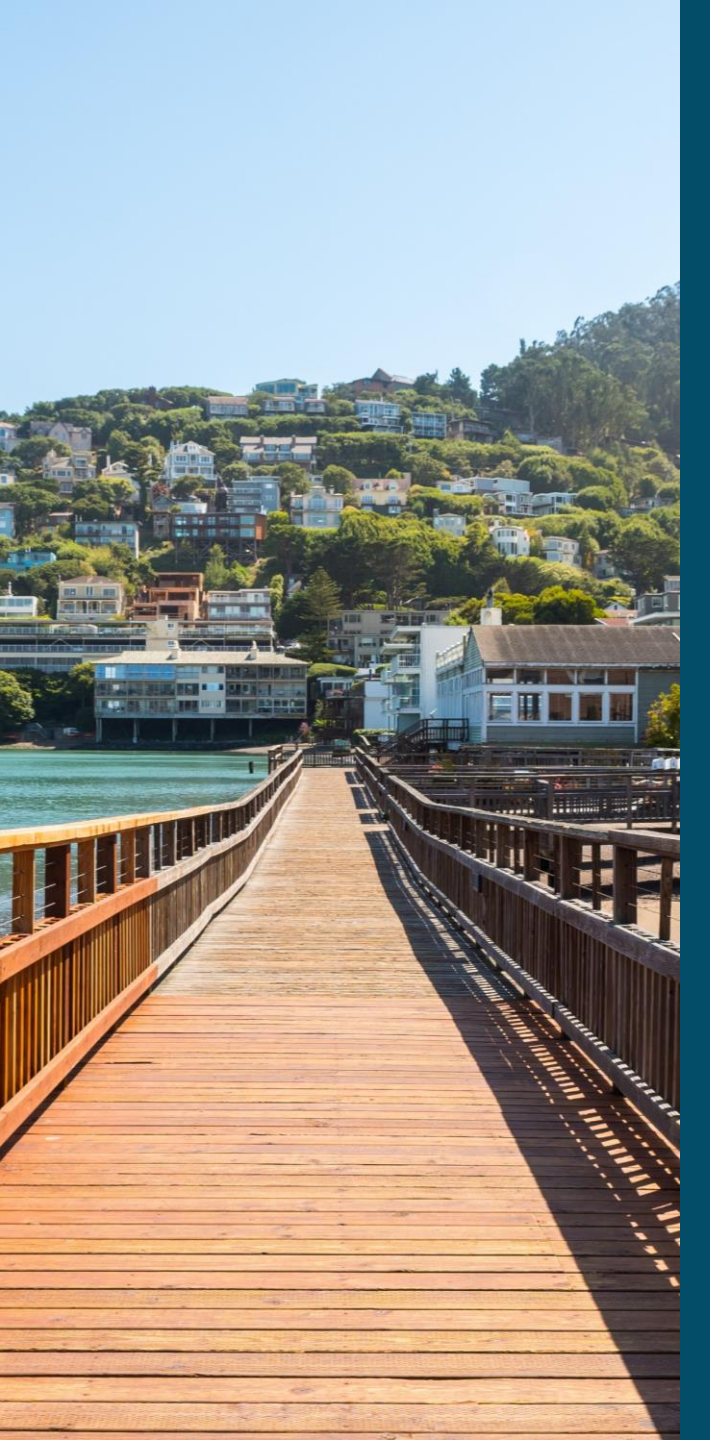
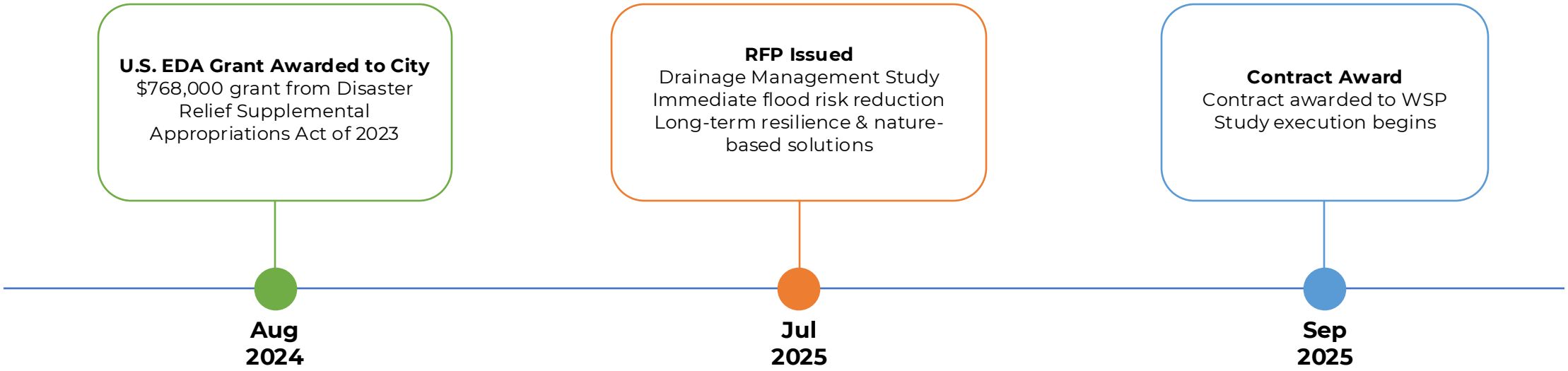


Gate 5 Road Drainage Management Study

Sausalito City Council Meeting
September 1, 2026

Gate 5 Road Funding & Procurement Timeline



Previous Drainage Study: 2011 West and Yost - Gate 5 Road Conceptual Drainage Study

CITY OF SAUSALITO

Gate 5 Area Drainage Management Study

The Gate 5 Area Drainage Management Study is a City of Sausalito initiative to address chronic flooding and sea level rise risks in the Marinship/Gate 5 Road corridor. The effort focuses on locations currently affected by storm events, coastal flooding, and aging drainage infrastructure. This feasibility study is evaluating these vulnerabilities and developing targeted strategies to protect infrastructure, reduce flood impacts, and strengthen long-term resilience for residents, businesses, and shoreline resources.

Location: The project area covers Gate 5 Road and adjacent waterfront lands, a district with industrial, commercial, and natural shoreline uses that are central to Sausalito's identity.

Project Aim: Address current and future flooding along Gate 5 Road and in surrounding areas

Where does flooding come from?

Tides: Flooding that results from high tides encroaches along the shoreline or pushes water up a storm drain network

King tides: The highest tides that occur throughout the year, typically during new and full moons

Storm surges: Rises in still water levels caused by strong winds blowing water towards the shore.

Sea level rise: Long-term increase in the average level of the world's oceans

Rainfall: Heavy rains runoff from upland areas to lowland areas

Subsidence: The gradual sinking of the ground surface over time due to natural or human-caused processes. In coastal areas, subsidence lowers land relative to sea level, compounding flood risk.

Gate 5 Area Drainage Management Study

WSP Scope

Task 1: Vulnerability Assessment

Task 2: Development of Conceptual Designs

Task 3: Community Engagement

Task 4: Project Management

Task 5: Implementation Plan

Timeline: Feasibility analysis and conceptual design will continue through 2026. Future phases will proceed as the study concludes and additional funding becomes available.

Vulnerability Assessment

Gate 5 Area Drainage Management Study

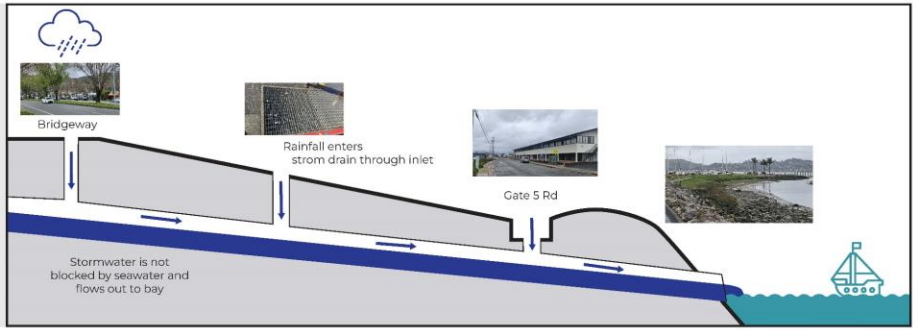
Vulnerability

How Does Flooding Happen?

= Stormwater = Seawater

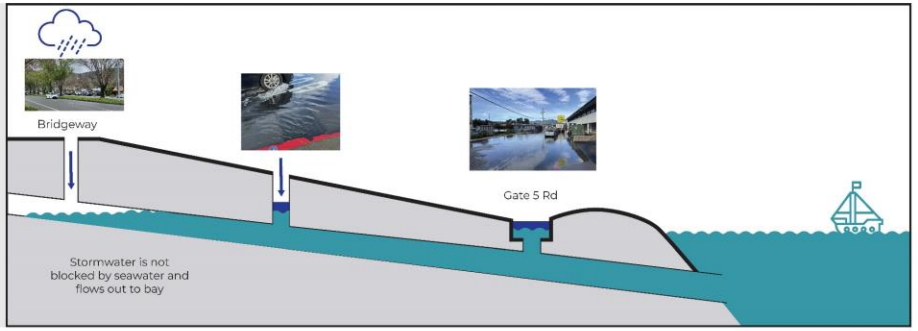
Current conditions, low tide

When it rains, stormwater is able to flow back out to the Bay through the storm drain system. Tidal waters are not backing up the storm drain system.



Current conditions, heavy rain with 1-year surge

Generally causes flooding because seawater backflows through system and into the neighborhood. Rainfall has a negligible impact on total flooding.

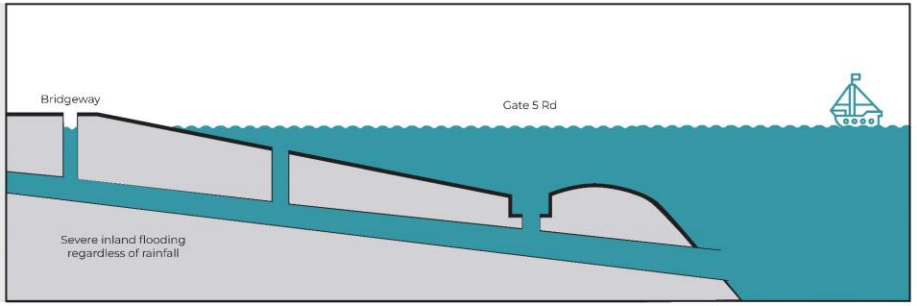


Current conditions, 100-year surge

Tidal waters back up the storm drain system, flooding Gate 5 Road and approaching Bridgeway.

Water surface elevation data are from NOAA and predicted water surface elevations are from a study done by AECOM.

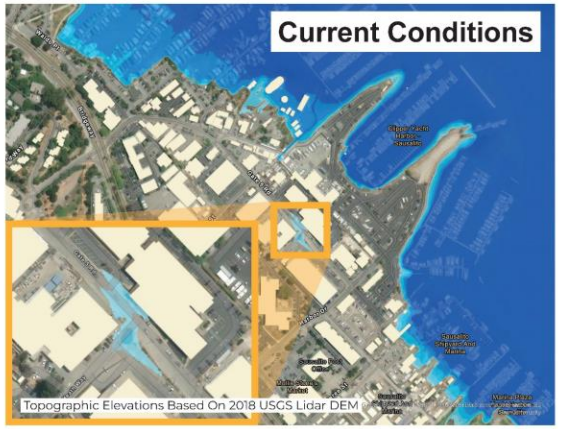
A 1-yr storm surge is expected to occur once per year while a 100-yr storm surge has a 1% chance of occurring in any given year

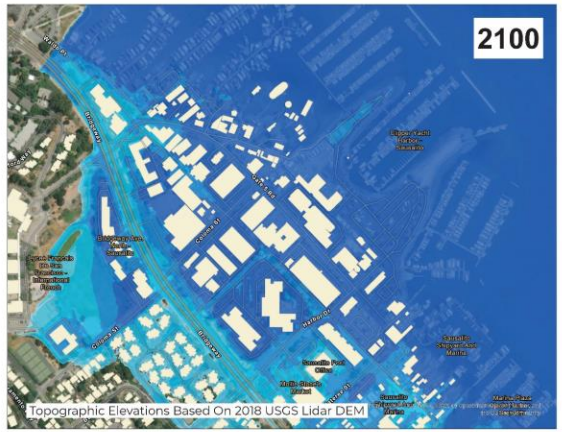


Gate 5 Area Drainage Management Study

Vulnerability

Flooding Over Time (Daily High Tide)



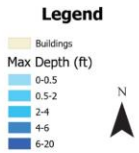


These maps show how flooding will change in the future during the highest tide of the day when there is no rain.

Flooding is predominantly driven by storm surge and overland flow from Richardson Bay, with rainfall playing a secondary and decreasing role over time.

- **Current conditions,** daily high tide floods portions of Gate 5 Road
- **By 2050,** flooding expands to affect most of Gate 5 Road and everything out to the Bay.
- **By 2080,** flooding comes down Coloma Street and reaches Bridgeway.
- **By 2100,** Bridgeway is completely flooded.

Overland flooding is the primary source of inundation even in the absence of a high storm surge event, and most of the area from the coast up to Gate 5 Road will be under water during a typical tidal cycle.

