CWCCG
California Wastewater Climate Change Group

c/o California Association of Sanitation Agencies
1225 Eighth Street, Suite 595
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February 28, 2014

California Natural Resources Agency
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Email: safeguarding@resources.ca.gov

Re: California Wastewater Climate Change Group Comments on the DRAFT report *Safeguarding California: Reducing Climate Risk*

To Whom It May Concern:

The California Wastewater Climate Change Group (CWCCG) appreciates the opportunity to comment on the draft report *Safeguarding California: Reducing Climate Risk* (Draft Safeguarding Plan) prepared by the California Natural Resources Agency (CNRA). The CWCCG is a statewide group of small, medium, and large municipalities that collect and treat over 90 percent of the municipal wastewater in California, many of whom also provide recycled water services and actively participate in the beneficial use of biosolids and biogas. The CWCCG's mission is to address climate change policies, initiatives, and challenges through a unified voice advocating for wastewater community perspectives. CWCCG members are actively engaged in helping the State achieve its multiple mandates and goals set for 2020 under Assembly Bill 32 (AB 32) to mitigate climate change and its impacts. These include: (1) providing 33 percent of the State's energy needs from renewable sources; (2) reducing carbon dioxide equivalent emissions to 1990 levels; (3) reducing the carbon intensity of transportation fuel used in the State by 10 percent; and (4) recycling 75 percent of the solid waste generated in the State.

With respect to the Water sector, the Draft Safeguarding Plan focused on ways to adapt the State's water resources under changing climatic conditions and providing long-term solutions. As you are aware, California is experiencing severe drought that has had serious economic impact in the Central Valley, the nation's most productive agricultural region. Throughout California, the impact of unpredictable precipitation and decreased water content in snowpack has resulted in a statewide effort to reduce water consumption. This is being accomplished through conservation efforts and the development of underused water supply sources such as recycled water and desalination projects. The need for these alternative and local water supply sources will only increase in light of the expected impacts of climate change.

CWCCG agrees that recycled water (both direct and indirect potable reuse) and desalinated water are significantly underused reliable and local water resources that the wastewater community can provide. In addition, improved stormwater management (including low impact development and other forms of green infrastructure), groundwater remediation, and conjunctive management of surface and underground water storage are key strategies for meeting local water demands. All of these sources are important for meeting municipal demands, and will be critical for meeting agricultural demands to support our nation's economy.

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Related to agricultural demands, the Draft Safeguarding Plan includes an inaccurate statement on page 226:

> "*Agriculture relies extensively on the state's aquifers;* ***groundwater is the only source of water for much of our most productive farmland****, and agricultural water needs are likely to be heightened during prolonged hot and dry periods***.**"

The bold statement is simply not true. While there are areas in California that rely exclusively on groundwater, on average groundwater supplies 35 to 40 percent of water used by cities and farms (up to 60 percent during a drought).

The sentence should either be deleted or modified to read:

> "*Agriculture relies extensively on the state's network of surface water supplies and aquifers. As surface water becomes more constrained, groundwater use will increase to provide for agricultural needs and this demand will likely heighten during prolonged hot and dry periods*."

Turning the Focus to the Wastewater Community

Unfortunately, the Draft Safeguarding Plan fails to emphasize the vulnerability of the wastewater community and its infrastructure to impacts of climate change – there is only brief mention of it in the Emergency Management, Ocean and Coastal Ecosystems and Resources, and Water Sections. Wastewater treatment facilities provide a vital public service and will be among the hardest hit by climate change, in part, because treatment plants are generally located at the low point in each watershed to make efficient use of gravity for conveyance purposes. This means that in coastal areas, wastewater facilities are often located near the coast or within an estuary and may have an ocean or bay outfall with a direct hydraulic connection to the facility. Even in the case of inland locations, treatment facilities and the outfalls are often found within river valleys and floodplains. As sea level rises and storm surges increase in coastal areas:

- Facility outfall elevations may need to be increased or may require pumping in order to discharge.
- Inundation of facilities, including higher coastal groundwater levels causes more inflow of brackish or salty water that in turn requires higher volumes or treatment levels (and makes water recycling more energy intensive).
- Increased inland flooding events will put critical infrastructure and services at risk of failure.

Moreover, wastewater collection systems are already stressed when managing wet weather flows. In a changing climate, we expect further increases in extreme storm events, and greater increases in peak wet weather flows. Flood protection adaptation measures such as levees and seawalls will be needed to address both rising seas and floods associated with increased and extreme precipitation and runoff. Extreme storm events and overall precipitation increases will also drive the need for wet weather program enhancements (including stormwater capture and reuse). Recent weather events in places like Colorado and the New York Metropolitan area appear to be a portent of the climate-modified environment we face. These extreme storms can result in water inflow that exceeds the current capacity of much of our wastewater infrastructure, meaning we will need to invest significantly in upgrading systems to prevent sewage overflows and potential impacts to public health. Thus, wastewater agencies will acutely experience the effects of sea level rise and storm events attributable to climate change.

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The California Association of Sanitation Agencies (CASA) and National Association of Clean Water Agencies (NACWA) have testified to the United States Congress that *existing* infrastructure demands on wastewater agencies are estimated to exceed $298 billion over the next 20 years.[1] Additionally, the American Society of Civil Engineers (ASCE) recently assigned an overall grade of "C" to California's infrastructure ("C+" for wastewater) with an annual shortfall of $65 billion. These amounts do not take into account the costs to address challenges of climate change. The ASCE suggests that public policy options and funding are needed to rehabilitate and revitalize the State's infrastructure.

