Facilitator Guide for Game of Floods
Princeton, San Mateo County

November 2024

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To learn more about Plan Princeton, scan the QR code or look up the following URL for the County's webpage:

https://www.smcgov.org/planning/plan-princeton

Game of Floods – Princeton

Tools needed for activity:

- Game materials (one set for each team): game board, game cards (budget, assets, roles, adaptation strategies and sea level rise scenarios), and participant workbooks with accompanying asset inventory table, strategy summary list and adaptation planning table
- Writing utensils for each team and a ruler
- At least 2-3 dry erase markers per team (if game boards have been laminated)
- Name tags

Facilitators should use this guide to assist their team in completing the Game of Floods[1]. Each team will have a defined sea level rise scenario and a set budget, but the rest of the planning is up to the team. The Facilitator (or assigned scribe) should use the worksheets provided separately to record all team decisions and to report on how the teams selected their respective adaptation strategies at the end of the game. Participants can also complete their own worksheets if they like.

1 INTRODUCTION AND PURPOSE OF THE GAME

To help participants:

- Develop better understanding of how sea level rise and coastal erosion will impact life in Princeton
- Gain better understanding of policies and physical strategies that may help Princeton adapt to sea level rise
- Understand the complexities and trade-offs of adaptation planning!

SEA LEVEL RISE PROJECTIONS

The gameboard shows two sea level rise exposure zones, each with storm surge from a 1% annual chance storm. The sea level rise amounts shown on the game board are for 3.3 and 6.6 feet, taken from USGS's Coastal Storm Modeling System data. These amounts are used for the game because they align with San Mateo County's Sea Level Rise Policy for County-Owned Assets and the County's 2018 Sea Level Rise Vulnerability Assessment. The data aligns with (but is not identical to) the projections from the State of California Sea Level Rise Guidance released in 2024 by the Ocean Protection Council. Your team will have one scenario to keep in mind

[1] The Game of Floods was originally developed for Marin County, California as a planning tool to allow stakeholders to better understand and prioritize adaptation strategies for responding to sea level rise and coastal flood hazards. This interactive tool was leveraged and expanded by Kris May and Rebecca Verity at AECOM with permission from Marin County. USDN further developed the game, incorporating extreme heat into a version called The Game of Extremes. Additional refinements were made for San Mateo County.

when assessing the vulnerability and consequences for assets in Princeton. It is important to consider the time of expected exposure when selecting adaptation strategies.

- **Intermediate Scenario: sea levels may rise 3.3 feet by 2100, and 6.6 feet by 2150.**
- **High Scenario: sea levels may rise 3.3 feet by 2070, and 6.6 feet by 2100.**

Facilitator to provide the team with their allocated sea level rise scenario.

GAME PLAY – SETTING THE SCENE

FACILITATOR ACTIONS:

1) Hand out Game of Floods game board (if not already on the table), and sea level rise scenario to each team. (Do not have any other cards available to participants at this point).
2) Ask each participant to introduce themselves to the team (name and organization) and then assign them a "role card" to each participant that defines whether they will be representing an elected official, a utility, or the community. Choose a role that is very different to what they do in real life. Ask them to read out the card to the table (front and back). It may be helpful for participants to tape the role card to their clothing to display and remind everyone of respective roles throughout the game. Remind participants that this is a game, so even if they know the individual who plays that role in real life, they can inhabit that character as they like and don't get personal!

4) Familiarize participants with the board using the following key points:
   - Note the sea level rise and erosion hazard zones and that the Princeton beach shoreline is actively eroding but there isn't modelled data predicting how much it will erode in the near future for it to be shown on the board.
   - Note that the word 'assets' describes a building, a structure, a facility or a natural resource that is important for life in Princeton. The zones on the board have been created for the purposes of game play but do not exist in real life.
   - Assume that affected assets within sea level rise hazard zones are permanently inundated or temporarily impacted by storms, or damaged, unless otherwise protected.
   - **Ask for someone to volunteer to scribe and someone to provide feedback at the end of the game to the whole group (could be same person).**

Roles

• Harbormaster • Surfer • Local Resident • Business Owner	• Fishing Association President • Supervisor • County Planner • Chief Engineer

2 ASSET INVENTORY

Before a sea level rise adaptation strategy can be developed, we need to understand which assets are vulnerable.

