STATE OF CALIFORNIA—NATURAL RESOURCES AGENCY
EDMUND G. BROWN, JR., *GOVERNOR*

CALIFORNIA COASTAL COMMISSION

45 FREMONT STREET, SUITE 2000
SAN FRANCISCO, CA 94105- 2219
VOICE (415) 904- 5200
FAX (415) 904- 5400
TDD (415) 597-5885

To: Coastal Commission District Staff, Coastal Planning Departments
From: Kelsey Ducklow, Coastal Commission, Statewide Planning Unit
Date: January 3, 2019

Re: **Example language for identifying sea level rise and coastal hazards information necessary for a complete CDP application**

Purpose

This memo is intended to provide coastal analysts with information and example language that can be used in a non-filing/incomplete letter (or to gather information prior to submittal of a CDP application) when asking for an analysis of coastal hazards and sea level rise from an applicant. This language is generally similar to the information coastal analysts have requested in the past to be included in technical studies that analyze potential impacts from coastal hazards, but includes additional detail on how to incorporate sea level rise into those analyses.

Please note that the information and example language below pertains only to the coastal hazards-related portion of a CDP application. It is not meant to address other common issues such as the need for a more detailed project description or project plans, or additional information on impacts to public access and recreation, ESHA, visual resources, and so on, except insomuch as there is overlap with those issues and coastal hazards.

Additionally, note that in most cases, the example language below will need to be modified, expanded, or deleted to address site or project-specific concerns. There are three general situations in which analysts will be asking for coastal hazards and sea level rise analysis:

1. Development along shorelines that could be flooded under various conditions now or in the future
2. Development situated atop bluffs or dunes that could be impacted by erosion now or in the future
3. Development on a site that is currently protected by some type of shoreline armoring.

Although there will be some overlap in the type of analysis necessary, each of these scenarios will call for slightly different information. For example, CDP applications for development proposed on high blufftops would not need details on flood risk while CDP applications for low-lying/beach-level development would not require bluff stability information, but development on low bluffs may need both.

This memo provides general statewide recommendations. In addition to modifying the language to address site and project specific characteristics, you may need to modify the recommended language in light of applicable local coastal program requirements. Please use your best judgement and knowledge of the proposed project and any local issues when using the below language, and contact Coastal Commission Staff with any additional questions or concerns you have related to how to address sea level rise in CDP applications.

Note: *The following example language generally follows the steps recommended in Chapter 6 of the CCC Sea Level Rise Policy Guidance for addressing sea level rise within the context of CDPs. Please see Chapter 6 and Appendix B for more information on these topics. You may also choose to direct applicants to these resources.*

See page 99 of the Guidance for a list of general situations in which sea level rise should be considered in the project analysis. A variety of sea level rise modeling and mapping tools – for example CoSMoS, TNC's Coastal Resilience tool, the Pacific Institute hazards viewer and maps, Cal-Adapt, and the NOAA SLR Viewer – may help analysts identify if a project site is likely to be impacted by sea level rise. Please contact Coastal Commission staff for more information on SLR mapping and modeling resources.

Note that these analyses may be provided in a geotechnical report, a wave run-up analysis, a vulnerability assessment, a coastal hazards study, or other similarly named technical studies – although these terms can mean slightly different things, the objective is to get the information described below.

Sea Level Rise and Coastal Hazards Analysis

Due to the proposed project's location [on/adjacent to] a [bluff/beach/shoreline/wetland etc.], it has the potential to be impacted by a variety of coastal hazards, including [tidal and storm flooding, wave runup, and erosion], each as influenced by sea level rise over time. Please provide an analysis of potential impacts from coastal hazards and sea level rise over the anticipated lifetime of the development. Reports should include the following information and should clearly describe how the proposed project will avoid or minimize risks from coastal hazards.

1. ***Identify project area and scope***: Identify the project site and describe the scope of the project in detail, including information related to all project phases, as applicable. The description should include details on the local setting (*e.g.*, geologic conditions of the site, historical trends related to coastal hazards like flooding and erosion) and existing site conditions, including regarding all existing structures and any existing armoring (*e.g.* identify structures that depend on existing armoring and provide details on the age of existing structures, ownership status of the bluff and/or beach, and future plans for existing structures and armoring). Secondary impacts related to the proposed development, such as impacts to other coastal resources over the anticipated life of the structure, should also be considered, as explained in #4 below.

