County of San Mateo California

Coastal Conservancy

ARCADIS

LWC
Lisa Wise Consulting, Inc.

San Mateo County Vulnerability Assessment

Report on Asset Categorization and Classification

September 22, 2015

Tables

Figures

1. Introduction

A critical part of a comprehensive sea level rise (SLR) vulnerability assessment (VA) is categorizing and classifying the built and natural assets that will be exposed to present and future inundation in San Mateo County. Because there are so many different assets and asset types in urban areas like San Mateo County, it could be overwhelming for decision makers to understand what is and will be exposed to inundation, what it could mean if assets were inundated, and whether the vulnerability of some assets warrants action. Asset categories and classes enable us to think about this issue differently and provides a framework to focus on the most critical issues first.

The approach taken in this SLR VA has two parts and is complimentary to (the) regional Adapting to Rising Tides SLR VA methodology.[1] In addition to categorizing assets by their similar function or sector (part I), this method also integrates a risk component whereby prior to any evaluation of an asset, the asset will be assigned to a risk class (1, 2, 3, or 4) according to the severity or magnitude of the consequences if it were to flood (part 2). In the end, this additional step in the methodology will provide a high-level understanding of what kinds of assets are at risk in the County, and where those assets are located. The risk-based criteria described below provide a sense of the criticality in terms of public health, safety, and welfare. It further provides preliminary insight into cross-cutting vulnerabilities, and into the Adapting to Rising Tides (ART) guiding question: *If exposed to climate impacts, what is the expected magnitude of the consequences?*[2]

The approach used in this assessment accounts for all of the built and natural assets within the project boundary, including attention to human assets, and provides a framework for future risk analyses and a flood risk management/sea level rise adaptation strategy. As described below, the overall methodology including the asset classification component was developed to better prepare San Mateo County and its cities to apply for federal funding to reduce flood risk.

---

[1] San Francisco Bay Conservation Development Commission (BCDC). (2012). Adapting to Rising Tides project. Accessible: http://www.adaptingtorisingtides.org/

[2] BCDC. (2012). Adapting to Rising Tides: Chapter 1, page 10.

1.1 Purpose

The purpose of this document is to describe the previously defined categories and classes into which San Mateo County assets will be organized, and to explain the rationale and criteria used to classify the assets. This document also provides a preliminary list of San Mateo County's assets, assigned to the appropriate asset class.

1.2 Definitions and Background

To support a better understanding of this document, this section discusses some key terms and background.

Flood risk is the product of the likelihood of inundation and the potential for adverse consequences when inundation occurs. For purposes of this project, the terms *inundation* and *flood* are used interchangeably.

Risk-based criteria means that the consequences to public health and safety of inundation are a determining factor in assigning built assets to classifications.

A *flood risk management strategy* (Figure 1 below) is an overall strategy aimed at reducing flood risk; it is developed based on a clear understanding of risk, and incorporates stakeholder preferences and economic efficiency.

A *flood risk assessment* (Step 1 in Figure 1 below) provides a clear understanding of risk, and involves identifying the likelihood of inundation and the potential consequences of inundation. The consequences are determined by who and what lie in harm's way, and how vulnerable they are to inundation (vulnerability assessment, Figure 1 below).

An *asset category* refers to a group of assets that are similar in function or service; for example, energy infrastructure and pipelines, ground transportation, hazardous materials, and natural areas.

An *asset class* refers to a group of assets that are organized based on risk and criticality for built assets, and based on habitat type or species for natural assets. Classifying assets is a critical part of understanding risk (part of Step 1 in Figure 1 below).

It is important to distinguish asset *classification* from asset *prioritization.* Asset classification is objective and transparent; it organizes built assets such as housing, transportation infrastructure, energy infrastructure, and critical infrastructure, according to their function and criticality as it relates to public health, safety, and welfare. Asset classification also objectively captures natural and human assets without a weight or preference that could influence investment decisions or the outcomes of future assessments; it is part of the Vulnerability Assessment in Step 1 of Figure 1 below.

