

Creating a climate ready port

Climate vulnerability assessments &
resilience planning

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Haley & Aldrich

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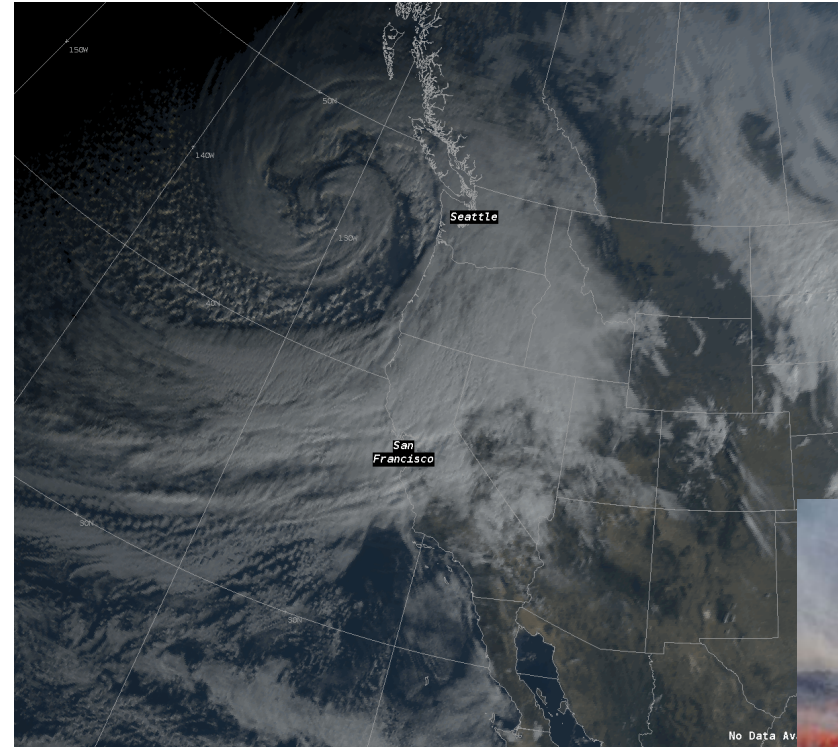
HALEY
ALDRICH

Agenda

- 1 Resilience in the face of climate change
- 2 Climate vulnerability assessments
- 3 Steps to resilience planning
- 4 Funding opportunities

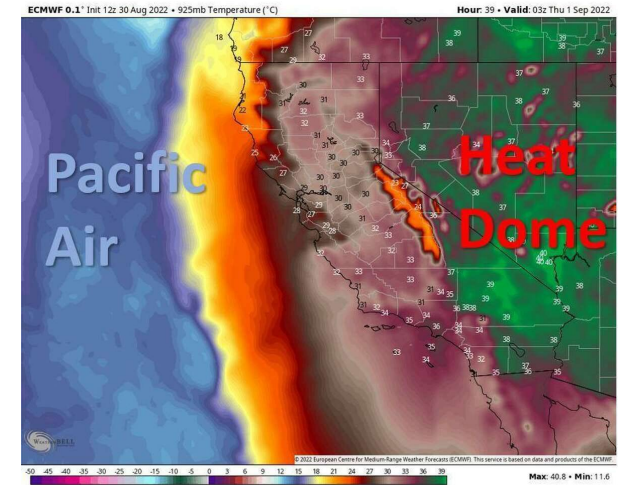
Climate change will amplify current hazards

