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CLIMATE

Here's where sea levels are rising fastest in California. Homes, a nuclear facility and part of Highway 101 are all at risk



Alexandra Hootnick / Special to The Chronicle

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ARCATA, Humboldt County — Anchored by the cities of Eureka and Arcata and known for its redwood forests, cannabis tourism and cool, misty beaches, Humboldt Bay also has an unwelcome distinction: It has the fastest rate of sea level rise on the West Coast.

Tectonic activity is causing the area around the bay roughly 300 miles north of

San Francisco to sink, which gives it a rate of sea level rise that is about twice the state average. Compared to 2000, the sea in the area is expected to rise 1 foot by 2030, 2.3 feet by 2050 and 3.1 feet by 2060, according to California Ocean Protection Council.

Residential areas, wastewater treatment plants and a segment of Highway 101 that connects Eureka and Arcata are all at risk — especially when the frequent and intense storms associated with climate change trigger more flooding. There are even long-term worries about a nuclear waste storage facility on the bluffs. Yet the region also has become a test case for how to adapt to a problem that faces all of coastal California, including by restoring wetlands that were filled in for logging and farming in earlier eras.

Sea level rise along Humboldt coastline

The sea level is expected to rise 3.1 feet by 2060 in Humboldt Bay, the fastest rate on the West Coast, according to the California Ocean Protection Council. This map models what an environmental group thinks that could look like during a 100-year storm event, such as one that hit the area in 1964.