Asset *prioritization,* on the other hand, is subjective; it comes later in the flood risk management process (Step 4 in Figure 1 below), and is part of an overall flood risk management and sea level rise adaptation strategy. Such a strategy would be developed based on the results of a full risk assessment (Step 1), the effectiveness of risk-reduction measures (Steps 2 and 3) including cost, and an overall vision with specific goals and objectives that incorporate stakeholder preferences.

Figure 1   Components of a flood risk management and adaptation strategy
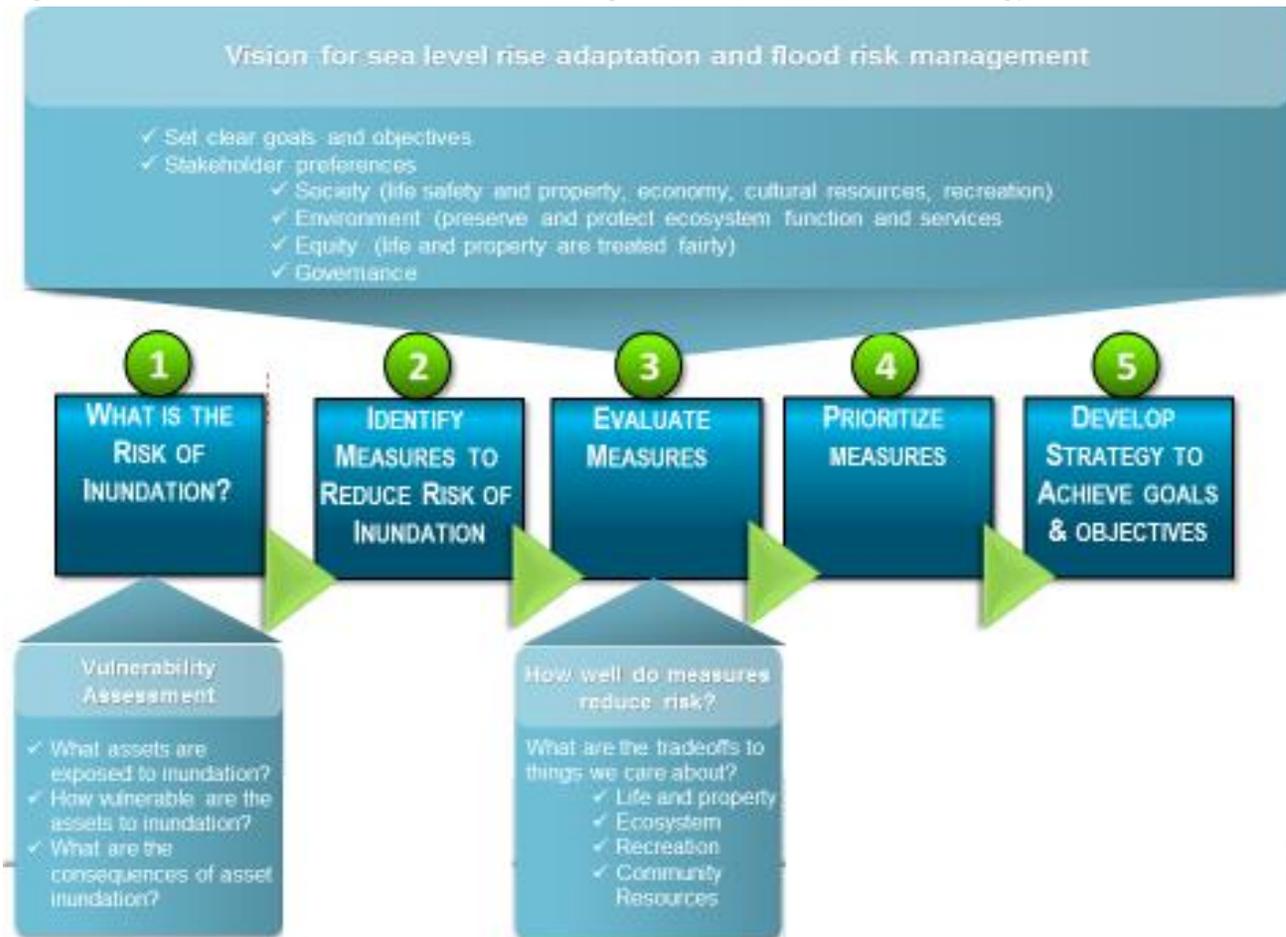
2. Approach to Asset Categorization and Classification

