

Adapting to Rising Tides project
www.adaptingtorisingtides.org

Oakland/Alameda Resilience Study

- Improve understanding of how to make assets and facilities resilient to multiple hazards
- Develop strategies to respond to earthquake and flooding hazards
- Refine and integrate information from the ART project and ABAG Airport and Infrastructure Resilience Study and apply to the Oakland / Alameda study area

The overarching goals of this study are to:

- Develop potential risk mitigation strategies for multiple hazards (earthquakes and sea level rise / flooding) that affect multiple assets
- Improve understanding of how to make assets and facilities resilient to multiple hazards – in this case, sea level rise and earthquakes
- Refine and integrate information from two projects - Adapting to Rising Tides and ABAG's Airport and Infrastructure Resilience Study
- Apply information from these projects to the Oakland/Alameda study area

Oakland/Alameda Working Group

- Provide best professional judgment
- Share agency perspectives and focus on priorities
- Assist in the collection of information and data on assets and services
- Regularly attend working group meetings

The working group plays an important role in carrying out this project. In particular, we are asking members of the working group to:

- Provide their best professional judgment regarding assets their organizations/agencies own or operate;
- Share agency perspectives and help identify priorities;
- Assist in the collection of information and data on assets and services; and,
- Regularly attend working group meetings

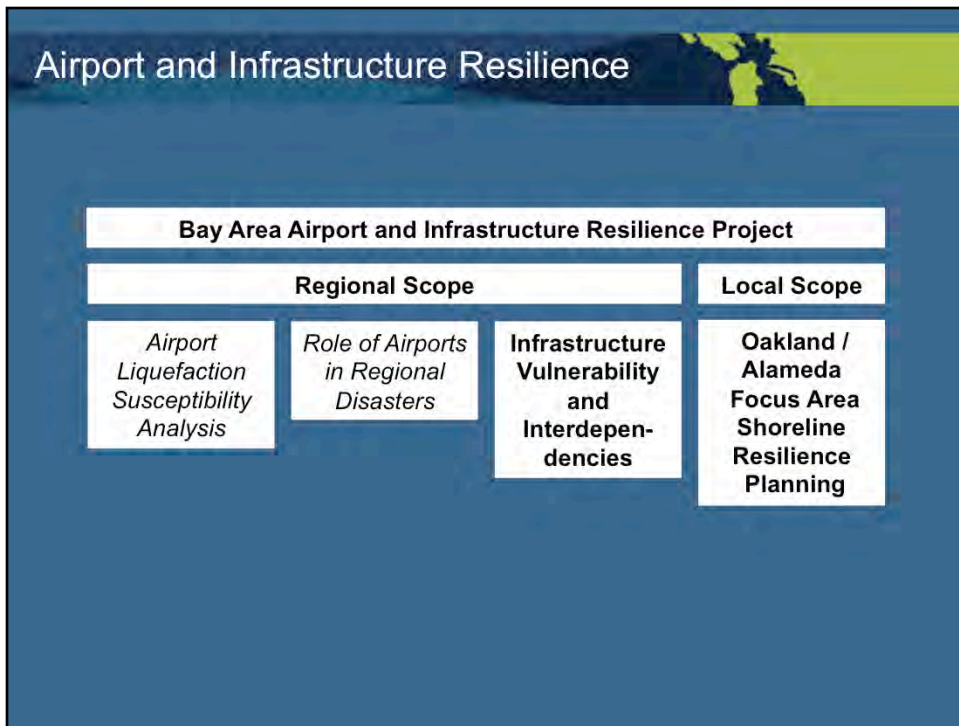
Oakland/Alameda Background

Foundational Projects

- **Airport and Infrastructure Resilience**
(ABAG Earthquake and Hazards Program)
- **Adapting to Rising Tides (ART)** – Alameda County Pilot Project (BCDC)

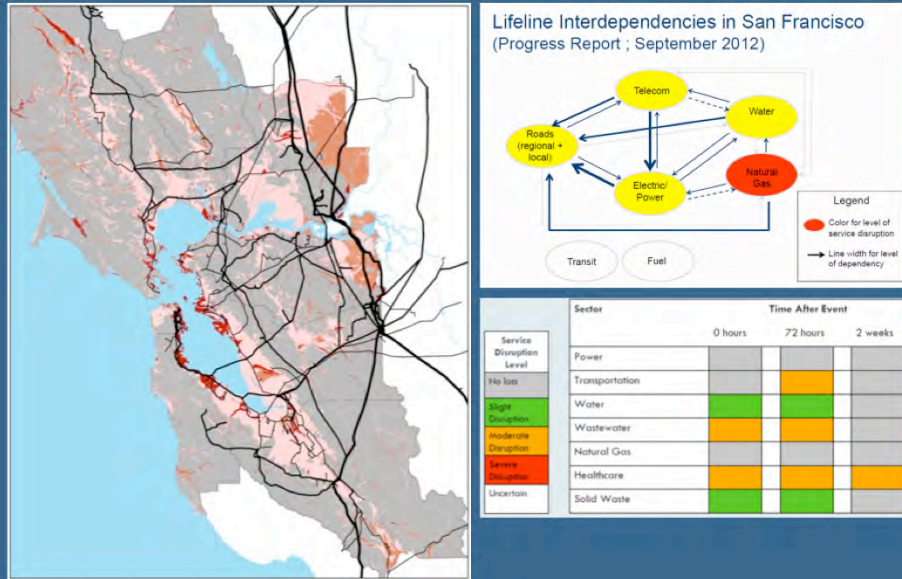
We will be building on information from two projects: ABAG's Airport and Infrastructure Resilience project and BCDC's Adapting to Rising Tides project.

Airport and Infrastructure Resilience



The Bay Area Airport and Infrastructure Resilience Project has four components and is being conducted at two different scales. At the regional scale, two studies have already been completed: the Airport Liquefaction Susceptibility Analysis, and a study on the Role of Airports in Regional Disasters. The third regional study, which is assessing the vulnerability and interdependencies of networked infrastructure in the Bay Area region, is in progress. The fourth component, which is local in scope, is the current project – Oakland/Alameda Focus Area Shoreline Resilience Planning.

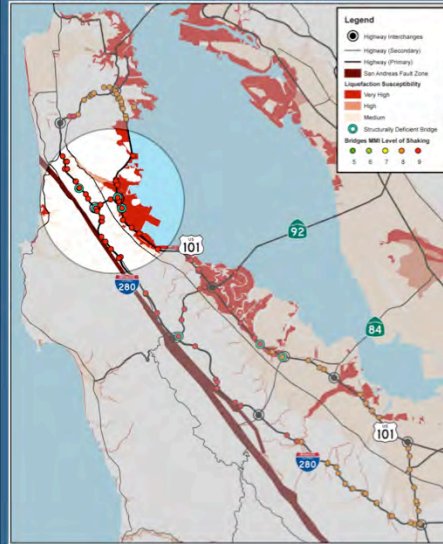
Airport and Infrastructure Resilience



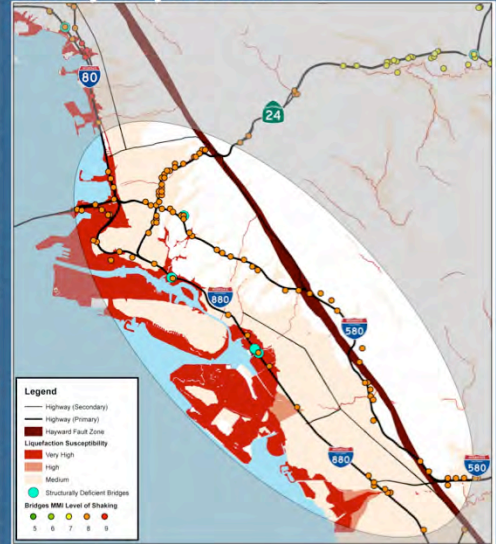
The Airport and Infrastructure Resilience project is identifying critical, networked infrastructure that overlays zones that are vulnerable to liquefaction or violent shaking during seismic events. It also identifies how these infrastructure systems are connected and dependent upon one another, in order to analyze how impacts to one system (e.g., electricity transmission) might affect another (e.g., oil refinery / pumping)

Airport and Infrastructure Resilience

Peninsula – San Andreas Event



East Bay – Hayward Event



This slide is an example of roadways in liquefaction zones for the San Andreas and Hayward faults. The green dots show critical bridges in liquefaction zones.

