



CEAC Flood Control and Water Resources Committee

John Bourgeois, ESA
December 4, 2019

Climate change presents one of the biggest, most complex and political challenges in our lifetime and for future generations



The sustainability of the infrastructure we manage, the communities we protect, and our credibility as flood control agencies hinges upon how we respond to this challenge.

Why CHARG?

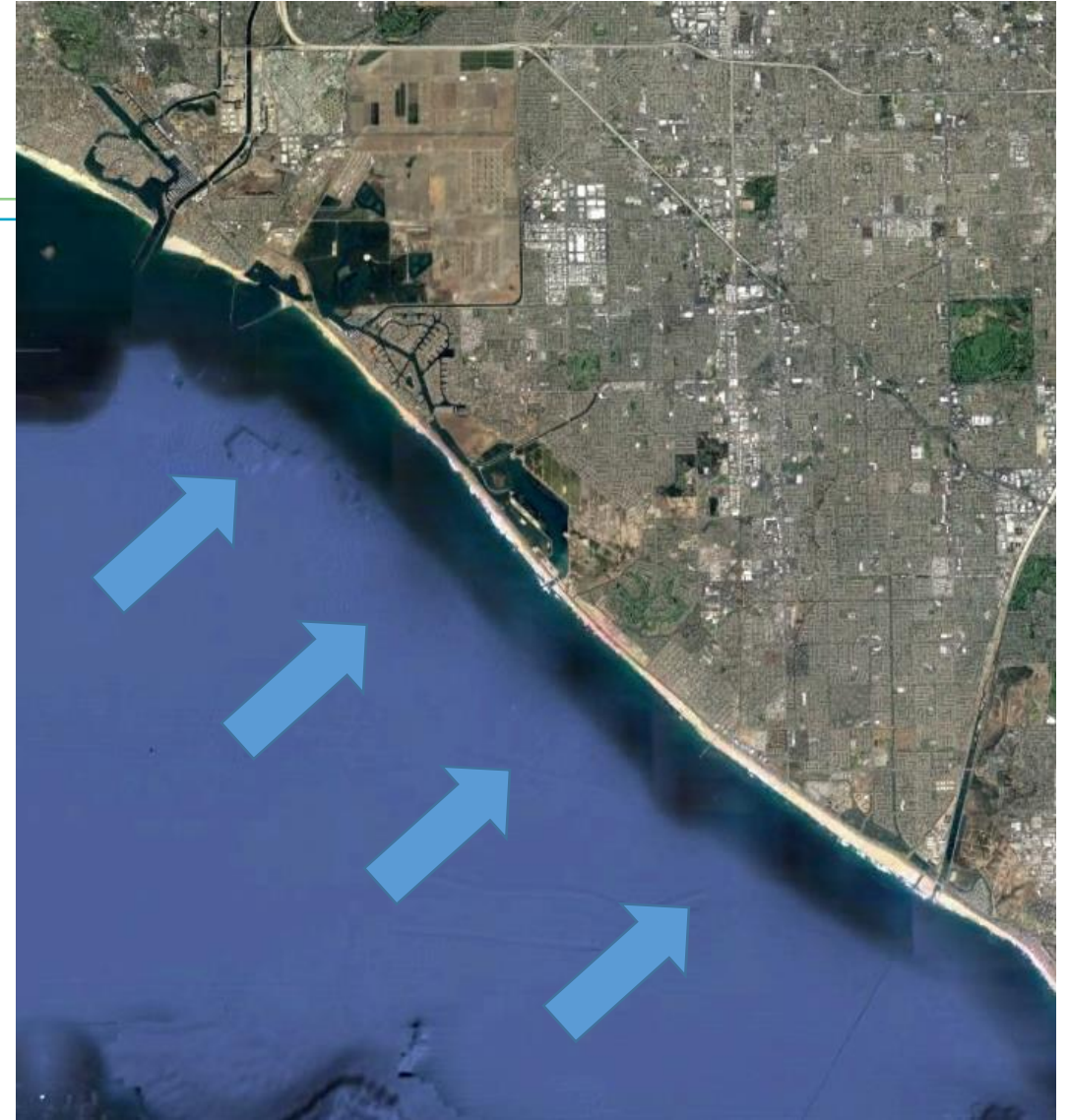
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Sheltered Bay



