and capricious. Other recent decisions addressing Endangered Species Act compliance and environmental review have drawn similar conclusions.[15]

Present Dangers Demand a Robust Adaptation Policy

The need to confront the death of stationary and to adapt to a changing climate will only increase in the coming years, because the water-related consequences of climate change resemble a modern list of biblical plagues.[16] DWR's reports, among others, recognize that rapid climate change presents major risks even within a relatively short planning horizon. These reports have utilized increasingly sophisticated models and studied multiple scenarios, both statewide and within individual watersheds. The risks include the following:

- **Snowmelt Loss:** Sierra snowpack is projected to experience a 25 to 40 percent reduction from its historic average by 2050. Climate change will result in less snowfall at lower elevations. Five million acre-feet or more of annual snowpack storage may be lost—a figure more than double the historic deliveries of the State Water Project.[17]
- **Drought:** Warming temperatures and changes in rainfall and runoff patterns will increase the frequency and intensity of droughts. Regions that rely heavily upon surface water (rivers,

streams, and lakes) could be particularly affected as runoff becomes more variable, and more demand is placed on groundwater.[18]

- **Floods:** As California's hydrology changes, current 100-year floods may strike more often, leaving many communities at greater risk.[19]
- **Water quality:** Changes in the timing of river flows and warming atmospheric temperatures may affect water quality and water uses (resulting in pollution, contaminants, higher water temperatures, and fisheries impacts).[20]
- **Sea level rise:** Recent peer-reviewed studies estimate a rise in sea level of seven to 55 inches by 2100 along California's coast, increasing risks of coastal flooding, salinity damage, catastrophic levee failure, and harm to drinking water.[21]
- **State Water Project and Central Valley Project operation:** Climate change may adversely affect State Water Project and Central Valley Project operations, prompting major reductions in Delta exports and reservoir carryover storage, and increased reliance on groundwater pumping.[22]
- **River flows and reservoirs:** Changes in climate will affect the timing and quantity of flows to Lake Oroville, the "backbone" of the State Water Project, which depends heavily on temperature-sensitive snowmelt in the Upper Feather Basin.[23] The Feather River is expected to be one of the first affected by climate change-induced losses of snowmelt.[24]
- **Hydroelectric generation:** Climate change will reduce the reliability of California's hydroelectricity operations (by changing the timing and flow of reservoirs and reducing power generation).[25]
- **Economic conflict and costs:** Climate change will likely intensify the competition for limited water supplies available for urban, agricultural and environmental uses. The water consequences of climate change may produce billions of dollars in direct costs.[26]

This is a sobering list, particularly when combined with the growing body of scholarship linking the collapse of civilizations—the Akkadians, the Maya, the Anasazi and the Hohokam, among others—to unsustainable management of water systems in the face of a changing climate.[27] But as environmental engineering professor Jay Lund has noted, "handwringing is not adaptation."[28] A key difference between these lost civilizations and present-day California, however, is that "we can now anticipate and plan for climate change."[29]

The Ghost of Climate Present—Overcoming Disconnection

Disconnection and Reconnection of Water Planning

As California adapts to climate change, it must also overcome a legacy of fragmentation and disconnection on several levels. The first is the need to address the "profound discontinuity" between science and law that often emerges in complex areas of water policy.[30] The second is the need to coordinate choices in a largely decentralized system, which includes roughly 3000 districts and agencies responsible for various aspects of water planning and decision-making.[31] The third is that climate change compounds other major water challenges, such as protecting species, responding to economic and population pressures, producing reliable energy, and containing risks from earthquakes, floods and fires.[32]

Fortunately, California's adaptation strategy includes a diverse body of new research, and new tools, that may assist in overcoming the sources of disconnection. In particular, the state has produced periodic scientific assessments of the impacts of climate change in California and of potential adaptation responses. The Third Assessment, also known as the *California Vulnerability and Adaptation Study* (2012), addresses climate vulnerability and adaptation options in the state and regional context. This project, funded by the California Energy Commission, contains 30 new papers, involving more than 120 researchers, providing detailed discussion of the scientific, regulatory, legal, socioeconomic, and other issues facing adaptation policy.[33] These studies illustrate the need for adaptation analysis to inform a wide range of interrelated legal and policy problems.[34]

Does Uncertainty Support Inaction?

Uncertainty no longer justifies inaction on climate change adaptation. As DWR and the U.S. Environmental Protection Agency observe in their *Climate Change Handbook for Regional Water Planning*, "[w]hile significant uncertainty still exists about how quickly and to what degree climate change will occur, a preponderance of the scientific evidence related to projected future climate changes compels planners to act now. It is therefore imperative that regional water planners begin to consider potential futures where temperatures have increased appreciably and precipitation patterns no longer follow the statistical distribution of past observations."[35]

Berkeley professor Daniel Farber, one of the foremost authorities on adaptation law, provides similar counsel, noting that "[i]t is sometimes tempting to ignore the imperfectly understood dimensions of hazards as speculative. That is clearly the wrong approach."[36]

Professor Farber also cites the "broad consensus among economists that uncertainty about climate change is not an excuse for inaction."[37] Investor groups have likewise called for water utilities and other companies to display greater candor about water-related climate risks.[38] In 2010, the Securities and Exchange Commission included the water risks of climate change in its guidance to publicly traded companies on climate risk disclosure.[39]

Will the State's Commitments Match Its Science?

California's recent efforts focusing on climate change adaptation have coincided with a major shift toward integrated water management, in which state and regional planners look at scenarios that consider uncertainty and adaptation. These developments are discussed in more detail in Katherine Spanos' commentary, *infra*, which reviews the efforts at state and regional levels to develop and fund Integrated Regional Water Management (IRWM), and in particular California's IRWM law, which establishes a procedure for California regions to develop water management plans that consider adaptation to climate change.[40]

Such regional coordination is a positive development, but it is too early to know whether integrated management plans will have sufficient incentives and sources of authority to overcome years of institutional conflict and imbalances of power that have sometimes frustrated efforts at regional coordination. Comparative studies of adaptation efforts in other countries provide a useful comparison, since they indicate that many have largely amounted to a "plan to make a plan."[41] Moreover, a preliminary review of new regional IRWM plans in California suggests that some still "do not offer many clues" about what a process for adaptive management may include.[42] Although IRWM has taken useful steps to facilitate constructive regional planning, regions within California need more assistance in the selection and use of downscaled models, and in ensuring ongoing coordination and action.[43]

In addition, the state must do more to ensure that its own agencies set a good example and act consistently in addressing the consequences of climate change. In two recent Environmental Impact Reports (EIRs) on major projects involving water resources, the Oroville Dam relicensing EIR[44] and the Monterey Plus EIR,[45] DWR took opposing positions on whether the twentieth century range of hydrologic variability is expected to continue in the foreseeable future (answering yes in the former and no in the latter). This disconnect illustrates the continuing need for policy-makers and water managers to do a better job coordinating with scientists, and with each other.

The Ghost of Climate Yet to Come—Overcoming Institutional Resistance

The need for California to adapt to climate change undoubtedly presents many daunting challenges. But there are also reasons for optimism that the state can rise to meet these challenges if it effectively uses climate adaptation tools, as well as the numerous talents and resources that we can marshal if we choose to do so. To succeed, however, California will need to ensure that its institutions overcome outmoded planning assumptions and act promptly and consistently to face the reality of a warming world.

Rethinking Water Supply and Demand

California water management and project planning must adapt to climate change at an inopportune time. As Robert Wilkinson has observed, "[e]very major water supply source in California is in a state of 'overshoot' in systems terminology."[46] Moreover, water allocations in California have often been portrayed in exaggerated terms of certainty and entitlement. California's courts and lawmakers have only recently started to confront discrepancies between "paper water" and deliverable supplies and to require more rigorous water accounting in planning and project review.[47] Climate change will likely shrink the available supply of "wet" water, making it even more difficult to demonstrate that projects have a reliable water supply.

During the twentieth century, "supply-side" approaches such as building dams and aqueduct systems were the dominant response to such water supply concerns. But they left an unsustainable environmental legacy that in the long run threatens the natural conditions needed to maintain California's prosperity and beauty. For the next quarter-century, efficiency gains—including improvements in water use efficiency, groundwater recharge and management, and water reuse—deserve consideration as California's largest potential new source of water supply. Robert Wilkinson's commentary, *infra*, examines these issues in detail and contends that an integrated approach to water, energy, and climate can achieve major gains in efficiency and yield multiple benefits. Policy changes will be needed to encourage water and energy suppliers to maximize efficiency and achieve these gains.

Bringing Environmental Laws to Bear on Climate Change Adaptation

Environmental review of major infrastructure projects under the National Environmental Policy Act (NEPA) or the California Environmental Quality Act (CEQA) often requires water forecasting, to ensure that the project has a reliable water supply or can reliably serve water-dependent purposes. In light of the science described above, failing to account for climate change in these forecasts would undermine the analysis, insulating the project from the foreseeable context in which the project will operate.[48] That exclusion from the environmental analysis would compromise the ability of an environmental review document to support informed decision-making.

More work needs to be done simply to ensure that NEPA and CEQA review incorporates climate adaptation analysis, as Paul Kibel observes in his commentary on climate change adaptation strategies for protecting coldwater fisheries, *infra*.[49] Professor Kibel suggests that climate-change-induced alterations of the physical environment, such as higher instream temperatures, could be addressed by using a "future baseline" under CEQA instead of limiting analysis to the traditional static snapshot of pre-project physical conditions. Although courts have sometimes rejected the use of "future baselines" under different circumstances (for example, where they are hypothetical constructs drawn from maximum permitted activity, or engineered to minimize accountability for project impacts),[50] Professor Kibel provides a framework for requiring CEQA baselines to incorporate projections of how environmental conditions are expected to change over the life of the project. Among other authorities, he discusses the implications for climate change analysis of *Neighbors for Smart Rail v. Exposition Metro Line Construction Authority*, a case involving other issues currently on review in the California Supreme Court.[51] If the Supreme Court provides guidance on the appropriate use of future baselines, it could potentially help facilitate incorporation of climate change adaptation in environmental review (and should not be used more cynically as an excuse for agencies to avoid climate analysis).

Beyond the subject of baselines, adaptation to climate change also raises a number of other CEQA issues involving water resources:

- For projects requiring water analysis, will a failure to take climate change into account violate CEQA's standards for reasonable forecasting and information disclosure?[52]
- Will climate change need to be addressed in the assessment of the "no project" alternative, which requires analysis of "what would be reasonably expected to occur in the absence of the project?"[53]
- Will climate change play a role in attempts to satisfy CEQA's standards for showing a reliable water supply, and to comply with California's "show me the water" laws?[54]
- Will climate change compound or lengthen a project's impacts on the environment, and require further assessment of mitigation and alternatives?
- Will projects sited in an area made riskier by climate change require CEQA analysis, despite the holding in *Ballona Wetlands Land Trust v. City of Los Angeles*?[55]

Environmental assessment laws such as NEPA and CEQA may be insufficiently rigorous, by themselves, to bring about timely effective climate change adaptation strategies. Due to the urgent need for adaptation to climate change, and its relevance to existing infrastructure as well as new projects, legal observers have also argued for the development of more rigorous laws addressing climate change adaptation, and expanded application to climate change of substantive statutes such as the Endangered Species Act.[56] Complex policy choices clearly remain to be made about potentially costly adaptation strategies and who will pay for them.[57] Still, an important starting point will be to ensure that environmental review analyzes projects in the context of the climate-constrained future California expects, rather than testing performance based only upon a "future" that is already an artifact of the past.

<u>Adaptation, Institutions and Politics</u>

As this century's warming transforms California hydrology, successful adaptation to climate change will ultimately demand a rethinking of California's water culture, and a commitment to ensure that its institutions adapt to change.

Reacting to the suggestion that California leads the nation in water preparedness for climate change, water blogger Emily Green responded: "If a state that turned Owens Lake into a salt bed, that led the West in destroying the Colorado River estuary and is well on its way to finishing off the Sacramento-San Joaquin Bay Delta gets a top ranking for water management in the face of climate change, it must be asked: What merits a fail?"[58] This reaction, while slightly cynical, provides a useful counterpoint to the "happy talk" that has sometimes accompanied California water institutions' premature announcement of mission accomplished in water policy. While adaptation to climate change offers opportunities as well, much about it will be difficult, and will present our water institutions and decision-makers with hard choices.

Californians, known for their creativity as well as their complicated water politics, still have an opportunity to show that, in actions and investments as much as in words, the commitment to climate change adaptation is real. To do so, they must show as much ingenuity in the conservation and reuse of water as many of their predecessors showed in its extraction and appropriation.

INTEGRATED REGIONAL WATER MANAGEMENT AND CLIMATE CHANGE PLANNING: HOW TO ADAPT TO AN UNCERTAIN FUTURE

by Katherine A. Spanos

Katherine A. Spanos

Adapting California's water management systems to respond to climate change presents one of the most significant challenges for the 21st century. The California Department of Water Resources (DWR) has taken a leading role in doing so, in conjunction with its partner agencies, with the publication of the *Climate Change Handbook for Regional Water Planning* (*Climate Change Handbook*).[59] The *Climate Change Handbook* is the most recent effort to bring together two separate areas of water planning—integrated regional water management and climate change mitigation and adaptation. The key to this planning synthesis is a significant change in the way water planners have addressed issues of water management. This portion of the article looks at the development of integrated regional water management and climate change planning by DWR, and how these two planning efforts have been united.

Introduction

Climate change is already affecting California's water resources. Warmer temperatures, changes in precipitation patterns and runoff, and rising sea levels increasingly affect the ability to manage water and other natural resources. Like those of most regions, California's water management objectives include ensuring water supplies and water quality for multiple uses, managing floods, and protecting ecosystem functions and critical habitats.[60] In an era when California's water resources are strained and future demands for water supply for agriculture and urban uses and for environmental purposes are expected to increase, managing these resources in a way that considers the effects of one action on another and maximizes the beneficial uses of water is critical. Climate change adds to the complexity of these issues since it affects California water resources in several ways. Sea levels are rising, snowpack is decreasing, runoff is occurring earlier in the season and water temperatures are increasing. In the future, it is expected that droughts will become more frequent and more severe and storm intensities will increase. These changes affect the ability to meet crucial water management objectives.