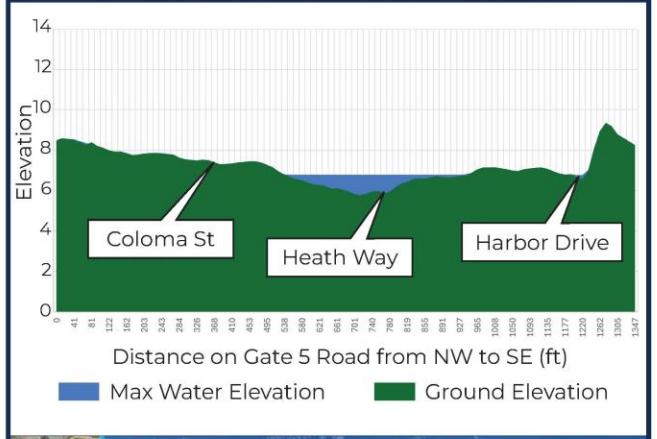


Gate 5 Area Drainage Management Study

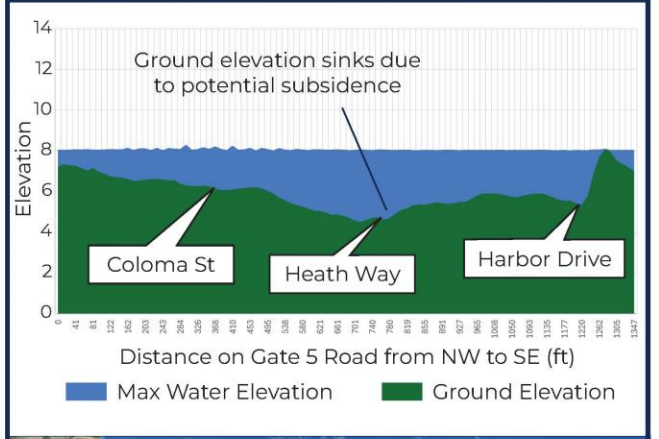
Vulnerability

How Long Will The Road Stay Flooded?

2025
Flooded up to 9 hours per day, no rain, 1-yr surge



2050
Flooded up to 19 hours per day, no rain, 1-yr surge



Imagine standing on Gate 5 Road in such a way that you had a side view of the entire road and were able to see down the three cross streets. This is what the three cross streets could look like during a 1-year storm surge, without rain.

Note: A 1- yr storm surge is expected to occur once per year.

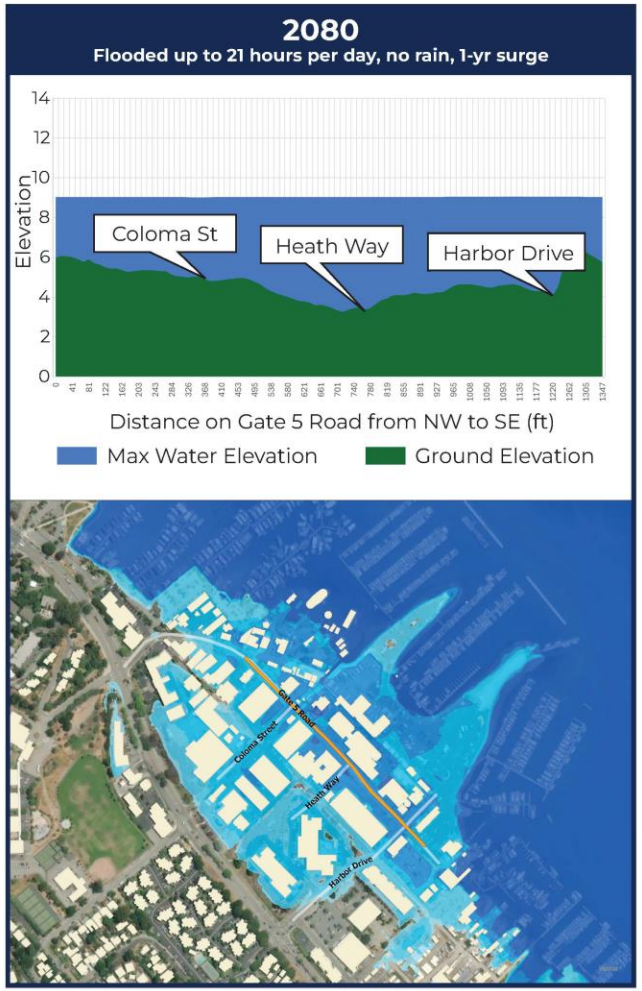
Gate 5 Area Drainage Management Study

Vulnerability

How Long Will The Road Stay Flooded?

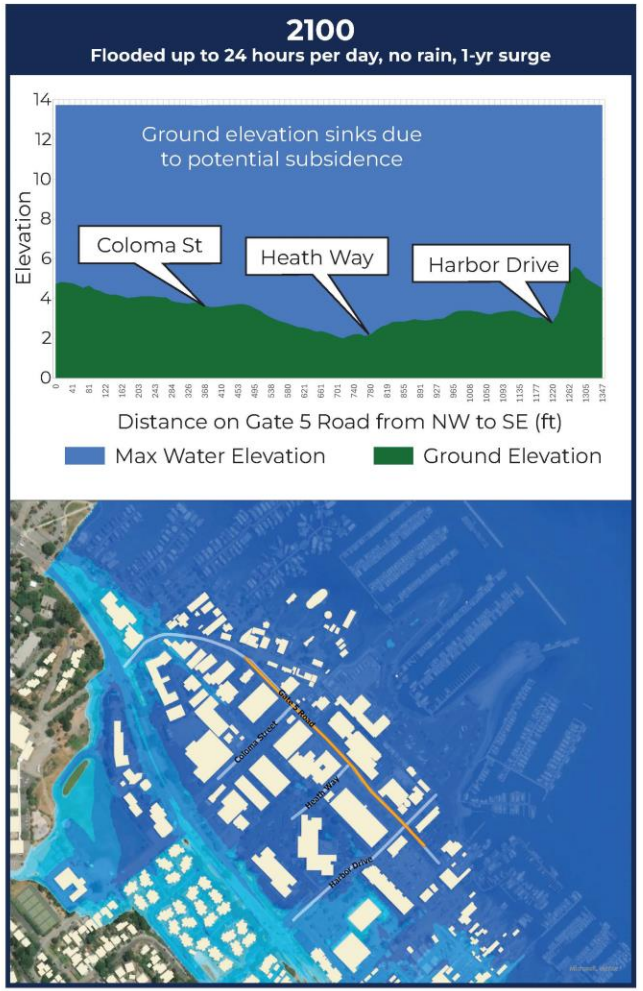
2080

Flooded up to 21 hours per day, no rain, 1-yr surge



2100

Flooded up to 24 hours per day, no rain, 1-yr surge



By mid-century, flooding could last 19-21 hours, and by end-of-century, durations approach a full day.

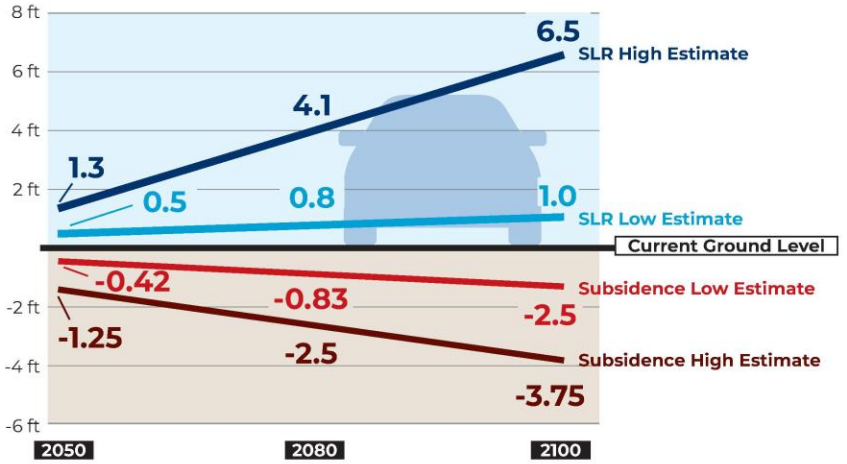
Note: A 1- yr storm surge is expected to occur once per year.

Gate 5 Area Drainage Management Study

Vulnerability

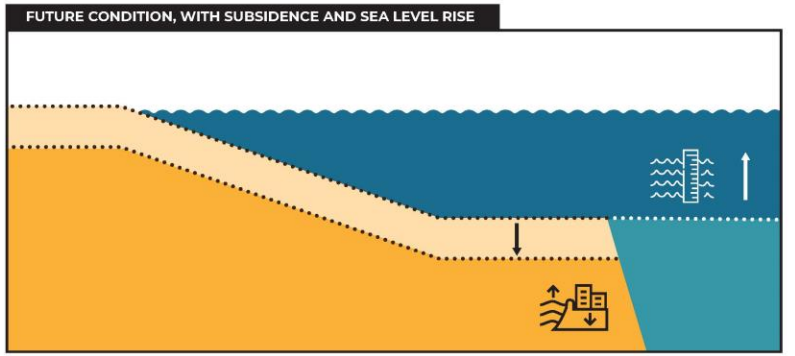
How Will Subsidence and Sea Level Rise Exacerbate Flooding?

Subsidence is the gradual sinking of the ground surface over time due to natural or human-caused processes. In coastal areas, subsidence lowers land relative to sea level, compounding flood risk. Ground elevations in the project area are lowering at rates between approximately 0.2 and 0.6 inches per year. By mid century, the ground could sink by 0.42 and 1.25 feet, and by end of century, it could sink by between 2.5 and 3.75 feet.



High and low estimates for subsidence are from USGS and NORCE data. High and low estimates for sea level rise (SLR) are from OPC 2024. The sea level rise scenarios align with those used by the Sausalito Vulnerability Assessment.

Sea level rise (SLR) is the long-term increase in average ocean water levels resulting from climate change, driven by the thermal expansion of warming ocean waters and melting of glaciers and ice sheets. As seen in the chart, by 2050, sea levels may rise 0.5 to 1.3 feet, and by the end of the century, the ocean may rise by up to 6.5 feet.

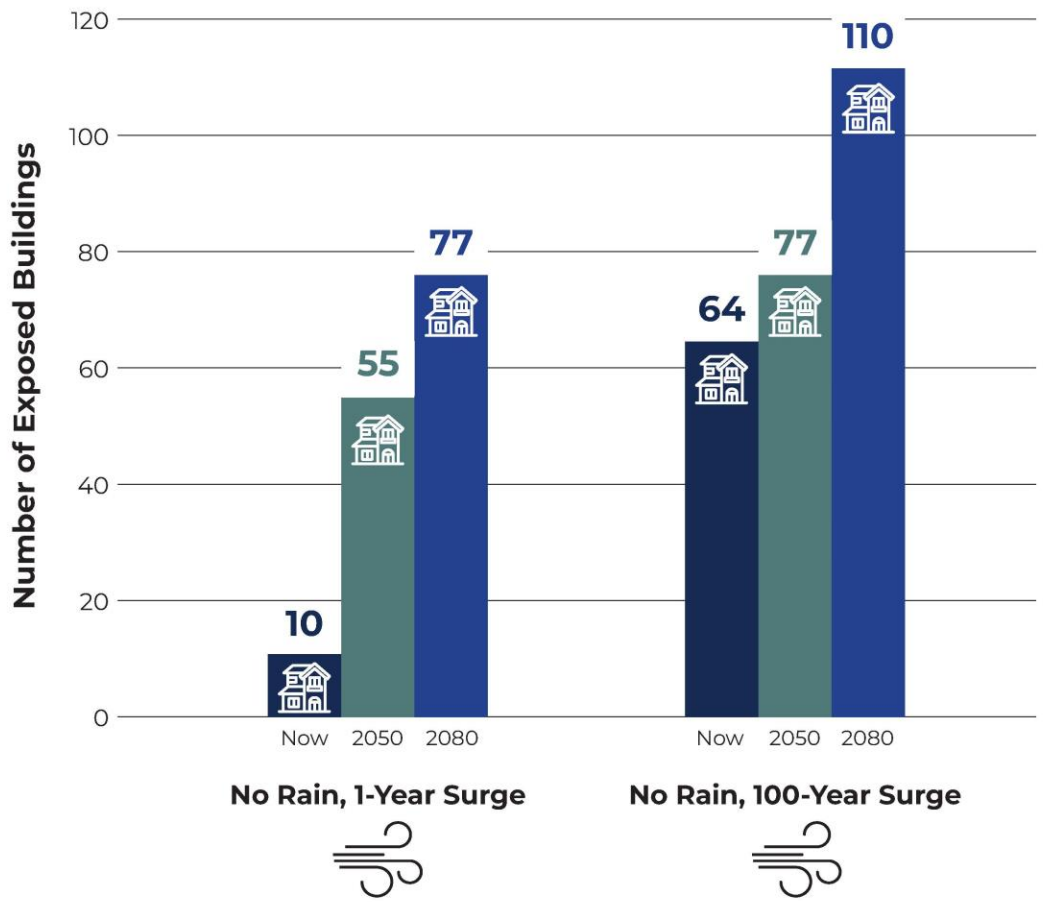


Gate 5 Area Drainage Management Study

Vulnerability

How Are Buildings Affected by Flooding?

The charts below show an estimate of the number of buildings impacted by flooding now and in the future during storms of two different magnitudes. These charts were made using the *Flooding Over Time Maps* shown separately.



Flood damages to buildings from storm surges rise from approximately $5 million annually now to nearly $13 million annually by 2050 and over $30 million annually by 2080.

Over time, flooding could cause $370 million* in total building structure damages if nothing is done.

* At today's prices

Community Engagement

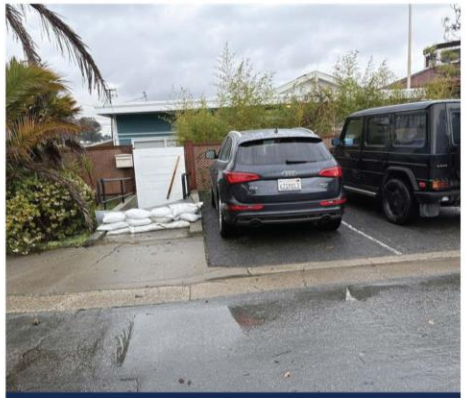
Gate 5 Area Drainage Management Study

Community Feedback – Current Solutions

Current Efforts to Address Flooding

These photographs were taken shortly after the King Tide that of January 1st, 2026.

Private property pumps discharge onto Gate 5 Road

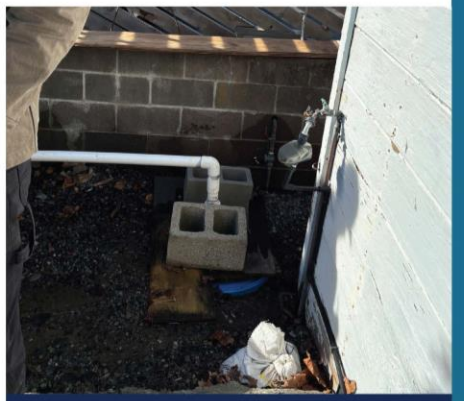


Sand bag protection on Gate 5 Road

Private property sump pump system

Sand bag protection on Gate 5 Road

City's temporary pump installation on Gate 5 Road



Private property sump pump system

How is Flooding Currently Managed

- Currently, private property owners use pumps on their property to drain water onto Gate 5 Road and into the Bay.
- Many property owners also use sandbags to prevent flooding into their homes and businesses.

