SPUR

CASE STUDY
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Look Out Below

Groundwater rise impacts on East Palo Alto — A case study for equitable adaptation

Acknowledgments

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The findings and recommendations of this report are SPUR's and do not necessarily reflect the views of any reviewer or interviewee. Any errors are the author's alone.

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About Nuestra Casa
Nuestra Casa exists to uplift Latinx families in East Palo Alto and the mid-peninsula through community education, leadership development, and advocacy. Nuestra Casa has served the safety-net needs of immigrant and low-income populations for more than 20 years. The organization started small, offering English language classes and engagement support to help parents navigate services and schools. Newer programs include Community Outreach, Promotora (community outreach worker training), Environmental and Water Justice, Housing Advocacy, and Food Rescue/ Distribution. Programs and communications are offered in both English and Spanish. All the organization's efforts are informed by three core strategies: community education, leadership development, and community-driven advocacy.

Contents

Executive Summary

As the impacts of sea level rise and accompanying groundwater rise become better understood, scientists and community leaders have become increasingly concerned about low-lying communities on the San Francisco Bay shore. One of these communities is East Palo Alto. Nuestra Casa, a community-based organization in East Palo Alto, partnered with SPUR to learn more about the threat of groundwater rise and potential policy responses to address it.

Thanks to the work of researchers from Pathways Climate Institute, the San Francisco Estuary Institute, the University of California–Berkeley, and the U.S. Geological Survey (USGS), among others, scientific understanding of groundwater rise is rapidly advancing. Shallow groundwater is fresh water that is stored in soils below the ground surface. This groundwater is often full of pollutants from fertilizers, roadway runoff, and past and current industrial land uses. As sea levels rise in response to climate change, salty San Francisco Bay and Pacific Ocean water can move further inland, pushing the groundwater up through the soil in a process known as groundwater rise. The closer the groundwater table is to the ground's surface, the more likely that heavy rains will cause flooding of roads, streets, and homes. Beyond flooding, researchers have found that groundwater rise is likely to corrode and disrupt below-grade infrastructure, increase pollution entering the San Francisco Bay, mobilize soil contaminants, and raise the risk of soil liquefaction during earthquakes.

Based on a review of the technical data, this report summarizes the risks of groundwater rise for East Palo Alto and offers recommendations for action at the local, regional, and state levels. Although the findings are specific to East Palo Alto, the risks of groundwater rise are comparable across the Bay Area's low-lying communities. Similarly, the report's recommendations are applicable to the entire region.

FINDINGS

Located adjacent to Bay marshland, East Palo Alto is particularly vulnerable to compound flooding from sea level rise, storm surges, extreme precipitation, and riverine overflows at San Francisquito Creek. The city already struggles with flooding during winter storms; groundwater rise is likely to worsen this flooding. East Palo Alto's aging infrastructure, contaminated shoreline industrial sites, and current liquefaction risk will all be affected. The impacts of groundwater rise will be felt long before sea level rise causes overland flooding.

Groundwater rise will increase inland flood risk in the eastern neighborhoods of East Palo Alto. Without intervention, rising groundwater levels will make flooding increasingly common in neighborhoods east of Pulgas Avenue. Flooding will make it difficult to move around the

neighborhood and access basic needs and services. Homes may be damaged by floodwaters. Residents who come in contact with floodwater may be exposed to contaminants and waterborne illnesses. Flooding can increase rates of mold and fungi growth, which can lead to unhealthy indoor air quality and to respiratory illnesses.

Groundwater rise will damage local infrastructure, particularly belowground water infrastructure. Sanitary sewer, stormwater, and drinking water systems are some of the municipal systems most affected by groundwater rise. The majority of water infrastructure consists of pipes located underground within 6 feet of the ground surface. Groundwater rise can increase corrosion rates and degrade underground pipes faster than expected as the shallow groundwater becomes more saline. The seasonal rise and fall of the shallow groundwater table will stress pipes by destabilizing surrounding soils, increasing the number of pipe leaks and breaks. A higher groundwater table will also increase groundwater infiltration into storm and sewer pipes through these leak points. Damaged infrastructure could pose a threat to human health and require costly repairs.

Groundwater rise will mobilize contaminants at legacy industrial sites. East Palo Alto has about 50 industrial sites vulnerable to groundwater rise. Research shows that soil contaminants, such as volatile organic compounds (VOCs) found at legacy industrial sites, can travel into cracked storm and sanitary sewer pipes and enter nearby homes. Even remediated industrial sites should be revisited to assess contamination risk with groundwater and sea level rise and to protect residents from health impacts.

Groundwater rise will increase liquefaction and lateral spreading risk in parts of East Palo Alto. Soil liquefaction, when the ground acts like a liquid during intense earthquake shaking, causes the ground to sink and shift, which can severely damage homes and roads. During a major earthquake, East Palo Alto could experience liquefaction and lateral spreading due to its location and soil characteristics. According to the U.S. Geological Survey, groundwater and sea level rise could increase liquefaction risk in low-lying areas, such as East Palo Alto, built on marshland and fill.

Local, regional, state, and federal planning and guidance documents for sea level rise and climate change have only recently recognized groundwater rise, and some documents, including California's State Hazard Mitigation Plan (SHMP) 2023 Update, still omit this risk. Incorporating groundwater rise risk in planning documents will give jurisdictions and communities greater access to the scientific knowledge and financial resources that could aid in adaptation. If groundwater rise is not included in government guidance documents at all scales, funding will remain limited, and research and adaptation will be slowed. Now is the time to take action to mitigate the worst impacts of groundwater rise on public health, ecosystem health, economic development, and community resilience. In the last few years, San Mateo County and East Palo Alto have received funding for sea level rise adaptation projects, such as the San Mateo County OneWatershed Climate Resilience Framework and the Strategy to Advance Flood protection, Ecosystems and Recreation

along San Francisco Bay (SAFER Bay Project). Community and government leaders of these two efforts already understand the importance of mitigating groundwater rise risk and seek to address it through implementation projects. These will likely be key projects in the development of groundwater rise adaptation solutions. With community leadership, funding, and continued research on solutions, the Bay Area will be able to collaboratively advance equitable adaptation pathways that prioritize the health and needs of those most impacted by climate change.

RECOMMENDATIONS

SPUR and Nuestra Casa have developed recommendations for policymakers to manage and reduce the risks of groundwater rise in the City of East Palo Alto and San Mateo County. Many of these recommendations could be more broadly applied to other vulnerable communities in the Bay Area.

Recommendation 1

Require all city plans and infrastructure projects to assess the risks of groundwater rise and compound flooding.

Recommendation 2

Consider adopting Shallow Groundwater Rise Overlay Districts, which specify design and retrofit requirements for underground infrastructure, roadways, and new shoreline development in high-hazard areas.

Recommendation 3

In partnership with impacted communities, update guidance for remediation requirements of shoreline sites to incorporate risks of contaminant mobilization from groundwater and sea level rise.

Recommendation 4

Update sea level rise and flood maps to reflect shallow groundwater rise so that relevant agencies can begin planning processes to address it.

Recommendation 5

Pursue a variety of innovative funding mechanisms to support groundwater rise research, adaptation planning, and implementation projects.

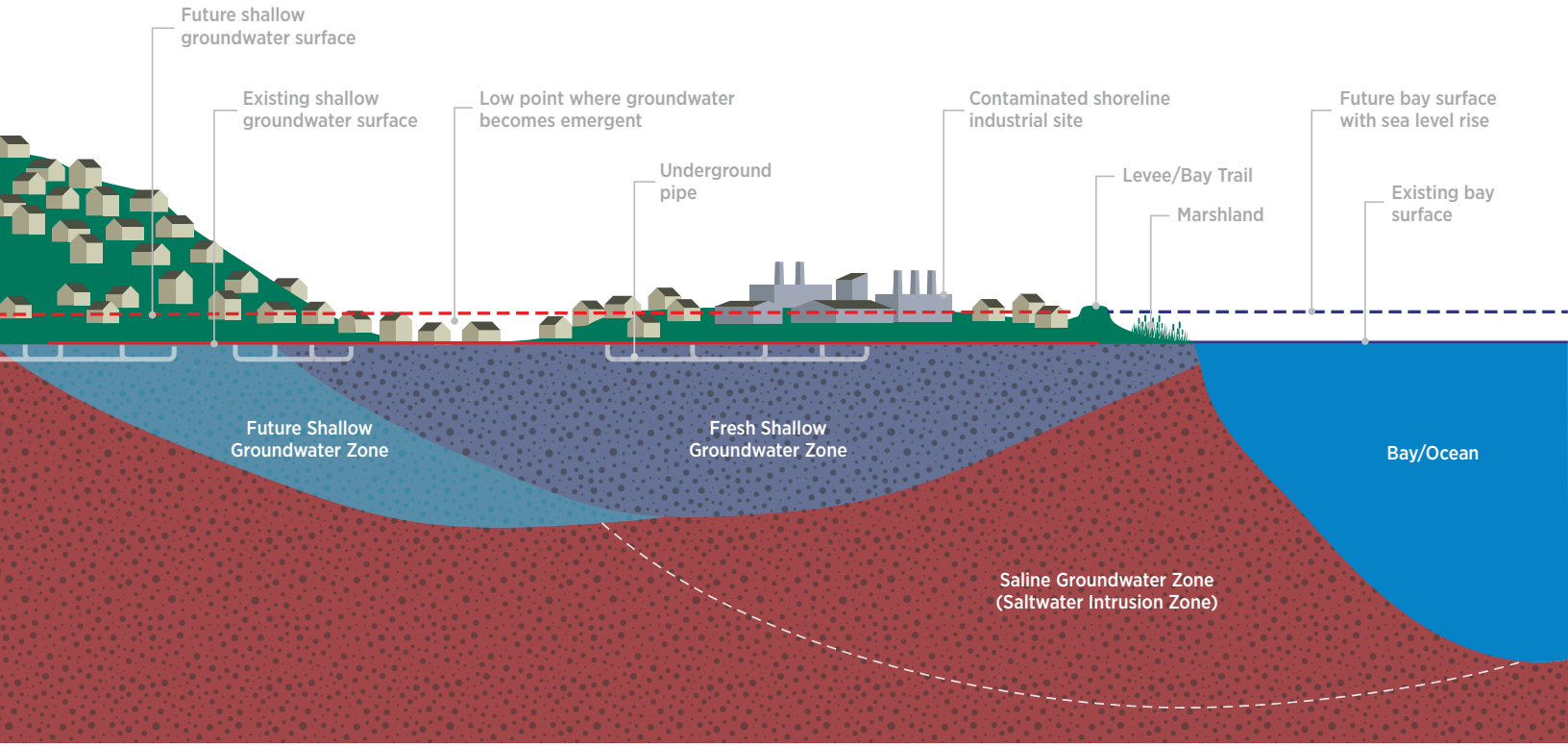
Introduction

Shallow groundwater is fresh water that is stored in soils below the ground surface. This groundwater is often full of pollutants from fertilizers, roadway runoff, and past and current industrial land uses. As sea levels rise in response to climate change, salty San Francisco Bay and Pacific Ocean waters move further inland, pushing the groundwater up through the soil in a process known as groundwater rise (Exhibit 1).[1] When the shallow groundwater table is closer to the ground's surface, the soil becomes more saturated and does not have the space to absorb rainwater, increasing the likelihood that heavy rains will lead to flooding of roads and homes. When soils are fully saturated (when the groundwater table is at the ground's surface), rainfall runoff can immediately contribute to flooding. Over time, flooding will become more common in low-lying areas unless groundwater management interventions are implemented.

EXHIBIT 1

Sea level rise will cause shallow groundwater to rise closer to the ground surface and to sometimes emerge as floodwater.

Source: SPUR illustration based on diagram from C. L. May, A. Mohan, E. Plane, D. Ramirez-Lopez, Michael Mak, L. Luchinsky, T. Hale, and K. Hill, "Shallow Groundwater Response to Sea-Level Rise: Alameda, Marin, San Francisco, and San Mateo Counties," Pathways Climate Institute and San Francisco Estuary Institute, 2022, https://www.sfei.org/documents/shallow-groundwater-response-sea-level-rise-alameda-marin-san-francisco-and-san-mateo.



[1] C. L. May, A. Mohan, E. Plane, D. Ramirez-Lopez, M. Mak, L. Luchinsky, T. Hale, and K. Hill, *Shallow Groundwater Response to Sea-Level Rise: Alameda, Marin, San Francisco, and San Mateo Counties*, Pathways Climate Institute and San Francisco Estuary Institute, 2022, https://www.sfei.org/documents/shallow-groundwater-response-sea-level-rise-alameda-marin-san-francisco-and-san-mateo.

The City of East Palo Alto is particularly vulnerable to sea level and shallow groundwater rise because it is low-lying and directly adjacent to the San Francisco Bay and San Francisquito Creek. Today, shallow groundwater levels are 0 feet to 6 feet below the ground across the city's eastern half. By 2050, with a projected 1 foot of sea level rise, a higher shallow groundwater table will increase the likelihood of regular and prolonged flooding during winter storms in neighborhoods east of Pulgas Avenue. Beyond flooding, groundwater rise will lead to increased liquefaction risk, contaminant mobilization, and damage to critical infrastructure, such as sewer systems, drinking water pipes, roads, and building foundations.

Understanding of groundwater rise is advancing rapidly due to the work of researchers from Pathways Climate Institute, the San Francisco Estuary Institute, the University of California–Berkeley, and the U.S. Geological Survey (USGS), among others. In the last two years, in federal, state, and regional studies, groundwater rise has been highlighted for the first time as a threat accompanying sea level rise.[2] However, many federal, state, and local plans, including California's State Hazard Mitigation Plan (SHMP) 2023 Update, overlook the risk of groundwater rise. Integrating groundwater rise into planning for climate change will help local governments take action to mitigate the worst impacts on public health, ecosystem health, economic development, and community resilience.

California's SHMP is a guidance document for local hazard mitigation plans, which are required for cities that wish to apply for federal disaster assistance and hazard mitigation funding. In March 2023, SPUR, Pathways Climate Institute, the San Francisco Estuary Institute, and the Bay Area Climate Adaptation Network submitted a letter to the Governor's Office of Emergency Services advocating for the SHMP to include groundwater rise.[3] When groundwater rise is not included in plans like the SHMP, funding for continued research and adaptation planning will be lacking. Fortunately, the San Francisco Bay Conservation and Development Commission will reflect the issue in its regional adaptation guidance, to be released in 2025.

This report, prepared in partnership with the community-based organization Nuestra Casa, reviews existing research on shallow groundwater rise and places it in the context of East Palo Alto to highlight specific risks and recommended policy actions. Although the findings are specific to East Palo Alto, the risks are comparable across low-lying communities along the San Francisco Bay shore. Similarly, the report's recommendations are applicable to the entire region. By focusing groundwater rise research and adaptation efforts on low-income communities of color that are most at risk, the region can prioritize equitable adaptation strategies that can be implemented widely.

[2] Groundwater rise is identified as a risk in the U.S. government's *Fifth National Climate Assessment*, the California Ocean Protection Council's 2024 draft guidance on sea level rise, San Mateo County's OneShoreline Sea Level Rise Planning Guidance, and the Department of Toxic Substances's draft guidance on sea level rise.

[3] S. Atkinson, W. Chabot, K. May, and M. McCormick, "RE: Public Comment on the Draft 2023 State Hazard Mitigation Plan," letter to State Mitigation Planning Unit, March 23, 2023, https://www.spur.org/sites/default/files/2023-04/3.23.2023%20SPUR%20Letter%20to%20CalOES%20on%20draft%202023%20State%20Hazard%20Mitigation%20Plan.pdf.