DWR—one of the state agencies responsible for managing and protecting California's water—has taken an active role in the state in identifying challenges and ways of coping with climate change. DWR's efforts include evaluating the water-energy relationship and greenhouse gas (GHG) emissions in the planning process; identifying mitigation strategies to reduce GHG emissions for water supply projects; developing a department-wide GHG emissions reduction plan; identifying impacts of climate change on water supply planning processes and adaptation strategies to help ameliorate the adverse impacts of climate change on water supply and water quality; establishing a state-wide plan to guide, direct and advise local and regional water planners; and encouraging regional and watershed approaches to water planning.

A key focus of DWR's efforts has been to bring together two previously distinct water planning efforts, integrated regional water management planning and climate change mitigation and adaptation. This planning synthesis represents a significant change in the way water planners address issues of water management. In the past, planners relied primarily on the historical record and often did not look at the relationship of their projects to other projects. Planners today are encouraged, and sometimes required, to manage the uncertainty caused by climate change by looking not only at the historical record but also at projected changes in precipitation and temperature—and to plan in an integrated manner that considers the relationships of projects in regions and watersheds and even outside of the region.

The publication in 2011 of the *Climate Change Handbook*, developed as a cooperative effort of DWR and the U.S. Environmental Protection Agency, the Resources Legacy Fund, and the United States Army Corps of Engineers, is the most recent effort to bring together these two separate areas of water planning.[61] As highlighted by the *Climate Change Handbook*, "[w]hile significant uncertainty still exists about how quickly and to what degree climate change will occur, a preponderance of the scientific evidence related to projected future climate changes compels planners to act now. It is therefore imperative that regional water planners begin to consider potential futures where temperatures have increased appreciably and precipitation patterns no longer follow the statistical distribution of past observations."[62]

California's Historical Approaches to Water Policy Planning

California has, for the most part, considered water policy planning to be a local responsibility. Cities and counties have the primary authority to plan where and when urban and agricultural development will occur; and local government, including special water districts, has the primary responsibility to develop and provide the water needed for local growth. Within the last 5-10 years, however, there has been a greater emphasis on regional water planning. This shift in focus has included developments such as DWR's use of integrated water management planning as an objective and tool in its periodic updates to the *California Water Plan*—a comprehensive planning document that evaluates water supplies and assesses agricultural, urban, and environmental water uses to quantify the gap between water supplies and uses, which the California Water Code requires DWR to update every five years[63]—and the passage of the Integrated Regional Water Management Planning Act in 2002 (both of which are discussed in greater detail below).

At the same time, concerns about effects of urban and agricultural development and of water supply development on the environment have led to a number of state and federal legislative and administrative regulatory actions to protect the environment, as well as expansive grant and loan programs to encourage water conservation, water recycling, groundwater management, and other water management efforts.

California has also invested in, and depends upon, systems that rely on historical hydrology as a guide to the future for water supply and flood protection. These systems are based on anticipating rainfall that fluctuates significantly, with periods of extreme drought alternating with periods of heavy rain and even flooding. Water planners and flood experts have always understood that models based on previous water years would not necessarily anticipate the full range of events that might occur. Due to climate change, however, it is widely assumed that the hydrology of the past is an even less reliable an indicator of future conditions. As a result, there has been a greater emphasis within the last 5-7 years on identifying the impact of water supply planning on GHG emissions reduction (mitigation) and on identifying the risks of climate change on water planning—both for supply and flood management—and strategies to manage such risks (adaptation).

Climate Change Planning

DWR has been active in its efforts to respond to climate change and has incorporated climate change into its planning activities in a number of ways. These planning efforts fall into two general categories, adaptation and mitigation.

Adaptation in the context of climate change has been described as "[a]djustments in natural or human systems in response to actual or expected climatic stimuli or their effects, which minimize harm or take advantage of beneficial opportunities."[64]

California has been taking the lead nationally in a number of efforts to respond to climate change, but Executive Order S-3-05, issued June 1, 2005, stands out among them as an historic document that framed the issues of climate change adaptation and mitigation as they affected California and established a comprehensive approach for California with regard to these issues. The Executive Order recognized that "California is particularly vulnerable to the impacts of climate change."[65] The Order requires biennial reports on the impacts of climate change on California, and on mitigation and adaptation plans to combat these impacts.[66]

DWR issued three significant reports in the three years following the adoption of the Executive Order that set the foundation for current climate change water management planning. First, in its 2005 Update to the *California Water Plan* (*CWP Update 2005*), DWR substantively assessed the threats of climate change, which at the time was a landmark for any major State planning process. The *CWP Update 2005* also introduced for the first time policy recommendations regarding climate change planning and planning for an uncertain future. With regard to global climate change, it found that "[t]he prospect of significant climate change warrants examination of how California's water infrastructure and natural systems can be managed to accommodate or adapt to these changes, and whether more needs to be done. . . . Incorporating flexibility and adaptability into our current system can strengthen our ability to respond to change."[67] The *CWP Update 2005* recommended that DWR evaluate management responses to potential impacts of global climate change on the State Water Project and California's hydrology, and work with climate change experts to develop alternative flow data to help State and regional planners test potential effects of global climate change on different management strategies.[68]

Second, the very next year in 2006, DWR issued *Progress in Incorporating Climate Change into Management of California's Water Resources*,[69] a technical report that described in detail the potential impacts of climate change to the operations of the State and federal water projects, the Delta, and flood management. This report, updated in 2008,[70] documented the DWR's first efforts to quantify and incorporate multiple climate change scenarios into the management of California's water resources.

Third, in 2008, DWR issued *Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water* (*Managing an Uncertain Future*).[71] This groundbreaking adaptation document focuses discussion on the need for California's water managers to adapt to the impacts of climate change, some of which are already affecting our water supplies. The report noted that "[w]hile the exact conditions of future climate change remain uncertain, there is no doubt about the changes that have already happened."[72]

The report further echoed the conclusion of the *CWP Update 2005* that historic hydrologic patterns can no longer be solely relied upon to forecast the water future; and that precipitation and runoff patterns are changing, thereby increasing the uncertainty for water supply and quality, flood management, and ecosystem functions. It stated that "the hydrologic record cannot be used to predict expected increases in frequency and severity of extreme events such as floods and droughts. Going forward, model calibration or statistical relation development must happen more frequently, new forecast-based tools must be developed, and a standard of practice that explicitly considers climate change must be adopted."[73] Finally, *Managing an Uncertain Future* proposed 10 adaptation strategies to address climate change impacts, grouped into four categories: investment strategies, regional strategies, statewide strategies, and strategies aimed at improving management and decision-making.[74] The California Natural Resources Agency used the report as the primary basis for its discussion of water management adaptation strategies in its 2009 *California Climate Adaptation Strategy*.[75]

<u>Mitigation</u> in the context of climate change has been described as human intervention to reduce the sources of greenhouse gases or to enhance sinks that remove them from the atmosphere.[76] Two major areas of California law frame the issue of mitigation: efforts to reduce GHG emissions, and the identification of adverse impacts and mitigation measures under the California Environmental Quality Act (CEQA).

With respect to emission reductions, California has established ambitious targets for reducing the amount of GHG emissions the state adds to the atmosphere each year. In 2005, Executive Order S-3-05 adopted a goal of reducing GHG emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80 percent below 1990 levels by 2050.[77] In 2006, the California legislature enshrined the 2020 target in state law by passing the California Global Warming Solutions Act (AB 32).[78] AB 32 requires the California Air Resources Board (CARB) to adopt regulations to achieve the maximum technologically feasible and cost-effective GHG emission reductions in order to meet this target. In accordance with this mandate, CARB adopted a *Climate Change Scoping Plan* in 2008, which outlined regulations, market mechanisms, and other actions that would be undertaken to meet the 2020 emissions target.[79] The *Climate Change Scoping Plan* includes recommendations for 39 GHG reduction measures that will allow the state to meet the 2020 target of 1990 emission levels, and will put it on a path toward reaching the long-term 2050 goal of reducing emissions to 80 percent below 1990 levels. A number of these measures apply to DWR's activities.

DWR has adopted a Sustainability Policy (2009) and Sustainability Targets (2010) and an Environmental Stewardship Policy (2011) and Principles (2012), which include provisions that are consistent with the executive and legislative call to reduce GHG emissions in California. The Sustainability Policy articulates DWR's intentions to minimize its impact on the environment and be a sustainability leader in state government and the water community. DWR's Sustainability Targets establish several specific goals for reducing water use, wastewater production, energy use, carbon emissions, and waste generation. DWR has adopted or will adopt a number of measures to achieve the targets, including reducing GHG emissions to 50 percent of 1990 levels by 2020. In 2009, responding to the call to adequately analyze and mitigate for any increased GHG emissions, DWR also established an internal review committee, called the CEQA Climate Change Committee, to review all DWR documents for their analysis of climate change. To streamline the consultation and review process, the Committee developed several guidance documents to assist DWR staff and consultants. These include a summary of DWR's approach to addressing climate change in CEQA documents, as well as a more detailed guidance document on how to compile an emissions inventory and model climate change sections for the three types of CEQA documents. The initial focus of the documents was on the mitigation aspect of climate change. The review of each project by the CEQA Climate Change Committee has helped provide consistency among DWR CEQA documents.

More recently, DWR adopted the first phase of its Climate Action Plan in May 2012.[80] The Climate Action Plan is a response to the call to reduce GHG emissions and to analyze and mitigate for any increased emissions. This first stage of the Climate Action Plan is a Greenhouse Gas Emissions Reduction Plan (Plan) for most of DWR's activities through 2020. This is the first plan of its type and may serve as example for other water districts and state agencies that have similar operational, construction and business activities. The objectives of the Plan are (1) to document DWR's progress in reducing its GHG emissions consistent with the GHG emissions reduction targets established in AB 32, Executive Order S-3-05, and CDWR policy as expressed in the DWR Sustainability Policy and Sustainability Targets; and (2) to provide DWR's analysis of forecasted GHG emissions and GHG emissions reductions associated with certain future DWR projects and activities, which can then be relied on by DWR in the GHG impacts sections of later project-specific CEQA environmental documents. Future phases of the Climate Action Plan will address technical approaches for characterizing and analyzing the impacts of climate change on DWR projects (both existing and planned), and measures for resiliency and adaptation to future conditions expected as a result of climate change.

With respect to addressing climate change in CEQA environmental reviews, CEQA has since its adoption in 1970 required public agencies to identify potential significant adverse environmental effects of projects they carry out, permit or fund, and to avoid or mitigate any such effects. In 2010, the California Natural Resources Agency updated its regulations that implement CEQA—called the CEQA Guidelines[81]—to address GHG emissions specifically, in response to the Legislature's directive in Senate Bill 97 (2007).[82] The 2010 Guidelines amendments clarify how CEQA applies to GHG emissions and climate change impacts; and they also address those situations where analysis of GHG emissions may differ in some respects from more traditional CEQA analyses and refer to the use of GHG emission reduction plans. The amendments make clear that a project's GHG emissions, and the contribution of those emissions to the problem of global climate change, are an impact that must be included in CEQA environmental review documents—and that feasible mitigation must be provided for any significant GHG emissions impacts. They also added a section that encourages agencies to adopt greenhouse gas reduction plans to govern their own activities. Provided that such plans contain certain specific requirements, they may be appropriately relied on in a cumulative greenhouse gas impacts analysis.[83] DWR's Greenhouse Gas Emissions Reduction Plan discussed above is such a plan. DWR issued a CEQA environmental document to cover the Plan so that it can be used for CEQA purposes, which means that for most of its projects DWR may rely on and incorporate by reference the analysis and conclusions in the Plan when analyzing the projects' cumulative impacts to climate change and GHG concentrations in the atmosphere.[84]

Integrated Regional Water Management Planning

At the same time as California has been developing its responses to global climate change, the state has improved its understanding of the value of regional water management planning and has taken significant steps to implement integrated regional water management (IRWM). Previously, water management entities tended to work with a narrow focus on their service area and primary function, sometimes competing against similar efforts to resolve similar issues or advancing duplicate efforts. IRWM planning, by contrast, looks at water management issues from a multitude of perspectives as diverse stakeholders engage one another. The process can result in multi-benefit projects that achieve several entities' goals and objectives in a more cost-effective manner than each entity acting on its own.[85]

Formally, IRWM is a comprehensive approach for determining the appropriate mix of water demand and supply management options and water quality actions. IRWM planning identifies and brings together water management stakeholders from throughout a region, and then focuses the planning and decision-making process on ensuring that all of their various objectives and concerns are addressed. This approach provides reliable water supplies at the lowest reasonable cost, and with the highest benefits for economic development, environmental quality and other societal objectives. Moreover, if appropriately developed and implemented, IRWM plans—in combination with other regional planning efforts for transportation and land use—can serve as the basis for broader community adaptation plans for climate change.[86]

Although the concept of IRWM planning has been around for a while, significant steps occurred in 2002, when the legislature enacted the Integrated Regional Water Management Planning Act. The IRWM Planning Act encouraged local agencies to work cooperatively to manage local and imported water supplies to improve the quantity, quality and reliability of these supplies.[87] DWR subsequently incorporated IRWM planning into its updates of the *California Water Plan*, its comprehensive planning document that evaluates water supplies and needs.[88] The *CWP Update 2005*, discussed above, was a significant milestone in California water management planning.

With the 2005 *Update*, DWR began a much more open and collaborative planning framework for elected officials, agencies, tribes, water and resource managers, businesses, academia, stakeholders, and the public to develop findings and recommendations and make informed decisions for California's water future. As DWR Director Snow stated in the introduction:

> Update 2005 represents a fundamental transition in how we look at water resource management in California. It also represents a fundamental transition in the way state government needs to be involved with local entities and interest groups to deal with water issues in the state. The way we manage California's water resources is changing. We need to consider a broader range of resource management issues, competing water demands, new approaches to water supply reliability, and new ways of financing. Methods like storage and conveyance are being adapted to include more water conservation, recycling, desalination, and many other strategies.[89]

CWP Updates 2009 and 2013 continue and add to the process begun with *CWP Update 2005* to produce a strategic water plan that meets California Water Code requirements, guides State investments in innovation and infrastructure, and advances integrated water management and sustainable outcomes.[90]

In addition, bond programs providing grants and loans for water projects have similarly focused historically on narrow areas or subject matters.[91] But they, too, have been evolving to embrace a more integrated approach. In 2002, the same year that the IRMW Planning Act was adopted, voters passed Proposition 50, which provided approximately $500 million in funding for competitive grants for projects consistent with an IRWM plan.[92] Proposition 50 provided some monetary encouragement for local agencies to think as a region with regard to water management planning, although it gave little guidance for IRWM planning or implementation. In 2006, voters approved Proposition 84 and Proposition 1E, which provide over $1 billion in funding for IRWM programs.[93] Propositions 84 and 1E, for the most part, have divided the water management grant and loan pie into two pieces: flood management and integrated regional water management.