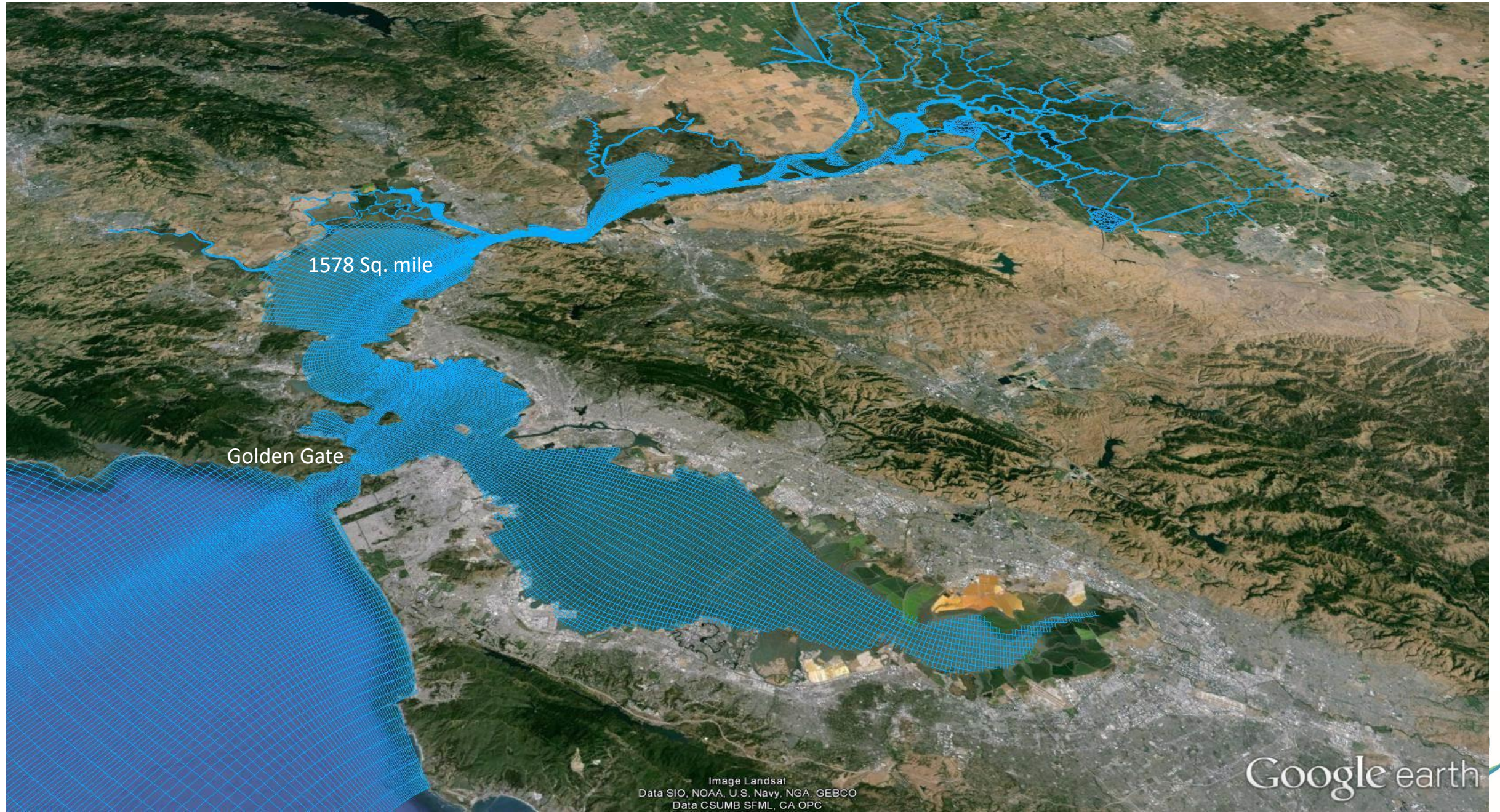
Open Coast



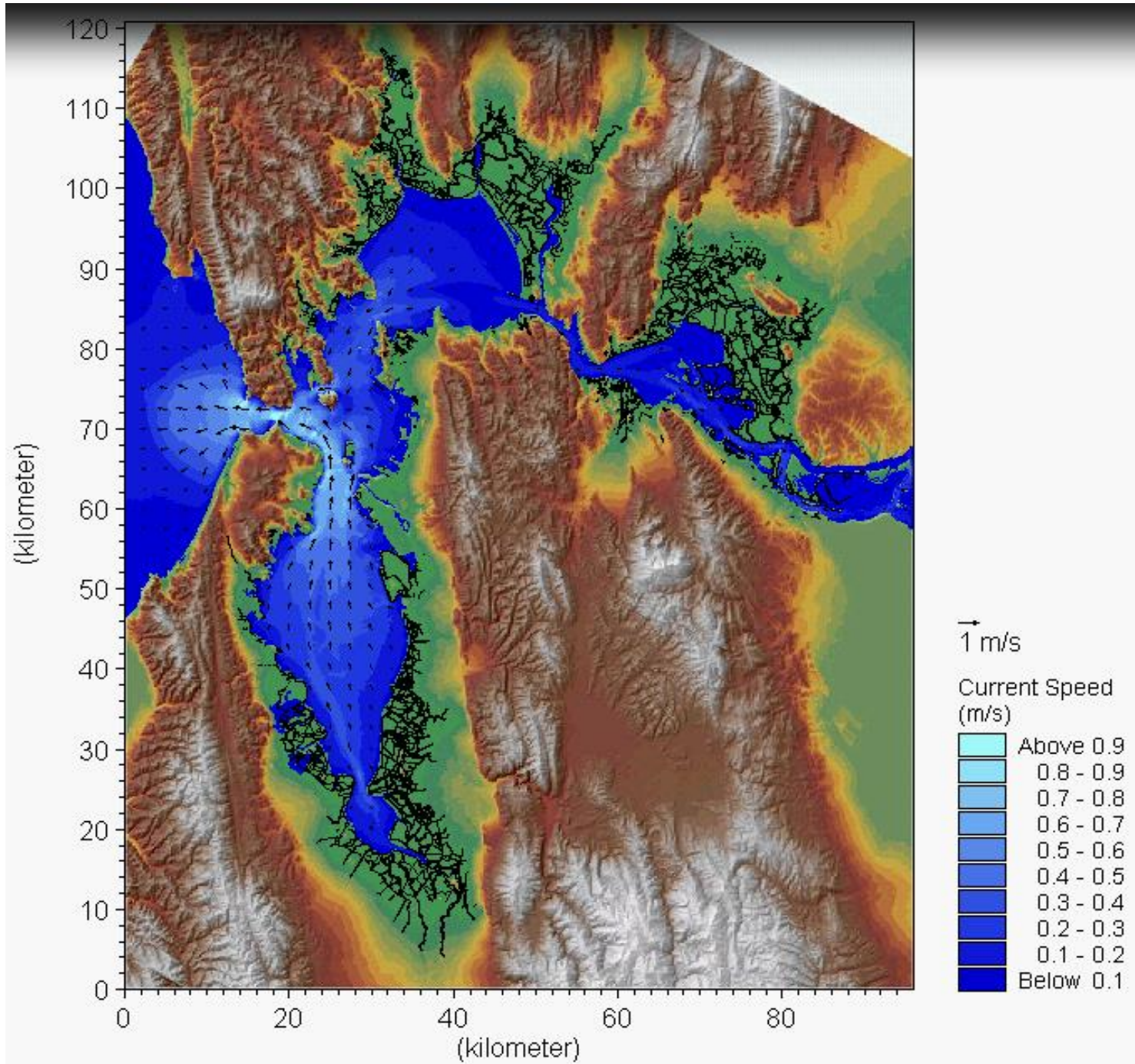
Open Coast Sea Walls and Dikes



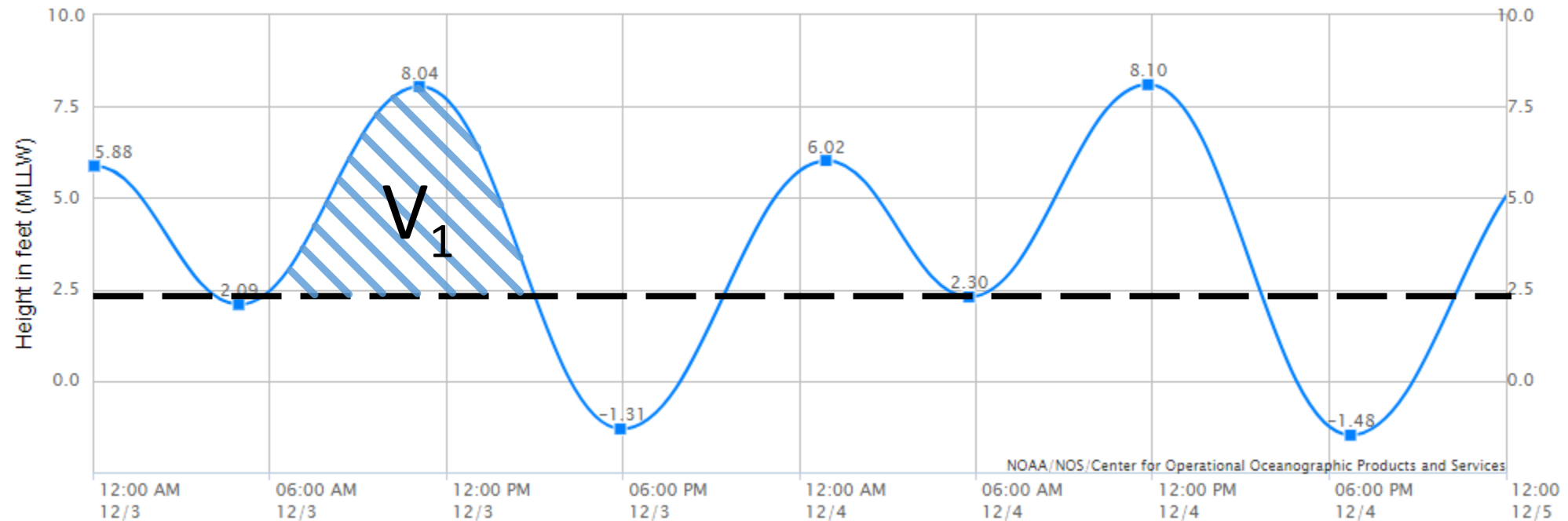
Sheltered Bay



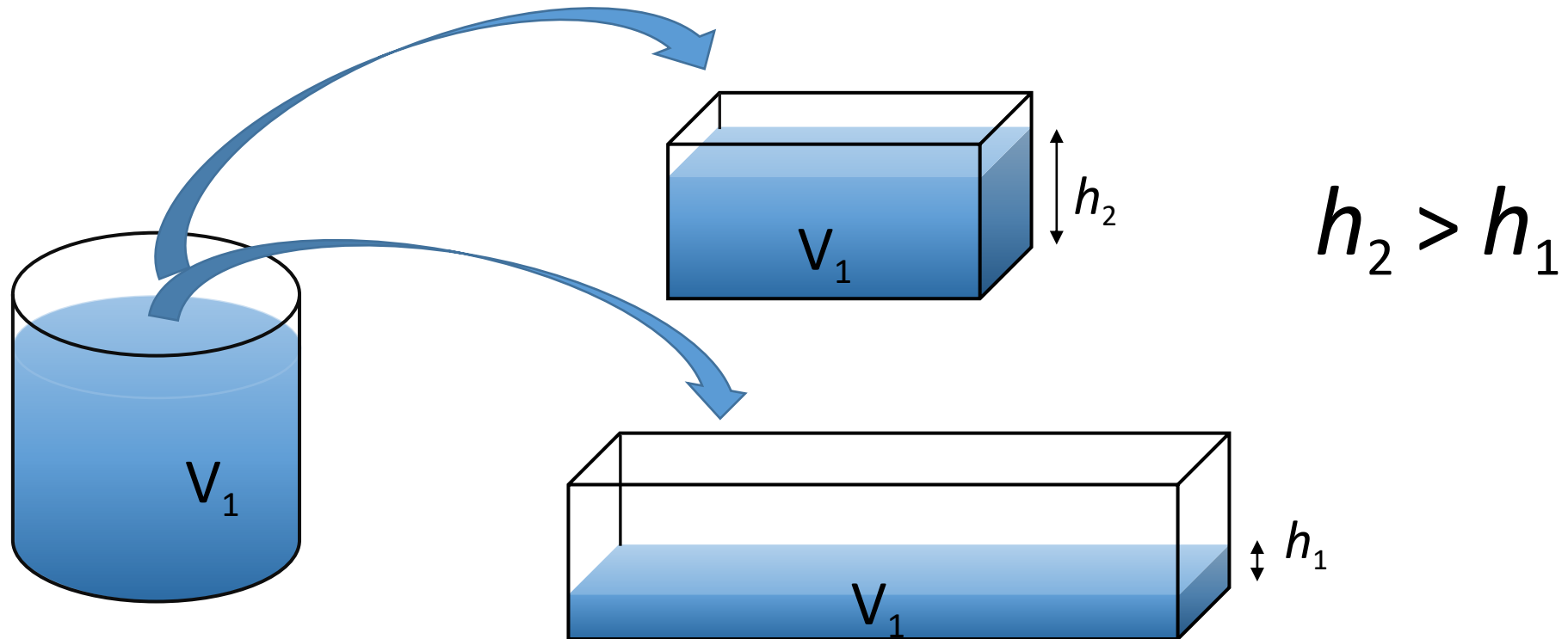
Understanding the Bay Hydrodynamics



San Francisco Bay daily tide cycles



Elevation of water within a *container* is driven by the *size of the container* (The Bay)



A unified regional strategy is needed

- CHARG was formed to provide the **vision** and a **unified and equitable** approach for a One Bay Plan that will protect the billions of dollars in infrastructure upon which our Bay economic engine depends
- CHARG provides a platform for those who are **responsible for reducing risk to communities** from fluvial, tidal, and SLR flooding to advocate for implementable and scalable solutions

Who is CHARG?

