Groundwater Rise:
Community Health and Partnerships for Policy Change

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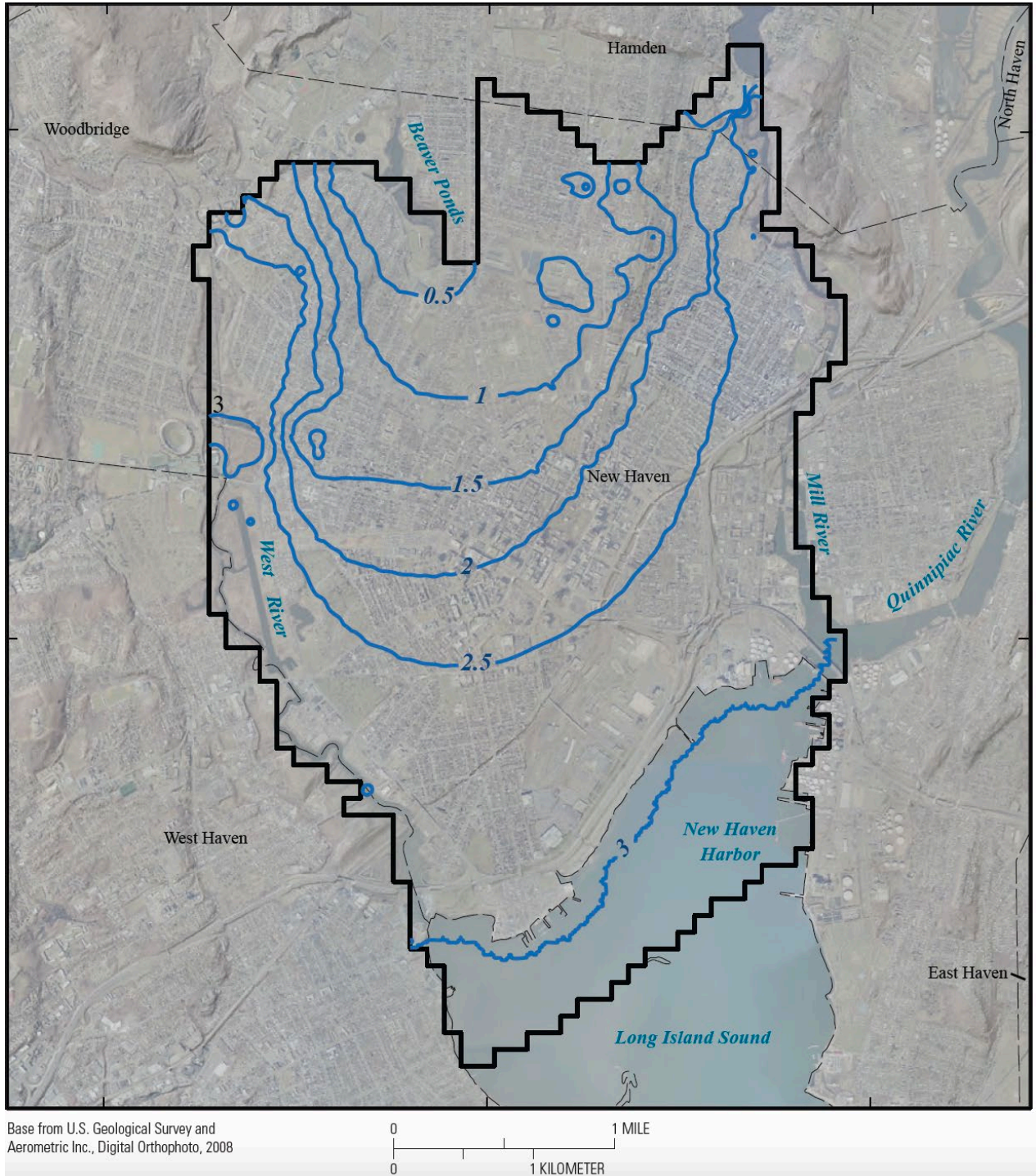
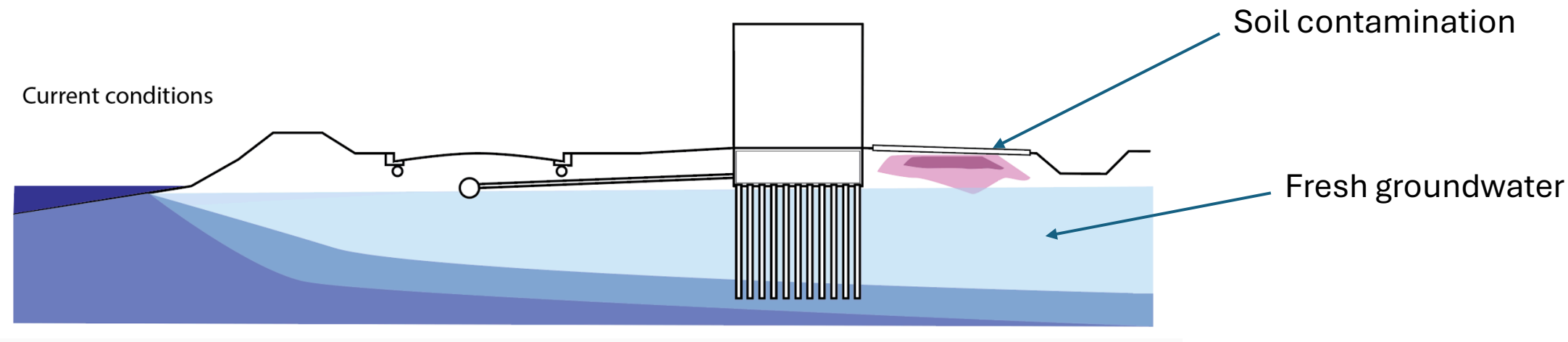
USGS research (2012)

A team of researchers led by David Bjerklie was the first to model the impacts of sea level rise on groundwater depth in an American coastal watershed, showing that shallow, unconfined coastal groundwater may rise, and that the effect could extend as far as 3 miles from the shore with 3 feet of SLR.

Bjerklie, D.M., Mullaney, J.R., Stone, J.R., Skinner, B.J., and Ramlow, M.A., 2012, Preliminary investigation of the effects of sea-level rise on groundwater levels in New Haven, Connecticut: U.S. Geological Survey Open-File Report 2012–1025, 46 p., at http://pubs.usgs.gov/of/2012/1025/.