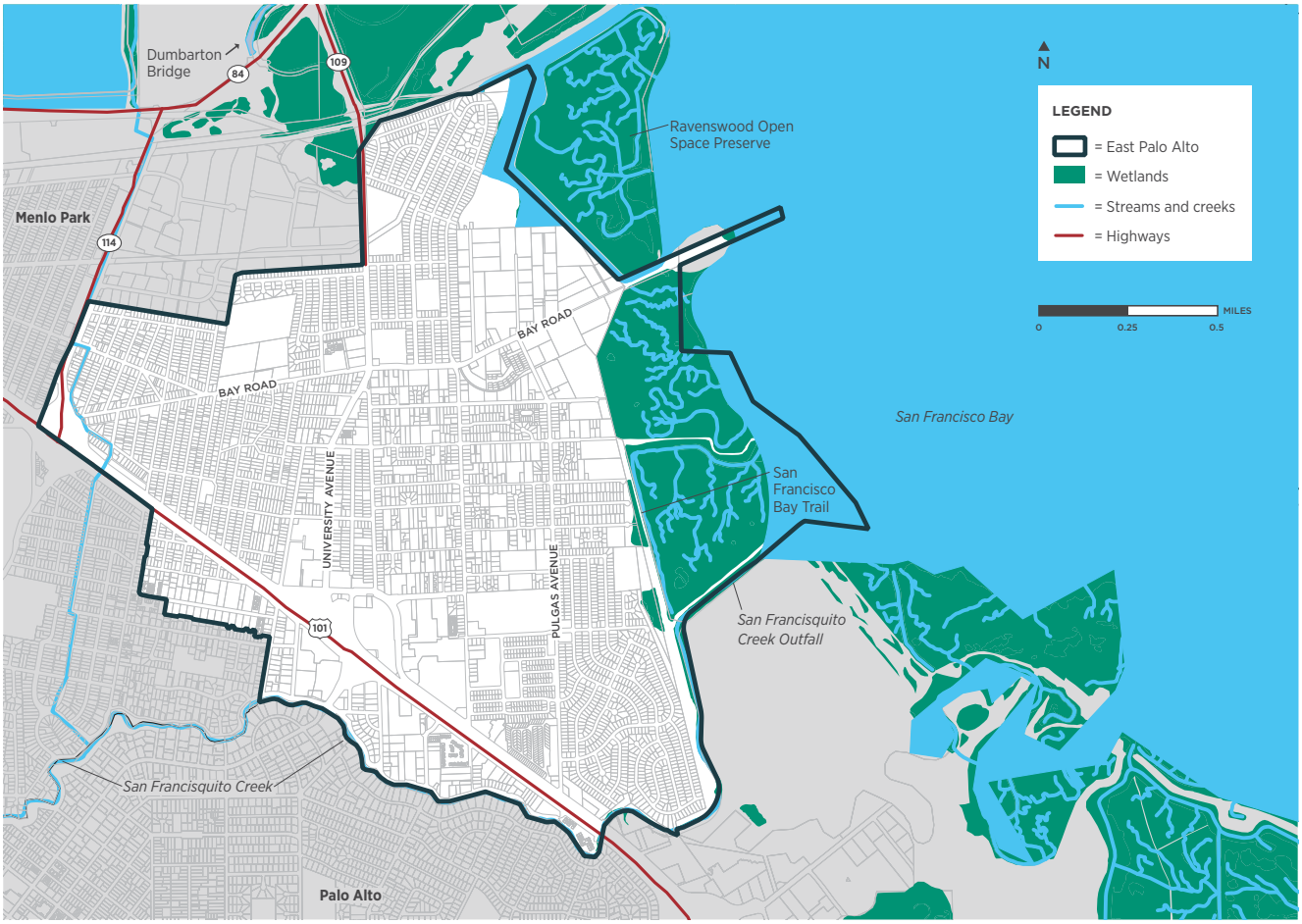
East Palo Alto: A Community Surrounded by Water

East Palo Alto, California, (Exhibit 2) located in San Mateo County, has a complex history that reflects broader trends in American urban development, racial segregation, and economic inequality. That history and the city's vulnerability to climate change make it an important case study for exploring groundwater rise risks and identifying strategies for equitable resilience and adaptation.

EXHIBIT 2

East Palo Alto is located along San Francisco Bay adjacent to the Dumbarton Bridge and Highway 101. The city is bounded by water on three sides.

Source: SPUR.



A brief history of East Palo Alto

The area now known as East Palo Alto was originally inhabited by the Ohlone, also known as the Costanoan Native American people, who lived along the San Francisco Peninsula for thousands of years prior to European colonization. The Ohlone tribe that made its home in the area of present-day East Palo Alto is known as the Puichon.[4]

In the 1800s, the region saw agricultural development and small-scale industrial activity. In 1857, the County of San Mateo was established. East Palo Alto remained an unincorporated area of the county and included neighborhoods that are now within the cities of Menlo Park and Palo Alto (both of which incorporated in the late 1800s and early 1900s).[5]

In 1932, Highway 101 (Bayshore Highway) opened, dividing East Palo Alto neighborhoods and exacerbating segregation and existing social and racial disparities.[6]

In the 1940s and '50s, the northern areas of East Palo Alto were designated as industrial zones for activities such as hazardous waste recycling, auto maintenance, and steel production.[7] The African American population continued to grow as families sought work opportunities and housing and were excluded from other neighborhoods due to discriminatory housing practices, including redlining and restrictive covenants. Palo Alto and Menlo Park annexed some of the unincorporated commercial areas in East Palo Alto, shrinking the community to its current size of 2.5 square miles.[8] Highway 101 was widened to six lanes, and the only crossings were at University Avenue and Willow Road, creating accessibility and connectivity challenges and further isolating East Palo Alto residents from surrounding neighborhoods.

In the 1960s and '70s, the Nairobi Movement inspired political and cultural activism in East Palo Alto that reflected civil rights and Black Power movements happening nationally and globally.[9] Community organizing and civic activism have been, and continue to be, central to the development of East Palo Alto.

In 1983, voters approved a ballot measure to incorporate East Palo Alto. The campaign was led by a diverse coalition of residents who advocated for greater social and fiscal autonomy, following years of disinvestment and neglect by the county and other regional government agencies.

In the 1990s and early 2000s, rapid tech job growth in San Mateo County and Silicon Valley led to high increases in rental rates and sales prices for properties in East Palo Alto. Black families were displaced, or they left to find more affordable housing in other places. At the same time, the Hispanic/Latinx population grew rapidly in East Palo Alto, becoming the city's largest ethnic group.

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[4] City of East Palo Alto, "East Palo Alto General Plan," 2018, https://www.cityofepa.org/sites/default/files/fileattachments/community_amp_economic_development/page/2731/epa_gp_chapter_2_introduction_final_201807271720503745.pdf.

[5] County of San Mateo, "History of East Palo Alto," https://www.smcgov.org/district-4/history-east-palo-alto.

[6] City of East Palo Alto, "East Palo Alto General Plan."

[7] City of East Palo Alto, "East Palo Alto General Plan."

[8] County of San Mateo, "History of East Palo Alto."

[9] U.S. Environmental Protection Agency Community Archive, "Collection: Nairobi Movement Timeline Collection (1960–1979)," https://catalog.epacommunityarchive.org/collection/nairobi-movement-timeline-collection-(1960-1979).

Today, East Palo Alto remains a diverse community with a rich cultural heritage, but it continues to grapple with issues of inequality, housing affordability, and unemployment. The city's racial and ethnic composition is 60% Hispanic/Latinx, 13% Black and African American, 12% white, and 6% Asian, whereas San Mateo County's population is majority white (37%) and Asian (33%) (Exhibit 3). Median household income, educational attainment, and homeownership are lower in East Palo Alto than in San Mateo County as a whole, and poverty rates are higher in the city than in the county.

EXHIBIT 3

East Palo Alto is majority Hispanic/Latinx, whereas San Mateo County is majority white and Asian.

Source: Census.gov. "Income & Poverty: 2022 ACS 5-year estimates," Tables S1901, S1701, S1501, S1903.

Note: Under Race/Ethnicity, the "Other" category includes all other census groups not identified in the table: American Indian and Alaska Native, Native Hawaiian and other Pacific Islander, and "two or more races."

DEMOGRAPHIC DATA	EAST PALO ALTO	SAN MATEO COUNTY
Population (2022)	28,383	728,929
Race/Ethnicity		
Hispanic/Latinx	61%	24%
Black/African American	13%	3%
White, Non-Hispanic	12%	37%
All Other Races/Ethnicities	8%	3%
Asian	6%	33%
Income, Poverty, and Education		
Median Household Income	$103,248	$149,000
Percent of People in Poverty	12%	7%
Educational Attainment—Percent of People with Bachelor's Degree or Higher	25%	53%
Housing		
Median Gross Monthly Rent	$2,140	$2,805
Homeownership Rate	48%	60%

East Palo Alto's hazard vulnerability

In East Palo Alto, compounding hardships make it difficult to prepare for disasters — climate, flood, and earthquake resilience are not top of mind when rents are rising and residents must work multiple jobs to stay afloat. Low-income residents of East Palo Alto will be relatively hard-hit by climate hazards and disruptions due to intersecting factors such as poverty, race, age, disability, homeownership, and immigrant status.[10] Low-income individuals enter disruption events, from losing a job to being displaced from their home due to flooding, with fewer resources such as financial savings to aid in short-term and long-term recovery.

Because East Palo Alto is bound on its north and east by the San Francisco Bay and bay marshlands and to its south by San Francisquito Creek, it is particularly vulnerable to compound flood hazards from storm events, sea level rise, and groundwater rise. Flooding is caused by creek overflows, stormwater overflows, and storm surges (an abnormal rise in seawater levels during storms that is above predicted tidal levels).[11] East Palo Alto's existing shoreline protection is made up of nonengineered berms and recently constructed engineered floodwalls along San Francisquito Creek (see Appendix A for examples of current flood protection projects). As sea level rises, East Palo Alto will experience prolonged and frequent flooding due to higher groundwater levels unless investments in groundwater management are made.

In the last 30 years, East Palo Alto has experienced three major floods. In 1998, San Francisquito Creek overflowed and flooded more than 1,000 homes.[12] In 2012, the creek overflowed again and caused extensive flooding on Highway 101 and Embarcadero Road. From late December 2022 to mid-January 2023, back-to-back storm systems caused another creek overflow that damaged property and led to spot flooding along low-lying areas of roads (Exhibit 4). Despite recovery needs, many residents impacted by flooding did not qualify for, were rejected by, struggled to or were afraid of applying for the the Federal Emergency Management Agency's (FEMA) disaster assistance funding. Storm systems are likely to become more intense as global temperatures rise, with periods of extreme drought and extreme storms.[13]

[10] K. Thomas, R. D. Hardy, H. Lazrus, M. Mendez, B. Orlove, I. Rivera Collazo, J. T. Roberts, M. Rockman, B. P. Warner, and R. Winthrop, "Explaining Differential Vulnerability to Climate Change: A Social Science Review," *WIREs Climate Change* 10 (2): e565, https://wires.onlinelibrary.wiley.com/doi/10.1002/wcc.565.

[11] U.S. Department of Commerce, National Oceanic and Atmospheric Administration, "What Is Storm Surge?" https://oceanservice.noaa.gov/facts/stormsurge-stormtide.html.

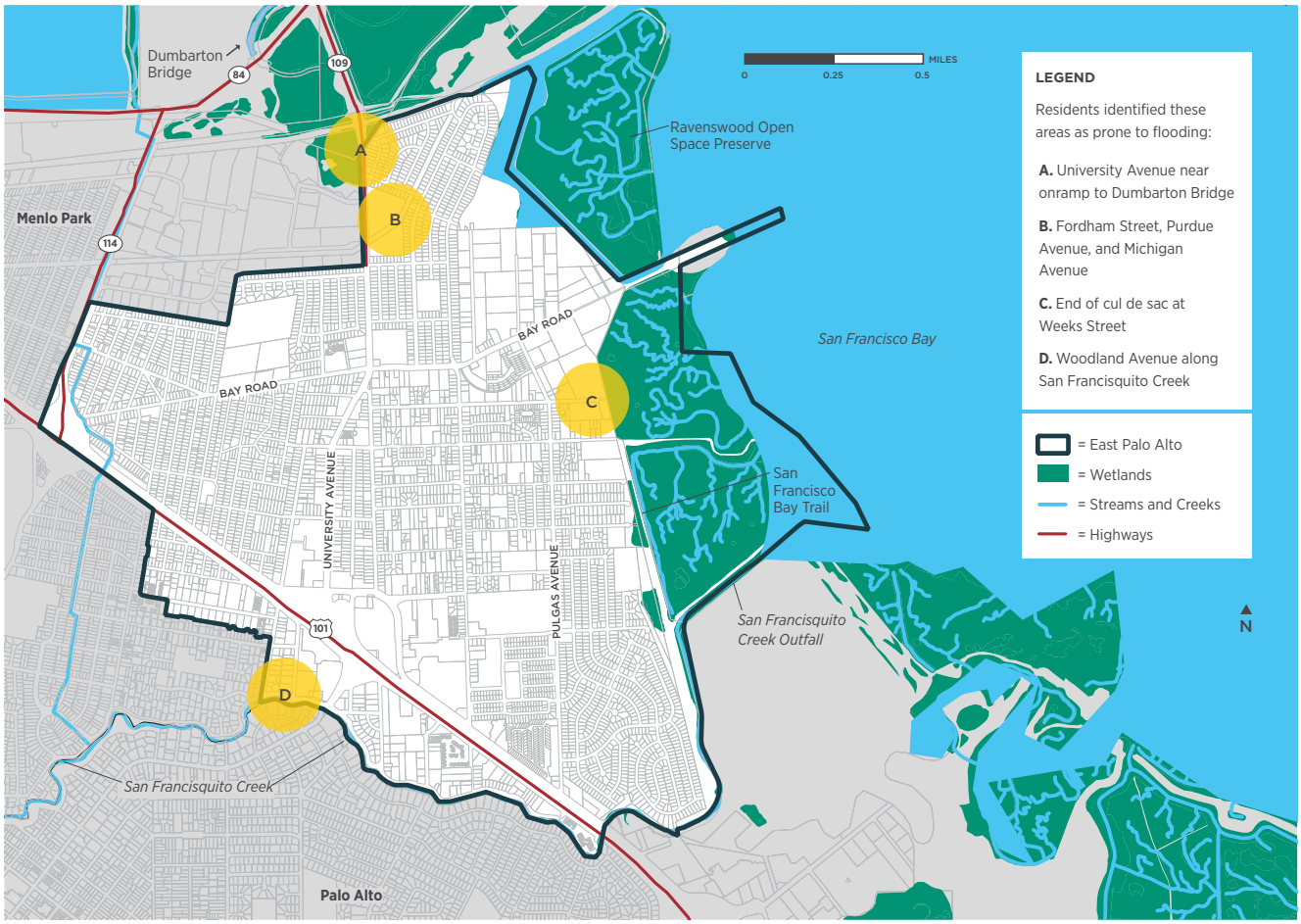
[12] S. Dremann, "A Flood Next Time?" *Palo Alto Online*, February 3, 2018, http://www.paloaltoonline.com/news/2018/02/03/a-flood-next-time/.

[13] M. J. DeFlorio et al., "From California's Extreme Drought to Major Flooding: Evaluating and Synthesizing Experimental Seasonal and Subseasonal Forecasts of Landfalling Atmospheric Rivers and Extreme Precipitation during Winter 2022/23," *Bulletin of the American Meteorological Society* 105 (1): E84–104, https://journals.ametsoc.org/view/journals/bams/105/1/BAMS-D-22-0208.1.xml; M. Mak, J. Neher, C. L. May, J. Finzi Hart, and M. Wehner, *San Francisco Bay Area Extreme Precipitation in a Warmer World: Volume 1 — State of the Science*, 2023, prepared for the City and County of San Francisco.

EXHIBIT 4

From late December 2022 to mid-January 2023, back-to-back storm systems caused spot flooding and property damage in multiple areas of East Palo Alto.

Source: Flood locations were identified in conversations with East Palo Alto residents and city staff. This is a non-exhaustive list of areas that experience winter flooding during storm events.



Conversations with East Palo Alto residents and city staff identified a handful of areas where flooding in winter 2023 damaged homes, cars, and storage units. The city has plans to resolve flooding issues at Weeks Street and at the intersection of Fordham Street and Purdue Avenue.[14]

In the last few years, San Mateo County and East Palo Alto have received funding for flood and sea level rise adaptation projects such as the San Mateo County OneWatershed Climate Resilience Framework, led by the City/County Association of Governments of San Mateo County, and the Strategy to Advance Flood protection, Ecosystems and Recreation along San Francisco Bay (SAFER Bay Project), led by the San Francisquito Creek Joint Powers Authority (see Appendix A).

[14] H. Javed, Public Works Director, City of East Palo Alto, personal communication, July 6, 2023.

These existing projects acknowledge the risk of groundwater rise. However, whether and how existing funding will allow these projects to address groundwater risk remains uncertain. As part of the SAFER Bay project, groundwater rise will be considered as part of California Environmental Quality Act analysis, but the project is not specifically focused on addressing groundwater.

Unfortunately, current strategies for adapting to sea level rise may not be effective for managing groundwater. For example, constructing seawalls, floodwalls, and berms or maintaining natural levees such as dune ecosystems can help keep rising seawater at bay and reduce overland flooding.[15] However, these interventions do not protect against inland flooding from high groundwater tables unless they are paired with other management interventions, such as groundwater pumping or the installation of cutoff walls and other underground barriers that keep saltwater from moving inland.[16] If strategies to adapt to groundwater rise are included in San Mateo County's Bay shore climate adaptation projects, including SAFER Bay and OneWatershed, communities like East Palo Alto will avoid costly failures that slow adaptation or result in maladaptation.

Like sea level rise, groundwater rise will require short- and long-term strategic and equity-focused planning. Without intervention, the impacts of groundwater rise will disrupt the lives of East Palo Alto residents years before the impacts of overland coastal flooding, because the effects of a rising groundwater table can extend farther inland than sea level rise inundation. Adaptation planning that is innovative and community-led and that addresses multiple hazards will be critical to making East Palo Alto a place where residents can continue to grow and thrive.

[15] E. Plane, K. Hill, and C. May, "A Rapid Assessment Method to Identify Potential Groundwater Flooding Hotspots as Sea Levels Rise in Coastal Cities," *Water* 11 (11): 2228, https://www.mdpi.com/2073-4441/11/11/2228; K. M. Befus, P. L. Barnard, D. J. Hoover, J. A. Finzi Hart, and C. I. Voss, "Increasing Threat of Coastal Groundwater Hazards from Sea-Level Rise in California," *Nature Climate Change* 10 (10): 946–52, https://www.nature.com/articles/s41558-020-0874-1.

[16] C. L. May, A. T. Mohan, O. Hoang, M. Mak, and Y. Badet, *City of Alameda: The Response of the Shallow Groundwater Layer and Contaminants to Sea Level Rise*, https://www.alamedaca.gov/files/assets/public/v/2/alameda-pio/slr2020.pdf.

How Shallow Groundwater Rise Will Affect East Palo Alto

Shallow groundwater rise will have four main impacts on East Palo Alto.

IMPACT 1

The eastern neighborhoods of East Palo Alto could experience inland flooding from groundwater rise before overland flooding from sea level rise.

