3.3 Flooding Pains and Dream House Gains

AGE RANGE

9th—12th grade

TIME REQUIRED

70 minutes

ACTIVITY OVERVIEW

Engage: FEMA Floodplain Map
Explore: GOMSurge.org
Explain: Student Reading
Elaborate: Student Beach House
Evaluate: Beach House Ordinances

MATERIALS

Computers
FEMA Floodplain Map
Student Worksheet
Student Reading

LESSON TOPIC: Floodplains and ordinances

ACTIVITY SUMMARY: Students explore flooding hazards and municipal flood ordinances.

OBJECTIVES:

Students will be able to:

- Explore digital tools for viewing flood and storm surge risk.
- Identify areas along the coast that are vulnerable to sea-level rise and storm surge.
- Identify flood ordinances for buildings.

LESSON BACKGROUND: The FEMA Flood Map Service Center: https://msc.fema.gov/portal/home is the public source for flood hazard information produced to support the National Flood Insurance Program (NFIP).

FEMA identifies flood hazards on floodplain maps for community members to understand their specific risk. Special Flood Hazard Areas (SFHA) are the areas that have a 1% annual chance of a flood exceeding that depth and extent. SFHA are labeled as: Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30. In the SFHA, a base flood elevation is identified to set standards of recommending building practices. The areas between the 1% annual exceedance probability flood and the 0.2% annual exceedance probability flood are moderate flood hazard areas and labeled as Zone B or Zone X (shaded). The areas outside of the special flood hazard area are at minimal flood risk and are labeled as Zone C or Zone X (unshaded).

Scientists and our governments are able to use the information available to develop models that help us prepare for the impacts of sea-level rise and flooding.

FEMA uses a model called SLOSH which stands for Sea, Lake and Overland Surges from Hurricanes (SLOSH). This model is a computerized numerical model developed by the National

Weather Service (NWS) to estimate storm surge heights resulting from historical, hypothetical, or predicted hurricanes by taking into account the atmospheric pressure, size, forward speed, and track data. These parameters are used to create a model of the wind field that drives the storm surge.

Other researchers use ADCIRC (Advanced Circulation Model) and couple it with SWAN (Simulating WAves Nearshore). ADCIRC simulates circulation and storm surge generation whereas SWAN simulates waves. When these two models are coupled, you are able to capture the complex interactions between waves and currents and the effects of both on storm surge.

SLOSH and ADCIRC+SWAN are two common models used to generate the 1% annual chance exceedance probability, sometimes known as the 100-year floodplain or the SFHA.

To make projections of sea-level rise impacts on our coastal communities, scientists use models to add in the interactions of different processes. For example, understanding how wind and waves erode sand from a coastline and change the shape allows the projection of how sea-level rise impacts might be altered with a different coastline shape. A model commonly used for this is XBeach, which simulates morphological change, including erosion and deposition, and has its own circulation and wave module. This is one of the most advanced models in terms of simulating storm impacts, and it is a high-resolution model. It can resolve processes on very small scales and it can simulate flow and sediment transport around infrastructure.

VOCABULARY:

Buildings and Structures	Structures built for permanent use (e.g., a dwelling) or that is built by putting parts together and that usually stands on its own (e.g., a house, tower, bridge, etc.).
Built Environment	Basic structures and facilities (e.g., buildings, roads, and power supplies) needed for a community.
Ordinances/Codes	Laws and regulations passed and enforced by a municipality in order to maintain safety and preserve community standards.
Planning and Land Use	Process of designing potential futures for a community, city, etc. Land use is a type of planning that is implemented through zoning, which can change management of land and lead to impactful changes.

ENGAGE:

Show students the two images of the same location on Dauphin Island, Alabama fifteen years apart. **Ask** students what might be impacting the changing shoreline. **Ask** students if they think there are any guidelines for people building their homes. What might those guidelines be? **Ask** students at which point do communities need to discuss if there is no more land for their homes. This can start a discussion about the need for managed retreat in some areas.

Image: West end of Dauphin Island, Alabama, in 2000. Yellow outline is the outline of the main land mass in 2000. The yellow arrows are pointing to houses that can be used as benchmarks for the next figure. Imagery from Google Earth. Source: Embracing the dynamics of shorelines. Eric Sparks. Mississippi-Alabama Sea Grant Consortium. Apr 04, 2018.