Where pumping limits groundwater rise, it will get saltier – and the saltwater boundary can rise higher.



Werner, Adrian D., and Craig T. Simmons. "Impact of sea-level rise on sea water intrusion in coastal aquifers." Groundwater 47.2 (2009): 197-204.

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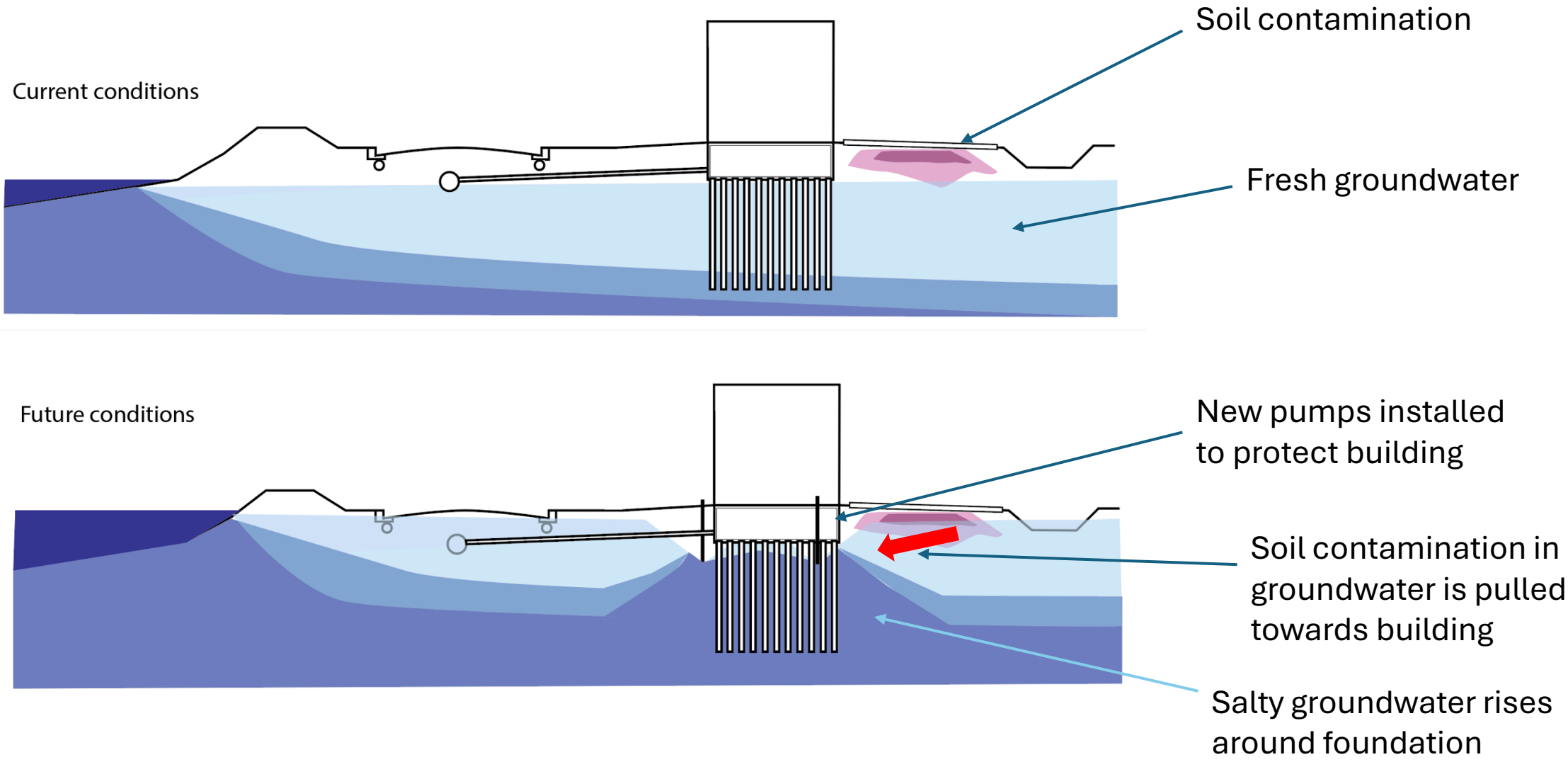

Rising groundwater can mobilize contaminants unexpectedly

- Metals will migrate down-gradient (affected by pumping) into creeks, marshes and the Bay
- Pesticides and other Persistent Organic Pollutants (POPs) will also migrate towards creeks, marshes and the Bay