In 2009, the National Association of Clean Water Agencies (NACWA) and the Association of Metropolitan Water Agencies (AMWA) released a study on the kinds of impacts and challenges the wastewater community expects to encounter in the coming years (including impacts of climate change), and the projected costs of meeting those challenges. The report, titled "Confronting Climate Change: An Early Analysis of Water and Wastewater Adaptation Costs", examines the likely climate-related effects on our water resources and the resulting impacts to our water systems. According to the NACWA/AMWA report, the nationwide cost for water and wastewater agencies to adapt to climate change is expected to be in the range of one-half to one trillion dollars through 2050. Of this, the total estimated cost to adapt wastewater systems to climate change across the U.S. is between $123 billion and $252 billion **above and beyond** existing wastewater system infrastructure upgrade, renewal, and replacement needs.[2] The State's first efforts should be to address the unmet existing infrastructure needs that place the State at further risk to climate change impacts.

For utilities to plan for future changing conditions and make commitments to invest hundreds of millions of ratepayer dollars in infrastructure (above and beyond what is needed to keep the existing systems in good repair), it is imperative that the "best available science" be used. For example, the California Coastal Commission has recently drafted the *Sea Level Rise Policy Guidance* (Draft SLR Guidance) that is intended to serve as the standard for local government planning and decisions associated with sea level rise. The San Francisco Public Utilities Commission (SFPUC) recently submitted comments on the Draft SLR Guidance raising their concerns with regard to the use of science in that document. These comments include:

- The 2012 National Research Council (NRC) Report is the exclusive source of science cited in the Draft SLR Guidance.
- The Draft SLR Guidance does not accurately represent the key science conclusions of the NRC Report.
- The Draft SLR Guidance appears to prohibit use of other important sources of best available science in the development of Local Coastal Programs (LCPs) and Coastal Development Permits (CDPs).
- As a result of the bulleted item above, the Draft SLR Guidance provides decision makers with an unnecessarily wide array of sea level rise effects, making the planning and permitting environment more difficult for both permittee and the Commission.

The SFPUC's comment letter with discussion and recommendations is attached to the end of this letter for your review and consideration.

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[1] "Clean Watersheds Needs Survey 2008: Report to Congress." USEPA, May 2010.

[2] "Confronting Climate Change: An Early Analysis of Water and Wastewater Adaptation Costs," Association of Metropolitan Water Agencies, National Association of Clean Water Agencies, 2009.

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The Wastewater Community Can Also Contribute to the Overall Resilience of Other Sectors

As summarized above, climate change will acutely impact wastewater treatment facilities and infrastructure on a number of fronts, and the wastewater community has multiple ways in which it can contribute toward a more resilient water supply for the State and nation. In addition, the wastewater community has opportunities within several of the 9 sectors identified in the Draft Safeguarding Plan (which are Agriculture, Biodiversity and Habitat, Emergency Management, Energy, Forestry, Ocean and Coastal Ecosystems and Resources, Public Health, Transportation, and Water). These opportunities can simultaneously contribute toward multiple 2020 and 2050 mandates and goals under AB 32. However, there are challenges or barriers that prevent publically owned treatment works (POTWs) from fully contributing towards each. CWCCG has developed the following comments by sector for CNRA's consideration.

Agriculture

CWCCG supports the following actions identified for improving the understanding of climate impacts on agriculture, as well as those actions identified for developing and promoting adoption of management strategies that reduce climate risks, including:

- Research on changing water needs for agriculture in times of more sustained higher temperatures and extreme heat events
- Further studies on barriers to efforts to prepare for climate risks and ensure the long-term sustainability of California agriculture, including possible strategies for overcoming such barriers
- Studies of the effectiveness of different cropping practices (i.e., crop rotation, fertilization, etc.) for addressing climate risks to agriculture
- Developing incentive programs for sustainable, science-based practices that create resilience to climate impacts, including pilot-projects to demonstrate proof-of-concept
- Management strategies that reduce climate risks to water including, but not limited to, enhanced flood management, water use efficiency, and regional groundwater management for drought resiliency

In support of the above actions, CWCCG recommends using a replacement fertilizing/soil amending material that reduces water demand, reduces GHG emissions, sequesters carbon in the soil below, and provides other co-benefits. Specifically, land application of highly treated wastewater solids (biosolids) should be considered as an efficient recycling practice that avoids use of fossil fuel intensive synthetic fertilizer (requiring approximately 0.22 gallons per pound of inorganic nitrogen), reduces water demand, and sequesters carbon in the soil. Studies have shown that land applied finished compost and other biosolids serve to increase carbon storage in the soil. Over a 34-year reclamation project, the mean net soil carbon sequestration was 1.73 (0.54-3.05) megagrams of carbon per hectare annually in biosolids amended fields as compared with -0.07 to 0.17 megagrams of carbon per hectare annually in fertilizer controls, demonstrating a high potential of soil carbon sequestration by the land application of biosolids.[3]

[3] Tian, G.; Granato, T. C.; Cox, A. E.; Pietz, R. I.; Carlson, C. R.; Abedin, Z. Soil carbon sequestration resulting from long-term application of biosolids for land reclamation. J. Environ. Qual. 2009, 38, 61–74.