- Storms
- Floods
- Landslides
- Heatwaves
- Fires
- Drought



NOAA, 10.24.21

SF Chronicle, 9.01.2022



Slow-onset hazards

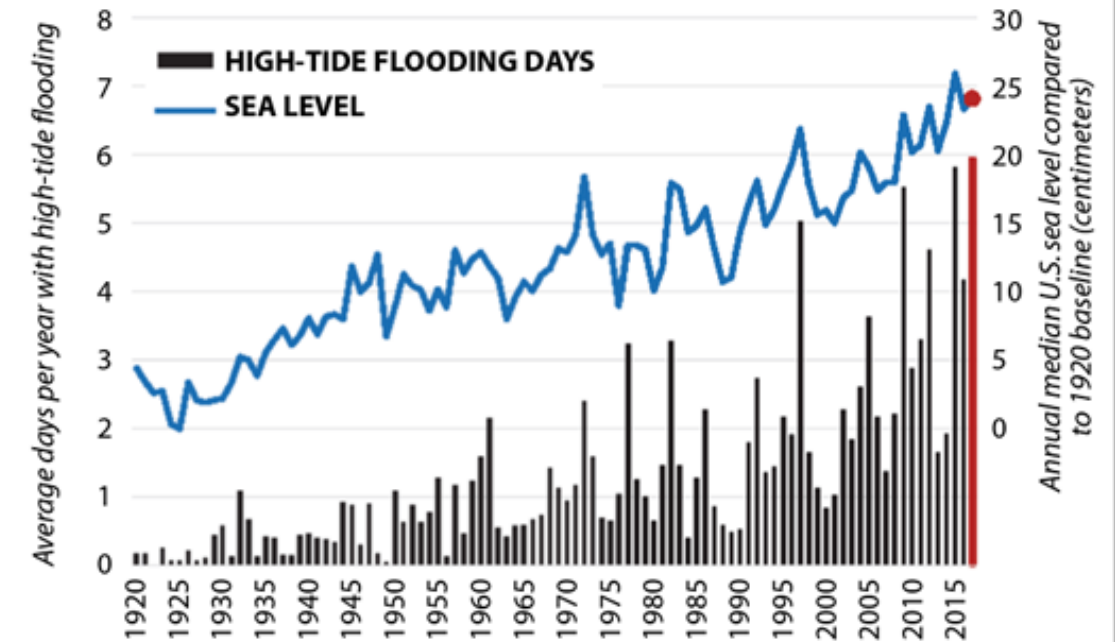
- Sea-level rise
- Groundwater rise
- Saltwater intrusion



Tidal Flooding Is Rising with the Sea

The frequency of high-tide flooding has doubled over the past 30 years along U.S. coasts, driven by rising sea levels. This chart shows the average number of days per year across tide gauges tracked by NOAA.

U.S. HIGH-TIDE FLOODING AND COASTAL SEA LEVEL
1920-2017



SOURCE: NOAA

InsideClimate News

What is resilience?

The ability to withstand or recover from stressor(s).



- Response – Emergency response, rescue, and meeting immediate needs of public
- Recovery – short- and long-term recovery of basic services and pre-disaster conditions
- Resilient port – long-term adaptation to changing climate; Only as resilient as connecting roads, infrastructure, and surrounding community

