

Hazard Mitigation and Climate Adaptation Risk Assessment Overview

An in-depth risk assessment can provide a comprehensive understanding of vulnerabilities and consequences within a community, and can lead to the development and implementation of more appropriate and achievable mitigation and adaptation actions. The outcomes of the assessment can also help guide long-range planning and future land use decisions, spur important partnerships with utilities and the business community, and provide additional incentive to help protect vulnerable communities, small businesses, or unique community features such as historic structures or critical park and recreational facilities.

The assessment process described in this overview closely follows FEMA's Local Mitigation Planning Handbook. We do suggest one additional step, Step 1, which has you select community goals before the assessment rather than when wait until you are developing mitigation or adaptation actions. In addition, we broaden Step 3 from solely identifying community assets to taking the time to determine the overall assessment approach including how you will gather the information about risk. These changes were made to help ensure that your assessment is locally meaningful and actionable.

The assessment process presented below is broken into the following steps:

- Step 1: Set Community Goals**
- Step 2: Describe Hazards**
- Step 3: Determine your Assessment Methods**
- Step 4: Conduct the Assessment**
- Step 5: Summarize Vulnerability**

At the end of the assessment you will have the following outcomes:

- Goals to guide the assessment and development of mitigation actions
- Prioritized hazards, hazard scenarios, and maps to be used in your assessment
- An inventory of assets, by asset class and specific assets, to be used in your assessment
- Exposure analysis – maps and data describing which assets are exposed to which hazards
- Assessment information about vulnerability and consequences
- Vulnerability problem statements
- Fulfillment of Element B1 in FEMA's Local Mitigation Plan Review Tool Checklist**
- Fulfillment of Element B2 in FEMA's Local Mitigation Plan Review Tool Checklist**
- Fulfillment of Element B3 in FEMA's Local Mitigation Plan Review Tool Checklist**
- Fulfillment of Element B4 in FEMA's Local Mitigation Plan Review Tool Checklist**
- Fulfillment of Element C3 in FEMA's Local Mitigation Plan Review Tool Checklist**

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Step 1: Select Community Goals

Key points of this step:

- Identify community goals to help frame and guide the assessment. These goals can be based on existing community goals or developed specifically for the purpose of the risk assessment.

The Hazard Mitigation and Adaptation Plan can be a critical tool for advancing existing community goals and may provide an opportunity to establish new goals focused on resilience. For example, community goals to increase quality of life or maintain affordability can be achieved, in part, by protecting housing from earthquakes and flooding, or by keeping small businesses intact after a natural disaster. New goals may also emerge that focus on specific vulnerabilities present in your jurisdiction and identified through your risk assessment, such as a large elderly population that should be considered prior to a hazard event and will likely need extra support after a disaster.

Selecting community goals early in the planning process helps scope the assessment and prioritize which community assets should be analyzed. Later in the assessment process, community goals help guide development of locally meaningful mitigation and adaptation actions. To develop locally relevant goals, start with existing community goals that can be found in General Plans, Specific Plans, Climate Mitigation Plans, Climate Adaptation Plans, Sustainability Plans, or other local planning documents. Use these goals to help determine what assets, and what degree of detail for each asset, is needed to conduct a meaningful risk assessment. Be aware that the process of scoping and conducting a risk assessment may also reveal additional goals. Through a better understanding of your community's specific hazard and vulnerability profile, you may uncover issues that are not fully addressed in existing community goals.

Since goals help explain what the community wants to achieve with the plan they are usually broad policy-type statements that are a vision for reducing or avoiding losses from hazards. Community and mitigation goals, and supporting mitigation actions, are developed in order to:

- Build transparency into the process at the outset so that all participants and others with an interest in the process know what will be included and what will likely be a priority.
- Engage the project team early in deciding what shared outcomes they will work cooperatively to achieve, and provide an opportunity for them to ask their stakeholders for input and feedback on the project direction.
- Provide a foundation upon which future project decisions can be made and help in evaluating how well mitigation actions will help meet established community values and expectations.

Outputs:

- Goals to guide the risk assessment and development of mitigation and adaptation actions
- Fulfillment of Element C3 in FEMA's Local Mitigation Plan Review Tool Checklist**

Resources:

- Community Goals Worksheet (attached)

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Identifying Community Goals

Existing community goals can help to rally stakeholders around the Hazard Mitigation and Adaptation planning process as well as assist with deciding where to focus time and resources during the risk assessment. The Hazard Mitigation and Adaptation Plan is a tool to help promote existing community goals as well as identify new community goals.

Goals that may be supported by your Hazard Mitigation and Adaptation Plan may be goals like the following:

- Example existing goal: Protect affordable housing for low-income residents.
- How your plan can support this: If housing is damaged after a disaster, low-income residents will likely be displaced. Additionally, housing that is currently low income may be rebuilt at current market rates. To protect affordable housing, you need to protect housing from significant damage in a disaster. In your risk assessment, you may wish to prioritize analyzing existing housing vulnerability. In your mitigation actions, you may include a mitigation strategy that requires the retrofit of vulnerable housing types.

You may find community goals in the following plans or plan elements:

- General Plan
- Housing Element
- Community Safety Element
- Sustainability Plan
- Climate Action Plan
- Climate Adaptation Plan
- Previous Hazard Mitigation Plan

Step 2: Describe Hazards

Key points of this step:

- Identify and describe current and future hazards in your community
- Document past disasters
- Determine which hazards will impact your community the most

Before you develop your risk assessment, you must identify and describe the hazards that are present within your community. An important part of this step is identifying which hazards pose the greatest threat to your community, either through the extent of the hazard, the severity of the hazard, or the consequences of the hazard.

Within the Bay Area different communities are at risk from different hazards. One community may be located in a very high fire hazard severity zone, while another may have low wildfire risk but large flooding exposure. Fortunately, there are a number of resources that Bay Area communities can use to map and describe the natural hazards that will affect them. For example, the State Hazard Mitigation Plan and MyPlan website describes all of the natural hazards that can impact the State of California, while *Risk Landscapes*, produced by the Association of Bay Area Governments (ABAG), identifies the hazards that will impact the Bay Area. Both of these resources can be used in combination with local data and knowledge, such as local liquefaction assessments and knowledge of past disasters, to characterize the hazards your community may face.

The following describes a stepwise process that will help you describe your hazards as part of your risk assessment.

Describe and map current and future hazards

Explore the current and future hazards that are of greatest concern by downloading the *Risk Landscapes* hazard layers for use in your own GIS at ABAG's Open Data webpage, viewing maps online using the ABAG viewer at <http://gis.abag.ca.gov/website/Hazards>, and by reviewing local hazard maps your city, county, or district may keep. Using these resources, develop local-scale maps and written descriptions of the hazards from your community's perspective, including the location, expected frequency, and severity of the hazard, such as the strength (magnitude) of an earthquake or the geographic extent or duration of flooding.