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Energy

CWCCG supports CNRA's recommendation to diversify the energy supply portfolio as needed, specifically by "expanding distributed generation." Unfortunately, there was no mention of bioenergy sources (biogas and sewage sludge) from POTWs.

Increasing the production and use of biogas (bioenergy) at POTWs provides numerous co-benefits including: (1) reduced GHG emissions through the increased capture and utilization of biogas; (2) increased production of renewable energy displacing fossil fuel use, which helps meet the renewable portfolio standard (RPS) goals under AB 32; (3) avoided landfill methane emissions from decomposition of high-strength waste (e.g., food waste) by diverting the waste to existing anaerobic digesters at POTWs having excess capacity; and (4) production of low and potentially net negative carbon intensity fuels designed to meet the low carbon fuel standard (LCFS) under AB 32.

In addition, increased energy generation and cogeneration (i.e., combined heat and power - CHP) capacity at POTWs may provide the most reliable (i.e., sustainable) source of distributed generation currently available, with the added benefit that POTWs will always need to be located relatively close to the customers they serve (be a local source of energy). Resource recovery and energy generation activities will generally be conducted onsite at the treatment facilities, making energy generation and distribution at numerous treatment facilities a key component to distributed generation.

Many POTWs already have anaerobic digestion infrastructure in place, and they are increasingly providing the option to receive hauled-in organic waste (such as fats, oils, and grease (FOG) and food waste) and anaerobically digesting it. Enabling POTWs to accept more FOG and food waste would reduce the need for its disposal at landfills, reduce GHG emissions from landfills, and increase biogas production. This is just one example of a project that can be done within the wastewater community providing many co-benefits (supporting one of the seven strategies of the Draft Safeguarding Plan - "Maximizing returns on investments by prioritizing projects that produce multiple benefits").

In order to maximize the benefits associated with these activities, CWCCG is working with CalRecycle and CARB to develop the necessary incentives, address long-term risks to public agencies, and reduce cost and regulatory (including permitting) barriers to get the necessary equipment for pre-processing hauled-in waste streams to a digestible form, infrastructure for anaerobic digestion, and equipment necessary for processing biogas into a pipeline grade or transportation biofuel in place. In addition, we would like to work with CNRA, CARB, and the California Public Utilities Commission (CPUC) in examining interconnection issues, as well as research, development and demonstration of bioenergy and cogeneration/CHP technologies.

Finally, as part CNRA's recommendation for energy-related research in the California Climate Research Plan, CWCCG strongly recommends considering POTWs for existing and future opportunities with cogeneration/CHP systems and bioenergy generation projects. The use of biosolids for energy production offers broad opportunities for increased energy production, as well as reduced GHG emissions. CWCCG would also like to support CNRA in its plans to explore post-2020 GHG emissions targets for the energy sector that are compatible with the 2050 goal of reducing GHG emissions by 80 percent from 1990 levels under AB 32.

Forestry

CWCCG supports the effort to improve forest management practices and the capacity of the forest sector to withstand and recover from climate impacts in order to protect the value and continued productivity of forest resources. Protecting forest ecosystems provides many co-benefits, including

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improved water quality and supply, wildlife habitat, air quality protection, recreation values and more. Benefits should extend to POTWs since the use of biosolids to reclaim fire-ravaged land and to reduce the potential of future fires is a proven but underused strategy (adopted in Santa Ana Regional Water Quality Control Board Emergency Resolution following the Freeway Complex Fires of 2008). To reduce wildfire risk, the Strategic Fire Plan should consider use of biosolids from POTWs as a means for reclaiming fire-ravaged land (and carbon sequestration) and fire prevention.

Transportation

CWCCG members can support this sector in achieving GHG emissions reduction goals for 2020 under AB 32, as well as RPS and LCFS goals, through production of renewable transportation fuel from wastewater biogas. CARB staff has recently calculated that transportation fuels from wastewater biogas may have the lowest carbon intensity available (as low as negative 63 grams carbon dioxide equivalent emissions per megajoule). As part of CNRA's action item to better understand the opportunities associated with alternative energy supplies for vehicles, CWCCG is working with CARB (and would like to coordinate that work with CNRA) to identify opportunities and barriers in installing on-site facilities for direct energy production from biogas and/or conversion of biogas to transportation fuel. Investment in this area will help ensure that wastewater biogas is used to produce ultra-low carbon fuels and clean, renewable electricity instead of flaring (i.e., wasting) a valuable fuel supply.

Conclusions

We agree with CNRA that legislative and regulatory support is needed in order for the wastewater community to help the State move toward climate resiliency while continuing to fulfill our primary mission to protect human health and the environment. As it states on page 7 of the Draft Safeguarding Plan, "The recommendations in the Safeguarding California Plan are meant to work with existing laws and regulations; however, in order to fully implement actions to prepare for climate risks in California, some laws may need to be amended to better reflect new and changing climate conditions that did not exist when those laws were initially enacted, and new implementing authorities may be needed."