The California Ocean Protection Council (OPC) estimates that sea level in the San Francisco Bay Area could rise 1 foot to 6.5 feet by 2100 based on "high" to "low" sea level rise scenario projections (Exhibit 5).[17] SPUR uses OPC's "intermediate" sea level rise scenario to contextualize the future risk of flooding from sea level and groundwater rise. Under OPC's intermediate scenario, the Bay Area is likely to experience 1 foot of sea level rise by 2060 and 2 feet of sea level rise between 2080 and 2090. The relative rate of groundwater rise in response to sea level rise depends on various factors, including salinity, soil characteristics, shore slope, precipitation, and the presence of nearby tributaries or lagoons and wetlands. Rainfall, on the other hand, is the primary contributor to seasonal changes in groundwater table elevations (that is, winter rainfall leads to higher groundwater levels in winter and spring).

EXHIBIT 5

Sea levels could rise by about 1 foot in the Bay Area by the year 2060.

Source: California Ocean Protection Council, "DRAFT: State of California Sea Level Rise Guidance: 2024 Science and Policy Update," 2024, https://opc.ca.gov/wp-content/uploads/2024/01/SLR-Guidance-DRAFT-Jan-2024-508.pdf?utm_medium=email&utm_source=govdelivery.

Note: SPUR uses OPC's "Intermediate" sea level rise scenario to contextualize the future risk of flooding from sea level and groundwater rise. All values are median values of sea level rise scenarios, in feet, for San Francisco, used here as a proxy for East Palo Alto.

YEAR	LOW	INT. LOW	INTERMEDIATE	INT. HIGH	HIGH
2020	0.2	0.2	0.2	0.3	0.3
2030	0.3	0.4	0.4	0.4	0.4
2040	0.4	0.5	0.6	0.7	0.8
2050	0.5	0.6	0.8	1.0	1.3
2060	0.6	0.8	1.1	1.5	2.0
2070	0.7	1.0	1.4	2.2	2.9
2080	0.8	1.2	1.8	3.0	4.1
2090	0.9	1.4	2.4	3.8	5.3
2100	1.0	1.6	3.1	4.8	6.5

[17] California Ocean Protection Council, "DRAFT: State of California Sea Level Rise Guidance: 2024 Science and Policy Update," 2024, https://opc.ca.gov/wp-content/uploads/2024/01/SLR-Guidance-DRAFT-Jan-2024-508.pdf?utm_medium=email&utm_source=govdelivery.

The closer the shallow groundwater table to the ground's surface, the more saturated the soil becomes and the less capacity it has to absorb rainwater, increasing the likelihood of flooding during heavy storms. Exhibit 6 includes three maps of East Palo Alto showing (1) current depth to groundwater levels, (2) depth to groundwater with 1 foot of sea level rise, and (3) depth to groundwater with 2 feet of sea level rise. The data were gathered by local researchers using historical groundwater measurements to estimate the highest annual groundwater table and develop future projections.[18] Thus, the maps show current and future groundwater levels under wet winter conditions. Today, emergent (aboveground) groundwater, shown in purple, is concentrated in areas along the Bay Trail and adjacent to San Francisquito Creek.

[18] C. L. May, A. Mohan, E. Plane, D. Ramirez-Lopez, M. Mak, L. Luchinsky, T. Hale, and K. Hill, *Shallow Groundwater Response to Sea-Level Rise: Alameda, Marin, San Francisco, and San Mateo Counties*, https://www.sfei.org/documents/shallow-groundwater-response-sea-level-rise-alameda-marin-san-francisco-and-san-mateo.

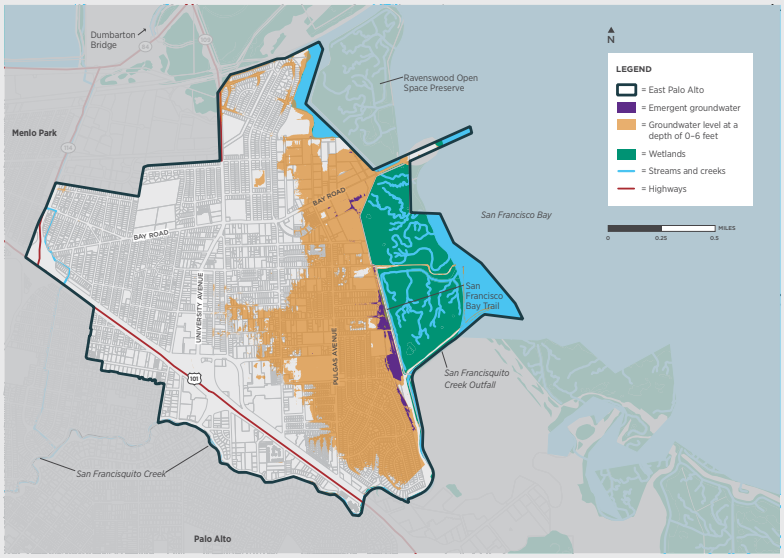
EXHIBIT 6

East Palo Alto's eastern neighborhoods already experience high groundwater levels. Future sea level rise will push groundwater closer to the surface, where it will contribute to frequent flooding.

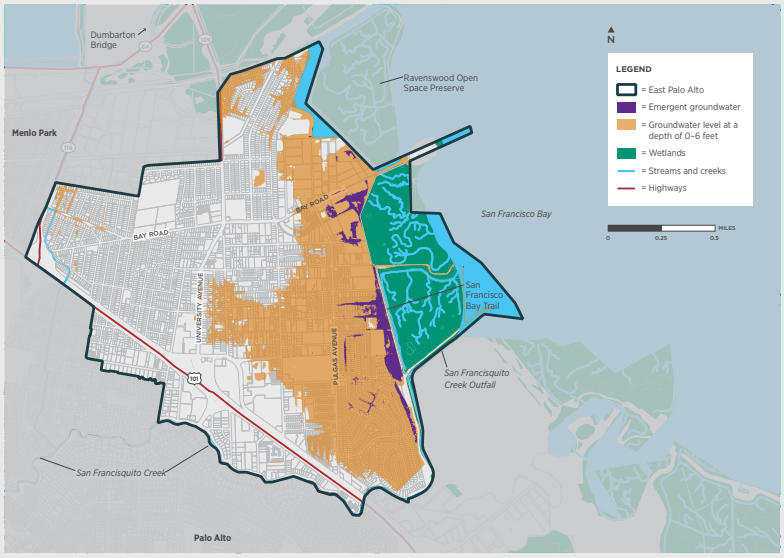
Source: SPUR using depth-to-groundwater data sourced from C. L. May, A. Mohan, E. Plane, D. Ramirez-Lopez, Michael Mak, L. Luchinsky, T. Hale, and K. Hill, "Shallow Groundwater Response to Sea-Level Rise: Alameda, Marin, San Francisco, and San Mateo Counties," Pathways Climate Institute and San Francisco Estuary Institute, 2022, https://www.sfei.org/documents/shallow-groundwater-response-sea-level-rise-alameda-marin-san-francisco-and-san-mateo.

Notes: Groundwater data reflect the "highest annual" shallow groundwater table (wet winter season groundwater levels) to predict groundwater rise response to sea level rise.

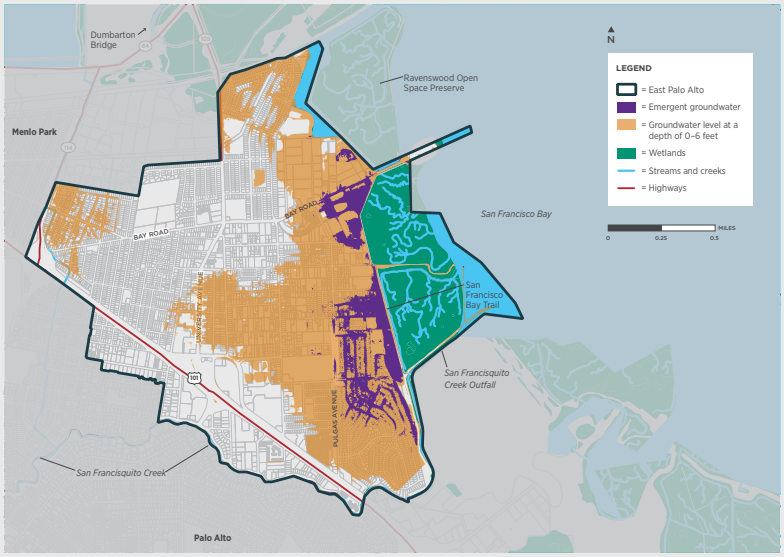
Current groundwater levels



Projected groundwater levels with 1 foot of sea level rise



Projected groundwater levels with 2 feet of sea level rise



With 1 foot of sea level rise, projected by 2060, high groundwater levels will lead to emergent (aboveground) groundwater in the mostly undeveloped lands at the city's eastern edge along the marsh and in the industrial area along Bay Road. Some streets and low points within neighborhoods east of Pulgas Avenue will also be impacted by emergent groundwater.

Under 2 feet of sea level rise, projected by 2080–2090, high groundwater levels and emergent groundwater will make it difficult for residents to navigate neighborhoods east of Pulgas Avenue due to flooded roads. Homes may become flooded, and residents may find it difficult to access critical locations — grocery stores, work, school, and so on. Flooding of homes and other buildings will increase rates of mold and fungi growth, which can lead to unhealthy indoor air quality.[19] Long-term exposure to mold and fungi can increase the risk of respiratory illnesses such as asthma.[20] Flooding can also pose health risks to residents who come in contact with floodwater, exposing them to contaminants and waterborne illnesses such as *E. coli*, shigella, giardia, and viral infections.[21]

In 2018, San Mateo County completed the *County of San Mateo Sea Level Rise Vulnerability Assessment*. The report includes a city-specific assessment of the exposure of natural and built assets to sea level rise under baseline, mid-level, and high-end climate change scenarios. The report acknowledges groundwater rise as a related sea level rise hazard, but it does not include groundwater level projections in its exposure assessment. Each of the three sea level rise scenarios includes flooding caused by a 1%-annual-chance flood — that is, a flood with a 1% chance of occurring in a given year (Exhibit 7). This type of flood occurs, on average, every 100 years based on the historical record. By comparison, a 500-year flood has a 0.2% chance of occurring in a given year. The assessment's three scenarios were constructed with sea level rise data from the U.S. Geological Survey and Point Blue's Our Coast, Our Future tool.[22] In 2021, groundwater data was included in the OCOF tool to aid planners in addressing groundwater rise risks in their area.

[19] C. L. May, A. Mohan, E. Plane, D. Ramirez-Lopez, M. Mak, L. Luchinsky, T. Hale, and K. Hill, *Shallow Groundwater Response to Sea-Level Rise: Alameda, Marin, San Francisco, and San Mateo Counties.*

[20] M. J. Mendell, A. G. Mirer, K. Cheung, M. Tong, and J. Douwes, "Respiratory and Allergic Health Effects of Dampness, Mold, and Dampness-Related Agents: A Review of the Epidemiologic Evidence," *Environmental Health Perspectives* 119 (6): 748–56, https://ehp.niehs.nih.gov/doi/10.1289/ehp.1002410.

[21] County of San Mateo, California State Coastal Conservancy, and Arcadis, *County of San Matteo Sea Level Rise Vulnerability Assessment,* 2018, page 99, https://www.smcsustainability.org/wp-content/uploads/2018-03-12_SLR_VA_Report_2.2018_WEB_FINAL.pdf.

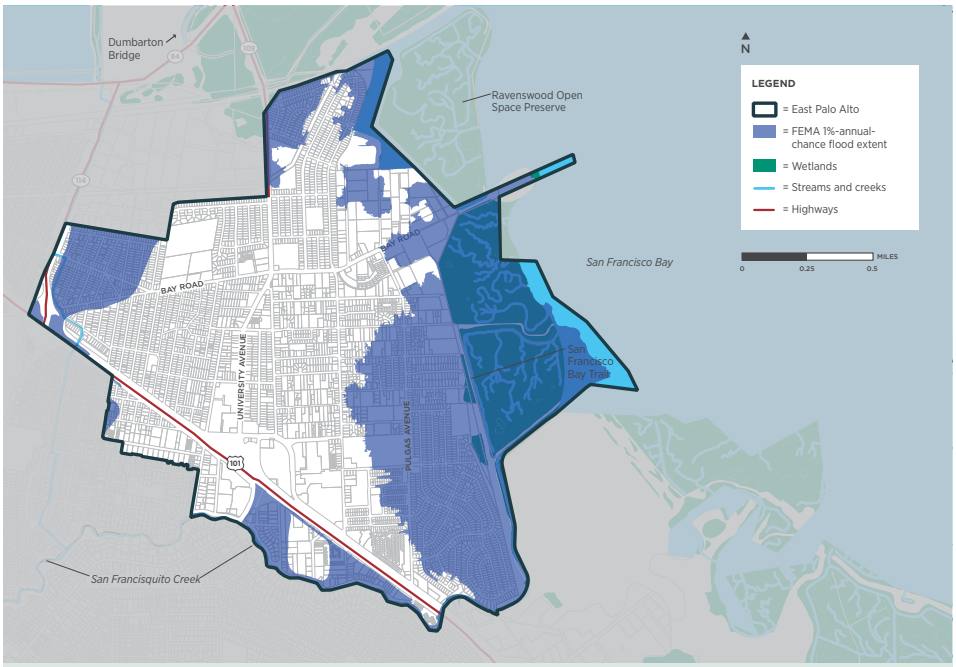
[22] County of San Mateo, California State Coastal Conservancy, and Arcadis, *County of San Matteo Sea Level Rise Vulnerability Assessment*.

EXHIBIT 7

Based on the historical record, the Federal Emergency Management Agency (FEMA) estimates that a 1%-annual-chance flood would inundate roughly a third of East Palo Alto.

Source: FEMA Flood Insurance Rate Map, https://www.fema.gov/flood-maps.

Note: FEMA flood maps of East Palo Alto show both coastal and riverine flood hazards. They underestimate current flood risk because they do not include groundwater or pluvial flooding (rainfall runoff causing storm system overflows). FEMA flood maps also underestimate flood risk by overlaying risks atop one another instead of combining them. Combined or "compound" flood hazards occur when two or more flood hazards interact, increasing flood extent.



What is a 1%-annual-chance flood?

A 1%-annual-chance flood, also known as a "100-year flood," is a flood with a 1% chance of occurring in any given year. Don't let the name fool you: a 100-year flood can occur two years in a row.

When people talk about a 100-year floodplain, they're talking about the area where flood water (in this case from overlayed coastal and riverine hazards) is most likely to spread during a really big flood. It's important for city planners and residents to know about these floodplains so they can take safety precautions and mitigate flood damage.

Exhibit 8 shows a few of East Palo Alto's natural and built assets exposed to sea level rise under the three scenarios, assuming there is no change to the county's current flood protection and sea level rise adaptation infrastructure. In the mid-level scenario (1%-annual-chance flood plus 3.3 feet of sea level rise), 34% of the urban land area, 27% of the city's population, nearly 15 miles of local roads, 4 miles of storm drains, six schools, and 39 hazardous material sites will be exposed to flooding from sea level rise.

EXHIBIT 8

The flood risk exposure of East Palo Alto's population, land areas, and infrastructure could more than triple by 2080 without measures to manage groundwater rise.

Source: County of San Mateo, California State Coastal Conservancy, and Arcadis, *County of San Matteo Sea Level Rise Vulnerability Assessment,* 2018, https://www.smcsustainability.org/wp-content/uploads/2018-03-12_SLR_VA_Report_2.2018_WEB_FINAL.pdf.

Note: Detailed maps of the risk exposure of other natural and built assets in East Palo Alto and San Mateo County are available online at SeaChange San Mateo County.

	AT RISK UNDER BASELINE SCENARIO: 1%-ANNUAL-CHANCE FLOOD CURRENT CONDITIONS	AT RISK UNDER MID-LEVEL SCENARIO: 1%-ANNUAL-CHANCE FLOOD PLUS 3.3 FEET OF SEA LEVEL RISE PREDICTED TIMELINE: 2080–2100	AT RISK UNDER HIGH-END SCENARIO: 1%-ANNUAL-CHANCE FLOOD PLUS 6.6 FEET OF SEA LEVEL RISE PREDICTED TIMELINE: 2100–2150
Population	9%	27%	45%
Total land area	20%	44%	61%
Urban land area	8%	34%	54%
Natural land area	74%	84%	88%
Built Infrastructure			
Local roads (42.5 miles total)	4.3 miles	14.6 miles	22.5 miles
Highways (6.8 miles total)	0 miles	0 miles	0.1 mile
Natural gas pipelines (2.2 miles total)	0.4 miles	0.9 miles	1.0 miles
Storm drains (13 miles total)	2.1 miles	4 miles	6 miles
Stormwater pump stations (2 total)	1 station	1 station	1 station
Community Infrastructure			
Schools (10 total)	1 school	6 schools	10 schools
Parks (5 total)	1 park	2 parks	5 parks
Emergency shelter sites (12 total)	2 sites	7 sites	9 sites
Other			
Hazardous material sites (44 total)	4 sites	39 sites	44 sites

Although the *County of San Mateo Sea Level Rise Vulnerability Assessment* is a thorough assessment of the county's risks, the sea level rise scenarios that it has used to identify risks reflect neither groundwater rise modeling nor the compound flood impacts of groundwater rise, sea level rise, and a 100-year flood. Groundwater rise will damage local roads and highways, building

foundations, and other infrastructure *before* the impacts of sea level rise will be felt. Consequently, the assessment underestimates the risk exposure of the area's population and natural and built infrastructure to flooding, as well as the timeline for responding to that risk exposure. Adapting to groundwater and sea level rise will require coordination among the many local, regional, and state agencies that govern shoreline planning (see Appendix B for a non-exhaustive list of governing agencies). These agencies must incorporate the risk of groundwater rise in their efforts to adapt to sea level rise.

