STRONGER HOUSING, SAFER COMMUNITIES

STRATEGIES FOR SEISMIC & FLOOD RISKS

SUMMARY REPORT March 2015

Cover graphic: Communities at Risk in Fragile Housing Map

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INTRODUCTION

In the Bay Area, retaining housing is crucial to expediting and ensuring an effective disaster recovery. Limiting catastrophic housing damage and keeping residents in their homes not only helps people who may lack the resources to effectively recover from a disaster, but keeps communities intact. Understanding where the most vulnerable housing types are located, especially those that house vulnerable community members, is a crucial first step to gain a more comprehensive understanding of multi-level risk within the region and to better understand where mitigation needs to be prioritized.

For the region as a whole to become more resistant to disasters, jurisdictions need comprehensive, actionable strategies to reduce vulnerabilities and build more resilient communities. The Bay Area Housing and Community Multiple Hazards Risk Assessment is a multi-agency project led by the Association of Bay Area Governments (ABAG) and the Bay Conservation and Development Commission (BCDC) designed to better characterize both the structural and community components of vulnerability, as well as develop strategies to address these specific vulnerability characteristics. The purposes of this project has been to:

- Understand the characteristics of San Francisco Bay Area housing and communities that increase vulnerability to earthquakes and sea level rise related flooding.
- Identify and assess housing and community vulnerability at regional and community scales.
- Develop strategies that reduce housing and community vulnerability to help the region meet its resilience, sustainability, prosperity, and equity goals.

The analysis was conducted with a focus on housing and the residents who live in it. There are other factors aside from housing integrity that influence a resident's ability to stay in a home, including impacts to infrastructure and availability of utilities, availability of jobs, and access to resources that fulfill daily needs, such as grocery stores, hardware stores, medical and childcare facilities. While these factors are extremely important, they are only touched upon briefly in this project and may be included in future analysis.

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HOUSING AND COMMUNITY VULNERABILITY

This chapter describes the assessment methodology to identify places where housing stock and portions of the community are particularly vulnerable to natural disasters. The approach concentrates on three aspects of vulnerability: identifying areas subject to hazards that have known potential to create damage at a level that could displace residents from their homes, housing types that are vulnerable to the natural hazard events identified, and community characteristics that makes it less likely that the population will be able to prepare for, respond to, or recover from a disaster. Following are the key considerations for each of these vulnerability types.

Description of Hazards used in the Vulnerability Analysis

Hazard	Description
Ground Shaking	MMI VIII or above, from expected ground shaking from a M7.8 (San Andreas fault) M6.9 (Hayward fault)
Liquefaction	Moderate Hazard
	High Hazard
Flooding	Current 100-year flood zone
	Future, sea level rise = 24”
	Future, sea level rise = 36”
	Future, sea level rise = 48”

Hazards

The vulnerability analysis considered three hazards: ground shaking, liquefaction, and flooding. The specific hazard scenarios used in the analysis are summarized in the table below.

Different earthquakes cause differing levels of ground shaking throughout the region. We selected shaking scenario maps from two previously modelled earthquake scenarios – a Magnitude 7.9 scenario on the San Andreas Fault and a Magnitude 7.0 scenario on the Hayward fault – and determined areas likely to experience ground shaking hazard levels of MMI VIII or above in these scenarios. The ground shaking hazard analysis only includes homes that are likely to be exposed to MMI VIII and greater ground shaking, as they are the most likely to be significantly damaged, thus displacing residents.

Liquefaction hazard levels were determined based on liquefaction susceptibility combined with shaking intensity (MMI). For the purpose of this project, moderate or high liquefaction hazard areas were examined using MMI from the future earthquake shaking scenario maps for the two scenarios outlined above (a San Andreas or Hayward event), as they are the most likely to cause major building damage that displaces residents from their homes.

Any amount of flooding has the potential to displace residents from their homes, as even short duration flooding can undermine building structures or create unsafe living conditions due to mold growth and contamination. Current flooding scenarios are based on published National Flood Insurance Program (NFIP) rate maps.

Definition of Fragile Housing Type Correlated with Hazard Type

Hazard Type	Fragile Housing Type
Ground Shaking MMI XIII or above	Hillside
	Single family cripple wall
	Single family house over garage
	Unreinforced masonry
	Multi-family cripple wall
	Multi-family weak story or open front
	Multi-family non-ductile concrete
Moderate Liquefaction Hazard	Insufficient foundation to withstand liquefaction, e.g., less than 10 floors
High Liquefaction Hazard	
Current flood zone	All housing types
Future flooding with sea level rise	

Future flooding scenarios are based on three regional inundation maps developed by NOAA Coastal Services Center. These three inundation maps are used to represent future flooding from different combinations of sea level rise and tide levels.