- CHARG BAFPAA Subcommittee
- CHARG Steering Committee



CHARG Governance

■ CHARG-BAFPAA Subcommittee

- Erika Powell, BAFPAA Chair and **San Mateo County** Flood Resilience Manager
- Rohin Saleh and Hank Ackerman, **Alameda County** Flood Control District
- Paul Detjens, **Contra Costa County** Flood Control and Water District
- Vincent Gin, **Santa Clara Valley** Water District (now Valley Water)
- Roger Leventhal, **Marin County** Public Works
- Richard Thomasser, **Napa County** Flood Control and Water Conservation District



CHARG Governance

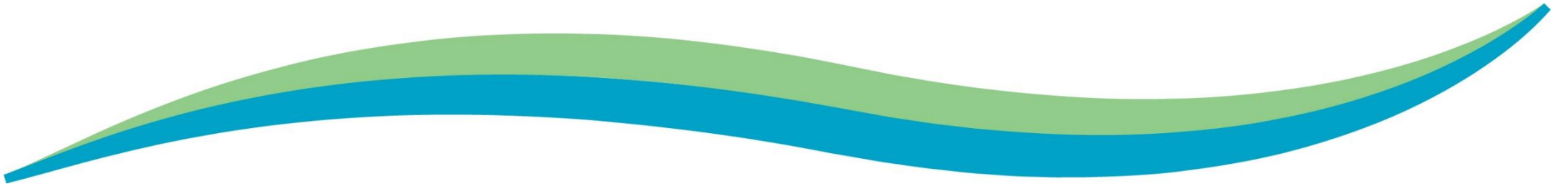
■ CHARG Steering Committee

- BCDC
- State Coastal Conservancy
- San Francisco Estuary Institute
- BART
- USGS
- Department of Water Resources
- East Bay Dischargers Authority
- SFO
- Caltrans
- Corps of Engineers
- FEMA
- California Marine Affairs and Navigation Conference
- Port of Oakland
- RWQCB
- San Mateo County Public Works
- UC Berkeley
- Silicon Valley Leadership Group



What is CHARG Doing?

Outreach & Technical Priorities



Past Action Highlights

March 2019	April 2019	May 2019	June 2019
<ul style="list-style-type: none"> • CHARG - Technical Priorities Next Steps (3/7) • BCDC – Technical Priorities + Partnering (3/18) • SAME – Panel presentation by Erika Powell (3/21) • CHARG – Subcommittee Meetings (3/21) • Dutch Consulate Meeting 	<ul style="list-style-type: none"> • CEAC – Present to Public Works Officers Institute (4/3) • CHARG – Subcommittee (4/4, 4/18) • BART – Meeting (4/10) • RBD – Book Launch (4/16) • CHARG added to BCDC Technical Advisory Group • CHARG – Technical Priorities Workshop (4/23) 	<ul style="list-style-type: none"> • SFEI – OLU Webinar (5/2) • BCDC – Adapting to Rising Tides Working Group (5/8) • BPC – Spring Summit (5/10) • BCDC – RAP Meeting (5/22) • CHARG – Subcommittee (5/2, 5/16) 	<ul style="list-style-type: none"> • SFEI – Adaptation Atlas (6/3) • BCDC – Partnering + Advisory Committee Role (6/4) • RWQCB – Partnering + Sharing Goals (6/6) • Silicon Valley Leadership Group – Panel presentation (6/14)

Past Action Highlights



Technical Priorities Plan *Vision*

- Provide *technical leadership*
- Put forward a *Call to Action* on SLR
- Inform funding and policy on near and long-term solutions
- Make the case for a *regional approach*

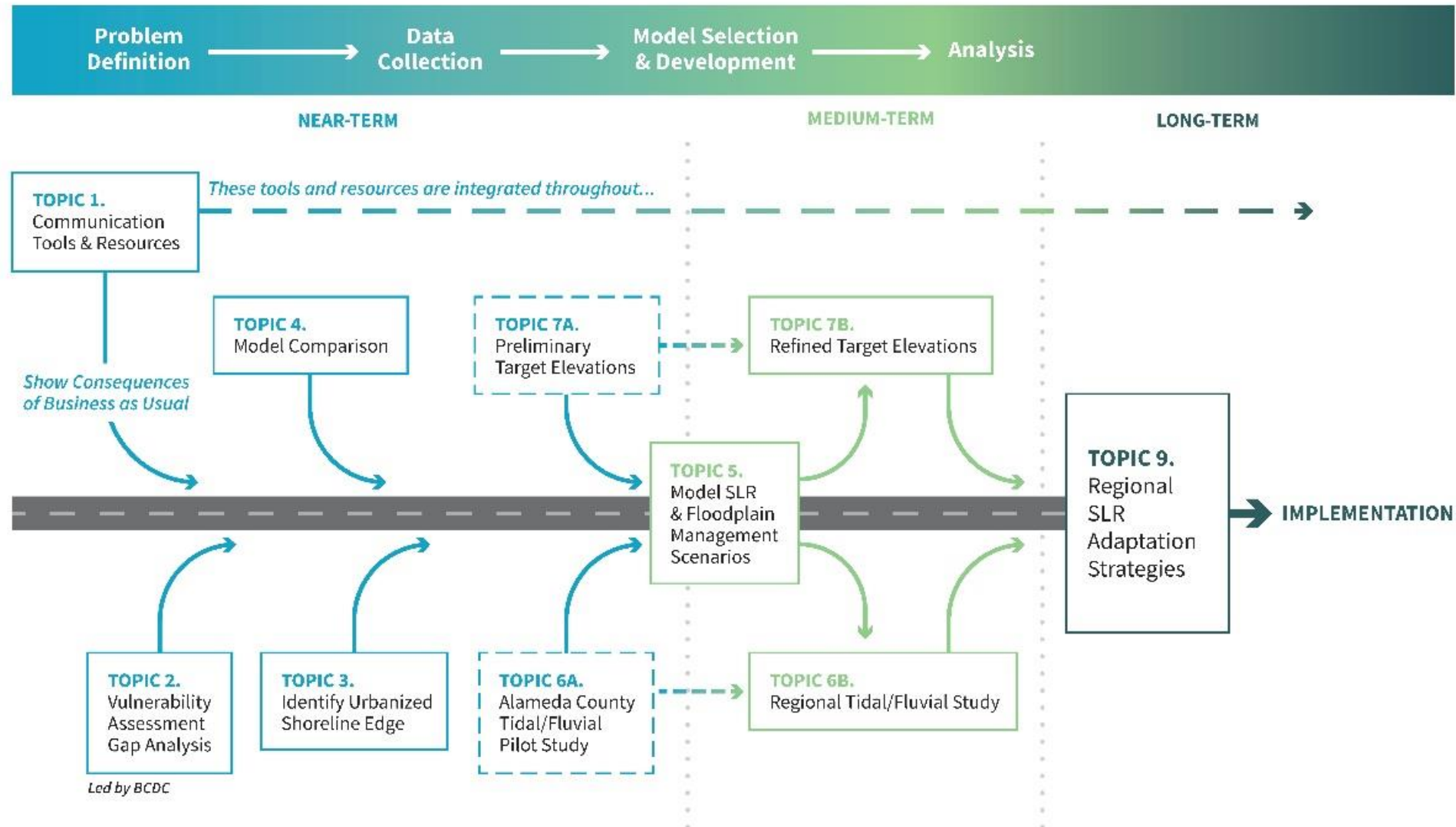


Topic	Purpose
Near-Term Priorities	
Topic 1. Develop communication materials and tools to make the case for regional SLR adaptation.	Results will increase stakeholder and public understanding of a regional approach to SLR adaptation. Value: will bring more support and funding for regional approaches to SLR, enabling the region to speak with one voice, which will ultimately create sustaining solutions.
Topic 2. Review available Bay area vulnerability assessments and identify strategic gaps.	Results will identify key issues that are not receiving adequate attention in San Francisco Bay SLR vulnerability assessments. Value: Ensure SLR adaptation investments address the most critical vulnerabilities, are effective and sustainable.
Topic 3. Identify and document the current and planned urbanized shoreline edge of San Francisco Bay	Results will provide accurate shoreline boundaries for use in modeling and in adaptation planning. Value: Increased transparency on modeling inputs and assumptions, avoiding future disruptions when modeling results are questioned, and ensuring more accuracy and uniformity across the region.
Topic 4. Compare models suitable for sea level rise analysis in San Francisco Bay	Results will allow floodplain managers to more quickly select models and compare between models for vulnerability and adaptation planning for more efficient use of resources. Value: Enables flood managers to provide more value to constituents by being more conversant on various models and results, and making more informed and cost-effective recommendations to decision-makers.

Topic	Purpose
Medium-Term Priorities	
Topic 5. Model Bay water levels for SLR and Bay floodplain management scenarios	Results will quantify the change in Bay water levels for simplified adaptation scenarios (e.g., minimum and maximum floodplain connections). Value: Bookend the potential magnitude of redirected flood effects, provide a basis for equitable distribution of risk, demonstrate the benefits of regional coordination.
Topic 6. Analyze combined Bay and fluvial flooding for existing conditions and future scenarios.	Results will identify the frequency of occurrence for water levels at the mouths of creeks and upstream considering SLR and more intense precipitation. Value: Inform asset vulnerability and adaptation at creek mouths, outfalls, and upstream floodplains; e.g., demonstrate how flood control facilities will be affected and may require upgrades.
Topic 7. Identify threshold water levels along the San Francisco Bay shoreline where flood protection requires subregional and regional coordination.	Results will raise awareness of the need for multi-jurisdiction coordination for effective flood protection with SLR. Value: identify the water level at which neighboring or regional jurisdictions must coordinate on flood protection and adaptation.

