



# ONESF

Building Our Future

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There's only one San Francisco. Let's take care of it.



## FY 2017 HAZUS Analysis

February 27, 2017

# HAZUS

## Overview

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- HAZUS is a nationally-applicable methodology developed by FEMA to estimate potential losses from earthquakes, hurricanes, and floods
  - Input: Soil maps, ground shaking maps, building inventory maps, building structural data, building occupancy data, building economic data
  - Output: **Estimated** economic impact, building damage, and casualties
  
- It is a relative risk model, and helps prioritize mitigation efforts, emergency preparedness, and response and recovery planning

### MITIGATION

- Prioritize seismic retrofits of existing facilities
- Support development of local hazard mitigation plans
- Support development of hazard-resistant building codes & land use planning activities

### EMERGENCY PREPAREDNESS

- Create scenarios for use in developing emergency response plans (e.g., temporary housing, debris removal, etc.) and for emergency response exercises

### RESPONSE & RECOVERY

- Assess the need for post-disaster damage assessment
- Support response planning for critical transportation outages
- Recovery planning

# HAZUS

## Recap of previous analyses in San Francisco

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- HAZUS for earthquakes in San Francisco was first conducted in 2012
  - The initial run included 82 high-priority buildings
  - High-priority buildings included emergency response facilities, emergency shelter locations, primary department operation centers (DOCs), and vulnerable buildings
- The analysis has been updated twice since then, with the last run in 2013
  - The last run included 214 high-priority buildings
- In each analysis, four earthquake scenarios were modeled to estimate the impact on each building
- Significant driving factors affecting potential losses include building design level, building occupancy, building exposure value, and liquefaction potential

# HAZUS

## Uses

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- ▣ Improved capital planning
  - ▣ Better understand where further seismic analysis is needed
  - ▣ Prioritize seismic-related capital projects
  - ▣ Offer a consistent planning framework going forward
  - ▣ Examples of vulnerable buildings identified by previous HAZUS analyses include:
    - ▣ Veteran's Building (*recently-completed retrofit*)
    - ▣ Animal Care and Control facility (*replacement facility is in design*)
    - ▣ 101 Grove (*relocation of staff is in planning*)
    - ▣ Hall of Justice (*some depts. relocated, complete exit is in planning*)
- ▣ Guidance for important emergency response planning decisions
  - ▣ Inform emergency response actions plans, and locations of Emergency Operating Centers
  - ▣ E.g. seismically sound facilities with high peak occupancy (e.g. Moscone Center) may not need structural work, but do need a robust emergency response plan
- ▣ Improves eligibility for federal grants or FEMA reimbursement, and identified as action 3.I in the City's 2014 Hazard Mitigation Plan