As of 2011, IRWM planning covered over 87% of the state and included approximately 99% of the population. Some regions cover an entire hydrological area and others watersheds have multiple IRWM planning regions.[94]

The Union of Climate Change and Water Management Planning

For several years, climate change adaptation documents had been referring to IRWM planning as a strong tool for planning for climate change. At the same time, IRWM documents were encouraging regional plans to consider climate change as a critical issue. More recently, IRWM planning and climate change planning have finally come together in a united planning approach.

The Legislature gave this unification a significant boost in 2008, when it repealed and replaced the 2002 IRWM Planning Act with a 2008 IRWM Planning Act.[95] In addition to strengthening the tie between IRWM plans and planning regions and bond funding, the legislation also specifically requires IRWM Plans to include an evaluation of the adaptability to climate change of water management systems in the region.[96]

DWR also provided further impetus that same year with the publication of *Managing an Uncertain Future*, the agency's climate change adaptation strategy discussed above, which was developed along with the *CWP Update 2009* process and the California Natural Resources Agency's *Climate Adaptation Strategy*. The report heavily emphasized the importance of integrated regional water management planning as a vehicle for implementing climate change adaptation. The adaptation strategies identified in the report included (1) providing a continuous and sustainable source of funding for IRWM planning, and (2) full development of the potential for IRWM planning to address the effects of climate change.[97] The report made further suggestions for how regional IRWM plans should incorporate climate change adaptation, such as identifying how local groundwater storage and banking can be coordinated with local surface water storage; assessing how vulnerable the region is to increased flood or drought risks; identifying aggressive conservation and efficiency strategies; encouraging low-impact development land use policies that reduce water demand and stormwater runoff; and planning for sharing of water supplies and infrastructure during emergencies such as droughts.[98]

DWR went a step further in 2010 with its publication of IRWM Grant Program Guidelines for Proposition 84 and related Proposition 1E funding.[99] These Guidelines expanded the scope of issues that need to be addressed in IRWM Plans, and for the first time added climate change adaptation and greenhouse gas mitigation as required elements of planning and project selection.[100] The Guidelines require that IRWM Plans must include a discussion of the potential effects of climate change on the IRWM region, including an evaluation of the IRWM region's vulnerabilities to the effects of climate change and potential adaptation responses to those vulnerabilities; and a process that discloses and considers GHG emissions when choosing between project alternatives.[101] The Guidelines also provided an Appendix with additional detail to help IRWM practitioners in developing or revising IRWM plans, including information regarding the legislative and policy context for these climate change requirements, guidance on assessing mitigation and adaptation options, and a list of references that can provide further assistance.[102]

Most recently, DWR and EPA, in partnership with the U.S. Army Corps of Engineers and the Resources Legacy Fund, published the *Climate Change Handbook*.[103] The *Climate Change Handbook* provides guidance for water planners on how to address climate change issues in an integrated water resource management process. It outlines quantitative tools and techniques to address climate change adaptation and GHG emissions mitigation, offers guidelines for assessing the vulnerability of a watershed or region to climate change impacts, and presents case studies in which the latest methodologies have been applied in a water planning context. In doing so, the *Climate Change Handbook* "provides a framework for considering climate change in water management planning . . . , [presenting] [k]ey decision considerations, resources, tools, and decision options . . . that will guide resource managers and planners as they develop means of adapting their programs to a changing climate."[104]

The *Climate Change Handbook* uses DWR's IRWM planning framework as a model into which analysis of climate change impacts and planning for adaptation and mitigation can be integrated. It offers an innovative analytical framework for incorporating climate change impacts into a regional and watershed planning approach, and brings together information from both the climate change and integrated regional water management planning spheres that can be used not only by California practitioners but by practitioners in other states and other countries when incorporating climate change into any watershed or water supply planning process.[105] In doing so, the document aims to provide water resource planners with the means "to integrate climate change considerations into decisions and planning processes, today and in years to come."[106]

The Future

Although integrated regional water management and climate change planning efforts began independently, in hindsight, their current union is not at all coincidental. In fact, it appears to have been inevitable. As the *Climate Change Handbook* recognizes, "[i]ntegrated regional water planning is an excellent framework for addressing water-related climate impacts, as it provides a process for stakeholders with varied water-related priorities to work together to develop solutions that satisfy all water uses and needs. Because climate change impacts so many aspects of water resources, this process is ideal for addressing adaptation to climate change and for developing measures to help mitigate future climate change."[107] As the integration of these planning efforts continues to develop, water resource planners, legal practitioners, and others may want to keep the following considerations in mind.

Some Things We Can Expect

- More interactive websites. Websites such as the California Natural Resources Agency (CNRA) *Cal-Adapt* website[108] allow viewers to visualize what the future may look like.
- Climate Change Modeling for Water Planning. As a follow-up to the 2010 report *Climate Change Characterization and Analysis in California Water Resources Planning Studies*,[109] a recently appointed scientific advisory panel will work with DWR to look at whether a specific modeling approach or approaches should be recommended.
- California Water Plan Update 2013. The Plan will continue providing guidance and developing new tools for agencies to use in considering climate change and integrated regional management planning.[110]
- Strategic Plan for the Future of Integrated Regional Water Management in California 2013. DWR is developing a plan. It held meetings in early 2013 asking for public input on visions and goals.[111]
- Development of Adaptation Guidance Tools. CNRA will produce an update to its 2009 *California Climate Adaptation Strategy.* CRNA also adopted an *Adaptation Policy Guide* in September 2012, which follows the model of the *Climate Change Handbook* by providing local communities with tools for climate change adaptation planning and introducing a step-by-step process for assessing local and regional climate vulnerability and developing adaptation strategies.[112] CNRA is also continuing to provide better data and tools for its interactive Cal-Adapt program.
- Further efforts at the legislative and executive level to identify who is diverting water and in what quantity. A recent CEC White Paper, *Climate Vulnerability and Adaptation Study for California: Legal Analysis of Barriers to Adaptation for California's Water Sector*, contains a number of recommendations regarding surface water.[113]

So What Does This All Mean?

- State funding drives innovation, and it has been incredibly effective in the area of IRWM. State planning incentives (through state IRWM bond funding) have encouraged local planning efforts to move to a more regional approach.
- As IRWM develops further, there will be:
  - More carrots and sticks for IRWM and flood planning to promote regional planning for all aspects of water management—environmental as well as water supply.
  - More tools developed to help local and regional planners.
  - Expanding relationships between and among regions.
  - Further efforts to enact legislation to mandate additional reporting and planning requirements.
  - Recognition that the natural environment is an infrastructure that must be protected and managed to protect and maintain water supply.
  - Further efforts to work towards a more sustainable future for all uses of water.
- Water planners working on providing water for natural resources and human uses must continue to look at scenarios that consider uncertainty and adaptation. Resource agencies and regulatory agencies may need to change their approach from trying to assure certainty to focusing on how best to manage risk.

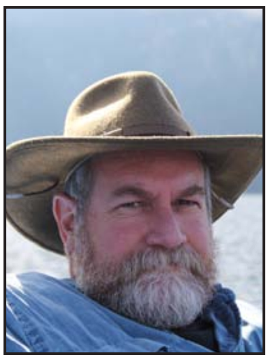
What can lawyers do?

- Encourage clients to work with regional water management groups on projects that support sustainability of water supply and environmental community.

- Work with clients to identify incentives and funding for Integrated Regional Water Management Planning.
- Work with clients to help them consider adaptation and management of risk when carrying out water planning for both water supply and environmental benefits.
- Work with clients to consider legal aspects of climate change when litigation is possible.
- Be active in executive and legislative efforts to encourage quantification and management of water, such as State Water Resources Control Board and Delta Stewardship Council activities, California Water Plan updates, executive orders, and legislation.

INTEGRATED RESPONSE STRATEGIES FOR MITIGATION AND ADAPTATION

By Robert Wilkinson, Ph.D.



Robert Wilkinson, Ph.D.

California's *Global Warming Solutions Act of 2006* opens with this statement: "Global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California."[114] As this passage recognizes, the potential impacts of climate change and variability to California are serious.[115] This paper argues that both *mitigation strategies* (i.e., reducing greenhouse gas emissions) and *adaptation strategies* (i.e., dealing with impacts) are important in responding to this threat, and should be pursued in tandem as *integrated response strategies*. One important strategy in particular that policymakers should consider is integrated water and energy planning. California's water systems use large amounts of energy in transporting and processing water to end users. Improvements in water use efficiency and shifts in supply sources can therefore help the state adapt to climate change by conserving increasingly scarce water resources, while at the same time saving energy and helping the state reduce its greenhouse gas emissions. Integrating water use and energy policies can therefore achieve multiple benefits by focusing technological development on cost-effective efficiency improvements that will save water and energy, thereby promoting both economic and environmental quality goals.

Climate Change Poses Important Policy Challenges

Science is indicating that both the *rate* and *magnitude* of climate change are increasing. The most recent report of the Intergovernmental Panel on Climate Change in 2007 projected that the rate of warming over the 21st century—up to 11.5 degrees Fahrenheit—will be much greater than the observed changes during the 20th century.[116] It projected that these increased temperatures will result in more frequent hot extremes, heat waves, and heavy precipitation events; more intense hurricanes and typhoons; decreases in snow cover, glaciers, ice caps, and sea ice; and a rise in global mean sea level of 7 to 23 inches, without taking into account accelerated ice sheet melting and other factors.[117]

Climate models consistently indicate a warmer future for the U.S. West. Evidence of warming trends is already being seen in winter temperatures in the Sierra Nevada, which rose by almost 4 degrees Fahrenheit during the second half of the 20th century. Trends toward earlier snowmelt and runoff to the Sacramento–San Joaquin Delta over the same period have also been detected for over a decade.[118] Water managers are particularly concerned with the mid-range elevation levels where snow shifts to rain under warmer conditions, thereby reducing snow storage. California's Department of Water Resources has been tracking the climate science for years and has undertaken initial studies to build an understanding of potential impacts.[119]

This growing body of evidence regarding the impacts of climate change highlights the need for California to respond both by reducing its greenhouse gas emissions and by making plans to adapt to a warmer world with more limited and more uncertain water supplies.

The Connection Between Water and Energy—and the Need for Integration of California's Response Strategies to Climate Change

Water and energy systems are interconnected in a number of important ways. Developed water systems provide energy (e.g., through hydropower), and they consume energy through pumping, thermal, and other processes. In addition, both water and energy are often transported over long distances from their sources to the place where they are ultimately used. As technological capacity developed over the past century, surface water diversions, groundwater extraction, and conveyance systems increased in volume and geographic extent. Interbasin transfers (systems that move water from one watershed to another) supplemented water available within natural hydrological basins or watersheds, and agricultural and urban uses of arid lands were vastly extended by imported water. Similarly, energy systems have evolved from largely local sources a century ago to continent-wide electricity grids and pipeline networks, and to global supply lines.

The focus of technology development and policy for much of the past century has been on the supply side of both the energy and water equations. That is, the emphasis was on extracting, storing, converting, and conveying water and energy from natural systems to users. Water and energy policy throughout the world have generally been designed to facilitate the development and use of these supply-side technologies.

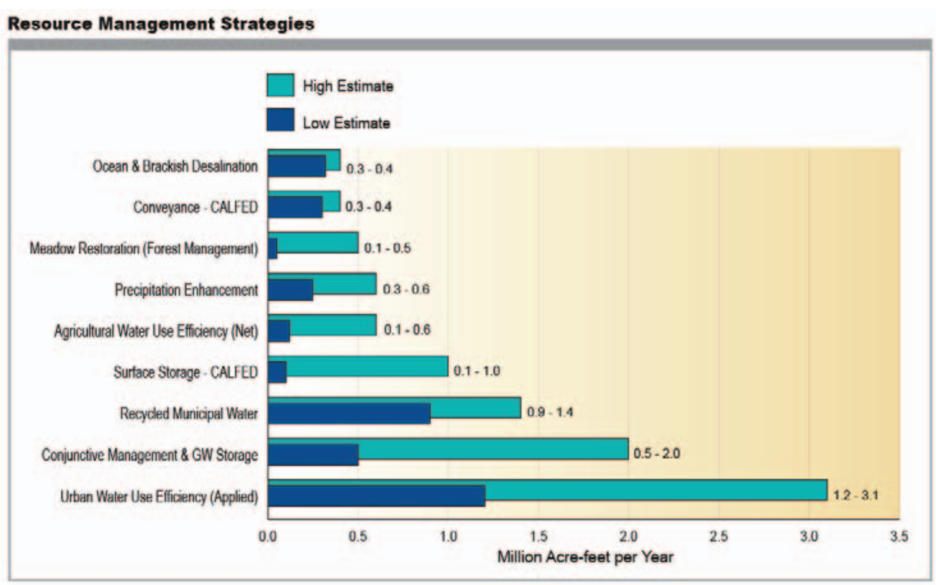
Today, however, the main constraints on water and energy *supply* are not technology limitations. The limits are increasingly imposed by competing claims on scarce water and energy resources, legal constraints, and environmental impacts. In the water supply arena, for example, the problem is not in the systems for getting water from sources to end users. To the contrary, there is significant spare capacity for pumping and conveyance in many areas. Moreover, the cost of building and maintaining infrastructure has also risen dramatically. The projected cost for simply maintaining existing water and wastewater systems is staggering, with the American Society of Civil Engineers estimating an annual need for over $30 billion to address water resource needs in the United States—$11 billion for safe drinking water systems and about $20 billion for properly functioning wastewater treatment systems—with about $1 billion more per year needed to repair unsafe non-federal dams, the number of which has increased by a third in the past decade.[120]

In the last quarter century, therefore, technological innovation has increasingly been applied to improvement of the *efficiency of use* of energy and water resources. ("*Efficiency*" as used here describes the useful work or service provided by a given amount of water or energy.) Significant potential economic as well as environmental benefits can be cost-effectively achieved through efficiency improvements in water and energy systems. Various technologies, from electric motors and lighting systems to pumps and plumbing fixtures have vastly improved end-use efficiencies. In the areas of end-use water applications and water treatment, innovation and the development of technology have progressed rapidly. Techniques and technologies ranging from laser leveling of fields and drip irrigation systems to the improved design of plumbing fixtures, industrial processes, and treatment technology have changed the demand side of the water equation. End-uses of water now require much less volume to provide equivalent or superior services. Rainwater capture for groundwater recharge and other innovative water capture strategies are also enhancing water supply reliability.[121] Water supply systems (e.g., treatment and distribution) are also becoming more efficient.