Key Considerations

Hazards can have significant impacts on communities that live in high hazard areas

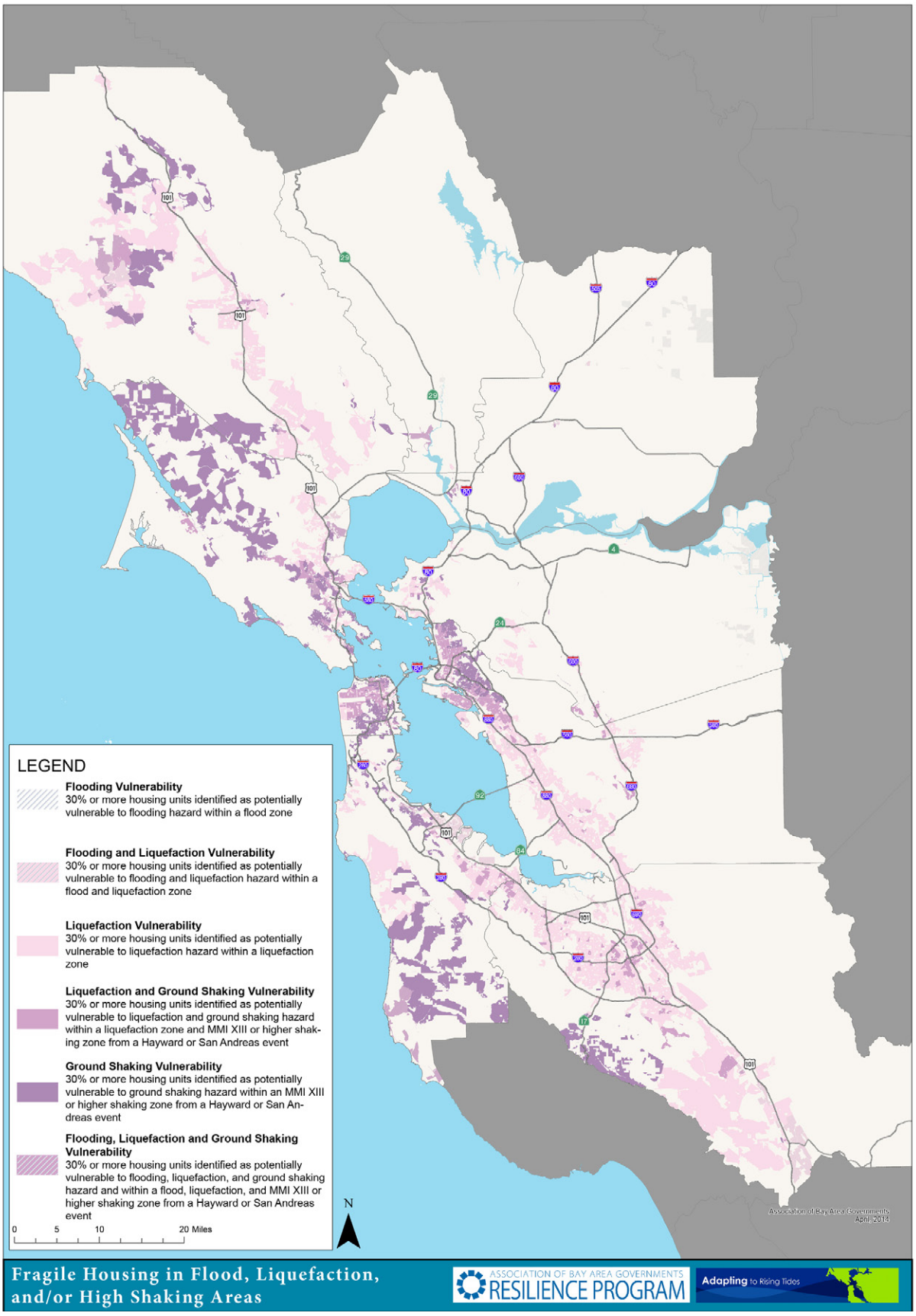
Much of the Bay Area is exposed to natural hazards that have the potential to cause significant impacts on the region and its residents. Seismic events may cause ground shaking or liquefaction, and many shoreline areas are vulnerable to existing flooding and may experience increased flooding in the future due to sea level rise.

Housing Vulnerability

Regional housing vulnerability was determined based on the eight potentially fragile building types commonly found in the Bay Area. The presence of vulnerable housing is indicated if 30% or more of housing units in a block group are a fragile housing type located in an area of ground shaking, liquefaction, or flooding hazard.

The fragile housing typology is designed to identify subsets of the Bay Area housing stock that are likely to possess characteristics that increase their vulnerability. This method identifies only what are deemed as the most fragile common housing structure types found within the Bay Area due to likely poor structural performance in an earthquake (i.e., those conditions most likely to cause housing to be red-tagged, requiring either demolition or extensive and lengthy repairs). This method considers critical combinations of material, system, etc. that indicate high fragility. As key data such as structure type (wood frame, concrete, etc.) is not widely available, proxies such as size, age, number of stories, and location that are associated with the most

BAY AREA HOUSING AND COMMUNITY MULTIPLE HAZARD RISK ASSESSMENT



Fragile Housing in Flood, Liquefaction, and/or High Shaking Areas

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Adapting to Rising Tides

Housing is generally built to life safety standards rather than shelter-in-place standards.

common fragile housing types are used. As different hazards interact with building types differently, hazards including liquefaction, ground shaking, and flooding are examined separately.

Each fragile housing type was mapped at the block group level to identify block groups with the characteristic combinations associated with each fragile housing type. Only block groups exposed to the identified hazard level for ground shaking, liquefaction, and flooding are flagged; vulnerability is a combination of exposure and fragility.

Key Considerations

Ground shaking can damage cripple wall and house-over-garage single-family homes

Many established residential neighborhoods have single-family homes that could be significantly damaged during an earthquake. These include homes with short unreinforced walls that raise the first floor 1-5 feet above ground level (i.e., cripple walls) and those that are two or more stories with garages or other large openings on the first floor. Renters and owners of single-family homes that are not retrofitted may be displaced from their existing neighborhood and could have a difficult time rebuilding or finding a replacement home.