As an example, your hazard description might read: "The western portion of the city has very high liquefaction susceptibility while the remainder of the city has low likelihood of liquefaction. Liquefaction may occur in earthquakes with very high levels of shaking, including one from the Hayward fault, which runs adjacent to the city and has a high probability of occurring in the next thirty years." When describing the probability of future events, it is important to take into consideration how hazards may change over time. For example, as the climate changes and sea level rises, flooding will become more frequent or severe and some areas that currently experience temporary flooding may become permanently inundated.

Create a list of past disasters

Past disasters can help your community understand where disasters may reoccur and can help to estimate the likelihood of a disaster in the future. Understanding past disasters can also help you estimate the scale of

impact if the disaster reoccurs, although if land uses and populations have changed the impacts and consequences will likely be different.

In addition to considering how land use change may affect the location, frequency or severity of disasters, you must also consider the potential effect climate change could have, including the intensification of disasters in areas already at risk, or the expansion of hazards into areas where they have not occurred in the past.

Risk Landscapes includes a table with all state and federally declared Bay Area disasters since 1950. You will also need to include information about local disasters that may not have been state or federally declared. When describing past disasters, include as much information as possible, including the extent and severity of the disaster as well as the impacts (i.e. “this portion of the city has flooding even in moderate rain events,” or “a fire in 2012 destroyed a transmission line interrupting power to 3,000 residents for 36 hours”).

In addition, you must also list National Flood Insurance Program (NFIP) insured structures in your community that have suffered repetitive damaged due to flooding (see box to the right)¹. To obtain this list, you will need to go through the following steps:

1. Obtain a sample request letter either from ABAG’s website (<http://resilience.abag.ca.gov/projects/2016-mitigation-adaptation-plans/>) or from your local NFIP Bureau & Statistical Agent
2. Adapt the sample letter with your jurisdiction’s information, letterhead, and signature from your department head
3. Mail the completed letter to your NFIP Bureau & Statistical Agent
4. The Bureau will send you a list of repetitive loss properties including property address, claim amounts, and date of claim for your jurisdiction
5. Use this information to map repetitive loss properties in relation to the floodplain and to aggregate loss information for your plan (though individual addresses and claim amounts for a specific property are private information, so do not include this in your plan)

The NFIP representative for the Bay Area is Adam Lizarraga, ALizarraga@nfip-iservice.com, (916) 375-0927.

Prioritize the hazards that are most important to your community

For your risk assessment, you will want to prioritize the hazards that could have the most impact on your community. You can estimate which hazards will have the most impact by considering the extent of exposure

¹ Sources: NFIP Flood Insurance Manual, FEMA. Revised October, 2012
44 CFR §79.2(g)

Repetitive and Severe Loss Properties

Repetitive loss property: an NFIP insured structure that has had at least two paid flood losses of more than \$1,000 each in any ten-year period since 1978.

Severe repetitive loss property: any NFIP insured single or multifamily residential properties that:

1. Have incurred flood-related damage for which 4 or more separate claims payments have been made, with the amount of each claim exceeding \$5,000 and the cumulative amount exceeding \$20,000; or
2. For which at least 2 separate claims payments have been made under such coverage, with the cumulative amount exceeding the market value of the building.
3. In both instances, at least two of the claims must be within 10 years of each other (claims made within 10 days of each other count as one claim).

(this can be measured by the number of people exposed, number of buildings exposed, or the value of assets exposed), the potential impacts of a hazard, and the likelihood of the hazard occurring. FEMA provides a worksheet for summarizing and prioritizing hazards in their *Local Mitigation Planning Handbook* (**Worksheet 5.1**, page A-29).

Once you have prioritized hazards it is a good time to consider if you need to refine the goals you previously outlined. In addition, now that you know where hazards may affect your community you can use that information to guide the remainder of the risk assessment, including which assets should be considered and what information needs to be gathered.

Outputs:

- Prioritized hazards, hazard scenarios, and maps to be used in the risk assessment
- Fulfillment of Element B1 in FEMA's Local Mitigation Plan Review Tool Checklist**
- Fulfillment of Element B2 in FEMA's Local Mitigation Plan Review Tool Checklist**
- Fulfillment of Element B4 in FEMA's Local Mitigation Plan Review Tool Checklist**

Resources:

- FEMA *Local Mitigation Planning Handbook* Worksheet 5.1, Hazards Summary Worksheet (attached)
- ABAG *Risk Landscapes* document
<http://resilience.abag.ca.gov/projects/2016-mitigation-adaptation-plans/>
- ABAG Open Data webpage
<http://resilience.abag.ca.gov/opendata/>
- State NFIP coordinator or local floodplain administrator
Adam Lizarraga, ALizarraga@nfip-iservice.com, (916) 375-0927
- ART How-to Guide: Climate Scenarios and Climate Impacts Statements
http://resilience.abag.ca.gov/wp-content/documents/mitigation_adaptation/ART%20H2G-Climature%20Impact%20Statements_Vf1.pdf
- CalEMA's MyPlan website
<http://myplan.calema.ca.gov/>
- California State Hazard Mitigation Plan
http://hazardmitigation.calema.ca.gov/docs/SHMP_Final_2013.pdf

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Hazards Summary Worksheet

Use this worksheet to summarize hazard description information and identify which hazards are most significant to the planning area. The definitions provided on the following page can be modified to meet local needs and methods.

Hazard	Location (Geographic Area Affected)	Maximum Probable Extent (Magnitude/Strength)	Probability of Future Events	Overall Significance Ranking
Avalanche				
Dam Failure				
Drought				
Earthquake				
Erosion				
Expansive Soils				
Extreme Cold				
Extreme Heat				
Flood				
Hail				
Hurricane				
Landslide				
Lightning				
Sea Level Rise				
Severe Wind				
Severe Winter Weather				
Storm Surge				
Subsidence				
Tornado				
Tsunami				
Wildfire				

Worksheet 5.1

Hazard Summary Worksheet

Definitions for Classifications

Location (Geographic Area Affected)

- **Negligible:** Less than 10 percent of planning area or isolated single-point occurrences
- **Limited:** 10 to 25 percent of the planning area or limited single-point occurrences
- **Significant:** 25 to 75 percent of planning area or frequent single-point occurrences
- **Extensive:** 75 to 100 percent of planning area or consistent single-point occurrences

Maximum Probable Extent (Magnitude/Strength based on historic events or future probability)

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions

Hazard	Scale / Index	Weak	Moderate	Severe	Extreme
Drought	Palmer Drought Severity Index ³	-1.99 to +1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli Scale ⁴	I to IV	V to VII	VII	IX to XII
	Richter Magnitude ⁵	2, 3	4, 5	6	7, 8
Hurricane Wind	Saffir-Simpson Hurricane Wind Scale ⁶	1	2	3	4, 5
Tornado	Fujita Tornado Damage Scale ⁷	F0	F1, F2	F3	F4, F5

Probability of Future Events

- **Unlikely:** Less than 1 percent probability of occurrence in the next year or a recurrence interval of greater than every 100 years.
- **Occasional:** 1 to 10 percent probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** 10 to 90 percent probability of occurrence in the next year or a recurrence interval of 1 to 10 years
- **Highly Likely:** 90 to 100 percent probability of occurrence in the next year or a recurrence interval of less than 1 year.