Gate 5 Area Drainage Management Study

Community Survey Results – 116 responses

Most common ways people manage flooding on their property: sandbags, raised parking lot/driveway, portable water pumps.

Almost Everyone Sees Multiple Issues

96% observe tidal flooding

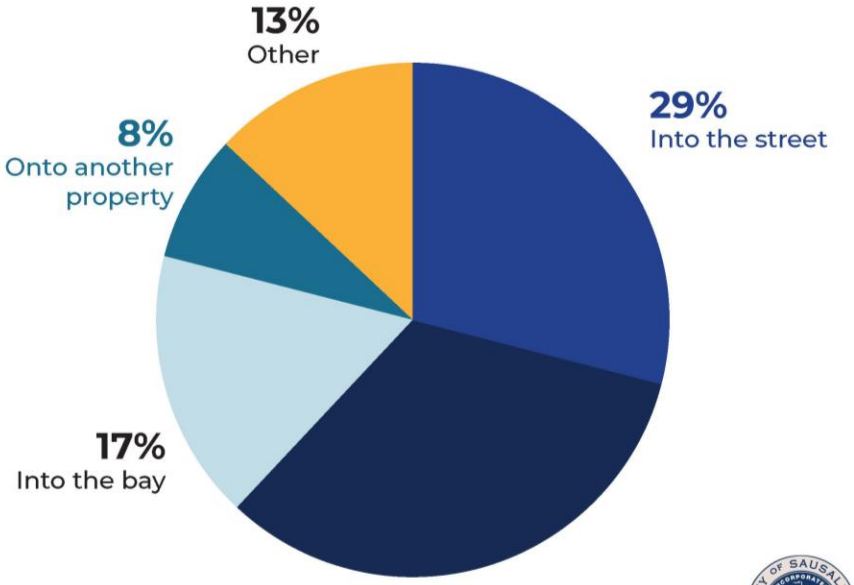
+80% report access impacts

60% report property damage

Of those who reported using pumps, electric pumps are the most commonly used.

Respondents use between 2 and 9 pumps on their properties. Most of these pumps drain water into the street or into the storm drain system.

Where does the water from your pump(s) discharge?



Gate 5 Area Drainage Management Study

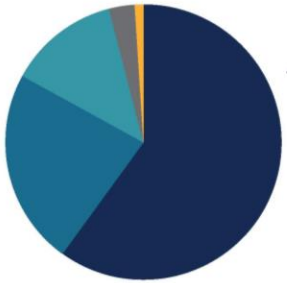
Community Engagement

What is your connection to the Gate 5 Road area?

How disruptive is flooding on Gate 5 Road?

30% of respondents say flooding disrupts their daily life

How willing are you to accept disruptions such as construction impacts or changes to parking or access?



60% of respondents would welcome change

Which Sausalito community do you live or work in?

Gate 5 Area Drainage Management Study

Community Workshop

- April 29, 2026 4:30-6pm at Bay Model
- 51 attendees
- Summary of feedback:
  - Strong Concern for Near-Term Flooding, Particularly at Varda Landing
  - Support for Nature-Based Solutions and Stormwater Storage
  - Concerns about Costs and Funding Mechanisms
  - Desire for Multi-Jurisdictional Approaches
  - Costs of Doing Nothing, Redevelopment, and Managed Retreat

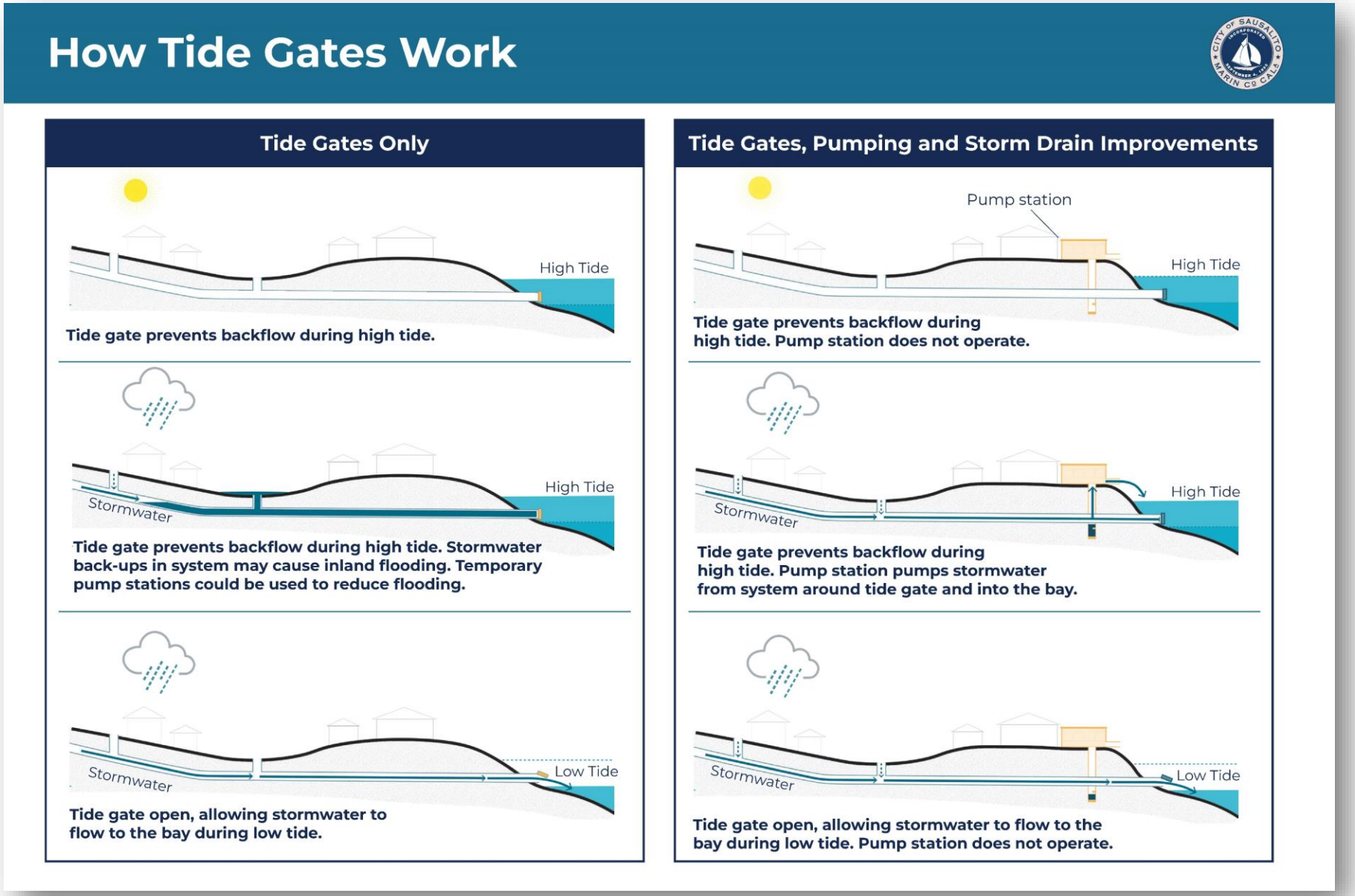
Conceptual Design
Near-Term (Present- 2035)
Improvements

Gate 5 Area Drainage Management Study

Conceptual Design - Near Term (Present-2035)

Alternatives Reviewed:

- *Tide Gates*
- *Pump Stations*
- *Storm Drain Improvements*
- *Storage*
- *Vertical Solutions*
  - *Seawalls*
  - *Raising Roads*
  - *Raising Properties*
- *Green Infrastructure*



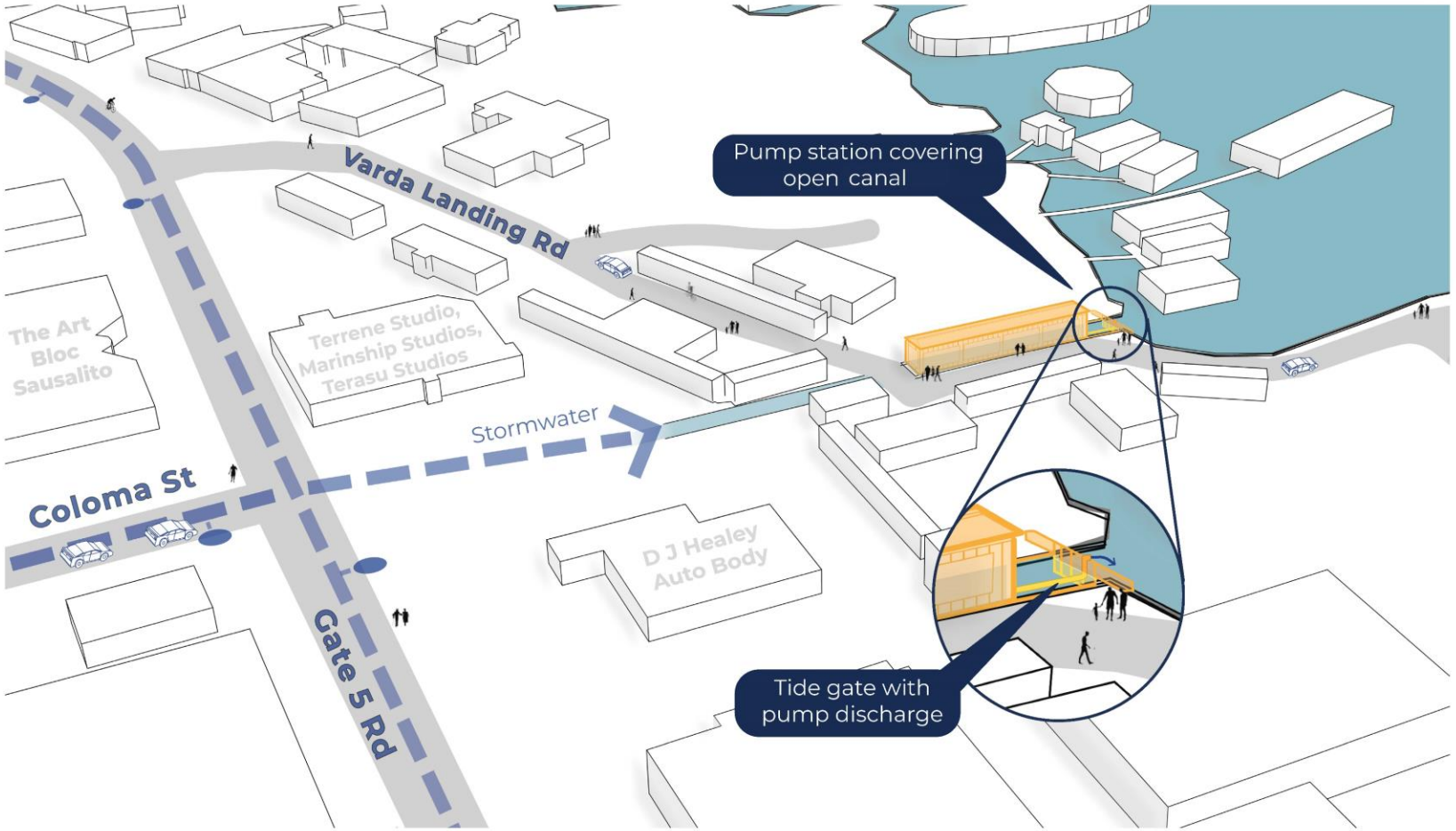
Gate 5 Area Drainage Management Study

Conceptual Design - Near Term (Present-2035)

Current Flooding along Gate 5 Road:

- *Mainly from Tidal Activity & Storm Surge*
- *Secondarily from Storm Runoff*
- *Requires Tide Gates, Pump Station, & SD Improvements*

Near-Term Pump Station (Coloma St Canal)



Gate 5 Area Drainage Management Study
Conceptual Design - Near Term (Present-2035)

Pump stations can take on many forms

Example Pump Stations From Other Cities

Queensland, Australia

The murals on this pump sation were painted by a local artist. The scenes depict the natural beauty of the area, and relate to the function of the pump station as a facility to move water from one place to the other.

Richmond, CA

For a WSP stormwater drainage project, a local artist was brought onto the team to help design the pump house. The design allows the public to see the interior workings of the station, as a means of connecting the community with the infrastructure that serves them.

San Rafael, CA

Reykjavík, Iceland

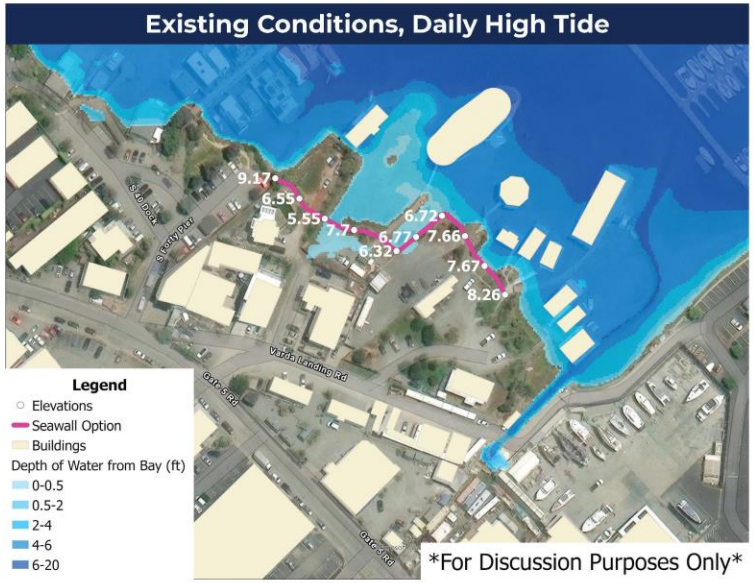
Charleston, SC

Alexandria, VA

Gate 5 Area Drainage Management Study

Conceptual Design - Near Term (Present-2035)

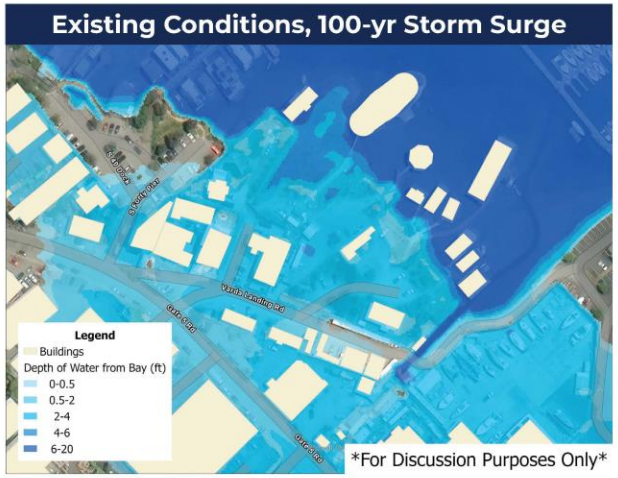
Currently, flooding also occurs in Varda Landing area



Example Solutions

Modular Flood Control Barrier

Seawall made with vinyl or concrete



Near-Term Varda Landing Area Improvements

Because of existing topography and the layout of existing properties and roadways, Varda Landing requires near-term recommendations on top of the recommendations already discussed.