Ground shaking can damage weak story, concrete and cripple wall multi-family housing

There are a number of multi-family housing types that can be significantly damaged if not properly retrofitted. This includes those with parking or retail on the ground floor (i.e., weak story or open front), those built from concrete that is not properly reinforced (i.e., non-ductile), or those that have short unreinforced walls that raise the first floor 1-5 feet above ground level (i.e., cripple walls). Depending on the number of units, damage to multi-family housing can displace a large number of residents, many of who are likely renters. In addition, multi-family housing does not always receive an equitable share of state or federal financial and technical assistance during recovery efforts and therefore may not always be rebuilt in a timely manner.

Housing is generally built to life safety standards rather than shelter-in-place standards

The current building code is designed to a life safety standard to protect occupant lives during an earthquake event. Newly constructed housing built to life safety standards can still be significantly damaged during an earthquake, displacing residents while the structure is repaired or replaced. The result is that some residents will not be able to shelter-in-place or remain in their homes, and that extensive repairs or rebuilding may be required.

Most foundations cannot withstand liquefaction

Homes located where soils are susceptible to liquefaction, (e.g., along the Bay shoreline or on fill) may experience significant enough damage during an earthquake to become uninhabitable. Most single- and multi-family homes under 10 stories are unlikely to have foundations stable enough to withstand liquefaction even if they can withstand ground shaking.

Most houses cannot withstand any amount of flooding

If exposed to flooding, most housing built in the Bay Area will be damaged as current construction materials, siting and design standards do not consider potential exposure to either water or salt. As sea level rises, existing and future housing of all types within FEMA identified Special Flood Hazard Areas (SFHAs) will be at

greater risk of flooding, and housing in low-lying areas not currently at risk may begin to experience flooding.

Houses with habitable space or critical equipment below-grade are at risk from flooding

Homes with habitable living space or critical building equipment below-grade are likely to be significantly damaged by flooding. Neighborhoods close to the bay shore, with existing drainage issues, such as street or basement flooding during current rainfall events or when groundwater levels are high, will be at even greater risk as the Bay rises due to sea level rise.

Community Vulnerability

Community vulnerability was determined using ten indicators. They represent socio-economic characteristics of individuals and households that affect their ability to prepare for, respond to, and recover from a disaster. These indicators collectively present a picture of a community's vulnerability. A concentration of these indicators is assumed to influence the recovery of a community. Key themes that emerged included age-related vulnerabilities, language and ethnicity vulnerabilities, cost-burdened residents, housing tenure issues, and access to resources.

Indicators were defined using the method developed by the Metropolitan Transportation Commission (MTC) to identify Communities of Concern (CoC). These indicators were applied to identify block groups with higher than average concentrations of the particular indicator and therefore may have higher concentrations of vulnerability.

Key Considerations

Many community members have limited access to resources

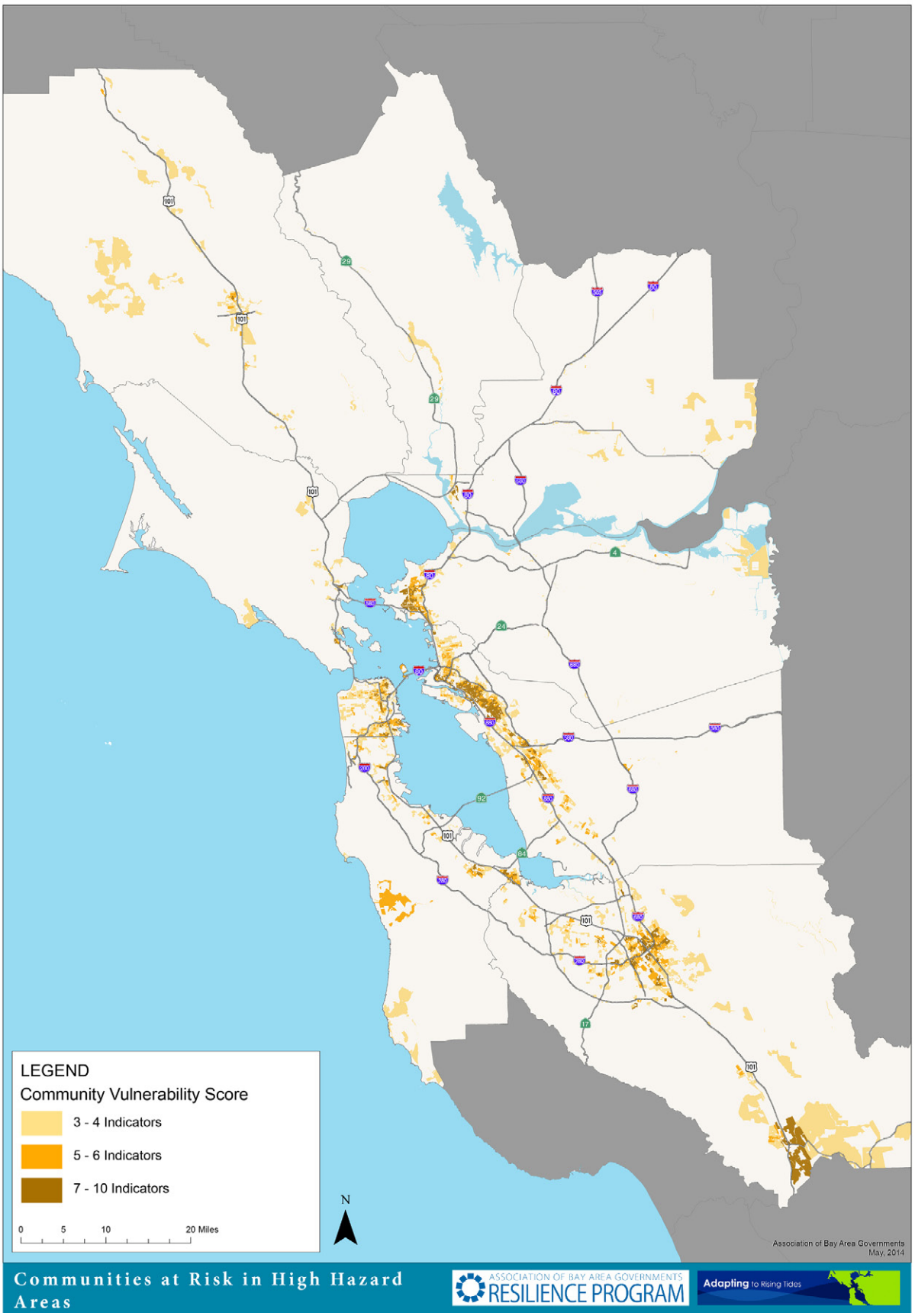
Many Bay Area residents that live in areas at risk from natural disasters are resource-constrained. This includes households that are low- and very low-income, households of all income levels that are housing and transportation cost-burdened, and transit-dependent households that do not own a car. Resource-limited households are less able to prepare for natural disasters, and if displaced from damaged homes, will likely struggle to find housing that is affordable and near to the jobs, schools, medical facilities, and other services on which they rely.