Again, CWCCG appreciates the opportunity to provide comments on the draft report *Safeguarding California: Reducing Climate Risk*. Public wastewater agencies can play an important role in delivering climate change solutions. We need to change the view of wastewater facilities – from one of being a waste processor to being invaluable resource recovery facilities imperative to our future. We want to emphasize the opportunities of wastewater agencies as being significant renewable energy providers, suppliers of a marketable renewable organic fertilizer/soil amendment product, and suppliers of a sustainable (drought-proof) water supply. In many cases, all that is lacking is the funding to develop the appropriate infrastructure and technological support to make these projects a reality.

Please contact me if you have any questions at (925) 705-6404 or sdeslauriers@carollo.com. We welcome the opportunity to discuss the wastewater community's position.

Sincerely,

Sarah A. Deslauriers
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February 14, 2014

VIA EMAIL

California Coastal Commission
c/o Sea-Level Rise Working Group
45 Fremont Street, Suite 2000
San Francisco, CA 94105

RE: Comments on Public Review Draft, California Coastal Commission Sea-Level Rise Policy Guidance

Dear Sea-Level Rise Working Group,

The San Francisco Public Utilities Commission (SFPUC) appreciates the opportunity to comment on the California Coastal Commission's Draft Sea-Level Rise Policy Guidance (DG), dated October 14, 2013. These comments are intended to supplement and support comments provided by Roger Kim, Senior Advisor to San Francisco Mayor Edwin M. Lee. Our focus here is on a particular area of expertise at the SFPUC which is also a focus of the DG: the use of science in assessing vulnerability and planning adaptation to climate change.

The SFPUC is a Department of the City and County of San Francisco and is comprised of three essential 24/7 service utilities: Water, Power, and Sewer. We are the third largest public utility in California, working in seven California counties with a combined annual operating budget of over $850 million.

Climate change poses significant challenges to vital infrastructure, public health and safety, and resource management. Planning for climate change also challenges us to come up with new ways of making decisions – while we can no longer rely upon past practice, the nature of the future is also difficult to discern with precision. As the now-clichéd saying goes, "stationarity is dead." This means that the past climate is no longer representative of future climate.[1] An important corollary to this "new normal" is that the stationary record has not yet been replaced with anything remotely resembling it, with excursions outside our experience all but certain but the nature of those excursions not yet well understood.

The DG is a landmark document as it is among the first with the potential for direct regulatory impact seeking to guide local government planning and decisions associated with the effects of sea level rise (SLR). At the heart of

[1] Milly, P.C.D. et al. *Stationarity is Dead: Whither Water Management*, Science, 2008.

the DG, as with all processes relating to assessing and adapting to the effect of SLR, is the use of "best available science." We agree wholeheartedly with the DG's repeated emphasis that best available science should be the benchmark for this work. We have several concerns in regards to the use of science in the DG:

1. The DG does not accurately represent the key science conclusions of the National Research Council Report, the exclusive source of science cited in the DG.
2. The DG unadvisedly relies on a single source of information, the NRC Report.
3. The DG in places appears to prohibit the use of other important sources of best available science in the development of Local Coastal Programs (LCPs) and Coastal Development Permits (CDPs).
4. The DG, as a result of the above, provides decision makers with an unnecessarily wide array of SLR effects, making the planning and permitting environment more difficult for both permitees and the Commission.

Comment 1: The Guidance inappropriately relies on some of the science conclusions from the NRC report while ignoring others.

The DG cites only the more extreme bounding ranges of SLR presented in the NRC Report, but does not mention the SLR estimates and ranges that are presented by NRC as being most likely – the "projections." The bounding "ranges," as presented in Tables 1 and 3 of the DG, include SLR of 2-12" in 2030, 5-24" in 2050 and 17-66" in 2100.[2] In contrast, the NRC "projections" are 6" +/- 2" for 2030, 11" +/- 4" for 2050 and 36" +/- 10" for 2100. The projections are clearly presented in numerous places, often alongside the bounding ranges.[3] Generally, the "ranges" in the NRC Report represent extreme, or worst case, levels of SLR that *may* occur but are considered by scientists *less likely*, or perhaps unlikely, to occur. The projections are considered the most likely SLR effects we will see in the respective time period. The projections were developed using a middle range emissions scenario drawn from the 2007 IPCC 4th Assessment Report (A1B) to derive the steric component of SLR and an extrapolation of continued accelerating land ice melt (independent of emissions scenario) but without substantial loss of the West Antarctica ice sheets or catastrophic ice melt in Greenland for the most significant land ice component.[4] It is important to note that current observations do not indicate that this kind of catastrophic ice melt will occur in this century to an extent that will lead to the extreme high figures for SLR.[5] Finally, the NRC sea level rise projections and their uncertainty (the +/-

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[2] All comments herein refer to SLR figures in the NRC report pertaining to the area between Cape Mendocino and the Mexican border.
[3] Including: Table 5.2 (p. 89); Figure 5.5 (p. 92); Table 5.3 (p. 96); Figure 5.10, pg 103; Figure S.1 (p. 5), which is repeated as Figure 5.9 (p. 102); and the narrative beginning on page 92.
[4] NRC Report, Table 5.2, p. 89, and Table 5.3, p. 96
[5] Pfeffer, W.T., et al. *Kinematic Constraints on Glacier Contributions to 21st-Century Sea-Level Rise,* Science, Vol 321 (2008). Also: *Climate Change 2013: The Physical Science Basis. Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Summary for Policymakers.* 2013. p. 23-24. Intergovernmental Panel on Climate Change. Also: Personal communication, Tad Pfeffer (NRC Report co-author);

numbers) reflect one standard deviation,[6] meaning that the projections encompass 15%/85% confidence intervals. In other words, NRC Report authors considered it 70% likely that seas will rise *between 26" and 46"* (10" above and below the projection of 36") by the Year 2100, 15% likely it will rise *less than 26"* and 15% likely it will rise *more than 46."*