Near-Term Vertical Solutions Options:

- Shoreline Improvements/Seawall
  - Would require private property owner cooperation
  - Figure on left shows approximate extents of seawall to address 1-year surge under current conditions
- Raising Varda Landing Road
  - Limited protection would be provided
- Recommended Minimum Vertical Solution Elevations
  - 8.2 feet top elevation for current conditions, 1-year surge protection
- Access points would be included along seawall options to maintain property function

A 1- yr storm surge is expected to occur once per year while a 100-yr storm surge has a 1% chance of occurring in any given year.

Gate 5 Area Drainage Management Study

Conceptual Design - Near Term (Present-2035)

How Will We Evaluate Potential Solutions?

Potential solutions are being evaluated using the following criteria. The relative importance of each criterion is being decided collaboratively with stakeholders.

Short-term effectiveness: the ability of a solution to address immediate flooding problems

Long-term effectiveness: the ability of a solution to address long term flooding problems

Implementability: a measure of how straightforward the solution is to construct and the impact construction might have on surrounding areas and the community

Cost: includes cost to construct, operate, and maintain the mitigation action

Agency acceptance: a measure of how acceptable a solution might be to agencies involved in approvals and permitting; or how long these might take to obtain

Community feedback: the degree to which a solution addresses community concerns

Sustainability and ecological benefits: the extent to which a solution could provide benefits through green infrastructure or ecological restoration; or the extent that a solution is more sustainable to construct, e.g. a lower carbon footprint

Recreational and aesthetic benefits: the extent to which a solution could enhance the aesthetic character of the area; or provide recreational benefits such as access to the shoreline

Gate 5 Area Drainage Management Study

Conceptual Design - Near Term (Present-2035)

Considerations for Potential Near-Term Solutions

Below are a list of performance evaluation criteria to measure how potential solutions compare. Use this chart to weigh in on your preferred solution on the board.

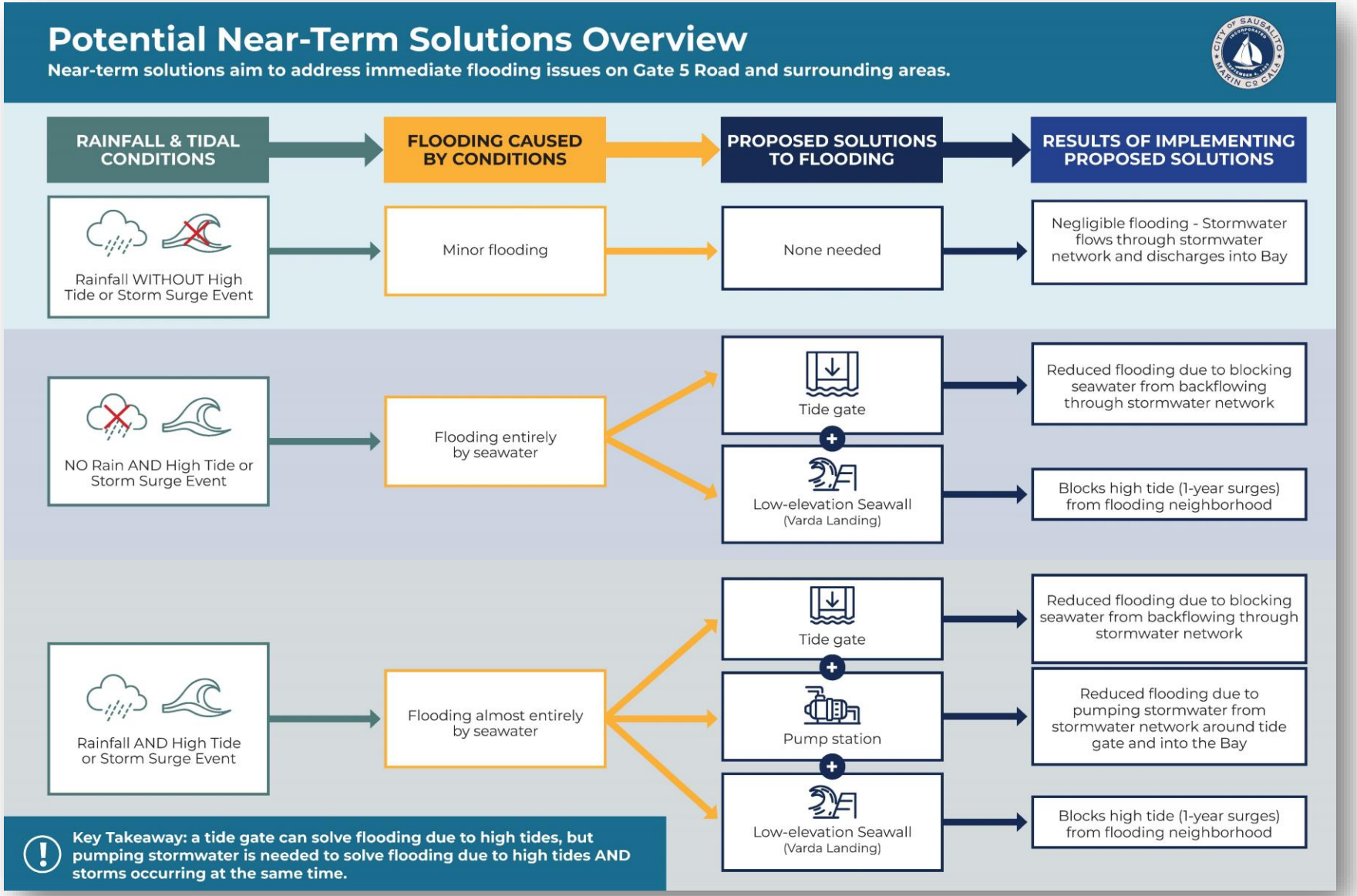
■ = Most closely satisfies criterion ▲ = Satisfies some aspects of criterion

● = Least closely satisfies criterion ○ = Not applicable

NEAR-TERM (PRESENT TO 2035)	Short Term Effectiveness	Long Term Effectivenes	Implement-ability	Agency Acceptance	Ecology and Sustainability Opportunities	Recreational Opportunity	Capital Cost	O&M Cost
TIDE GATE AND PUMP OPTIONS								
Continue Current Approach	●	●	■	○	●	●	$	$
Tide Gates Only	▲	●	■	▲	●	●	$	$
Tide Gates, Pumping, and Storm Drain Improvements	■	▲	▲	▲	●	●	$$	$$
VERTICAL SOLUTION OPTION								
Seawall for Varda Landing, Recommendation only – to be completed by Private Landowners	▲	●	■	○	●	●	$	$

O&M Cost = Operation and Maintenance Costs

Gate 5 Area Drainage Management Study
Conceptual Design - Near Term (Present-2035)



Gate 5 Area Drainage Management Study

Conceptual Design - Near Term (Present-2035)

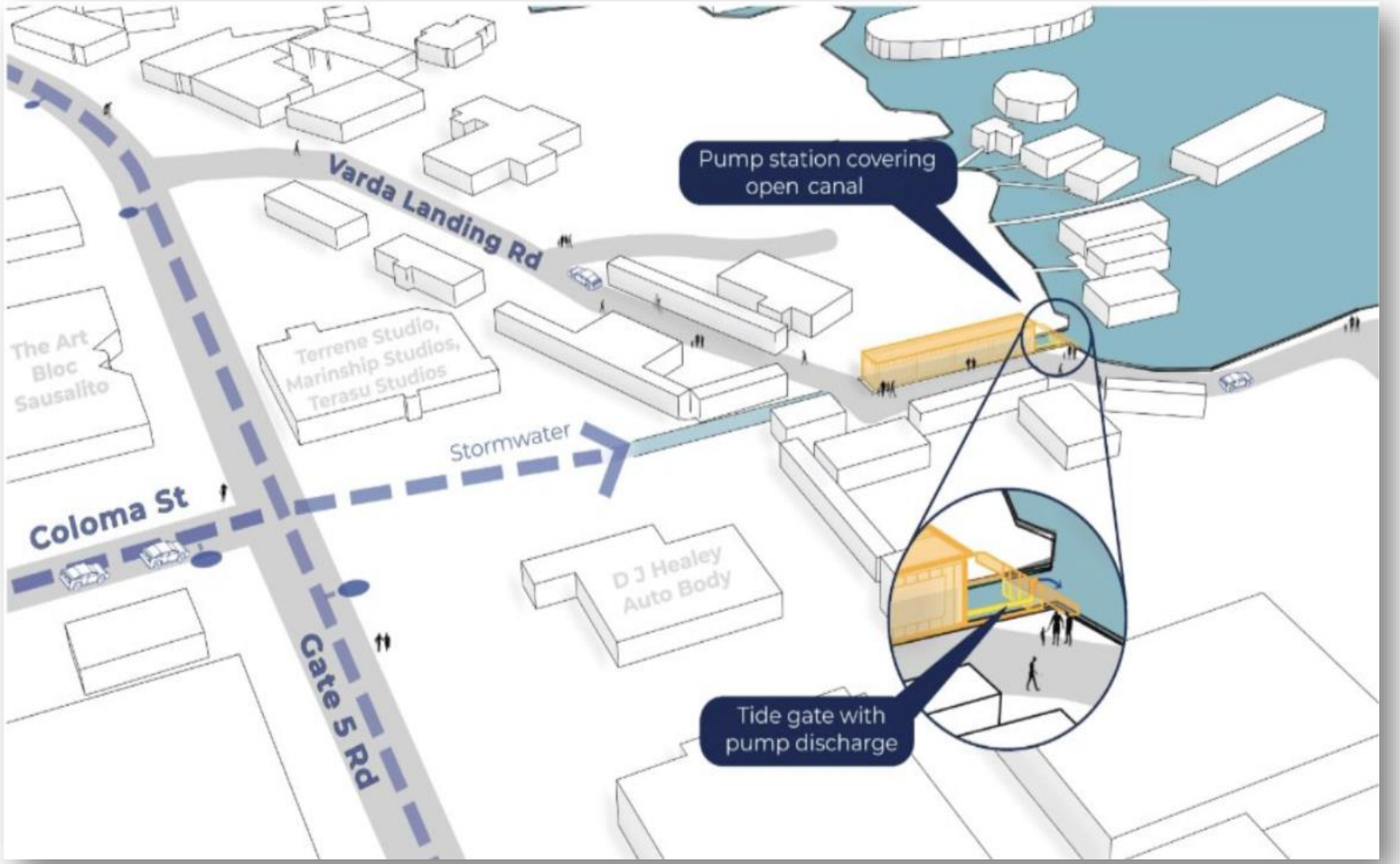
Near-Term Mitigation Option	Key Benefits	Key Limitations	Planning-Level Cost
• Add Tide Gates to Existing Outfalls • Pump Station on Coloma Street Canal (2-Year Rainfall Capacity) • Storm Drain Improvements	• Addresses Backflow of Coastal Water • Addresses Stormwater Flows While Tide Gates Are Closed • Relatively Fast Implementation (3 to 4 years) • Within City Right of Way	• Moderate O&M for Pump/Tide Gates • Potential Permitting Delays at Canal • Structural Assessment of Canal Must Be Done First	$4.8 million
• Varda Landing Seawall (1-Year Storm Surge Elevation) • Raising Varda Landing to 1-Year Storm Surge Elevation (Portion on Private Property)	• Reduces Overland Flooding from the Bay • Initial Private Owner Approval	• Requires Private Owner Coordination	$1.6 million

Gate 5 Area Drainage Management Study

Conceptual Design - Near Term (Present-2035)

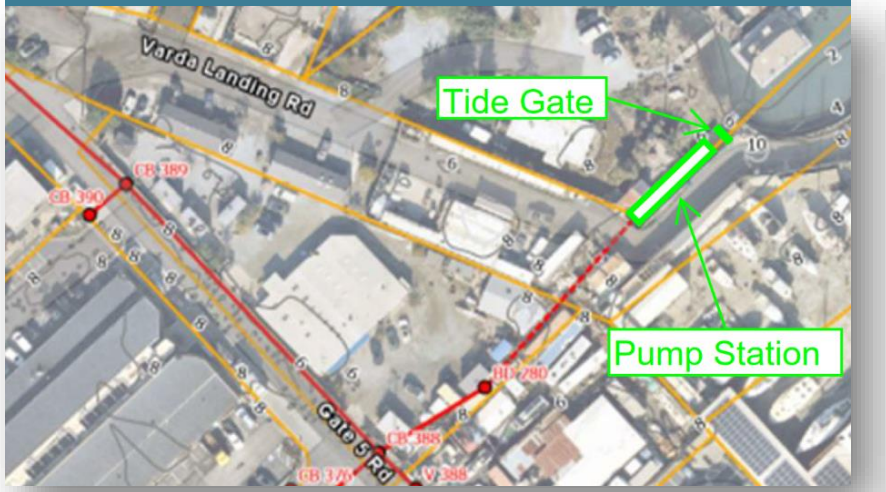
Recommended Concept

- Tide Gate
- Pump Station (Coloma Canal)
- Storm Drain Improvements (at Harbor)