IMPACT 2

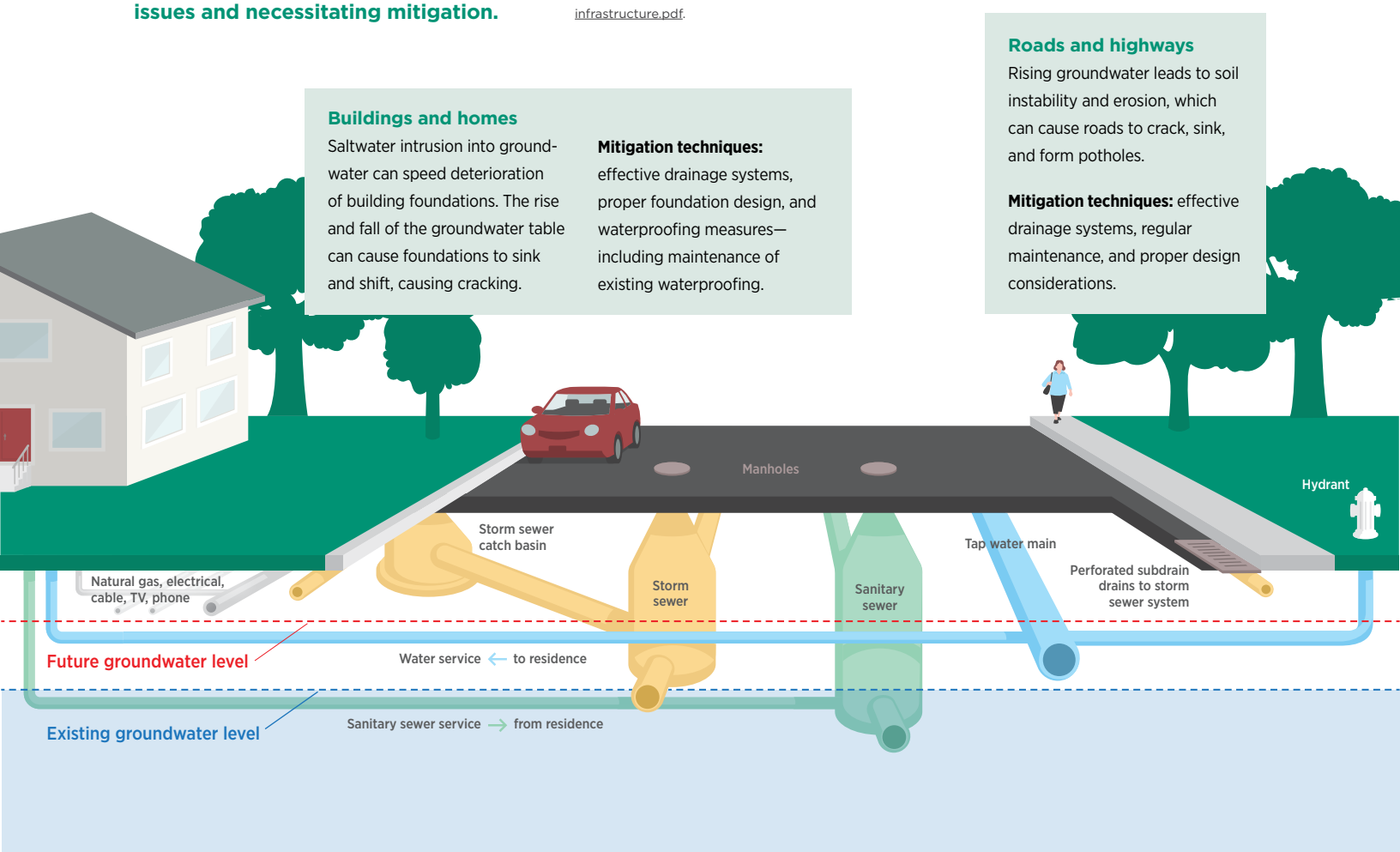
Groundwater rise will damage local infrastructure, particularly belowground water infrastructure.

The infrastructure most at risk of damage from groundwater rise is belowground water infrastructure — sanitary sewer, stormwater, and tap water infrastructure typically located within 0 feet to 6 feet of the ground surface (Exhibit 9). Other infrastructure (such as building foundations, roads, and energy infrastructure) is also at risk but is not discussed in detail in this report. Impacts on underground infrastructure are less likely to be detected in a timely manner because they are inconspicuous, and they are expensive to repair.

EXHIBIT 9

East Palo Alto's underground infrastructure will be impacted by rising groundwater, creating multiple safety issues and necessitating mitigation.

Source: SPUR illustration based on an image sourced from the National Geospatial Advisory Committee, Geospatial Information: The Key to Smart Infrastructure Investments, 2017, https://www.fgdc.gov/ngac/meetings/dec-2017/ngac-paper-geospatial-information-for-infrastructure.pdf.



Most belowground infrastructure has been designed to withstand historical groundwater highs.[23] However, historical groundwater levels may no longer be an effective design standard. Belowground infrastructure that has not historically been exposed to groundwater is now, or soon will be, regularly exposed to saturated or waterlogged soils.[24] When belowground water infrastructure is exposed to groundwater, pipes and critical facilities will be at risk of damage from corrosion, soil destabilization, and water infiltration (Exhibit 10). Ultimately, groundwater rise could greatly reduce the lifespan of existing water infrastructure and require costly upgrades and repairs.

EXHIBIT 10

Groundwater will impact three types of water infrastructure.

Source: SPUR.

GROUNDWATER RISE WILL LEAD TO...	STORMWATER INFRASTRUCTURE	SANITARY SEWER INFRASTRUCTURE	TAP WATER INFRASTRUCTURE
Soil subsidence and swelling, which will cause pipe cracks and leaks.	x	x	x
Corrosion of pipes by salty/saline groundwater, which will cause pipe cracks and leaks.	x	x	x
Water infiltration into pipes through cracks, connections, and joints.	x	x	

Stormwater infrastructure: When it rains in East Palo Alto, stormwater runoff enters the stormwater system through street gutters that empty into San Francisquito Creek and the San Francisco Bay. Due to its low elevation, East Palo Alto's stormwater system cannot rely on gravity drainage (unlike other systems) and is therefore dependent on the O'Connor Pump Station and the Ravenswood Pump Station (Box 1) to pump stormwater through 21 miles of storm drain pipes to 15 outfalls.[25] Groundwater infiltration into East Palo Alto's stormwater pipes through cracks, connections, and joints will reduce the capacity of the system to convey stormwater to outfalls. When the stormwater system is unable to convey water effectively, localized flooding can occur. East Palo Alto's stormwater system is designed to manage stormwater from 10-year rainfall events; however, several locations around the city already experience flooding during these events.[26] Addressing the impacts of groundwater rise on stormwater infrastructure will require critical upgrades and

[23] C. May, A. Mohan, E. Plane, D. Ramirez-Lopez, M. Mak, L. Luchinsky, T. Hale, and K. Hill, *Shallow Groundwater Response to Sea-Level Rise: Alameda, Marin, San Francisco, and San Mateo Counties*.

[24] C. May, A. Mohan, E. Plane, D. Ramirez-Lopez, M. Mak, L. Luchinsky, T. Hale, and K. Hill, *Shallow Groundwater Response to Sea-Level Rise: Alameda, Marin, San Francisco, and San Mateo Counties*.

[25] County of San Mateo, California State Coastal Conservancy, and Arcadis, *County of San Matteo Sea Level Rise Vulnerability Assessment*.

[26] Schaaf & Wheeler Consulting Civil Engineers, *City of East Palo Alto Storm Drain Master Plan*, 2014, https://www.cityofepa.org/sites/default/files/fileattachments/public_works/project/16061/storm_drain_master_plan_1-10-2014.pdf.

regular maintenance schedules to identify and plug leaks, install linings, or replace corroded pipes. Investing in green infrastructure like raingardens, bioswales, and green roofs can also help reduce water flows during high rainfall periods by delaying discharge into stormwater pipes.

Box 1: Reducing the Vulnerability of East Palo Alto's Pump Stations to Sea Level and Groundwater Rise

The O'Connor Pump Station, built in the 1980s, is operated by the City of East Palo Alto and is located next to San Francisquito Creek at the end of O'Connor Street. The pump station protects residents living in the eastern part of the city from stormwater flooding during heavy rainfall. The Ravenswood Pump Station, built in the 1980s and operated by Caltrans, serves East Palo Alto and Menlo Park and is located near the Dumbarton Bridge. Both pump stations are vulnerable to sea level and groundwater rise due to their locations.

The O'Connor Pump Station urgently needs improvements due to high water levels submerging the station and the buildup of sediment blocking pump flow.[a] In 2022, the City of East Palo Alto received more than $800,000 in federal funding to upgrade the station (see Appendix A for more information on the O'Connor Pump Station improvement project).[b] Further analysis is needed to determine the vulnerability of the Ravenswood Pump Station to sea level rise, and additional funding will be required for mitigation efforts.[c] These stormwater system upgrades will be critical to improving drainage capacity and mitigating the impacts of groundwater rise on East Palo Alto.

[a] Schaaf & Wheeler Consulting Civil Engineers, *City of East Palo Alto Storm Drain Master Plan,* 2014, https://www.cityofepa.org/sites/default/files/fileattachments/public_works/project/16061/storm_drain_master_plan_1-10-2014.pdf.

[b] City of East Palo Alto, "The City of East Palo Alto Receives Federal Funding to Improve the O'Connor Pump and Build Small Business Incubator," press release, April 7, 2022, https://www.cityofepa.org/sites/default/files/fileattachments/city_manager039s_office/page/21300/earmark_press_release_4-7-2022.pdf.

[c] AECOM, San Francisco Estuary Institute, and Skeo, *Dumbarton Bridge West Approach + Adjacent Communities Resilience Study*, prepared for the Metropolitan Transportation Commission, 2020, https://www.adaptingtorisingtides.org/wp-content/uploads/2020/06/Dumbarton-Bridge-West-Approach-Adjacent-Communities-Resilience-Study-Final-Report.pdf.

Sewer infrastructure: Sewer systems collect and carry wastewater to treatment plants, which tend to be located at low elevations near the coast to minimize the cost of collecting and discharging wastewater. [27] Sewer collection systems in East Palo Alto are the responsibility of the East Palo Alto Sanitary District in the southern portion of the city and the West Bay Sanitary District in the

[27] M. A. Hummel, M. S. Berry, and M. T. Stacey, "Sea Level Rise Impacts on Wastewater Treatment Systems Along the U.S. Coasts," *Earth's Future* 6 (4): 622–33, https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017EF000805.

northern portion. The West Bay Sanitary District conveys wastewater via the Menlo Park Pump Station to Silicon Valley Clean Water for treatment and discharge to the San Francisco Bay. The East Palo Alto Sanitary District conveys water from 32 miles of its underground collection system to the Palo Alto Regional Water Quality Control Plant, located next to the Palo Alto Airport. Under a scenario with 1 meter (3.3 feet) of sea level rise, San Mateo County identified five wastewater treatment plants, including the Menlo Park Pump Station, that will be subject to flooding. These plants do not include the Palo Alto Regional Water Quality Control Plant, which is located in the City of Palo Alto, part of Santa Clara County, and which is also at risk. Infiltration of groundwater into sewer systems reduces the capacity of pipes and pump stations to convey wastewater and increases the cost of water treatment, putting an additional burden on treatment plants. Saltwater and saline groundwater intrusion at sewer treatment plants may also disrupt biological treatment processes.[28] Sanitary sewer overflows (SSOs) occur when wastewater flow exceeds the amount a treatment plant can handle. As a result, partially treated or untreated wastewater is discharged directly into the Bay, threatening human and ecosystem health.

The East Palo Alto Sanitary District, a special district governed by a board of directors, has been a center of controversy in East Palo Alto. It has implemented high connection fees for sanitary sewer system upgrades and expansion projects, making it difficult for the city to incentivize new business and housing developments.[29] The City of East Palo Alto recently opted to incorporate the East Palo Alto Sanitary District. As part of this transition, the city will need to consider the impacts of groundwater rise on the sanitary sewer system and will need to seek ways to reduce rates for low-income residents.

Tap water infrastructure: In East Palo Alto, tap water (the water that comes from the tap for drinking, showering, washing dishes, etc.) is provided by three water utilities: the City of East Palo Alto Water System, Palo Alto Park Mutual Water Company, and O'Connor Tract Co-Operative Water Company. Palo Alto Park Mutual and O'Connor Tract Mutual are unusual due to their small size and water source — local groundwater wells reaching deep aquifers (different from shallow groundwater). Palo Alto Park Mutual sources water from an aquifer located between 70 feet and 480 feet belowground. The two small water systems serve about 3,000 people each. Small systems, especially small systems serving disadvantaged communities, tend to have difficulty maintaining the technical, managerial, and financial capacity needed to safely operate.[30] O'Connor Tract Mutual and Palo Alto Park Mutual have previously been cited for safe drinking water violations, and Palo Alto Park Mutual has been flagged by the Water Board for poorly maintained infrastructure.[31] At present, East Palo Alto's drinking water meets standards set by the federal government. Still, many residents buy bottled water or use water filters because they do not trust that the water is safe to

[28] A. Egea-Corbacho, P. Romero-Pareja, C. Aragón Cruz, C. Pavón, J. M. Quiroga, and M. D. Coello, "Effect of Seawater Intrusion Using Real Wastewater on an Attached Biomass System Operating a Nitrogen and Phosphorus Removal Process," *Journal of Environmental Chemical Engineering* 9 (1): 104927, https://www.sciencedirect.com/science/article/abs/pii/S2213343720312768.

[29] E. Mibach, "East Palo Alto Sanitary District Loses Its Independence; City Will Take Control of Sewer System," *Palo Alto Daily Post*, November 20, 2023, https://padailypost.com/2023/11/20/east-palo-alto-sanitary-district-loses-its-independence-city-to-control-sewer-system/.

[30] California Water Boards, *California Drinking Water Needs Assessment*, 2023, https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/needs.html.

[31] California Water Boards, *California Drinking Water Needs Assessment*.

drink. Nuestra Casa has been working on drinking water quality issues for the past few years. In September 2023, the organization hosted an event to discuss drinking water quality concerns with residents. SPUR participated in the event.

Because of a lack of capacity for additional inspections and maintenance, the two small drinking water systems in East Palo Alto are particularly at risk from the impacts of rising groundwater. If drinking water systems are not maintained, water leaks may occur because of groundwater rise, and drinking water service may be impacted.

Most urban areas in San Mateo County are served by water suppliers that purchase the bulk of their water from the San Francisco Regional Water System (SFRWS), the wholesaler branch of the San Francisco Public Utilities Commission. Water from the SFRWS is sourced mainly from Hetch Hetchy Reservoir, with a small amount from other mountain sources and groundwater. The water from SFRWS is very high-quality, meeting public health standards as well as getting high marks from customers for taste and odor. The City of East Palo Alto Water System, operated by Veolia, serves about 80% of East Palo Alto and supplies water from the SFRWS.

IMPACT 3

Groundwater rise can cause certain contaminants at hazardous material sites to mobilize.

Many of the San Francisco Bay Area's industrial sites are located along the San Francisco Bay shore. Rail stations, chemical manufacturing plants, landfills, recycling centers, refineries, military sites, and underground storage tanks have left legacy contaminants in the soil. Shallow groundwater rise can cause these soil contaminants to "mobilize," or move. Mobilized contaminants can then enter underground sewage and stormwater pipes, creeks, or floodwater and impact nearby residents.[32]

Across the United States, low-income communities of color have been disproportionately exposed to contaminants and pollution as a result of de facto (socially incited) and de jure (incited by law) discriminatory practices such as school segregation, redlining, and unfair siting of polluting land uses.[33] The environmental justice movement started in response to this disproportionate exposure. Community advocates are again calling for clean up of hazardous material sites, this time with a focus on shoreline sites impacted by sea level and groundwater rise.

A recent study identified 15 federal Superfund sites and 5,282 state-managed contaminated sites across the Bay Area that are at risk of inundation by groundwater rise under a scenario with 1 meter (about 3.3 feet) of sea level rise.[34] Some of these sites remain in active use, some have been left vacant and ignored, and many are in some stage of cleanup.

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[32] K. Hill, D. Hirschfeld, C. S. Lindquist, F. Cook, and S. Warner, *Rising Coastal Groundwater as a Result of Sea-Level Rise Will Influence Contaminated Coastal Sites and Underground Infrastructure*, 2023, https://www.researchgate.net/publication/371068344_Rising_coastal_groundwater_as_a_result_of_sea-level_rise_will_influence_contaminated_coastal_sites_and_underground_infrastructure.

[33] R. D. Bullard, 1996, "Environmental Justice: It's More Than Waste Facility Siting," *Social Science Quarterly* 77 (3): 493–99, https://www.jstor.org/stable/42863495.

[34] K. Hill, D. Hirschfeld, C. S. Lindquist, F. Cook, and S. Warner, *Rising Coastal Groundwater as a Result of Sea-Level Rise Will Influence Contaminated Coastal Sites and Underground Infrastructure*.