For a vulnerability assessment to be useful regionally, the method should support, align with, or compliment other regional best practices. For a vulnerability assessment method to be credible, it should be transparent, defendable, and based on the best available science.

To that end, the San Francisco Bay Conservation Development Commission (BCDC) developed a methodology in the *Adapting to Rising Tides* (ART) project to guide vulnerability assessments in the San Francisco Bay area. This method is being adopted and used by many local jurisdictions as they begin to address SLR adaptation. The ART project specifically identifies and describes 12 asset categories into which assets should be organized for analysis[3]. This enables communities to assess vulnerabilities and risk to entire sectors. Therefore, to align with regional efforts, all natural and built assets in San Mateo County will be categorized in to the same 12 categories identified in the report and listed below.

Meanwhile, flood risk management under federal guidance (US Army Corps of Engineers) identifies life safety as paramount; federal funding for flood risk reduction and hazard mitigation is almost exclusively allocated to projects that reduce risk to life and property.[4] California state guidance on sea level rise preparedness[5] (Safeguarding California, California Coastal Commission Sea Level Rise Guidance) places an emphasis on nature-based solutions and protection of vulnerable populations. In addition, this project is funded through California State Coastal Conservancy Climate Ready grant funds, which require a focus on protection of natural resources. Therefore, it is critical to incorporate these elements into a vulnerability assessment since the vulnerability assessment is one of the first steps to developing a flood risk management and sea level rise adaptation strategy.

---

[3] San Francisco Bay Conservation Development Commission (BCDC). (2012). Adapting to Rising Tides: Existing Conditions and Stressors

[4] California Department of Water Resources (DWR). (2013). Floodsafe California: California's Flood Future: Recommendations for Management the State's Flood Risk.

2.1 Built Assets

The American Society of Civil Engineers (ASCE) developed guidance on building standards in order to protect public health, safety, and welfare in the event of a hazard. In the guidance, titled *ASCE 24-14 Flood Resistant Design and Construction*[6] and *ASCE 7-10 Minimum Design Loads for Buildings and Other Structures*[7], built assets are assigned a risk classification according to the assets' function or occupancy type, and the classes range from class 1—no or low risk to public safety and society (including economic disruption)—to class 4—highest risk to public safety and society. The guidance documents then provide construction and design guidelines for assets in each class in order to minimize risk to public safety, and society. The ASCE built asset classes are used by FEMA in its Hazard Mitigation Assistance programs[8], whereby flood mitigation measures must be designed for a flood elevation that is associated with each asset class. The ASCE asset classes have also been adopted by the International Building Code Council[9]and by the California Building Codes[10]; it is therefore appropriate to use them in this vulnerability assessment. This approach of asset classification is also consistent with the State of Florida Department of Emergency Managements' Public Facilities Flood Mitigation Initiative[11]

In addition to assigning each asset type to one of the 12 *Adapting to Rising Tides* (2012) categories referenced above, all built assets in San Mateo County will be herein classified according to the same criteria used to classify assets in *ASCE*

---

[6] American Society of Civil Engineers (ASCE). (2015). 24-14 Flood Resistant Design and Construction

[7] ASCE (2013). 7-10 Minimum Design Loads for Buildings and Other Structures

[8] FEMA (2015). Hazard Mitigation Assistance Guidance Addendum. Available from: http://ecodes.biz/ecodes_support/free_resources/2013California/13Building/PDFs/Chapter%2016%20-%20Structural%20Design.pdf