We are not suggesting that the bounding ranges be ignored. On the contrary, best and worst case scenarios are clearly needed in planning for a variety of reasons and in a variety of situations. But omitting the projections leaves out one of the critical – and valuable – science conclusions of the NRC report. Exclusively referencing the extremes will cause greater confusion for stakeholders and greater difficulty making thoughtful, prudent development and spending decisions. The bounding ranges, when presented alone, provide a bewildering, even paralyzing range of potential effects around which to plan and we are concerned this will have a deleterious effect on processes before the Commission.

We recognize that the State of California Sea-Level Rise Guidance Document (State Guidance)[7] omitted the more moderate projection estimates and ranges and therefore the Commission may feel constrained to do the same.[8] The State Guidance, however, specifically called out the importance of local considerations and approaches in the use of SLR projections in a flexible manner, providing the Commission with considerable latitude:

> Although the estimates of future SLR provided in this document are intended to enhance consistency across California state agencies, the document is not intended to prescribe that all state agencies use specific or identical estimates of SLR as part of their assessments or decisions. [9]

More important, we suggest that omitting substantive (not to mention useful) science conclusions in the NRC Report from the DG undermines the "best available science" advice to local governments that appears throughout the DG.

We are also concerned that the confoundingly wide range 17-66" for 2100 will get shorthanded to "66 inches." This is precisely what happened when the Rahmstorf semi-empirical projection of 21-55", the state-adopted range from the actual peer-review science ,[10] was shorthanded by the media, many agencies, and much of the public as simply "55 inches." Again, we are not suggesting that the extremes be taken off the table – relying on them exclusively, however, is what we call "catastrophizing," using only the worst case possible futures in decision making processes. In practice, this approach virtually assures that scientific information is used in a way that is most likely to be incorrect. In addition, we believe such an approach will make it

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[6] NRC Report, Table 5.2, p. 89, and Table 5.3, p. 96
[7] *State of California Sea-Level Rise Guidance Document. Developed by the Coastal and Ocean Working Group of the California Climate Action Team (CO-CAT), with science support provided by the Ocean Protection Council's Science Advisory Team and the California Ocean Science Trust. March 2013 Update.*
[8] We have been invited to provide similar comments to these to the Ocean Protection Council and Ocean Science Trust, who led development of the State Guidance.
[9] State Guidance, p. 1
[10] *2009 California Climate Adaptation Strategy: A Report to the Governor of the State of California in Response to Executive Order S-13-2008.* California Natural Resources Agency. p. 15.

difficult for decision-makers to produce cost-effective and robust long-term strategies. The DG, in the very first paragraph, appears to initiate this potential reduction of the science when it states that "the National Research Council projected that sea level may rise by as much as 140-165 centimeters (55-65 inches) in California by 2100," rather than citing the range. [11]

An approach, intentional or not, that leads to planning focused primarily or exclusively on the highest possible SLR estimate in the NRC report clearly strays from the stated goal of the DG of using "best available science."

Recommendation: The projections from the NRC Report should be added to the DG in all places where SLR figures from the Report are cited in the DG. The relative meaning of the projections and the ranges should be presented in the DG to help achieve clarity and transparency.

Comment 2: The Draft Guidance rigidly relies on a single report while ignoring all other credible science.

There is tremendous uncertainty associated with climate change. This uncertainty relates not to the *fact* of climate change, on which there is virtually no doubt within scientific circles, but to the *nature* and *scope* of climate change's secondary effects such as SLR. New projections are emerging regularly, models are getting more complex and improving, and observations are accumulating. In such a dynamic environment, decision-makers are regularly cautioned by climate scientists and science translation professionals to never rely upon a single source of information, be it a single climate model or a single expert.

In general, the DG appears to approach the use of best available science in a highly rigid manner. It appears to consider the NRC Report the single, exclusive, authoritative source of information on SLR, when in fact there are numerous authoritative sources in addition to NRC that decision-makers (and the Commission) can and should consider when assessing vulnerabilities and risk, making planning decisions, and funding adaptation efforts. The Commission's guidance appropriately advocates the use of "best available science" at the time of publication. However, the Final Guidance document should also recognize that other sources of SLR projections exist now, or may be available in the near future, and the guidance document should allow local governments to rely on those sources, in part or in full, *provided* those sources are peer-reviewed, widely accepted within the scientific community, and locally relevant.