In East Palo Alto, there are more than 50 open and closed contaminated sites (Exhibit 11; see Appendix C for a complete list of these sites).[35] The majority of these sites are concentrated in the northern part of the city in the area zoned for industrial uses. Open sites are sites where cleanup is being investigated or where cleanup efforts are still in progress. Closed sites are sites where investigations or cleanup activities are considered complete according to the lead agency. Contaminated sites in East Palo Alto are known to contain lead, arsenic, volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), and organochlorine pesticides (OCPs), among other contaminants.[36]

EXHIBIT 11

Sample List of Contaminated Sites in East Palo Alto

SITE	CLEANUP STATUS	LEAD AGENCY	CONTAMINANTS OF CONCERN	OWNER OF SITE
Romic Environmental Technologies 2081 Bay Rd.	Active cleanup site with land use restrictions	U.S. Environmental Protection Agency	Total petroleum hydrocarbons (TPHs), polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), metals including lead and mercury, organochlorine pesticides (OCPs), etc.	Bay Road Holdings
Electrite Company Inc. 1801–1805 Bay Rd.	Leaking underground storage tank; site case closed in 2009	San Francisco Bay Regional Water Quality Control Board (SF RWQCB)	Metals including lead and mercury, OCPs, etc.	Owner unknown; site of Ravenswood Family Dentistry
Myrtle Street High School campus Multiple addresses: 980–1056 Myrtle St.	School cleanup with land use restrictions	Department of Toxic Substances Control	Lead and OCPs	Sequoia Union High School District
Touchatt Trucking 2535 Pulgas Ave.	No active cleanup	San Mateo County Local Oversight Program and SF RWQCB	VOCs, TPHs, and OCPs	Sycamore Real Estate (as of 2020)

Sources: California Department of Toxic Substances Control, "EnviroStor," https://www.envirostor.dtsc.ca.gov/public/; T.Y. Lin International, "Updated Soil and Groundwater Plan: Bay Road Phase II and III Improvement Project Palo Alto, California," 2018, https://www.cityofepa.org/sites/default/files/fileattachments/public_works/project/3491/attachment_c_sgmp.pdf; K. Hill, D. Hirschfeld, C. S. Lindquist, F. Cook, and S. Warner, *Rising Coastal Groundwater as a Result of Sea-Level Rise Will Influence Contaminated Coastal Sites and Underground Infrastructure*, 2023; Sycamore Real Estate, *Phase II Environmental Site Assessment Report: 2519 and 2535 Pulgas Avenue, East Palo Alto, California 94303*, https://www.cityofepa.org/sites/default/files/fileattachments/planning/project/19355/appendix_d_phase_i_phase_ii_and_haz_mat_memorandum_part_2.pdf.

Note: These examples show the types of site uses and contaminants of concern found in East Palo Alto. See Appendix C for a full list of contaminated sites in the city.

[35] California Department of Toxic Substances Control, "EnviroStor," https://www.envirostor.dtsc.ca.gov/public/.

[36] California Department of Toxic Substances Control, "EnviroStor."

VOCs, a variety of chemicals, are a common contaminant found at auto body and auto recycling shops and painting and coating facilities. When VOCs, particularly the highly volatile trichloroethylene (or TCE) and tetrachloroethylene (or PCE), are present in subsurface soils and come in contact with rising groundwater or floodwaters, they may be exposed to air, allowing them to evaporate and travel as a vapor.[37] As a vapor, VOCs can enter into underground stormwater and sewer pipes and travel hundreds of feet through cracked plumbing and into homes and businesses, contributing to poor indoor air quality.[38] Health effects of exposure to VOCs vary from headaches and fatigue to liver and kidney damage and increased risk of some cancers.[39] In the early 2000s, concerns about East Palo Alto's contaminated sites, and the public health impacts from exposure to contamination, sparked leaders from Youth United for Community Action to organize the community around closing the hazardous waste facility known as Romic Environmental Technologies (Box 2).

Box 2: Residents of East Palo Alto Help Close Hazardous Materials Site

One hazardous materials site has remained the focus of community activists' efforts in East Palo Alto for decades: Romic Environmental Technologies. Romic, a 12-acre site located near the intersection of Bay Road and Pulgas Avenue, was a solvent recycling, wastewater treatment, and hazardous waste storage site dating back to the 1960s. According to the U.S. Environmental Protection Agency (EPA), Romic, now owned by Bay Road Holdings, has sitewide groundwater contamination to a depth of 80 feet.[a] Residents of East Palo Alto were integral to the closing of the site, which is under continual monitoring and remediation as of 2024.

2007: The Department of Toxic Substances Control shuts down Romic after numerous violations, including the injury of two employees and the release of 4,000 gallons of solvents in June 2006.[b] Community organizing efforts, led by Youth United for Community Action, are key to the closure of Romic.

Continued →

[a] U.S. Environmental Protection Agency, "Bay Road Holdings LLC (formerly Romic Environmental Technologies Corporation)," R. 09, September 19, 2017, https://www.epa.gov/ca/bay-road-holdings-llc-formerly-romic-environmental-technologies-corporation.

[b] "Official Announcement and Shut-Down Order on Romic," *Palo Alto Online*, May 2007, https://www.paloaltoonline.com/news/2007/05/31/official-announcement-and-shut-down-order-on-romic.

[37] Santa Ana Regional Water Quality Control Board, "Vapor Intrusion," https://www.waterboards.ca.gov/santaana/water_issues/programs/scp/docs/Ford/VaporIntrusion_FAQs.pdf.

[38] K. Hill, D. Hirschfeld, C. S. Lindquist, F. Cook, and S. Warner, *Rising Coastal Groundwater as a Result of Sea-Level Rise Will Influence Contaminated Coastal Sites and Underground Infrastructure*.

[39] U.S. Environmental Protection Agency, "Indoor Air Quality (IAQ): Volatile Organic Compounds' Impact on Indoor Air Quality," https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-quality.

2009: All surface structures are demolished.

2019: The EPA initiates remediation of the site's soil and groundwater, which contain VOCs, petroleum hydrocarbons, PCBs, and arsenic. The main cleanup strategy is biological remediation, a process whereby natural bacteria break down solvents.[c]

2024: Remediation and contaminant monitoring continue, and land use restrictions remain. The owner, Bay Road Holdings, continues to seek opportunities to redevelop the land. Proposed adaptation measures in the face of climate change include construction of a floodwall to protect against storm surges, the addition of several feet of fill to raise the site elevation, and design measures that reduce future flood damage.[d] Cleanup of this site is likely to take decades due to the extent of contamination.

[c] U.S. Environmental Protection Agency, "Bay Road Holdings LLC (formerly Romic Environmental Technologies Corporation)."
[d] U.S. Environmental Protection Agency, "Bay Road Holdings RCRA Site Climate Vulnerability Assessment Technical Memorandum," September 28, 2023, https://www.epa.gov/system/files/documents/2024-04/cad009452657-bay-road-holdings-rcra-site-climate-vulnerability-assess-tech-memorandum-2023-09-28.pdf.

Contaminated site cleanup is managed by the California Environmental Protection Agency, the California Department of Toxic Substances Control (DTSC), the California State Water Resources Control Board (SWRCB), the San Francisco Bay Regional Water Quality Control Board (RWQCB), and the San Mateo County Health System as part of the RWQCB's Local Oversight Program. Many of these agencies have internal guidelines for managing sea level rise as part of cleanup actions. Unfortunately, information on site contamination and remediation plans can be difficult to find and interpret, and many community leaders are frustrated by the lack of transparency and accessibility of information on site contamination and remediation.

In February 2023, the DTSC released a draft plan for adapted cleanup site management with consideration of sea level and groundwater rise.[40] The guidance is still in draft form, and many environmental organizations, including the Sierra Club, have submitted public comments.[41]

The San Francisco Bay RWQCB also recently revised regulations requiring 16 bayfront municipal solid waste landfills to consider long-term flood protection methods with groundwater rise in mind. These new regulations require bayfront landfills to submit a long-term flood protection plan that considers a 100-year storm event in addition to the 2050 "medium-high" to "extreme" sea level rise scenarios in the Ocean Protection Council's 2018 guidance on sea level rise.[42] No landfills affected by these revised regulations are located in East Palo Alto. However, seven of the 16 landfills are

[40] Department of Toxic Substances Control, *Sea Level Rise Guidance to DTSC Project Managers for Cleanup Activities*, February 2023, https://dtsc.ca.gov/wp-content/uploads/sites/31/2023/02/DTSC-SLR-GUIDANCE-February-2023.pdf.

[41] Sierra Club Bay Alive, "Sea Level Rise Guidance to DTSC Project Managers for Cleanup Activities," email to the Department of Toxic Substances Control, October 30, 2023, https://www.sierraclub.org/sf-bay-alive/sea-level-rise-guidance-dtsc-project-managers-cleanup-activities.

[42] State of California Regional Water Quality Control Board, San Francisco Bay Region, "Order No. R2-2022-0031, Amending Waste Discharge Requirements for Bayfront Landfills Listed in Table 1," 2022, https://www.waterboards.ca.gov/sanfranciscobay/board_decisions/adopted_orders/2022/R2-2022-0031.pdf.

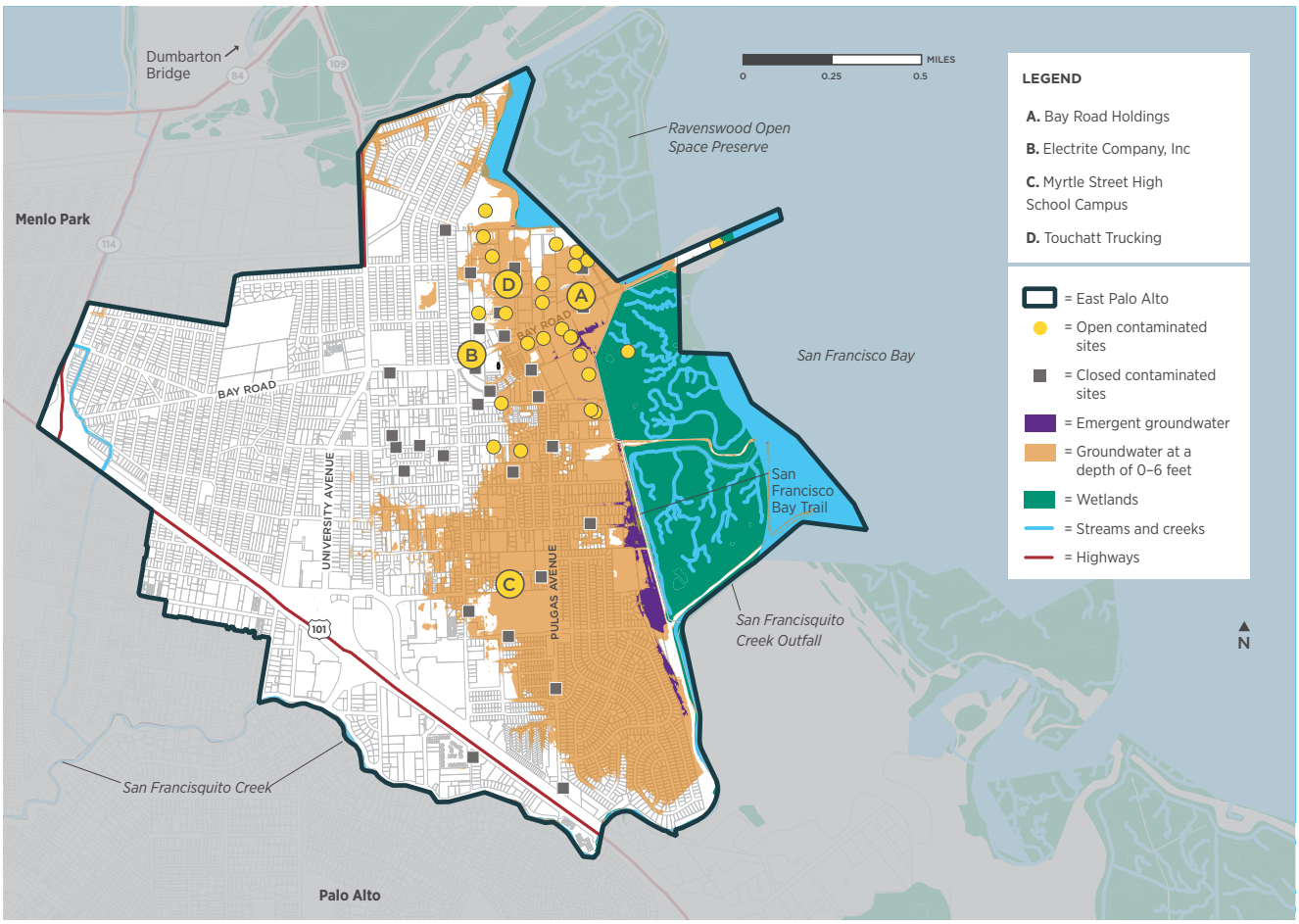
located in San Mateo County. The Marsh Road landfill, located in Menlo Park, is the nearest to East Palo Alto.

More research is needed to determine how contaminants, such as VOCs, may be mobilized by groundwater and what health impacts these contaminants may have on communities surrounding contaminated sites. The health impacts will likely depend on many factors, including the type, location, and concentration of contaminants at any given site; the location of underground pipes or neighboring creeks that can carry contaminants away from the site, the level of exposure (number of VOCs entering a specific home or business); the length of exposure; and individual human factors that may increase or decrease sensitivity to contaminants. Local community organizations are particularly concerned about health effects on East Palo Alto residents living and working near the contaminated sites impacted by groundwater rise (Exhibit 12).

EXHIBIT 12

About 60% of East Palo Alto's contaminated sites are already impacted by high groundwater levels.

Source: SPUR based on groundwater-level data sourced from Pathways Climate Institute and contaminated sites data sourced from K. Hill, D. Hirschfeld, C. S. Lindquist, F. Cook, and S. Warner, *Rising Coastal Groundwater as a Result of Sea-Level Rise Will Influence Contaminated Coastal Sites and Underground Infrastructure,* https://www.researchgate.net/publication/371068344_Rising_coastal_groundwater_as_a_result_of_sea-level_rise_will_influence_contaminated_coastal_sites_and_underground_infrastructure



Because groundwater rise research is evolving rapidly, previously closed and remediated hazardous waste sites have not managed cleanup in accordance with new knowledge about groundwater rise. In fact, contaminated site remediation strategies often do not effectively address sea level rise. In most cases, contaminated industrial sites are remediated by simply capping (covering) contaminated soils with low-permeability materials (concrete, sand, gravel, plastic, clay, and so on) to reduce runoff caused by rainwater and isolate contaminants underground.[43] Capping is used to prevent human and ecosystem exposure while minimizing cleanup costs. It neither contributes to soil remediation nor isolates contaminants from the underlying groundwater table. Wells on the site are used to monitor contaminants in groundwater. Capping can, however, be paired with soil remediation efforts. To effectively address the issue of contaminant mobilization, additional research on contaminant exposure pathways, human health impacts, and mitigation strategies will be critical. This research must be supported by state, federal, and philanthropic funding.

Other strategies for managing contaminated sites in the face of groundwater and sea level rise include the use of cutoff walls and groundwater pumping. Cutoff walls physically isolate inland groundwater from the San Francisco Bay, reducing groundwater rise but creating a challenge for managing stormwater runoff.[44] Groundwater pumping may be used in tandem with cutoff walls to manage stormwater runoff and inland flooding. However, studies have shown that pumping groundwater can raise the water table's saltwater interface, and salty groundwater can more readily mobilize certain buried metals.[45]

Exposure to contaminated sites is not just an issue in East Palo Alto. More than 5,000 contaminated sites are located along the San Francisco Bay shoreline (Exhibit 13).[46] In San Francisco, the Hunters Point Naval Shipyard, a Superfund site controlled by the U.S. Navy, is similarly vulnerable to groundwater rise and contaminant mobilization. In the face of negative health outcomes in Bayview–Hunters Point, residents and community advocates have, for years, demanded that the U.S. Navy remediate the site to protect public health. In January 2024, the U.S. Navy released its fifth 5-year review of the shipyard and found that the remediation efforts were not adequate to address future sea level rise and groundwater rise.[47]

[43] U.S. Environmental Protection Agency, "A Citizen's Guide to Capping," 2012, https://www.epa.gov/sites/default/files/2015-04/documents/a_citizens_guide_to_capping.pdf.

[44] C. May, A. Mohan, E. Plane, D. Ramirez-Lopez, M. Mak, L. Luchinsky, T. Hale, and K. Hill, *Shallow Groundwater Response to Sea-Level Rise: Alameda, Marin, San Francisco, and San Mateo Counties*.

[45] Water Resources Mission Area, U.S. Geological Survey, "Saltwater Intrusion," https://www.usgs.gov/mission-areas/water-resources/science/saltwater-intrusion, and K. Hill, D. Hirschfeld, C. S. Lindquist, F. Cook, and S. Warner, *Rising Coastal Groundwater as a Result of Sea-Level Rise Will Influence Contaminated Coastal Sites and Underground Infrastructure*.