Housing affordability is an existing challenge that could hinder recovery

Indicators of Community Vulnerability

Indicator	Measure
Housing cost burden	% household monthly housing >50% of gross monthly income
Transportation cost burden	% household monthly transportation costs >5% of gross monthly income
Home ownership	% not owner occupied housing
Household income	% households with income <50% AMI
Education	% persons > 18 years without a high school diploma
Racial/Cultural Composition	% non-white
Transit dependence	% households without a vehicle
Non-English speakers	% households where no one ≥ 15 speaks English well
Age - Young children	% young children < 5 years
Age – Elderly	% elderly, > 75 years

BAY AREA HOUSING AND COMMUNITY MULTIPLE HAZARD RISK ASSESSMENT



Housing affordability is an existing challenge that will be compounded after a natural disaster.

Housing affordability for both renters and owners is an existing challenge in the Bay Area that will compound the number of community members displaced by a natural disaster. Much of the region is cost-burdened with regard to housing already, spending 50% or more of income on housing. After a disaster, if many housing units are lost, a constrained market may drive up the cost of housing even further. Loss or damage of housing that results in increased costs to either renters or home-owners will likely increase the number of permanently displaced Bay Area residents as finding housing that is affordable and near jobs, schools, medical facilities, and other services on which they rely will be challenging.

Renters have limited ability to improve their housing resilience

Many Bay Area residents that live in areas at risk from natural disasters are renters. Renters have a limited ability to improve the housing in which they live and often do not have hazard insurance to protect themselves and their belongings in case of a disaster. Communities with a large number of renters, and in particular resource-limited renters, will need to assist these residents both during a disaster (e.g., with shelter-in-place facilities), as well as post-disaster with finding interim, affordable housing to avoid the permanent displacement of renters from communities due to damaged housing.

Many community members have limited or inadequate information about hazards

Access to timely, correct, and meaningful information both before and after a natural disaster can be challenging in all communities and can be a particular challenge in communities that are ethnically and culturally diverse, and where there is a large number of households in which English is not the primary language spoken. Additionally, in the Bay Area many of these same community members are resource-constrained renters who are often living in overcrowded housing. Damage to housing during a natural disaster can lead to a significant amount of displacement and a struggle to find housing that is affordable and near enough to jobs, schools, medical facilities, and other services.