Topic	Purpose
Long-Term Priorities	
Topic 8. Perform a literature review and develop case studies of SLR adaptation around the world in regions with conditions similar to San Francisco Bay.*	Results will provide insight and lessons learned on adaptation strategies used in areas similar to San Francisco Bay. Value: Ensures cutting edge and effective solutions will be considered in development of future regional adaptation plans.
Topic 9. Perform a preliminary evaluation of regional SLR adaptation strategies	Results will provide the building blocks and tools for a regional approach to SLR adaptation. Value: identifies needs, gaps, and advances a One Bay approach.

Technical Priorities Road Map

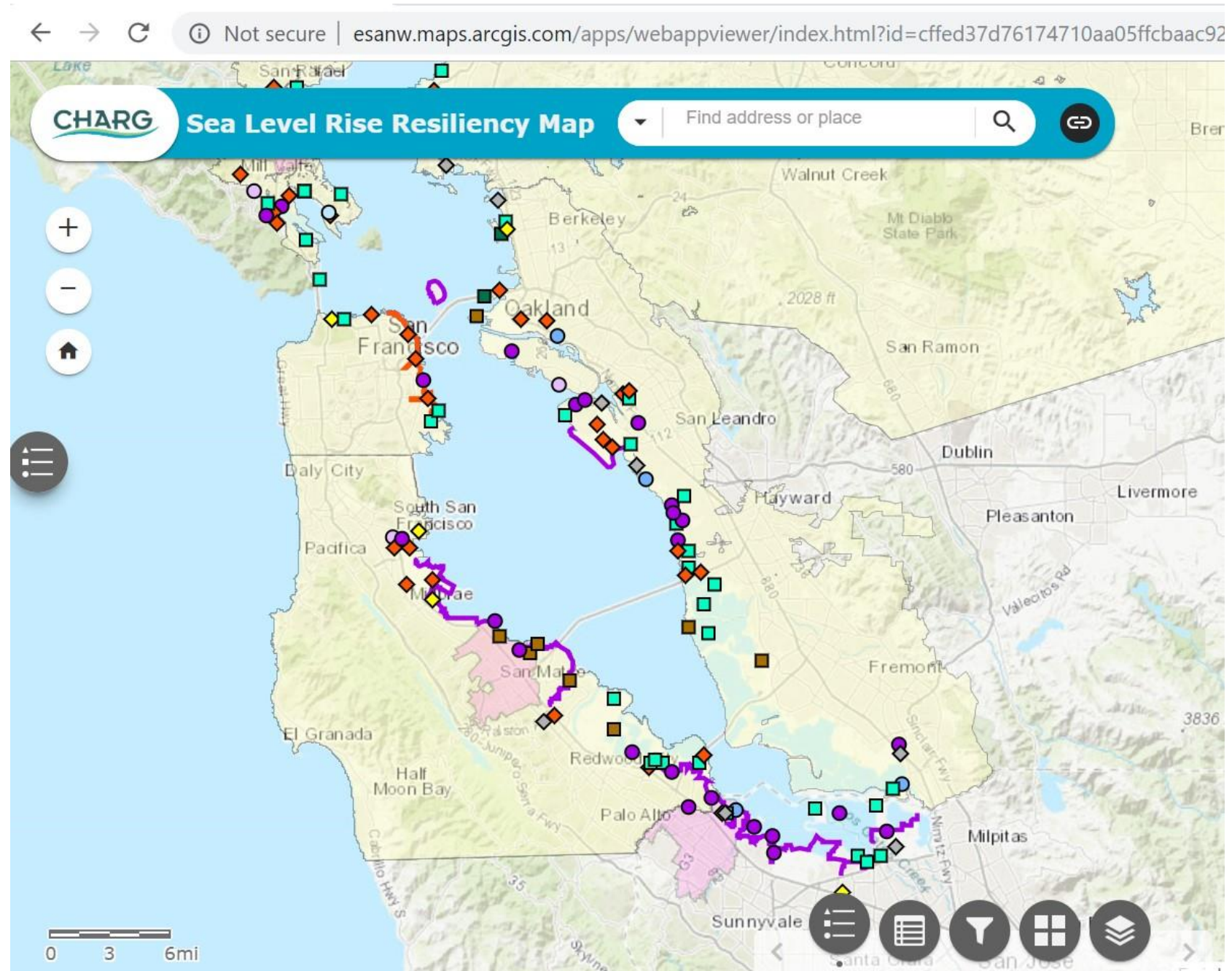


Technical Priorities Plan

Content and Use

- Prioritize tasks per CHARG mission
- Direct CHARG activities in 2019 and 2020
- Advocate and/or fund tasks through strategic partnerships
- A working document to stimulate discussion

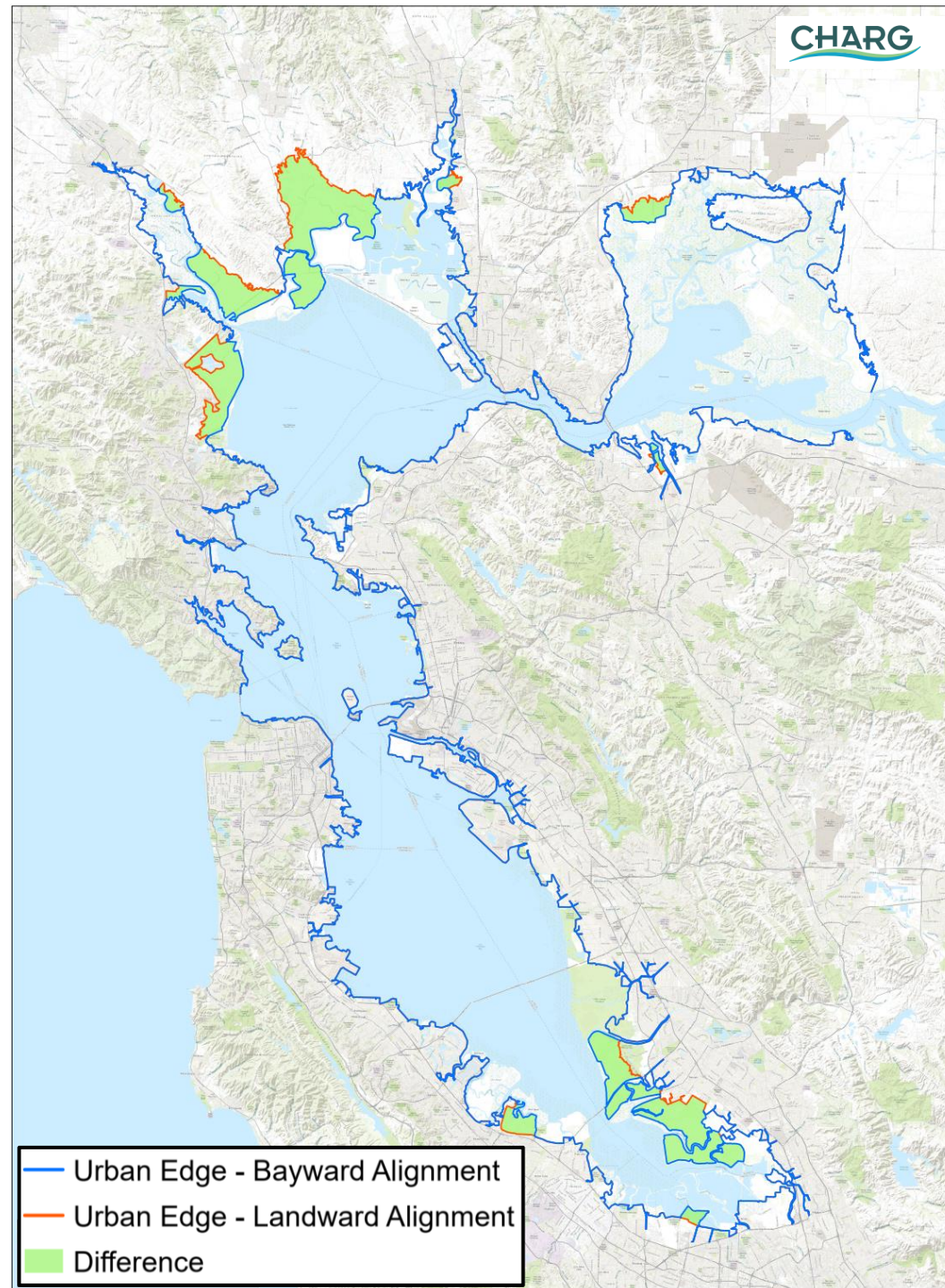
SLR Project Map



Urbanized Shoreline Edge

- Landward alignment
 - Assumes existing buildings and infrastructure to be protectedOR
 - High ground at 100-yr water level + 5 ft SLR
- Bayward alignment
 - Landward alignmentAND
 - Assumes wetlands used for industrial processes, proposed shoreline development, and agricultural lands to be protected
- Difference in area
 - 35% of San Pablo Bay
 - 26% of South Bay