[9] International Code Council, see table 1604.5 Available from: http://publicecodes.cyberregs.com/icod/ibc/2012/icod_ibc_2012_16_par023.htm

[10] California Building Codes, 2013, see table 1604.5, available from http://ecodes.biz/ecodes_support/free_resources/2013California/13Building/PDFs/Chapter%2016%20-%20Structural%20Design.pdf

[11] Florida Division of Emergency Management (2015). Public Facilities Flood Hazard Mitigation Assessment Manual. Accessible: http://www.floridadisaster.org/Mitigation/SMF/Index.htm

24-14. This approach is transparent and defendable; it also enables consideration of societal disruption, as well as issues of equity because all assets are classified objectively using the same criteria.

2.2 Natural Assets

To date, no guidance exists to assign *natural assets* to a risk class (low to high) as in the built asset method, and there is currently not consensus among the scientific community on which ecosystem types are more critical or valuable than others in a way that would support a risk classification for natural assets. If natural assets were assigned to the classes under *ASCE 24-14*, they would in most cases be assigned to the lowest risk class because inundation would not necessarily pose a threat to public health, safety, and welfare. As a result, a decision maker, unless he or she has time to do a detailed investigation into each of the classified assets, would not be aware of potentially critical habitat or natural asset. Therefore, it would be inappropriate to assign natural assets a risk-based classification.

However, natural assets such as wetlands, marshes, beaches, and endangered species are of great importance to San Mateo County, the State of California, and the federal government (see applicable State of California Coastal Act policies[12], Executive Order 11990 on the protection wetlands, Executive Orders 11988 and 13690 on the wise use of floodplains, and the Federal Endangered Species Act,). Not only do natural assets provide intrinsic value to San Mateo County and its residents, but natural assets are also recognized for the services they may provide, including biodiversity, flood and erosion control, water quality improvement, and carbon sequestration.[13] Therefore natural assets will be included in this vulnerability assessment. Natural assets will be classified as simply N, 'Natural,' with a descriptor partially based on the habitat types assessed in the *Climate Change Vulnerability Assessment for the North-Central California Coast and Ocean* [14], such as *N-beach*, or *N-wetlands*, *N-rocky*

[12] California Coastal Act Sections: 30230, 30231, 30240, and 30253

[13] BCDC. (2012). *Adapting to Rising Tides.* Chapter 4

[14] Hutto, S.V., K.D. Higgason, J.M. Kershner, W.A. Reynier, D.S. Gregg. (2015). Climate Change Vulnerability Assessment for the North-central California Coast and Ocean. Marine Sanctuaries Conservation Series ONMS-15-02. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD.

intertidal, or *N-species of concern* (Table 2). This provides an inventory of natural assets to support future flood risk analyses, and provides a baseline against which future adaptation strategies can be compared, in terms of how strategies may positively or negatively affect the county's natural assets.

2.3 Human Assets

The protection of human health and safety is often the priority of a flood risk management strategy, therefore the vulnerability assessment offers an opportunity to identify the number of people that are exposed to a flood hazard or will be exposed in the future (Methodology report, steps five, six, and seven). Further, some individuals and communities are less able to respond and adapt to natural hazards like flooding (and the risks posed by sea level rise); instead, they are more vulnerable than the general population at large and may experience disproportionate impacts from flooding. Strategies to reduce the risks from flooding to vulnerable populations may need to be considered explicitly. The factors that could affect an individual's or community's ability to respond include (but are not limited to), things like age, income, education, and mobility. It is therefore imperative in SLR planning that the County understand where socially vulnerable or disadvantaged communities are, and consider this in the risk reduction strategies.