ART Project Objectives

- Create an integrative (cross-sector/ cross-jurisdiction) adaptation planning framework that can be applied in other planning processes
- Develop, test, and refine adaptation tools and processes to help the region address climate change
- Identify how adaptation planning can be scaled to different geographic extents – local, regional, state, federal



The ART project was designed as pilot project with several objectives in mind.

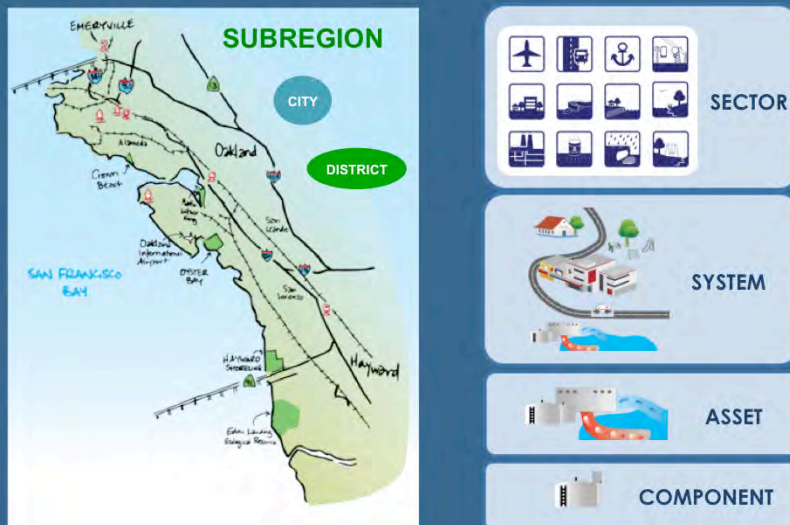
The first was to develop an approach for conducting vulnerability and risk assessments and adaptation responses that address multiple sectors and jurisdictions.

It was also really important that the project result in adaptation tools and processes that other geographic areas and agencies could use to do their own work.

A key question throughout the project has been to identify the relationship between the scale of the geographic area and the adaptation planning process. Which geographic scale works best to develop a vulnerability and risk assessment? Which scale is best for adaptation responses?

There are three major elements that were central to the ART pilot project and that will be carried through to the Oakland/Alameda project. These elements are addressed on the next three slides.

ART Planning Framework



The first element was a framework that crossed multiple scales. This applied both to geography and to the assets analyzed.

The project area included most of the Alameda County shoreline, from Emeryville to Union City, and encompassed 7 cities, the county, and multiple special districts.

The project included twelve asset categories or sectors (e.g., airport, ground transportation, utilities, parks, etc.), which were assessed at various scales. For example, in assessing wastewater, the project team looked at the entire system, then at individual 'assets' within the system, such as a wastewater treatment plant, and then at components of assets, such as individual pump stations within a treatment plant. The team conducted assessments at a variety of scales to determine which scale worked best to answer which questions.

ART Collaboration

Working Group plus Communication and Technical Subcommittees





| | |
|------------------------------|-------------------------------------|
| ABAG | City of Hayward |
| Alameda County (AC) | City of Oakland |
| AC Public Works | City of San Leandro |
| AC Community Development | City of Union City |
| AC Public Health Department | East Bay Dischargers Authority |
| AC Transportation Commission | East Bay Municipal Utility District |
| BART | East Bay Regional Park District |
| Bay Institute | H.A.R.D. |
| Bay Trail | Pacific Institute |
| CA Coastal Conservancy | PG&E |
| Capitol Corridor JPA | Port of Oakland |
| City of Alameda | San Francisco Estuary Institute |
| City of Emeryville | San Francisco Estuary Partnership |



The second element has to do with participation and engagement. In addition to a partnership with NOAA Coastal Services Center, the pilot project included agencies and organizations from the project area, who formed a working group. This group met regularly and participated in interviews, surveys, exercises, and project review throughout the process. Many of our working group members are here today and I would like to thank them for their engaged and sustained participation throughout the project.

ART Frames

Four frames were applied to each phase of the ART process

| Society and Equity | Economy | Environment | Governance |
|--|--|---|---|
| Addresses the effects on communities and the services on which they rely with specific attention to disproportionate impacts due to existing inequalities. | Addresses the economic values that may be affected such as costs of physical/infrastructure damages or lost revenues during periods of recovery. | Addresses the environmental values that may be affected, including ecosystem function and services, and species biodiversity. | Addresses factors such as ownership, management responsibilities, jurisdiction, mandates, and organizational structure that influence vulnerability and resilience. |
|  |  |  |  |

The third element of the ART pilot project which will also be part of the Oakland/Alameda project was the application of four themes, or frames, to every phase of the project. These frames are: Society and equity; Economy; Environment; and Governance. The team analyzed the potential effects of sea level rise and storm event flooding on these frames and kept them in mind when developing adaptation responses. In addition, the team developed white papers on equity in adaptation and governance in adaptation. These papers are available here: <http://www.adaptingtorisingtides.org/wp-content/uploads/2012/06/Equity-White-Paper.pdf> and here: http://www.adaptingtorisingtides.org/wp-content/uploads/2013/06/Governance-Issue-Paper_FinalMay2013_Full.pdf



The ART pilot project resulted in a number of products, such as reports and white papers detailing project findings and academic exploration of major issues in adaptation planning, as well as communication tools such as climate impact statements, profile sheets, and adaptation response 'cards.' All products are available at www.adaptingtorisingtides.org.

ART Next Steps

Moving from ART *Project* to ART *Program*

- Develop a portfolio of planning process tools, materials, and lessons learned
- Continue shoreline park adaptation planning
- Adaptation planning at various scales: scaling up and scaling down
- Providing technical assistance to support adaptation planning around the region

The next steps for the ART project is to transition into a program. Key components of the ART program include:

Providing adaptation tools and processes to help the region address climate change. The ART team is developing a portfolio of art products and resources that will be rolled out over the next year.

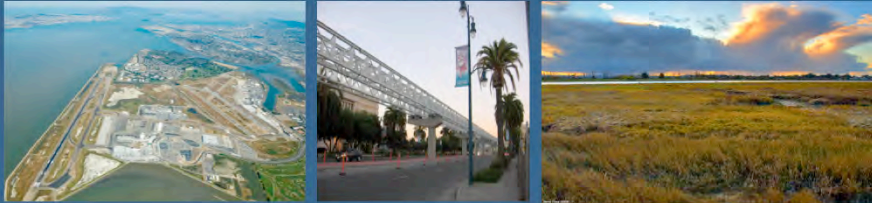
Continuing the work in Alameda County through our NOAA Coastal Fellow's project to assist shoreline parks develop and implement adaptation responses for specific park vulnerabilities.

Initiate adaptation planning at various scales – both focus area/neighborhood scale and regional scale. This work will be conducted collaboration with Association of Bay Area Governments and will seek to integrate adaptation and hazard mitigation planning.

Lastly, we will continue to support our ART working group members and project partners in communicating the project outcomes and in furthering the development and implementation of adaptation responses. And we will be providing technical assistance and support to others in the region that are engaging in adaptation planning.