Climate vulnerability assessments and resilience planning



Action-oriented
planning process



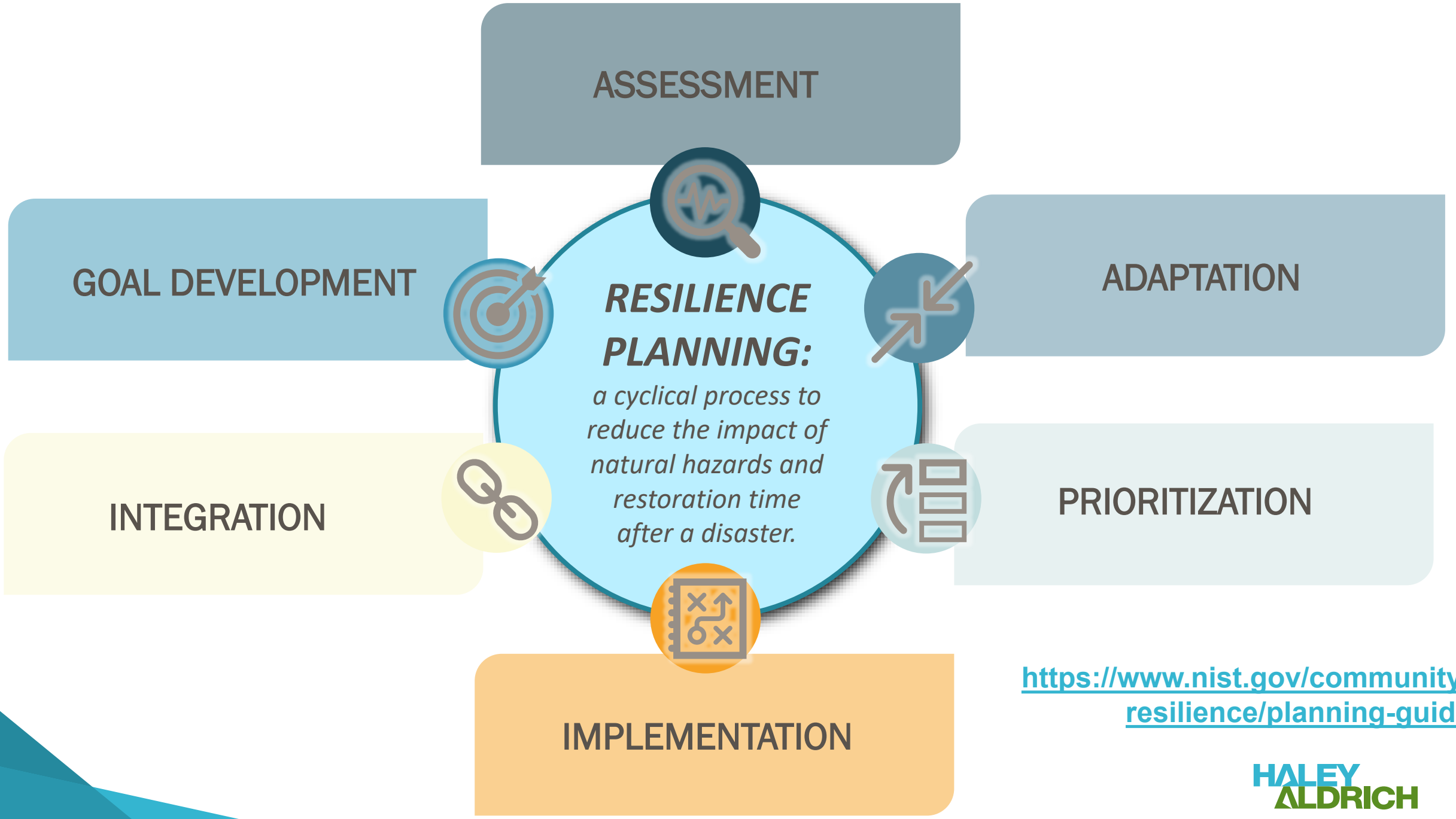
Uses trusted
information



Communicates
risk



Adaptive



ASSESSMENT

ADAPTATION

PRIORITIZATION

IMPLEMENTATION

INTEGRATION

GOAL DEVELOPMENT

**RESILIENCE
PLANNING:**

*a cyclical process to
reduce the impact of
natural hazards and
restoration time
after a disaster.*

<https://www.nist.gov/community-resilience/planning-guide>

GOAL DEVELOPMENT



- Engage **stakeholders**
- Identify **hazards, communicate risks**
- Determine **critical functions and timeline for adaptation and disaster recovery**

	4	3	2	1
Vulnerability rating	Mitigation required to prevent damage due to the identified hazard	Some mitigation measures employed, potential for damage can be reduced with further mitigation measures	Mitigation sufficient to reduce vulnerability at this time, risk should be monitored	Mitigation is sufficient for current planning hazard, may need to be re-evaluated in the future
Downtime	>72 hours downtime anticipated	>24 hours downtime anticipated	<24 hours downtime anticipated	no downtime anticipated
Example	Occupied space has standing water; equipment is damaged and requires major repair or replacement	Floodwaters in occupied space recede quickly; equipment requires minor repair	Floors could get wet, windows leak, lab space operational	N/A

Goal: Reduce building vulnerability to require less than 24 hours of building downtime after an event

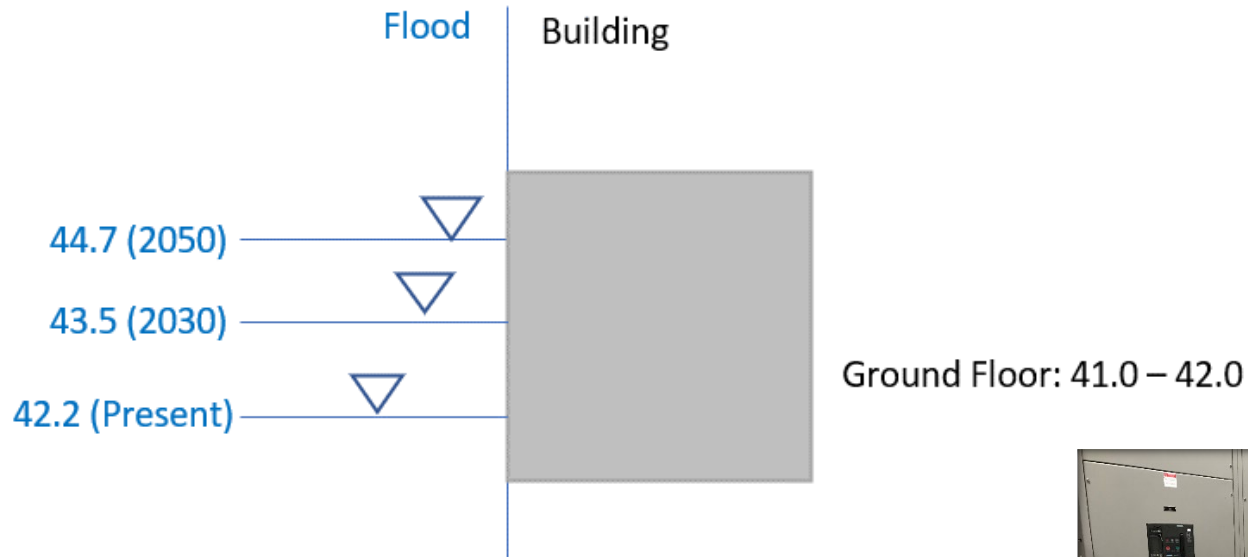
ASSESSMENT



- Existing conditions of facilities and operations
- Interdependencies and their vulnerabilities
- Anticipated performance during hazard event
- Existing capacities (human & material)