The most highly respected climate science body is the Nobel Prize-winning Intergovernmental Panel on Climate Change (IPCC). The IPCC's 5th Assessment Report (Working Group I) (AR5) was released in September, 2013, just a few weeks before the DG was released, and so we

[11] DG, p. 3. (This appears to be an errata: it's unclear where these figures appear, but the high end in NRC for net sea level rise is 167 or 166 cm for Los Angeles and San Francisco, respectively, rather than 165 cm).

understand why this report could not be incorporated into the DG. We recommend the AR5 SLR figures be incorporated into the final Guidance. Arriving over a year after the NRC report, which relied extensively on the IPCC's long-superseded 2007 4th Assessment Report, AR5 represents a 2013 consensus snapshot of the international climate science community findings on climate change, including global sea level rise. The AR5 report provides a somewhat different range of scientific opinion than the NRC Report. The IPCC projected SLR globally for the year 2100 at 11-39" overall and 21-39" under RCP 8.5 (the worst case emissions scenario).[12] This contrasts with the global SLR figures in the NRC Report of 20-55" in 2100 .[13] The NRC high end numbers are approximately 45% higher than the IPCC's.

The IPCC made the following statement explaining why it rejected estimating global SLR higher than 39" in 2100 (the top of the "assessed *likely* range" referenced below are the 21-39" projections for 2100):

> The basis for higher projections of global mean sea level rise in the 21st century has been considered and it has been concluded that there is currently insufficient evidence to evaluate the probability of specific levels above the assessed *likely* range. Many semi-empirical model projections of global mean sea level rise are higher than process-based model projections (up to about twice as large), but there is no consensus in the scientific community about their reliability and there is thus *low confidence* in their projections. (emphasis in original) [14]

It appears from the DG that local governments may be directed to ignore this and other relevant science in the development of LCPs and CDPs, and we believe such an approach unwise and not reflective of the DG stated goals of encouraging the use of "best available science."

Another major sea level rise report came out in December 2012 from the National Climate Assessment, about six months after the NRC Report.[15] The National Climate Assessment (NCA) is a massive, national study mandated by Congress as a state-of-the-art assessment of the nation's vulnerability to climate change. The NCA presents four SLR scenarios for planners to consider, including for 2100 a low of 8" and a high of 79", and two intermediate levels of 19" and 47" that are more likely, built largely upon different land ice assumptions [16]

The DG only selectively discusses the NCA findings, which pre-dated the DG, and does not substantively touch upon the AR5 science conclusions, which were released in final form just

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[12] *Climate Change 2013: The Physical Science Basis. Working Group 1 Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Summary for Policymakers.* 2013. p. 23-24. Intergovernmental Panel on Climate Change. Figures are relative to 1986-2005, while NRC Report figures are against a baseline of 2000.
[13] NRC Report, Table 5.2, p. 89.
[14] IPCC, op cit, p. 24.
[15] Parris, A., et al. *Global Sea Level Rise Scenarios for the United States National Climate Assessment*, December 6, 2012, produced for NOAA, USGS, SERDP and USACE.
[16] Ibid, p. 2.

prior to the DG. Figure 1 presents the low and high bounds and most likely SLR scenarios from the NCA, IPCC, and NRC Report.

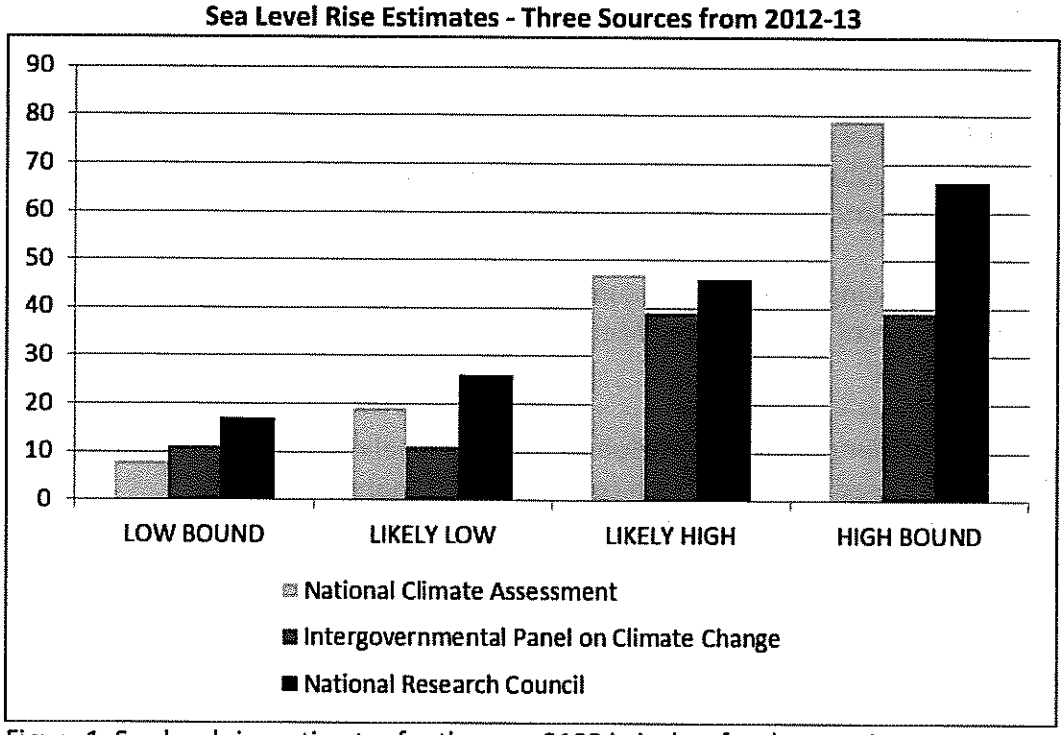

Figure 1. Sea level rise estimates for the year 2100 in inches for three major reports. Low and High Bound refers to extreme ends of each estimate, while "Likely Low" and "Likely High" as used here refers to estimates that don't require assumptions of worst case SLR conditions not considered likely to occur or highly successful GHG emission controls that also appear unlikely. For IPCC, the bounds and likely ranges are the same, as IPCC did not present extremes for which they found "insufficient evidence." For NRC, the likely low and high figures represent the one standard deviation, or confidence intervals, associated with the projection figures in the NRC Report.