Similar to natural assets, human assets will not be classified according to risk. Instead, human assets will be classified as an "H", *followed by a descriptor,* meaning *human asset.* The vulnerability assessment will inventory both the population at risk (*H-Population*), and in the identification of socially disadvantaged or vulnerable populations (*H‑Disadvantaged Community*). The assessment may also identify the location of affordable housing units (*H-Affordable Housing Unit*).

3. Asset Categories and Classes

All assets in San Mateo County will be assigned to one of the following 12 categories:

- Airport
- Community land use, services, and facilities
- Contaminated lands
- Energy infrastructure and pipelines

- Ground transportation
- Hazardous materials
- Natural areas
- Parks and recreation areas
- Seaport
- Structural shorelines
- Storm water
- Wastewater

For a detailed description of each category, please refer to *Adapting to Rising Tides: Existing Conditions and Stressors* (2012).

Table 1 below, is adapted from *ASCE 24-14* and describes each asset *class* according to the function of the asset or the occupancy of the building. The description includes examples of asset types that belong to each asset class. There are a number of asset types present in San Mateo County that were not explicitly listed in ASCE's table; therefore, these asset types are identified in the far right column and are organized according to asset class based on the description provided. In the far right column, where an asset has a number with parentheses, e.g., (4.*X*), the *X* refers to the number in the column to the left, as justification for why an asset was placed in that class.

Table 1   Classification for built assets in San Mateo County (Adapted from ASCE 24-14, Table 1-1)

Risk Classification	Description of Category	Asset type or function	San Mateo County assets not previously identified in ASCE list
1	Buildings and structures that normally are unoccupied and pose minimal risk to the public or minimal disruption to the community should they be damaged or fail due to flooding.	(1) temporary structures that are in place for less than 180 days (2) accessory storage buildings and minor storage facilities (does not include commercial storage facilities) (3) small structures used for parking of vehicles (4) certain agricultural structures.	Transit Maintenance Yard Trails and trailheads Beach access points
2	Buildings and structures that pose a moderate risk to the public or moderate disruption to the community should they be damaged or fail due to flooding, except those listed as Flood Design Classes 1, 3, and 4.	The vast majority of buildings and structures that are not specifically assigned another risk class, including most residential, commercial, and industrial buildings.	Marinas Job Centers Dept. of Defense Infrastructure (subset) Historic and Cultural Places/Resources Gas Fields Hotels/Hostels (subset) Parks
3	Buildings and structures that pose a high risk to the public or significant disruption to the community should they be damaged, be unable to perform their intended functions after flooding, or fail due to flooding.	(1) buildings and structures in which a large number of persons may assemble in one place, such as theaters, lecture halls, concert halls, and religious institutions with large areas used for worship (2) museums (3) community centers and other recreational facilities (4) athletic facilities with seating for spectators (5) elementary schools, secondary schools, and buildings with college or adult education classrooms (6) jails, correctional facilities, and detention facilities (7) healthcare facilities not having surgery or emergency treatment capabilities (8) care facilities where residents have limited mobility or ability, including nursing homes but not including care facilities for five or fewer persons (9) preschool and child care facilities not located in one- and two-family dwellings (10) buildings and structures associated with power generating stations, water and sewage treatment plants, telecommunication facilities, and other utilities which, if their operations were interrupted by a flood, would cause significant disruption in day-to-day life or significant economic losses in a community (11) buildings and other structures not included in Flood Design Class 4 (including but not limited to facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, hazardous waste, or explosives) containing toxic or explosive substances where the quantity of the material exceeds a threshold quantity established by the authority having jurisdiction and is sufficient to pose a threat to the public if released.	Confined Animal Facilities Water Sources, Canals, Intakes, and Outfalls Hazardous/Contaminated Sites (subset, 3.11) DoD Infrastructure (subset, 3.1, 3.11) Sports Facilities (3.1) Gas storage (subset, 3.11) Gas wells Nat. Gas Pipelines & Stations (3.11) Oil Pipelines (3.10, 3.11) Hotels/Hostels (subset, 3.1) Mines (subset, 3.11) Railroads Non-Federal Roads/Highways (3.10) Ports Transit Hubs Lighthouses
4	Buildings and structures that contain essential facilities and services necessary for emergency response and recovery, or that pose a substantial risk to the community at large in the event of failure, disruption of function, or damage by flooding.	(1) hospitals and health care facilities having surgery or emergency treatment facilities (2) fire, rescue, ambulance, and police stations and emergency vehicle garages (3) designated emergency shelters (4) designated emergency preparedness, communication, and operation centers, other facilities required for emergency response (5) power generating stations and other public utility facilities required in emergencies (6) critical aviation facilities such as control towers, air traffic control centers, and hangars for aircraft used in emergency response (7) ancillary structures such as communication towers, electrical substations, fuel or water storage tanks, or other structures necessary to allow continued functioning of a Flood Design Class 4 facility during and after an emergency (8) buildings and other structures (including, but not limited to, facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, or hazardous waste) containing sufficient quantities of highly toxic substances where the quantity of the material exceeds a threshold quantity established by the authority having jurisdiction and is sufficient to pose a threat to the public if released.	Hazardous/Contaminated Sites (subset, 3.11) Flood Control Infrastructure Fire Hydrants Evacuation Routes Gas Storage (subset, 4.8) Oil Pipelines (4.8) Bridges/Tunnels Mines (4.8) Federal Highways