California is currently integrating water and energy policies to help promote such technological innovation to respond to climate change and to tap multiple other benefits. The state is looking at water delivery system and end-use efficiency improvements, source switching, and other measures that save energy by reducing pumping and other energy inputs. New approaches to the integration of water and energy planning, including policy processes at the California Energy Commission, Public Utilities Commission, Department of Water Resources, and the State Water Resources Control Board, are being developed. Methodologies for accounting for embedded energy, from initial extraction through treatment, distribution, end-use, wastewater treatment and discharge, have been developed.[122] Institutional collaboration between energy and water management authorities is also evolving.

Water Management and Supply Options for the Next 20 Years

Improvements in urban water use efficiency have been identified by the Department of Water Resources as California's *largest new water supply* for the next quarter century, followed by groundwater management and reuse.[123] The following graph indicates the critical role that water use efficiency will play in California's water future.



Source: California Department of Water Resources

At the same time, increases in water use efficiency will also help address the state's challenges regarding its *energy supply*. The California Energy Commission (CEC) and the California Public Utilities Commission (CPUC) have both concluded that energy embedded in water presents large untapped opportunities for cost-effectively improving energy efficiency and reducing greenhouse gas (GHG) emissions. As the CEC has noted, "[a]s California continues to struggle with its many critical energy supply and infrastructure challenges, the state must identify and address the points of highest stress. At the top of this list is California's water-energy relationship."[124]

Water use efficiency measures can play an important role in addressing energy challenges because water systems in California account for approximately 19% of the state's total electricity use, and about 33% of its non-powerplant natural gas use.[125] Water use (based on embedded energy) is the second or third largest consumer of electricity in a typical Southern California home, after refrigerators and air conditioners.[126] One report, prepared for Southern California Edison, estimated that the electricity required to support water service in the typical home in Southern California is between 14% to 19% of total residential energy demand.[127] The Metropolitan Water District of Southern California (MWD) similarly estimated that energy requirements to deliver water to residential customers equal as much as 33% of the total average household electricity use.[128] In homes without air conditioning, this figure is even higher.

California's water systems are uniquely energy-intensive due in large part to the pumping requirements of major conveyance systems, which move large volumes of water long distances and over thousands of feet in elevation lift. Although some of the state's interbasin transfer systems are net energy producers, like the San Francisco and Los Angeles systems that capture water at higher elevations and convey it by gravity, others, such as the State Water Project and the Colorado River Aqueduct, require large amounts of energy to convey water. The CEC has estimated that the energy used to pump and treat this water exceeds 6.5 percent of the total electricity used in the state per year,[129] while another study has put energy use for water conveyance, including interbasin water transfer systems, at about 6.9% of the state's electricity consumption.[130] The CEC study also noted that the State Water Project—the state-owned storage and conveyance system that transfers water from Northern California to various parts of the state including Southern California—is the largest single user of electricity in the state, accounting for 2% to 3% of all the electricity consumed in California.[131] The MWD report referenced above on the energy requirements of water delivery to residential customers similarly found that nearly three quarters of this energy demand is for pumping imported water.[132]

The magnitude of these figures suggests that *failing* to target embedded energy in water and wastewater systems, and *failing* to target energy savings derived from water efficiency improvements in water supply and energy programs, would be a policy opportunity lost. The state's policymakers have recognized this reality, in both the energy and water supply arenas. For example, the CEC recommended in its 2005 *Integrated Energy Policy Report* that "[t]he Energy Commission, the Department of Water Resources, the CPUC, local water agencies, and other stakeholders should explore and pursue cost-effective water efficiency opportunities that would save energy and decrease the energy intensity in the water sector."[133] DWR has adopted corresponding policy positions in its 2005 Water Plan Update[134] and 2009 Water Plan Update.[135]

Moreover, saving energy by increasing water use efficiency can be far more cost-effective than other efforts to reduce energy use. For example, the CEC found in connection with its 2005 *Integrated Energy Policy Report* that if the state's investor-owned energy utilities were allowed to invest in water use efficiency, they could meet their energy and demand-reduction goals planned for the 2006-2008 program period through reduced water use. Remarkably, the CEC staff found that doing so could achieve these energy reduction benefits at less than half the cost to electric ratepayers of traditional energy efficiency measures—while also supplementing water utilities' efforts to conserve water.[136]

Tapping Multiple Benefits Through Integrated Planning

Integrating water policy and energy policy can help promote these efficiency goals by focusing decision-makers on the multiple benefits that accrue from increasing water use efficiency. When the costs and benefits of a proposed policy or action are analyzed, we typically focus on accounting for costs, and then we compare those costs with a specific, well-defined benefit such as an additional increment of water supply. We often fail to account for other important benefits that accrue from well-planned investments that solve for multiple objectives. With a focus on *multiple benefits*, however, we account for various goals achieved through a single investment.

For example, improvements in water use efficiency—meeting the same end-use needs with less water—also typically provide related benefits such as reduced energy requirements for water pumping and treatment (with reduced pollution related to energy production as a result), and reduced water and wastewater infrastructure capacity and processing requirements. Efficiency improvements can achieve such benefits both upstream and downstream of the point of use when the energy consumption of both water supply and wastewater treatment systems are taken into account. Impacts caused by extraction of source water from surface or groundwater systems are also reduced. Water managers often do not receive credit for providing these multiple benefits when they implement water efficiency, recharge, and reuse strategies, however. From both an investment perspective and from the standpoint of public policy, the multiple benefits of efficiency improvements and recharge and reuse should be fully included in cost/benefit analysis.

Integrated planning and policies that account for the full embedded energy of water use thus have the potential to provide significant additional economic and environmental benefits, for both the public and private sectors. Methods, metrics, and data are available to provide a solid foundation for policy approaches to account for energy savings from water efficiency improvements. Policies can be based on methodologies and metrics that are already established.

The Role of Price Signals Coupled with Policy

Impetus for technological innovation to improve energy and water-use efficiency has been provided by both price signals (increasing costs) and public policy (e.g., requirements for internalization of external costs).

Price signals have shifted the focus of technological innovation from supply development to improving efficiency through simple economics. When water is cheap, there is little incentive to design and build water-efficient technologies. As the cost of water increases, technology options for reducing waste and providing greater end-use efficiency become more cost-effective and even profitable. Technologies for measuring, timing, and controlling water use, and new innovations in the treatment and re-use of water, are growing areas of technology development and application as water has become more costly.

Public policy has supplemented the role of price signals by increasingly incorporating costs that were previously external, including those of climate change, into resource prices. As water and energy prices begin to reflect the full costs of these resources, including environmental costs previously externalized, they increase.

At the same time, technology has provided a wide range of options for expanding the utility value of these resources through efficiencies—i.e., by requiring less water and energy to perform a useful service. New technologies have enhanced the ability to treat and reuse water, have improved energy efficiency, and have substituted new ways to provide services previously performed by water and energy. In an economic and resource management sense, such efficiency improvements are now considered as *supply* options, to the extent that permanent improvements in the demand-side infrastructure provide reliable water and/or energy savings. Broader application of these technologies and techniques can yield significant additional energy, water, economic, and environmental benefits.

Public policy can be designed to encourage "best management practices" by both water and energy suppliers and users. Appliance efficiency standards (for both energy and water) and minimum waste requirements are examples. Policy measures have also been used to frame and guide market signals by implementing mechanisms such as increasing tiered pricing structures, meter requirements (some areas do not even measure use), and other means to utilize simple market principles and price signals more effectively.

Most experts agree that coupling technology options such as efficient plumbing and energy-using devices to economic incentives (e.g. rebates) and disincentives (e.g. increasing tiered rate structures) is the best strategy. This coupling provides both the means to improve productive water and energy use and the incentive to do it.

Conclusion: Opportunities for Integrated Response Strategies

During the last century, the focus of technological innovation in water systems was on the extraction, storage, and conveyance of water. Huge dams, aqueduct systems, and "appurtenant" facilities were designed, financed, and built to accomplish the task. Major rivers were entirely de-watered. The costs—economic, environmental, and social—are evident.

More recently, public concern regarding the environmental and other costs of diverting and extracting water has led to a shift in technology focus from extraction to efficiency. Precipitous declines in populations of fish, and damage to ecosystems around the world, are among the concerns that have driven this growing call for more efficient and sustainable water systems.

Moreover, efficiency improvements achievable with current technology can provide water supplies at substantially *less cost* than the development of new supplies in most areas. As water prices increase to reflect full capital, operating, and environmental costs, it is likely that technology will play an even greater role in providing water efficiency improvements.

The focus on efficiency in water use also has the potential to provide significant benefits in addressing energy supply challenges as well. Given the huge embedded energy in our water systems used to transport, store, and treat water and wastewater, using less water means using less energy. And using less energy is central to California's efforts to reduce its greenhouse gas emissions, given the state's heavy reliance on fossil fuels for its power generation needs

Integrated water and energy management strategies—with a focus on vastly improved end-use and economic efficiency for both, and careful consideration of alternative technology opportunities provided by advances in science and technology—can thus provide significant *multiple benefits* to society. With better information regarding the energy implications of water use, and the water implications of energy use, public policy combined with investment and management strategies can dramatically improve productivity and efficiency. Cost-effective improvements in energy and water productivity, with associated economic and environmental quality benefits, and increased reliability and resilience of supply systems (all elements of the “multiple benefits”), are attainable. Potential benefits include improved allocation of capital, avoided capital and operating costs, and reduced burdens on rate-payers and tax-payers. Other benefits, including restoration and maintenance of environmental quality, can also be realized more cost-effectively through policy coordination.

Policy frameworks are critical to achieving these benefits based on advances in science and technology. Full benefits derived through integrated water/energy strategies have not been adequately quantified or factored into policy, however. In considering policy alternatives, decision-makers should carefully analyze and consider the potential multiple benefits available from such integrated strategies. Methodologies and metrics exist to tap the multiple benefits of integrated water/energy strategies, though they can and need to be improved. The policies required to incentivize, enable, and mandate integrated water and energy policy exist and are being refined to take advantage of ample opportunities to improve both the economic and environmental performance of water and energy systems.

The United States, like other nations, faces formidable challenges in providing water and energy to its citizens in the face of scarcity, rising costs, security threats, climate change, and much else. We are fortunate, however, to have the scientific and technological capacity, and the institutions of governance, to take on these difficult challenges.

CAN SALMON AND STEELHEAD WEATHER CLIMATE CHANGE?

By Paul Stanton Kibel

Paul Stanton Kibel

Introduction: As Instream Temperatures Rise

In terms of climate change law and policy, at present there are efforts underway at the state, federal and international levels to curb greenhouse gas (GHG) emissions. These efforts to reduce GHG emissions (and thereby mitigate global warming and other climate changes resulting from such GHG emissions) are generally referred to as “climate mitigation” laws and policies.

In addition to climate mitigation, however, there is increasing recognition that the global warming and climate changes resulting from past and present GHG emissions are happening now and will continue to happen for many decades to come, regardless of whether we are successful in curbing GHG emissions going forward. This recognition has led to the development of legal and policy responses to anticipate and plan for the global warming and climate changes that are taking place. Efforts to anticipate and plan for the effects of past and present GHG emissions are generally referred to as “climate adaptation” laws and policies.

In the water resources sector, to date much of the climate adaptation focus has been on water supplies for out-of-stream uses (such as agriculture and municipal/urban uses) and on instream use of water for hydroelectric facilities—that is, on how climate change is affecting the supply of water we use for irrigation, drinking water and electric power generation.

Less attention, however, has so far been given to how climate change is impacting and will continue to impact fisheries due to rising water temperatures. These impacts are particularly acute for coldwater fisheries such as salmon and steelhead trout, which have limited biological capacity to adapt when instream temperatures rise.

This portion of the article discusses this current gap in climate adaptation law and policy, with emphasis on the potential role that the National Environmental Policy Act (NEPA), Endangered Species Act (ESA) and California Environmental Quality Act (CEQA) could play in filling this gap. It focuses on the provisions in these laws that establish that agency planning and decision-making should be based on the best available science, and notes that the best available science now confirms that GHG emission-induced climate change is already happening and will continue during this century. The discussion posits that the most appropriate and effective way to factor expected climate change into NEPA, ESA and CEQA analyses and determinations may be through the use of “future baseline conditions” against which project impacts are evaluated. The use of such future baseline conditions can provide a legal mechanism to ensure that climate adaptation strategies to protect coldwater fisheries are properly incorporated into agency plans and projects.

Although the starting point for the discussion’s assessment is coldwater fisheries in California, this assessment identifies regulatory questions and offers recommendations that may apply to cold water fisheries in other states as well.

Assessments of Climate Change Impacts on Coldwater Fisheries: Dire Forecasts for Salmon and Steelhead

In recent years, leadings studies on water and climate change impacts in California have taken note of the nexus between rising instream temperatures and the fate of our state's coldwater fisheries. These studies present a dire picture of how climate change will impact these fisheries in the years ahead.