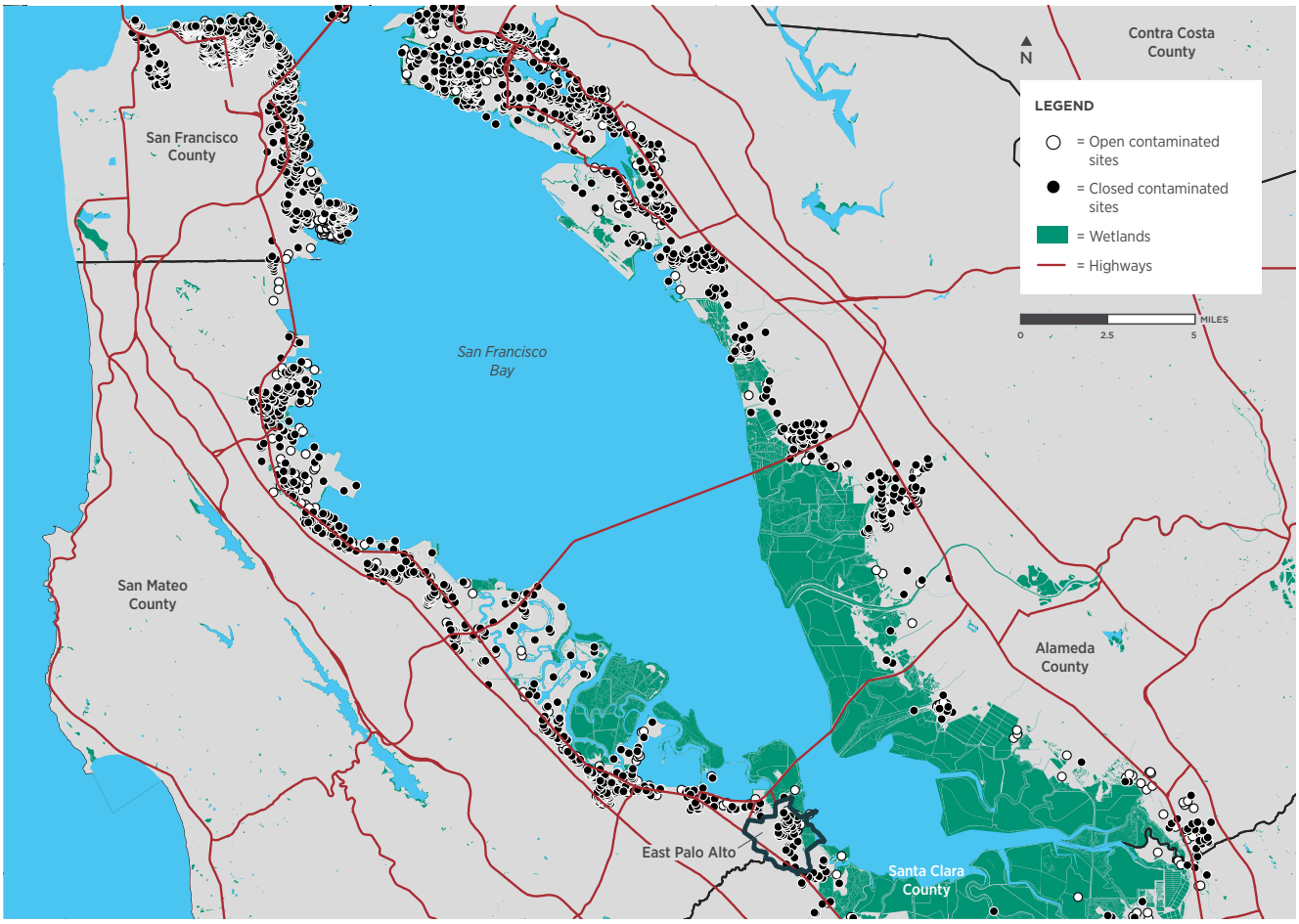
[46] K. Hill, D. Hirschfeld, C. S. Lindquist, F. Cook, and S. Warner, "Sea Level Rise, Groundwater Rise, and Contaminated Sites in the San Francisco Bay Area, and Superfund Sites in the Contiguous United States," dataset, 2023, https://datadryad.org/stash/dataset/doi:10.6078/D15X4N.

[47] *Base Realignment and Closure (BRAC) Program Management Office*, "Former NSY Hunters Point - Fifth CERCLA Five-Year Review (Draft)," November 2023, https://media.defense.gov/2024/Jan/23/2003380095/-1/-1/0/HPNS_NOV2023_5TH_5YR_DRAFT_REVIEW_RPT.PDF

EXHIBIT 13

East Palo Alto is not the only community at risk of contamination mobilization; more than 5,000 contaminated sites are at risk of groundwater rise around the San Francisco Bay.

Source: SPUR based on contaminated sites data sourced from K. Hill, D. Hirschfeld, C. S. Lindquist, F. Cook, and S. Warner, *Rising Coastal Groundwater as a Result of Sea-Level Rise Will Influence Contaminated Coastal Sites and Underground Infrastructure*, https://www.researchgate.net/publication/371068344_Rising_coastal_groundwater_as_a_result_of_sea-level_rise_will_influence_contaminated_coastal_sites_and_underground_infrastructure.



Nuestra Casa, with support from SPUR, has launched the Groundwater Rise Coalition, a group of community-based organizations seeking to develop strategies to address concerns related to local contaminated sites. The coalition includes leaders from Nuestra Casa, Youth United for Community Action, Climate Resilient Communities, Belle Haven Empowered, and the Belle Haven Community Development Fund. In April 2024, youth leaders from Youth United for Community Action hosted a community town hall to share information on groundwater rise risk and remediation efforts at the contaminated site Romic. Nuestra Casa and SPUR developed a community "Noticias" handout in English and Spanish to inform the community of local groundwater rise impacts (see Appendix E). The coalition is currently exploring next steps for community action on groundwater rise. SPUR looks forward to continuing to support the coalition.

IMPACT 4

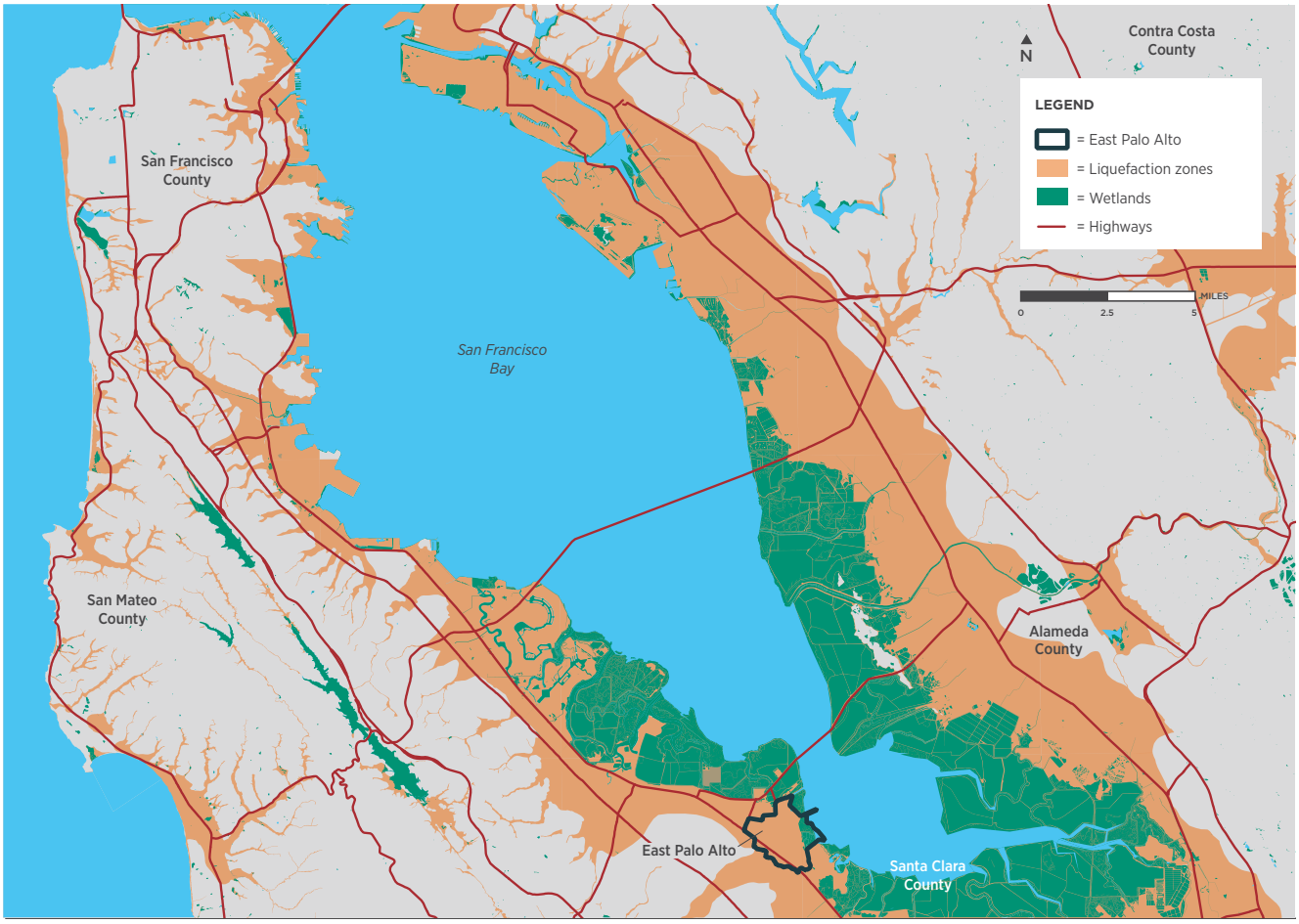
Sea level and groundwater rise will increase liquefaction and lateral spreading risk in parts of East Palo Alto.

Soil liquefaction, when the ground behaves like a liquid during intense earthquake shaking, can cause the ground to sink and shift, which can disrupt building foundations and critical infrastructure such as utilities, roads, and bridges. For liquefaction to happen, strong shaking must occur where there is loose and granular sediment that is saturated with water.[48] Lateral spreading, when earthquake shaking results in horizontal movement of soil toward a creek or another "free face" (such as an excavation or soil improvement boundary) is related to liquefaction risk. The combination of low-lying land, creeks, and loose granular sediment leaves East Palo Alto, especially neighborhoods along San Francisquito Creek, vulnerable to both liquefaction and lateral spreading (Exhibit 14).[49]

EXHIBIT 14

Like much of the Bay shoreline, East Palo Alto is in a liquefaction zone.

Source: Liquefaction zone data from the California State Geoportal Seismic Hazards Program, 2022, https://gis.data.ca.gov/datasets/cadoc::cgs-seismic-hazards-program-liquefaction-zones-1/explore.



[48] T. Poitras, A. Grant, A. Wein, K. Knudsen, K. Befus, M. Erdman, and K. Peterson, *Liquefaction and Sea-Level Rise: Sensitivity to Liquefaction Hazards from Sea-Level Rise in the San Francisco Bay Area, California*, U.S. Geological Survey, https://geonarrative.usgs.gov/liquefactionandsealevelrise/.

[49] Redwood City, *Public Safety,* https://www.redwoodcity.org/home/showpublisheddocument/5109/635782756603530000.

According to the U.S. Geological Survey, sea level and groundwater rise can increase the risk of liquefaction during earthquakes.[50] Major earthquakes may occur infrequently, but they are inevitable for a highly seismic area like San Mateo County, which is located near California's two major faults, the San Andreas and Hayward faults. To minimize possible displacement of low-income communities of color in East Palo Alto, community organizations and public leaders need to drive action on earthquake resilience, disaster preparedness, and the development of equitable recovery strategies. In a worst-case scenario, liquefaction could prompt large-scale property damage and population displacement (Box 3).

Liquefaction risk is a difficult hazard to mitigate effectively in highly developed areas, where typical strategies are expensive to implement. One way to reduce this risk is to excavate and replace existing soils with appropriately engineered soils or compacting soils to increase soil density.[51] Retrofitting foundations or constructing deeper foundations to withstand liquefaction forces is another mitigation method. In the face of sea level and groundwater rise, feasible mitigation methods and funding pathways must be explored. Where mitigation is infeasible, recovery plans and rebuilding policies must be prepared to protect residents and businesses from displacement.

Box 3: Liquefaction and Displacement in the 2011 Christchurch, New Zealand, Earthquake

The magnitude 6.3 earthquake in Christchurch in 2011 caused massive residential displacement of a suburb that was home to about 10,000 residents and built on wetland fill next to a river. The suburb experienced intense ground shaking and soil liquefaction. Due to the extent of the damages, relocation of residents from this 1,500-acre zone was considered the best course of action. The city designated the area a "red zone" and warned residents that public utilities, infrastructure, and insurance would no longer cover their homes if they chose to stay.[a] The national government implemented a voluntary purchase program (also known as a voluntary buyout program) for properties in this red zone and acquired 7,500 properties.[b]

[a] J. Hanrahan and S. Gibbs, "Inside the 'Red Zone': How a Bustling Dream Suburb Turned into a Ghostly and Overgrown Wasteland After Its 10,000 Residents Were Forced Out of Their Homes by the Christchurch Earthquake," *Daily Mail Australia*, October 7, 2019, https://www.dailymail.co.uk/news/article-7528019/Christchurch-earthquake-red-zone-revealed-incredible-new-pictures.html.

[b] W. J. Siembieda and L. A. Johnson, "Christchurch Recovers," *Planning,* August/September 2015, https://www.planning.org/planning/2015/aug/christchurchrecovers.htm.

[50] Redwood City, *Public Safety.*

[51] U.S. Army Corps of Engineers, "San Francisco Waterfront Flood Study Draft Plan," 2024, https://www.swt.usace.army.mil/Portals/41/SFWCFS_DIFR_EIS_Main%20Report_1.pdf.

Recommendations

Groundwater rise can no longer be overlooked by local city plans, flood and sea level rise adaptation projects, proposed developments, and infrastructure upgrade projects. It must be considered in tandem with other sources of flooding (e.g., sea level rise, storm surges, extreme precipitation) in all locations at risk of flooding before 2050. Yet no one city alone can adequately address its own risk, especially in the face of sea level and groundwater rise. Although the following recommendations are specific to East Palo Alto, they reflect the reality that mitigation and adaptation must be a regional and state responsibility as well as a municipal one.[52]

SPUR and Nuestra Casa have developed five key recommendations for addressing groundwater rise in East Palo Alto and San Mateo County.

Recommendation 1

Require all city plans and infrastructure projects to assess the risks of groundwater rise and compound flooding.

Responsible parties: City of East Palo Alto, County of San Mateo, and City/County Association of Governments of San Mateo County

Specific mitigation actions should be incorporated in planning to address present and future flood risk, underground infrastructure damage, liquefaction risk, and contaminant mobilization. Groundwater rise should be part of the management of publicly and privately owned infrastructure that is projected to experience groundwater tables 0 feet to 6 feet below the ground surface before 2050 and that has not been designed to manage high groundwater tables. Areas with the most vulnerable infrastructure should be first in line for maintenance and upgrades.

Groundwater rise should be incorporated into all planning documents that deal with sea level rise and flooding, especially local general plans (housing, environmental justice, and safety elements), stormwater management plans, climate action plans, and local hazard mitigation plans, as well as area-specific plans that overlap with areas having current groundwater tables between 0 feet and 6 feet belowground or emergent groundwater. These plans are usually developed by the city or county with community input and are, in certain cases, required by law. San Mateo County, Atherton, Belmont, Burlingame, East Palo Alto, Half Moon Bay, and San Bruno are currently collaborating on their Safety Element updates. Addressing groundwater rise impacts through policy actions should be key to plan updates in the Bay shore cities of East Palo Alto, Burlingame, San Bruno, and Brisbane.

San Mateo County owns 43 facilities that are at risk of flooding with 3.3 feet of sea level rise. In 2019, the county approved the Sea Level Rise Policy for County-Owned Assets, requiring sea

[52] Additional recommendations can be found in L. Tam and L. A. Johnson, *Safety First: Improving Hazard Resilience in the Bay Area*, SPUR, https://www.spur.org/publications/spur-report/2020-03-18/safety-first.

level rise to be considered in design and construction projects, leases, and property acquisitions and sales.[53] The policy mentions groundwater rise; however, it offers no guidance on adaptation solutions.

In 2023, SPUR advocated for Oakland's Safety Element update to include specific actions on groundwater rise, including a groundwater rise vulnerability assessment. SPUR sent a public comment letter with model policy language from planning policy guidance by OneShoreline, San Mateo County's Flood and Sea Level Rise Resiliency District (see Exhibit D1 in Appendix D).

Recommendation 2

Consider adopting Shallow Groundwater Rise Overlay Districts that include specific design and retrofit requirements for underground infrastructure, roadways, and new shoreline development in high-hazard areas.

Responsible parties: City of East Palo Alto, East Palo Alto City Council, East Palo Alto Planning Department, County of San Mateo, City/County Association of Governments of San Mateo County, Bay Conservation and Development Commission, Metropolitan Transportation Commission, and Association of Bay Area Governments

In 2023, OneShoreline, San Mateo County's Flood and Sea Level Rise Resiliency District, released planning guidance for sea level rise. The guidance suggests that San Mateo County jurisdictions adopt Shallow Groundwater Rise Overlay Districts as a tool to establish specific design and retrofit requirements for substantial construction and improvements of homes, buildings, infrastructure, roadways, and contaminated sites (see Exhibit D2 in Appendix D for OneShoreline's proposed design standards for underground infrastructure, contaminated sites, and sites susceptible to liquefaction).

The City of East Palo Alto should lead the way by adopting a zoning amendment to implement an overlay district, which would include areas of East Palo Alto that will experience groundwater levels from 0 feet to 6 feet under a 6.6 feet of sea level rise scenario.[54] Design and retrofit requirements are meant to address groundwater rise's contribution to buoyancy forces, seepage/infiltration, corrosion, contaminant mobilization, and liquefaction.[55] OneShoreline's planning guidance provides template language to aid cities such as East Palo Alto in making the zoning amendments.

[53] County of San Mateo, "Sea Level Rise Policy for County-Owned Assets," 2019, https://www.smcsustainability.org/wp-content/uploads/20191210_att_A-SLR-Policy.pdf.

[54] OneShoreline and Good City Company, *Planning Guidance Policy: To Protect and Enhance Bay Shoreline Areas of San Mateo County*, 2023, p. 43, https://oneshoreline.org/wp-content/uploads/2023/09/OneShoreline-Planning-Policy-Guidance-Final-June-21-2023-For-Web.pdf.

[55] OneShoreline and Good City Company, *Planning Guidance Policy: To Protect and Enhance Bay Shoreline Areas of San Mateo County*, p. 43.

Recommendation 3

In partnership with impacted communities, update guidance for remediation requirements of shoreline sites to incorporate risks of contaminant mobilization from groundwater and sea level rise.