Overall Significance

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

3 Cumulative meteorological drought and wet conditions: <http://ncdc.noaa.gov/>

4 Earthquake intensity and effect on population and structures: <http://earthquake.usgs.gov>

5 Earthquake magnitude as a logarithmic scale, measured by a seismograph: <http://earthquake.usgs.gov>

6 Hurricane rating based on sustained wind speed: <http://nhc.noaa.gov>

7 Tornado rating based on wind speed and associated damage: <http://spc.noaa.gov>

Example Hazard Summary: Waveland, Mississippi

Table 4.2. Hazard Summary for Waveland

Hazard	Frequency of Occurrence	Spatial Extent	Potential Magnitude	Significance
Climate Change (storm surge, sea level rise)	Highly Likely	Extensive	Catastrophic	Medium
Coastal/Canal Bank Erosion	Highly Likely	Limited	Negligible	Medium
Dam/Levee Failure	Unlikely	Limited	Negligible	Low
Drought	Occasional	Significant	Negligible	Low
Earthquake	Occasional	Extensive	Critical	Low
Extreme Heat	Highly Likely	Extensive	Limited	Low
Extreme Winter Weather	Likely	Negligible	Limited	Low
Flood: 100/500 year	Occasional	Significant	Critical	High
Flood: Stormwater/Localized Flooding	Highly Likely	Significant	Critical	High
Hurricane and Tropical Storms (includes ocean surf events)	Likely	Extensive	Catastrophic	High
Thunderstorm (includes hail, lightning, high wind)	Highly Likely	Significant	Limited	High
Tornado	Likely	Limited	Negligible	Low
Wildfire	Likely	Limited	Negligible	Low
Railroad: Hazardous Materials Release	Occasional	Limited	Negligible	Medium
Guidelines: Frequency of Occurrence: Highly Likely: Nearly 100% probability in the next year. Likely: Between 10 and 100% probability in the next year Occasional: Between 1 and 10% probability in the next year Unlikely: Less than 1% probability in the next year Potential Magnitude: Catastrophic: More than 50% of the area affected Critical: 25 to 50% of the area affected Limited: 10 to 25% of the area affected Negligible: Less than 10% of the area affected			Spatial Extent: Limited: Less than 10% of planning area Significant: 10-50% of planning area Extensive: 50-100% of planning Area Significance: Low Medium High	

Source: AMEC Data Collection Guide

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Step 3: Determine your Assessment Methods

Key points of this step:

- Select the assets you will analyze and consider if they will be assessed as a group or individually
- Determine your approach to understanding exposure, vulnerability and consequences

Hazards become meaningful only when they interact with assets within your community, including people, structures, facilities, and services. In this step you will get prepared to conduct the assessment by identifying the community assets to include and determining the assessment method you will use for your risk assessment, which helps you decide what information you need to determine the ability of the asset to withstand the hazards as well as the consequences to the community if the asset is damaged in a disaster.

Select your assets

In deciding which assets to include in your assessment, you will need to determine if you will be assessing individual assets, representative assets for an asset class, or the asset class as a whole. For example, a community can choose to evaluate transportation infrastructure as an asset class or can assess individual transportation assets, such as bus yards, train stations, bridges, etc. You can begin by first identifying which asset classes are applicable and important to your assessment, and then decide if you need to do a deeper analysis for each asset class. In general, we group assets into the following classes:

- People
- Buildings
- Critical Response Facilities
- Community Services
- Utilities Infrastructure
- Transportation Infrastructure
- Communication Infrastructure
- Recreation, Open Space, and Working Lands
- Hazardous Materials Sites and Contaminated Lands

More detail about each asset class, including the specific assets included and where to find information on them, is included in the **Identifying Community Assets Worksheet**.

The type of assets to be included in your assessment should be broad enough to ensure that the consequences of hazards on people where they live, work, access key services and conduct other day-to-day activities will be fully considered. Focusing on a single asset class can provide a deep understanding of vulnerability and can lead to implementation of specific actions, but may overlook vulnerabilities due to physical or organizational relationships among assets or agencies. For example, publicly-owned buildings and critical response facilities rely on a variety of other assets to maintain function such as power, road access, and wastewater services. Starting with a broader assessment and focusing in on individual assets as necessary based on your community goals, hazards identified and the potential consequences of the hazards is a good balance between broad and detailed approaches.

Risk assessments that include multiple asset classes can reveal how seemingly dissimilar assets, such as nursing homes, single access roadways, trails used by those with limited mobility, and tidal marshes that support threatened or endangered species, have similar vulnerabilities due to their unique function. Multi-class

assessments can also identify complexities in regulatory and other decision-making processes that cut across asset categories; for example, actions to address the vulnerability of a roadway that crosses a tidal creek can have similar regulatory challenges as improving the utility or rail crossings.

Once you have identified critical asset classes for your assessment, you should determine if the class contains assets that should be evaluated individually. Some assets should be evaluated individually while others can be evaluated as a class. Scaling down to individual assets can help identify specific vulnerabilities that are often caused by particular physical and functional characteristics. An assessment of individual assets can identify specific components, critical functions, or management challenges that will increase vulnerability.

Individual assessments should be conducted for unique, critically important or high consequences assets. Individual assessments do require a greater level of effort and more detailed information than may be available. Asset class assessments should be conducted when there are many similar assets and can be supplemented by evaluating representative assets (see sidebar) that will provide similar benefits as assessing individual assets. The **Risk Assessment Scoping Worksheet** (attached) provides guidance for selecting asset categories and for determining if they are best assessed individually or as a group.

Determine your approach

Before you conduct your risk assessment you need to decide how much information you are going to collect, both on your hazards and on individual assets, representative assets, and asset classes to be included in your assessment. The depth and scope of a risk assessment can vary significantly, and will depend on your community goals, the availability of data and information, resources to conduct the assessment, and individual interests of the jurisdiction and its residents. The simplest assessment includes an exposure analysis, which simply maps hazards on top of locations of key assets, to identify the assets likely to experience a hazard. This approach is most appropriate if there are a large number of assets, for example single-family residences, or for privately-owned facilities with limited available information (e.g., power substations).