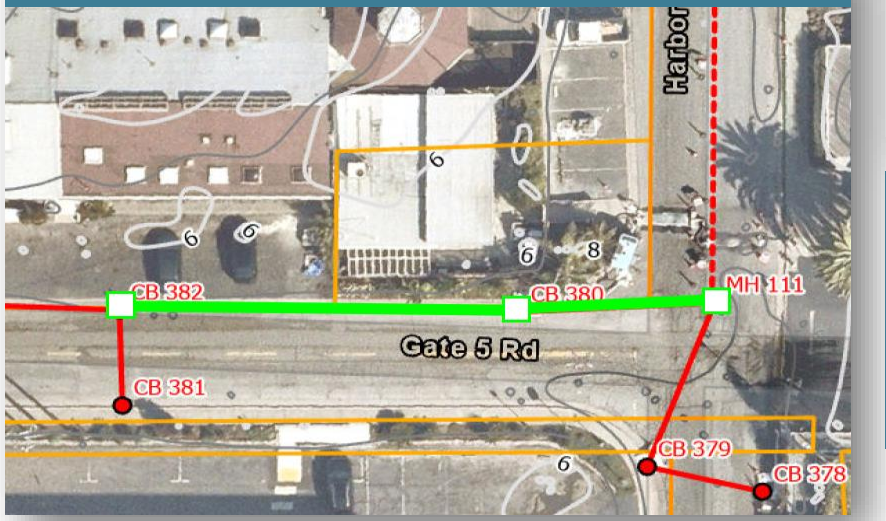


Gate 5 Area Drainage Management Study
Conceptual Design - Near Term (Present-2035)

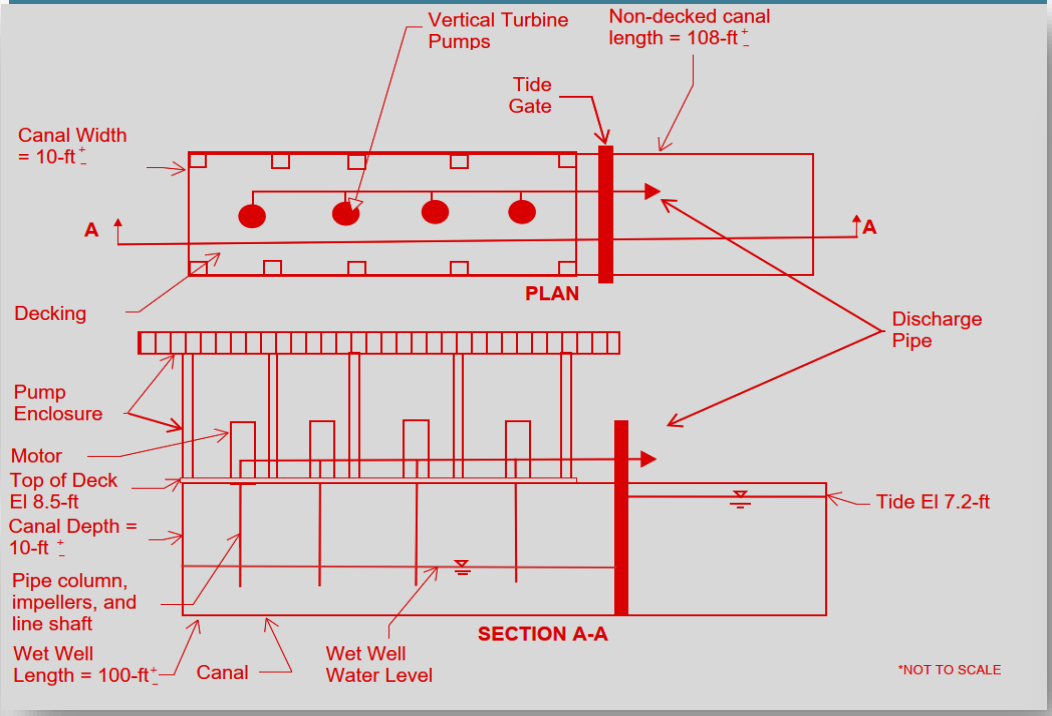
Pump Station & Tide Gate at Coloma Canal



Storm Drain System at Harbor & Gate 5 Road



38 cfs Pump Station with Wet Well Below



Tide Gate with Pump Station:

- *Allows runoff to flow to sea at low tide.*
- *Seals system shut during high tide/ storm surge*
- *Mechanically pumps runoff to Bay during high tide/ storm surge*

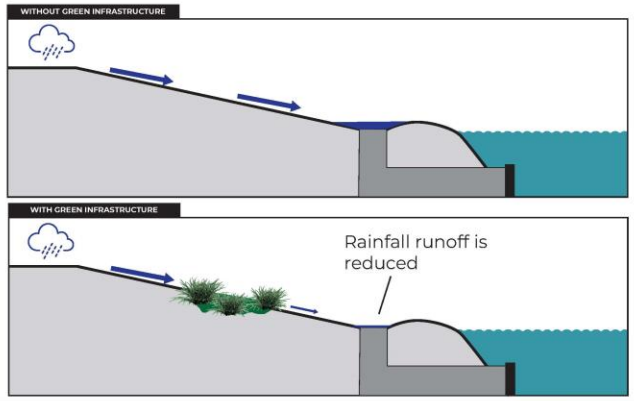
Tide Gate – Automatic, Vertically Operated Sluice Gate

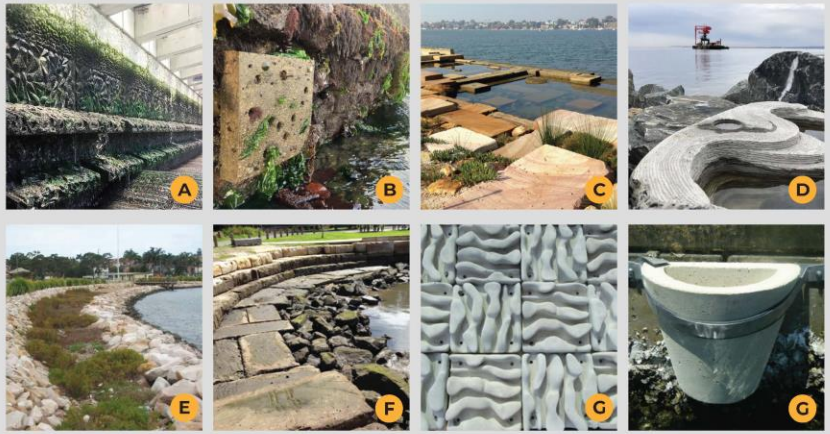
Conceptual Design
Mid-Term (2035-2050) and Long-Term (2050-2100) Improvements

Gate 5 Area Drainage Management Study

Conceptual Design – Mid Term (2035-2050), Long Term (2050-2100)

Natural Processes Protecting Against Flooding





A **Elliott Bay Central Seawall Project, Seattle**: Provides flood protection while improving ecosystem functions along its edge.

B **Living Seawall Pilot, San Francisco**: This project aims to incorporate ecology into projects that protect against sea level rise.

C **Crass Bush Park, Sydney, Australia**: Local stone was used to replace an existing traditional flood wall, including sculptural rock pools, to enhance ecology and biodiversity.

D **Staten Island, New York**: A curved structural living breakwater was constructed using carbon neutral concrete that integrated water pools to create oyster habitat.

E **Kogarah, NSW, Australia**: Reconstruction of a traditional flood protection wall with a stepped wall with saltwater marsh.

F **Fish Habitat Network, Australia**: Seawall constructed using natural materials and incorporating seating and habitat.

G **Sydney Harbor, Australia**: Enhancements to existing seawalls to provide habitat and increase biodiversity.

Green Infrastructure

Vegetated basins and swales, permeable paving, and other features act like sponges to slow down stormwater.

Advantages include ecological enhancements, improved water quality, reduced heat, aesthetics, and replenishment of groundwater. However, space may be limited, they require ongoing maintenance, and they are not as effective in areas of high groundwater (such as near the shoreline).

The use of green infrastructure in the Gate 5 area may be limited due to site-specific soil conditions and would likely need to be installed upstream of Bridgeway for maximum effectiveness.

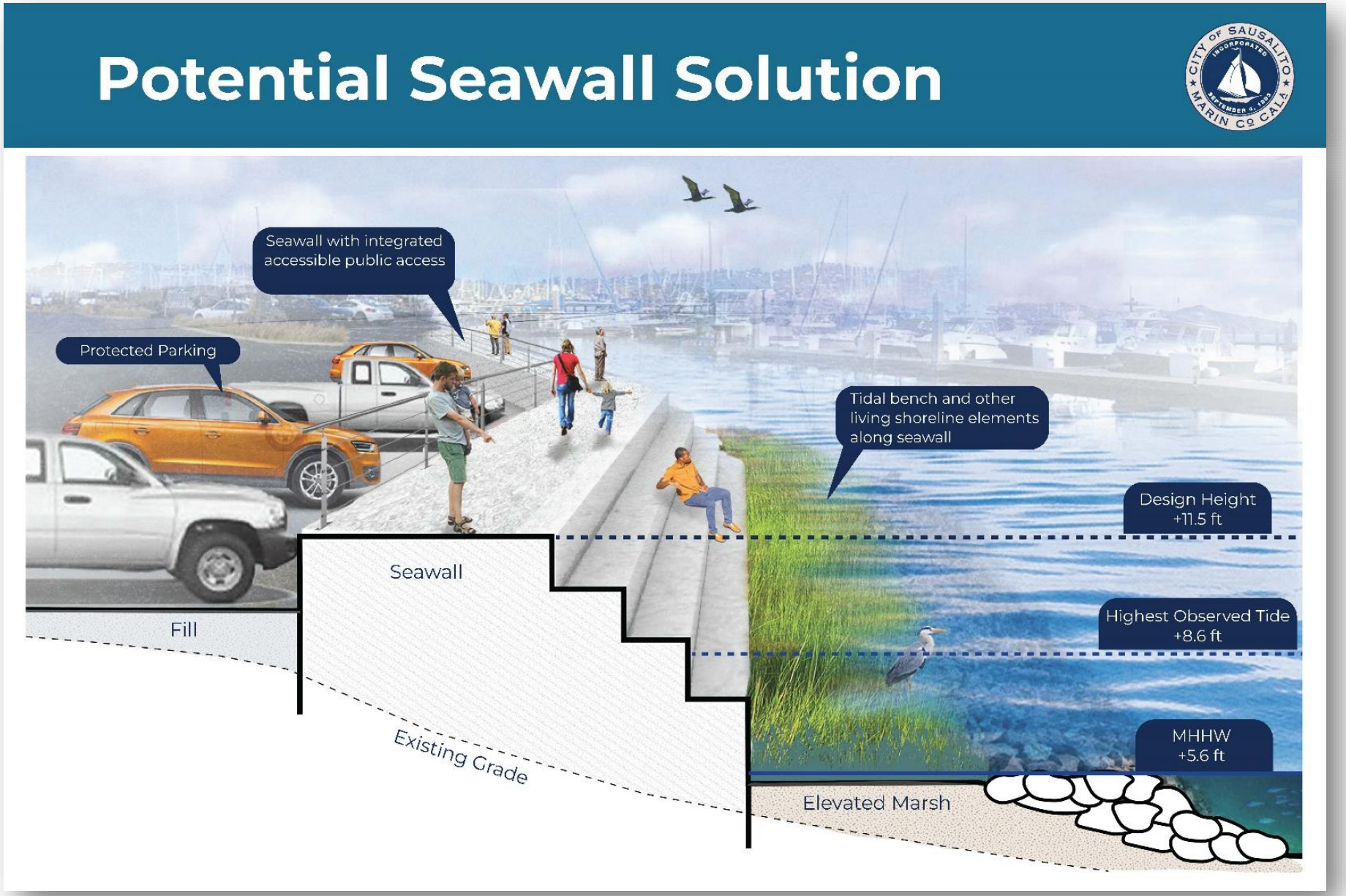
Nature-Based Shoreline Protection

In nature-based shorelines, natural features are used to absorb wave energy and stabilize soil to protect the shoreline from erosion, while providing advantages such as enhanced habitat, public access, community enjoyment and education. Hybrid approaches use a mix of natural features and traditional seawalls (which themselves can be designed to mimic natural habitat).