ART Program

- Scaling Up
 - Regional Housing and Population Vulnerability (with ABAG)
 - Regional Passenger Rail “Hot Spots” Assessment
 - Overarching Adaptation Responses
 - Joint Policy Committee Resilient Shorelines Project
- Scaling Down
 - Neighborhood scale *Focus Area* adaptation planning
 - East Bay Regional Park District adaptation planning



The ART team is scaling up to work with ABAG and MTC on regional projects for rail and housing.

And we will be scaling down to work with stakeholders in Oakland, Alameda and Hayward on local planning issues.

ART Oakland/Alameda Objectives

- Understand asset-specific and focus area vulnerabilities and risk
- Refine information regarding shoreline conditions
- Develop adaptation responses that can address multiple hazards that lead to implementation
- Apply ART project information and tools in a local planning effort
- Build and strengthen relationships and organizational adaptive capacity within the focus area

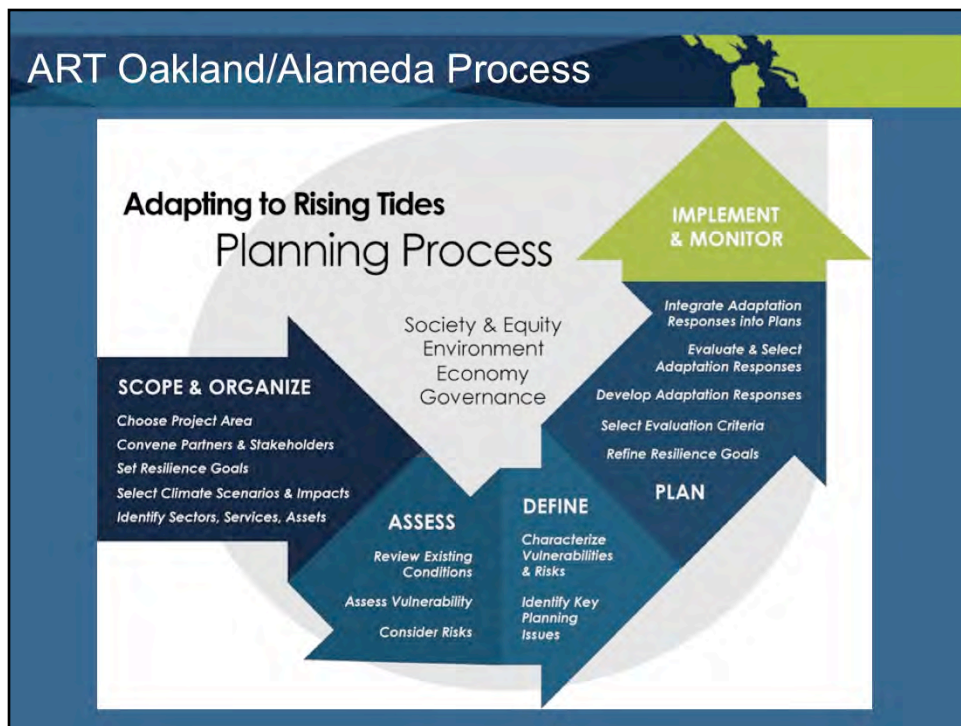
Oakland / Alameda project objectives

ART Oakland/Alameda

Why Oakland/Alameda?

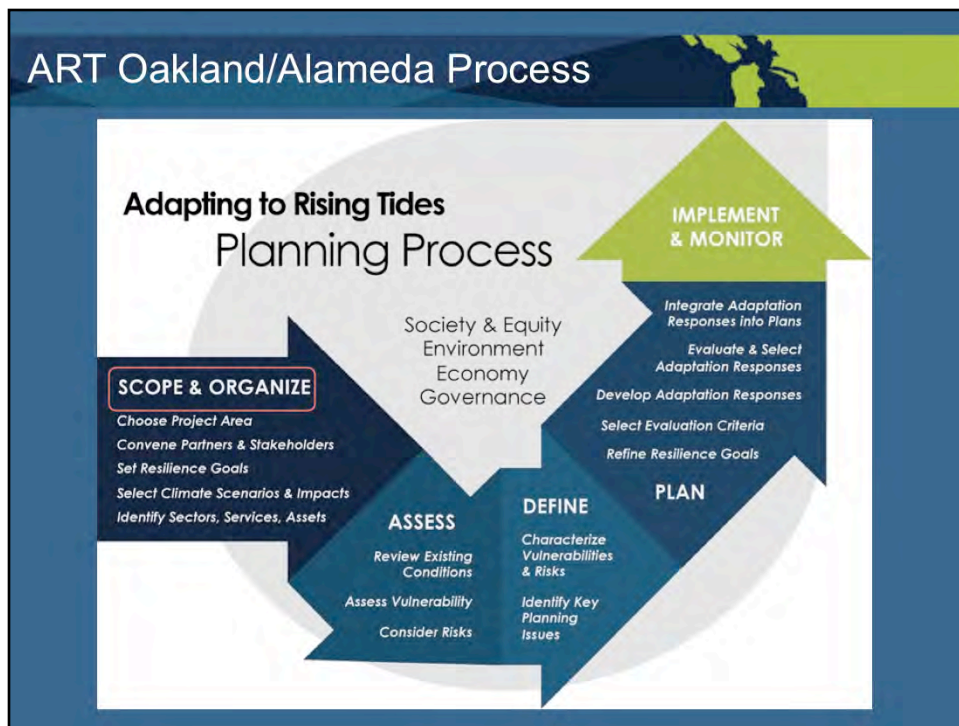
- **Vulnerable:** Early exposure, low adaptive capacity
- **Critical Assets:** Regionally significant assets and diverse land uses and natural areas
- **Challenging Issues:** Many interconnected assets requiring coordination in both planning and implementation
- **Existing Information:** Both the ART project and ABAG's project have developed information on many of the assets in the area

ART Oakland/Alameda Process



The ART project has a revised planning process based on input from the ART subregional working group. We are doing scope and organize today, will speed through assess because of existing information, and spend the bulk of our time together in the plan portion of the process. We will carry Society and Equity, Environment, Economy and Governance throughout the process.

ART Oakland/Alameda Process



Today we are focusing on the 'Scope and Organize' step, which has five components:

- Project area
- Convene partners and stakeholders
- Set resilience goals
- Select climate scenarios and impacts – for this study, we will also select seismic scenarios and impacts
- Identify sectors, services, and assets

We have drafts/ideas for each of these elements, except the resilience goals; we will share them today and get your feedback, and we will begin developing resilience goals later today.

Scope and Organize: Project Area

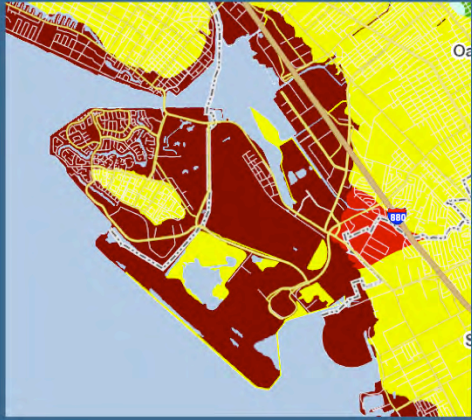


The red and blue lines delineate the proposed Oakland/Alameda Focus Area boundary.

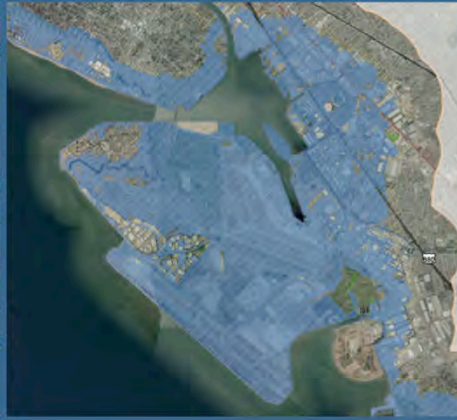
Scope and Organize: Multiple Hazards

Earthquake Liquefaction, Sea Level Rise, and Storm Events

Areas susceptible to liquefaction if shaken hard enough (Hayward or San Andreas event)



Areas potentially exposed to storm event flooding (100-year stillwater) with 55 inches of sea level rise



The climate and seismic scenarios will be described later in the presentation.