Recent Assessments

The Public Policy Institute of California reported in its 2011 book *Managing California's Water: From Conflict to Reconciliation* that "[w]arming is likely to significantly complicate the management of water to maintain adequate habitat for such fish as salmon and steelhead, now confined to the lower-elevation portions of rivers and streams because of dams . . . . The frequency of releases of warm water from reservoirs is likely to increase as conditions warm, increasing the temperatures of rivers and worsening conditions for many species of fish."[137]

The California Natural Resources Agency found in its 2009 *California Climate Adaptation Strategy* that "[i]n many low-elevation and middle-elevation streams today, summer temperatures often approach the upper tolerance for salmon and trout. Higher air and water temperatures will exacerbate this problem. Thus, climate change might require dedication of more water, especially cold water stored behind reservoirs, to simply maintain existing fish habitat."[138]

And in *Beyond Season's End: A Path Forward for Fish and Wildlife in the Era of Climate Change*, also published in 2009, a collaborative research initiative of conservation groups and the Association of Fish and Wildlife Agencies noted that "[w]ater temperature that is within the preferred range of coldwater fish, generally 50° to 65° F, may be the most critical characteristic of high-quality habitat. Physiological effects of warm water on trout and salmon include increased metabolic demands, increased stress due to reduced levels of dissolved oxygen [and] greater susceptibility to toxins, parasites and disease."[139]

Predictions for Coldwater Fisheries

Other studies have gone beyond acknowledging the general interrelationship between rising instream temperatures and declining coldwater fisheries, and have run more detailed simulations to quantify these effects. The results of these simulations reveal a grim scenario for our salmon and steelhead. For instance, Trout Unlimited found in its 2007 report *Healing Troubled Water: Preparing Trout and Salmon Habitat for a Changing Climate* that "[m]odels of Pacific Northwest salmon populations predict losses of 20-40% by the year 2050 because of the effects of climate change. In California, where high temperatures and water availability already pose a significant source of stress, greater declines are likely."[140] These findings echo those of a 2002 joint study by Defenders of Wildlife and the Natural Resources Defense Council (NRDC), titled *Effects of Global Warming on Trout and Salmon in U.S. Streams*, which estimated that "individual species of trout and salmon could lose 5-17% of their existing habitat by the year 2030, 14-34% by 2060, and 21-42% by 2090 . . . . For salmon, significant losses are projected throughout the current geographic range, with greatest losses expected for California."[141]

Methodologies to Downscale Global Warming to the Local Level

Our ability to anticipate (and therefore potentially plan for) the effects of GHG emission-induced global warming on coldwater fisheries has been greatly enhanced in recent years through the development of improved "downscaling" methodologies. "Downscaling" in context is the process of deriving finer-resolution data about warming impacts from a coarser-resolution data set. Such downscaling methodologies now enable climatologists to better predict the particular impacts of global warming on air and instream temperatures on a watershed basis, and even on a creek-by-creek or stream-by-stream basis. Such information, when considered alongside information regarding salmon and steelhead migration patterns and spawning locations and the specific temperature related tolerance/vulnerability of particular coldwater species, can provide the scientific basis for more localized and geographically specific climate adaptation strategies.

Downscaling tools are becoming more widely available for use in climate change planning. For example, the U.S. Department of Interior's Bureau of Reclamation, the Lawrence Livermore National Laboratory, the Santa Clara University Civil Engineering Department, Climate Central, and the Institute for Research on Climate Change and its Societal Impacts have teamed up to develop a data set of Global Climate Model simulation downscaled over the entire United States. The data set is available as a public archive, and it is increasingly being used in planning studies to characterize and analyze climate change impacts.[142]

These downscaling methodologies are now being incorporated into climate change/global warming assessments prepared by the California Climate Action Team (created by the California Governor's Executive Order S-3-05 in 2005) and the Cal-Adapt program of the California Energy Commission. For instance, in 2012 the California Natural Resources Agency (in conjunction with the Cal-Adapt program) co-authored the publication *California Adaptation Planning Guide: Understanding Regional Characteristics*. This publication included separate downscaled assessments of projected climate change impacts (including warming temperatures) for each of the different regions in the state.

Coldwater Fishery Climate Adaptation Strategies

In terms of on-the-ground (or perhaps 'on-the-river') strategies to maintain healthy salmon and steelhead fisheries in the face of rising instream temperatures, the literature suggests three primary alternatives. These climate adaptation strategy alternatives are not mutually exclusive and can be used in combination. If implemented, such adaptation strategies could help alleviate some of the adverse impacts that climate change will have on these species.

Reservoir Releases

Additional quantities of cold water from upstream dams/reservoirs can be released to reduce the temperature of downstream waters. The additional release of reservoir waters for this purpose may be resisted by existing agricultural and municipal water users of such waters, however.

Upstream Passage

The air and water temperatures in any given watershed tend to rise as the waters move further away from high elevation headwaters into lower reaches. To the extent that higher-elevation reaches of a watershed have lower instream water temperatures, one strategy to counter higher downstream water temperatures is to provide salmon and steelhead with improved access upstream. Presently access to such higher-elevation upstream reaches is often blocked by dams that provide little or no fish passage. Implementing this climate adaptation strategies for coldwater fisheries may therefore require modifying (or in some cases removing) existing dams. The modification and/or removal of dams for this purpose may be resisted by the owners of such dams and by water users and hydroelectric consumers that may be impacted by such changes.

Riparian Shading

Particularly in the narrower and bankside reaches of streams and creeks that support salmon and steelhead runs, trees and vegetation can provide enhanced shading that keeps instream temperatures cooler. The coldwater fishery benefits of enhanced riparian shading can be particularly pronounced for those waters that serve as spawning grounds, given the particular vulnerability of salmon and steelhead eggs to higher instream temperatures. Whether such riparian/bankside areas are located on private or public lands, the question arises as to how to fund (and who should fund) such riparian shading projects.

Coldwater Fishery Climate Change Adaptation under NEPA, the ESA and CEQA

Despite the consistent warnings that scientists have been providing for more than a decade about the threat climate change poses for coldwater fisheries, our environmental laws—and the government agencies tasked with implementing them—have been somewhat slow to react. Laws such as NEPA, the ESA and CEQA are flexible enough in their design to allow agencies to effectively analyze and address emerging conditions like climate change, but to date climate adaptation has not been addressed in such a manner. Nevertheless, the potential for these laws to be used to identify and implement effective climate adaptation strategies exists. Several recent developments suggest that, going forward, agencies may be more prepared to acknowledge and take into account the emerging scientific evidence on climate change impacts on coldwater fisheries.

One potential legal mechanism to do so is to include projected instream warming and related impacts in the baseline conditions under which NEPA and CEQA environmental analyses are performed. If such impacts are included in the environmental baseline against which the impacts of water resource projects are evaluated, then the projects can incorporate needed adaptation measures to help impacted fisheries survive in a warmer climate.

National Environmental Policy Act (NEPA)

NEPA requires federal agencies to evaluate the environmental impacts of actions that they approve or carry out. There are several types of federal agency actions subject to NEPA environmental review that may involve impacts on coldwater fisheries, including water storage and diversion facilities operated by the United States Bureau of Reclamation (such as dams/pumps that are part of the Central Valley Project in California) and on-stream hydroelectric projects licensed by the Federal Energy Regulatory Commission (FERC).

There are presently no provisions in the NEPA statute, in the Council on Environmental Quality (CEQ) NEPA implementing regulations, or in formal NEPA policy guidance that explicitly address the issue of climate adaptation—i.e., the extent to which NEPA environmental impact assessment documents can or must consider the ways in which anticipated changes resulting from GHG emissions are expected to alter the environmental effects of a particular project. The current absence of any explicit guidance does not mean that the issue of climate change adaptation has not arisen in the NEPA context, however. The CEQ has issued draft guidance suggesting that federal agencies consider how climate change will affect a project's environmental impacts, and that considering climate change in the articulation of baseline conditions may be an appropriate way to accomplish this result. Subsequent NEPA analyses for specific projects affecting coldwater fisheries have been something of a mixed bag, however, with some failing to address climate change impacts on fish habitat altogether, and others doing so in a stand-alone fashion that is detached from the core elements of the environmental impact assessment.

- *2010 Draft NEPA Guidance on Climate Adaptation*

In February 2010, the CEQ released its *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions (2010 Draft NEPA Guidance)*.[143] Although to date no action has been taken to formally adopt this draft guidance, the document offers some insight into how the CEQ believes that climate adaptation considerations should be incorporated into NEPA documents.

The *2010 Draft NEPA Guidance* recognizes that the NEPA process can be used "to reduce vulnerability to climate change impacts, adapt to changes in our environment, and mitigate the impacts of Federal agency actions that are exacerbated by climate change."[144] The document goes on to recommend that that the articulation of "baseline conditions" may be the appropriate place in NEPA analysis to factor in the anticipated effects of global warming. More specifically, the *2010 Draft NEPA Guidance* states "it may also be useful to consider the effects of any proposed action or its alternatives against a **baseline** of reasonably foreseeable future conditions that is drawn as distinctly as the science of climate change effects will support."[145] That is, instead of evaluating the environmental effects of a proposed action solely against the conditions that exist at the time the NEPA document is prepared, it may be advisable to evaluate such environmental effects against the conditions that are expected to exist in the future as a result of climate change.

The *2010 Draft NEPA Guidance* also notes that in projecting the impact of climate change on environmental conditions, "the outputs of coarse-resolution global climate models, commonly used to project climate change scenarios at a continental or regional scale, require **downscaling** . . . before they can be used in **regional** or **local** impact studies."[146] The document acknowledges, however, that that NEPA incorporates a "rule of reason" regarding the extent of research and analysis that an agency must undertake in its environmental analyses, and recognizes that "agencies need not undertake exorbitant research or analysis of projected climate change impacts in the project area or on the project itself . . . ." The development and availability of downscaling data and methodologies, such as the one developed by the U.S. Department of the Interior/Lawrence Livermore National Laboratory (discussed above), may make is increasingly difficult for federal action agencies to credibly claim that "exorbitant" research and analysis is required to downscale projected climate change impacts to the regional or local level.

Although the CEQ has not yet finalized this draft guidance, the preparation of the draft evidences the CEQ's growing recognition that, for NEPA to remain scientifically credible, climate adaptation considerations must be factored into the NEPA environmental assessment process. The draft guidance also reflects the CEQ's initial thinking that use of future environmental baselines may be the most appropriate way to achieve this incorporation.

- *2012 FERC EIS for Licensing of Middle Fork American River Hydroelectric Project*

In July 2012, FERC released its Draft Environmental Impact Statement (DEIS) in connection with a hydropower license for the Middle Fork American Hydroelectric Project in California. The project will impact coldwater salmon and steelhead fisheries on the American River, and it is projected to have a lifetime of 30 to 50 years based on the terms of the license. Although the DEIS recognizes that climate change is an important environmental challenge facing these fisheries,[147] FERC did not follow the future baseline approach to climate adaptation recommended by the CEQ in the *2010 Draft NEPA Guidance*.

FERC did undertake an analysis of the effects of the proposed project on instream water temperatures, and it acknowledges the relationship between instream water temperature and coldwater fisheries. To address the potential water temperature impacts of the project, the DEIR calls for implementation of a proposed "Water Temperature Monitoring Plan" to "confirm whether flows are protective of the basin plan designated beneficial uses of cold freshwater habitat . . . ," which would be used as a "key input" to monitor project impacts on coldwater fisheries whose "distribution and population vitality . . . are strongly related to water temperature."[148] But the document analysis relied on "**existing** conditions" as the benchmark for evaluating the impacts of the project on instream temperature change and resulting impacts on coldwater fisheries. That is, in contrast to the climate adaptation approach suggested in the *2010 Draft NEPA Guidance*, the FERC DEIS does not adopt a baseline (for instream water temperatures) that reflects the anticipated rise in instream water temperatures due to GHG emissions that is expected to occur during the 30-50 year term of the licensed project.

Additionally, the *2012 Draft FERC DEIS* analysis makes no attempt to downscale the effects of climate change on increased instream water temperatures in the project area, nor is there analysis of the effects of such increased instream water temperatures on coldwater fisheries in the project area. As a result, no alternatives or mitigation were proposed in the *2012 Draft FERC DEIS* to explicitly address these climate adaptation considerations.

- *2012 Bay Delta Conservation Plan Draft Joint EIS/EIR*

In February 2012, the California Natural Resources Agency released its administrative draft of the Joint EIR/EIS for the Bay Delta Conservation Plan (BDCP) prepared pursuant to NEPA and CEQA. The BDCP proposes (among other things) a new "isolated conveyance facility"—a canal and/or tunnel—that would divert substantial portions of water from the higher elevation/upstream reaches of the Sacramento River. This proposed isolated conveyance facility would replace current water diversions that occur in the lower elevation/downstream reaches of the Sacramento River near the Bay Delta are where the Sacramento and San Joaquin Rivers converge.

One of the rationales presented for the BDCP isolated conveyance facility was that fewer juvenile salmon and steelhead were anticipated to become entrained in the diversion pumps if the pumps were relocated further upstream. However, as noted above, the higher elevation/upstream reaches of a watershed tend to have colder instream temperatures than the lower elevation/downstream reaches. Therefore, while the relocation of diversion structures to points further upstream may reduce entrainment of salmon and steelhead, the increased diversion of the colder water upstream (in areas that are prime coldwater fishery habitat) could have other potential adverse impacts on salmon and steelhead.

The *2012 BDCP EIR/EIS* devotes a chapter to climate change adaptation considerations. The chapter "analyzes changes in future climate that could affect the water conveyance facilities and natural resources in the Plan Area," and evaluates how the various action alternatives evaluated in the EIR/EIS would affect the project area's resiliency to climate change impacts. In doing so, the document explains that "[t]he **current** environmental setting for climate change is the **baseline conditions** detailed in the other resource chapters."[149]

The *2012 BCDP EIR/EIS* finds that "future changes in water temperatures of rivers below Central Valley Project (CVP) and State Water Project (SWP) reservoirs are likely to occur as a result of the combination of changes in reservoir operations caused by the BDCP Delta operations and by climate change effects."[150] It notes further that such increased water temperatures "may have adverse effects on fish spawning (reduced egg survival) and may reduce the habitat zone (reduced abundance) of fish that are sensitive to high temperatures . . . ."[151] It also projects that less water may be available from the reservoir each year as a result of such impacts, because "[i]ncreased water temperatures can alter reservoir stratification and reduce the cold water volume (i.e. volume with temperatures of less than 55°), which may increase the minimum carryover storage required to protect downstream fish spawning and rearing."[152] But the document concedes that none of the project alternatives considered would "provide additional resiliency to this climate change effect."[153]

In this instance, while the NEPA document did not adopt the future baseline suggested in the *2010 Draft NEPA Guidance*, it nonetheless did contain some substantive analysis of how global warming is expected to increase instream water temperatures in the project area, and these projected increases in instream water temperatures were then considerations built into the models to assess the impacts of the BDCP alternatives on coldwater fisheries. Moreover, the document contains an express acknowledgement that the BDCP as currently conceived does not include measures/components to increase the ability of coldwater fisheries to adapt to such rising instream temperatures.[154]

On the one hand, therefore, the draft *2012 BDCP EIR/EIS*' inclusion of more substantive analysis of climate change impacts on instream water temperatures and coldwater fisheries can be seen as an improvement over the NEPA analysis in the *2012 Draft FERC DEIS* discussed above. However, there still remains a disconnect between this climate adaptation analysis and the alternatives and mitigation set forth in the draft *2012 BDCP EIR/EIS*. That is, the analysis did not lead to the inclusion of appropriate climate adaptation strategies, alternatives or mitigation in the proposed project (e.g. additional reservoir releases, improved upstream passage, expanded riparian shading on creeks/streams).