2. ***Identify anticipated project life and relevant sea level rise projections:*** Define the anticipated life of the project and identify the appropriate sea level rise projection(s) to analyze over that anticipated lifetime. A range of sea level rise and storm scenarios should be evaluated in order to identify a safe building envelope that avoids hazards over the anticipated life of the development.

   In line with statewide guidance, the California Coastal Commission currently recognizes the Ocean Protection Council 2018 State Sea-Level Rise Guidance as the current best available science on sea level rise projections for California. This report includes sea level rise projections for every 10 years from 2030 to 2150 for each of 12 tide gauges along the California coast, and recommends using the projections from the closest tide gauge to the project site. Simplified projection tables can be found in Appendix G of the CCC Sea Level Rise Policy Guidance. For this proposed project, the closest tide gauge is [***e.g.*, San Francisco**].

At a minimum, the ***[low; medium-high; or extreme]*** risk aversion projection for the anticipated life of the project should be used for analyses of future conditions (as described below). If avoidance is not possible for this sea level rise projection scenario, additional analyses using lower sea level rise scenarios should be undertaken to determine the threshold at which sea level rise and coastal hazard impacts occur.

> ***Note:*** *Some LCPs stipulate a specific anticipated lifetime and/or timeframe for hazards studies for various development types. If no such timeframe is specified, the anticipated lifetime for most single family residences is 75-100 years, and the anticipated lifetime for most major infrastructure development is 100 or more years.*
>
> *Once the anticipated lifetime of the project has been identified, SLR projection scenarios should be chosen based on the project type. While the medium-high risk aversion projection scenario will be appropriate for most projects, specifically for residential and commercial development, the low or extreme risk aversion scenarios may be appropriate in some cases. Notably, the extreme risk aversion scenario should be used for projects with little to no adaptive capacity that would be irreversibly destroyed or significantly costly to repair, and/or would have considerable public health, public safety, or environmental impacts should that level of sea level rise occur. See Step 1 of Chapter 6 and/or Appendix B in the Guidance for more information on identifying relevant SLR projections.*

3. ***Analyze physical effects of coastal hazards and sea level rise:*** Analyze and describe the physical impacts from coastal hazards and sea level rise that may constrain the project site and/or impact the proposed development. Current and future shoreline conditions, including both day-to-day hazards as well as potential hazards from storms and other extreme events, should be addressed. A checklist of information to include is provided here, and detail on how to perform erosion and flooding analyses is further below.

   Please include discussion, maps, profiles, surveys and/or other relevant information that address the following topics. Elevations should be defined relative to the NAVD88 vertical datum.

> ***Note:*** *One or more profiles showing the site that include the proposed development and identify the intertidal zone/beach/dune/bluff etc. along with current and future flood hazard areas and future shoreline conditions accounting for erosion are likely to be particularly helpful for understanding risks, so you may choose to specifically request profiles/site maps with this information.*

a. Current conditions at the site, including the current:

   - Shoreline, dune, or bluff edge, including a professional survey showing the current MHTL, in addition to all available historic surveys, with dates for each survey
   - Inland extent of flooding and wave run-up or overtopping associated with a seasonally eroded beach, extreme tidal conditions, and storm events equal to or greater than the 100-year (1% probability of occurrence) storm event
   - ***[for development along low-lying shorelines]*** Tidal range/intertidal zone

b. Projected future conditions at the site, accounting for sea level rise over the anticipated life of the project, including the future:

   - Shoreline, dune, or bluff edge position, accounting for long-term erosion and assuming an increase in erosion from sea level rise
   - Inland extent of flooding and wave run-up or overtopping associated with both storm (100-year or greater) and non-storm conditions, accounting for the long-term inland migration of the shoreline due to sea level rise
   - ***[for development along low-lying shorelines]*** Tidal range/intertidal zone accounting for an increase in elevation and inland migration due to sea level rise
   - ***[for development along low-lying shorelines]*** Groundwater elevation accounting for changes in groundwater dynamics as sea levels rise