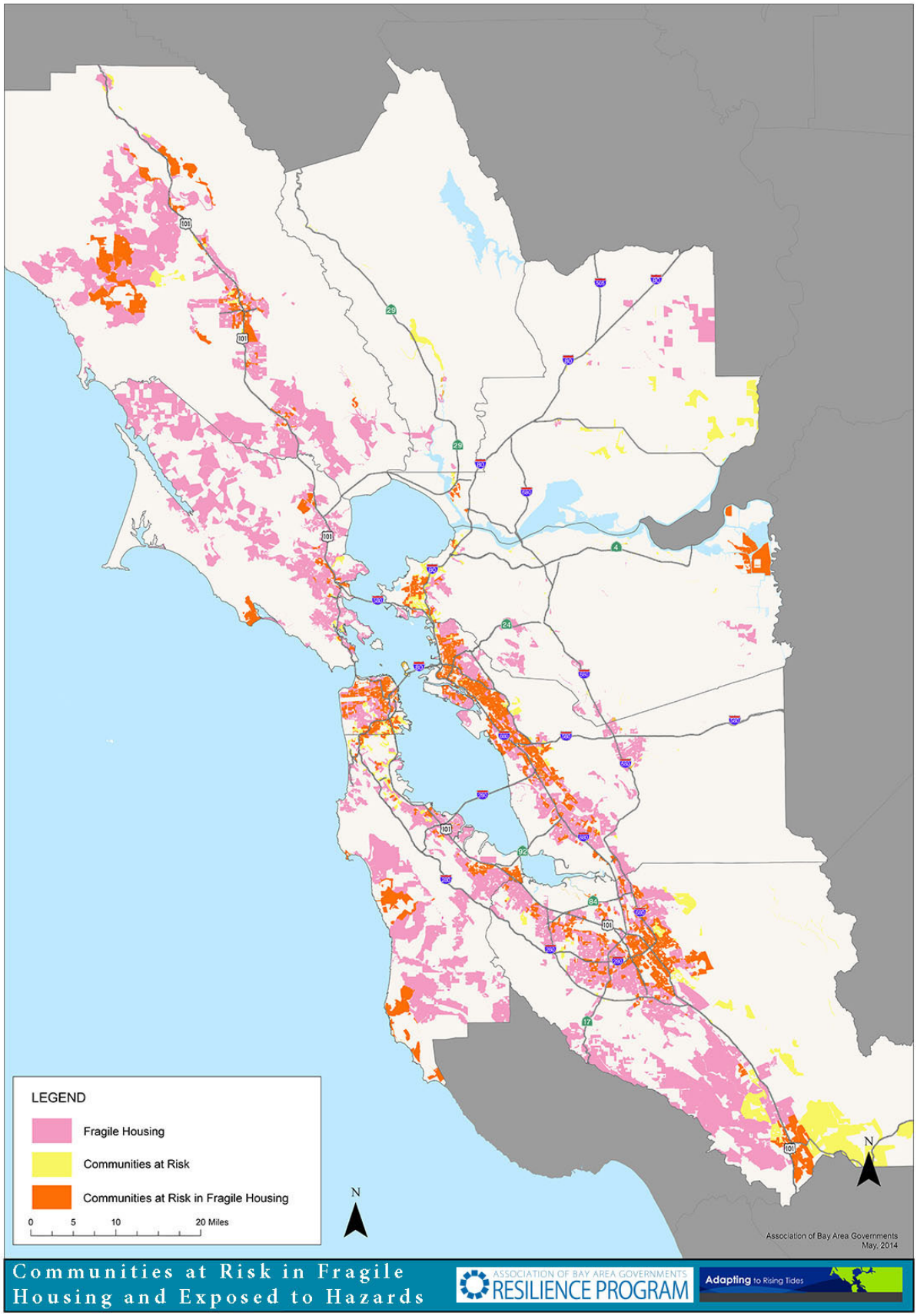
Information on elderly and very young community members is limited

Up-to-date and easily accessible information about the number of elderly and very young living in a community can be challenging to find, particularly during a disaster when it is most needed. It can be difficult to evacuate these community members, especially if they need specialized equipment or supervision, and shelter-in-place facilities need to be prepared to both house them safely and maintain communication with concerned family members.

Housing and Community Risk Map

The final mapping and analysis consists of three maps. The final maps represent block groups within the Bay Area that are likely to be exposed to hazards and also have housing and community characteristics that indicate higher vulnerability, or are more likely to be affected to the degree that residents will have trouble preparing for, responding to, and recovering from a major disaster. Local jurisdictions can use this analysis to zoom in on areas that require more nuanced vulnerability assessment, including more accurate fragile housing inventories and a more detailed understanding of community vulnerability that incorporates a qualitative understanding of community capacity.

BAY AREA HOUSING AND COMMUNITY MULTIPLE HAZARD RISK ASSESSMENT



SAFE, SMART GROWTH STRATEGIES

Strategy Overview

Once vulnerabilities were identified, the next step was to consider how these vulnerabilities could be reduced. A suite of implementation strategies were developed to help local jurisdictions reduce the vulnerability of housing and populations in the areas identified through the analysis, and to plan for future growth in a way that minimizes new vulnerability.

Strategy Summary Table

State-led Strategies		
1	Complete seismic hazard mapping of urban and urbanizing areas	Encourage the California Geological Survey (CGS) to complete mapping of seismic hazard zones for the portions of the Bay Area that are not currently mapped or in the process of being mapped with priority given to urban and urbanizing areas.
2	Evaluate current guidelines and the "state of practice" for mapping, evaluating and mitigating seismic hazards, particularly multi-hazard areas	Through its authority under the State Seismic Hazard Mapping Act, encourage the California Geological Survey (CGS) to work with regional and local agencies and the geology/geotechnical community in the Bay Area to evaluate current guidelines, as well as the current state of practice, for mapping, evaluating and mitigating seismic hazards, particularly in areas of expected growth that are also vulnerable to tsunami, flooding and permanent inundation.