This disconnect appears to have been by design rather than by oversight, as the introductory section to the climate change adaptation chapter in the *2012 Draft BCDP EIR/EIS* acknowledges that:

> This chapter is organized differently from the other resource chapters because analyzing the effect of climate change on the study area is a fundamentally different analysis than those presented in the other resource chapters. Whereas the other chapters are organized to identify effects of the action alternatives and how to mitigate them, this chapter's function is to analyze and disclose how the action alternatives affect the project area's resiliency to expected changes in climate.[155]

This acknowledgement evidences the ways that, even within NEPA documents, climate adaptation unfortunately continues to be treated as a stand-alone question somehow unrelated to traditional NEPA environmental impact assessment rather than a critical component of such assessment.

Endangered Species Act (ESA)

The ESA requires, among other things, that federal agencies ensure that any actions they approve or carry out will not jeopardize the continued existence of any endangered or threatened species, or result in adverse impacts such species' critical habitat.[156] These federal agency responsibilities are administered jointly by the United States Fish and Wildlife Service (FWS) and the National Marine Fisheries Services (NMFS). There are several types of FWS/NMFS actions under the ESA that may involve assessment of impacts on coldwater fisheries, including issuance of "Biological Opinions" (BiOps) regarding whether federal agency actions will cause "jeopardy" to a listed species or adversely modify the species' critical habitat; decisions on whether to list or delist species as "endangered" or "threatened"; and approval of incidental take permits and habitat conservation plans. Several recent court cases have determined that FWS and NMFS needs to take into account the growing body of scientific evidence regarding the effects of climate change when taking such actions. These decisions bode well for the prospects of incorporating climate change adaptation into water resource management decisions affecting coldwater fisheries.

- *Litigation on Bay Delta NMFS/FWS Biological Opinions*

In the past decade, there has been extensive ESA litigation over the effects of the federal Central Valley Project and California's State Water Project on the condition of salmon, steelhead and smelt fisheries in the Sacramento River/San Joaquin River/San Francisco Bay Delta watershed. The litigation has challenged the BiOps issued by FWS and NMFS evaluating the projects' impacts on these species and their habitat. In two prominent decisions—*NRDC v. Kempthorne*, 506 F.Supp.2d. 322 (2007), and *Pacific Coast Federation of Fishermen's Association (PCFFA) v. Gutierrez*, 606 F. Supp.2d. 1122 (2008)— former Judge Oliver Wanger of the U.S. District Court for the Central District of California invalidated the BiOps because they failed to adequately address the anticipated effects of climate change on the habitat of the endangered coldwater fisheries.

In *NRDC v. Kempthorne*, the court observed that there were a number of studies in the record predicting that anticipated climate change will adversely impact future water availability, which suggested that that climate change will be an important aspect of the problems facing fish species in the project area that should be analyzed in the BiOp. But the BiOp did not provide any meaningful discussion of the issue, and failed to evaluate the potential effect of climate change on Delta hydrology. The court therefore held that FWS acted arbitrarily and capriciously, explaining that "[t]he absence of any discussion in the BiOp of how to deal with climate change is a failure to analyze a potential 'important aspect of the problem.' "[157]

In PCFFA v. Gutierrez, the court noted readily available scientific data showing that climate change is projected to greatly reduce the Sierra snowpack and summer stream flow. But the BiOp did not discuss this data or indicate that NMFS had considered it. Instead, the BiOp relied on past hydrology and temperature models that assumed that historical temperature, hydrologic and climate conditions experienced from 1922 through 1994 will continue for the 25-year duration of project operations.[158] The court set aside the BiOp and remanded it back to NMFS to address these deficiencies.

These cases do not explicitly hold that BiOps must consider the effects of GHG-emission-induced rising instream temperatures on coldwater fisheries protected under the ESA. Nevertheless, the cases do establish generally that ESA BiOps may not lawfully rely on historical data regarding instream flow and temperatures if there is substantial evidence that such flow and temperatures will be significantly altered by global warming during the term of the project.

- *Litigation on Proposed Grizzly Bear Delisting*

In its 2011 decision in *Greater Yellowstone Coalition v. Servheen*, 665 F.3d 1015, the Ninth Circuit Court of Appeals affirmed a Montana district court ruling that blocked the FWS from removing Yellowstone grizzly bears from the ESA's threatened species list because the agency had failed to consider the potential impacts of climate change on the bears' continued survival.

The FWS has delisted the grizzly bears in the Greater Yellowstone Area based on an increase in their population from between 136-250 at the time of the listing in 1975 to around 580 in 2007. The district court invalidated the delisting because it found that the FWS had failed to adequately consider the anticipated impacts of global warming on the whitebark pine, an important food source for grizzly bears. In affirming this ruling, the Ninth Circuit noted that the FWS itself had found that whitebark pine seeds were a food source important to grizzly bear survival; that a well-documented association exists between reduced whitebark pine seed abundance and increased grizzly mortality; and that global warming was expected to lessen whitebark pine abundance. The Ninth Circuit went on to find that "the best science indicates that whitebark pines are expected to decline" due to global warming, and that the FWS failed to articulate "a rational connection" between the best available science and the conclusion that grizzly bears would be able to adapt to the decline of whitebark pines.[159] The Ninth Circuit explained that the FWS "must rationally explain why the uncertainty regarding the impact of whitebark pine loss on the grizzly counsels in favor of delisting now, rather than, for example, more study. . . . Otherwise, we might as well be deferring to a coin flip."[160]

The decision in *Greater Yellowstone Coalition* did not directly address fisheries, fisheries habitat or rising instream temperatures. However, the case does stand for the more general proposition that to the extent best available science indicates that anticipated global warming may affect the survival of a particular species protected under the ESA, a decision by FWS or NMFS to delist a particular species must directly and meaningfully address such impacts and provide a rational explanation for why delisting is nonetheless warranted.

<u>*California Environmental Quality Act (CEQA)*</u>

There are many types of projects that may impact coldwater fisheries that are subject to CEQA review, including California Department of Water Resources (DWR) water storage and diversion projects; projects involving appropriative diversion and storage rights for surface water; projects requiring streambed alteration agreements from the California Department of Fish and Wildlife; and logging activities in areas near streams that support coldwater fisheries requiring California Department of Forestry approval of a timber harvesting plan. As with NEPA, however, there are presently no statutory or regulatory provisions in CEQA or the CEQA Guidelines that explicitly address the issue of climate adaptation—i.e., the extent to which CEQA environmental impact assessment documents must consider how climate change may alter the environmental effects of a particular project. Nevertheless, the recent Court of Appeal decision in *Neighbors for Smart Rail v. Exposition Metro Line Construction Authority* (*Smart Rail*) (2012) 204 Cal.App.4th 1480—in which the court affirmed the use of a "future baseline" approach to CEQA similar to the approach proposed in the CEQ's *2010 CEQA Draft NEPA Guidance* discussed above—may shed some light on how to approach climate adaptation considerations under this statute.

The *Smart Rail* case involved a challenge to the baseline conditions used in an EIR addressing the impacts of an urban rail transportation project in Los Angeles. Under Section 15125 of the CEQA Guidelines, the environmental conditions "as they exist at the time" of the EIR "will normally constitute the baseline physical conditions by which a lead agency determines whether an impact is significant." In *Smart Rail*, however, the lead agency departed from the default "existing conditions" approach set forth in Section 15125 in its analysis of traffic levels, and instead relied upon future anticipated population growth to establish the "baseline" traffic conditions against which it evaluated the project's impacts. The petitioner challenged this "future baseline" under CEQA, but the Court of Appeal disagreed and upheld the use of the future baseline approach. The court reasoned that the conditions that existed at the time of the EIR will no longer exist when the project comes online and over the life of the project, and so reliance on the existing conditions at that time "would rest on the false hypothesis that everything will be the same 20 years later."[161] The court continued: "The important point, in our view, is the reliability of the projections and the inevitability of the changes on which those projections are based. . . . Population growth, with its concomitant effects on traffic and air quality, is not hypothetical in Los Angeles County; it is inevitable."[162]

Smart Rail's holding on future baseline conditions provides a potential roadmap for how to address projected climate change impacts in the context of CEQA EIRs. As a result of the work of the United Nations Intergovernmental Panel on Climate Change and other scientific bodies, there now appears to be substantial evidence of the inevitability of certain projected climate-change-induced alterations in the physical environment, such as higher instream temperatures. What *Smart Rail* suggests is that the appropriate place in a CEQA EIR to account for anticipated climate change impacts on the location where a project is proposed may be through the lead agency's reliance on "future baseline conditions" for its environmental analysis.

The California Supreme Court has granted cert to review *Smart Rail* and the California Court of Appeal decision has been depublished pending this appeal, so it remains to be seen whether the Court of Appeal's acceptance of the use of future baseline conditions will be affirmed. Notably, however, the Association of California Water Agencies (ACWA) filed an amicus brief with the California Supreme Court that speaks directly to the potential impact of the case on CEQA EIRs involving water resources. ACWA's brief advocated for affirming *Smart Rail* not because of the organization's concerns regarding coldwater fisheries, but rather to help better insulate water agencies (some of whom operate large-scale water diversion and storage projects) from future liabilities for water resource impacts caused by climate change. These motivations aside, the ACWA amicus brief argues that "[b]oth common sense and scientific methodology lead to the conclusion that, in appropriate circumstances, a future or predicted baseline must be utilized because a comparison to conditions at the time the CEQA document is prepared will not result in an accurate portrayal of actual conditions against which the project will operate."[163] The ACWA brief further explained that public water infrastructure projects often will not come on line for many years and then will operate for many decades, and that during that time "**ambient conditions** in the project vicinity often change significantly from those in existence at the time of project approval."[164]

Although the ACWA brief does not specifically mention climate change or global warming, its argument regarding changed "ambient conditions" appears to encompass these changes. A reformulation of ACWA's point in the context of salmon and steelhead might therefore be that evaluating the operational impact of water storage/diversion projects (such as California's State Water Project or the federal Central Valley Project) against a baseline of anticipated higher instream temperatures will result in a more accurate assessment of the impact of these projects on the coldwater fisheries present in the waters diverted/stored during the extended lifetime of the project.

Conclusion: Moving Climate Adaptation Into the Mainstream of Environmental Law

The impact of climate-change-induced rising instream temperatures is likely to be devastating on coldwater fisheries such as salmon and steelhead unless effective climate adaptation strategies are implemented. These climate adaptation strategies include increased releases of coldwater from upstream reservoirs to downstream waterways, improved fishery passage around existing dams to reach colder upstream waters, and increased shading along streams and creeks whose waters serve as coldwater fishery spawning grounds.

Although there are now improved data and methodologies to downscale the effects of climate change to anticipate temperature rises in particular watersheds and rivers/streams, and although there is now an improved scientific understanding of how rising instream temperatures adversely affect coldwater fisheries, we are still at a relatively early stage in terms of integrating such information and analysis into environmental laws such as NEPA, the ESA and CEQA.

Going forward, if NEPA, the ESA and CEQA are interpreted to require more quantified analysis of the impacts of rising instream temperatures on coldwater fisheries, and also to require formulation of specific project design and mitigation measures to address such impacts, these laws may play an increasingly important role in the development and implementation of effective climate adaptation strategies to help California's already imperiled salmon and steelhead fisheries weather the hotter days that lie ahead.

ENDNOTES

* Roger B. Moore is a partner at Rossmann and Moore, LLP, in Berkeley. He can be reached at rbm@landwater.com.

† Katherine A. Spanos is Senior Staff Counsel at the California Department of Water Resources in Sacramento. Ms. Spanos' portion of the article was developed as a result of two panel discussions in which she participated. The first was a panel for the American Bar Association's Section of Environment, Energy and Resources in March of 2012 on the subject *The Climate has Changed: Now what*? The second was the panel at the 2012 Environmental Law Conference at Yosemite® in which she participated with the other authors. The opinions expressed herein are those of the author and do not necessarily reflect those of the Department of Water Resources or any other entity.

‡ Robert Wilkinson, Ph.D., is Adjunct Associate Professor at the Donald Bren School of Environmental Science and Management, and teaches in the Environmental Studies Program at the University of California, Santa Barbara. He can be contacted at Wilkinson@es.ucsb.edu.

§ Paul Stanton Kibel is an Associate Professor at Golden Gate University School of Law. Professor Kibel's portion of the article is based on a paper entitled *Coldwater Fisheries in Hot Water* that he presented at the panel at the 2012 Environmental Law Conference at Yosemite® in which he participated with the other authors. In fall 2013, University of Maine School of Law's Ocean and Coastal Law Journal will publish an expanded version of this article, entitled *A Salmon Eye Lens on Climate Change.*

1. B. DeVoto, The West Against Itself (Harper's 1947).
2. See W. Kahrl, Water and Power, p. 1 (1983) (describing "the history of California in the twentieth century" as "the story of a state inventing itself with water"); pp. 201-202 (quoting official invitations for the Los Angeles Aqueduct opening ceremony, and William Mulholland's remarks at that ceremony).
3. R. Wilkinson, *Comments Submitted to DWR Regarding the California Water Policy Planning Process and Bulletin 160-2003* (March 19, 2000).
4. Natural Resources Agency, *2009 California Climate Adaptation Strategy*, p. 22, available at www.energy.ca.gov/2009publications/CNRA-1000-2009-027/CNRA-1000-2009-027-F.PDF.
5. M. Hanemann, D. Lambe, & D. Farber, *Climate Vulnerability and Adaptation Study for California: Legal Analysis of Barriers to Adaptation for California's Water Sector*, California Energy Commission white paper, p. 4 (July 2012), available at www.energy.ca.gov/2012publications/CEC-500-2012-019/CEC-500-2012-019.pdf.
6. See P.C.D. Milly, *Stationarity is Dead: Whither Water Management?*, 319 Science 573, 573 (2008); R.K. Craig, '*Stationarity is Dead'—Long Live Transformation: Five Principles for Climate Change Adaptation Law,* 34 Harv. Envtl. L. Rev. 9, 15 (2010); C. Brickely, et al., *How to Take Climate Change Into Account: A Guidance Document for Judges Adjudicating Water Disputes*, 40 E.L.R. 11215, 11223 (2010).
7. Milly, *supra* note 6, p. 573.
8. Many of the watersheds most affected by climate warming are the most valuable for water resources and for ecosystem services, including the American, Yuba, Feather, Stanislaus, King, and San Joaquin Rivers. See S. Null, J. Viers, & J. Mount, *Hydrologic Response and Watershed Sensitivity to Climate Warming in California's Sierra Nevada*, PloS ONE 5(4) (2010), available at www.plosone.org/article/info:doi/10.1371/journal.pone.0009932.
9. S. Cloern, et al., *Projected Evolution of California's San Francisco-Bay Delta-River System in a Century of Climate Change*, PLoS ONE 6(9) (2011), available at www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0024465.
10. R. Shibatani, *Climate Change and Water: Ongoing*

Opportunities for Regulatory Discretion, paper presented at the Argent Communications Group's California Water Law and Policy Conference (San Francisco, Apr. 13, 2013), p. 9.3.6; see also S. Null & J. Viers, *Water and Energy Sector Vulnerability to Climate Warming in the Sierra Nevada: Water Year Classification in Non-Stationary Climates*, California Energy Commission Pub. No. CEC-5-2012-015 (2012) (analyzing consequences of climate change for water year classifications in the Sacramento Valley and San Joaquin Valley).