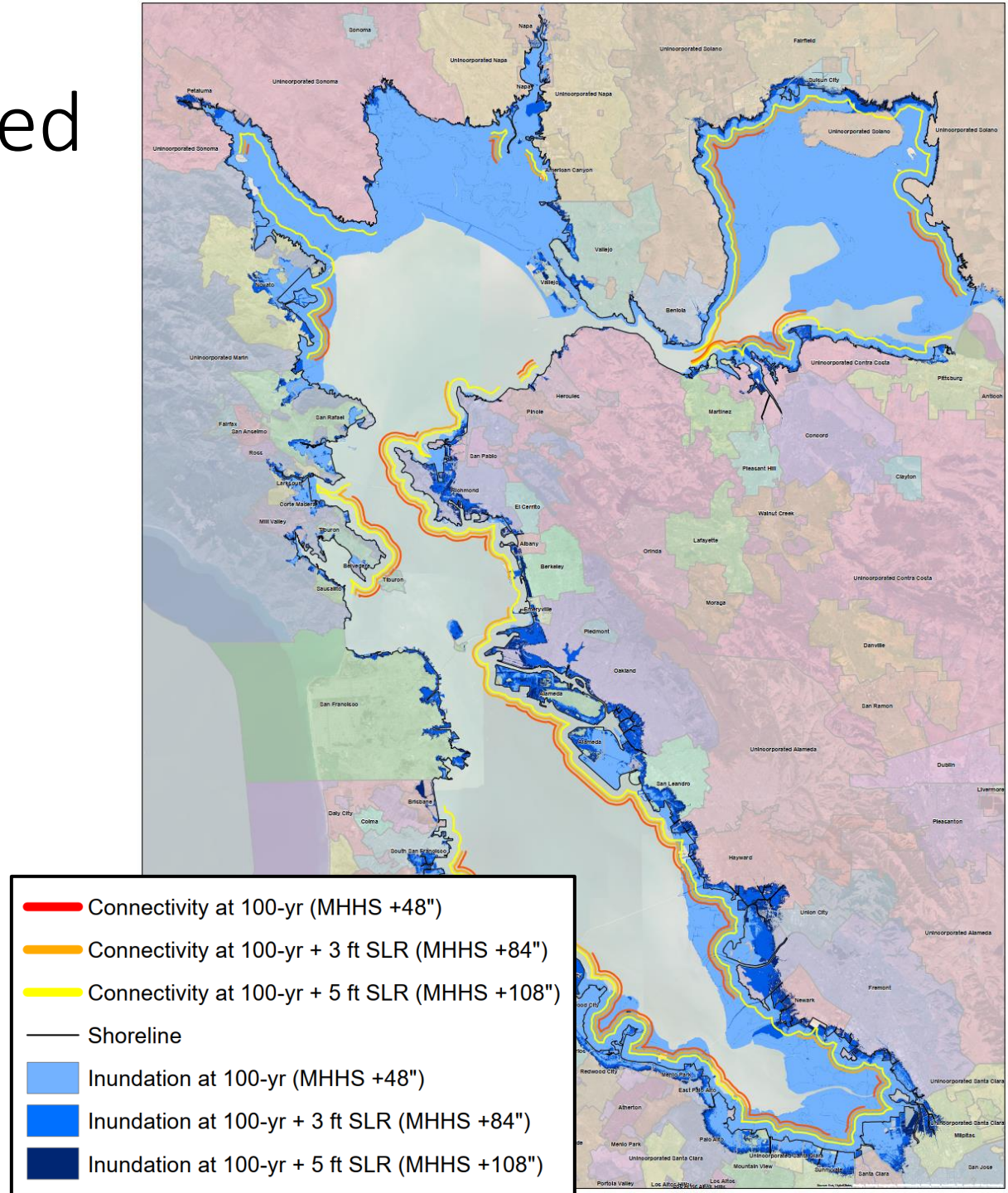
Note: These alignments are based on readily available information, and only intended for high-level regional planning. Actual land use decision-making authority remains with local agencies and land owners.



Hydraulically Connected Jurisdictions

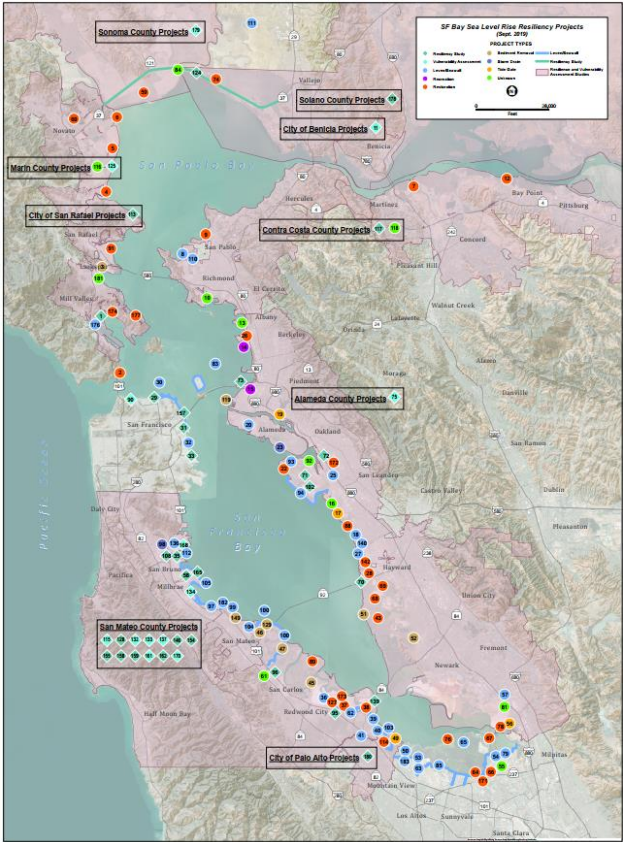
■ Methodology

- ART inundation mapping for:
 - 100-yr storm surge
 - 100-yr + 3 ft SLR
 - 100-yr + 5 ft SLR
- Assign urbanized shoreline edge to city boundaries
- Identify connected boundaries where inundation depths exceed one foot for more than 200 linear feet of city-to-city boundary



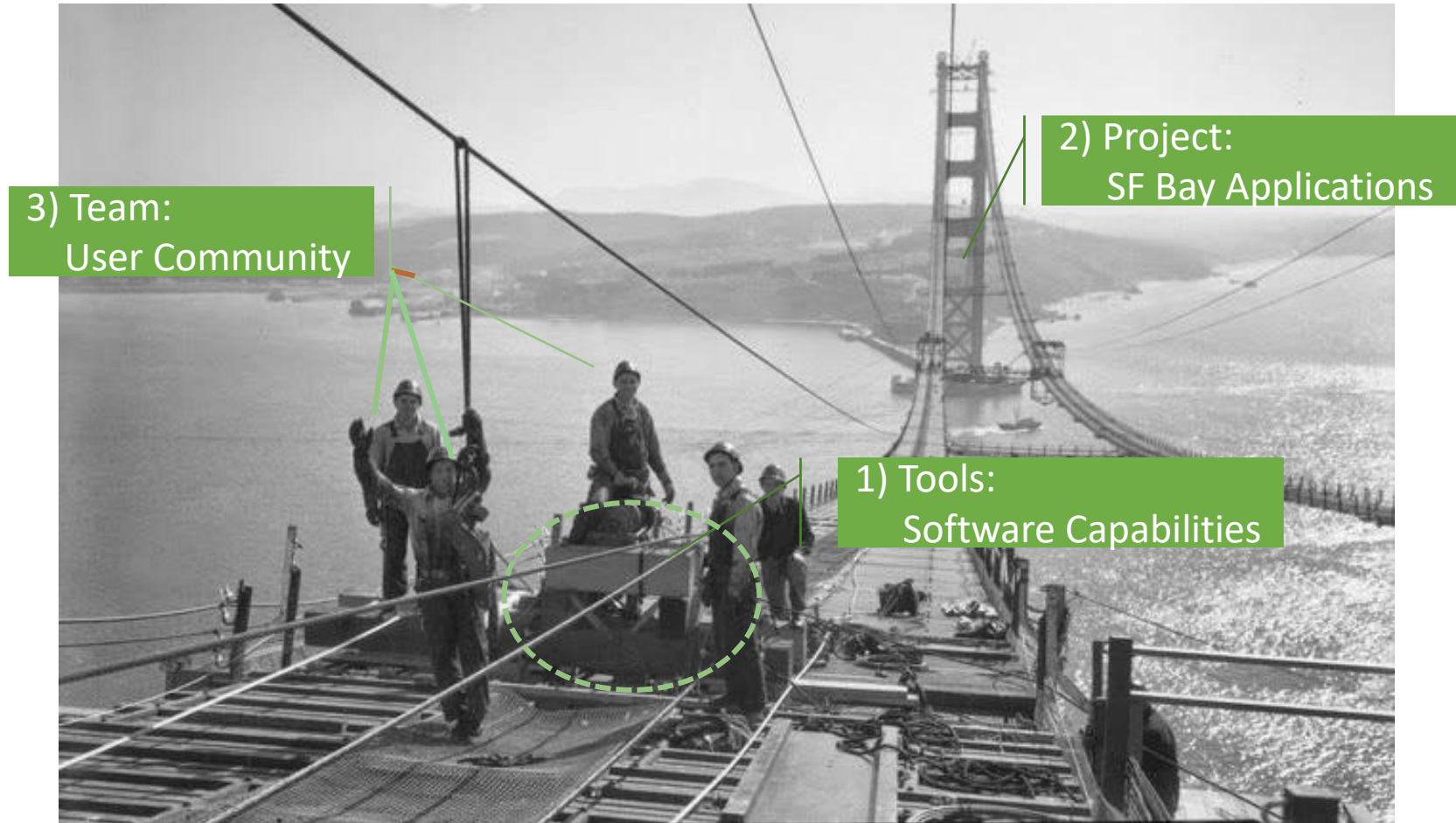
Cost Estimating Sources

- What is the cost of ‘business as usual’?
- Existing projects with at least rough-order-of-magnitude (ROM) cost estimates
 - E.g. South SF Bay Shoreline Project – Alviso, San Francisco Seawall, Treasure Island, SAFER Bay
 - Approximately 9% of shoreline