Green Infrastructure in Upstream Watershed

Gate 5 Area Drainage Management Study

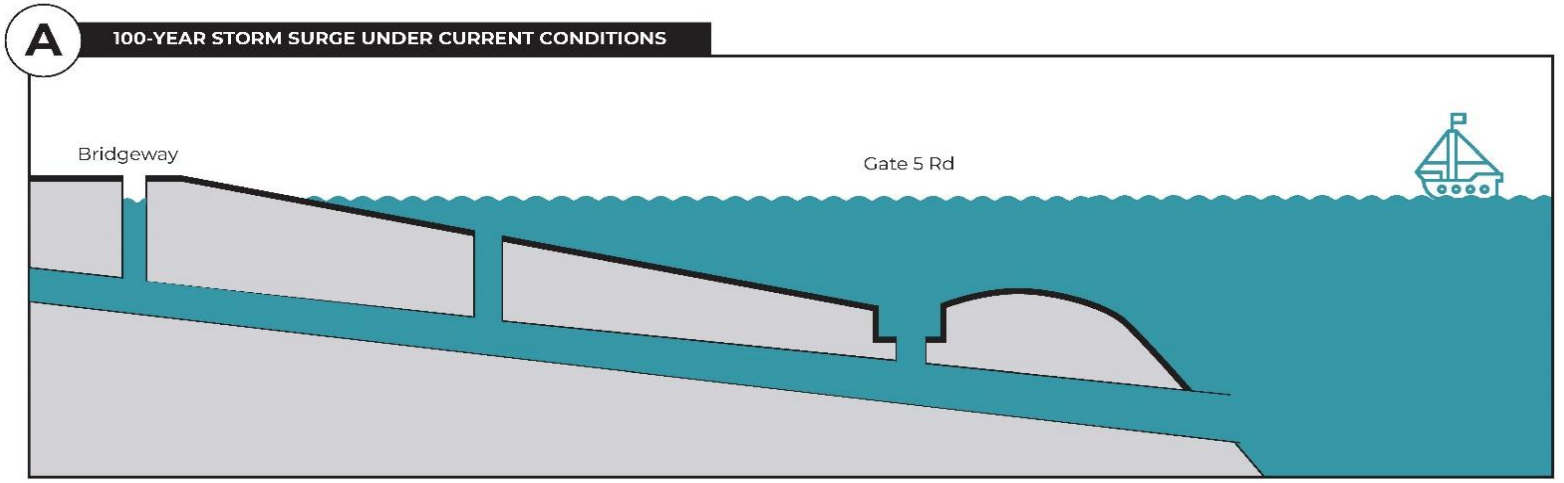
Conceptual Design – Mid Term (2035-2050), Long Term (2050-2100)

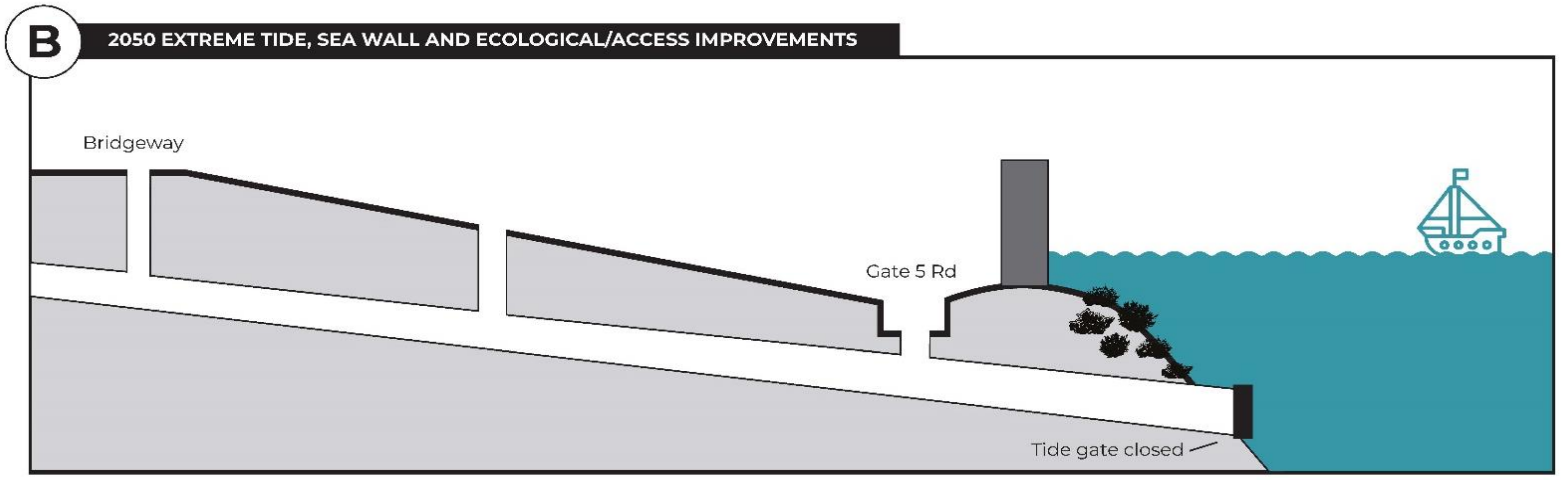


Gate 5 Area Drainage Management Study

Conceptual Design – Mid Term (2035-2050), Long Term (2050-2100)

Potential Seawall Solution





Gate 5 Area Drainage Management Study

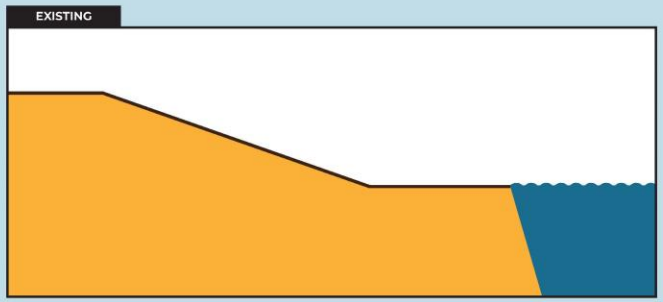
Conceptual Design – Mid Term (2035-2050), Long Term (2050-2100)

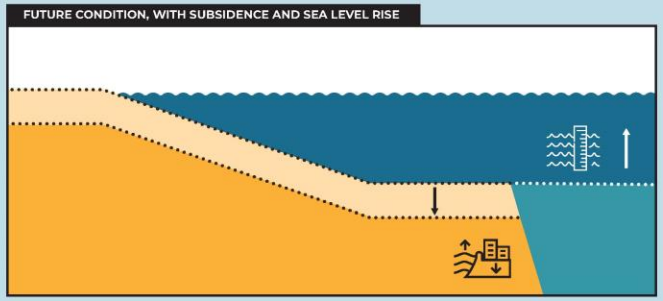
Subsidence and Sea Level Rise

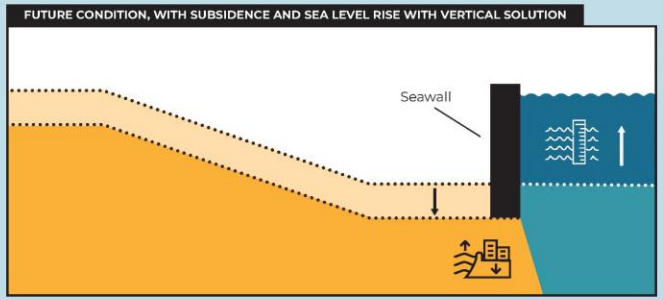
If a seawall is built, it has to be designed with enough height and structural capacity to handle not just today's water levels, but the future ones as well. That means accounting for both sea level rise and land subsidence, which together can significantly increase the effective water height. If the ground beneath or around the sea wall is sinking, the relative height of the wall decreases even if the wall itself does not move. Designing the wall to accommodate these long-term changes ensures that it maintains its protective function throughout its intended lifespan, reducing the risk of overtopping, flooding, and structural failure.

Term	Year-Sea Level Cond.	Water Elevation		Ground Elevation	Vertical Solution	
		Sea Level Rise (ft)	Surge Condition	Subsidence (ft)	Water Depth Above Ground Elevation (ft)	**Recommended Minimum Vertical Solution Height**
Existing	2025	0	100-Yr	0	2.1	N/A
Mid-Term	2050 Int.	0.8	100-Yr	-1.3	4.3	5.3
Long-Term	2100 Int.	3.1	100-Yr	-3.8	9.1	10.1
	2100 High	6.5	100-Yr	-3.8	12.5	13.5*

*Raising adjacent land will be needed to ensure that access/views to the Bay are maintained. This will require complete community/shoreline participation to redevelop the entire area to an agreed-upon elevation.







Gate 5 Area Drainage Management Study

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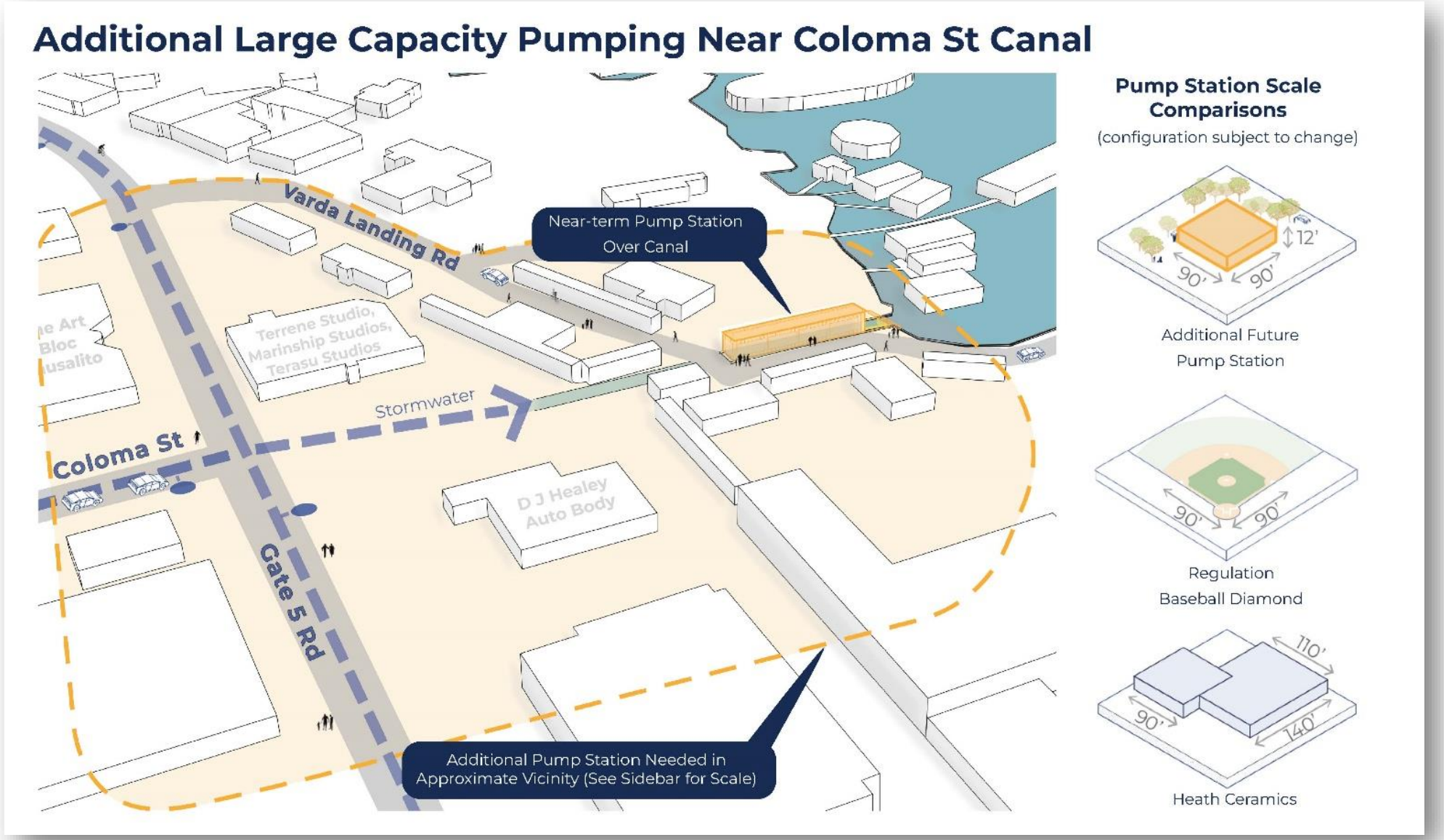


Gate 5 Area Drainage Management Study

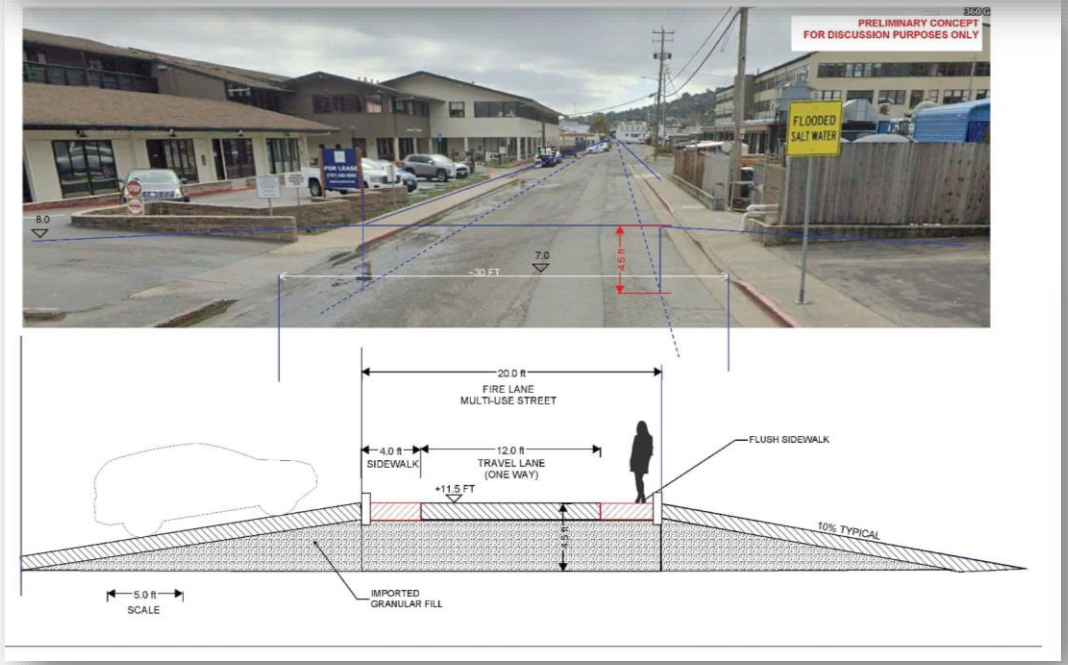
Conceptual Design – Mid Term (2035-2050), Long Term (2050-2100)