11. Craig, *supra* note 6, p. 30 (quoting D. Farber, *Rethinking the Role of Cost-Benefit Analysis*, 76 U.Chi. L. Rev. 1355, 1400 (2009) (climate change adaptation requires recognition that "the status quo will become unsustainable due to climate change")).

12. Department of Water Resources, *Managing an Uncertain Future*, p. 4 (2008) (emphasis added), available at www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf.

13. L. Brekke, *et al.*, *Climate Change Impacts Uncertainty for Water Resources in the San Joaquin River Area, California,* Paper No. 02103 of the *Journal of the American Water Resources Association* (2004), *reprinted in* Department of Water Resources, *2005 California Water Plan Update*, Vol. 4.

14. *Natural Resources Defense Council v. Kempthorne*, 506 F.Supp.2d 322, 368 (E.D. Cal. 2007) (rejecting use of past hydrology over 20-year planning horizon); *Pacific Coast Fed'n of Fishermen's Ass'ns v. Gutierrez*, 606 F.Supp.2d 1122, 1183-1184 (E.D. Cal. 2008) (25-year planning horizon).

15. *South Yuba River Citizens League v. National Marine Fisheries Serv.*, 2010 U.S. Dist. LEXIS 67796, *74-75 (E.D. Cal. July 8, 2010) (finding biological opinion arbitrary and capricious under *Kempthorne* and *Gutierrez* because it failed to address extra-record study on potential of climate change to alter flow regimes); *Voices for Rural Living v. El Dorado Irrigation Dist.*, 209 Cal.App.4th 1096, 1113 (2012) (finding inconsistency, in CEQA exemption case, between agency's reliance on "past historical use and supply" in its project decision and the conclusion in its Drought Preparedness Plan that "plausible future conditions associated with climate change expose all future plans and decisions to a level of vulnerability and risk that should be considered as part of rational policy setting").

16. Health & Saf. Code § 38501 (water-related risks of climate change include "a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems").

17. Department of Water Resources, *Progress in Incorporating Climate Change into Management of Water Resources*, p. 2-6 (2006); *Managing an Uncertain Future*, *supra* note 12, p. 3. On the State Water Project's historic deliveries, see *Planning and Conservation League v. Department of Water Resources* 83 Cal. App. 4th 892 (2000).

18. *Managing an Uncertain Future*, *supra* note 12, p. 5.

19. *Ibid.*

20. *Id.,* p. 6.

21. *Id.*, pp. 7-8.

22. Department of Water Resources, *Using Future Climate Projections to Support Water Resources Decision-Making in California*, California Climate Change Center report, p. 24 (May 2009).

23. *Id.,* pp. 25, 26.

24. K. Koczot, S. Markstrom, & L. Hay, *Watershed scale response to climate change—Feather River Basin, California* (USGS, 2012).

25. *Managing an Uncertain Future*, *supra* note 12, p. 7; see also M. Guegan, K. Madani, & C. Uvo, *Climate Change Effects on the High-Elevation Hydropower System with Consideration of Warming Impacts on Electricity Demand and Pricing*, California Energy Commission white paper (July 2012); available at www.energy.ca.gov/2012publications/CEC-500-2012-020/CEC-500-2012-020.pdf.

26. *Using Future Climate Projections*, *supra* note 22, p. 7.

27. See, e.g., L.C. Peterson & G.H. Haug, *Climate and the Collapse of Maya Civilization*, 93 American Scientist 322, 329 (2005); H. Weiss, *What Drives Societal Collapse*?, 291 Science 609-610 (2001); J. Diamond, Collapse (2005); J. Powell, Dead Pool (2010); C. Childs, House of Rain (2008).

28. J. Lund, *Climate Change and California Water,* blog post, California Water Blog (January 13, 2013), available at http://californiawaterblog.com/2013/01/13/climate-change-and-california-water-past-present-and-future/.

29. S. Weiss, quoted in R. Conniff, *When Civilizations Collapse* (Environment Yale 2012), available at http://environment.yale.edu/envy/stories/when-civilizations-collapse/. See also S.K. Tanaka, et al., *Climate Warming and Water Management Adaptation for California*, Climatic Change, Vol. 76, No. 3-4, pp. 361-387 (June 2006); J. Medellin-Azuara et. al., *Adaptability and Adaptations of California's Water Supply System to Dry Climate Warming*, Climatic Change, Vol. 87, Sup.1, March, pp. S75-S90 (2008).

30. See R. Glennon, Unquenchable (2009) ("[w]ater policy suffers from a profound discontinuity between science and law").

31. J. Lund, *et al.*, *Water Management Lessons for California from Statewide Hydro-Economic Modeling* (U.C. Davis, 2009), *reprinted in* Department of Water Resources, *2009 California Water Plan Update*, vol. 4, p. 5.

32. *Id.*, p. 4.

33. The central conclusions of these reports are summarized in *Our Changing Climate 2012: A Summary Report on the Third Assessment*, available at www.climatechange.ca.gov/adaptation/third_assessment.

34. *See, e.g.*, S.E. Null and J.H. Viers, *Water and Energy Sector Vulnerability to Climate Warming in the Sierra Nevada: Water Year Classification in Non-Stationary Climates*, California Energy Commission white paper, p. 3 (July 2012), available at www.energy.ca.gov/2012publications/CEC-500-2012-015/CEC-500-2012-015.pdf.

35. U.S. Environmental Protection Agency & California Department of Water Resources, in partnership with U.S. Army Corps of Engineers & Resources Legacy Fund, *Climate Change Handbook* (2011). The *Climate Change Handbook* and a searchable database of climate change resources are available at www.water.ca.gov/climatechange/CCHandbook.cfm.

36. D. Farber, *Uncertainty*, 42 E.L.R. 10725, 10732 (2012).

37. D. Farber, *Adaptation Planning and Climate Impact Assessment: Learning From NEPA's Flaws*, 39 E.L.R. 10614, 10616 (2009).

38. D. Cusick, *Investor Group Calls for Water Utilities to Be More Open About Climate Risks*, E&E Climate Wire (Apr. 4, 2013), available at www.eenews.net/stories/1059978868; CERES, *Murky Waters? Corporate Reporting on Water Risk*, pp. 22-23 (Feb. 2010), available at www.ceres.org/resources/reports/corporate-reporting-on-water-risk-2010/view.

39. Securities and Exchange Commission, *Commission Guidance Regarding Disclosure Related to Climate Change; Final Rule*, 75 Fed. Reg. 6290, 6291 (Feb. 8, 2010).

40. Wat. Code § 10530, *et seq*.

41. D. Farber*, The Challenge of Climate Change Adaptation: Learning from National Planning Efforts in Britain, China, and the United States,* 23 J. Envtl. L. 359 (2011).

42. E. Conrad, *Climate Change and Integrated Regional Water Management in California—A Preliminary Assessment of Approaches*, p. 26 (U.C. Berkeley, 2012).

43. *Id.*, pp. 47-48.

44. Department of Water Resources, *Oroville Facilities Relicensing—FERC Project No. 2100 Final Environmental Impact Report*, p. 3-29 (June 2008) (claiming the hydrologic variability "that has occurred over the last 100 years is expected to continue into the foreseeable future…"). This author (R. Moore) represents one of the petitioners in the pending challenge to that EIR. See *County of Butte, et al. v. Department of Water Res.*, No. C071785 (Third App. Dist.).

45. Department of Water Resources, *Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) And Associated Actions As part of a Settlement Agreement (Monterey Plus), Final Environmental Impact Report*, Vol II, p. 12-1 ("[M]anaging water resources with a changing climate will likely prove different than managing for historic variability. Climate change could produce historic conditions and extremes of a different nature than current systems were designed to manage.").

46. Wilkinson, *supra* note 3.

47. See R. Isaac, *Estimated Water Use on Large Projects, 2004-2006*, p. 11 n. 17 (California Research Bureau, 2008), available at www.library.ca.gov/crb/08/08-012.pdf; see also *Vineyard Area Citizens for Responsible Growth v. City of Rancho Cordova*, 40 Cal. 4th 412, 721 (2007); *Planning and Conservation League v. Department of Water Resources*, 83 Cal. App. 4th 892, 915 (2000).

48. See, e.g., 40 C.F.R. § 1508.27 (NEPA requires consideration of "context" and "intensity").

49. Other recent observers have also highlighted the need to ensure a thorough analysis of climate change adaptation in the context of hydropower licensing. See J. Viers, *Hydropower Relicensing and Climate Change* 47 J. Amer. Wat. Resources Assoc. 1 (2011); see also CEC Fact Sheet, *Considering Climate Change in Hydropower Relicensing* (July 2012), available at www.energy.ca.gov/2012publications/CEC-500-2012-FS/CEC-500-2012-FS-027.pdf.

50. *Communities for a Better Env't v. South Coast Air Quality Mgmt. Dist.*, 48 Cal.4th 310 (2010).

51. *Neighbors for Smart Rail v. Exposition Metro Line Constr. Auth.*, No. S202828 (Cal. Sup. Ct.).

52. See, e.g., CEQA Guidelines § 15144; *Berkeley Keep Jets Over the Bay Comm. v. Board of Port Comm'rs*, 91 Cal.App.4th 1344 (2001).

53. CEQA Guidelines § 15162.6(e)(2).

54. Department of Water Resources, *Guidebook for Implementation of Senate Bill 610 and Senate Bill 221 of 2001* (Oct. 2003), available at www.water.ca.gov/pubs/use/sb_610_sb_221_guidebook/guidebook.pdf.

55. *Ballona Wetlands Land Trust v. City of Los Angeles* 201 Cal.App.4th 455 (2011). Some CEQA defense counsel have questioned the value of *Ballona*, arguing that the prudent course for agencies is to analyze factors such as sea level rise and place that information in the administrative record. See, e.g., B. Fulton, *Deal: CEQA Streamlining for Ballona Wetlands?,* California Planning and Development Report (Jan. 18, 2013), available at www.cp-dr.com/node/3315.

56. See, e.g., Craig, *supra* note 6, at p. 54; but see K. Baldwin, *NEPA and CEQA: Effective Legal Frameworks for Compelling Consideration of Adaptation to Climate Change*, 82 So. Cal. Law Rev. 769 (2009).

57. D. Farber, *Adapting to Climate Change: Who Should Pay*, 23 Land Use & Envtl. L. 1 (2007).

58. Emily Green, *PLUS ÇA CHANGE, PLUS C'EST LA MÊME CHOSE*, blog post, Chance of Rain blog (April 6, 2012), available at http://chanceofrain.com/2012/04/plus-ca-change-plus-cest-la-meme-chose/.

59. *Climate Change Handbook*, *supra* note 35.

60. Department of Water Resources web page, *Mission & Goals*, www.water.ca.gov/about/mission.cfm.

61. *Climate Change Handbook*, *supra* note 35.

62. *Id.*, p. 1-4.

63. DWR refers to the *California Water Plan* updates as the "Bulletin 160" series. Previous reports and Bulletins in the early part of the 21st century set the foundation for later reports. *See* www.waterplan.water.ca.gov/previous/index.cfm.

64. Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2001: Synthesis Report and Glossary of Terms*, IPCC Third Assessment Report, available at www.grida.no/publications/other/ipcc_tar/.

65. Exec. Order S-3-05, at p. 1, available at http://gov.ca.gov/news.php?id=1861.

66. *Id.*, ¶ 4, pp. 2-3.

67. Department of Water Resources, *California Water Plan Update 2005–A Framework for Action*, DWR Bulletin

160-05 (2005), available at www.waterplan.water.ca.gov/previous/cwpu2005/index.cfm.

68. *Id.*, p. 5-16.

69. Department of Water Resources, *Progress in Incorporating Climate Change into Management of California's Water Resources* (2006), available at http://wwwdwr.water.ca.gov/climatechange/docs/DWRClimateChangeJuly06.pdf#pagemode=bookmarks&page=1.

70. Department of Water Resources, *Progress in Incorporating Climate Change into Management of California's Water Resources* 2008), available at http://wwwdwr.water.ca.gov/climatechange/docs/ClimaticChange_DWRarticle_Mar08.pdf.

71. *Managing an Uncertain Future*, *supra* note 12.

72. *Id.*, p. 3.

73. *Id.*, pp. 23.

74. More recent documents have built upon the foundations laid in the three DWR documents discussed in the text above. They include a May 2009 report of the California Climate Change Center, *Using Future Climate Change Projections to Support Water Resources Decision Making in California* (available at http://wwwdwr.water.ca.gov/pubs/climate/using_future_climate_projections_to_support_water_resources_decision_making_in_california/usingfutureclimateprojtosuppwater_jun09_web.pdf), which evaluates how climate change could affect the reliability of California's water supply; and the 2009 California Water Plan Update (available at www.waterplan.water.ca.gov/docs/cwpu2009/0310final/v1c5_uncertfuture_cwp2009.pdf), which continues to build upon the climate change planning policy recommendations first proposed in *CWP Update 2005* and by incorporating *Managing an Uncertain Future*. The 2009 California Water Plan Update also significantly expands the modeling and explanation of potential climate change impacts on California water resources. In addition, in October 2010, the Coastal and Oceans Climate Action Team Sea Level Task Force issued its *Final Interim Sea Level Rise Guidance Document* (available at http://wwwdwr.water.ca.gov/climatechange/docs/SLR_GuidanceDocument_SAT_Responses.pdf.). Also in December 2010, DWR issued *Climate Change Characterization and Analysis in California Water Resources Planning Studies* (available at http://wwwdwr.water.ca.gov/climatechange/docs/DWR_CCCStudy_FinalReport_Dec23.pdf), which provides a comprehensive and comparative look at planning studies by DWR and its partner agencies that have addressed climate change. This report reviews and summarizes thirteen studies completed since 2006 or that are in the process of being completed. In July 2011, the Journal of Hydrology (vol. 405, pp. 83-92) published *Isolated and integrated effects of sea level rise, seasonal runoff shifts, and annual runoff volume on California's largest water supply* (available at www.sciencedirect.com/science/article/pii/S0022169411003222), written by staff of the DWR Bay-Delta Office. Finally, in 2012 the California Energy Commission Public Interest Energy Research Program published *Our Changing Climate 2012: Papers on Vulnerability and Adaptation to the Increasing Risks from Climate Change in California* (available at www.energy.ca.gov/research/new_reports.html). This state-sponsored research follows a first assessment of the impacts of greenhouse gas emissions; and a second assessment that determined that climate adaptation is an equally necessary response to climate impacts, and complementary to GHG emissions reductions. *Our Changing Climate 2012* is a third assessment that focuses on the extent and nature of the state's vulnerabilities to climate change and identifies opportunities for taking actions that can reduce the impacts of climate change.