Shoreline Type	Unit Cost, \$ / linear foot
Seismically stabilized seawall	\$300,000
Raise shoreline elevation	\$4,000
Landfill cap stabilization & erosion protection	\$3,000
High ground w/development - erosion protection	\$1,000

Modeling Tools to Bridge the Bay



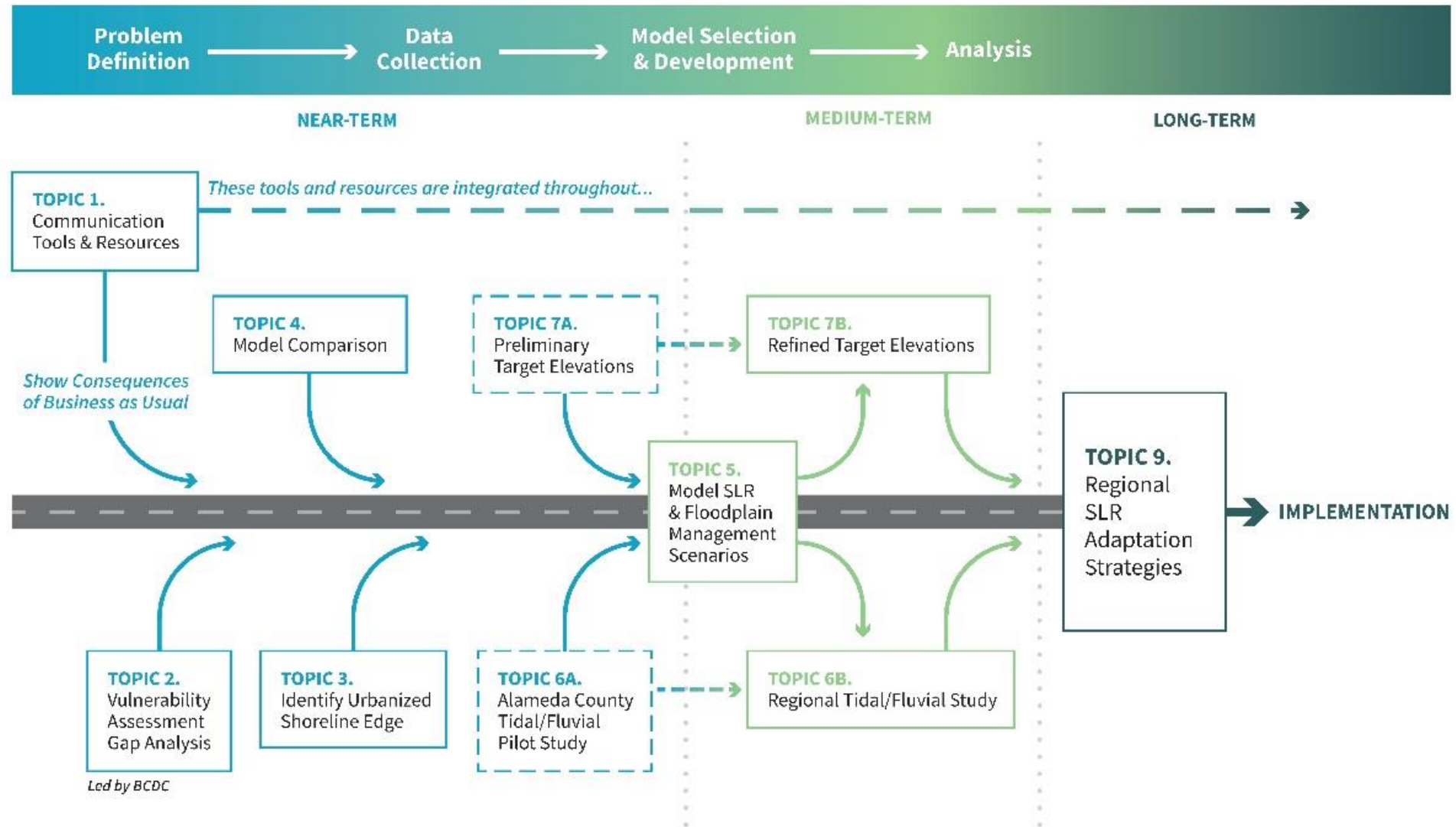
Model Comparison

Tools: Software Capabilities

Projects: Applications in San Francisco Bay

Team: User Community

Technical Priorities Road Map




Importance of Regional Evaluation

- Identify scalable, multi-benefit projects that benefit the region.
- Unify priorities of a “One Bay” approach to funding.
- Create inclusive governance.
- Leverage the Bay’s “best and brightest” as a technical resource.



The challenge of SLR, particularly extreme scenarios, demands:

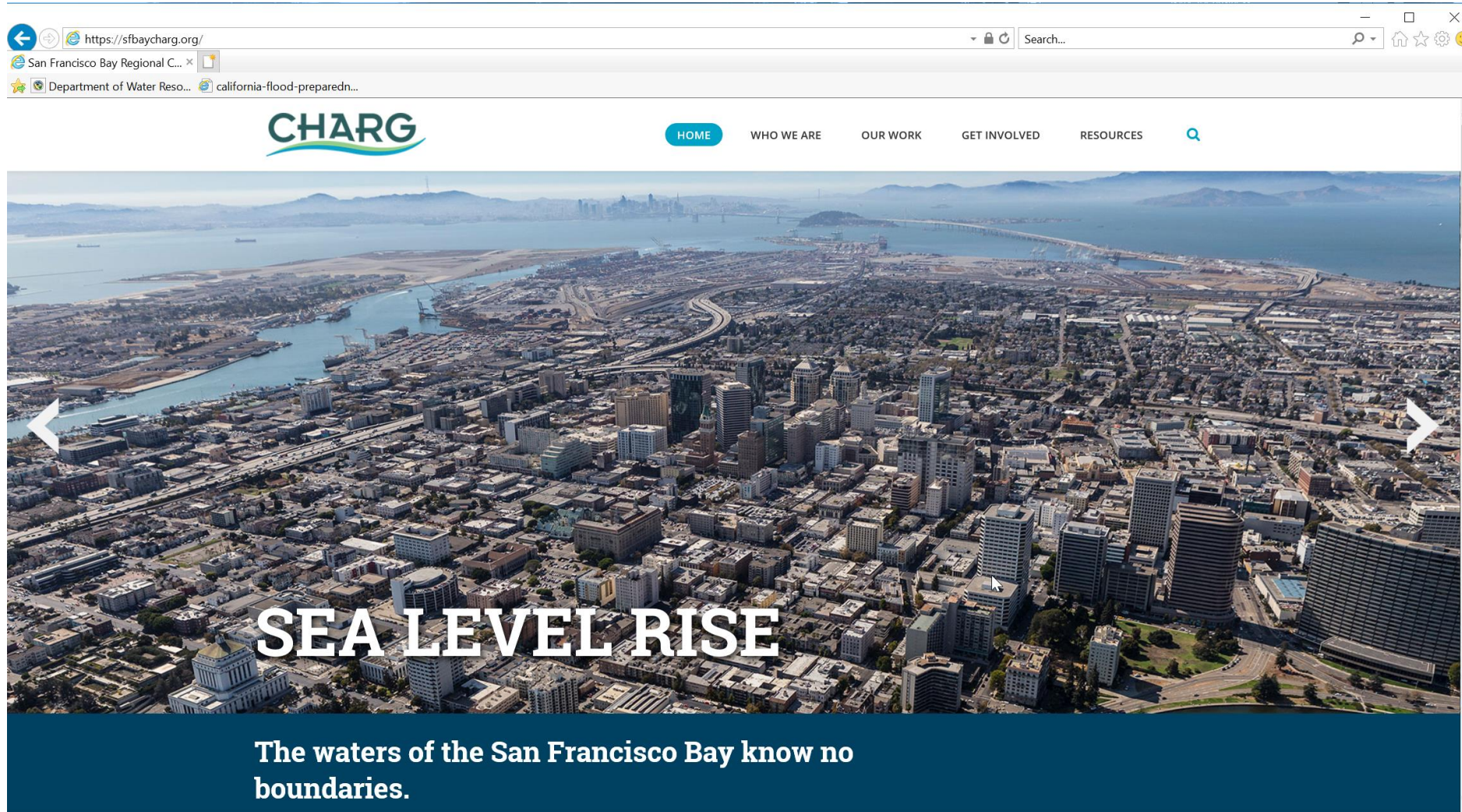
- **Leaders** who can remove long-term distractions and create regional buy-in.
- **A Unified Strategy** which considers sub-regional and regional solutions.
- Solid foundation in **Science and Engineering**.



Lead future generations to go beyond our current way of problem solving to create adaptable and enduring solutions.

Are we up to the challenge?

Questions?



Extra Slides

Overview Messages

- There are many SLR adaptation strategies being contemplated at different scales but we must first evaluate their impacts and effectiveness and then decide whether to keep them or disregard them as an alternative.
- We must think beyond a 50-year CIP horizon – what we do today must be able to adapt at least for the next 80+ years.
- All adaptation strategies need to be evaluated based on feasibility, technical practicality, environmental impacts, community acceptance and more using an all inclusive decision matrix.
- We must also plan to accommodate the H++ flood level (9.3 feet).