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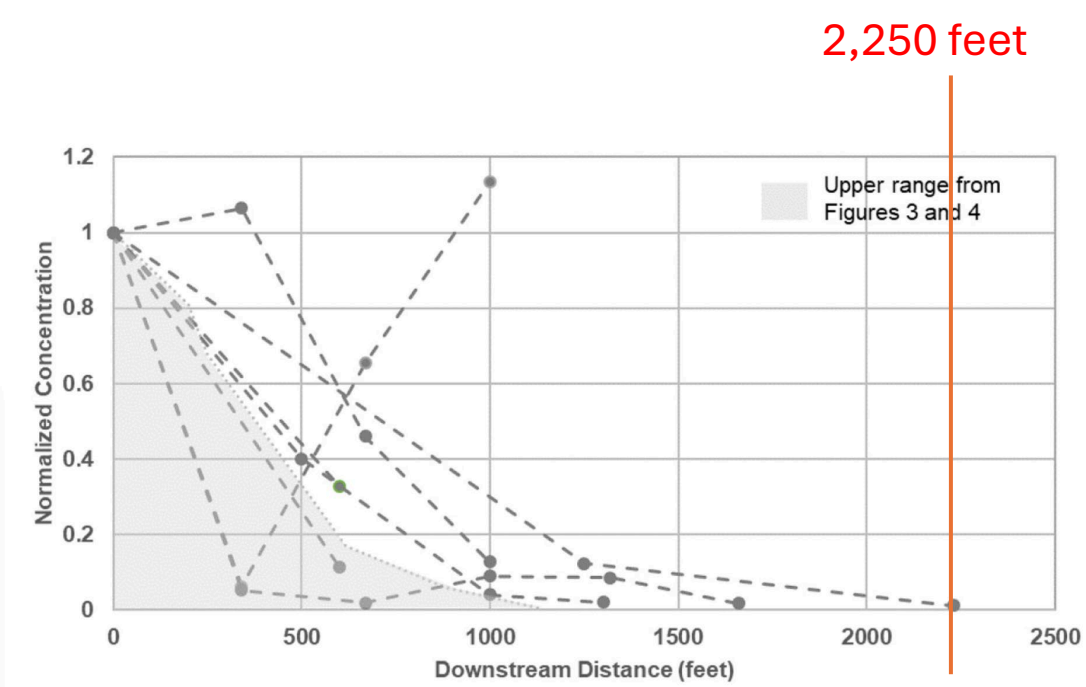
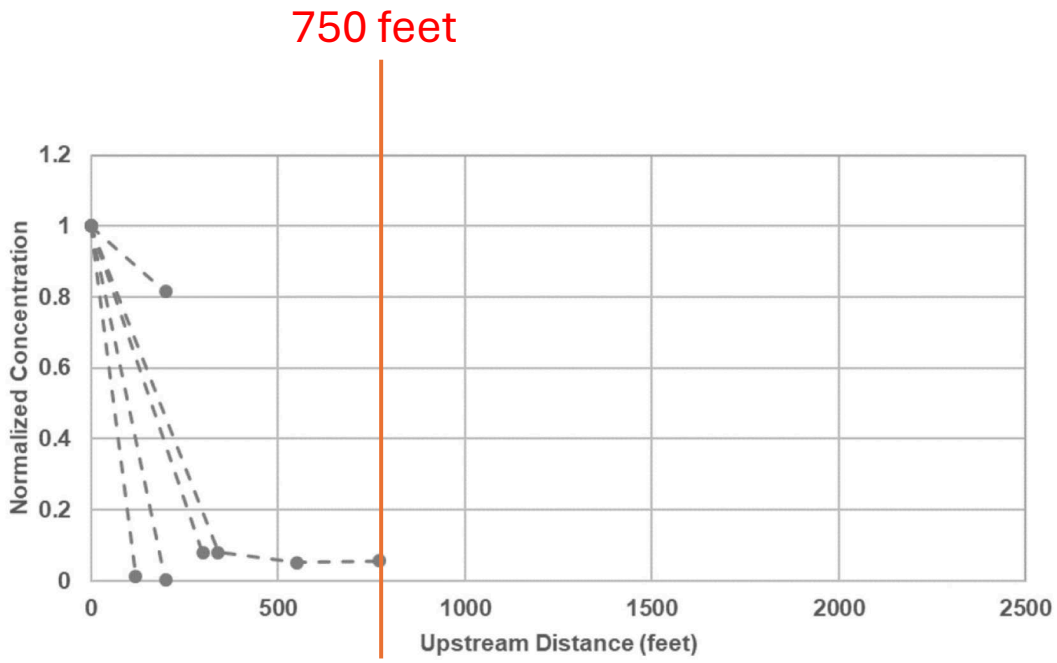
Surprise!

If Volatile Organic Compounds (VOCs) are mobilized, the gas component can travel **uphill** in pipes and utility trenches and enter the indoor air of buildings.

How far can VOCs travel in a sewer pipe or trench?



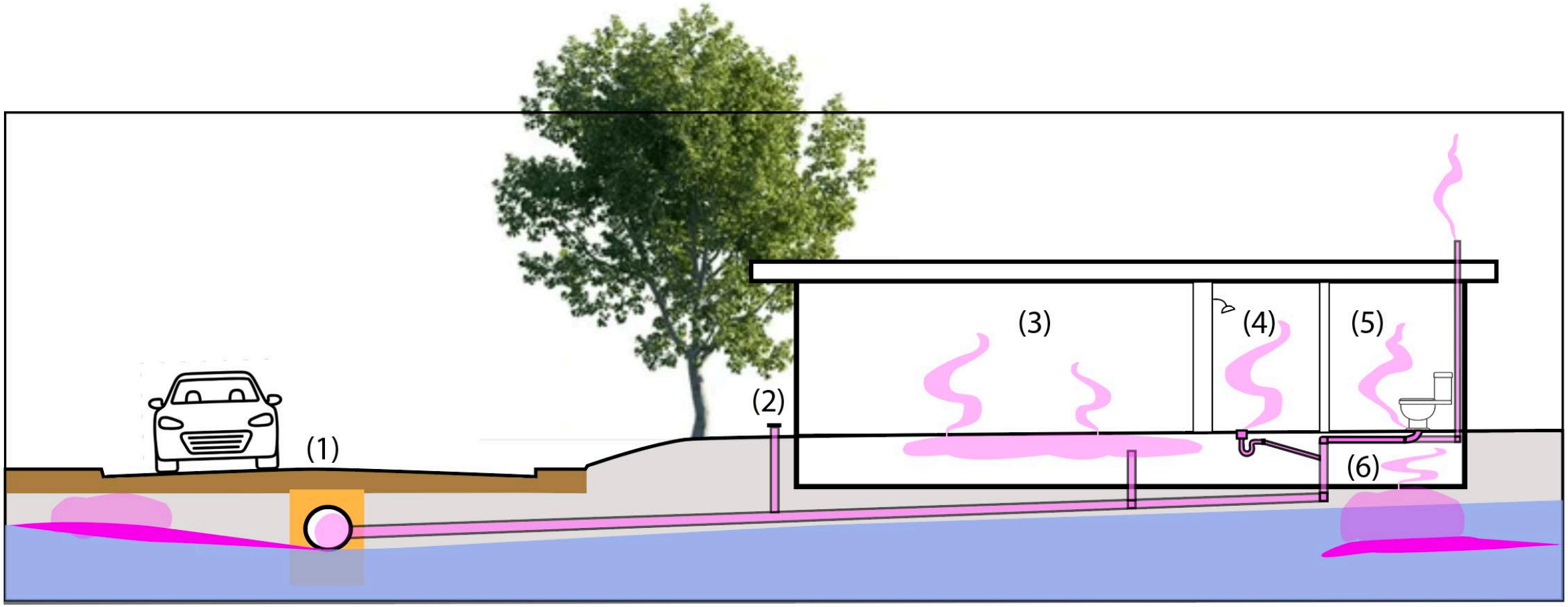
VOCs can travel 2,250 feet down-gradient in a sewer pipe.



VOCs can travel 750 feet up-gradient in a sewer pipe.

Beckley and McHugh 2020

VOCs can enter schools, residences and work places from sewer pipes and utility trenches, then through cracks and old plumbing.



Our 2023 study found 1,480 “open” contaminated sites over rising groundwater in the SF Bay Area.