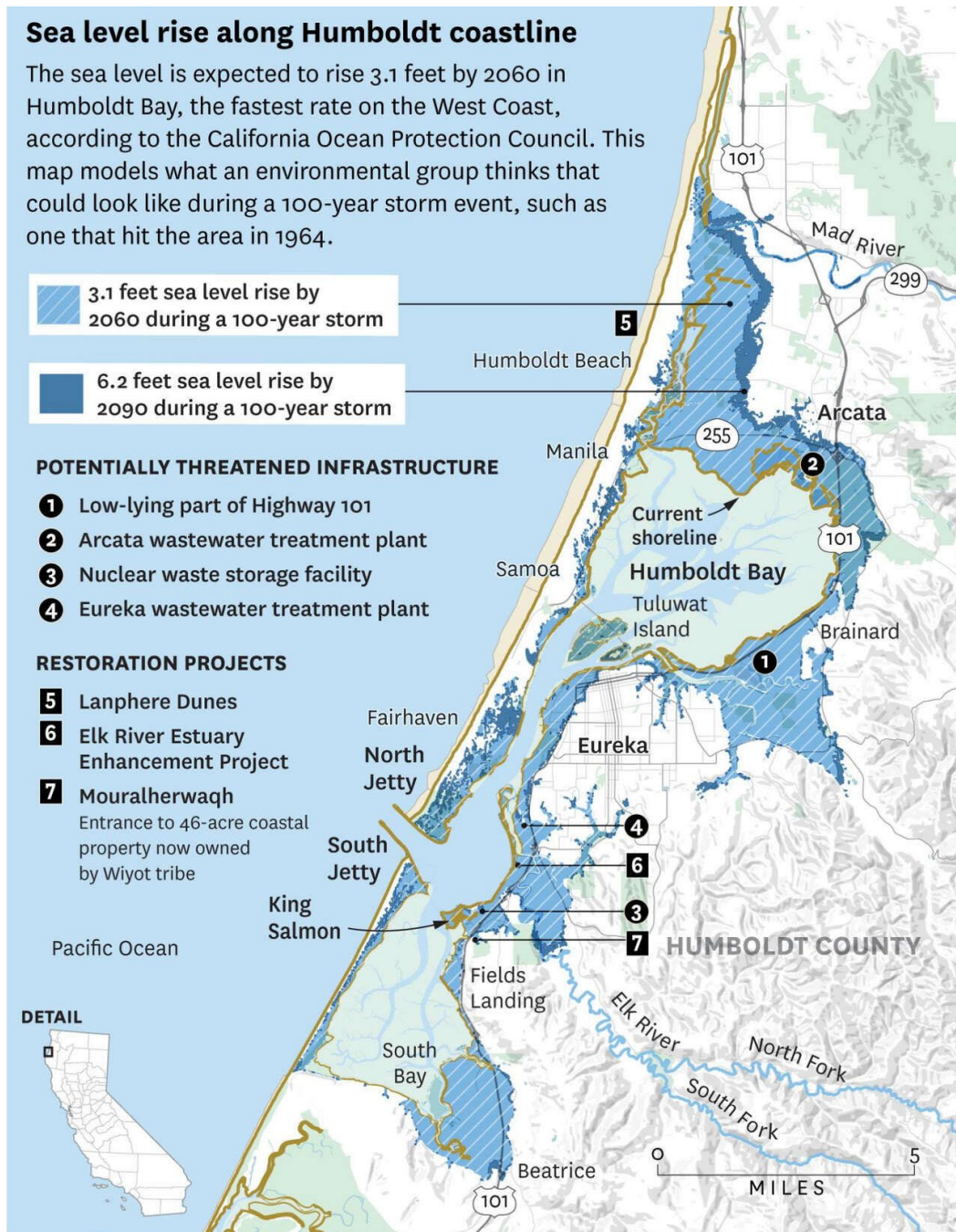


Chart: John Blanchard / The Chronicle

Source: Humboldt Baykeeper and Northern Hydrology & Engineering

"We say the bay is going to take back from us what we borrowed for the last hundred years or so," said Jennifer Kalt, director of the nonprofit group Humboldt Baykeeper and a member of the Cal Poly Humboldt Sea Level Rise Institute.

Residents get a preview of what's in store during king tides, when highways and boat ramps are inundated and sloughs become bloated pools. During a king tide last year, a historic redwood barn on the Eel River Estuary south of the bay was photographed being battered by waves that reached it after years of subsidence and erosion in the surrounding farmland.

City, county and state officials, working with scientists at California State Polytechnic University Humboldt in Arcata, have created multiple reports and studies on how best to address the problem, which is caused as the arctic ice sheet and glaciers melt and seawater expands as its temperature increases. But it's also hard to prioritize action on an issue that is due to have its worst impact decades from now.

"Although slow, sea level rise must be planned for and mitigation efforts developed now to protect communities and infrastructure," read a Humboldt County Civil Grand Jury investigation released in May that cited threats to 30 electrical transmission towers, 9.6 miles of municipal water transmission lines, 52 cultural sites of the Wiyot tribe, contaminated former pulp mills and the access road to the town of King Salmon. "Sea level rise planning needs to be a priority among all elected officials in the county."

The gold standard for responding to the threat is what is known as managed retreat, or moving infrastructure out of harm's way — but that is also the most expensive and disruptive approach, said Joel Gerwein, North Coast deputy regional manager at California Coastal Conservancy, which funds restoration projects.

Caltrans may end up having to do so with a highway it has already begun upgrading: a 6-mile segment of Highway 101 that hugs the edge of the bay between Eureka and Arcata and is due to be flooded regularly by 2030.

"Potentially during a king tide event, we could have the water going over the highway, and then that would shut down the highway," said Clancy De Smet, Caltrans climate change adaptation branch chief for the region.

An adaption plan due from Caltrans in 2025 could involve moving part of the highway inland. De Smet said that some of the new bridges were engineered so that they could be elevated if necessary.

The southern end of the bay has the biggest subsidence problem. That's because

of geologic activity about 30 miles away: three tectonic plates converge, one of which is sliding under another. The harbor village of King Salmon, built on landfill in the mid-20th century, is located here.

King Salmon is one of several areas in the bay that have been designated as vulnerable to flooding during 100-year-storms, calamitous events that used to have only a 1% chance of happening each year but have become more frequent with climate change.

King Salmon's location also puts it at risk of tsunami. Its tsunami evacuation route is a footpath that happens to lead from the bay to a good vantage point for the PG&E power plant, where 37 tons of spent nuclear fuel from a decommissioned nuclear power plant is stored in a concrete bunker.

Though experts say the site is likely safe for decades, the nuclear storage area is situated on a hill that is very close to the eroding shoreline. The erosion worsened after jetties, first built in the 1890s, helped shape the entrance to the bay, channeling wave activity toward the shore.

"When it was built, sea level rise was not as well understood as it is now," said Kalt, who is also a lecturer at Cal Poly Humboldt in Arcata. The California Coastal Commission also wants the federal government to move the waste, citing natural hazards.

Carina Corral, a spokeswoman for PG&E, which runs the site where the utility once operated the now-decommissioned nuclear plant, said that the site is regularly inspected and was built to "withstand the effects of environmental conditions and extreme events." She noted that PG&E is waiting for the government to follow through on its commitment to build a long-term national storage facility, which would allow it to move the fuel.