FACILITATOR ACTIONS:

1) Distribute all asset cards and the asset inventory worksheets to the team and highlight the descriptions on the back of the card. Remind the participants that depending on their assigned role, they may be particularly interested in some assets or asset types. These assets are all identified on the game board.
2) Guide the team to work together to develop a list of assets they agree are important when considering comprehensive adaptation strategies for the community. The team should select up to 10 assets (out of the provided 19 cards).
    - Maintain master list of prioritized assets on the Asset Inventory worksheet.
    - Use your table to match the time horizon to sea level rise amounts, shown on the game board.
    - **Encourage team members to advocate for assets consistent with their respective roles.**
    - Keep conversation on task.
    - You have 2 blank asset cards which you can provide IF your team wants to include a missing asset.

Note: All asset descriptions are developed for the purpose of the game only. Where possible, they are derived from reports, maps, and observed conditions. They may not accurately reflect the asset.

Asset List*	
Central Industrial Zone	Highway 1
Waterfront Industrial Zone	Capistrano Road
West Point Avenue Residential Zone	Prospect Way
Princeton/Columbia Mixed-Use Zone	West Point Avenue
Pillar Point Harbor	Princeton Avenue
Half Moon Bay Yacht Club	Airport Street / Vassar Avenue
Marsh	West Point Parking Lot
Princeton Beach	Airport Street Bus Stop
West Shoreline Access Path	Public Works Corporation Yard
Princeton Pump Station	

*Selected for the purposes of the game. Exclusion is not an indication of the importance of the asset to Princeton. The 'Zones' have been made up for the purpose of the game and are not formal zones in real life.

3 VULNERABILITY AND CONSEQUENCE

ASSESSING VULNERABILITY

For the purposes of the Game of Floods, the vulnerability of each asset is assessed based on its exposure and sensitivity to flooding. The exposure of an asset is determined by what sea level rise scenario it is subject to and where it is located. The sensitivity of an asset may primarily rely on its uses and physical characteristics. For example, what an asset is made of and its physical condition strongly relates to how it will respond to temporary impacts.

Vulnerability = Exposure + Sensitivity

Note: *All asset descriptions and sensitivity scores are developed for the purpose of the game only. Where possible, they are derived from reports, maps, and observed conditions. They may not accurately reflect the asset.*

FACILITATOR ACTIONS:

1) Ask the teams to assign a vulnerability rating based on the exposure and sensitivity of each asset.
    - Each team should review the game board to identify which exposure zone the assets are within. Use scoring definitions to evaluate exposure. For example, assets that are highly exposed would receive a High (5 point) rating.
    - Sensitivity ratings are provided for each asset. If the team knows more about an asset's condition and/or sensitivity, encourage discussion and score it based on the team's knowledge. For example, assets that are highly sensitive (suffer irreversible change and permanent loss of function) would receive a High (5 point) rating.
    - If the team came up with a new proposed asset, make sure to determine an appropriate sensitivity score.
2) Once an asset is rated for exposure and sensitivity, an overall vulnerability score can be assigned and a priority list in the ranking column developed.
    - Use the scoring definitions to encourage conversation. If the team knows more about an asset's condition and/or sensitivity, encourage discussion and score it based on the team's description.
    - Utilize asset description cards to review asset information.
    - Help team to determine vulnerability scores.
    - Ensure scribe is keeping a master list of prioritized assets.
    - Keep conversation on task.
3) Ask the team to prioritize asset list based on vulnerability score.

Remember, *exposure* is the degree to which an asset may physically interact with flooding and *sensitivity* is the degree to which an asset is adversely affected by flooding. Suggested scores are provided below.

Score		Exposure Definition:
5	**High**	Floods with 3.3 ft of SLR.
4	**High-Medium**	Floods with 3.3 ft of SLR + 1% Annual Chance Storm.
3	**Medium**	Floods with 6.6 ft of SLR.
2	**Medium-Low**	Floods with 6.6 ft of SLR + 1% Annual Chance Storm.
0	**Not Exposed**	Not in an exposure zone.

Score		Sensitivity Definition:
5	**High**	Irreversible change to asset/natural resource and permanent loss of function.
3	**Medium**	Substantial but reversible change to asset/natural resource or function.
1	**Low**	Short-term, minor, or reversible change to asset/natural resource or function.
0	**Not Sensitive**	No change to asset or natural resource function.