Risk assessments can be expanded or focused based on three different elements:

1. The number of asset classes you include in your assessment, and the number of representative assets or individual assets you assess within each class. At a minimum, you should assess your emergency response facilities and strongly consider assessing your public buildings. A more comprehensive assessment may include residential units, infrastructure systems, and/or recreational spaces.

Representative vs. Individual Asset Assessments

Representative Assets

Answering the assessment questions for representative assets works well for asset categories that have numerous, similar assets. For example, contaminated sites may be very similar in their vulnerability to specific hazards, therefore rather than assessing each site individually, answering the questions for a few examples that represent a cross-section of the types of contaminated sites can reveal the range of vulnerabilities and consequences that are likely.

Individual assets

Unique assets for which the findings from the assessment questions are unlikely to be similar between assets need to be assessed individually. Examples of these types of assets include wastewater treatment plants. Additionally, if there are only a small number of assets in the asset class the assessment questions can be answered for each.

2. Whether your assessment will evaluate assets as a class, as representative assets, or as individual assets. The most comprehensive approach would be to evaluate all assets individually, but this will likely require more resources than are available. This process can be simplified by choosing a representative asset to assess that may be similar to many others, house important services, or serve a large number of residents. If assessing a representative asset is not possible, asset classes can be assessed with far fewer resources, but can still provide information useful for your community.
3. The amount of information you collect on each asset. At a minimum, you need the location and use for each asset that you include in your assessment, but more information can make your assessment much more meaningful. Including more information about how the asset is vulnerable to a hazard, or what the consequences are if it is damaged can transform the assessment into something that tells a story and sets up actions.

Because it is important to understand what will happen to assets and the people and services that rely on them if they are exposed to a hazard it is important to go beyond the exposure analysis. Assessment questions can help simplify and facilitate the collection of information, either qualitative or quantitative, about asset conditions and characteristics that can either increase or reduce vulnerability and consequences.

The Adapting to Rising Tides (ART) Program has developed a robust list of assessment questions that provide a framework for collecting the data and information that lead directly to the identification of vulnerabilities and consequences. The ART assessment questions, which have been applied and refined based on a number of on-the-ground assessments, can be used for a wide variety of sectors at the individual, representative or asset class scale. Answers to the questions help build an understanding of the underlying causes and components of vulnerability and the potential consequences of those vulnerabilities on society and equity, environment and economy.

A reduced list of assessment questions based on the full list of ART assessment questions is attached. These represent the short-list of questions that if answered, will provide a fairly detailed understanding of vulnerability and consequences. The full set of questions is available here: http://resilience.abag.ca.gov/wp-content/documents/mitigation_adaptation/ART%20Assessment%20Questions%20Supplement%20V1.xlsx.

With an understanding of your hazards and the assets you would like to assess, you can map out your approach to your risk assessment using the **Risk Assessment Scoping Worksheet** before you begin to work through your assessment.

Outputs:

- Asset classes and specific assets to be assessed
- Assessment methodology and approach

Resources:

- Identifying Community Assets Worksheet (attached)
- Risk Assessment Scoping Worksheet (attached)
- ART Scope and Scale Issue Paper
http://resilience.abag.ca.gov/wp-content/documents/mitigation_adaptation/Scope&Scale_IssuePaper20140708.pdf

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Community Asset Identification Worksheet

Having a general sense of the types of assets you have in your community can help to guide your risk assessment and allow you to focus your resources in areas with the most impact. Gathering information on your assets now can also help you identify where data gaps exist.

Asset Class: People	Data Sources
<input type="checkbox"/> Total population – current and future	<input type="checkbox"/> U.S. Census <input type="checkbox"/> American Community Survey <input type="checkbox"/> Plan Bay Area <input type="checkbox"/> Priority Development Areas <input type="checkbox"/> Regional Housing Needs Assessment <input type="checkbox"/> ABAG Projections Series 2013 <input type="checkbox"/> County Quick Facts <input type="checkbox"/> Local General Plan or Specific Plans <input type="checkbox"/> Local Housing Element <input type="checkbox"/> Local Zoning Code
Population with access or functional needs, including: <ul style="list-style-type: none"> <input type="checkbox"/> Age dependent, children and seniors <input type="checkbox"/> Medically or mobility dependent <input type="checkbox"/> Language constraints <input type="checkbox"/> Low income <input type="checkbox"/> Lack of education <input type="checkbox"/> Culture or ethnicity <input type="checkbox"/> Cost burdened (housing and/or transportation) <input type="checkbox"/> Transit dependent (no car) <input type="checkbox"/> Housing tenure (renters) 	<input type="checkbox"/> U.S. Census <input type="checkbox"/> American Community Survey <input type="checkbox"/> County Health Department Status Reports <input type="checkbox"/> Bay Area Regional Health Inequities Initiative <input type="checkbox"/> East Bay Indicators-East Bay Economic Development Alliance <input type="checkbox"/> Local General Plan or Specific Plans <input type="checkbox"/> Local studies <input type="checkbox"/> Local Housing Element <input type="checkbox"/> Local Hazard Mitigation Plan <input type="checkbox"/> Non-Profit and Community Based Organizations

Asset Class: Building Stock	Data Sources
<input type="checkbox"/> Publically-owned buildings	<input type="checkbox"/> County Tax Assessor Parcel Data
Privately-owned buildings: <ul style="list-style-type: none"> <input type="checkbox"/> Residential buildings, e.g., single and multi-family, mobile homes, senior and dependent housing <input type="checkbox"/> Nonresidential buildings, e.g., industrial, commercial or institutional structures 	<input type="checkbox"/> U.S. Census <input type="checkbox"/> American Community Survey <input type="checkbox"/> County Tax Assessor Parcel Data <input type="checkbox"/> Local General Plan or Specific Plans <input type="checkbox"/> Local Housing Element <input type="checkbox"/> Local Zoning Code <input type="checkbox"/> Google