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3	Develop education program(s) to encourage homeowners and renters to purchase of hazard insurance	This strategy recommends creating targeted education programs that encourage homeowners and renters to better understand their risk and make more informed decisions about the purchase of earthquake insurance. This includes education about retrofitting versus insurance, understanding the site-specific hazards of their building, helping them understand what the costs versus benefits are of purchasing insurance, and what is and is not covered by hazard insurance policies.
4	Improve the quality assurance of non-engineered retrofits by developing a statewide retrofitting license for contractors, with contractor training and technical materials	Increase the number of skilled contractors, contractor knowledge, consistency in retrofit quality, and owner assurance and trust in non-engineered retrofits by developing a regional or statewide program to train and license or certify contractors in non-engineered seismic retrofits.
Region-led Strategies		
5	Establish a cooperative shoreline management program	Coordinate with government agencies, organizations, and land owners to establish and maintain a cooperative shoreline management program. This cooperative program could identify strategies for shared decision-making and funding to reduce current and future flood risks in a manner that benefits and balances issues of equity, economy, and environment.
6	Develop guidelines for the siting and design of transit-oriented development to reduce seismic and flood risks	Encourage the Metropolitan Transportation Commission to include an annex to its Station Area Planning Manual that contains guidelines for on-site planning and design techniques that could reduce risk to areas vulnerable to flooding, shaking, and liquefaction hazards.
7	Encourage innovative insurance solutions at the state and federal levels, and in partnership with the private sector	Lobby and advocate for the expansion of state- and federally-mandated catastrophe insurance programs, such as the California Earthquake Authority. Better insurance solutions could enhance mitigation efforts by offering incentives such as building permit rebates, lower premiums or deductibles for retrofitted homes, state-level tax incentives, and state and federal grants to fortify homes and business.
8	Advocate for changes to federal and state programs to improve multi-family rebuilding efforts	Lobby at the state and federal levels to ensure multi-family housing receive a fair and equitable share of financial and technical assistance during rebuilding and recovery efforts.

9	Decrease reliance on grid-supplied power	Promote buildings that will maintain livable conditions in the event of extended loss of power or heating fuel. This can be done through incentives for residential energy efficiency retrofits, weatherization projects, building design standards that promote energy load reductions and on-site generated electricity or bi-direction energy sources, that make homes habitable when there are utility outages caused by disasters.
10	Host a regional "Smart and Safe" growth design competition	Develop a region-wide design competition to promote innovative approaches to resilient design and new solutions to building high-density, mixed-use community development or redevelopment in a safe and smart manner in areas that are susceptible to multiple hazards
Locally-led Strategies		
11	Develop locally-specific seismic hazard maps	Encourage local governments to develop locally specific seismic hazard maps to improve upon mapping resolution and, support more informed and nuanced decision-making about development and hazard mitigation, particularly in urban and urbanizing seismically hazardous areas.
Strategies that reduce development in the highest hazard areas		
12	Increase protection of critical facilities and lifelines in high hazard areas	Encourage local governments to require critical infrastructure and public-service facilities to be located or relocated outside high hazard areas, or that seismic- and flood-related mitigation and other protective measures be undertaken to enhance the structural integrity, overall performance, and functionality of facilities that must be located within high hazard areas.
13	Reduce or prohibit development in the most hazardous areas while ensuring equity and beneficial use of these areas	Reduce or prohibit development in high hazard areas, incentivize relocation out of these areas, and reduce or prohibit rebuilding after a disaster. This strategy also works to create beneficial uses, such as open space, flood mitigation and recreation, for non-developable high hazard lands.
14	Establish overlay zoning districts to help facilitate safe and smart new development	Establish overlay zoning districts, such as a Planned Unit Development (PUD) overlay district, to cluster new development into lower hazard areas on a particular site while also establishing special conditions for development in high hazard areas.
15	Establish a Transfer of Development Rights program to redirect development from high hazard areas to preferred, low hazard areas	Amend local development codes to establish a Transfer of Development Rights (TDR) program, which could place permanent conservation or hazard mitigation easements on properties in high hazard areas, to prevent or minimize the vulnerability of new development to seismic and flood hazards.

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Strategies to retrofit fragile housing in seismic hazard areas		
16	Create a fragile housing inventory	Create and maintain a database that includes the type and location of fragile housing by building type and housing tenure (owner vs. renter), and the property's retrofit status. This would include developing and sustaining standardized, transferrable procedures for collecting and managing data. The inventory should contain, at a minimum, unreinforced masonry buildings, soft-story buildings, and non-ductile concrete buildings.
17	Develop soft story retrofit program	Develop voluntary of mandatory retrofit program(s) to address soft story housing in areas where it makes up a large percentage of a jurisdiction's housing stock (as a whole or for a specific vulnerable community). Pair programs with financing tools and incentives. Consider different incentives and financing tools for more vulnerable communities, such as low-income residents or renters. The program should consider how to handle compliance and enforcement standards, mechanisms for enacting the program, and which retrofit standards to use.
18	Develop cripple wall retrofit program	Develop a retrofit program to address cripple wall housing in areas where it makes up a large percentage of a jurisdiction's housing stock (as a whole or for a specific vulnerable community). Pair programs with financing tools and incentives. Consider different incentives and financing tools for low-income homeowners or renters. The program should consider how to handle compliance and enforcement standards, mechanisms for enacting the program, and which retrofit standards to use.
19	Require hazard disclosure for renters	This strategy recommends the development of policies that require residential property managers and landlords to disclose hazard risk information to renters in a manner similar to that required when residential properties are sold, including if the property is listed on a fragile housing inventory.
20	Ensure that major upgrades and repairs to existing buildings address seismic and flood-related hazards.	Encourage local governments to develop and adopt special repair and upgrade standards for existing buildings that are not typically part of hazardous building abatement programs and are also potential candidates for conversion to mixed-use or higher-density residential use in areas of expected growth. This strategy focuses on reducing the risks posed by existing hazardous buildings by addressing both seismic and flood-related hazards at the time of upgrade (such as a mixed-use or residential conversion) or major repairs following a disaster.
Strategies to increase building standards for new construction in seismic hazard zones		
21	Assign higher seismic importance factor to new large scale residential buildings.	Amend the local building code to enhance structural and nonstructural design requirements for new large-scale residential buildings by adoption of increased seismic importance factor to improve their seismic performance level.