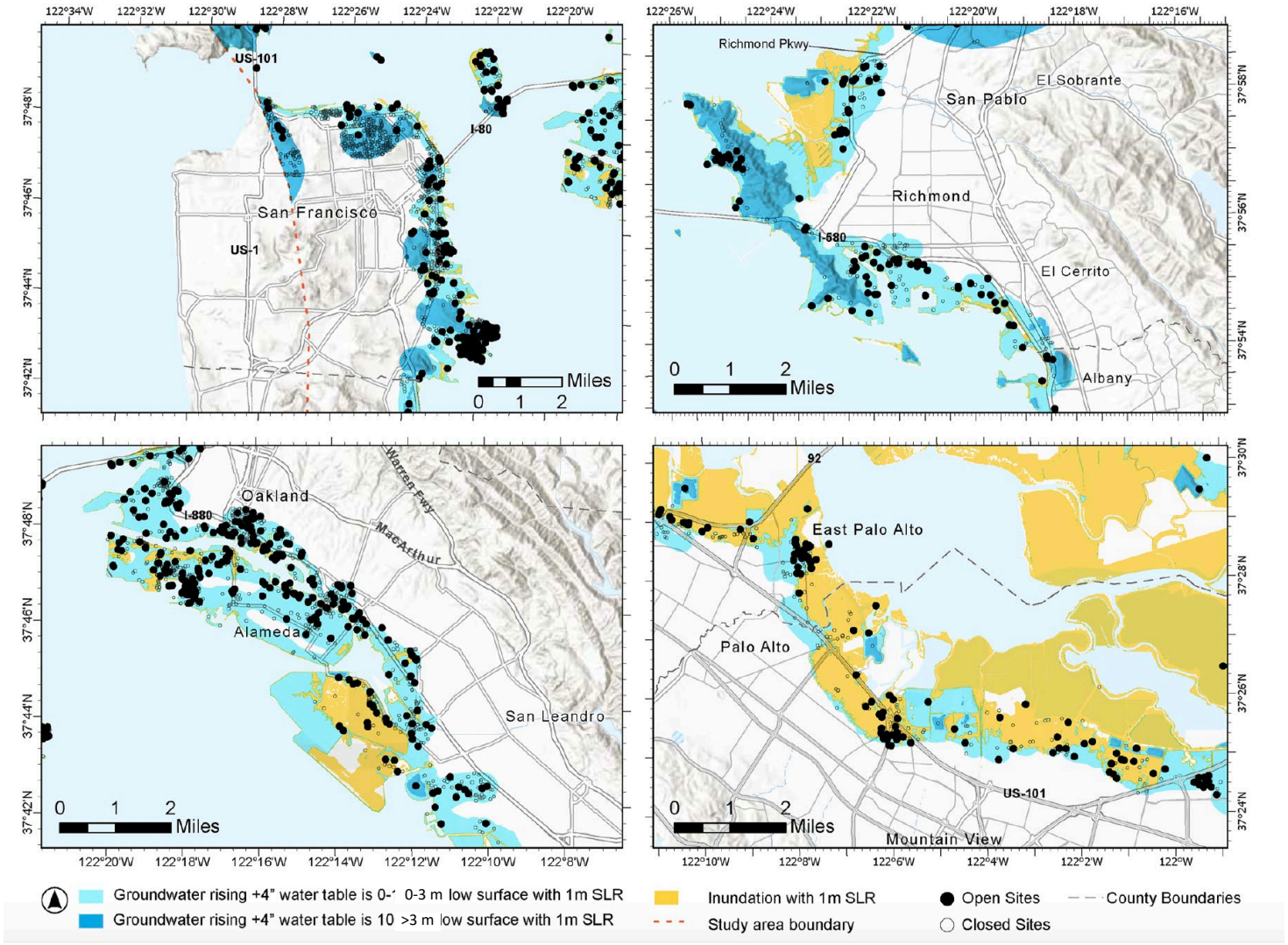


Table 4

Summary by County of the Number and Status of Contaminated Sites, Including Superfund Sites, That Are Located Over Rising Groundwater or Inundated Under the 0.5 and 1.0 m Sea-Level Rise Scenarios

SF bay area county	0.5 m SLR	1.0 m SLR
Alameda	339 (745)	425 (954)
Contra Costa	191 (233)	245 (344)
Marin	79 (183)	88 (225)
Napa	24 (133)	27 (168)
San Francisco	225 (535)	237 (839)
San Mateo	156 (343)	211 (552)
Santa Clara	100 (121)	127 (172)
Solano	81 (364)	91 (448)
Sonoma	20 (92)	29 (115)
Total by status	1,215 (2,749)	1,480 (3,817)
Total	3,964	5,297