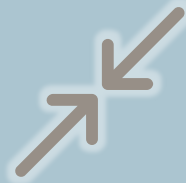
ASSETS/VULNERABILITIES

- Facilities
- Structural
- Nonstructural
- Equipment
- Material resources
- Human/personnel resources
- Financial resources
- External and internal relationships
- Public



ADAPTATION

- Identify **gaps** between goals and vulnerabilities
- Design **adaptation** and resilience **strategies** to close gaps
- Analyze **cost-benefit** of design options



PRIORITIZATION

- Address **critical facilities and operations & hazard timeline**
- Engage community and plan for **equity**
- Capitalize creative solutions that expedite **low-hanging fruit**



Resilience Summary

Vulnerabilities consist of potential flooding in the basement including mechanical room, and electric room. Fire pump and mechanical equipment is elevated off the ground floor on approximate 3-6" concrete pads. Electrical equipment is elevated off ground floor approximately 3" or is raised on the wall. Site grades in the area are below the predicted flood elevations which could limit access to the building in the event of a flood.

Current Vulnerability Rating

Hazard	Present	2030	2050
Precipitation Flooding	4	4	4

Recommended Resilience Measures

Recommended physical and operational resilience measures such as additional training, emergency planning, and additional flood barriers, including access to the tunnel, reduce the vulnerability for all events. Additional resilience measures include relocating vulnerable equipment and waterproofing the building envelope.

Vulnerability Rating with Recommended Resilience Measures

Hazard	Present	2030	2050
Precipitation Flooding	3	3	3

Flood

protect building from the hazard

- Extensive waterproofing
- Temporary flood barriers around perimeter
- Upgraded sump pumps
- Elevated mechanical equipment on dunnage

Rough order of magnitude:
\$2M - \$10M

Flood

remove building from hazard

- Elevate floor above flood elevation
- Replace façade
- Relocate mechanical equipment to roof

Rough order of magnitude:
\$10M - \$90M

IMPLEMENTATION



Fit the **pieces** of the puzzle **together**:
Invest **recommended adaptation measures** within a schedule that meets shared goals.

INTEGRATION



Integrate adaptation into:

- Capital improvement programs
- Deferred maintenance
- Budget planning
- Sustainability goals

22Q2	22Q3	22Q4	23Q1	23Q2	23Q3	23Q4	24Q1Q2	24Q3Q4	2025+
Program	Scoping/Costing								
		Implement operational measures							
				Implement capital in alignment with plans					

Engineered barrier solution



Funding opportunities

- Federal

- Inflation Reduction Act: \$2.5 billion for Port resilience grants & loans
- Infrastructure Investment and Jobs Act: \$1.2 Trillion
 - **FEMA**: Building Resilient Infrastructure and Communities (BRIC)
 - **EPA**: Healthy Communities Grant
 - **DOT**: Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT)
 - **DOT**: Rebuilding American Infrastructure with Sustainability and Equity (RAISE)
 - **NOAA**: Coastal Resilience Grants

- State

- \$54 billion in FY 23 for resilience
 - Integrated Climate Adaptation and Resilience Program (ICARP) ResilientCA.org
 - Coastal Conservancy
 - Department of Water Resources
 - CAL FIRE
 - Caltrans
 - Multiple other state agencies

Capacity building funds available

Thank you

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Extra slides



Example adaptation measures to increase resilience

Flood hazard (coastal or precipitation)

- Waterproofing
- Engineered flood barriers at entrances or perimeter
- Upgraded pumping capacity
- Elevated mechanical equipment on dunnage or rooftop
- Elevate floor above flood elevation
- Flood water detention
- Restore wetlands
- Seawall
- Replace façade
- Preventive maintenance
- Emergency response plans (divert/remove water, etc.)

Fire hazard

- Hardscape reconfiguration
- Landscape redesign with fire-resistant plantings
- Replace windows or façade
- Building fire suppression
- Preventive maintenance
- Emergency response plans (maintain moist vegetation, etc.)

Flood elevations