   > ***Note:*** *SLR will cause groundwater levels to rise, but the extent of rise is an area of developing science so site specific analysis may be needed. Consider how groundwater rise could increase flood hazards, impact the effectiveness of SPDs, change/increase liquefaction risk, change salinity, and/or impact development such as basements, roads, underground utilities, etc.*

c. Safety of the proposed structure from current and projected future hazards, including:

   - Identification of a safe building envelope on the site that avoids identified hazards
   - Identification of design or siting options to minimize hazards if no safe building envelope exists
   - Analysis of the adequacy of the proposed building/foundation design to ensure stability of the proposed project relative to expected inundation, flooding, wave run-up or overtopping, and sea level rise for the anticipated life of the development in both storm and non-storm conditions
   - Description of any proposed future sea level rise adaptation measures, such as incremental removal or relocation when threatened by coastal hazards

d. Discussion of the assumptions used in the analysis including:

   - The data, calculations, and/or other resources used to determine long-term erosion and the elevation and inland extent of current and future flooding and wave runup

> ***Note:*** *The following section provides details for how to do erosion risk and geologic safety analyses for development proposed atop bluffs or dunes. The purpose of this analysis is to demonstrate safety from erosion and the inland migration of the bluff/dune. Note that some local building codes may specify different standards for bluff slope stability analyses, which may be appropriate. Otherwise, the language listed below is consistent with many past Commission actions. Structures atop low bluffs/dunes that may also be subject to flooding impacts would need to complete this analysis as well as the flooding analysis further below (though redundant information requirements from this example language could be edited out).*

Bluff or Dune Erosion Hazard Analysis: To examine risks from erosion, the predicted bluff edge or dune profile should be evaluated considering not only historical retreat, but also acceleration of retreat due to sea level rise and other climatic impacts.

- The eroded bluff or dune condition should take into account the long-term retreat that could occur over the anticipated life of the structure, considering the ***[low; medium-high; or extreme]*** risk aversion sea level rise projection identified in Step 2. For new development or redevelopment, the analysis should assume that any current armoring does not exist, such that the site would erode in a manner similar to unarmored sites in the same vicinity. Future long-term erosion should be based upon the best available information, using resources such as the highest historic retreat rates, CoSMoS projections, or shoreline/bluff/dune change models that take rising sea levels into account. The analysis should also consider episodic or rapid erosion, based on recent observations from the project site or nearby areas of comparable geology.
- Proposals for blufftop development should include a quantitative slope stability analysis that identifies a geologic setback, as measured from the bluff edge, which should be sufficient to maintain a minimum factor of safety against sliding of at least 1.5 (static) and 1.1 (pseudostatic, k=0.15 or determined through a quantitative slope stability analysis by a geotechnical engineer). A stable site setback should provide for a stability following long-term erosion, thus the distance from the bluff edge where a minimum factor of safety of 1.5 (static) and 1.1 (pseudostatic) is achieved today should be added to the expected bluff retreat over the life of the development.

> ***Note:*** *The following section provides details for how to do a flood risk analysis for low-lying development. The purpose of this analysis is to demonstrate safety from flooding associated with tides, waves, and storms, and should be completed for all development in low-lying areas that could be subject to these impacts now or in the future. The various sea level rise mapping and modeling tools can be useful as a screening tool to determine if proposed development may be subject to these impacts.*

Flood Hazard, Wave Run-Up, and Overtopping Analysis: The analysis should address current flood hazards as well as flood hazards associated with sea level rise over the anticipated life of the project and should include a description of both day-to-day conditions (current and future daily tidal inundation) as well as extreme conditions (*e.g.*, King Tides, storm events).

- To examine current hazards and risks from flooding, including daily tidal inundation, wave impacts, runup, and overtopping, the site should be examined under conditions of a seasonally eroded shoreline combined with a large storm event. Flood risks should take into account daily and annual high tide conditions, water level rise due to El Niño and other atmospheric forcing, storm surge, and waves associated with a large storm event (such as the 100 year storm or greater). The analysis should consider impacts both with and without any existing shoreline protection.