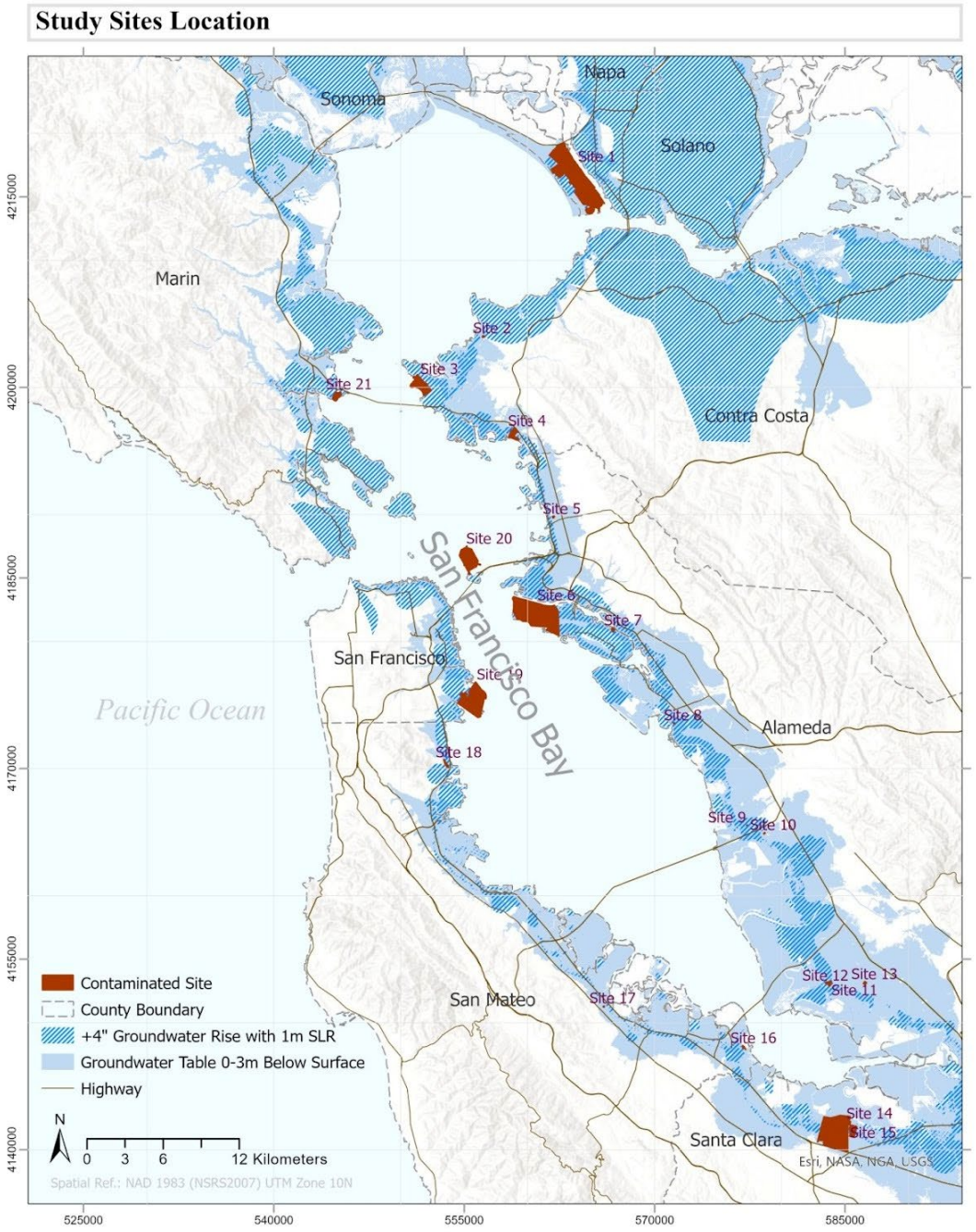
Note. The number of closed sites is shown in parentheses, following the number of open sites. The final total includes both open and closed sites.

Hill et al, 2023, Earth’s Future

SF Bay Area VOC study

Identify buildings with potential exposure to VOCs to prioritize contaminated sites for more detailed investigations

Partners: UC Berkeley / UC Santa Cruz / GreenAction
Funding: Ocean Protection Council, Prop 68



SF Bay Area VOC study

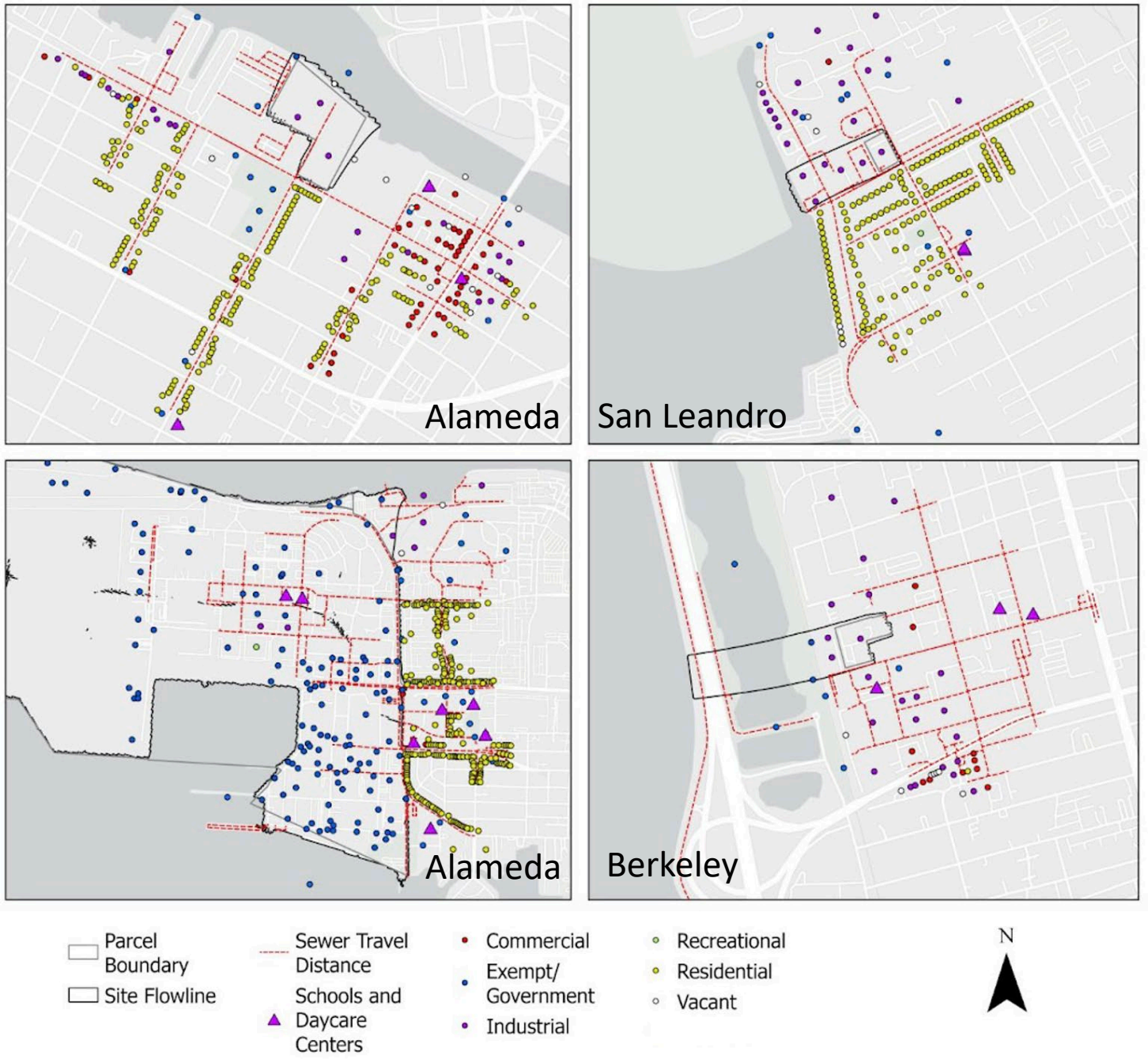
GreenAction identified 55 sites in socially-vulnerable neighborhoods. Together we examined the records for those sites and determined that VOCs were present at 21 of those sites.