Scope and Organize: Asset List

- Community Land Use, Facilities, and Services
- Transportation
- Utilities
- Shorelines



Preliminary Asset list – please contact us with additions/changes. The ART pilot project grouped the assets – infrastructure, facilities, landscape features, etc., into four broad groups: Community Land Use, Facilities, and Services; Transportation (includes airport and ground transportation); Utilities (gas and electric, wastewater, stormwater/flood control, telecommunications); and shorelines.

Scope and Organize: Asset List

Community Land Use, Facilities, and Services

- Residential Land Use
- Commercial & Industrial Land Use
- Oakland Fire Station #27
- Alameda Fire Station #4
- Alameda Fire Station #29
- Alameda 911 Dispatch Center
- Senior Housing – Waters Edge Lodge
- Senior Housing – Villa Milano
- Peter Pan School
- Earhart Elementary School
- St. John Boys Home
- East Oakland Community Project - Crossroads
Emergency Housing
- Coliseum Arena Complex

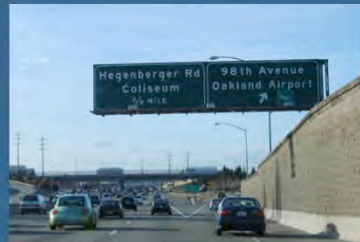


These are the Community Land Use, Facilities, and Services assets selected for analysis. Note that there are a few 'representative assets' – there are many schools and senior housing facilities, so rather than analyzing each of them, a couple of each category have been selected so that we can learn about general elements that make them vulnerable to the hazards addressed in this project. Please contact us with additions/changes.

Scope and Organize: Asset List

Ground Transportation

- Coliseum Amtrak Station & track alignment
- Coliseum/ Oakland Airport BART Station
- Coliseum/ Oakland Airport BART Connector
- Bay Farm Island Bridge
- SR-61 Doolittle Drive
- I-880 (Coliseum Way to 98th Avenue)
- Ron Cowan Parkway
- Harbor Way Parkway
- 98th Street
- Hegenberger Road
- Airport Access Road
- San Leandro Street



These are the ground transportation assets selected for analysis. Please contact us with additions/changes.

Scope and Organize: Asset List

Oakland International Airport

- Commercial Airfield – Southfield
- General Aviation – Northfield
- Terminal #1
- Terminal #2
- Executive Terminal at Northfield
- Control Tower
- Perimeter Dike
- Heating / Cooling Facility
- Cargo Facilities



The airport has been divided into nine component assets. Please contact us with additions/changes.

Scope and Organize: Asset List

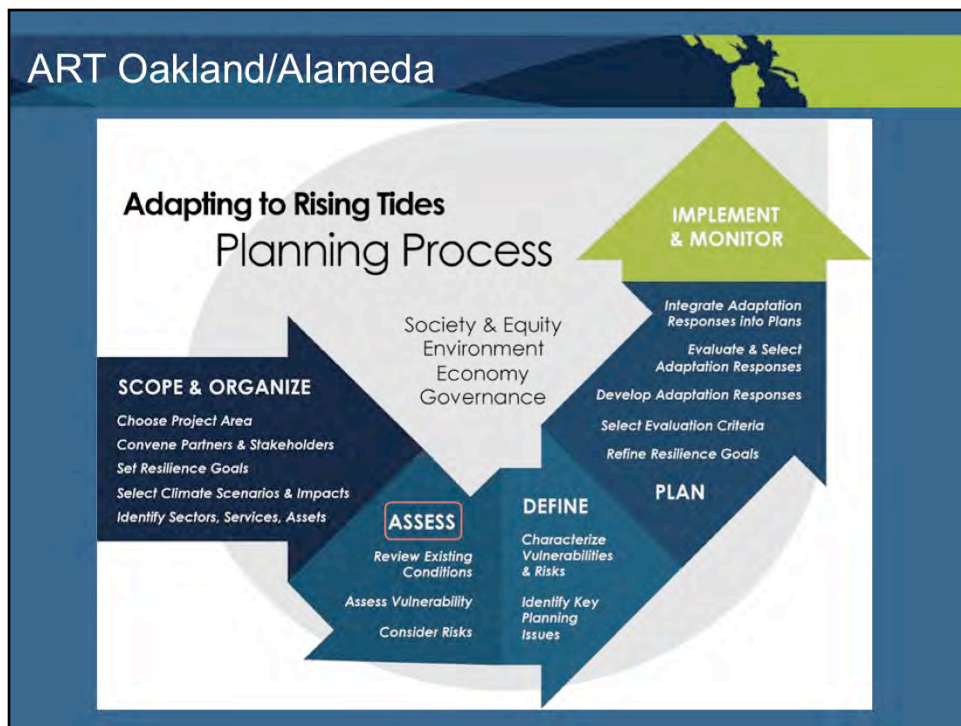
Shorelines

- MLK Regional Shoreline - New Marsh and Arrowhead Marsh
- San Leandro Creek
- Airport Channel
- Elmhurst Creek
- Damon Slough, Damon Marsh, and Edgewater Restoration



Several shoreline segments, including parks, flood control channels, and marshes, have been selected for analysis. Please contact us with additions/changes.

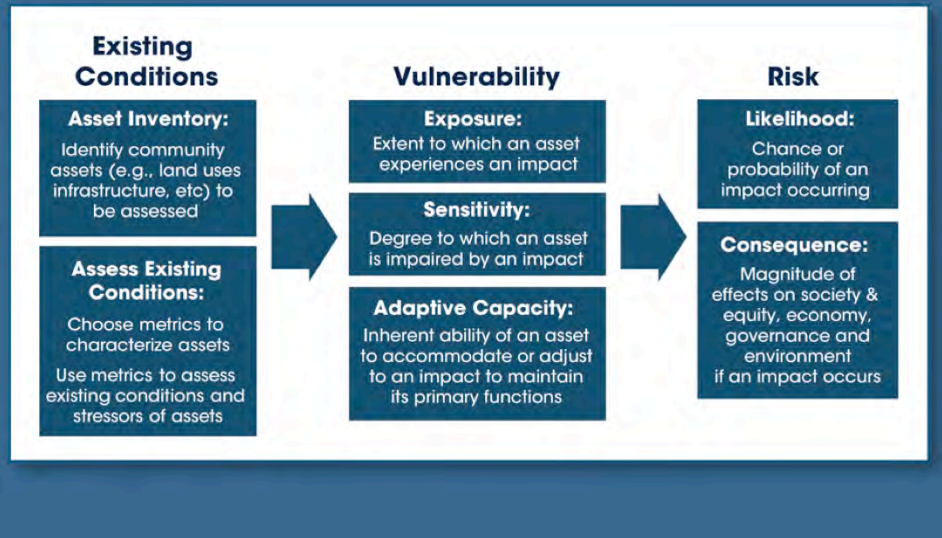
ART Oakland/Alameda



What we have to work with: ART vulnerability and risk reports, ABAG's information from the existing conditions and stressors, process tools

What we need from you - we are refining for asset specific information-expect phone calls/visits/emails

Assess



The Assess step includes identifying impacts, considering vulnerabilities, and determining risks. Vulnerability can be thought of as the combination of exposure, sensitivity, and adaptive capacity. The ART project assessment of risk focused on the consequences of an impact on the four frames – economy, environment, society and equity, and governance.