<input type="checkbox"/> Future buildings, growth areas and infrastructure	<input type="checkbox"/> Plan Bay Area <input type="checkbox"/> Regional Housing Needs Assessment <input type="checkbox"/> Capitol Plans <input type="checkbox"/> City and County Budgets <input type="checkbox"/> Local General Plan or Specific Plans <input type="checkbox"/> Local Housing Element <input type="checkbox"/> Local Zoning Code <input type="checkbox"/> Local Growth Boundaries or growth phasing ordinances
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Asset Class: Critical Response Facilities	Data Source:
<input type="checkbox"/> Public health infrastructure, e.g., hospitals and medical facilities	<input type="checkbox"/> County Tax Assessor Parcel Data <input type="checkbox"/> Local Safety Element <input type="checkbox"/> Local Emergency Operations Plans <input type="checkbox"/> Local Area Formation Commission Municipal Service Reviews
<input type="checkbox"/> Police stations	<input type="checkbox"/> County Tax Assessor Parcel Data
<input type="checkbox"/> Fire stations	<input type="checkbox"/> County Tax Assessor Parcel Data
<input type="checkbox"/> Public schools	<input type="checkbox"/> County Tax Assessor Parcel Data

Asset Class: Community Services	Data Sources
<input type="checkbox"/> Community facilities, e.g., day cares, food banks, senior centers, grocery stores	<input type="checkbox"/> County Tax Assessor Parcel Data <input type="checkbox"/> City licensing and regulating authorities <input type="checkbox"/> Local General and Specific Plans <input type="checkbox"/> Local Zoning <input type="checkbox"/> Google
<input type="checkbox"/> Places of worship	<input type="checkbox"/> County Tax Assessor Parcel Data (Same as above)
<input type="checkbox"/> Education and research institutions, e.g., schools, colleges, universities	<input type="checkbox"/> County Tax Assessor Parcel Data (Same as above)
<input type="checkbox"/> Waste transfer stations	<input type="checkbox"/> CalRecycle <input type="checkbox"/> County Environmental Health Departments
<input type="checkbox"/> Household hazardous waste collection sites	<input type="checkbox"/> CalRecycle <input type="checkbox"/> County Environmental Health Departments

Asset Class: Utilities Infrastructure	Data Sources
<input type="checkbox"/> Water systems, including reservoirs and dams	<input type="checkbox"/> Urban Water Management Plans <input type="checkbox"/> Bay Area Integrated Regional Management Plan
<input type="checkbox"/> Wastewater, e.g., industrial and sanitary sewer systems)	<input type="checkbox"/> Urban Water Management Plans <input type="checkbox"/> Bay Area Integrated Regional Management Plan



<input type="checkbox"/> Flood control infrastructure	<input type="checkbox"/> County Tax Assessor Parcel Data <input type="checkbox"/> City/county public works or flood control district <input type="checkbox"/> Local General Plan or Specific Plans <input type="checkbox"/> Google
<input type="checkbox"/> Stormwater (storm drain) system	<input type="checkbox"/> City/county public works <input type="checkbox"/> Special studies within cities and counties <input type="checkbox"/> Local Agency Formation Commission
<input type="checkbox"/> Power utilities, e.g., electricity generation, distribution, transmission systems	<input type="checkbox"/> California Energy Commission <input type="checkbox"/> California Public Utilities Commission <input type="checkbox"/> PG&E
<input type="checkbox"/> Pipelines, e.g., fuel and natural gas	<input type="checkbox"/> National Pipeline Mapping System <input type="checkbox"/> California Energy Commission <input type="checkbox"/> Kinder Morgan
<input type="checkbox"/> Oil refineries	<input type="checkbox"/> EPA <input type="checkbox"/> Air Resources Board <input type="checkbox"/> State Employment Statistics <input type="checkbox"/> County and City General Plans

Asset Class: Transportation Infrastructure	Data Sources
<input type="checkbox"/> Local streets and roads	<input type="checkbox"/> Metropolitan Transportation Commission 2011TeleAtlas
<input type="checkbox"/> Federal and state highways	<input type="checkbox"/> Metropolitan Transportation Commission 2011TeleAtlas <input type="checkbox"/> CA Department of Transportation
<input type="checkbox"/> Bridges, tubes and tunnels	<input type="checkbox"/> Metropolitan Transportation Commission 2011TeleAtlas <input type="checkbox"/> CA Department of Transportation <input type="checkbox"/> Bay Area Toll Authority
<input type="checkbox"/> Railroads, passenger and freight lines	<input type="checkbox"/> Metropolitan Transportation Commission 2011TeleAtlas <input type="checkbox"/> Capitol Corridor JPA <input type="checkbox"/> Altamont Corridor Express <input type="checkbox"/> Caltrain
<input type="checkbox"/> Transit services (bus, BART, light rail)	<input type="checkbox"/> Metropolitan Transportation Commission 2011TeleAtlas <input type="checkbox"/> Bay Area Rapid Transit
<input type="checkbox"/> Ferry service	<input type="checkbox"/> Golden Gate Bridge Highway and Transportation District <input type="checkbox"/> Water Emergency Transportation Authority
<input type="checkbox"/> Bike/pedestrian routes	<input type="checkbox"/> Local General Plan <input type="checkbox"/> San Francisco Bay Trail
<input type="checkbox"/> Airport	<input type="checkbox"/> Federal Aviation Administration <input type="checkbox"/> Regional Airport Planning Committee



<input type="checkbox"/> Seaports and Marine terminals	
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Asset Class: Communication Infrastructure	Data Sources
<input type="checkbox"/> Land line telephone systems	<input type="checkbox"/> Communication service providers
<input type="checkbox"/> Cable systems	<input type="checkbox"/> Communication service providers
<input type="checkbox"/> Cellular telephone antennae	<input type="checkbox"/> Communication service providers
<input type="checkbox"/> Underground communication conduits	<input type="checkbox"/> Communication service providers

Asset Class: Recreation, Open Space and Working Lands	Data Sources
<input type="checkbox"/> Park and recreation facilities	<input type="checkbox"/> California Protected Areas Database
<input type="checkbox"/> Designated open space	<input type="checkbox"/> California Protected Areas Database <input type="checkbox"/> Conservation Lands Network Explorer Tool
<input type="checkbox"/> Bike/pedestrian trails	<input type="checkbox"/> San Francisco Bay Trail
<input type="checkbox"/> Natural areas	<input type="checkbox"/> San Francisco Estuary Institute (SFEI) EcoAtlas
<input type="checkbox"/> Agricultural and working lands	<input type="checkbox"/> National Land Cover Database <input type="checkbox"/> County Tax Assessor Parcel Data <input type="checkbox"/> Local General Plan

Asset Class: Hazardous Materials Sites and Contaminated Lands	Data Sources
<input type="checkbox"/> Hazardous Materials Sites, e.g., RCRA regulated sites, CUPA sites	<input type="checkbox"/> US EPA Envirofacts
<input type="checkbox"/> Landfills (open and closed)	<input type="checkbox"/> US EPA Envirofacts <input type="checkbox"/> State Water Resources Control Board Geotracker
<input type="checkbox"/> Clean up sites, e.g., US EPA or DTSC regulated brownfield, cleanup sites, or landfills	<input type="checkbox"/> US EPA Envirofacts <input type="checkbox"/> State Water Resources Control Board Geotracker



Risk Assessment Scoping Handout

Use this scoping handout to help you plan the assessment your community will undertake. To help decide which assets to evaluate and if they will be assessed as individual assets, as an entire asset class, or if representative assets will be selected, consider both your community's goals and if data and information is readily available to begin answering the assessment questions.