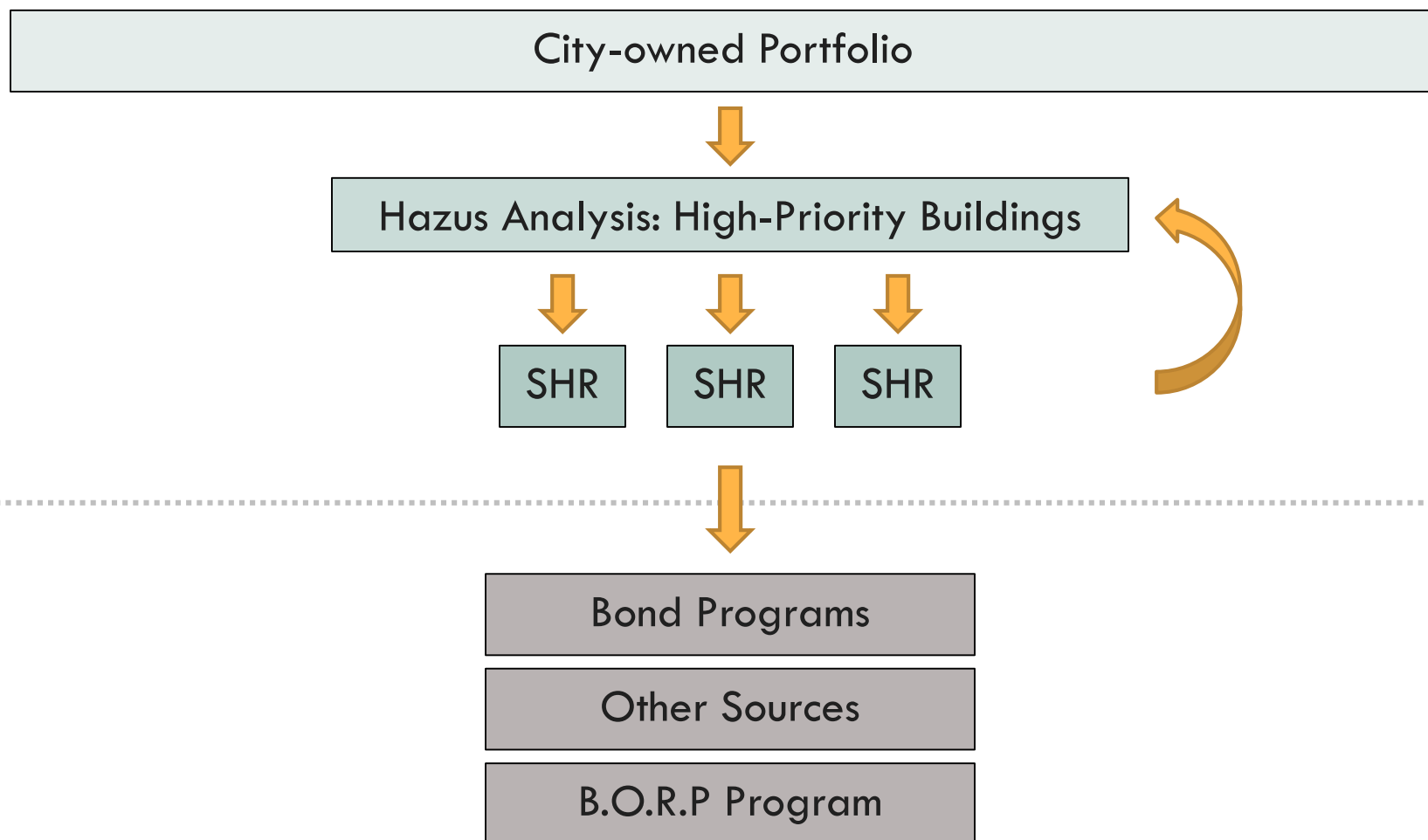
# HAZUS

## Prioritization Process

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ANALYSIS

CAPITAL PROGRAMS



# HAZUS

## FY 2017 Analysis

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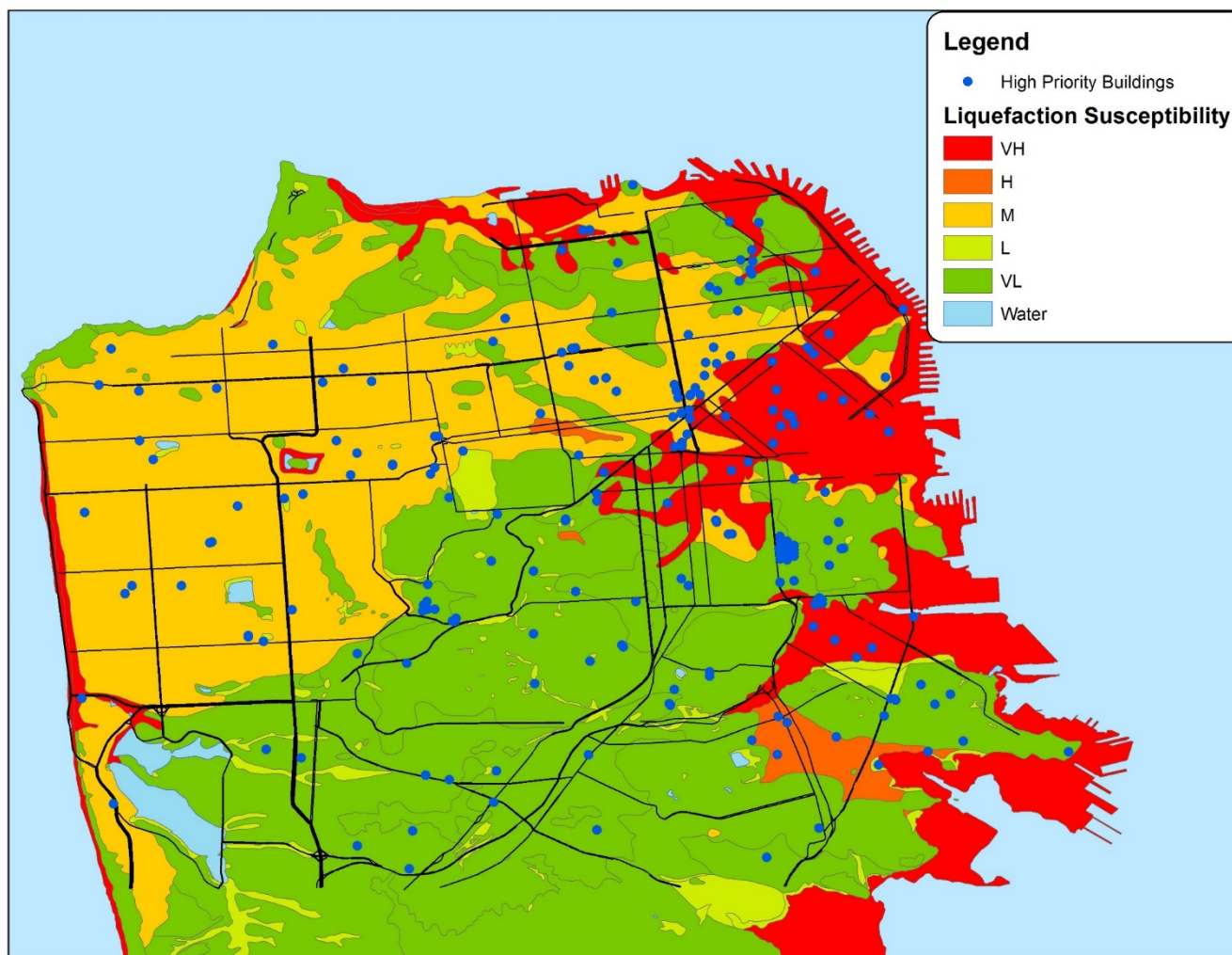
- Recently completed an update of the HAZUS analysis, in conjunction with Public Works and Rutherford + Chekene
- Analysis was expanded to include 239 facilities
- Structural information for all buildings was further vetted by Public Works
- Occupancy and content value assumptions were updated by departments