Key Takeaways

- Evaluate ALL possible adaptation strategies for its impacts on the entire Bay.
- Make decisions only after we fully understand the regional impacts of each strategy.
- Consider projects that reach beyond our existing governance constraints into grander regional solutions.

Technical Priorities Plan *Development*

- **Priorities reflect content from numerous sources**
 - 2016 CHARG prioritization matrix and workplans
 - June 2018 Workshop input and outcomes
 - July 30 CHARG-team Work Session at ACFCD
 - Calls or meetings with staff from SFEI, NOAA, BCDC
- **Detailed priorities developed over 5-month period**
 - Reflects input from many CHARG members

Tools: Software Capabilities

- Hydrodynamics
 - 2D water levels and velocities, forced by tides, discharge, and winds
- Waves
 - Wave generation, propagation, and attenuation
- Additional capabilities
 - 3D hydrodynamics
 - Water quality (e.g. salinity, nutrients)
 - Sediment transport & geomorphic change
- Exemplars:
 - Coupled software suites water quality: SCHISM, Delft3D, MIKE, UnTRIM

Projects: Applications in San Francisco Bay

- Domain & geometry
 - Extent – Bay & Delta
 - Resolution – well-resolved levees & floodwalls
- Model calibration & validation
 - Bay storm surge
 - Delta flood events
- Scenarios
 - Present day flooding
 - Future flooding with sea-level rise, increased rainfall & runoff
 - Operational flood forecasting
- Exemplars
 - Calibration & validation for multiple Bay storm surge events
 - FEMA & DHI (MIKE), USACE & Anchor QEA (UnTRIM)
 - Multi-decadal hindcast & extreme value analysis
 - FEMA & DHI (MIKE), USACE & Anchor QEA (UnTRIM)
 - Operational forecasting
 - CoSMoS / USGS (Delft3D)
 - Linked to biological assessment
 - CASCaDE / USGS (Delft3D)

Team: User Community

- Software costs
- Size of user community
- Institutional custodianship
 - Support ongoing development
 - Integrate updates with systematic version control
- Access to model inputs & outputs
- Exemplars
 - Free or low-cost: HEC-RAS, SCHISM, Delft3D
 - Institutional custodianship: DWR (SCHISM), USGS (Delft3D)
 - Input & methods comparison: Sea The Future

Topic 1. Communication Tools

- Why?
 - Make the case for a regional approach to SLR adaptation.
- Value: Bring support to regional efforts.
- Key Partnerships: BAFPAA, SFEI



Topic 2. Vulnerability Assessment White Paper

- Why?
 - Make the case for a regional approach to SLR adaptation.
- Value: Ensure investments address most critical vulnerabilities.
- Key Partnerships: BAFPAA, SFEI, BCDC



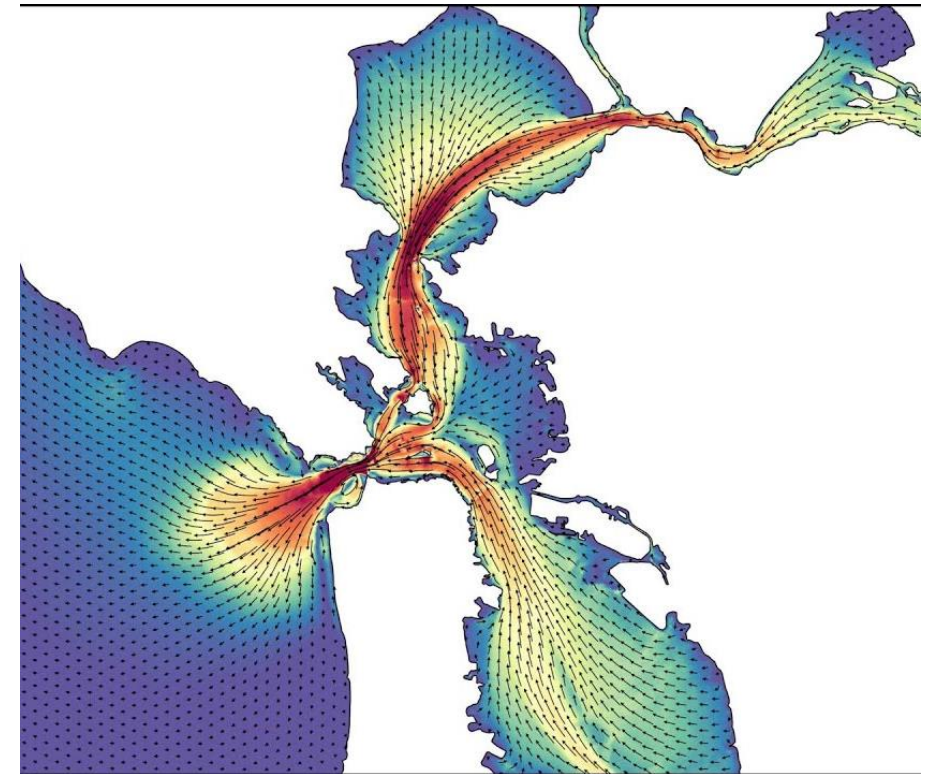
Topic 3. Document Shoreline Edge

- Why?
 - Resolve uncertainty on a bayside boundary for modeling purposes.
- Value: Ensuring regional uniformity.
- Key Partnerships: SFEI, SPUR, BAFPAA, ABAG, BCDC, Cities and Counties



Topic 4. Model Comparison

- Why?
 - Provide unified guidance on which models are appropriate for use in simulating SLR and how models compare to one another.
- Value: More informed decision-making.
- Key Partnerships: USGS, BAFPAA member agencies, UC Berkeley, FEMA



Topic 5. Model Regional SLR Adaptation Strategies

- Why?
 - Bookend the range of potential changes in water levels around the Bay for different amounts of SLR and different floodplain management scenarios.
 - Highlight the benefits of regional SLR adaptation approaches.
- Value: Demonstrates benefits of, and need for, regional coordination.
- Key Partnerships: USGS, ACFCD, UC Berkeley, BCDC/AECOM



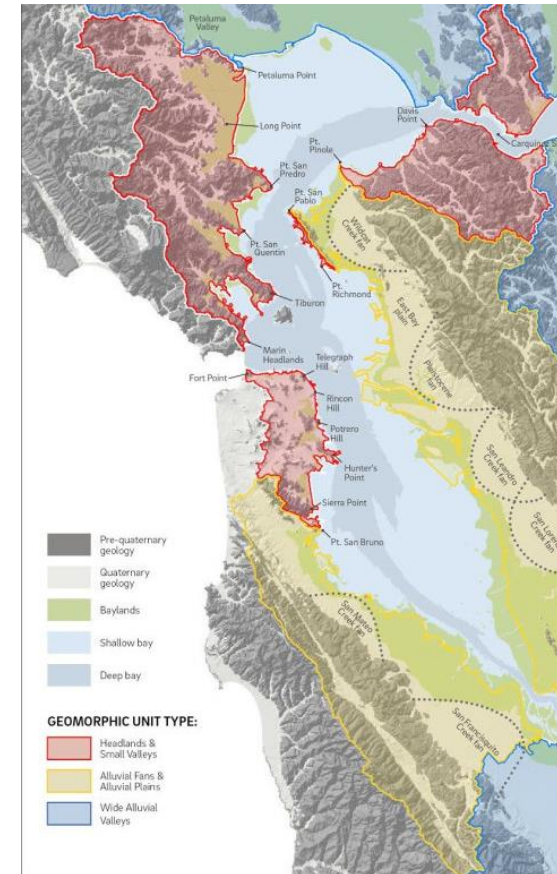
Topic 6. Analyze Combined Bay/Fluvial Flooding

- Why?
 - Rising seas will affect flooding at the mouths of creeks that drain to the Bay.
- Value: Inform asset vulnerabilities at creek mouths.
- Key Partnerships: ACFCD (local study already underway)



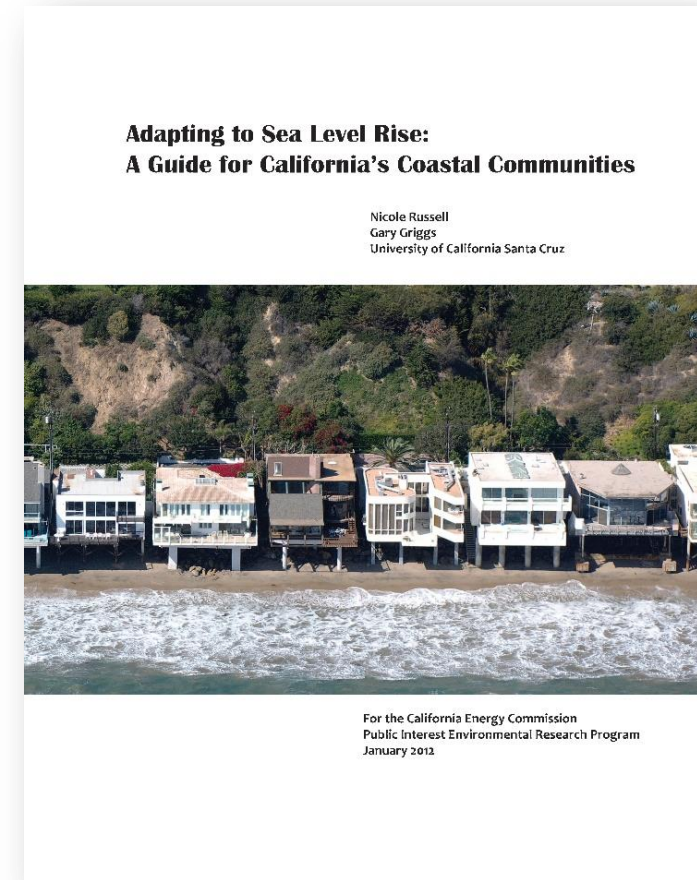
Topic 7. Thresholds for Subregional Coordination