75. Natural Resources Agency, *2009 California Climate Adaptation Strategy*, available at http://resources.ca.gov/climate_adaptation/docs/Statewide_Adaptation_Strategy.pdf. This Climate Adaptation Strategy was developed in response to Executive Order S-13-08 (available at http://gov.ca.gov/news.php?id=11036).

76. U.S. Climate Change Science Program, *Weather and Climate Extremes in a Changing Climate, Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* (Thomas R. Karl et al., eds., June 2008), available at www.climatescience.gov/Library/sap/sap3-3/final-report/default.htm.

77. Exec. Order S-3-05, *supra* note 65, ¶ 1.

78. AB 32 (Nuñez), the California Global Warming Solutions Act of 2006, stats 2006, ch. 488, codified in Health & Saf. Code § 38500 *et seq*.

79. California Air Resources Board, *Climate Change Scoping Report: A Framework for Change* (2008), available at www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm.

80. Department of Water Resources, *Final Climate Action Plan Phase One: Greenhouse Gas Emissions Reduction Plan* (2012), available at http://wwwdwr.water.ca.gov/climatechange/docs/Final-DWR-ClimateActionPlan.pdf. The plan was the subject of a CEQA Negative Declaration, which is available at http://wwwdwr.water.ca.gov/climatechange/docs/Final-CAP-IS-ND.pdf.

81. California Environmental Quality Act, Pub. Res. Code § 21000 et seq.; CEQA Guidelines, Cal. Code Regs., tit, 14, § 15000 et seq.

82. SB 97 (Dutton), the Sustainable Communities and Climate Protection Act of 2008, stats 2007, ch. 185 (adding Section 21083.05 to the Public Resources Code), available at http://www.leginfo.ca.gov/pub/07-08/bill/sen/sb_0051-0100/sb_97_bill_20070824_chaptered.pdf.

83. CEQA Guidelines, Cal. Code Regs., tit, 14, § 15183.5, subd. (b).

84. The Greenhouse Gas Emissions Reduction Plan was the subject of a CEQA Negative Declaration. See *supra*, note 80. Under Guidelines Section 15183(b), Cal. Code Regs., tit, 14, § 15183.5, subd. (b), this means that the Plan can be used to support a GHG cumulative impacts analysis.

85. Department of Water Resources, brochure, *Integrated Regional Water Management* (2011) (response to Frequently Asked Question *"How is IRWM different than what came before"*), available at http://wwwdwr.water.ca.gov/irwm/grants/docs/Brochures/IRWM6.Background_120306.pdf.

86. *Managing an Uncertain Future*, *supra* note 12, at p. 11.

87. SB 1672 (Costa), the IRWM Planning Act of 2002, stats 2002, ch. 676 (adding Part 2.2 (commencing with Section 10530) to Division 6 of the Water Code), available at www.leginfo.ca.gov/pub/01-02/bill/sen/sb_1651-1700/sb_1672_bill_20020921_chaptered.pdf.

88. DWR refers to the *California Water Plan* updates as the "Bulletin 160" series. Previous reports and Bulletins in the early part of the 21st century set the foundation for later reports. See www.waterplan.water.ca.gov/previous/index.cfm.

89. *CWP Update 2005*, *supra* note 67, Director's Message.

90. Subsequent California Water Plan updates, and other related documents, are available at www.waterplan.water.ca.gov/.

91. 1996 Proposition 204, available at http://vote96.sos.ca.gov/; and 2000 Proposition 13, available at http://primary2000.sos.ca.gov/VoterGuide/pdf/13.pdf.

92. 2002 Proposition 50, the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002 (codified at Cal. Water Code §§ 79560-79565), available at http://vote2002.sos.ca.gov/2002-vig/pdf/bp_pe01.pdf.

93. 2006 Proposition 84, available at http://vote2006.sos.ca.gov/voterguide/props/prop84/prop84.html.

94. See map, *Integrated Regional Water Management Brochure*, *supra* note 85.

95. 2008 SB X 2 1 (Peralta), stats. 2008, special sess., ch. 1, available at www.leginfo.ca.gov/pub/07-08/bill/sen/sb_0001-0050/sbx2_1_bill_20080930_chaptered.pdf.

96. Water Code § 10451(e)(1).

97. *Managing an Uncertain Future*, *supra* note 12, pp. 10-12, Strategies 1 & 2.

98. *Id.*, p. 12.

99. Note that program guidelines and selection criteria for Proposition 84 programs are not subject to Office of Administrative Law review. See 2006 Proposition 84, § 75076, available at http://vote2006.sos.ca.gov/voterguide/props/prop84/prop84.html.

100. Department of Water Resources, *Proposition 84 & Proposition 1E Integrated Regional Water Management Guidelines* (Aug. 2010), available at www.water.ca.gov/irwm/grants/docs/Archives/Prop84/Guidelines_PSPs/GL_Final_07_20_10.pdf. The Guidelines have since been updated. See Department of Water Resources, *Proposition 84 & Proposition 1E Integrated Regional Water Management Guidelines* (Nov. 2012), available at www.water.ca.gov/irwm/grants/docs/Guidelines/GL_2012_FINAL.pdf.

101. *Id.*, p. 24.

102. *Id.*, App. C.

103. *Climate Change Handbook*, *supra* note 35.

104. *Ibid*.

105. *Id.*, Foreword.

106. *Id.*, p. 1-1.

107. *Ibid*.

108. Natural Resources Agency, *Cal-Adapt Website*, http://resources.ca.gov/climate_adaptation/science/cal-adapt.html

109. *Climate Change Characterization and Analysis in California Water Resources Planning Studies*, *supra* note 74.

110. Department of Water Resources, *California Water Plan Update 2013*, available at www.waterplan.water.ca.gov/cwpu2013/index.cfm.

111. Department of Water Resources, *Strategic Plan for the Future of Integrated Regional Water Management in California 2013* (2012), available at *http://wwwdwr.water.ca.gov/irwm/stratplan/*.

112. Natural Resources Agency, *California Adaptation Planning Guide* (2012), available at http://resources.ca.gov/climate_adaptation/local_government/adaptation_policy_guide.html.

113. *Legal Analysis of Barriers to Adaptation for California's Water Sector*, *supra* note 5.

114. AB 32, California Global Warming Solutions Act of 2006, Health & Saf. Code § 38501(a).

115. See generally Intergovernmental Panel on Climate Change (IPCC) documents available at www.ipcc.ch/index.htm; see also Robert C. Wilkinson, *The Potential Consequences of Climate Variability and Change for California, The California Regional Assessment* (2002), available at www.ncgia.ucsb.edu/pubs/CA_Report.pdf.

116. R. Alley et al., *Summary for Policymakers*, p.4 , *in* Climate Change 2007: The Physical Science Basis—Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (2007), available at www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf.

117. *Summary for Policymakers*, *supra* note 116.

118. Michael D. Dettinger & Dan R. Cayan, *Large-scale atmospheric forcing of recent trends toward early snowmelt runoff in California*, 8 Journal of Climate 606 (1994).

119. Department of Water Resources, *Progress on Incorporating Climate Change into Management of California's Water Resources* (2006), available at www.climatechange.ca.gov/documents/2006-07_DWR_CLIMATE_CHANGE_FINAL.PDF.

120. American Society of Civil Engineers, *Report Card for America's Infrastructure* (2005), available at www.asce.org/reportcard/2005/page.cfm?id=23.

121. Noah Garrison, Robert C. Wilkinson & Richard Horner, *A Clear Blue Future: How Greening California Cities Can Address Water Resources and Climate Challenges in the 21st Century*, Natural Resources Defense Council & Bren School of Envtl. Science and Mgmt., U.C. Santa Barbara (2009), available at www.nrdc.org/water/lid/default.asp.

122. Robert C. Wilkinson, *Methodology For Analysis of The Energy Intensity of California's Water Systems, and an Assessment of Multiple Potential Benefits Through Integrated Water-Energy Efficiency Measures* (2000), available at http://sustainca.org/sites/default/files/WPuUSA-CA-LBNL.pdf; California Energy Commission, *Integrated Energy Policy Report*, Doc. No. CEC-100-2005-007-CMF (Nov. 2005), available at www.energy.ca.gov/2005publications/CEC-100-2005-007/CEC-100-2005-007-CMF.PDF.

123. *California Water Plan Update 2005*, *supra* note 67; Department of Water Resources, *California Water Plan Update 2009*, Bulletin 160-00 (2010), available at www.waterplan.water.ca.gov/cwpu2009/index.cfm.

124. Gary Klein, California Energy Commission, *California's Water-Energy Relationship*, Final Staff Report Prepared in Support of the 2005 Integrated Energy Policy Report Proceeding (04-IEPR-01E), Doc. No. CEC-700-2005-011-SF (Nov. 2005), available at www.energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011-SF.PDF.

125. California Energy Commission, *Integrated Energy Policy Report*, Doc. No. CEC-100-2005-007-CMF (Nov. 2005), available at www.energy.ca.gov/2005publications/CEC-100-2005-007/CEC-100-2005-007-CMF.PDF.

126. Wilkinson, *supra* note 122; QEI, Inc., *Electricity Efficiency Through Water Efficiency*, Report for the Southern California Edison Company (1992).

127. *Electricity Efficiency Through Water Efficiency*, *supra* note 126.

128. Metropolitan Water District of Southern California, *Integrated Resource Plan for Metropolitan's Colorado River Aqueduct Power Operations* (1996).

129. Navigant Consulting, Inc., *Refining Estimates of Water-Related Energy Use in California*, CEC PEIR Final Project Report, Doc. No. CEC-500-2006-118 (Dec. 2006), available at www.energy.ca.gov/publications/displayOneReport.php?pubNum=CEC-500-2006-118.

130. Wilkinson, *supra* note 122.

131. Public Interest Energy Research - Industrial, Agriculture and Water, *supra* note 129.

132. *Integrated Resource Plan*, *supra* note 128.

133. *Integrated Energy Policy Report*, *supra* note 125.

134. *See California Water Plan Update 2005*, *supra* note 67. The California Energy Commission explained in its report entitled *California's Water-Energy Relationship* (*supra* note 124), which was prepared as part of the 2005 Integrated Energy Policy Report: "In many respects, the *2005 Water Plan Update* mirrors the state's adopted loading order for electricity resources described in the Energy Commission's *Integrated Energy Policy Report 2005* and the multi-agency *Energy Action Plan*."

135. *California Water Plan Update 2009*, *supra* note 123.

136. *California's Water–Energy Relationship*, *supra* note 124.

137. Hanak et al., *Managing California's Water: From Conflict to Reconciliation*, pp. 146-147 (Public Policy Institute of California, 2011).

138. *2009 California Climate Adaptation Strategy*, *supra* note 4, p. 81.

139. Bipartisan Policy Center, *Beyond Seasons' End: A Path Forward for Fish and Wildlife in the Era of Climate Chang*e, p. 34 (2004), available at www.seasonsend.org/pdfs/Beyond_Seasons_End.pdf.

140. Trout Unlimited, *Healing Troubled Waters: Preparing Trout and Salmon Habitat for a Changing Climate*, p. 3 (Oct. 2007).

141. Defenders of Wildlife & Natural Resources Defense Council, *Effects of Global Warming on Trout and Salmon in U.S. Streams*, pp. 3-4 (May 2002).

142. *Climate Change Characterization and Analysis in California Water Resources Planning Studies*, *supra* note 74, p. xv.

143. *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions* (Council on Envtl. Quality, Feb. 2010).

144. *Id.*, p. 2.

145. *Id.*, p. 7 (bold added).

146. *Id.*, p. 8 (bold added).

147. Federal Energy Regulatory Commission, *Draft Environmental Impact Statement for Hydropower License*, Middle Fork American River Hydroelectric Project, FERC Project No. 20179-069, p. 96 (July 2012) ("The American River population is classified at high risk of extinction; increasing demands for water and the potential effects of climate change are likely to increase this risk.").

148. *Id.*, pp. 125-130.

149. Department of Water Resources, Bureau of Reclamation, U.S. Fish & Wildlife Service, & National Marine Fisheries Service, *Administrative Draft of EIR/EIS for Bay Delta Conservation Plan*, p. 29-2 (Feb. 2012) (bold added), available at http://baydeltaconservationplan.com/Library/DocumentsLandingPage/EIREISDocuments.aspx.

150. *Id.*, p. 29-20.

151. *Ibid.*

152. *Id.*, pp. 29-23, 29-25.

153. *Ibid*.

154. *Ibid*.

155. *Id.*, p. 29-1.

156. 16 U.S.C. § 1536(a)(2).

157. 506 F.Supp.2d at 367-370.

158. 606 F.Supp.2d at 1183.

159. *Greater Yellowstone Coalition v. Servheen*, 665 F. 3d 1015, 1030 (9^{th} Cir. 2011).

160. *Id.*, p. 1028.

161. *Neighbors for Smart Rail v. Exposition Metro Line Constr. Auth.*, Case No. B232655 (2d Dist. Ct. App.), decision affirming trial court judgment (Apr. 17, 2012), p. 15, 204 Cal. App. 4^{th} 1480 (decision depublished pending appeal to California Supreme Court), 2012 Cal. App. LEXIS 434, *17.

162. *Id.*, pp. 19-20 of decision, 2012 Cal. App. LEXIS 434, *35.

163. Application by Association of California Water Agencies for Leave to File *Amicus Curiae* Brief and *Amicus Curiae* Brief in Support of Respondents (filed Dec. 11, 2012), in appeal of *Smart Rail* to California Supreme Court (Case No. S202828), p. 9.

164. *Id.*, p. 2.