Since VOCs represent the most immediate human health risk, we decided to develop a screening method using those 21 sites.

SF Bay Area VOC Study

Examined 21 contaminated sites in neighborhoods that already have high pollution burdens from other sources.

Found 22 schools and hundreds of residential buildings where people could potentially be exposed to VOCs via sewer lines as sea level and groundwater rise.

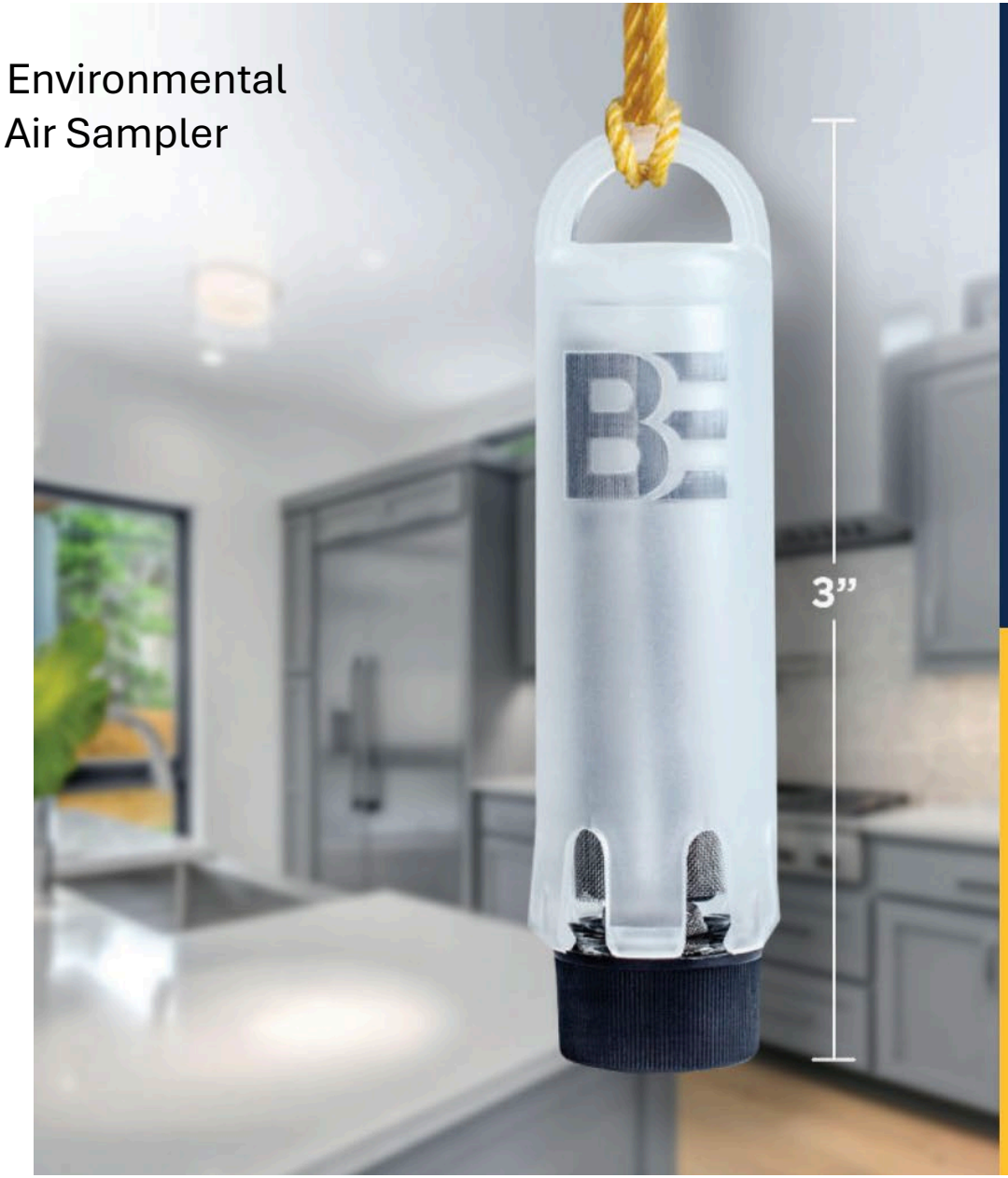


Richmond South Shoreline

Sewer clean-out air sampling, winter 2025

Partners: UC Berkeley / Richmond Shoreline Alliance
Funding: UCOP Breast Cancer Research Program