- Future flood hazard analyses should account for the seasonally eroded shoreline, storm events, *and* the long-term erosion and inland migration of the shoreline associated with sea level rise. For new development, redevelopment, or additions, the analysis should assume that any current armoring does not exist, such that the site would erode in a manner similar to unarmored sites in the same vicinity. Future long-term erosion should be based upon the best available information, using resources such as the highest historic retreat rates, CoSMoS projections, or shoreline change models that take changing sea level into account. Once the appropriate shoreline change has been determined, the same type of flood analyses identified above should be addressed (inundation, flooding, wave runup, and overtopping associated with daily and annual high tides, El Niño, storm surge, and waves from large storm event (i.e. the 100-year event)).
- Flood risk from the ***[low; medium-high; or extreme]*** risk aversion sea level rise scenario over the anticipated life of the development should be examined for the conditions noted in the above bullet. If no risks are posed to the proposed site/project from that sea level rise projection projection plus an extreme storm event over its anticipated lifetime, no other sea level rise scenarios need to be assessed. If hazards do pose a risk to the project/site, additional analyses using lower sea level rise scenarios should be undertaken to determine the threshold at which impacts occur, along with a discussion of what sea level rise amounts could be addressed through a combination of hazard avoidance, minimization, and/or future adaptation.

  Additionally, the analysis should consider the *frequency* of future flooding impacts (*e.g.*, daily impacts versus flooding only from extreme storms) and describe the extent to which the proposed development would be able to avoid, minimize, and/or withstand impacts from such occurrences of flooding.

> ***Note:*** *The 100-year storm is normally used as the design storm, regardless of time period that the proposed structure is expected to be in place. However, if the proposed project is a critical facility that would have far-reaching consequences if damage occurred from a larger storm, or if it is expected to be in place for more than 100-years, it may be appropriate to examine risks associated with larger storms, such as a 500-year storm event. Temporary development or development with only limited consequence risks may not need to examine significant storms like the 100-year event.*

4. ***Analyze impacts to coastal resources considering sea level rise:*** Analyze and address how the project may impact coastal resources such as public access and recreation, water quality, coastal habitats, and visual resources over time, given the influence of sea level rise. Consider in particular how coastal resources like wetlands or sandy beaches could be narrowed or lost if the proposed development will limit their natural migration, as well as

how existing or planned future adaptation strategies such as elevation could impact visual and or other coastal resources.

5. ***Identify project alternatives, as necessary:*** Identify and describe project alternatives that avoid resource impacts and minimize risks to the project. Alternatives may include, for example, larger setbacks, building a smaller structure in an unconstrained portion of the site, elevating the structure, or providing options that would allow for incremental or total removal of the structure if and when it is impacted in the future. Include an assessment of any sea level rise adaptation measures that may be implemented in the future, such as relocation or removal if and when the development is threatened by coastal hazards.

Note: *There is a difference between "analyzing" and "designing" for a worst-case scenario. Although analyses should consider a worst-case scenario (e.g., a high SLR projection plus an extreme storm at high tide on a seasonally eroded beach), it may not be necessary to site and design a structure to avoid such a scenario. Different types of development will be able to tolerate different impacts based on their different uses and associated management options. For example, it may be acceptable for parking lots to flood on a monthly basis, while such frequent flooding on a highly trafficked roadway would not be tolerable.*

Thus, development that is designed to avoid impacts from, for example, daily tidal inundation with sea level rise for the next 75 years may be reasonable, even if it is only expected to be safe from extreme storms plus sea level rise for the next 50 years, provided that the longer-term risks are understood and minimized to the greatest extent feasible.

If the analysis shows that the project will not be safe from future hazards over its anticipated lifetime, the proposal should identify and describe possible future adaptation measures that ensure safety and protect coastal resources (also see subsection (c) on page 4 of this memo).

Please use your best judgement when analyzing the extent to which the development will adequately avoid, minimize, or withstand both day-to-day hazards and hazards from storms or other extreme events.