Assets	Exposure Analysis Individual Asset	Assessment Questions			Would assessing this asset help your community achieve your goals?	What information sources are available to help conduct the assessment?
		Individual Asset	Asset Class	Representative Assets		
Publicly-owned buildings	X					
Critical response facilities	X					
Police						
Fire						
Public schools						
Public health facilities						
Residential buildings						
Non-residential buildings						
People						
Total population						
Population with access or functional needs						
Community services						

	Exposure Analysis	Assessment Questions			Would assessing this asset help your community's goals?	What information sources are available to help conduct the assessment?
		Individual Asset	Asset Class	Representative Assets		
Assets	Individual Asset					
Utility infrastructure						
Power						
Water supply						
Wastewater						
Stormwater/Flood control						
Transportation						
Roads						
Rail						
Seaport						
Airport						
Bike/pedestrian routes						
Communication						
Recreation, open space and working lands						
Hazardous materials sites and contaminated lands						

Step 4: Conduct the Assessment

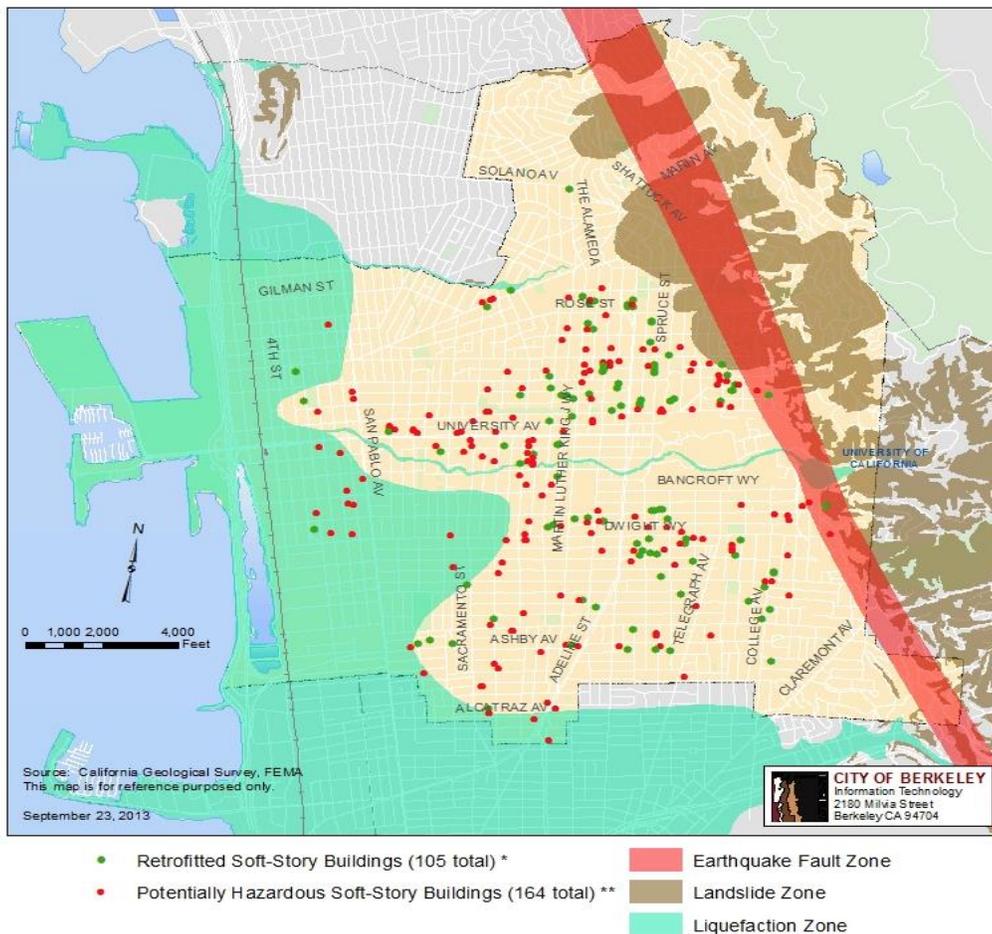
Key points of this step:

- Conduct an exposure analysis using your chosen hazards and assets
- Gather information on your assets to answer the assessment questions
- Understand what data you need if you want to conduct further refined evaluations using tools such as FEMA’s HAZUS-MH model

Exposure analysis

An exposure analysis helps identify which assets will be exposed to a specific hazard and provides a basic understanding of the magnitude of possible damage or loss after a disaster. An exposure analysis can determine how many housing units are likely to be exposed to the highest ground shaking during an earthquake and provide a high-level estimate of the economic impacts and number of residents who could be displaced. While an exposure analysis is necessary for your risk assessment it does not capture the nuances of how hazards may affect certain assets; for example, if homes have been retrofitted, or are of newer construction types, they may be able to withstand more ground shaking than older, unretrofitted homes.

Example exposure map from City of Berkeley Hazard Mitigation Plan (Map 3.8 Retrofitted and Unretrofitted Soft-Story Buildings)



To conduct an exposure analysis you will need to combine the location and extent of the hazards with the location of your community assets. This is generally done through GIS mapping using pre-identified hazard scenario map layers and mapped community asset locations. An exposure analysis is a stepwise process (for more detail see **ART How-to Guide: Exposure Analysis**):

1. Add your relevant hazard layers into a new or existing map in ArcGIS. It's helpful to load all of the layers into a single map so that you can turn them on and off as needed. Many hazards are well-mapped, such as earthquake shaking scenarios, current flood zones, and fire zones. For future hazards, some, such as inundation from higher high tides due to sea level rise, may have ready-to-use mapping tools available to evaluate asset exposure. For hazards that are not as well-studied or understood (e.g., salinity intrusion due to sea level rise or precipitation patterns) reliable information may not be readily available.
2. Gather and map the locations of the community assets included in your assessment. Publically-available data sources for a range of asset categories are provided in the **Identifying Community Assets Worksheet**. To do this step, you will need to have the location of the assets (latitude and longitude) or a previously made map layer that contains your assets.
3. Compare your assets to the hazard layers. Note which assets are in which hazard zones, the magnitude of the hazard they are exposed to (for example, light, moderate, strong, very strong, violent, or very violent ground shaking) or the probability of the hazard (1% flood hazard zone vs. 0.2% flood hazard zone), and assets that are exposed to multiple hazards.
4. Create maps showing the extent of hazards and the location of assets that intersect with those hazards. It is also a good idea to develop summary tables for large asset classes to communicate the different types and levels of hazards exposure.
5. Ask those with local knowledge and experience to review the maps and analysis to help pinpoint locations that do not adequately characterize local conditions and where additional studies, field verification, remapping or reanalysis is needed