Beacon Environmental
Passive Air Sampler



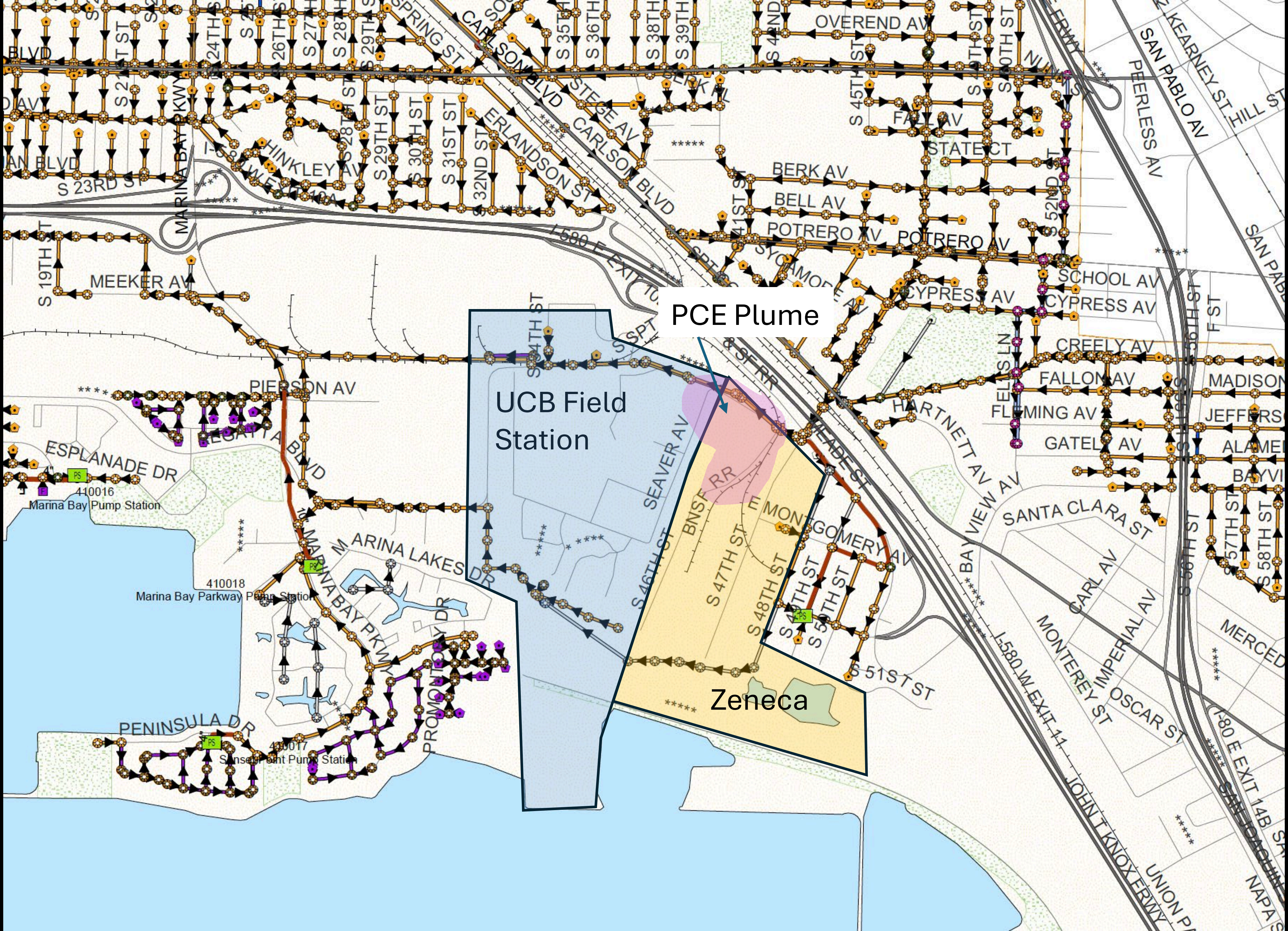
BENEFITS

- Time-weighted average concentrations
- Sample for hours, days, or weeks
- Target petroleum and chlorinated compounds, including Vinyl Chloride
- Air quality monitoring during remediation
- More accurate than other passive methods
- Sensitive – Detection limits in the ppt range
- Easy-to-use BeSure Sample Collection Kit™

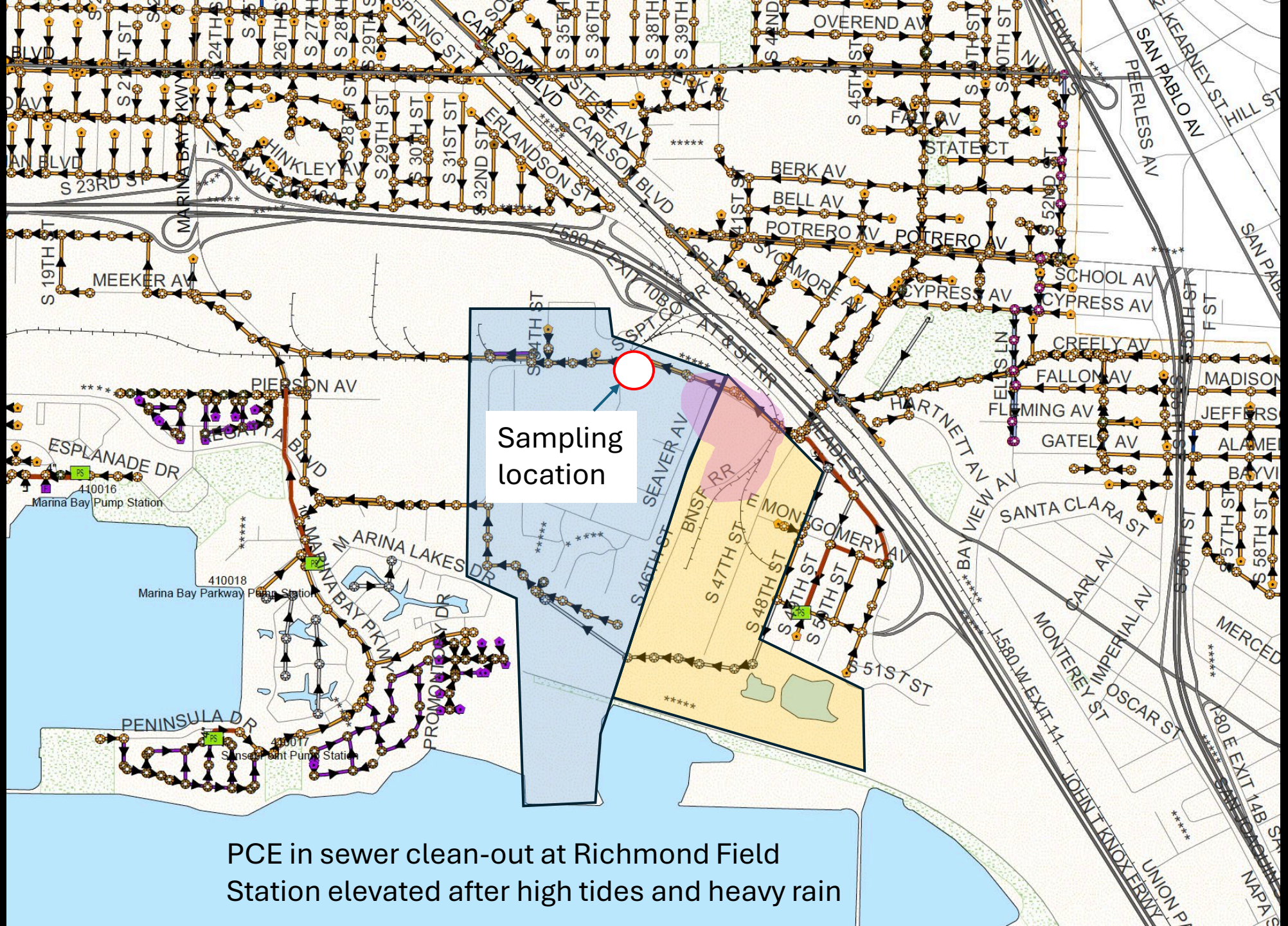
APPLICATIONS

Vapor Intrusion Monitoring

Sewer Gas Sampling



PCE Plume
UCB Field Station
Zeneca
410016
Marina Bay Pump Station
410018
Marina Bay Parkway Pump Station
410017
Sunset Point Pump Station
MEEKER AV
PIERSON AV
ESPLANADE DR
REGATTA BLVD
PENINSULA DR
SEAVER AV
BNSF RR
S 46TH ST
S 47TH ST
S 48TH ST
S 51ST ST
BERK AV
BELL AV
POTRERO AV
SCHOOL AV
CYPRESS AV
CREELY AV
FALLON AV
FLEMING AV
GATELY AV
HARTNETT AV
BAYVIEW AV
SANTA CLARA ST
CARL AV
IMPERIAL AV
MONTEREY ST
OSCAR ST
JOHN T KNOX FRWY
OVEREND AV
STATE CT
SAN PABLO AV