The Nuclear Regulatory Commission said in a statement that it takes appropriate action to protect safety when new information comes to light, and the site currently meets requirements.

Another concern for Kalt are the dozens of former lumber and pulp mills that once stood around the bay during its logging heyday, which likely left contaminants in the soil that could emerge once both the sea level and groundwater rise. Kalt and her colleagues are working on a database to see which of the sites are most vulnerable.

To add to its worries, Humboldt County also has the highest rate of coastal cliff erosion in California according to a recent study, though not at Humboldt Bay; one of the worst stretches is at Centerville Beach to the south.

As the sea rises, another way to prepare that is less expensive than moving highways or other forms of managed retreat are projects that restore some of the coastline's original features like wetlands and native dunes. But these projects, often called nature-based solutions, are considered interim solutions, according to Gerwein.

Andrea Pickart, an ecologist at U.S. Fish and Wildlife Service, has been working for close to 40 years to restore native plants at Lanphere Dunes, which create a barrier on a strip of land that separates the northern part of the bay from the ocean. The process involves removing invasive European beach grass, which covers most of the coast with a sage green monochrome of pointy leaves, with native species like yellow sand verbena, goldenrod and beach strawberry.

Using a walking stick to march over the sand, her hiking shoes dislodging rusty pollen from flowering seaside buckwheat, Pickart explained that these delicate plants are more effective in shoring up dunes than beach grass. According to a study she co-authored in July, native dunes were found to recover more quickly after storms because they allowed sand from the ocean to migrate inland. Meanwhile, the nonnative dunes formed steep slopes that remained static, making them less resilient to storms and rising seas.

"It shows we can use restoration as a way of adapting to climate change," she said, adding: "It increases the biodiversity and ecological value of the site at the same time."

Inside the bay, wetlands restoration is a more common strategy. Ninety percent of wetlands in the area were filled in over a century ago by European settlers. Land that was diked for farming tends to sink below sea level, making it even more vulnerable to flooding — especially when it's been grazed by cattle, whose heavy footsteps help press the spongy earth down.

In Eureka, former pastureland is being transformed for the Elk River Estuary Enhancement Project, where excavators are digging a channel that will snake south from the Elk River and turn 114 acres back into tidal marshland.

Among other benefits, the \$6 million project will protect a section of nearby Highway 101 from flooding as it provides room for floodwaters from both the river and the sea to go during storms — which the wetlands did naturally before they were filled in.

“It’s a really amazing amount of real estate to be able to bring back into the natural landscape,” said Katie Marsolan, the project manager. “We’re trying to make up for lost time.”

Just south of the project, the Wiyot Tribe plans to do the same as it restores an ecologically and culturally significant area called Mournalherwaqh, where it recently purchased a 46-acre parcel with \$1.2 million grant from the state Ocean Protection Council.

“Habitat conservation is a nature-based solution to sea level rise that can also provide opportunities for environmental justice and indigenous land return,” said the tribe’s natural resources director Adam Canter, who is also co-chair of the Cal Poly Humboldt Sea Level Rise Institute.

On a recent tour, Canter tore down thick strands of invasive English ivy from native Sitka spruce leftover from when the land was used for logging.

The property has large freshwater wetlands that Canter describes as looking like two lungs on a map, which he said will eventually be inundated as the sea rises. Though it sounds destructive, that will allow saltwater habitat to migrate inland in an area that’s otherwise developed and provide habitat for wildlife seeking refuge from climate change, he said.

Natalie Arroyo, a Eureka City Council member who will start a term on the Humboldt County Board of Supervisors in January, said that local governments are well aware of the issue of sea level rise but often don’t have funding for major improvements.

“We acknowledge that these infrastructure changes are needed, but they’re, five, 10, 20 years away, and we’re dealing with this year’s budget,” she said.

For example, some people have called for moving the Eureka wastewater treatment facility away from its bayside location, which makes it vulnerable to sea level rise.

Arroyo is more concerned about underground wastewater and drinking water lines that are in need of upgrades but often can't be prioritized because there's a broken sewer main that needs to be fixed immediately.

"The problem with climate change preparedness, generally speaking, is that local governments have limited resources," she said. "We will need a level of investment that as a small coastal city we don't currently have."

Editor's note : This story was updated to clarify how the bridges that were built for a Highway 101 upgrade were engineered.

San Francisco Chronicle data reporter Yoohyun Jung contributed to this story.

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