Assess

Metrics: Questions to ask yourselves, your agency, or neighbors to determine vulnerability and risk

Vulnerabilities

- Information
- Management Control
- Physical Qualities
- Functional Qualities

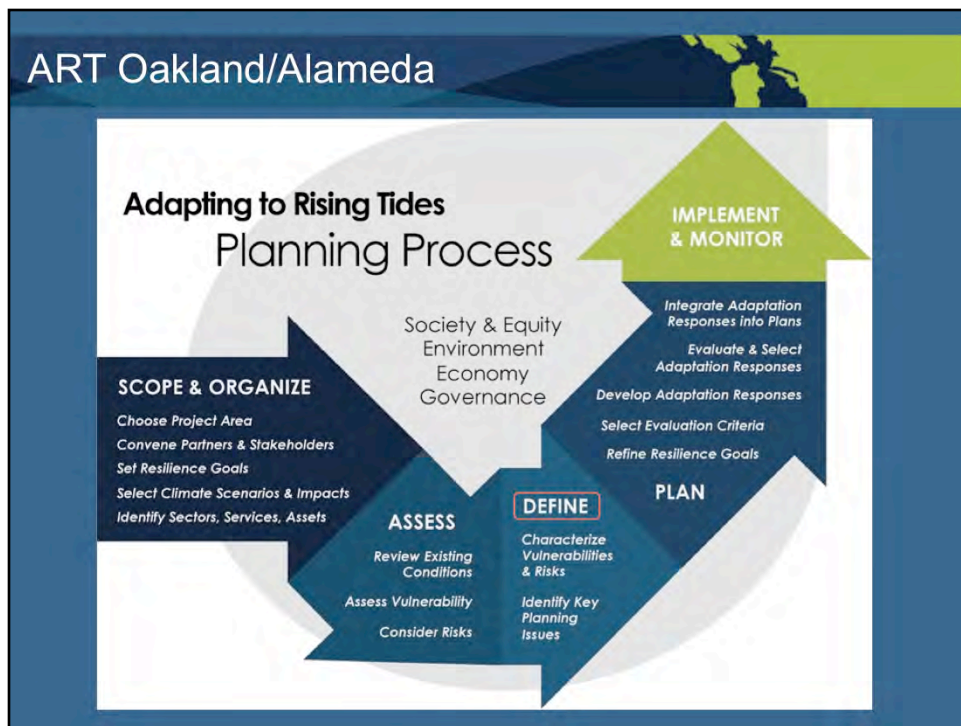
Consequences

- Society & Equity
- Environment
- Economy



Metrics are how we are searching for and organizing information about existing conditions, vulnerability, and risk. The questions fall into four 'types' of vulnerability: information, management control, physical qualities, and functional qualities; and questions about consequences representing three of the four frames (governance is addressed through the 'management control' vulnerability).

ART Oakland/Alameda



What we have to work with for the DEFINE Step: ART classifications for vulnerabilities.

What we will do together: weigh and explore key issues.

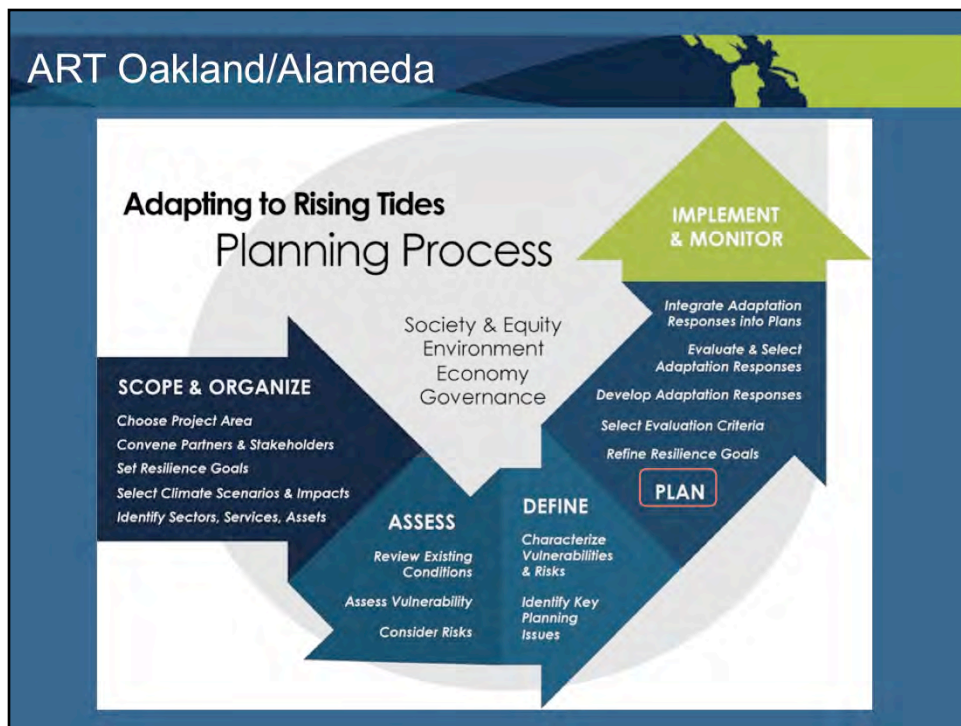
Define

- Organize vulnerability and risk findings, both within and across asset categories
- Clearly communicate key issues and outcomes of the V&R assessment
- Ease the transition from assessment into adaptation



The Define step supports the transition from assessment to adaptation. The ART project developed a vulnerability classifications approach as the bridge between vulnerability and risk and developing response strategies. Classifying vulnerabilities helps guide planners to effective actions. As an example, you cannot build your way out of an information vulnerability. This is not prioritization but helps sort the many and connected vulnerabilities.

ART Oakland/Alameda



What we have: ART Portfolio of tools and 65 Adaptation Responses in five categories

What we will do together: Refine responses, build suites that fit together, relevant evaluation criteria

Plan

The ART Adaptation Approach:

- Connect actions directly to assessment outcomes
- Present a number of possible actions
- Characterize actions by type, priority, and implementation scale
- Identify potential implementation partners and processes



When developing adaptation strategies to respond to the vulnerabilities identified in the assessment, it became clear that simple strategies describing an action would not work. When the project team presented the actions we had developed in a working group meeting exercise, the working group identified a number of things that would assist them in moving towards implementation and would make it less likely that these responses sat on a shelf once completed. These items included: the need to connect the actions to the assessment findings to make a case for taking action, the need to include the likely steps necessary to achieve the action and to include more than one pathway or action to take, to identify implementation and funding partners, the process that the action could be implemented with and also identified the importance of developing a phased strategy approach, with multiple actions presented in a sequence that would help to holistically address the vulnerability. The ART team felt that it was also important and helpful to characterize actions by type, priority, and scale or scales at which the action could be implemented.