22	Enhance minimum design requirements for new small scale residential building foundations in liquefaction zones	Amend the local building code to require enhanced foundation design requirements for new small-scale residential development (e.g. single or two-family dwellings) and for significant modifications to existing small-scale residential development to limit foundation damage due to liquefaction.
23	Restrict use of significant structural irregularities in residential buildings	Amend the local building code to restrict the use of structural irregularities in the design of new residential construction as well as existing residential construction subject to significant modification in areas with high or moderate shaking and liquefaction potential.
24	Enhance minimum requirements for non-structural anchorage and bracing of interior partition walls in residential buildings	Amend the local building code to include enhanced non-structural anchorage and bracing requirements for interior partition walls in existing residential buildings in areas with shaking potential.
25	Develop and adopt guidelines for building utility connections to incorporate earthquake safety features	Amend the local building code to require that utility connections to buildings incorporate safety features to prevent adverse impacts from earthquakes. Develop guidelines on safety measures such as adequate displacement allowance for building utility connections, if there are no existing guidelines.
Strategies to address flooding hazards		
26	Participate in FEMA's Community Rating System	Encourage local governments to participate in FEMA's Community Rating System (CRS), a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum National Flood Insurance Program (NFIP) requirements by reducing local flood insurance rates.
27	Reduce flood risk through integrated watershed management	Develop a program to work with public and private landowners to decrease the risk of flooding by advancing watershed management projects that reduce and/or store runoff during rainfall events, including the installation of green infrastructure and Low Impact Development (LID) practices, and improve the condition in the floodplain, for example through floodplain restoration or improvement.
28	Increase standards in local floodplain management ordinances beyond the minimum requirements of FEMA's NFIP program	Adopt a floodplain management ordinance that exceeds the minimum requirements of the NFIP to reduce potential risk from flood events that exceed the 100-year (1% annual chance) event. A strong floodplain management ordinance will ensure that land-use decisions account for current flood risks based on available information and assessments and consider more extreme events and/or future flood risk associated with sea level rise.

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29	Require flood-proof construction methods and techniques within and adjacent to special flood hazard zones	Amend the applicable local codes to require flood-proof construction techniques in structures in special flood hazard zones, high hazard zones, and adjacent areas. Requiring flood-proofing techniques in these special flood hazard and high hazard zones could reduce the potential of damage to a structure and its contents in the event of a flood. Requiring the same level of flood-proofing in areas adjacent to these zones could reduce the potential for damage in areas that may be flooded in the future with sea level rise, or by flood events that exceed the FEMA 1% annual chance (100-year) flood conditions.
30	Revise minimum building elevation standards and maximum building height-limits for new development	Revise building standards to require that habitable building space and sensitive building components be elevated above current and future flood levels. In tandem, maximum building height limits may be increased to reduce conflicts where these codes are applied together.
31	Incorporate sea level rise guidance within the capital planning process	City and County departments submit projects for incorporation within the respective local government's capital plan. The goal of the capital plan to provide clear direction on how the local government's assets will be maintained and improved over time, and to identify and prioritize projects for funding within the multiyear capital plan timeframe.
Policy tools that support financing mechanisms		
32	Create geologic hazard abatement districts (GHADS) to fund hazard mitigation	Establish Geologic Hazard Abatement Districts (GHADs) as a mechanism for raising funds and defining responsibility for the prevention, mitigation, abatement or control of geologic hazards, including landslides, land subsidence, soil erosion, earthquake, fault movement or any other natural or unnatural movement of land or earth.
33	Create Mello-Roos Community Facilities Districts to provide financing to property owners for resiliency improvements	Facilitate collaboration among local governments and property owners to form a district in which property owners opt in to participate, wherein the district would use capital raised by issuing bonds to make resiliency improvements, which is paid back through a property tax assessment.
Strategies to prepare for post-disaster recovery		
34	Create a pre-disaster rebuild and recovery plan	Make decisions about long-term disaster recovery, and implement as policy, such as when, where, and how rebuilding will occur after a natural disaster, which areas will be rebuilt according to existing plans and codes and which will be re-planned, whether rebuilt homes will be encouraged or required to be more likely to withstand the effects of future hazard events, and who will be in charge of coordinating and overseeing the recovery process through the development of a pre-disaster recovery plan.

35	Revise local plans and development codes to allow temporary land uses to facilitate and expedite post-disaster recovery	Revise local plans and development codes to permit interim or temporary land uses to support critical public facilities to facilitate and expedite recovery after a disaster event.
36	Develop and implement a shelter-in-place program	Develop a comprehensive shelter-in-place program, and plans for implementing the program, to allow residents to remain in their homes after a disaster. Establish engineering criteria to determine shelter-in-place capacity, develop acceptable habitability standards for sheltering-in-place, and prepare and adopt regulations that allow for the use of these standards in a declared housing emergency period.
37	Improve the resilience of rental units and ensure they are re-built after loss or damage due to a natural disaster	Adopt new policies, and strengthen existing policies, to improve the resilience of available rental units, and develop policies to ensure that rental units damaged during a natural disaster are replaced in kind (with a similar number/type) during rebuilding and recovery rather than being converted to owner-occupied properties.
38	Protect affordable housing during recovery	Develop a more fair community planning process for rebuilding affordable housing after a disaster, adopt policies to support the replacement of affordable housing units that have been damaged or demolished, and prioritize the deployment of interim housing in vulnerable communities.
Strategies for coordination with non-profit organizations and community organizations		
39	Create a community capacity inventory	This strategy recommends developing or enhancing an existing community capacity inventory by first defining the elements that should be included (such as critical facilities and community services), engaging NGOs and city agencies to utilize current work, and then developing and sustaining standardized, transferrable procedures for collecting and managing data.
40	Disseminate best available hazard and climate risk information through community-based organizations and non-traditional partners	This strategy recommends seeking opportunities to expand existing, successful community-based programs (e.g. programs on crime, blight, neighborhood beautification, education or other important community issues) in order to better communicate hazard and climate risk information to community members.