Assessing Consequences

Risk is typically assessed by evaluating the probability (or *likelihood*) that climate impacts would occur and the *consequence* of these impacts. Since likelihood can be difficult to quantify when considering future climate related impacts, potential consequence is often the primary consideration. Consequence considers the magnitude of the impact that would occur under the selected sea level rise scenario. Information about the asset, such as how it would be damaged by flooding, what disruption would be caused and how much it would cost to replace or repair are often informative when considering the consequences.

FACILITATOR ACTIONS:

Ask the teams to describe the consequences of climate change impacts on each asset in terms of damage, disruption, and overall relative cost.

The questions below can be useful in framing the consequence of sea level rise related impacts.

- Damage:
  - What is the level of damage to the asset?
  - Can the asset be repaired, or would the asset require complete replacement?
- Disruption:
  - Is there a disruption in service?
  - What is the length of disruption, i.e., hours, days, weeks? Does the disruption threaten public health and safety?
  - Will disruption at this asset have cumulative effects throughout an interconnected system (e.g. could the failure of a pump station cause wastewater backups upstream)?
- Cost:
  - What is the cost to repair or replace the asset?
  - What are the economic (or health and safety) costs associated with the disruption?
  - Are there secondary impacts that need to be considered (i.e., potential impacts to human health and safety, or costs to other sectors, such as the environment and public recreation)?
- Please remember to keep conversation on task.

4 DEVELOPING ADAPTATION STRATEGIES

To reduce the impacts of sea level rise, adaptation strategies can be implemented to protect vulnerable assets or aid in future adaptation planning. Adaptation strategies can be either structural (such as levees and seawalls) or non-structural (such as policy) solutions. The consequences assessment will help prioritize selecting adaptation strategies for assets whose vulnerability poses high risks. Together, understanding vulnerability and consequence can help develop a prioritized list of assets for adaptation strategy development and implementation.

While only estimated capital costs have been included in the Game of Floods for simplicity, a full assessment would consider the costs of inaction and repeated repair and replacements. In order to successfully adapt in the future, it is likely that new ways of funding and/or new ways of local governments budgeting may be needed. Note: *All strategy costs provided are estimates developed for the purpose of the game only. Where possible, they are derived from reports and case studies. They are illustrative only, and will vary greatly depending on location, exact design of strategy, permitting requirements, construction costs and vulnerability of the asset (among other variables*).

In many instances, it is not feasible or cost effective to design and build for long-term potential sea level rise scenarios of a highly uncertain nature, such as at the upper end estimates for the year 2100. In this case, a project could be designed and constructed to account for mid-century sea level rise conditions (for example, 1 foot of sea level rise by 2050), while also designing the facility with the ability to adapt to more severe sea level rise conditions over time. Adaptation strategies can therefore include both near-term and long-term solutions.

FACILITATOR ACTIONS:

1) Provide each team with their allocated budget, the strategy cards, a summary list of potential adaptation strategies with associated costs and the strategy selection tables.
2) Ask teams to strategize on how best to protect assets based on their allotted funding.
    - Instruct team to implement a range of strategies to protect the area through 2100.
    - Review the scenario card to see if this means 3.3ft or 6.6ft of sea level rise
    - Remind the team that they should consider policy strategies first to help development to move out of the exposure zones over time. Accommodate strategies should be considered next to help protect existing structures against periodic storm surge in the short term. Then consider physical strategies that take time to consult on, design, permit and fund.
    - Make sure the scribe is making a master list of adaptation strategies selected and their associated cost.
    - Keep conversation on task.
3) If time, prompt the team to think about the three additional questions presented in the workbook:
    - Think about outreach and engaging the community, what activities would you need to complete to finalize your Plan and during implementation?
    - Are there long-term maintenance costs that have not been considered?
    - If there is one more thing you wanted to do to increase the ability of the community to adapt, but could not afford, what would it be and why?
4) Report out final results.

5 DECISION MAKING UNDER UNCERTAINTY EXERCISE (OPTIONAL, IF TIME)

Based on the best available science, it is best to plan for a range of sea level rise scenarios. Decisions in adaptation planning are often made under uncertainty with the future. This exercise should be discussion-based.

FACILITATOR ACTIONS:

1) Provide your team with the new sea level rise scenario.
2) Ask teams to think about the four additional questions presented in the workbook:
    - Instruct team to discuss planning under uncertainty and how the identified strategies might perform under their new scenario.
        - Are the selected assets protected under the new scenario? How well do your adaptation strategies work now?
        - What strategies would you change? Which would you prioritize?
        - How do we make our choices less vulnerable to uncertainties about the sea level rise scenarios?
3) Keep conversation on task.