Plan

Overarching Adaptation Response

Adapting to Rising Tides

Information Vulnerability

Vulnerability O4: There is a limited understanding of how dynamic baylands habitats such as tidal marshes, intertidal mudflats, and subtidal areas will respond to accelerating sea level rise, or how these habitats will be affected by shoreline adaptation responses (e.g., structural solutions such as levees) that may change tide, wave or sediment conditions.

| Action Number | Action | Action Type | Process | Possible Actors | Action Characterization |
|---------------|---|----------------------------------|-------------------------------------|---|---|
| O4.1 | Establish and support a regional research agenda to advance the understanding of how baylands will respond to accelerating sea level rise in light of declining sediment supply and limited space to migrate inland | Evaluation, Coordination | New Initiative | EBRPD, HARD, ACFWCDC, SCC, DFW, BCDC, RWQCB, Port, USACE, USFWS, FEMA, City, County, CBOs, Private Sector, SFBRA | Unlocking, Regional, High Priority |
| O4.2 | Research and test restoration and management actions that will improve baylands resilience | Evaluation | Project Planning and Design | EBRPD, HARD, ACFWCDC, SCC, DFW, BCDC, RWQCB, Port, USACE, USFWS, FEMA, City, County, CBOs, Private Sector, SFBRA | Unlocking, Regional, High Priority |
| O4.3 | Develop and implement a Regional Sediment Management Plan for the Bay | Coordination, Policy Development | Long-range Planning, New Initiative | CSMW, BCDC, USEPA, USACE, RWQCB, LTMS stakeholders, USFWS, NOAA, City DPW, Flood Control Agencies, Private Sector | Unlocking, Multi-benefit, Regional, High Priority |

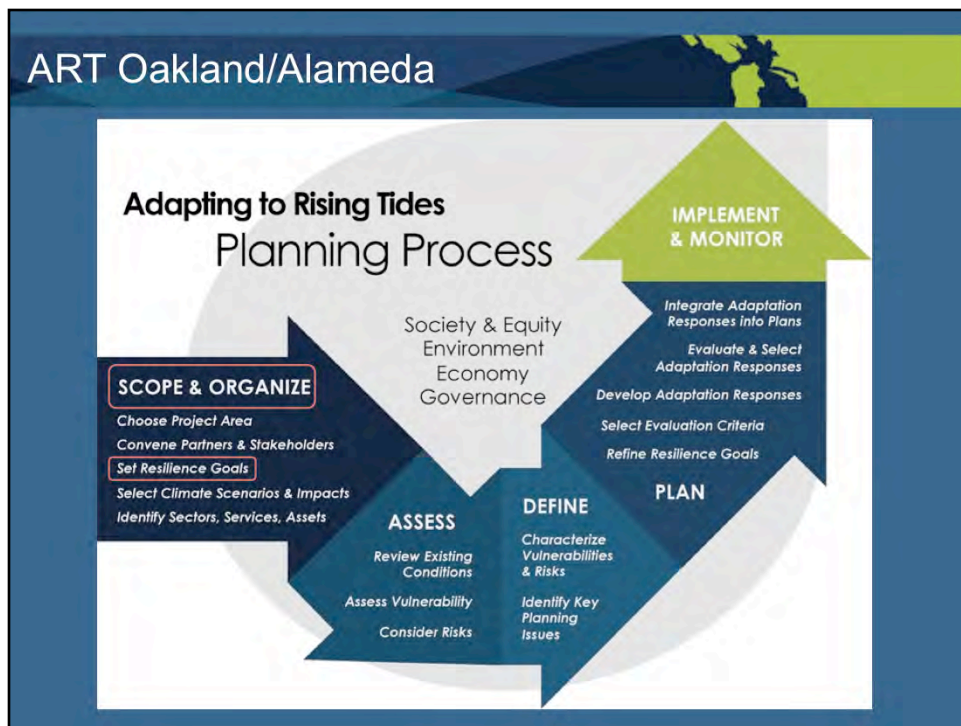
Adapting to Rising Tides Subregional Adaptation Responses - July 2013

Example response; to see the other 65, please visit www.adaptingtorisingtides.org

ART Oakland/Alameda

Questions on the study process?

ART Oakland/Alameda



Today we will work to complete the 'scope and organize' step by beginning to develop resilience goals for the Oakland/Alameda Study.

Resilience Goals

Develop resilience goals that:

- Include the four frames: economy, society and equity, environment, and governance
- Reflect a shared vision for the Oakland/ Alameda Resilience Study while reflecting the differences among the assets, services, agencies and organizations
- Should be designed to inform the prioritization of adaptation actions and implementation

These are goals for this process - you should be able to see your own agency's mission in the goal but some parts of it/them may be tangential to your goals. Goals can be specific or broad, near or long term.

Resilience Goals: Mapping Exercise

What values and functions does the focus area provide?

- Society and Equity: people where they live, people where they recreate, people where they work, public health and safety
- Environment: habitat, ecosystem services, endangered species
- Economy: goods movement, air passenger service, general aviation services, commuter movement, high cost for repair or replacement

Mapping exercise-what values does the focus area serve? How are they distributed? What assets do they rely on?

Resilience Goals: Mapping Exercise



Mapping exercise – place value/function stickers over parts of the focus area where those values or functions exist (e.g., 'habitat' over Arrowhead Marsh; 'people where they live' in NW portion of Bay Farm Island)

Resilience Goals: Mapping Exercise

Exercise Debrief - Lightning Round

- Words or phrases to include in Resilience Goals
- Values and vision of your agency?

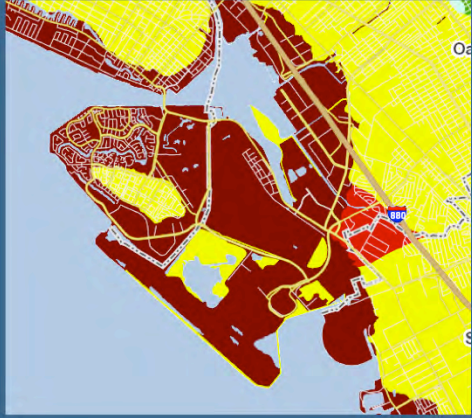


Mapping exercise-what values does the focus area serve? How are they distributed? What assets do they rely on?

Hazard Scenarios and Impacts

Earthquake Liquefaction, Sea Level Rise, and Storm Events

Areas susceptible to liquefaction if shaken hard enough (Hayward or San Andreas event)



Areas potentially exposed to storm event flooding (100-year stillwater) with 55 inches of sea level rise



Climate Impacts

Five potential climate impacts:

- More frequent floods
- Floods that last longer
- Permanent inundation
- Shoreline erosion and overtopping
- Elevated groundwater and salinity



The five climate impacts being investigated

More Frequent Floods

Today's extreme high water levels will occur more frequently, causing more flooding in flood-prone areas and new flooding in areas currently not at risk.

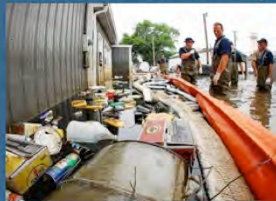
- Overwhelmed flood protection and storm drainage systems
- Disruption of day-to-day activities and emergency services
- Lost wages and lower productivity
- Increased repeat-loss claims and higher insurance rates



Floods Last Longer

Higher water levels, especially during storm events, will flood larger areas for longer periods of time.

- Changes in sediment processes that sustain marshes
- Die-off of tidal wetland vegetation
- Pollutant mobilization, e.g., from contaminated lands or hazardous waste sites
- Release of untreated/partially treated wastewater



Permanent Inundation

Higher water levels will cause frequent or permanent inundation of areas currently not exposed to the tide.

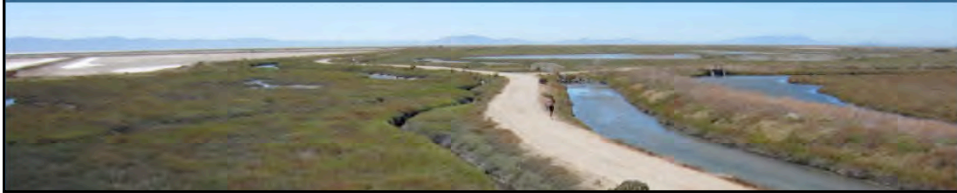
- More frequent maintenance, repair, or replacement of structures in, over, or on the edge of the Bay
- Relocation of communities, facilities, jobs and services
- Loss of trails, beaches, vistas, recreation areas and public access



Shoreline Erosion and Overtopping

Higher water levels will increase tide and wave energy leading to increased erosion, scour and overtopping during storm events.

- Failure of shoreline protection and flooding of private and public property
- Increased cost to maintain and repair shoreline structures
- Loss of tidal marshes and intertidal mudflats
- Loss of shoreline recreational opportunities



Elevated Groundwater / Salinity

Higher water level will result in higher groundwater levels and intrusion of salinity into freshwater coastal aquifers.