It is unclear from the language in the DG the degree to which the Commission is proposing to limit the use of peer-reviewed climate science on the part of Californians updating or applying for LCPs or CDPs. In some places, it appears the intent is to exclude sources other than the NRC, for example:

> The 2012 NRC Report is the best available science on California's regional sea-level rise, and it should be used when sea-level rise projections are needed. [17]

In other places, the DG states this document is but one among many sources that may be consulted in conducting assessment and planning adaptation:

[17] NRC Report, p. 119.

> Use range of SLR scenarios based on best available science (e.g. NRC Sea Level Rise Report).[18]
>
> Using the NRC report or other comparable study, determine the range of sea-level rise for the planning horizons of concern.[19]

And finally, elsewhere the intent is ambiguous:

> The best available science should be used in planning and regulatory actions. . . This science may include peer-reviewed and well-documented climate science, adaptation strategies, and management practices. At the time of this report's publication, the best available science on sea-level rise in California is the 2012 National Research Council (NRC) Report, *Sea-Level Rise for the Coasts of California, Oregon and Washington: Past, Present and Future* (NRC, 2012)" (underlined emphasis added). [20]

While the IPCC and NCA represent two of the most eminent international and domestic entities, there are other sources that may be worth the Commission's (and decision-maker) consideration. One recent peer-reviewed survey demonstrates that the range presented in the NRC Report and the DG does not represent consensus opinion in the scientific community on likely SLR. Lead author Benjamin Horton (a co-author of the NRC Report) and co-authors including Stefan Rahmstorf compiled survey responses about future sea level rise from 90 of the top published SLR experts in the world. The "median likely ranges" from this expert sample provided a range of 0.7-1.2 meters (28-47") of SLR by 2100 under RCP 8.5, the highest emissions scenario.[21] These figures are strikingly similar to the findings in NRC, IPCC, and NCA for the most likely SLR levels for 2100 (see Figure 2).

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[18] DG, Figure 1, p. 8 and Figure 2, p. 11.
[19] DG, p. 38
[20] DG, p. 22.
[21] Benjamin P. Horton, Ramstorf, S, Engelhart, S, and Kemp, A. *Expert assessment of sea-level rise by AD 2100 and AD 2300*, Quarternary Science Reviews 84 (2014) 1-6.

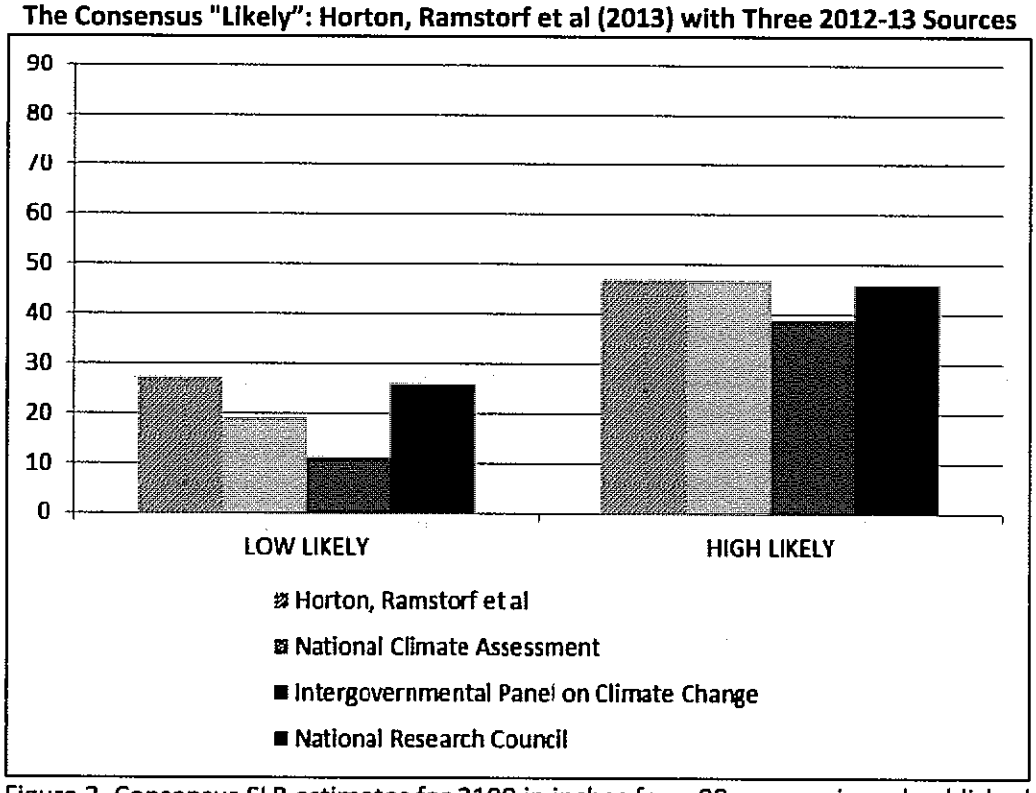

Figure 2. Consensus SLR estimates for 2100 in inches from 90 peer-reviewed published SLR scientists, as reported in Horton, Rahmstorf (2013), compared to likely figures from three prominent estimates as also shown in Figure 1.