# HAZUS

## FY 2017 Analysis

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### LIQUEFACTION SUSCEPTIBILITY



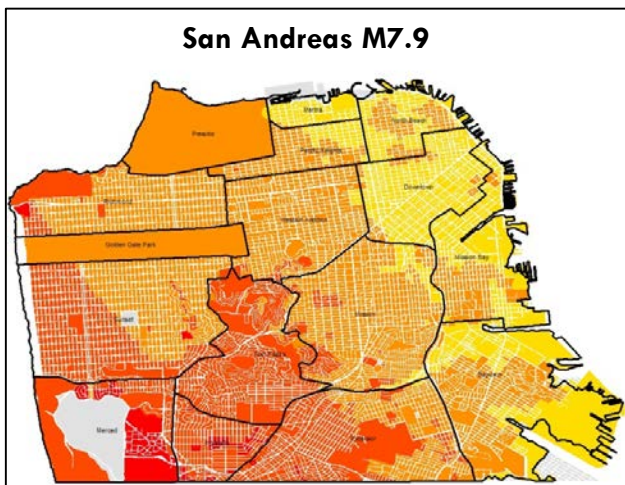
# HAZUS

## FY 2017 Analysis

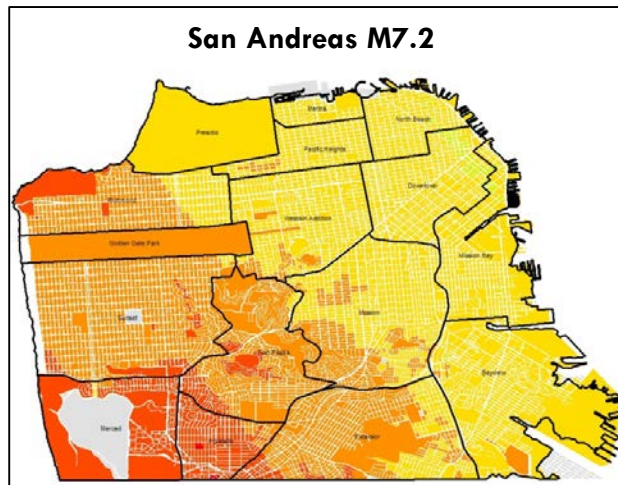
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### GROUND SHAKING MAPS