- Increased risk of liquefaction
- Reduced fresh water supply from coastal aquifers
- Lost capacity for gravity drainage and additional requirements for pumping
- Mobilization of pollutants from contaminated lands

Climate Scenarios

Six (6) ART Subregional Scenarios:

- Sea level rise of 16" and 55"
 - High tide (MHHW)
 - Storm event (100-year)
 - Storm event with wind driven waves

Multiple ART Focus Area Scenarios:

- ACFCWCD's six new inundation maps
 - Based on FEMA SF Bay Study water levels
 - Uses same high resolution LIDAR topography

The study will use the six ART subregional scenarios as well as six new inundation maps from Alameda County Public Works Department

Focus Area Scenarios

NEW sea level rise inundation maps help understand:

- Sea level rise from 6" to 60"
- Various storm events from 1 to 100 year

| | Sea Level Rise (inches) | | | | | | | | | | |
|-----|-------------------------|----------------|----------------|----------------|---------------|--------|----------------|----------------|---------------|--------|----------------|
| Map | 0 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 |
| 1 | 1-yr | | MHHW | | | | | | | | |
| 2 | 5-yr 10-yr | 2-yr | 1-yr | | MHHW | | | | | | |
| 3 | 25-yr 50-yr | 10-yr 25-yr | 5-yr 10-yr | 2-yr | 1-yr | | MHHW | | | | |
| 4 | | 100-yr | 25-yr 50-yr | 10-yr 25-yr | 5-yr 10-yr | 2-yr | 1-yr | | MHHW | | |
| 5 | | | | | | 100-yr | 25-yr 50-yr | 10-yr 25-yr | 5-yr 10-yr | 2-yr | 1-yr |
| 6 | | | | | | | | | | 100-yr | 25-yr 50-yr |

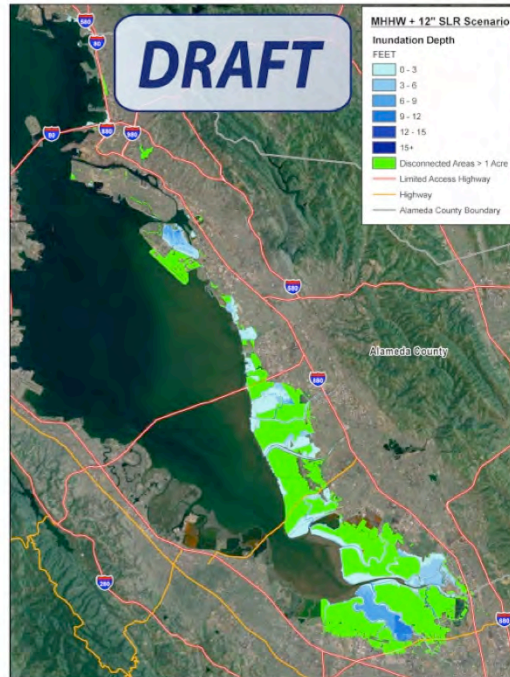
The six sea level rise maps represent different combinations of sea level rise and storm events (extreme water levels)

Scenarios #1

MHHW + 12" SLR

OR

1-year storm + 0" SLR



Scenarios # 2

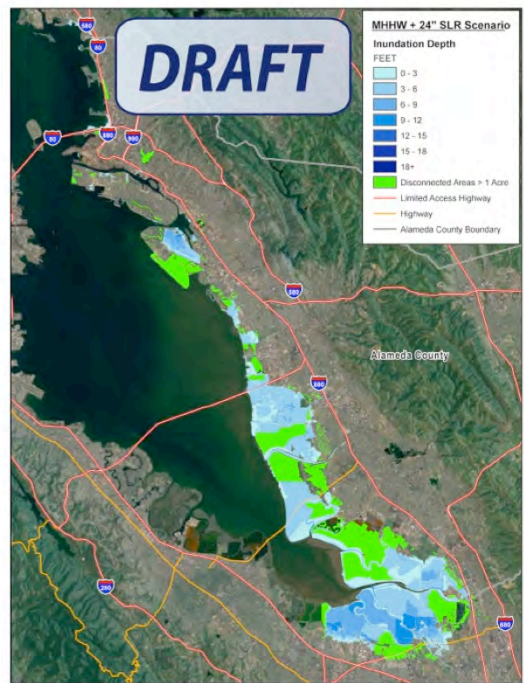
MHHW + 24" SLR

OR

1-year storm + 12" SLR

2-year storm + 6" SLR

10-year storm + 0" SLR



Scenarios # 3

MHHW + 36" SLR

OR

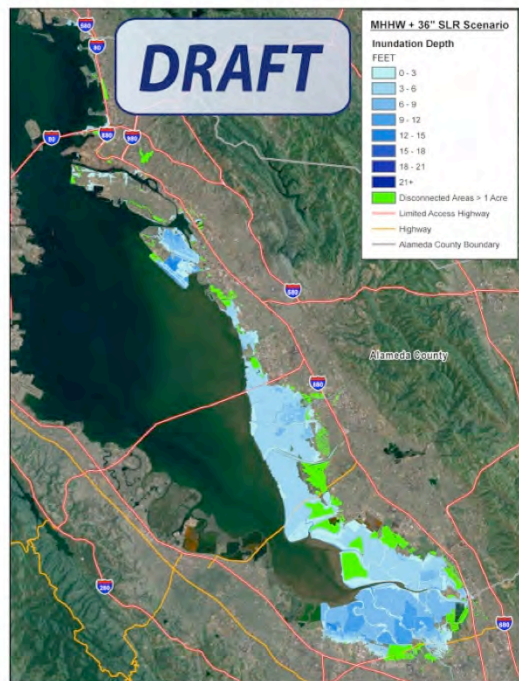
1-year storm + 24" SLR

2-year storm + 18" SLR

10-year storm + 12" SLR

25-year storm + 6" SLR

50-year storm + 0" SLR



Focus Area Scenarios

Revised “overtopping” analysis shows when and where flooding will occur on the shoreline.

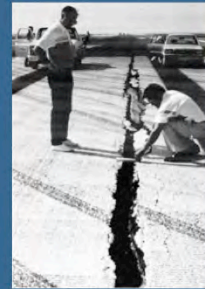


The six sea level rise maps represent different combinations of sea level rise and storm events (extreme water levels)

Earthquake Impacts

Three potential earthquake impacts:

- Ground shaking
- Liquefaction
- Tsunamis



The three seismic impacts being investigated

Ground Shaking

Oakland/Alameda focus area may experience severe ground shaking (MMI 9) in a Hayward or San Andreas event

- Wood-framed buildings shift off foundations
- Damage older air control and terminal facilities
- Break underground pipes and damage overhead power lines
- Ground cracks damaging runways, roads, or buried utilities



Liquefaction

Loose or sandy soils may liquefy if shaken long and hard enough, causing sinking, displacement, sand boils, or lateral spreading

- Significant threat to underground pipelines, runways, and road surfaces due to ground shifting
- Foundation movement or cracking due to soils shifting or loss of bearing capacity
- Levee damage and failure, increasing flooding risk




Tsunamis

Underwater displacements caused by offshore earthquake fault rupture or landslides

- Focus area is within maximum tsunami run-up inundation line
- Risk of inundation considered low in Bay Area