<u>Recommendation</u>: The Draft Guidance should be revised wherever best available science is discussed to provide greater flexibility to local governments to use the latest peer-reviewed science and broad scientific agreement as to likelihood and the expected scope and timing of sea level rise. The conclusions of both the IPCC and the NCA should be presented in context in the Guidance alongside the NRC Report conclusions.

<u>Comment 3: Vertical land motion guidance fails to consider local conditions by requiring a one-size-fits-all set of assumptions for the area from Cape Mendocino to the Mexican border.</u>

The DG states in several places that an assessment of SLR vulnerability requires an understanding of local conditions. Embedded in the ranges from the NRC Report that are the basis of the DG, however, are vertical land motion (VLM) projections which are acknowledged in the DG to NOT consider local conditions:

> The NRC Report has adjusted regional sea level projections for the large-scale uplift and subsidence that has been observed along the coast. However, the NRC

> projections have not taken into account the local variations in vertical land motion that occur.[22]

Vertical land motion for the area south of Cape Mendocino is estimated in the NRC Report at 0.4 – 5.5" for 2050 and 1-11" for 2100.[23] The upper end of these ranges are used to derive the upper end of the overall ranges for relative SLR (so 5.5" of VLM makes up about 23% of the 24" high end 2050 SLR figure, and 11" of VLM comprises 17% of the 66" high end 2100 SLR figure). These are non-trivial components of the overall ranges.

The DG requires local governments in the Cape Mendocino to Crescent City area to revise these projections to accurately reflect local conditions. Other regions, however, are strongly discouraged from evaluating local conditions to identify an appropriate projection.[24] This precludes the possibility that other regions may have the ability to produce credible VLM projections that accomplish what the NRC Report did not seek to accomplish – accurate local conditions.[25] In fact, the NRC Report Committee broke down the coast line examined in the report in broad swaths only because its time and resources were too limited to provide finer scale detail, not because it judged that finer scale detail was unobtainable.[26]

<u>Recommendation</u>: Sections of the DG that appear to discourage or prohibit local government from developing local vertical land motion estimates appropriate to their jurisdiction should be removed.

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[22] DG, p. 127.
[23] NRC Report, Table 5.3, p. 96
[24] DG, p. 39: "Adjustments for vertical land motion are not recommended for other locations." p. 126: "For all other areas, this step can be skipped." p. 128: "When local vertical land motions are used to modify the regional sea-level rise projections, there should be at least one scenario that examines the consequences from the unmodified regional sea-level rise range."
[25] The DG in two places, p. 127 and in footnote 19 on p. 39, cites a statement in Appendix B of the State Guidance, the response to questions for a panel of NRC Report authors in which those authors state: "We do not believe that there is enough certainty in the sea-level rise projections nor is there a strong scientific rationale for specifying specific sea-level rise values at individual locations along California's coastline." The DG interprets this sentence to admonish localities to not attempt to determine local VLM except for that between Cape Mendocino and Crescent City. We believe this interpretation of Appendix B in the State Guidance is incorrect. The sentence cited in the DG most significantly addresses the question of differentiating sea level rise along different parts of the coast, not VLM. While much of Appendix B has a "reading tea leaves" quality to it, a close reading of the text that follows the sentence cited in the DG reveals that the supporting arguments are primarily about SLR, not VLM.

Of great interest are these sentences on pg. 11, which also happens to support our Comment 1:
"We believe that using a single sea-level rise value is the [sic] presently the best and most tractable approach… Table 5.2 in the NRC report [this reference is actually to Table 5.3] projects essentially identical values for both San Francisco and Los Angeles for 2030 (14.4-14.7 +/- 5 cm), 2050 (28-28.4 +/- 9.1 cm), and 2100 (91.0-93.1 +/ 25 cm)."

First, these figures are most significantly about SLR, not VLM. And to reiterate the point related to our Comment 1, the scientific panel chose to use the "projections" from Table 5.3 in pinpointing expected SLR up and down the coast -- not the bounding ranges.
[26] Personal Communication, Tad Pfeffer (NRC Report co-author)

Thank you again for the opportunity to comment. We look forward to working with the Coastal Commission in the continued development of this important Guidance and in all our work together to protect our priceless coastline.

In discussions with other interested parties regarding this Guidance, it has been suggested that it might be useful before finalizing the Guidance to convene a meeting or workshop of some kind featuring sea level rise scientists, Coastal Commission and other state agency staff, and decision-makers working on assessing and adapting to the effects of sea level rise. Talking through the complex and often conflicting meaning of all these scientific sources, their regulatory and permitting implications, and the largely uncharted territory of adaptation design, would in our view be a valuable conversation prior to finalization. The San Francisco Public Utilities Commission would be happy to assist in convening such a meeting if the Sea-Level Rise Working Group were interested.

If you have any questions regarding these comments, please contact me at (415) 554-3221 and dbehar@sfwater.org.

Thank you for your consideration of these comments.

Sincerely,

David Behar
Climate Program Director