KEY TERMS AND DEFINITIONS

The following key terms are used throughout the workshop and within this workbook.

Adaptation	The practice of planning for anticipated climate change and developing strategies to address potential impacts.
Asset	Property, often a facility or structure (or a component of the facility or structure) regarded as having value. In this context, an asset is typically a physical component that is essential to enable, sustain or enhance living conditions, such roads, trails, buildings, pump stations, etc. Natural resources, including open space, parks, and habitat, are also assets which may be considered in adaptation planning.
Climate	Climate is often defined as the "average weather," or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities (such as temperature, air pressure, humidity, precipitation, and wind) over a period of time ranging from months to thousands of years. The traditionally accepted time period is 3 decades, as defined by the World Meteorological Organization (WMO). Climate in a wider sense is the state, including a statistical description, of the climate system.
Climate Change	Climate change refers to any significant change in the measures of climate lasting for an extended period of time. In other words, climate change includes major changes in temperature, precipitation, wind patterns, or sea level rise, among others, that occurs over several decades or longer.
Climate Impact	The physical manifestation of a short- or long-term climate stressor, such as flooding, degradation, damage, or destruction.
Climate Hazard	The component of climate (e.g., sea level rise, storm surge, precipitation, temperature) or event (e.g., extreme storm) that causes short- or long-term stress or impact to an asset, system, or community over time. Also referred to as a climate *stressor*.
Consequence	Something that happens to an asset or facility as a result of a particular climate impact or a combination of climate stressors. In a practical sense, consequence often considers damage, disruption, and/or costs to repair or replace. Also includes indirect consequences, such as impacts to supply chain or economic losses due to loss of function of an asset.
Exposure	The exposure of an asset is the degree to which an asset is susceptible to hazards (i.e., depth of flooding due to sea level rise, storm surge and wave run up).
FEMA	Federal Emergency Management Agency.
Flooding	The temporary inundation of a normally dry area as a result of abnormally high water levels. *Coastal* flooding is caused by the combination of high tides and waves. *Riverine* flooding is caused by prolonged or intense precipitation within a watershed that causes a river or creek to overtop its banks and inundate its floodplain. *Urban* flooding is caused by intense precipitation in developed areas that overwhelms the stormwater collection system. One type of flooding may be exacerbated by another – for example, urban flooding may be worsened during high tides due to back-up of the stormwater system.

H:V	A slope ratio commonly used in engineering and construction to describe the steepness of a slope. It means that for every number of horizontal units (H), there is a rise or fall of a certain number of vertical units (V).
Levee	A man-made embankment.
Mitigation	The process of reducing the severity or impacts of climate change.
Overtopping	The amount of water over the crest of a coastal structure such as a seawall, due to wave action.
Planning Horizon	The timeframe that should be considered when planning for and adapting to climate change (e.g., 2050, 2100, 2100+)
Public Trust Boundary	The boundary between public and private land, usually along a natural resource that is held by the government for public use.
Sediment	Sediment is the sand, mud, and pebbles that were once solid rock.
Sensitivity	The degree to which an asset is, or could be, affected (i.e., temporary flooding causes minimal impact, or results in complete loss of asset or shut-down of operation) by a climate stressor, if exposed to that stressor.
Submarine Canyon	Channel incised into the seafloor, with shapes varying from straight, narrow cuts to meandering valleys.
Useful Life	The actual period of time the asset or facility will be in use at the given location (including regular repair and maintenance). The functional lifespan is typically longer than the engineering design life.
Vulnerability	The degree to which an asset may be physically or functionally impacted by a climate hazard. Vulnerability is a combination of exposure and sensitivity.
Wave Reflection	The phenomenon where a wave encounters a boundary or interface and is turned back into its original medium.
Wave Runup	The elevation of the sea level produced by waves at the shoreline.

Photo Credits

- **Front Page:** Pathways Climate Institute

For Powerpoint and Strategy Cards:

- **Riprap Revetment:** https://econcretetech.com/projects/port-of-san-diego/
- **Seawall:** David Hubbard, https://www.audubon.org/news/the-best-defense-against-sea-level-rise-leaves-little-room-birds
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- **Structure Elevation:** Google Maps
- **Structure Relocation:** San Mateo County