Financing Mechanisms

Consideration was given to identifying the most appropriate financing mechanisms that might be needed to implement the strategies. The strategies broadly fall into two categories. The first category comprises strategies related to planning, programs, and operations. Strategies in the first category can be implemented through existing departments and programs, sometimes at no additional cost, or through new or expanded programs for which a budget must be found. General fund resources, fee-based special purpose funds, or state, federal, or private grants are among the main sources of funds for these types of strategies.

The second category includes strategies related to capital expenditures. Strategies in the second category involve capital projects, which, by and large, require a level of funding that is a few orders of magnitude greater than planning-level, programmatic, or operational strategies. Depending on the strategy, funding may come from the private sector (individuals, a development company, or professional or philanthropic organizations), the public sector, or a cooperative effort among public and private actors.

Financing Mechanisms Table

Name	Administrator	Source of Repayment	Area of Application	Voter Approval Considerations	Applicable Strategies
City/County/ State Bond Program	City, County, Regional Agency, or State	General fund, sales tax, or hotel tax Service fees, property tax, tax increments	Citywide, Countywide, or Statewide	General obligation bonds require two-thirds voter approval. Revenue bonds require majority voter approval.	12, 20, 26
Parcel or Sales Tax	City, County, Regional, or State	Parcel tax or sales tax	Citywide, Countywide, Region-wide, or Statewide	Parcel or sales taxes require two-thirds voter approval	5, 12, 26, 38
Tax-based Special Districts	Special District	Ad-valorem property tax	Districtwide	Tax-based special districts need two-thirds voter approval to be able to levy special taxes.	5, 9, 12, 14, 17, 26, 32, 33, 38
Fee-based Special Districts	Special District	Service fees	Districtwide	Fee-based special districts do not need voter approval to issue bonds for capital generation. Similarly, fees charged by special districts do not require voter approval as long as the fees are for a specific benefit, service, or product provided directly to the fee payer.	5, 6, 12, 26

Table continued on next page

Name	Administrator	Source of Repayment	Area of Application	Voter Approval Considerations	Applicable Strategies
Infrastructure Financing Districts	City or County	Property tax increments within the district	Districtwide	Property tax increments proposed by infrastructure financing districts require both local and countywide approval, where both jurisdictions forego general fund revenue to pay back infrastructure investments.	6, 14, 36
Joint Powers Authorities (also known as Public Financing Authorities)	Joint Powers Authority appointed by City or County	Income from public project projects (e.g. income generated by a Port Authority by leasing space to businesses)	Multi-city, Countywide, Region-wide, District	This mechanism requires multi-jurisdictional buy-in before it can be implemented.	None
Municipal Enterprise Funds	City, County, or utility	Users of Infrastructure Services (e.g., water, energy, etc.)	Citywide, Countywide, District	Fees charged by municipal enterprises do not require voter approval as long as the fees are for a specific benefit, service, or product provided directly to the fee payer.	12
Development and Construction Loans	Local or regional banks	Income from investment	Neighborhood wide	None	6, 14, 15, 20, 21, 22, 23, 24, 25, 26, 28, 29, 30
Individual Home Improvement Loans or Commercial Renovation Loans	Local or regional banks, local, regional, state, and federal agencies	Individual or business income	Individual property owner or individual business	None	12, 17, 18, 20, 22, 23, 24, 25, 26, 28, 29, 37, 38
Revolving Loan Fund (RLF) Programs	Local, regional, state, and federal agencies	Income from investment, individual and business income	Citywide, neighborhood wide, individual households and businesses	None	12, 23, 24, 25, 26, 28, 29
Grant Programs	Local, regional state, or federal agencies, philanthropic organizations	None required	Citywide, neighborhood-wide	None	1, 2, 4, 5, 6, 10, 11, 12, 20, 22, 23, 24, 25, 26, 27, 28, 29, 35, 37, 38, 39, 40

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CONCLUSION

Improving resilience can address the intersection between fragile housing and community vulnerability. The assessment methodology and strategies coming from this project can also assist the region to actively avoid increasing community risk while still meeting ambitious growth and sustainability goals.

Local jurisdictions are encouraged to conduct more in-depth local analysis based on this project, for example by considering the methods and outcomes of the regional analysis in their Local Hazard Mitigation planning process. Local jurisdictions can also begin using the strategies based on the initial regional analysis even without local analysis. The region can use the outcomes of this project to incorporate resilience into region-wide policies on planning for future growth through Plan Bay Area and in helping jurisdictions decide where and how to grow. Assistance implementing strategies will be provided to local jurisdictions by ABAG through its Regional Resilience Plan throughout 2015 and 2016. The suite of strategies developed by this project are not intended as a one-time effort or a complete set of tools. As communities gain more experience with assessing vulnerability and implementing strategies, they may have additional insights to offer on potential actions or recommendations for modifying the strategies recommended here. ABAG's ongoing Resilience Program is one vehicle through which new lessons at the local level can be communicated to a broader regional audience.

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