Responsible parties: Department of Toxic Substances Control, U.S. Environmental Protection Agency, and San Francisco Bay Regional Water Quality Control Board

Regulators of contaminated lands, such as the Department of Toxic Substances Control, the U.S. Environmental Protection Agency, and the San Francisco Bay Regional Water Quality Control Board, should work in partnership with vulnerable communities to mitigate disproportionate exposure to contamination, made worse by the impacts of sea level and groundwater rise. Those living in proximity to contaminated sites should be given the knowledge and power to negotiate remediation measures and to determine acceptable levels of risk for their community.

Groundwater vulnerability assessments of contaminated sites will advance knowledge of contaminant mobilization under changing climate conditions. Site remediation measures should reflect the projected short-term and long-term impacts of contaminant mobilization on community health. Prioritizing contaminated sites for assessment and cleanup will require assessing sites based on a variety of community priorities, including location, known contaminants of concern, and previous cleanup actions. Climate Resilient Communities, a local community-based organization, is developing a contaminated site priority list for community review. Vulnerability assessments should include testing for contaminants in sewer lines and homes proximate to sites. These assessments will increase understanding of contaminant mobilization pathways for volatile organic compounds and other contaminants.

If groundwater rise is considered in San Mateo County's Bay shore climate adaptation projects, communities can avoid costly adaptation failures. San Mateo County and East Palo Alto have the opportunity to lead the region on groundwater rise adaptation planning.

Recommendation 4

Update sea level rise and flood maps to reflect shallow groundwater rise so that relevant agencies and affected communities are aware of the risk and can begin planning processes to address it.

Responsible parties: Bay Conservation Development Commission, Association of Bay Area Governments, City/County Association of Governments of San Mateo County, California Coastal Commission, and Federal Emergency Management Agency

Research and adaptation planning for sea level rise and flooding should consider all compounding flood risks that an area faces. Only the Cal-Adapt Coastal Inundation Tool, which uses data from the U.S. Geological Survey's Our Coast, Our Future tool, indicates groundwater rise hazards. Other hazard mapping tools, including the Bay Conservation and Development Commission's Adapting to Rising Tides Bay Shoreline Flood Explorer and the FEMA National Flood Hazard Layer, are

incomplete without the inclusion of groundwater rise. If groundwater rise is not included in hazard maps used by counties to plan for sea level rise and flooding, compound flood risks will not be effectively addressed by local plans and assessments and resulting flood management strategies. Efforts to update flooding maps have been stymied by lack of access to funding, however the Bay Conservation and Development Commission's Flood Explorer will include groundwater rise as soon as 2025. With map updates, it will be critical to minimize the impacts of flood insurance requirements on low-income homeowners.

Recommendation 5

Pursue a variety of innovative funding mechanisms to support groundwater rise research, adaptation planning, and implementation projects.

Responsible parties: Local residents and property owners, individual cities, the San Mateo County Board of Supervisors, City/County Association of Governments of San Mateo County, Association of Bay Area Governments, the Bay Conservation and Development Commission, and others

In 2023, the Bay Conservation and Development Commission released a report that estimated a $110 billion cost to protect the Bay Area from sea level rise and storm surge impacts by 2050.[56] Only $5 billion is available through existing federal, state, regional, and local funding programs, leaving a $105 billion funding gap. Compounding the problem, this gap does not reflect the costs of adapting to groundwater rise. Local and regional agencies must pursue a wide range of innovative funding mechanisms to manage groundwater rise risks, including stormwater fees, overlay districts, and local and state bonds (Exhibit 15).

[56] Metropolitan Transportation Commission/Association of Bay Area Governments and the San Francisco Bay Conservation and Development Commission, *Sea Level Rise Adaptation Funding and Investment Framework Final Report*, 2023, https://documents.coastal.ca.gov/reports/2023/7/W6e/W6e-7-2023-report.pdf.

EXHIBIT 15

Funding Mechanisms for Local and Regional Agencies to Pursue

FUNDING MECHANISM	EXAMPLE PROGRAM
Stormwater fees	In January 2024, the City of San Mateo adopted a Community Flood and Storm Protection Fee.[a] This is a property tax that is determined by the property's use of the stormwater system and the size of the property (to determine the volume of water runoff) and, for non-residential properties, the amount of impervious surfaces on the property. The dedicated revenue from this property tax will be used to fund repairs and improvements of aging stormwater infrastructure, which includes underground pipes, levees, and pumps.
Overlay district with tax assessment	A Geologic Hazard Abatement District (GHAD) is an independent governmental district that can assess and tax properties within a defined area and dedicate the revenue to abating or controlling hazards such as combined flooding and long-term and short-term sea level rise, in addition to other hazards such as wildfire, landslides, or seismic risks. The City of Dublin has established a GHAD to mitigate and repair landslide and erosion hazards that could directly affect properties in the district.[b] Because funding comes through property taxes, it is important that GHADs do not burden low-income property owners and renters. To address equity issues, a jurisdiction could construct a progressive tax rate or provide renters and property owners with deferral options. Establishing a county or regional GHAD could provide a way to mitigate hazards across the region through districtwide or individual property improvements. Learn more about GHADs in SPUR's 2020 report *Safety First*.[c]
Local/regional bonds	In 2014, Measure AA was approved by voters within a defined district covering parts of San Mateo and Santa Clara counties. Measure AA is a 30-year, $300 million general obligation bond authorized for use by Midpeninsula Regional Open Space District.[d] The funding is dedicated to projects that protect and restore regional open space and improve public access to trails, such as along Ravenswood Open Space Preserve adjacent to East Palo Alto. Bond funding will be an important tool in groundwater rise adaptation. (Note: In 2016, a different Measure AA, a Bay Area–wide parcel tax of $12, was adopted to protect and restore the San Francisco Bay.[e])
State bonds	Due to the state budget deficit, billions in funding for critical climate programs were delayed or cut in May 2024. To continue advancing toward the state's climate goals, two bills were proposed last year to establish a climate bond (AB 1567[f] and SB 867[g]). Lawmakers have until June 27, 2024, to negotiate the merging of these bills and finalize a climate bond proposal to get the resulting bill on the November 2024 ballot for voter approval. SPUR is in support of a climate bond and is advocating for climate bond funding to include groundwater rise projects. Local jurisdictions and regional agencies should also advocate for a climate bond and funding that addresses groundwater rise.

[a] City of San Mateo, "Community Flood & Storm Protection Initiative," https://www.cityofsanmateo.org/2288/Community-Flood-Storm-Protection-Initiat.

[b] City of Dublin, "Geologic Hazard Abatement Districts (GHAD)," https://www.dublin.ca.gov/1607/Geologic-Hazard-Abatement-Districts-GHAD.

[c] L. Tam and L. A. Johnson, *Safety First: Improving Hazard Resilience in the Bay Area*, SPUR, March 2020, https://www.spur.org/publications/spur-report/2020-03-18/safety-first.

[d] Midpeninsula Regional Open Space District, "Measure AA," https://www.openspace.org/what-we-do/projects/measure-aa.

[e] San Francisco Bay Restoration Authority. "Parcel Tax," https://www.sfbayrestore.org/parcel-tax.

[f] California State Legislature, "AB-1567 Safe Drinking Water, Wildfire Prevention, Drought Preparation, Flood Protection, Extreme Heat Mitigation, Clean Energy, and

[g] California State Legislature, "Senate Bill 867 Drought, Flood, and Water Resilience, Wildfire and Forest Resilience, Coastal Resilience, Extreme Heat Mitigation, Biodiversity and Nature-Based Climate Solutions, Climate Smart Agriculture, Park Creation and Outdoor Access, and Clean Energy Bond Act of 2024," https://legiscan.com/CA/text/SB867/id/2829882.

Source: SPUR.

At the local level, community benefit agreements may also support groundwater rise adaptation by requiring developers to provide funding for local infrastructure upgrades and other community improvements. Bay Area cities and counties should also pursue cross-jurisdictional grants such as adaptation planning and implementation project grants offered by the Office of Planning and Research, FEMA's Hazard Mitigation Grants, and the U.S. Environmental Protection Agency's Environmental and Climate Justice Community Change Grants, funded by the Inflation Reduction Act. Projects like SAFER Bay and the San Mateo County OneWatershed Climate Resilience Framework are examples of cross-jurisdictional efforts with funding for managing sea level rise and flood risk (see Appendix A). The state will play a critical role in advancing groundwater risk mitigation and adaptation.

Appendix A

Sample of Flood Protection and Infrastructure Upgrade Projects in East Palo Alto and San Mateo County

Exhibit A1

Five projects suggest the types of efforts government agencies are undertaking to put the brakes on damage from flooding.

PROJECT TITLE	TYPE	PURPOSE/OUTCOMES	LEAD	FUNDING SOURCE
Reach 1, Downstream Project	Creek widening and engineered levees	Project was completed in 2019 and included San Francisquito Creek widening, installation of floodwalls, new or improved marsh habitat, new public trails and connection to Bay Trail from Highway 101 to mouth of creek (near O'Connor Pump Station). Project also relocated and upgraded critical sanitary sewer, gas, and electrical infrastructure. Protections: Project protects more than 1,700 properties from a 100-year creek flood during king tide, with 3 feet of sea level rise.	San Francisquito Creek Joint Powers Authority (SFCJPA)	Funding from SFCJPA partners and California Department of Water Resources
Reach 2, Upstream or Urban Reach Project	Creek widening, bridge replacements, and existing floodwall repair and other potential alternatives	Reduce the risk of creek flooding in the creek-adjacent communities of East Palo Alto, Menlo Park, and Palo Alto. The project is in the planning and development stages. Parts of construction are planned to start in 2024–2025.	SFCJPA	SFCJPA members, Department of Water Resources, U.S. Army Corps of Engineers
San Mateo County OneWatershed Climate Resilience Framework	Shoreline adaptation plan	Project is in planning phase. Deliverables: Shared-risk water infrastructure asset and community vulnerability data inventory; climate resilience plan. Project will be a model for community-led risk identification for resilient neighborhoods and watersheds.	City/County Association of Governments of San Mateo County Flows to Bay Program	Governor's Office of Planning & Resilience Adaptation Planning Grant Program ($649,648 in 2023)

Continued →

PROJECT TITLE	TYPE	PURPOSE/OUTCOMES	LEAD	FUNDING SOURCE
Strategy to Advance Flood protection, Ecosystems and Recreation along San Francisco Bay (SAFER Bay)	Sea level rise and tidal flooding protection, habitat restoration, cultural and recreational shoreline access	Purpose: In partnership with JPA members, stakeholders, and community-based organizations, identify the most effective sea level and tidal flood risk reduction alternatives, and integrate habitat restoration and protection into project design. Goals: Protect vulnerable communities in Belle Haven in Menlo Park and East Palo Alto, protect vital energy, water, and transportation infrastructure, protect or restore critical habitat, and enhance recreational opportunities and access to nature. Groundwater rise will be considered in CEQA analysis. Status: Planning and design. The draft Programmatic EIR will be released for public comment in August 2025 . The Final Programmatic EIR is scheduled for November 2025.	SFCJPA for CEQA and permitting; SFCJPA members East Palo Alto and Menlo Park for implementation	SF Bay Restoration Authority, CA Department of Water Resources, FEMA HMGP, FEMA BRIC, PG&E and Meta
O'Connor Pump Station Stormwater Management Improvements	Infrastructure upgrade	Purpose: Extensive routine maintenance and upgrades	City of East Palo Alto	Community project funding allocated in 2022 federal budget ($800,000)

Sources: Information on SFCJPA projects was provided by Margaret Bruce, Executive Director of SFCJPA. San Francisquito Creek Joint Powers Authority (SFCJPA), "SF Bay to Highway 101: The Completed Reach 1 'Downstream Project,'" https://www.sfcjpa.org/reach-1-downstream-project; SFCJPA, "The Reach 2 — The 'Upstream' or 'Urban Reach' Project," https://www.sfcjpa.org/reach-2-upstream-project; M. Wong (OneShoreline), personal communication, July 3, 2023; SFCJPA, "The SAFER Bay Project," https://www.sfcjpa.org/safer-bay-project; and City of East Palo Alto, "O'Connor Pump Station Stormwater Management Improvements," https://www.cityofepa.org/publicworks/project/o%E2%80%99connor-pump-station-stormwater-management-improvements.

Appendix B

Agencies Governing Adaptation to Sea Level Rise

The land exposed to sea level and groundwater rise along the Bay shore of San Mateo County is owned and governed by multiple public agencies (Exhibit B1) and private stakeholders. Adapting to groundwater rise will require the collaboration of these entities, which have not always communicated effectively. Without collaboration, government agencies will have little ability to reduce communities' exposure risk. This is a representative list of agencies governing California's shoreline and sea level rise adaptation. It is not exhaustive.

EXHIBIT B1

More than 20 governing agencies play a role in planning for sea level rise adaptation in San Mateo County.

LOCAL	REGIONAL	STATE	FEDERAL
City governments	Bay Conservation and Development Commission	California Coastal Commission	U.S. Environmental Protection Agency
County of San Mateo	San Francisco Regional Water Quality Control Board	California Department of Toxic Substances Control	U.S. Army Corps of Engineers
City/County Association of Governments of San Mateo County	Association of Bay Area Governments	California Environmental Protection Agency	National Marine Fisheries Service
OneShoreline – San Mateo County Sea Level Rise Special District		Caltrans	U.S. Fish & Wildlife Service
San Francisquito Creek Joint Powers Authority		California Department of Fish and Wildlife	National Oceanic and Atmospheric Administration
		California State Parks Department	
		California State Coastal Conservancy	
		California State Lands Commission	

Source: County of San Mateo, California State Coastal Conservancy, and Arcadis, *County of San Matteo Sea Level Rise Vulnerability Assessment*, 2018, https://www.smcsustainability.org/wp-content/uploads/2018-03-12_SLR_VA_Report_2.2018_WEB_FINAL.pdf.

Appendix C
Contaminated Sites in East Palo Alto

EXHIBIT C1

With 50 contaminated sites in their city, East Palo Alto residents are likely to be particularly exposed to contamination as a result of groundwater rise.

SITE	CLEANUP STATUS (OPEN OR CLOSED)	LEAD AGENCY
1010 Runnymede Street	Open	Department of Toxic Substances Control Site Mitigation and Brownfield Reuse Program (DTSC SMBRP)
1039 Garden Street	Closed	San Francisco Bay Regional Water Quality Control Board (RWQCB)
1060 Weeks Street	Closed	San Francisco Bay RWQCB
1175 Weeks Street	Open	San Francisco Bay RWQCB
Formerly Starlinks Logistics, 1990 Bay Road	Open	San Francisco Bay RWQCB
2296 Pulgas Avenue	Closed	San Mateo County Local Oversight Program (LOP)
230 Demeter Street	Open	San Francisco Bay RWQCB
2555 Pulgas Avenue	Closed	San Francisco Bay RWQCB
350 Demeter Street	Open	San Francisco Bay RWQCB
391 Demeter Street	Open	San Francisco Bay RWQCB
755 Schembri Lane	Closed	DTSC SMBRP
Bay Area Auto Wreckers	Closed	San Francisco Bay RWQCB
Clarum Homes	Closed	San Francisco Bay RWQCB
Cooley Landing, Ravenswood Industrial Area	Open	San Francisco Bay RWQCB
East Palo Alto Youth Art and Music Center	Open	San Francisco Bay RWQCB
Electrite Company, 1805 Bay Road	Open/Closed	San Francisco Bay RWQCB
Former Call-Mac Transportation	Open	San Francisco Bay RWQCB
Former Rail Spur, Bay to Pulgas Section	Closed	San Francisco Bay RWQCB
Former UPRR Rail Spur	Closed	San Francisco Bay RWQCB

Continued →

SITE	CLEANUP STATUS (OPEN OR CLOSED)	LEAD AGENCY
Global Steel	Closed	San Francisco Bay RWQCB
Ibrahim Property	Closed	San Mateo County LOP
IDEA	Closed	San Francisco Bay RWQCB
Iwasaki Nursery, 2519 Pulgas Avenue	Open/Closed	San Francisco Bay RWQCB
J & J Rentals and Sales	Closed	San Mateo County LOP
Kung Property	Open	Unknown
MidPen Housing Corporation, 965 Weeks Street	Open	San Francisco Bay RWQCB
Miles Property	Closed	San Mateo County LOP
Mizufune Nursery	Closed	San Mateo County LOP
Myrtle High School 1010, 1020, 1040, 1054, and 1056 Myrtle Street	Closed	DTSC SMBRP
Myrtle High School 980 and 992 Myrtle Street	Open	DTSC SMBRP
Narita Property	Closed	San Mateo County LOP
Peck & Hiller	Closed	San Francisco Bay RWQCB
Peninsula Charter Lines	Closed	San Mateo County LOP
Peninsula Charter Lines	Open	San Mateo County LOP
Pick & Save Auto Wreckers	Open	San Francisco Bay RWQCB
Pitcher Drilling	Closed	San Mateo County LOP
Private Residence	Closed	San Francisco Bay RWQCB
2509 Pulgas Avenue	Open	San Francisco Bay RWQCB
Rainer Service Station	Closed	San Mateo County LOP
264 Tara Street	Open	San Francisco Bay RWQCB
Ravenswood Family Health Center, 1885 Bay Road	Closed	San Francisco Bay RWQCB
Re Borrmann's, 2450 Pulgas Ave.	Closed	San Francisco Bay RWQCB
Rhone-Poulenc, 1990 Bay Rd.	Open	San Francisco Bay RWQCB
Former Romic Environmental Technologies, 2081 Bay Road	Open	U.S. Environmental Protection Agency
Siri Bros. Nursery	Closed	San Mateo County LOP

Continued →

SITE	CLEANUP STATUS (OPEN OR CLOSED)	LEAD AGENCY
Siri Bros. Partnership	Closed	San Mateo County LOP
Touchatt Trucking, 2535 Pulgas Ave.	Open/Closed	San Francisco Bay RWQCB/ San Mateo County LOP
TWC TARA LLC	Open	San Francisco Bay RWQCB
Yamane Nursery	Closed	San Mateo County LOP

Sources: California Department of Toxic Substances Control, "EnviroStor," https://www.envirostor.dtsc.ca.gov/public/; T.Y. Lin International, "Updated Soil and Groundwater Plan: Bay Road Phase II and III Improvement Project Palo Alto, California," 2018, https://www.cityofepa.org/sites/default/files/fileattachments/public_works/project/3491/attachment_c_sgmp.pdf; K. Hill, D. Hirschfeld, C. S. Lindquist, F. Cook, and S. Warner, *Rising Coastal Groundwater as a Result of Sea-Level Rise Will Influence Contaminated Coastal Sites and Underground Infrastructure*, 2023, https://www.researchgate.net/publication/371068344_Rising_coastal_groundwater_as_a_result_of_sea-level_rise_will_influence_contaminated_coastal_sites_and_underground_infrastructure.

