

Sea Level Rise and Tam Valley – A Primer

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How high will the sea level rise (SLR) and when? How will it affect us in Tam Valley?

The short answer is that nobody knows for sure. There are far too many variables, including global warming, ice cap melting, and the El Niño-Southern Oscillation (ENSO) and Pacific Decadal Oscillation (PDO). Scientists at the National Oceanic Atmospheric Administration have categorized their predictions into three categories – Low, Intermediate, and Highⁱ.

- The *Low* prediction of 1.6-foot SLR by 2100 assumes global warming is limited to <2° Celsius, which is the goal set by the Paris Climate Agreement, and limited ice loss. The United Nations reports that we are unlikely to achieve these goals given current political trendsⁱⁱ.
- The *Intermediate* prediction of 1-foot rise by 2035 and 4 feet by 2100 assumes global carbon emissions rise through 2050 and then decline. Ice sheets melt at historic rates. This is a more likely scenario given the U.N. is predicting a 3 to 5 degree Celsius increase in global temperatures. *In Tam Valley, a 1-foot rise combined with a storm surge would breach levees and inundate almost all of Birdland nearly every day, and access to Miller Ave and Highway 101 would be blocked*ⁱⁱⁱ.
- The *High* prediction of 2-foot rise by 2045 and 6.5 feet by 2100 assumes continued rise in global carbon emissions and increasing loss of land ice (ie Greenland and Antarctica). This scenario is very possible. *In Tam Valley, a 2-foot rise would inundate Birdland between the slough and Highway 1 every day. During a storm surge, all of Birdland and most of Kay Park would be inundated and access to Miller Ave and 101 would be blocked.*
- Note that these numbers represent a “bathtub” sea level, in other words, they do not account for king tides which add a foot or more of water level, or storm surges which can add as much as 3 feet. The figures also do not account for rain runoff, such as from Coyote Creek, which increases the saturation levels of low-lying land.

Additional sobering possibilities add to the challenges identified in the different scenarios.

- Scientists at the Jet Propulsion Laboratory^{iv} think that the PDO has been in a cool phase in the last several decades but is cycling into a warm phase that will last another 20 years. What does that mean? It means we are likely to see increased frequency and severity of El Niños resulting in even higher sea level.
- And then there’s ice loss from West Antarctica. Scientists have found ice loss from West Antarctica affects California at a rate 25% higher than in other parts of the world. In other words, if ice loss increases global sea level by 1 foot, it would increase by 1.25 feet here.^v The USGS estimates that if all land-based ice on earth were to melt, sea levels would rise about 230 feet!

Take a look at the attached set of maps. They illustrate the predictions described above. I suggest you visit <https://explorer.adaptingtorisingtides.org/explorer> and play with different scenarios. It’s pretty shocking.

What can we do about it? What strategies are available?

Answers are super complicated but **we must take action now**. At stake are homes, businesses, roads, transit, utilities, other infrastructure, revenues from property taxes, and the health of bay ecosystems. Scientists and engineers from Marin County and Point Blue Conservation Science^{vi} studied adaptation alternatives and identified three categories of adaptations. Each of the options has various pros and cons which are addressed in their study:

- Category 1: “Grey” engineering adaptations such as seawalls, levees, pump stations, riprap, tidal gates. Note that SLR will not stop in 2050 so barrier design should allow for raising top elevation in the future for when SLR exceeds design values.
- Category 2: “Nature-based” engineering adaptations such as wetlands enhancement/conversion, wetlands creation, levees with wetlands transition zones, shoreline erosion protection
- Category 3: *Infrastructure and lifestyle adaptation*, including elevating structures above future tides, floodable and floatable developments (floating homes, Dutch “polders”), planned retreat (allowing lands

to become fully or partially inundated), infrastructure removed and relocated to higher location, and local zoning and permitting changes.

How can I learn more?

- First of all, register for and attend the **February 23 Community Forum on Sea Level Rise in Tam Valley**. To register, go to: <https://us02web.zoom.us/meeting/register/tZlvd--tqT8iE9EF2vbUvymY0HeMsckVSsv9>
- **Commit to becoming part of the conversation.** All of us in Tam Valley will continue to be impacted by SLR at ever increasing levels. We need to have a place at the table and an informed voice as decisions are made about our shared fate.
- The citations listed in the endnotes of this primer are very useful. In addition, the following sources are great if you want to do a deeper dive into the physical, political, and financial issues we must address if we want to avoid extraordinary dislocation and expense.
 - Marin Shoreline Sea Level Rise Vulnerability Assessment: Bay Waterfront Adaptation and Vulnerability Evaluation <https://www.marincounty.org/main/marin-sea-level-rise/vulnerability-assessment>
 - San Francisco Bay Shoreline Adaptation Atlas: Working with Nature to Plan for Sea Level Rise Using Operational Landscape Units <https://www.sfei.org/adaptationatlas>
 - Bay Adapt: Regional Strategy for a Rising Bay Joint Platform Executive Summary <https://www.bayadapt.org>

ⁱ Union of Concerned Scientists – “Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate” June 18, 2018 <https://www.ucsusa.org/resources/underwater>

ⁱⁱ Global Temperatures on track for 3-5 degree rise by 2100: U.N. by Reuters Staff November 29, 2018 <https://www.reuters.com/article/us-climate-change-un/global-temperatures-on-track-for-3-5-degree-rise-by-2100-u-n-idUSKCN1NY186>

ⁱⁱⁱ <https://explorer.adaptingtorisingtides.org/explorer>

^{iv} Buis, Alan “Changing Pacific Conditions Raise Sea Level Along U.S. West Coast” Jet Propulsion Laboratory November 9, 2020 <https://www.nasa.gov/feature/esnt/2020/for-us-west-coast-changing-pacific-conditions-raise-sea-level-rise-stakes>

^v Griggs, Gary et al (California Ocean Protection Council Science Advisory Team Working Group) “Rising Seas in California: An Update on Sea-Level Rise Science” April, 2017 California Ocean Science Trust <http://www.opc.ca.gov/webmaster/ftp/pdf/docs/rising-seas-in-california-an-update-on-sea-level-rise-science.pdf>

^{vi} Richardson Bay Shoreline Study: Evaluation of Sea Level Rise Impacts and Adaptation Alternatives Public Review Draft Oct 14, 2015 <https://www.marinwatersheds.org/resources/publications-reports/2015-richardson-bay-shoreline-study>