Global warming and the Bay Area – A handout for 2020 King Tides walks

Since the mid-20th Century, the earth has been warming at an increasing rate. Evidence is overwhelming that this is due to humanity’s increased discharge of greenhouse gases – mainly carbon dioxide but also others, including methane and nitrous oxide. By reflecting infrared energy back to the earth, these gases form a heat-trapping blanket that warms the earth.

This rapid change of climate is undermining earth’s systems in many ways. For the Bay Area, likely effects include longer and more extreme hot spells, more and fiercer wildfires, uncertain water supplies due to lessened and earlier snowmelt, and change and loss in plant and animal communities. Off our shorelines, as marine waters absorb more of our rampant carbon dioxide from the air, seawater is becoming more acidic. From microscopic floating creatures to corals, clams, oysters, and crabs, increased acidity already is making it harder to form the shells they need.

In the Bay Area, the most visible effect is likely to be sea-level rise. King Tides – winter’s highest daytime tides – are a glimpse of that future.

Sea levels are rising mainly due to melting ice and snow, but also because water expands as it warms. After rising about 8” since 1880, Bay Area sea level is expected to rise another ½ to 3 ft. by 2050, or 2 to more than 6 1/2 ft. by 2100. Rapid melting of the Greenland and Antarctic Ice Sheets could greatly increase this.

But oceans do not just rise quietly, like a filling bathtub. Most damage comes from storm tides, when high tides, storms, large waves, and heavy freshwater runoff coincide, accelerating erosion. Rising sea level can make these worse: waves become more powerful as they move across longer stretches of deeper water, and coastal marshes that can tamp down wave battering are drowned. A 2019 study by US Geological Survey researchers estimated that these factors could about triple damage done by rising seas alone.

To protect the people and places we love from challenges faced by sea-level rise, we will need some mix of all of the following:

- **Slow climate change by reducing emissions of greenhouse gases**: We can generate energy with sun, wind, tides, or other methods that produce little or no greenhouse gases. We can use low-emissions transportation and build cities more compactly to reduce transportation needs. We can improve energy efficiency of buildings, industry, and farming, and reduce waste (avoiding energy-wasting overproduction and methane emissions from burial in landfills). We can increase carbon storage (sequestration), in soil and plants or perhaps by as-yet-undeveloped engineered methods. We can reduce emissions politically, for example by regulations, a carbon tax, or cap-and-trade programs. Significant effects will require collective action.

- **Harden and build higher and drier**: Build, raise, or strengthen levees. Build dams, gates, or locks to control tidal flows. Strengthen bridges, docks, and seawalls against higher waves and storm surge. Strengthen and protect tunnels and pipes that are below high-tide levels. Elevate building pads or other surfaces. This will cost billions and require unprecedented planning and cooperation.

- **Accommodate**: Build floating buildings, docks, and bridges. Build to accommodate floods, from building on piers to using ponds and permeable surfaces to manage floodwaters. Accept that some roads, parks, etc. will be temporarily inaccessible.

- **Maintain and increase tidal marshes and “living shorelines”** that can absorb waves and surges. (Coastal wetlands, such as salt marshes, also can capture and store carbon.) Provide corridors or move plants and animals deliberately to areas where they can survive. These efforts can ease or delay problems but cannot solve them.

- **Move**: Move houses, roads, and critical infrastructure such as pipelines, railroads, and airports away from the Bay shore, low-lying areas that can flood, and areas that have subsided below sea level (mainly in the South Bay and Delta). History suggests that people will resist relocation.
You can join in actions that will protect us:

- **Reduce your carbon footprint – the amount of greenhouse-gas emissions you cause.** You can estimate your household’s greenhouse-gas emissions and get ideas on reducing them with a carbon-footprint calculator, like these from the Nature Conservancy [nature.org/en-us/get-involved/how-to-help/carbon-footprint-calculator](http://nature.org/en-us/get-involved/how-to-help/carbon-footprint-calculator) or UC Berkeley [coolclimate.org/calculator](http://coolclimate.org/calculator). Many actions can help – including what you eat, how you garden, what and how much you buy, and how you deal with waste. But as the calculators show, for most households, the biggest effects are likely to come from housing and transportation. Dense housing; good insulation and energy-efficient appliances; switching to green energy providers and/or solar power; using an electric vehicle or transit, cycling, and walking. These changes by individuals add up – but they will not solve the problem.

- **Support candidates, laws, policies, and funding that deal realistically with global warming.** Climate action plans are required in all cities. Your city’s clerk or Sustainability Committee/Commission can guide you to what your city is doing and how you can help. Most of the burden of dealing with sea-level rise is being left to local jurisdictions [lao.ca.gov/reports/2019/4121/coastal-adaptation-121019.pdf](http://lao.ca.gov/reports/2019/4121/coastal-adaptation-121019.pdf). You can support city and county actions such as increasing housing density and adopting energy-saving building codes. Effective action will almost certainly require unprecedented regional cooperation, difficult tradeoffs, and large new funding sources. You can get involved in regional planning efforts, for example by the Bay Conservation and Development Commission, Association of Bay Area Governments, and Metropolitan Transportation Commission. You can learn about, support, or seek to change state programs such as cap-and-trade and emissions targets.

- **Support and volunteer with nonprofits** working on climate initiatives. Work ranges from public education (including contributing photos to the California King Tides Initiative, coastal.ca.gov/kingtides) and hands-on efforts like planting trees, through research and political and legal action. Find something that seems effective and meaningful to you!

**Where to learn more**

**Maps project some sea-level rise effects:** Several maps project likely flooding at various levels of sea-level rise. These include NOAA’s Sea Level Rise Viewer (nationwide, down to community scale, coast.noaa.gov/slr/) the Bay Area Flood Explorer (by regional agencies, more detailed; explorer.adaptingtorisingtides.org/explorer) and Surging Seas Risk Finder, from nonprofit Climate Central and real-estate company Zillow (searchable down to parcels – and as the name implies, perhaps more aggressive; riskfinder.climatecentral.org/). None of these maps takes into account effects of heavy rains, flooding streams, soil conditions, erosion, or buried toxics.

**More information:** The California Landscape Commons Partnership’s Climate Commons, climate.calcommons.org/basic/welcome-climate-commons, has links to many reports and tools on all aspects of climate change in the state.

The Bay Conservation and Development Commission’s Adapting to Rising Tides, adaptingtorisingtides.org/, has guidance aimed at dealing with challenges in the Bay Area.

“We’re not Doomed – Restoring a Safe and Health Climate,” 6-9 PM Tues., Jan. 21, at Berkeley’s Brower Center, has tables with activist efforts, short films, and a panel, sponsored by Citizens Climate Lobby. ecologycenter.org/events/were-not-doomed-restoring-a-safe-and-healthy-climate/

This handout is on line, with clickable links, at www.fivecreeks.org/info/.