Appendix D
Oneshoreline's 2023 Model Policy Language and Development Standards

EXHIBIT D1

Through SPUR's advocacy, the City of Oakland's 2023 Safety Element adopted two goals of OneShoreline's policy guidance.

ONESHORELINE POLICY GUIDANCE	CITY OF OAKLAND'S 2023 UPDATED SAFETY ELEMENT
Shallow Groundwater Rise Vulnerability Assessment. Coordinate with adjacent jurisdictions as appropriate to establish a detailed understanding of the effects of rising shallow groundwater on people, the built environment, and water supply. This includes buoyancy, seepage, infiltration, liquefaction, corrosion, and contaminant mobilization hazards. This assessment should have an interactive map component that will be updated based on site-specific geotechnical and topographic data submitted by new developments (p. 17).	**Goal SAF-A.21.** Study compounding impact of sea level rise on groundwater threats in areas with hazardous facilities. Coordinate with adjacent jurisdictions as appropriate to create a Shallow Groundwater Rise Vulnerability Assessment to establish a detailed understanding of the effects of rising shallow groundwater on people, the built environment, and water supply. This includes buoyancy, seepage, infiltration, liquefaction, corrosion, and contaminant mobilization hazards. The assessment should have an interactive map component that will be updated based on site-specific geotechnical and topographic data submitted by new developments. Continue to comply with performance standards pursuant to the Alameda countywide National Pollutant Discharge Elimination System municipal stormwater permit (p. 5-5). Responsibility: Sustainability and Resilience Division, City Administrator's Office, Planning & Building, Public Works Timeframe: Short
Contaminated Sites. New and/or substantial construction on contaminated sites shall account for impacts of rising shallow groundwater on contaminant mobilization in project design and all steps of the site remediation process. This shall be documented in a vulnerability assessment and adaptation plan, which will also include a groundwater data monitoring plan (p. 46).	**Goal SAF-4.4 Contaminated Sites.** *Direct copy of OneShoreline policy guidance for contaminated sites (p. 5-5). **Goal SAF-5.1 Risks from Hazardous Materials Facilities.** Review proposed facilities that would produce or store hazardous materials, gas, natural gas, or other fuels to identify, and require feasible mitigation for, any significant risks. Regulations and enforcement of activities should be disclosed in a set of findings. The review shall consider, at a minimum, the following: Presence of seismic or geologic hazards; Presence of other hazardous materials; Proximity to residential development and areas in which substantial concentrations of people exist, particularly Environmental Justice communities already overburdened by pollution, including toxic releases from facilities, cleanup sites, **groundwater threats/threats from sea level rise**, and other sources; and Nature and level of risk and hazard associated with the proposed projects (p. 5-6).

Sources: OneShoreline, "Planning Guidance Policy: To Protect and Enhance Bay Shoreline Areas of San Mateo County," 2023, https://oneshoreline.org/wp-content/uploads/2023/09/OneShoreline-Planning-Policy-Guidance-Final-June-21-2023-For-Web.pdf, and Dyett & Bhatia, "2045 Oakland Safety Element," City of Oakland, 2023, https://www.oaklandca.gov/topics/oakland-2045-general-plan-safety-element#:-:text=The%20Safety%20Element%20is%20a,natural%20and%20human%2Dcaused%20hazards.

EXHIBIT D2

To protect and enhance the San Francisco Bay shoreline area of San Mateo County, OneShoreline proposed development standards for underground infrastructure, contaminated sites, and sites susceptible to liquefaction.

Underground Infrastructure	Impacts from shallow groundwater rise shall be considered and mitigated in the design of new subsurface utilities, including sewer, stormwater, and underground electrical systems. 1. Pump Stations. Pump station capacity shall account for anticipated increases in infiltration to the stormwater system from shallow groundwater rise over the pump station's anticipated service life. 2. Green Infrastructure. Impacts from shallow groundwater rise shall be considered and mitigated in the design of green infrastructure, as projects designed to current groundwater levels may not function as well when shallow groundwater rises nearer to the ground surface. Underdrains connected to the stormwater system can help ensure green infrastructure installations continue to function even if rising groundwater levels slow infiltration rates
Contaminated Sites	New and/or substantial construction on contaminated sites shall account for impacts of rising shallow groundwater on contaminant mobilization in project design and all steps of the site remediation process, in coordination with the relevant agencies responsible for the remediation plan for the site. This shall be documented in a vulnerability assessment and adaptation plan, which will also include a groundwater monitoring plan.
Liquefaction	New and/or substantial construction sited in "High" or "Very High" Liquefaction Susceptibility areas in the Bay Area Liquefaction Susceptibility Map provided by the U.S. Geological Survey shall account for liquefaction hazards and the impacts of rising shallow groundwater on liquefaction severity in project design. Sites most sensitive to increases in liquefaction susceptibility caused by sea level rise are those located on artificial fill around the Bay Area margins where the water table is already shallow.

Source: OneShoreline and Good City Company, *Planning Guidance Policy: To Protect and Enhance Bay Shoreline Areas of San Mateo County*, 2023, https://oneshoreline.org/wp-content/uploads/2023/09/OneShoreline-Planning-Policy-Guidance-Final-June-21-2023-For-Web.pdf.

Appendix E
Community "Noticias" on Groundwater Rise

EXHIBIT E1
English Version of Groundwater Rise "Noticias"
Page 1

Nuestra Casa

ISSUE #6
APRIL 2024

NOTICIAS

WHAT IS SHALLOW GROUNDWATER RISE?

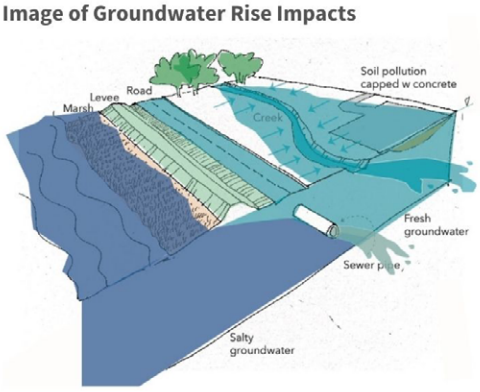
Shallow groundwater is water from rainfall that is stored in soils near the ground surface. As sea level rises, salty water from the bay migrates inland, pushing groundwater to the surface. We don't know everything about how this will affect us now and in the future. But, we do know that flooding will be more widespread than previously thought due to climate change and this will impact both infrastructure and public health.

HOW WILL GROUNDWATER RISE AFFECT MY COMMUNITY?

Groundwater rise is likely to lead to various impacts on low-lying communities along the San Francisco Bayshore. Impacts may include:

- **Increased flooding during wet winters** could lead to difficulties moving about and accessing services in parts of East Palo Alto, Belle Haven, & Redwood City.
- **More frequent stormwater and sewer overflows.** Pipes for rain and sewage cannot handle high groundwater levels, especially during heavy rainfall events. Overflows can impact public health and Bay ecosystem health.
- **Damage to building and home foundations.** Foundations of buildings wear out faster if regularly in contact with salty water. Fixing foundations can be expensive for owners.
- **Corrosion of roads and underground infrastructure like drinking water pipes.** Infrastructure may need to be upgraded to protect against groundwater infiltration and corrosion by groundwater. Infrastructure upgrades are costly and costs could be passed to the local customers if the City, State, or Federal government does not fund them.
- **Some contaminants left in soils on legacy industrial sites can travel into floodwaters and cracked storm and sewer pipes.** This can occur on industrial sites that have undergone remediation and on those that have not yet been cleaned. Within Redwood City, Belle Haven, and East Palo Alto, there are about 200 contaminated sites that could be affected by groundwater and sea level rise.

Image of Groundwater Rise Impacts



Source: Drawing by Dr. Kristina Hill. Bay Conservation and Development Commission (BCDC) Adapting to Rising Tides. https://www.adaptingtorisingtides.org/portfolio/shallow-groundwater-rise/

GET INVOLVED & STAY UPDATED!

EXHIBIT E1

English Version of Groundwater Rise "Noticias"

Page 2

Nuestra Casa

NOTICIAS

ISSUE #6
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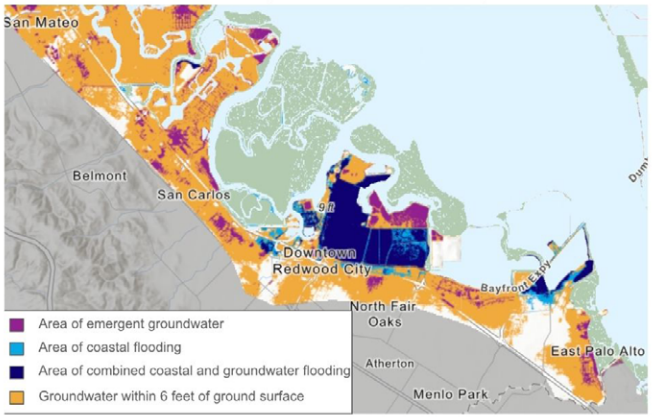
The California Ocean Protection Council estimates that sea level in the San Francisco Bay Area could rise by about **1 foot to 2 feet by the year 2060** (under intermediate to "worst case" climate change scenarios).

At **2-feet of sea level rise**, low-lying areas of Belle Haven, East Palo Alto (east of Pulgas Avenue), and Redwood City (a quarter mile of the Bayshore east of Highway 101) will likely experience consistent flooding from groundwater if no adaptation actions are taken. The map shows where this flooding would occur under this scenario.

Groundwater & Coastal Flooding with 2 Feet of Sea-Level Rise

*Map of groundwater levels under **2 feet of sea level rise scenario.** **Dark blue, purple, and light blue show areas of flooding due to sea level and groundwater rise.** Emergent groundwater (purple) refers to groundwater levels that are above ground (i.e. pooling on roads or other low-lying areas).*



*Source: Screenshot taken from Pathways Climate Institute & San Francisco Estuary Institute (2022) web-based maps.

HOW CAN I GET INVOLVED?

Nuestra Casa is monitoring groundwater rise and its impact on our community. With your support, we will be educating and working with our local policymakers to determine effective adaptation solutions.

Some ways you can take action now:

- Join our Environmental Justice Academy
- Share this Noticia with your family and friends
- Contact environmentaljustice@nuestracasa.org for more information

INVOLÚCRATE Y MANTENTE INFORMADO

FOR MORE INFORMATION:
environmentaljustice@nuestracasa.org

VISIT NUESTRA CASA'S WATER JUSTICE WEBSITE

EXHIBIT E2

Spanish Version of Groundwater Rise "Noticias"

Page 1

Nuestra Casa

EDICIÓN #6
ABRIL 2024

NOTICIAS

¿QUÉ ES EL AUMENTO DEL NIVEL DE LAS AGUAS SUBTERRÁNEAS SUPERFICIALES?

Las aguas subterráneas superficiales son agua de lluvia que se almacena en suelos cerca de la superficie terrestre. A medida que el nivel del mar sube, el agua salada de la bahía migra hacia adentro, empujando el agua subterránea hacia la superficie. No sabemos todo acerca de cómo esto nos afectará ahora y en el futuro. Sin embargo, sabemos que las inundaciones serán más frequentes de lo que se pensaba anteriormente debido al cambio climático, y esto impactará tanto en la infraestructura como en la salud pública.

¿CÓMO AFECTARÁ EL AUMENTO DEL NIVEL DE LAS AGUAS SUBTERRÁNEAS A MI COMUNIDAD?

El aumento del nivel freático probablemente llevará a diversos impactos en comunidades de baja altitud a lo largo de la costa de la Bahía de San Francisco. Los impactos pueden incluir:

- **Aumento de las inundaciones durante los inviernos húmedos,** lo que podría dificultar en moverse y el acceso a servicios en partes de East Palo Alto, Belle Haven y Redwood City.
- **Desbordamientos más frecuentes de aguas pluviales y aguas residuales.** Los tubos de drenaje de lluvia y aguas residuales no pueden manejar los niveles altos del agua subterránea, especialmente durante eventos de lluvia intensa. Los desbordamientos pueden afectar la salud pública y la salud del ecosistema de la Bahía.
- **Daños en los cimientos de edificios y viviendas.** Los cimientos de los edificios se desgastan más rápido si están regularmente en contacto con agua salada. Reparar los cimientos puede ser costoso para los propietarios.
- **Corrosión de carreteras e infraestructura subterránea como tuberías de agua potable.** Es posible que sea necesario mejorar la infraestructura para protegerse contra la infiltración del agua subterránea y la corrosión provocada por el aumento del nivel freático. Las mejoras en la infraestructura son costosas y los costos podrían trasladarse a los clientes locales si la ciudad, el estado o el gobierno federal no las financia.
- **Algunos contaminantes que quedan en los suelos de antiguos sitios industriales pueden desplazarse hacia las aguas de inundación y las tuberías de aguas pluviales y cloacas agrietadas.** Esto puede ocurrir en sitios industriales que han sido remediados y en aquellos que aún no han sido limpiados. En Redwood City, Belle Haven y East Palo Alto, hay alrededor de 200 sitios contaminados que podrían verse afectados por el aumento del nivel freático y del mar.

Imagen de los Impactos del Aumento de las Aguas Subterráneas

Fuente: Dibujo por la Dra. Kristina Hill. Bay Conservation and Development Commission (BCDC) Adapting to Rising Tides. https://www.adaptingtorisingtides.org/portfolio/shallow-groundwater-rise/

¡PARTICIPE Y MANTÉNGASE ACTUALIZADO!

EXHIBIT E2

Spanish Version of Groundwater Rise "Noticias"

Page 2

Nuestra Casa

NOTICIAS

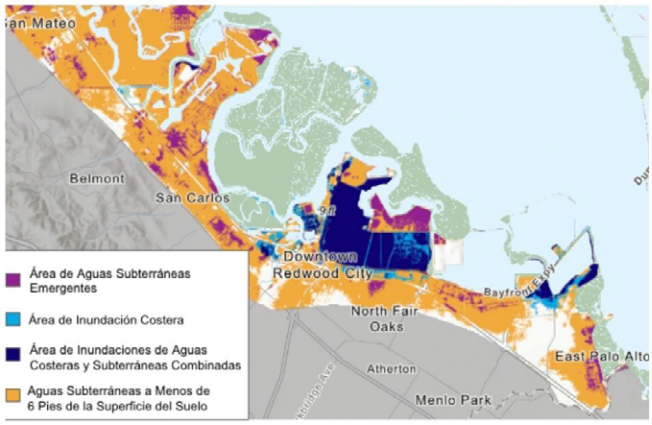
EDICIÓN #6
ABRIL 2024

El Consejo de Protección del Océano de California estima que el nivel del mar en el área de la Bahía de San Francisco podría aumentar entre **1 pie y 2 pies para el año 2060** (bajo escenarios de cambio climático intermedio a "peor caso").

Con un aumento del nivel del mar de 2 pies, es probable que las áreas bajas de Belle Haven, East Palo Alto (al este de Pulgas Avenue) y Redwood City (a un cuarto de milla de la costa este de la autopista 101) experimenten inundaciones consistentes por agua subterránea si no se toman medidas de adaptación. El mapa muestra dónde ocurrirían estas inundaciones bajo este escenario.

Inundaciones por Aguas Subterráneas y Costeras con un Aumento del Nivel del Mar de 2 Pies

Mapa de niveles de aguas subterráneas bajo el escenario de aumento del nivel ***del mar de 2 pies. El azul oscuro, morado y azul claro muestran áreas inundadas debido al aumento del nivel del mar y de las aguas subterráneas.*** *Las aguas subterráneas emergentes (color morado) se refieren a los niveles de aguas subterráneas que están por encima del suelo (es decir, se acumulan en carreteras u otras áreas bajas).*



**Fuente: Captura de pantalla tomada de los mapas en línea del Pathways Climate Institute & San Francisco Estuary Institute (2022).

¿CÓMO PUEDO PARTICIPAR?

Nuestra Casa está monitoreando el aumento del nivel freático y su impacto en nuestra comunidad. Con su apoyo, educaremos y trabajaremos con nuestros responsables políticos locales para determinar soluciones de adaptación efectivas.

Algunas formas en que puedes tomar acción ahora:

- Únete a nuestra Academia de Justicia Ambiental
- Comparte esta Noticia con tu familia y amigos
- Contacta a environmentaljustice@nuestracasa.org para obtener más información

¡PARTICIPE Y MANTÉNGASE ACTUALIZADO!

PARA OBTENER MÁS INFORMACIÓN:
environmentaljustice@nuestracasa.org

VISITA EL SITIO WEB DE JUSTICIA HÍDRICA DE NUESTRA CASA.

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