Sampling location
PCE in sewer clean-out at Richmond Field Station elevated after high tides and heavy rain
Marina Bay Pump Station
410016
Marina Bay Parkway Pump Station
410018
Sunset Point Pump Station
410017
MARINA BAY PKWY
MARINA LAKES DR
ESPLANADE DR
REGATTA BLVD
PENINSULA DR
PROMONTORY DR
PIERSON AV
MEEKER AV
S 19TH ST
S 23RD ST
S 24TH ST
S 25TH ST
S 26TH ST
S 27TH ST
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S 29TH ST
S 30TH ST
S 31ST ST
S 32ND ST
S 44TH ST
S 45TH ST
S 46TH ST
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S 48TH ST
S 49TH ST
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S 52ND ST
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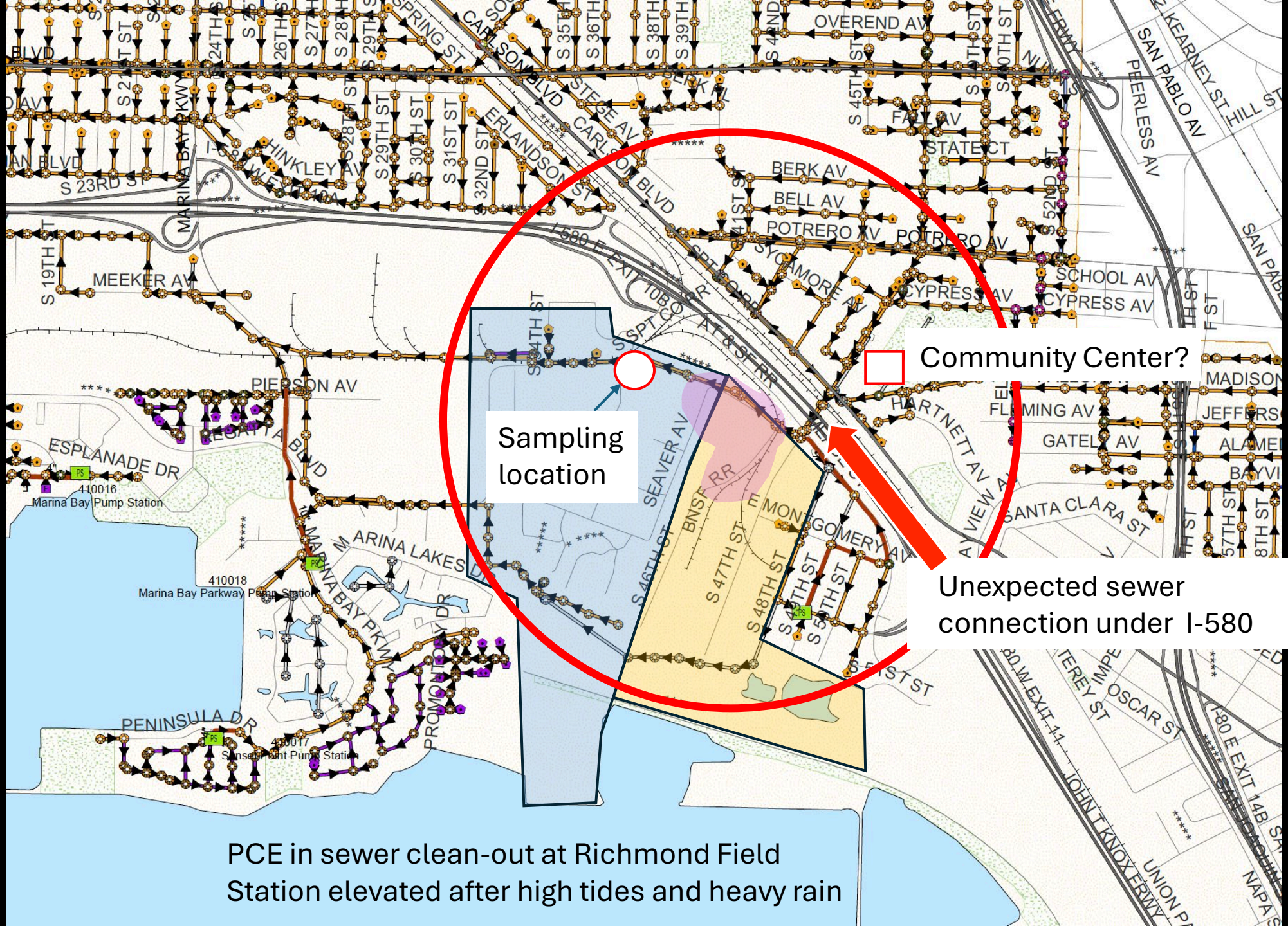
FALLON AV
FLEMING AV
GATELY AV
HARTNETT AV
BAY VIEW AV
SANTA CLARA ST
MONTGOMERY AV
SEAVER AV
CABLE ST
BNSF RR
SPT CO
AT & SF RR
I-580 E EXIT 10B
I-580 W EXIT 11
I-580 E EXIT 14B
JOHN T KNOX FRWY
SAN PABLO AV
PEERLESS AV
KEARNEY ST
HILL ST
CARL AV
IMPERIAL AV
MONTEREY ST
OSCAR ST
MERCED
F ST
MADISON
JEFFERS
ALAMEDA
BAYVIEW


Community Center?
Sampling location
Unexpected sewer connection under I-580
PCE in sewer clean-out at Richmond Field Station elevated after high tides and heavy rain
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PIERSON AV
ESPLANADE DR
410016
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MONTEREY ST
UNION PACIFIC
NAPA S

Partnerships are beginning to influence policy

- DTSC Sea Level Rise Vulnerability Assessments (SLRVAs)
- Asm. Boerner's proposed CA legislation (AB 1102)
- Rep. Mullin's proposed national legislation (HR 4144)

Community members from Marin City observing tidal flooding