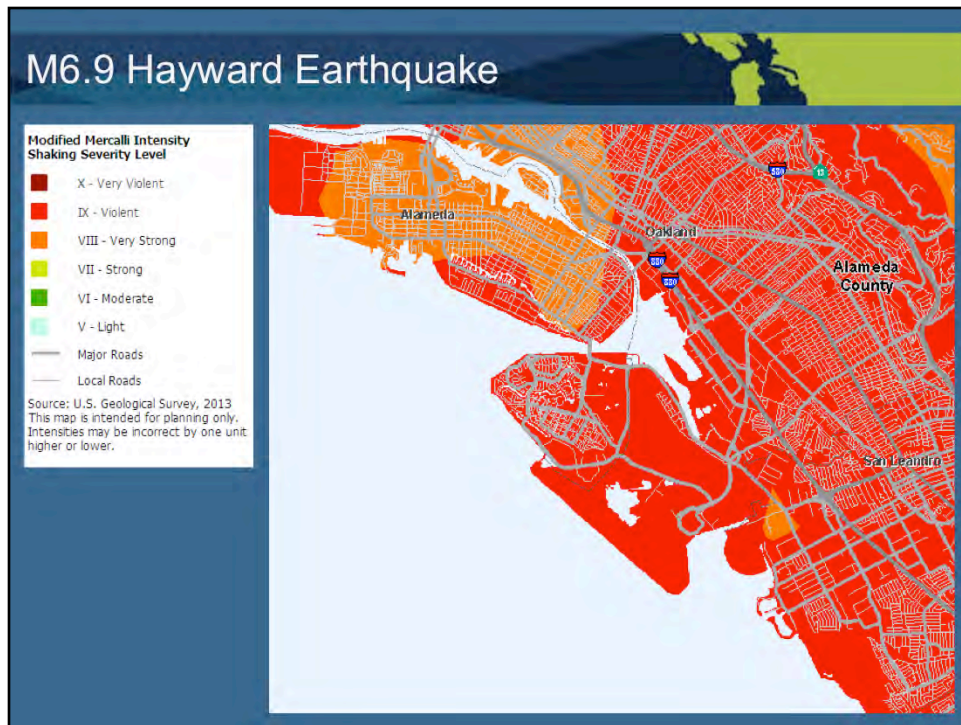


Earthquake Scenarios

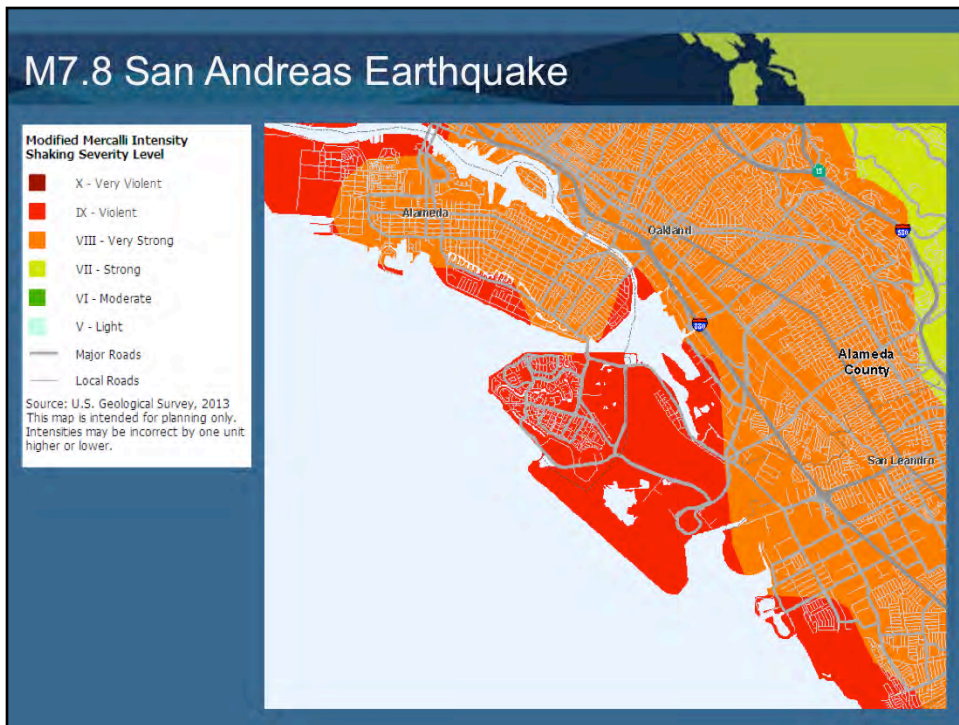


Two Focus Area Scenarios:

- M6.9 Hayward Fault
- M7.8 San Andreas Fault (Repeat 1906)
 - Both would cause violent (MMI IX) ground shaking in focus area



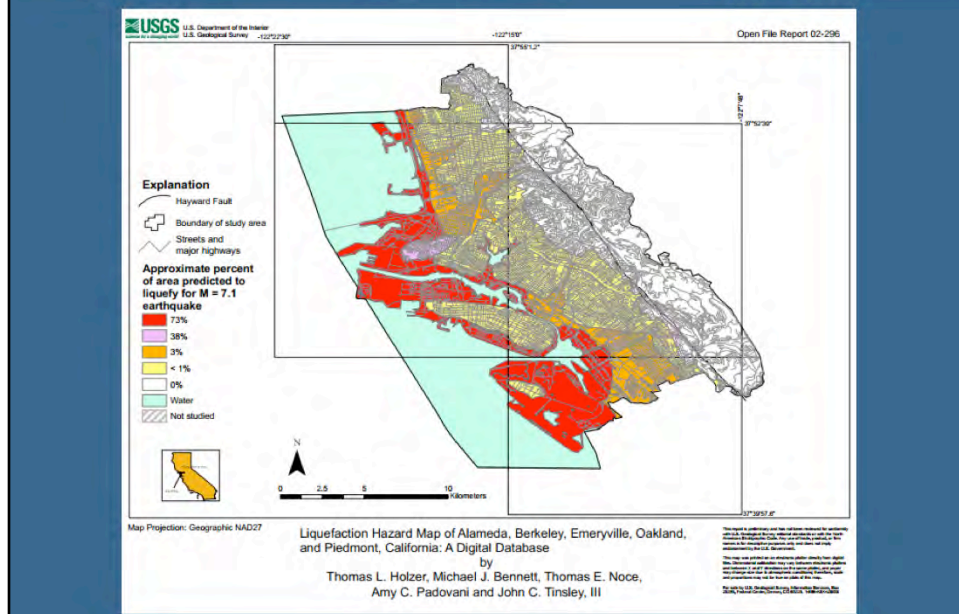
Most probable scenario, 31% probability of 6.7 or greater before 2036
Fault is closer to focus area
Magnitude expected is smaller because length of fault expected to rupture is shorter



21% probability before 2036, but would be a larger event. Attenuation from the greater distance from the fault to the site would cause the level of ground shaking to be similar in both scenarios, but the longer period of ground shaking could cause greater potential for building damage and soil liquefaction.

Soil conditions are such that shaking amplification from a major earthquake on either fault would be extremely high. Because of the Focus Area's relatively close proximity to both major faults and the likely epicenter of an earthquake on these faults, it will experience amplified

Liquefaction Susceptibility



Liquefaction is highly likely to take place here. This map shows the percentage of certain areas that are likely to liquefy in a M7.1 earthquake. Historic Bay Farm Island is composed of dense Merritt Sand, and has a very low liquefaction risk (less than 1% of the area is expected to liquefy in the scenario even). However, the rest of the focus area is composed of soils that have a much higher liquefaction potential. The majority of the focus area is in the highest liquefaction hazard zone (approx 73% of the area is expected to liquefy in the scenario event). The airport itself is built entirely on fill over estuarine deposits, including a tidal marsh, tidal flat, and shallow bay environments. These conditions

ART Oakland/Alameda Next Steps

- Project staff will draft resilience goals, develop and refine asset-specific information based on ABAG and ART prior analysis
- Next meeting: Early January
 - Confirm resilience goals
 - Review asset specific vulnerability and risk
 - Discuss ways to collect additional asset-specific information, e.g. surveys, interviews, data requests
 - Discuss relationships among assets

Process will be six meetings between now and next June; staff will produce a report next summer.

ART Oakland/Alameda

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Feel free to contact us with questions or input.