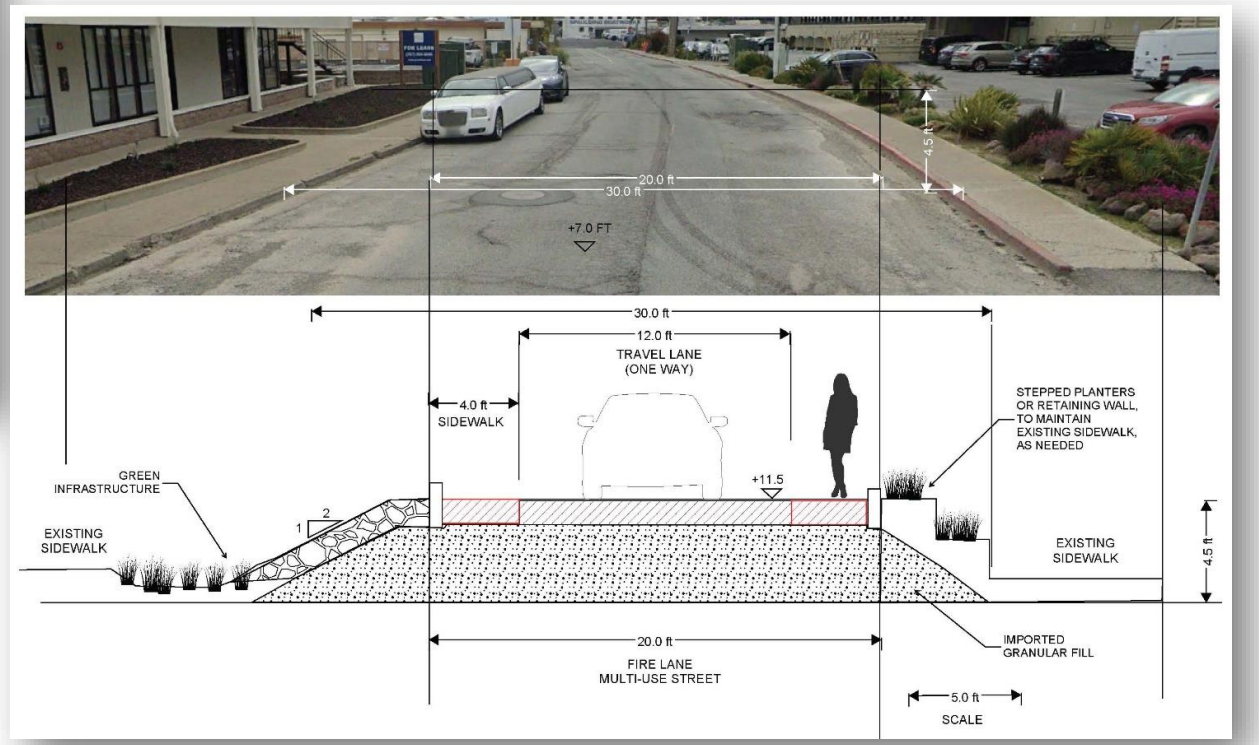
Upstream Stormwater Storage (Requires Additional Small Pump Station)

Gate 5 Area Drainage Management Study

Conceptual Design – Mid Term (2035-2050), Long Term (2050-2100)

Road Raising Considerations

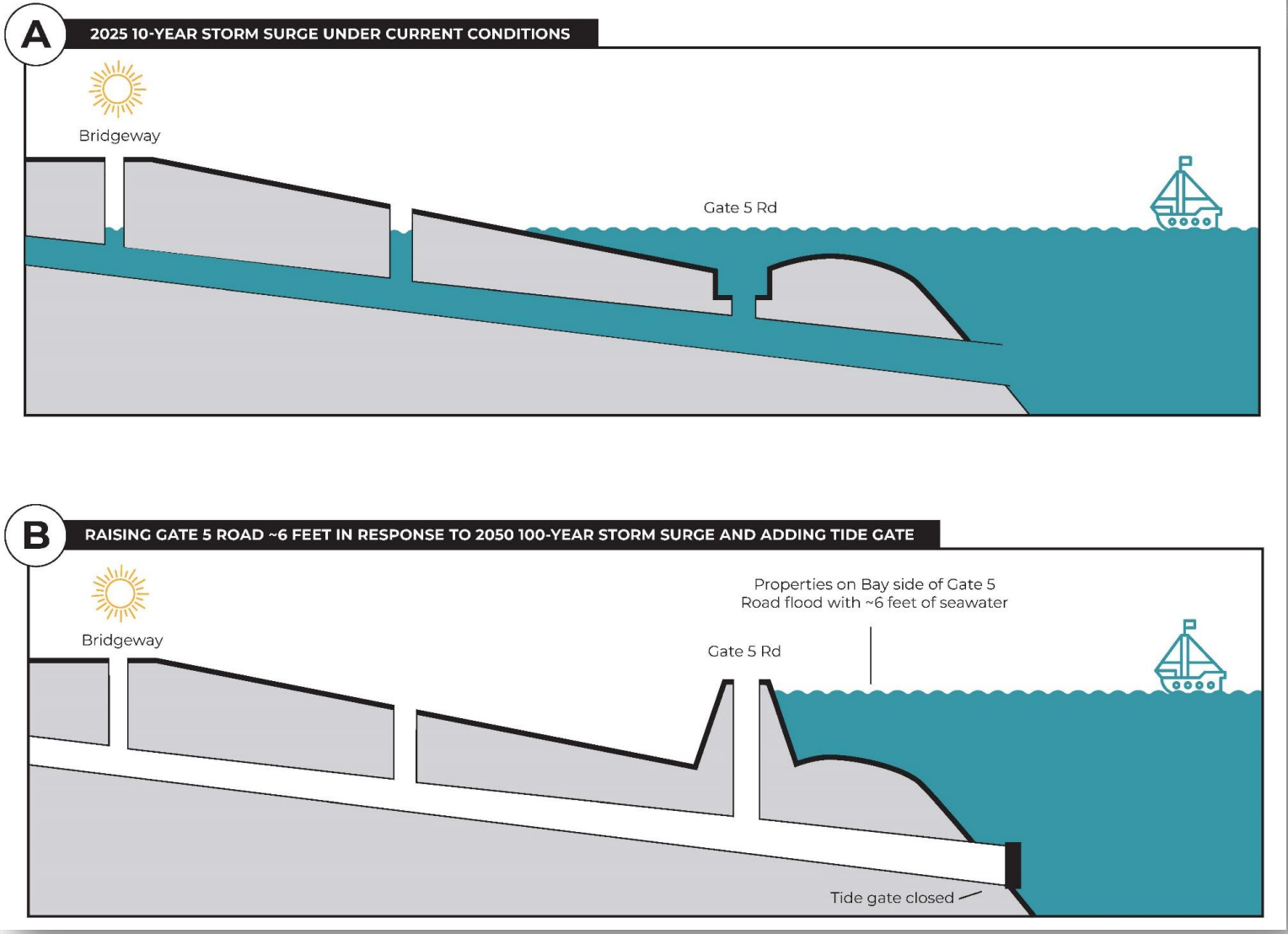




Gate 5 Area Drainage Management Study

Conceptual Design – Mid Term (2035-2050), Long Term (2050-2100)

Road Raising Considerations



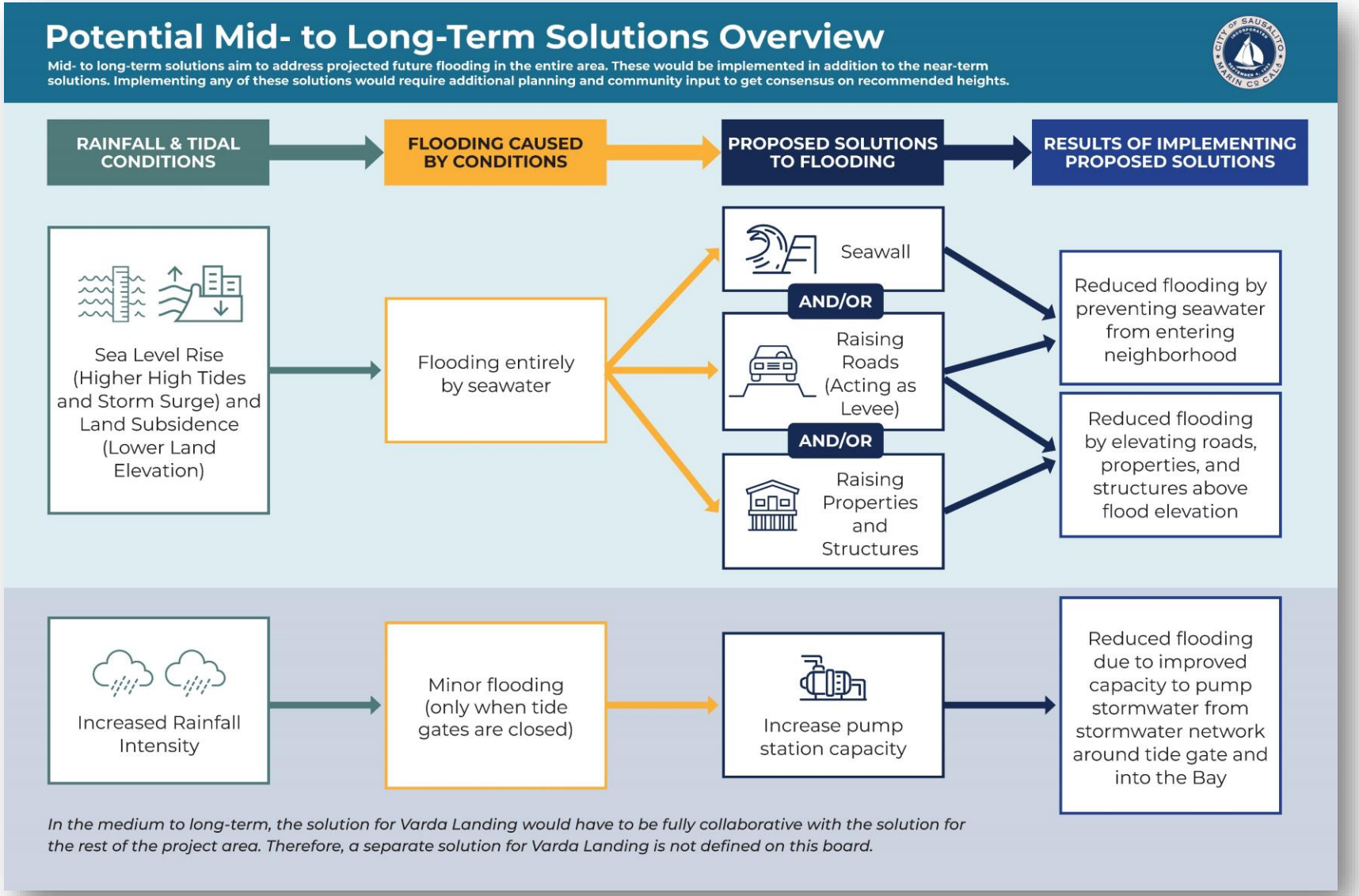
Gate 5 Area Drainage Management Study

Conceptual Design – Mid Term (2035-2050), Long Term (2050-2100)

MID- TO LONG-TERM (2035-2100)	Short Term Effectiveness	Long Term Effectivenes	Implement-ability	Agency Acceptance	Ecology and Sustainability Opportunities	Recreational Opportunity	Capital Cost	O&M Cost
TIDE GATE AND PUMP OPTIONS								
Additional Large Capacity Pumping	■	■	▲	■	▲	●	$$$	$$$
Upstream Stormwater Storage (Requires Additional Small Pump Station)	■	■	▲	■	▲	●	$$$$$	$$
VERTICAL SOLUTION OPTIONS								
Raise Gate 5 Road (1-year Storm Surge)	▲	●	●	▲	▲	●	$$$	$
Raise Gate 5 Road (2080 100-year Storm Surge)	■	●	●	▲	▲	▲	$$$$$	$
Seawall – Shoreline Alignment	■	■	■	●	●	●	$$$	$
Seawall – Shoreline Alignment with Ecological and Recreational Enhancements	■	■	▲	▲	■	■	$$$	$
Raise Properties and Structures	■	▲	●	■	●	●	$$$$$	$
OTHER IMPROVEMENTS								
Green Infrastructure	▲	●	▲	■	■	▲	$	$

Gate 5 Area Drainage Management Study

Conceptual Design – Mid Term (2035-2050), Long Term (2050-2100)



Gate 5 Area Drainage Management Study

Conceptual Design – Mid Term (2035-2050), Long Term (2050-2100)

Planning Horizon	Option	Key Benefit	Key Limitations	Planning-Level Cost
Mid-Term	• Increase Pump Station (PS) Capacity (Incrementally Towards 10-year Rainfall Capacity	• PS Can Handle Larger Rainfall Events • Moderate Cost	• Additional Space Needed for Pumps & Controls • Likely Requires Easements • Additional O&M	$6.9M
Mid-Term	• Underground Storage at MLK Park	• Reduces pump station sizing needs • Potential irrigation reuse	• High cost • Park impacts during construction	$28.8M
Mid-Term	• Green Infrastructure in Upstream Watershed	• Improves water quality, sustainability, and aesthetics • Reduces pump station sizing needs • Likely community support • Moderate cost	• Not a stand-alone flood protection strategy	$5.9M
Mid-Term	• Raise Gate 5 Road to 1-Year Storm Surge Elevation	• Improves access during frequent flood events • Low cost	• Does not protect properties waterward of Gate 5 Road • Requires property and utility coordination • Only one-way traffic	$0.6M
Long-Term	• Raise Gate 5 Road to 100-Year Storm Surge Elevation	• Improves access during high flood events • Low cost	• Does not protect properties waterward of Gate 5 Road • Requires property and utility coordination • Only one-way traffic	$0.9M
Long-Term	• Shoreline Seawall with Ecological and Recreational Improvements	• Addresses broader overland flooding • Provides ecological and recreational benefits • Protects the broader project area	• Requires property and utility coordination • Likely requires easements	$34.0M
Long-Term	• Raise Properties and Structures	• Reduces long-term exposure for individual parcels	• High cost • Piecemeal solution • Requires private owner participation	$185.0M

Gate 5 Area Drainage Management Study

Conceptual Design – Mid Term (2035-2050), Long Term (2050-2100)

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Gate 5 Area Drainage Management Study

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What Was Learned During This Project?

- Improved understanding of storm drain systems, especially along Harbor Drive and Gate 5 Road
- Greater insight into long term drainage concerns and solutions
- Greater insight into practical nature-based solution strategies
- Better understanding of community concerns and existing flood control practices
- Better understanding of current land elevations including recent modifications to coastal properties
- Better understanding of construction costs associated with potential mitigation actions
- Increased understanding of funding and permitting strategies
- Implementable solutions for near term and future flood control


QUESTIONS?