FEMA's HAZUS-MH

One assessment tool that can help inform the economic consequences of natural hazards is FEMA's HAZUS-MH software. HAZUS requires user input on structure type and value in order to calculate damages. HAZUS outputs can be used to identify areas where large investments will likely be lost and is used after a disaster to provide damage estimates to FEMA. HAZUS requires detailed and accurate data about individual structure type and value to be useful; therefore it is important to consider when, at what scale, and for which assets Hazus will be informative to your community. The type of data needed to run HAZUS includes:

- Building Type
- Replacement cost
- Content cost (if available)
- Occupancy class
- Year built
- Location
- Number of stories
- First floor elevation
- Foundation type
- Design level

You can download HAZUS software here:
<https://www.fema.gov/hazus-software>

Answering Assessment Questions

Assessment questions help you describe the existing conditions, different types of vulnerabilities, and consequences that may occur if an asset, or an asset class, is exposed to a specific hazard.

The process of answering the assessment questions is best approached in a stepwise manner (for more detail see ART How-to Guide: Assessment Questions):

1. Get familiar with the assessment questions and the types of vulnerability and consequence findings that these questions have revealed (see **Assessment Questions Worksheet**).
2. Develop an approach for answering the questions before diving in. Remember that the assessment questions are a tool to guide the collection of targeted information that can then be summarized in different ways. For each asset class identify whether the assessment questions will be answered for individual assets, the class as a whole, or representative assets. Recognize that it may be necessary to modify the approach for certain assets depending on input from the project team, availability of information, and preliminary findings as the assessment progresses.
3. Gather answers to assessment questions by conducting research to uncover readily available reports, documents, inspection and monitoring reports, and maps. Make a diligent effort to gather as much information as possible before seeking input from asset managers, owners or topic experts, as it is far easier and more efficient for them to help refine answers or provide specific resources to fill information gaps than to answer the entire worksheet. Keep in mind answers are typically a few sentences to a paragraph long. It is okay if the answer uncovers further, specific challenges that need to be further investigated.
4. Ground truth preliminary assessment answers with asset managers, owners, and topic experts. It can be beneficial to provide the preliminary assessment answers and sources of information to the asset manager, owner or topic expert before asking for their input. However, be sure to give them enough background on the assessment objectives if they are not already familiar with the risk assessment. Since input on the preliminary assessment answers is partially based on best professional judgment, it is often helpful to ask for assistance in engaging colleagues, co-workers, others in the field, community members and non-profit organizations to gather needed information. Lastly, be sure to ask if there are any additional data or resources available that can help fill in information gaps. If there are none then make sure to note this data need or knowledge gap as an information challenge.

Outputs:

- Exposure analysis demonstrating which assets are exposed to which hazards
- Answers to assessment questions

Resources:

- Assessment Questions Worksheet (attached)
- ART How-to Guide: Exposure Analysis
http://resilience.abag.ca.gov/wp-content/documents/mitigation_adaptation/ART_H2G-ExposureAnalysis_Vf5.pdf
- ART How-to Guide: Assessment Questions
http://resilience.abag.ca.gov/wp-content/documents/mitigation_adaptation/ART%20H2G-Assessment%20Questions%20Guide%20Vf5.pdf

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Risk Assessment Questions

Assessment questions help you understand the underlying causes and components of vulnerability and the potential consequences of those vulnerabilities. You can answer assessment questions in a very detailed way for individual assets that either a visual map inspection or a geospatial analysis has identified as being exposed to a hazard. Assessment questions can also be answered in a more general way for an entire asset class (e.g., residential housing) although this type of assessment is best supplemented by evaluating one or more representative assets.

Many of the assessment questions are broad and apply to all types of assets, while some are specific to a particular hazard or type of asset, so you will not need to answer all of the questions for all assets. In addition, some questions can easily be answered with readily available information, while others will require research or external input. It can be difficult to know how much effort to expend when answering assessment questions. Instead of spending a lot of effort to uncover hard-to-find, or in some cases nonexistent information, flag critical data needs and knowledge gaps that require further consideration and come back to these when developing your mitigation and adaptation actions.

Existing Conditions

Describe the asset and highlight current conditions or stressors that could affect vulnerability

1. Who owns and manages the asset? Note if the owner and manager are different entities.
2. What year was the asset built? What is the remaining service life?
3. Has there been an effort to extend the service life (e.g. improvements, seismic retrofit, mitigation actions)? If so, describe what was done and when.

Physical Vulnerabilities

Identify conditions or design aspects that make an asset particularly vulnerable to impacts

4. Does the asset have characteristics that make it vulnerable to flooding?
4a. Are there water or salt sensitive components of the asset are at-grade or below-grade, e.g., mechanical or electrical equipment, pumps, utilities, building heat, ventilation, power systems, or finished basements?



4b. Does the asset have openings are at-grade or below-grade that are entry points for flooding, e.g., entryways, tubes, tunnels, ventilation grates?
4c. Are their barriers (temporary or permanent) that can protect sensitive components or at- or below-grade entry points? Are there pumps or other systems in place to remove floodwaters if they do enter?
For building assets:
5. Does the asset have characteristics that make it vulnerable to earthquakes?
5a. Is the facility or building a mobile or manufactured structure? If yes, describe the foundation type.
5b. Is the facility or building constructed from unreinforced masonry? If yes, describe how and if seismic hazards have been assessed and/or mitigated.
5c. Is the facility or building multi-story, constructed from concrete and was built between 1950 and 1971? If yes, describe if and how seismic hazards have been assessed and/or mitigated.
5d. For residential buildings (either single family or multifamily), is it cripple wall construction (typically with short unreinforced walls that raise the first floor 1-5 feet above ground level)? If yes, describe how and if seismic hazards have been mitigated (i.e. the home has been bolted to the foundation and/or the cripple wall has been strengthened).
5e. For 1-2 unit residences, is the building house over garage construction? For multifamily residential, are there garages or other large openings on the first floor (soft-story construction)? If yes to either, describe how and if seismic hazards have been assessed and/or mitigated.
6. Have you taken any mitigation measures against wildfire? (e.g, does your city have an inspection system for fire mitigation actions?)