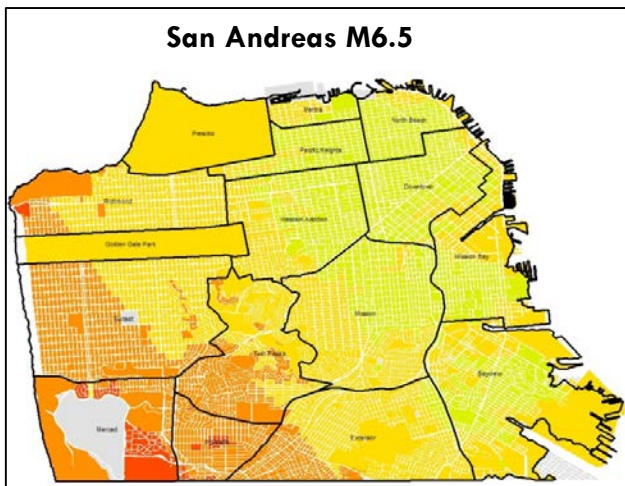
**San Andreas M7.9**



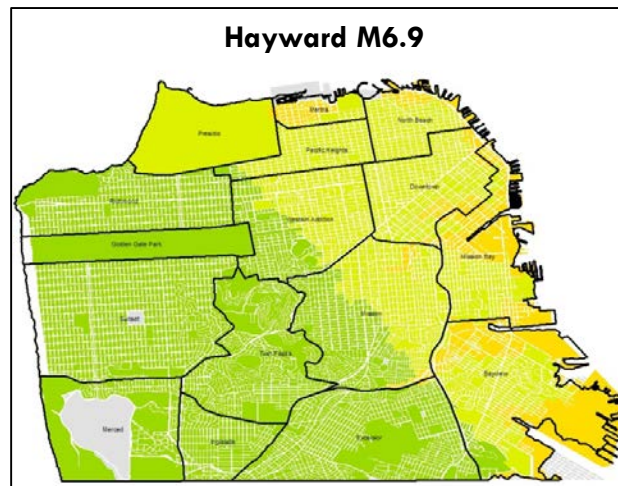
**San Andreas M7.2**



**San Andreas M6.5**



**Hayward M6.9**



# HAZUS

## FY 2017 Results (1/3)

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### PROJECTED ECONOMIC IMPACT (LOSSES)

<i>\$ in millions</i>	<b>Hayward M6.9</b>	<b>San Andreas M6.5</b>	<b>San Andreas M7.2</b>	<b>San Andreas M7.9</b>
Structural Damage	107.2	133.4	212.3	353.1
Non-Structural Damage	398.3	545.4	859.7	1,489.3
<b><i>Total Building Damage</i></b>	<b>505.5</b>	<b>678.8</b>	<b>1,072.0</b>	<b>1,842.4</b>
Content Damage	130.1	426.7	523.6	714.3
Operational Losses; Rent, Relocation & Lost Income	154.8	191.9	314.7	527.2
<b>Total Economic Impact</b>	<b>790.4</b>	<b>1,297.3</b>	<b>1,910.3</b>	<b>3,083.8</b>

# HAZUS

## FY 2017 Results (2/3)

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### PROJECTED BUILDING DAMAGE

	Hayward M6.9	San Andreas M6.5	San Andreas M7.2	San Andreas M7.9
Green-tagged	195	183	127	75
Yellow-tagged	32	44	89	74
Red-tagged	12	12	23	90
<b>Total Buildings</b>	<b>239</b>	<b>239</b>	<b>239</b>	<b>239</b>

# HAZUS

## FY 2017 Results (3/3)

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### POSSIBLE RED-TAGGED BUILDINGS WITH >70% DAMAGE (SAN ANDREAS M7.9)

- ▣ Animal Care and Control Facility – *replacement facility in design*
- ▣ DPH Central Office (101 Grove) – *relocation of staff planned*
- ▣ 9 Fire Stations – *3 will be addressed under ESER Program, others need further study*
- ▣ Fire Chief's Residence
- ▣ Hall of Justice – *some depts. already relocated, complete exit in planning*
- ▣ Hunters Point Art Studios
- ▣ Kezar Pavilion – *study underway*
- ▣ Maxine Hall Health Center – *renovation underway*
- ▣ McLaren Lodge
- ▣ Mothers Building
- ▣ Municipal Railway Overhead Lines – *will be replaced by new ACC facility*
- ▣ Park Police Station – *being considered for ESER Program*
- ▣ Park Senior Center
- ▣ Produce Market
- ▣ REC Corporate Yard Buildings
- ▣ SFFD Equipment Unit Headquarters – *being considered for ESER Program*
- ▣ Tom Waddell Clinic – *relocation planned*