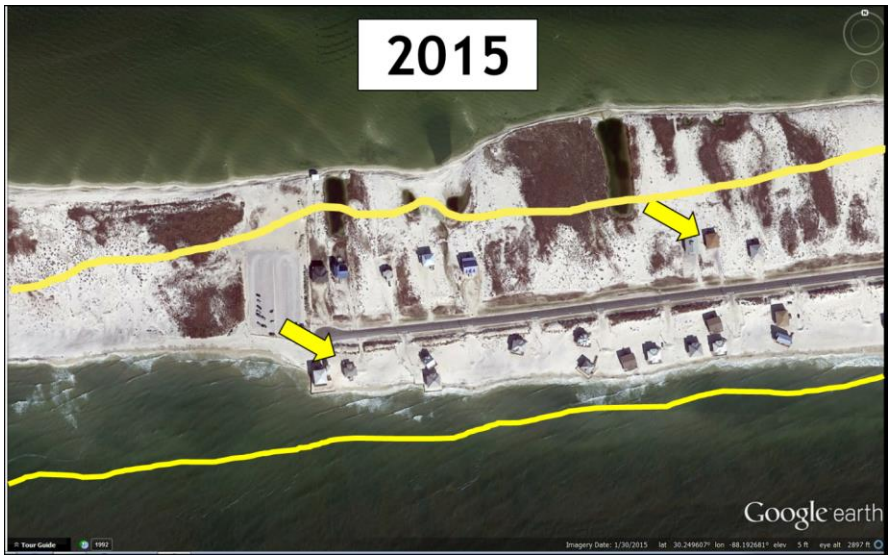


Image: West end of Dauphin Island, Alabama, in 2015. Yellow outline is the outline of the main land mass in 2000. The yellow arrows are pointing to houses that can be used as benchmarks

from the previous figure. Imagery from Google Earth. Source: Embracing the dynamics of shorelines. Eric Sparks. Mississippi-Alabama Sea Grant Consortium. Apr 04, 2018.

Show the video Amplified Storm Surge: Northern Gulf Sea-Level Rise (4.5 minutes): https://vimeo.com/323815181. This video introduces storm surge in the Northern Gulf of Mexico and introduces the tool GOMsurge.org that will be used later in the lesson.

Display the FEMA floodplain (https://msc.fema.gov/portal/home) map that includes the school location. Identify the zone in which the school is located.

Ask the students why is it important to understand floodplains? How could you use this map to make decisions?

EXPLORE:

Floodplain management works to mitigate coastal hazards and respond to disasters. Students will explore the features on the www.gomsurge.org website, and work through problem sets for potential future scenarios.

Students answer questions using Claim-Evidence-Reasoning. The claim is the statement that answers the question. The evidence is the data used to support the claim. The reasoning is the explanation of "why" and "how" the evidence supports the claim.

Procedure:

1) Students go to www.gomsurge.org and scroll down to the "Stillwater Storm Surge" section.
    a. These images indicate 1% annual chance probability of storm surge inundation, showing the area where water pushed in by a hurricane will go. The data was developed by examining models of astronomic tide, wind and wave, and hurricane storm surge. These 1% annual chance data (commonly referred to as 100-year floodplains) were developed to assess the effects of future coastal change on storm surge under different sea-level rise scenarios.
2) The slider bar in the middle of the page can be moved to display two different sea-level rise projections, the Low and the Intermediate-High projections, for 1% annual chance probability of storm surge inundation in 2100. The right side of the screen displays the Intermediate-High projection of 1.2 meters, or 3.9 feet, increase of sea-level rise from 2000. The left side of the screen displays the Low projection of 0.2 meters, or 0.7 feet. Deeper water is indicated by brighter purple color.