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Functional Vulnerabilities

Describe asset function and/or relationships with or dependence on other assets that can make them vulnerable to impacts

7. Is the asset part of a networked system such that damage to other parts of the system would affect the asset's ability to function? Describe what alternatives exist that could help maintain continuity of service if parts of the system are disrupted.
8. What external services, such as power, communications, food or fuel supplies or materials does the asset rely on? If these external services were interrupted, are there back up supplies ready and in place, and how long would they last?
For building assets:
9. Does the asset serve sensitive populations?
9a. Does the asset serve or house the elderly or very young, mobility or medically challenged individuals, or animals? If yes, describe what systems or plans are in place to enable either shelter-in-place or safe evacuation and relocation of the facility if necessary.
9b. Does the asset serve or house community members that are resource limited, e.g., are they low or very low income, housing or transportation cost burdened, renters, or without a car? If yes, what programs or plans in place to help these members prepare for, respond to, or recover from a hazard event?
9c. Does the asset serve or house community members that are ethnically or culturally diverse, have limited English-speaking capacity, or are non-English speakers? If yes, what programs or plans in place to help these members prepare for, respond to, or recover from a hazard event?
For transportation assets:
10. Does the asset serves as a critical access road, emergency or lifeline route, provide sole or limited access to communities or facilities, or provide service to transit dependent communities? If yes, describe the communities, services, and facilities the asset serves.



For recreation, open space, and working lands:
11. Does the asset provide recreational access or opportunities that are unique or limited in the area and/or region, e.g., access for persons with limited mobility, interpretive programs, access to the Bay, etc.? Could these functions be easily replaced in other areas?
12. Does the asset provide or protect habitat for threatened or endangered species? Is this habitat scarce in the region? Could this habitat be established in other areas?
For utility and communication infrastructure assets:
13. Does the asset provide critical services to sensitive populations (see question 12), emergency response providers, or critical facilities?

Governance Vulnerabilities

Describe challenges with management, regulatory authority, or funding options for adapting to impacts

14. Is the asset protected from flooding by land or assets owned or managed by others (e.g., structural protection, roadways, rail embankments)?
15. What types of permits (and from which agencies) are necessary to maintain, repair or improve the asset? Are there special processes for emergency repairs?
16. What funding sources currently exist that can be used to assess hazard risk or vulnerability to climate change? To improve asset resilience?



Consequences

Describe potential impacts on society, equity, the economy, and the environment

17. What economic disruption would occur if the asset was damaged, disrupted, or failed? Local, regional, state, or national? If your answer is based on a past weather event or an unplanned disruption, describe the type and duration of that disruption.

18. How would the community, particularly sensitive populations (see question 12), be affected by damage, disruption, or loss of asset function?

19. What would consequences to ecological services be if the asset was damaged or lost (e.g. habitat or species benefits, public access to the shoreline, or water quality)? What would the effect of this loss have on locally? Regionally?



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Step 5: Summarize Vulnerability

Key points of this step:

- Summarize assessment information into clear, outcome-oriented problem statements

After you have conducted your risk assessment you will need to summarize your findings to identify the most significant risks in your community. These findings will help you to craft appropriate and responsive mitigation and adaptation actions and create a clear and cogent “story” to help support decision-making by elected officials and other stakeholders and provide a foundation for seeking funds to reduce risks and increase community resilience.

This can be best achieved by developing problem, or key issue, statements. Key issue statements help communicate the critical planning issues that emerged during the risk assessment, for example which critical assets are particularly vulnerable, what areas currently have repetitive losses, or how many high hazard areas are currently zoned for future development. Problem statements can help you prioritize and focus on the areas that have the greatest need for mitigation or adaptation based on the vulnerabilities and consequences identified. They can also help clearly communicate which issues require collaborative decision making, shared funding, or changes in laws, regulations, policies or other processes.

Problem statements can be developed for each hazard, asset class, or specific individual assets you evaluated in your risk assessment, for example:

“The North Creek Sewage Treatment Plant is located in the 100-year floodplain and has been damaged by past flood events. It serves 10,000 residential and commercial properties and it is the primary treatment plant for this area.”

“City Hall is located in an area that is likely to experience very high levels of shaking in either a San Andreas or Hayward earthquake. The building is an unretrofitted unreinforced masonry building built before 1930 and therefore highly vulnerable to damage in an earthquake.”

“Five of the eight public elementary schools in this city are in moderate or high ground shaking areas and one is located in both a liquefaction zone and in the 100-year floodplain. One middle school is not currently in any hazard zone but will likely experience future flooding with 36” of sea level rise. There is a data gap around the retrofit status of any of the schools; it is unknown if any have been seismically retrofitted.”

The first step in writing problem statements is to review the exposure analysis maps and answers to the assessment questions. It is often the case that a number of assets will have similar characteristics, conditions and challenges, so it makes sense to read through and reflect on all of the answers before beginning to summarize.

The second step is to use the answers to the assessment questions to write brief summary statements describing the vulnerabilities and consequences identified. Depending on the process, the statements can summarize the assessment findings for individual assets, particular asset categories or services, the community as a whole, or the agencies and organizations that own, operate or manage the assets evaluated.

When writing problem statements, it is helpful to consider what vulnerabilities or consequences to include, and which can be coalesced into a single problem statement or which should have stand alone problem statements. Generally speaking problem statements describe vulnerabilities and consequences that:

- ✓ Produce broad or wide ranging effects on society and equity including impacts to a large geographic area, people where they live, or people with specific characteristics or special needs
- ✓ Affect the environment by reducing ecosystem benefits provided by natural areas, such as flood risk reduction, water quality improvement, and supporting biodiversity
- ✓ Affect the economy at multiple scales, including local, regional, statewide and national
- ✓ Are urgent because impacts will occur in a shorter timeframe than it takes to address the vulnerabilities identified. For example, there may be a stretch of shoreline that will allow inland areas to flood either with small amounts of sea level rise or under current storm conditions, but addressing this issue requires a long lead time to due to complexities in ownership, management, financing, and regulatory oversight.
- ✓ Could cause cascading effects on other assets, services, or communities. This is particularly an issue for networked assets, such as transportation, utilities, and shoreline protection, which are interconnected in a manner such that failure of one part of the system will disrupt the rest of the system. This will also be an issue for assets that rely on other assets to maintain functionality, for example hospitals, nursing homes, and wastewater treatment plants that rely on uninterrupted power supplied by others.

Outputs:

- Problem Statements
- Fulfillment of Element B3 in FEMA’s Local Mitigation Plan Review Tool Checklist**

Resources:

- ART How-to Guide: Vulnerability and Consequence Statements
http://resilience.abag.ca.gov/wp-content/documents/mitigation_adaptation/ART%20H2G-V&C%20Statement%20Guide_Vf3.pdf