Table 2 below identifies the classes that will be used to account for natural assets in San Mateo County. To date, they account for all natural assets in the dataset. Developing risk classes for natural assets may be a useful exercise in the future so that flood risk reduction measures can be evaluated for their effectiveness at reducing risk to critical ecosystems (as in Figure 1 above), or to those ecosystems and habitats most important to the region; however, this would require considerable scientific input, debate, and consensus. In the interim, as previously mentioned, existing legislation discourages building in floodplains, wetlands, or environmentally sensitive habitat areas, and the take of threatened species[15], so the suggested classification scheme for natural assets in San Mateo County should be appropriate. Details on the vulnerability of these natural assets and the services they provide will be assessed in the Asset Vulnerability Profiles if a natural asset is selected for a profile.

Table 2   Classification for natural assets in San Mateo County

Class	Natural Asset Descriptor	Natural asset type and examples
N-W	Natural Assets – Wetlands/ Estuaries	Wetlands, marshes, etc.
N-B	Natural Assets – Beaches/ Dunes	Beaches
N- R	Natural Assets – Rocky Intertidal	Rocky intertidal
N-S	Natural Assets – Species of concern	Federally or State-listed, threatened, or endangered species, or other species of concern, including those identified in the Climate Change Vulnerability Assessment for the North-central California Coast and Ocean, or elsewhere.
N-G	Natural Assets – Groundwater	Groundwater basin or source
N-O	Natural Assets – Other	Natural assets not listed in any other category

As mentioned, human assets will be accounted for and organized/classified in terms of the sheer number of the persons that are or could be exposed to current and future flooding posed by sea level rise, and in terms of communities that have been identified as socially vulnerable or disadvantaged. .

---

[15] Coastal Act Sections: 30230, 30231, 30240, and 30253

Table 3   Classification of human assets

Class	Human Asset Description
H-P	Population exposed to current or future flooding (in number of individuals)
H-DC	Disadvantaged community
H-H	Affordable housing unit

4. Next steps: inundation mapping and asset inventory

As described in the Methodology report, after all assets for which data are available have been both categorized and classified, those assets that are exposed to current flooding or future sea level rise (step four in the methodology) will be displayed on a map according to asset class (steps five and six). This will provide county, city, and asset managers a clear sense of what types of assets are at risk, and where they are located. Asset inventories and spreadsheets (step seven) that correspond with the assets on the inundation maps will then be developed. The inventories will identify the number and types of assets at risk in each area according to asset category and asset class. A sample asset inventory spreadsheet is included in the Methodology report.