ARCHIVE

Long-term flood interventions supported by respondents

39%

Structural/Hard Infrastructure

- Elevate structures or utilities
- Permanent flood walls or levees

15%

Nature-based/Green

- Rain gardens or bioswales
- Permeable pavement

46%

Site Modifications

- Improving site grading
- Other custom approaches

Most Desired Improvements

New or expanded drainage infrastructure

Improved pump systems

Floodwall

Backflow preventers

More communication during flooding events

Deployable floodgates

Permeable pavement

Bulkheads

Berm

Bioswales

Temporary flood barriers

Why Respondents Prioritized These Improvements

1. Effectiveness

2. Environmental Benefits

3. Cost

4. Apearance/aesthetics

5. Other, including access to shoreline, homes, and businesses

If Trade-Offs Must Be Made, Residents Prioritized As Follows:

Gate 5 Road and adjactent parking lots
Industrial/working waterfront areas

Emergency routes and evacuation paths
Residential neighborhoods near Bridgeway

Public access points and parks
Commercial corridors
(Caledonia Street, Downtown)
Other

Now it's your turn! Add your responses to the survey!

Timeline

	Current Condition	Near-Term (2026-2035)	Mid- to Long-Term (2035-2100)
FLOOD CONDITIONS ASSESSMENT	Flooding during king tide or storm surge events.	Slight increase of seawater flooding depth and frequency.	Daily flooding during high tide. Permanent flooding of certain areas of the neighborhood.
POTENTIAL SOLUTIONS	Sandbags around certain storm grates and targeted pumping.	Tide gates at all stormwater outfalls to Bay. Permanent pump station.	Increased pump station capacity. Stormwater detention facilities. Green bioretention facilities. Vertical solutions (raising roads, raising properties and/or construction of seawall), with ecological enhancements.
IMPLEMENTATION CONSIDERATIONS (RISKS, COSTS, BENEFITS, TRADEOFFS)	Temporary (must be set-up and torn down for each event). Can only benefit specific problem areas of the neighborhood.	Noise from pump station. Pump station capacity limited to small rainfall events (<1 year intensity). Does not address overland flow.	Requires property acquisition and/or easements from property owners. 10+ year timeframe to implement.

Gate 5 Area Drainage Management Study

Overview

Provides Implementable Strategies for:

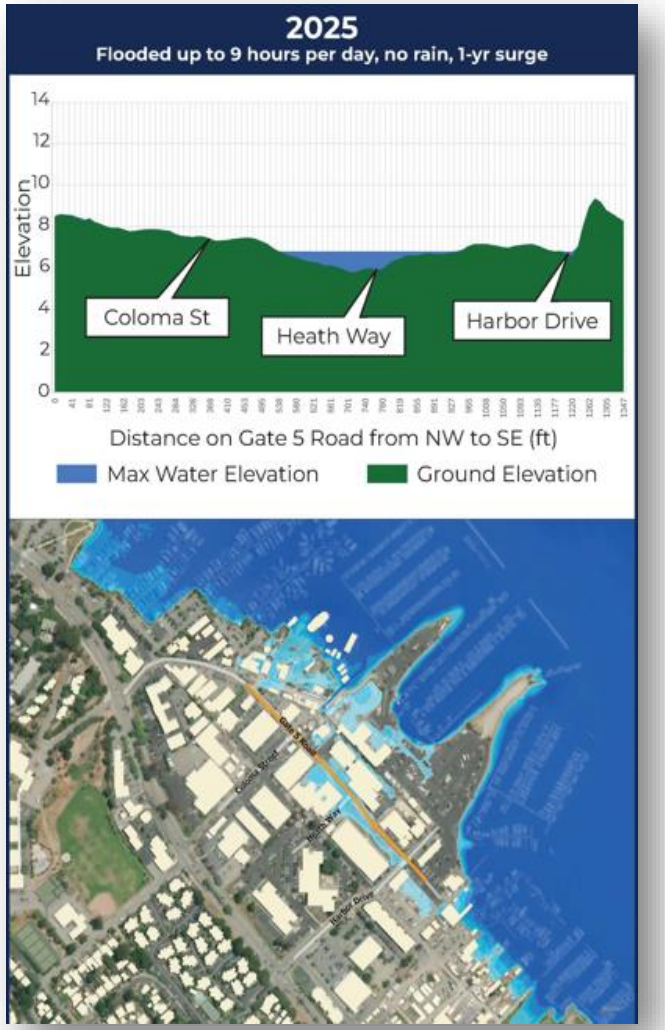
- Reducing Flood Risk in Gate 5 Area
- Establishing Framework for Future Adaptation.

Evaluates Existing and Future Flooding for:

- Gate 5 Road
- Coloma Street
- Harbor Drive
- Varda Landing
- Coloma Street Canal
- Adjacent low-lying shoreline areas
- Based on Storm Surge, Sea Level Rise, Subsidence, Stormwater Runoff

Translates Findings To Practical Improvement Strategies:

- For Phased Improvements:
  - Near-term (2025-2035),
  - Mid-term (2035-2050),
  - Long-term (2050-2100)
- Supporting Informed Decisions
- Prioritizing Future Investments
- Providing Basis to Advance Concepts through Implementation.



Gate 5 Area Drainage Management Study

Vulnerability Assessment

Assessed Flooding Using:

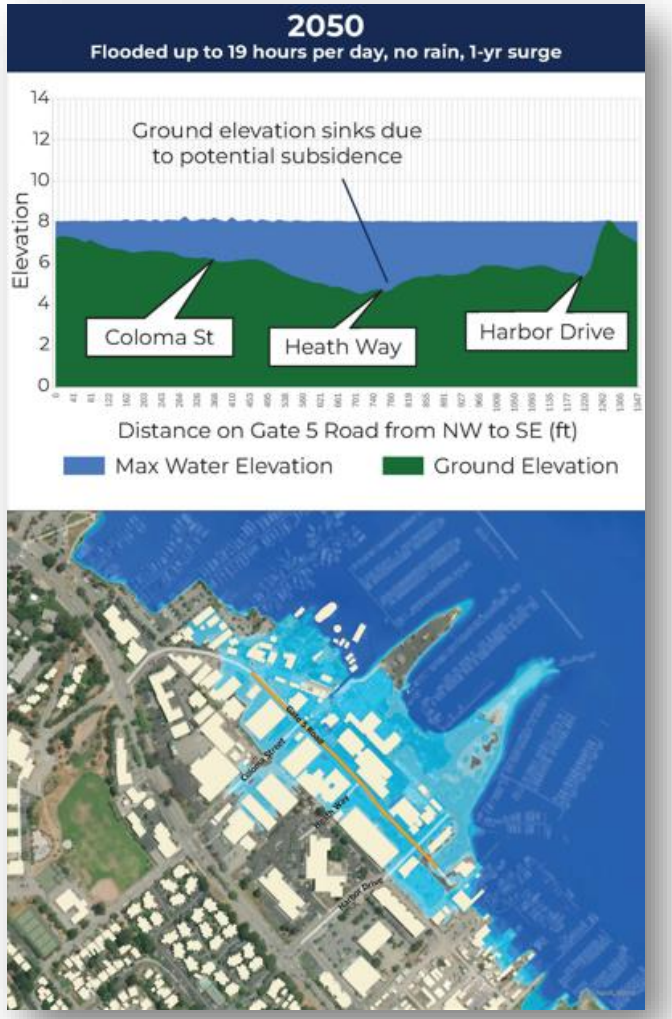
- Sea Level Rise (2025, 2050, 2080, 2100)
- Average Daily High Tide
- Storm Surge (1 Yr, 100 Yr)
- Precipitation (10-, 25-, 50-, 100-yr)
- Subsidence
- XP-SWMM Modeling

For Different Time Horizons:

- Existing (2025)
- Near Term (2025-2035)
- Mid-Term (2035-2050)
- Long-Term (2050-2100)

For 36 Scenarios:

- Used Combinations of these Factors
- Across each Time Horizon
- Showing Flooding in the Absence of Mitigation
- Results used for Conceptual Design Development
- Identified Key Areas for Near-Term Mitigation
- Key Areas for Mid- and Long-Term Mitigation



Gate 5 Area Drainage Management Study

Vulnerability Assessment Conclusions

Current Flooding:

- Primary – Tides/Storm Surge
- Secondary – Storm Runoff
- Seawater Flows up Storm Drains & Out Low Inlets
- Impacts Gate 5 Road Area Access, Properties & Operations

Future Flooding:

- Increased Risk from SLR & Subsidence
- Primary Flooding Becomes Overland Flow from Bay

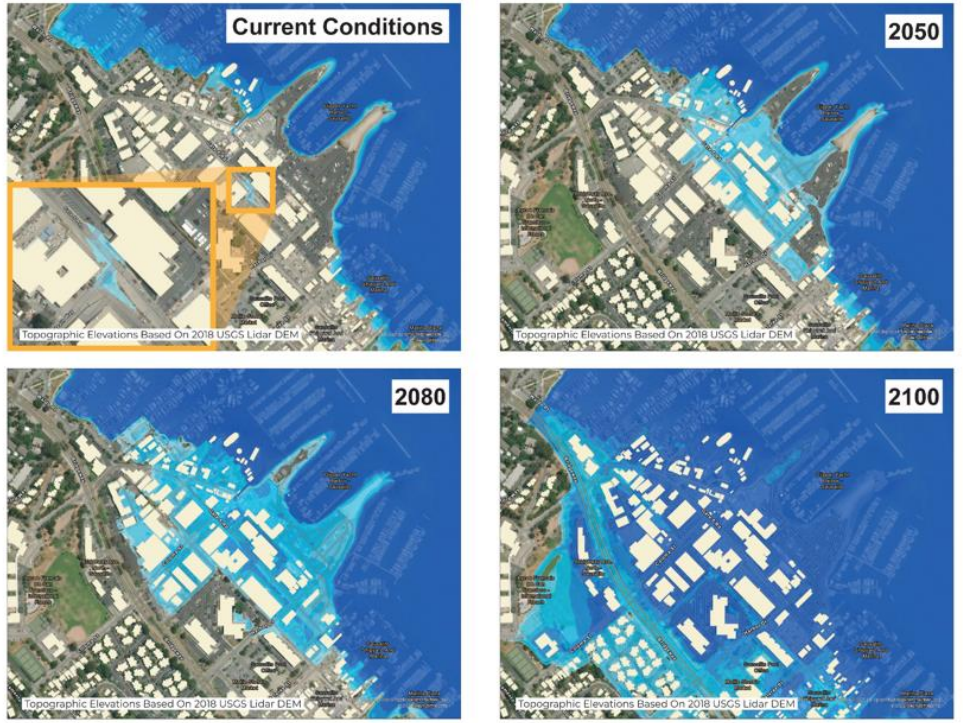
Requires Phased Improvements:

- Near-Term Solution to Reduce Current Flooding
- Mid- & Long-Term Solutions Additive to Near-Term

Risk Assessment Shows:

- Economic Basis for Advancing Improvements
- Do-Nothing – Building Damages up to $2.4 B (2025-2080)
- Underscores Value of Flood Reduction Measures

Flooding Over Time (Daily High Tide)



Gate 5 Area Drainage Management Study

Conceptual Design Near-Term (2025-2035)

Alternatives Reviewed:

- Pump Stations
- Tide Gates
- Storm Drain Improvements
- Storage
- Vertical Solutions
  - Seawalls
  - Raising Roads
  - Raising Properties
- Green Infrastructure

Recommended:

- Tide Gate at Outfalls
- Pump Station at Coloma Canal
- Gate 5 Road Storm Drain Improvements
- Seawall for a portion of Varda Landing
- Raising Varda Landing Road

Near-Term Mitigation Option	Key Benefits	Key Limitations	Planning-Level Cost
• Add Tide Gates to Existing Outfalls • Pump Station on Coloma Street Canal (2-Year Rainfall Capacity) • Storm Drain Improvements	• Addresses Backflow of Coastal Water • Addresses Stormwater Flows While Tide Gates Are Closed • Relatively Fast Implementation (3 to 4 years) • Within City Right of Way	• Moderate O&M for Pump/Tide Gates • Potential Permitting Delays at Canal • Structural Assessment of Canal Must Be Done First	$4.8 million
• Varda Landing Seawall (1-Year Storm Surge Elevation) • Raising Varda Landing to 1-Year Storm Surge Elevation (Portion on Private Property)	• Reduces Overland Flooding from the Bay • Initial Private Owner Approval	• Requires Private Owner Coordination	$1.6 million

Gate 5 Area Drainage Management Study

WSP Scope

Task 1: Vulnerability Assessment

- Background Conditions Review
- Existing Conditions Hydrologic Model Development
  - Existing Flood Patterns and Drainage Issues
  - Project Effects of Sea Level Rise
  - Subsidence Analysis
  - Meet with Property Owners
- Evaluation of Flood Risks

Evaluates Existing and Future Flooding for:

- Gate 5 Road
- Coloma Street
- Harbor Drive
- Varda Landing
- Coloma Street Canal
- Adjacent Low-Lying Shoreline Areas
- Events Based on Storm Surge, SLR, Subsidence, Stormwater Runoff

Gate 5 Area Drainage Management Study

WSP Scope

Task 2: Develop Conceptual Designs

- Field Data Collection
- Develop/Evaluate Conceptual Alternatives
  - Assess Feasibility (Technical, Cost-Effectiveness, Community Priorities)
  - Establish “Performance Evaluation Framework“
  - Ensure Compliance with Resiliency Regulations
  - Ensure Consistency with Agencies‘ Ability to Permit & Fund Construction
  - Provide Construction Cost Estimate for Conceptual Alternatives
- Provide Recommended Alternatives

Translates Findings To Practical Improvement Strategies:

- For Phased Improvements:
  - Near-term (2025-2035),
  - Mid-term (2035-2050),
  - Long-term (2050-2100)
- Supporting Informed Decisions
- Prioritizing Future Investments
- Providing Basis to Advance Concepts through Implementation.

Gate 5 Area Drainage Management Study

WSP Scope

Task 3: Community Engagement

- Facilitate and Document Stakeholder Input
  - Organize and lead public meeting
  - Develop and coordinate event logistics
  - Record and synthesize takeaways

Task 4: Project Management

Task 5: Implementation Plan

- Prepare Phased Implementation Plan
  - Develop a structured, phased approach with cost estimates
  - Identify and recommend potential funding sources and strategies