# Seismic Hazard Rating Categories

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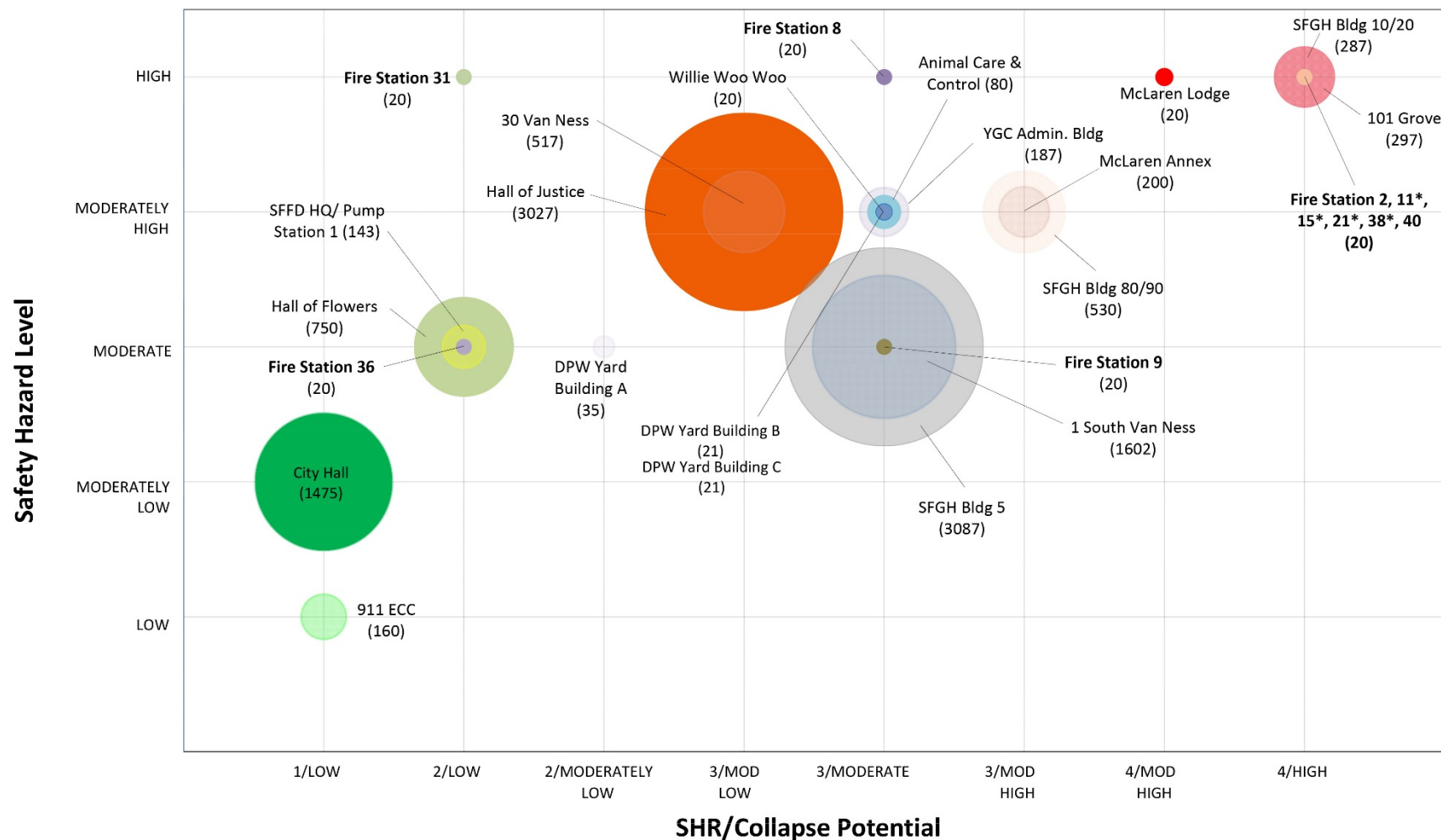
SHR	Description
SHR-1	<b>Minor damage</b> (good performance). Some structural or nonstructural damage and/or falling hazards may occur, but these would pose minimal life hazards to occupants. The damage can be repaired while the building is occupied and with minimum disruptions to functions.
SHR-2	<b>Moderate damage</b> (fair performance). Structural and nonstructural damage and/or falling hazards are anticipated which would pose low life hazards to occupants. The damage can be repaired while the building is occupied.
SHR-3	<b>Major damage</b> (poor performance). Structural and nonstructural damage are anticipated which would pose appreciable life hazards to occupants. The building has to be vacated during repairs, or possibly cannot be repaired due to the extent and/or economic considerations.
SHR-4	<b>Partial/total collapse</b> (very poor performance). Extensive structural and nonstructural damage, potential structural collapse and/or falling hazards are anticipated which would pose high life hazards to occupants. There is a good likelihood that damage repairs would not be feasible.

# Seismic Hazard Ratings

## Results for select City buildings

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**Seismic Hazard Rating Matrix - Draft**



# Building Occupancy Resumption Program (BORP)

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- Expedited post-disaster building inspection and occupancy determinations
- 156 private and 8 public buildings are participating in the program
- In addition, 22 facilities are part of the Port's BORP program



# Questions & Comments

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