- Why?
 - Multi-jurisdictional flooding pathways across shorelines require more regional coordination.
- Value: Identify critical elevations for coordination.
- Key Partnerships: SFEI, BCDC, USGS, SCVWD, BAFPAA



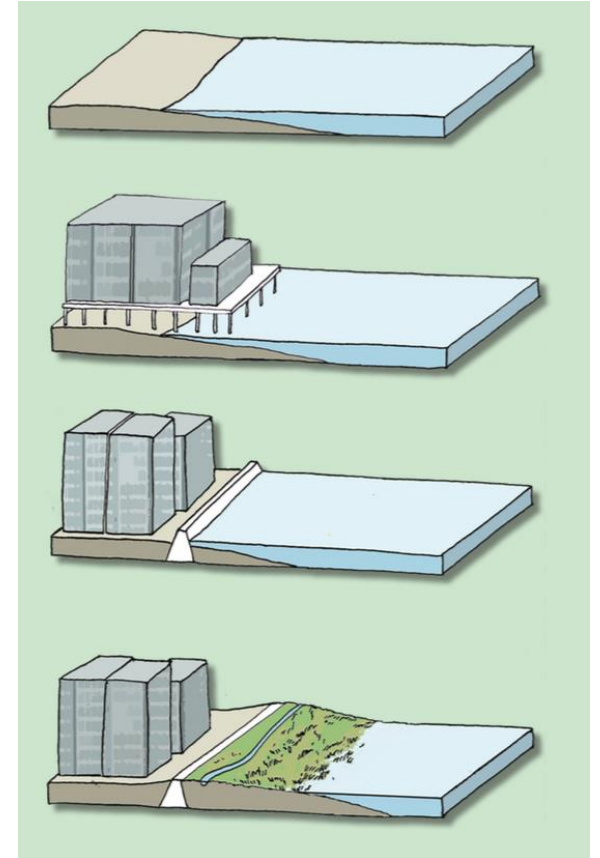
Topic 8. Adaptation Literature Review

- Why?
 - Provide careful consideration of adaptation strategies employed in other similar hydrologic and geographic contexts around the world.
- Value: Ensure best practices by learning from other regions.
- Key Partnerships: CHARG BAFPAA Subcommittee and Steering Committee, Universities



Topic 9. Plan for Regional SLR Adaptation Strategies

- Why?
 - Provide information and “building blocks” to future decision makers and stakeholders on regional adaptation, decision support, and tradeoffs.
- Value: Significant advancement of a regional strategy.
- Key Partnerships: CHARG and BAFPAA leadership, SFEI, BCDC, SCC, RbD, BARC, MTC, BayCAN, UC Berkeley, and others



CHARG is the regional voice for implementable climate change solutions

- CHARG identifies **regional solutions** to prevent unintended consequences and inform **cost-effective** and enduring investments
- CHARG **promotes a regional voice** to:
 - transform regional planning into effective implementation to create resilient communities
 - recommend federal and state funding priorities and create results at a regional scale
 - recommend permitting strategies to get projects built

History & Value of CHARG

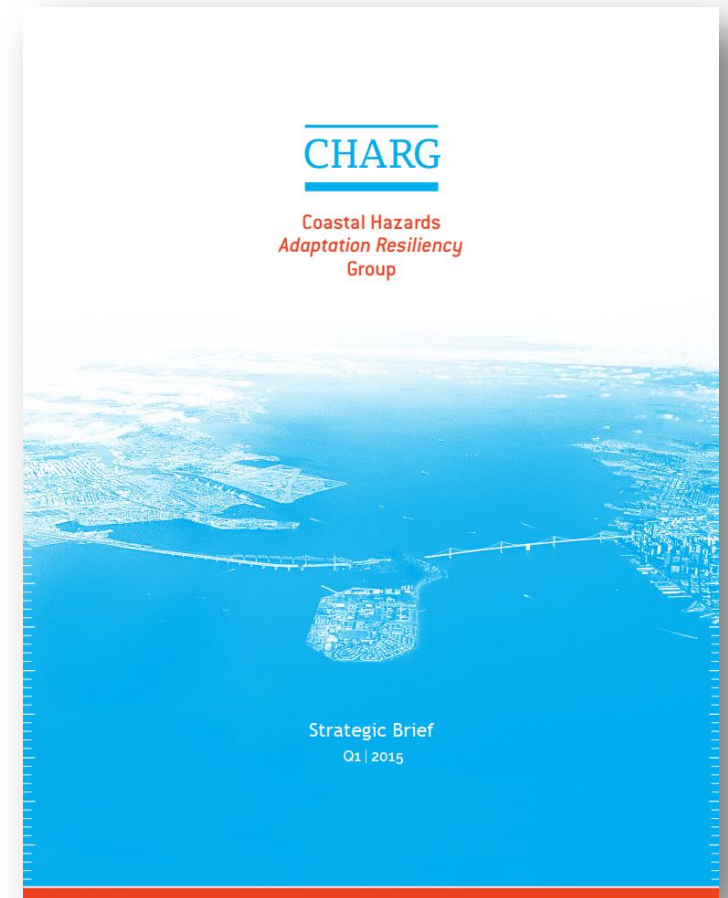
■ History of CHARG

- 2014
 - Founded by ACFCF & FEMA Region IX
 - Funded by ACFCF, FEMA, SCVWD
 - Developed Steering Committee of 13 federal, state, regional, NGO partners
 - Hosted 4 Stakeholder Meetings to Develop Strategic Brief

History & Value of CHARG (con't)

■ History of CHARG

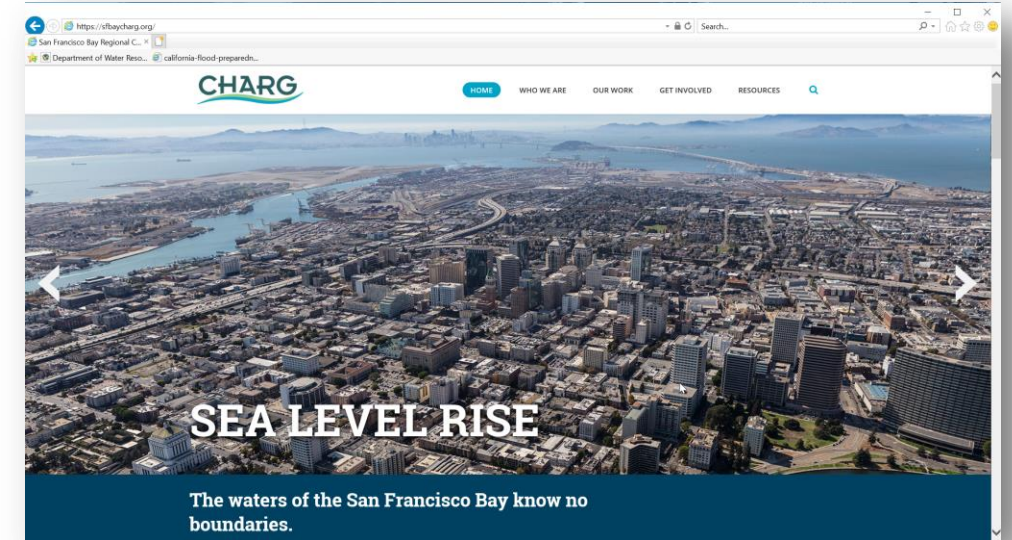
- 2014
- 2015
 - BAFPAA CHARG Joint Workshop (February 19)
 - Strategic Brief (Q1 2015): Collaborate across all levels of government and align resources to implement integrated and multi-benefit coastal hazards solutions to mitigate risk and improve and protect quality of life and property along the San Francisco Bay.
 - Developed Working Groups: Technical, Policy, Funding
 - Technical Priorities:
 - Broad reconnaissance
 - Sea level rise science
 - Regional adaptation strategies
 - Groundwater
 - Infrastructure and Coastal Erosion Vulnerabilities



History & Value of CHARG (con't)

■ History of CHARG

- 2014
- 2015
- 2016-2017
 - Working Groups Intermittently Continued
 - Contract + Funding Lull
 - ACFCFCD Re-Funds CHARG
- 2018 ReCHARG
 - CHARG Core Group Convened to ReCHARG
 - ACFCFCD, SCVWD, San Mateo County, MCFCD, CCCFCD, NCFCD, SFEI
 - Refocus on Technical Priorities from Implementers Perspective
 - Partner with Others to Inform Funding + Policy Priorities (eg. BayCAN, BCDC)
 - Now a Special Initiative of BAFPA (September 2018)
 - CHARG BAFPA Subcommittee + Steering Committee (Sept-present)
 - New [website](#) and draft Technical Priorities



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