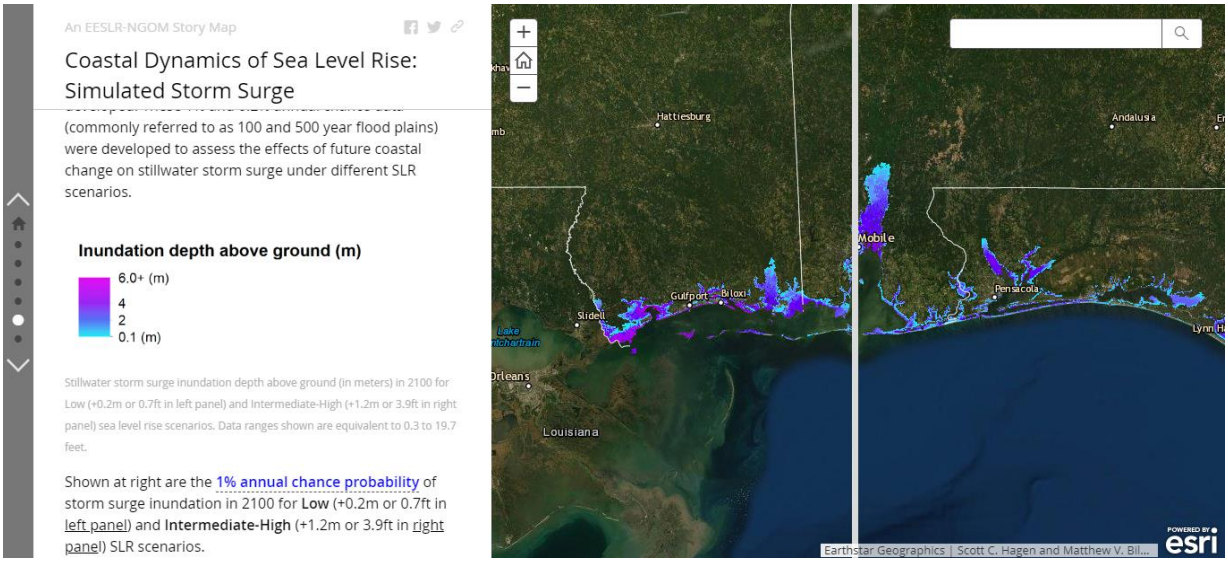


Image: a screen capture of the Stillwater Storm Surge section of gomsurge.org with the inundation depth color gradient visible. The color range is indicative of water depth in meter, lighter blue at the low end of 0.1m and brighter purple indicating water 6m and deeper. Source: www.gomsurge.org

3) Enter the following location into the search bar: 1815 Popps Ferry Road, Biloxi, MS. Zoom out until the colored inundation is visible. Answer the following questions about the area:
    a. Does water reach the specific building? (marked by a blue square on the left panel).
    b. What changes in water do you observe in the area? Does the water reach new areas? Do existing areas have deeper water?
4) Searching on the map find a location with a river leading to the Gulf of Mexico. Answer the following questions:
    a. What changes in water do you observe in the river inland and the river where it meets the Gulf of Mexico?
5) Search the map for a location with a large city close to the coast. Answer the following questions:
    a. What changes in water do you observe in the city compared to areas outside of the city?
6) Compare the differences in water inundation area and depth change from the river location to the city location. Why might you observe these differences?

EXPLAIN:

Marshes and bayous with plants are able to absorb more water than concrete. Explain that rivers can carry storm surge water farther inland, but that natural marsh and plant shorelines can help protect homes. Additionally, discuss how the floodplain is becoming larger as sea-level rises, putting more homes, businesses, and infrastructure at risk. *Connect back to Module 2 Lesson 1 about marshes if it was covered.*

Students read "100-Year Flood" reading.

ELABORATE:

Provide students with this prompt and building choices on the student worksheet.

Build your (dream) home! You are now the proud owner of property along the Gulf coast and now you get to design the home you hope to live in for many years. Your home is in the perfect location for outdoor recreation, and being close to the beach and bayous. Make a choice between the options given for each step. Once you have selected all the option make a sketch of your home.

> EXTENSION: Students explore houses with different structures before taking the house quiz. Using foam board, or another water-resistant material, students cut out general models of houses: a non-elevated house, a house on stilts, an elevated house with 2 solid walls, an elevated house with 2 lattice walls, an elevated house with 4 solid walls. Recreating an activity from Module 2 Lesson 2 with the water pans, students create a shoreline with clay on one side of a plastic container and place their home one top. They then create waves in the container and compare how each house is impacted.

EVALUATE:

Communities share information with residents about how to prepare for and protect their buildings from floods. The "Flood Damage Prevention Ordinance" for Coastal Communities is an ordinance that promotes public health, safety, and general welfare to minimize losses due to floods. The provisions designated to protect public and private buildings from flood conditions are:

(1) anything vulnerable to flooding needs be protected against flood damage at the start of construction;
(2) uses that are dangerous to health, safety, and property, or uses that lead to increased flood height, water velocity, or erosion will be restricted or prohibited;

(3) any filling, grading, dredging and other development which may increase flood damage or erosion are controlled;
(4) flood barriers that are constructed and unnaturally divert flood water or increase flood hazards in other areas are prevented or regulated;
(5) control the alteration of natural floodplains, stream channels, and natural protective barriers which are involved in the accommodation of flood waters.

Using the "Flood Damage Prevention Ordinance" for Coastal Communities the class will score their homes to how well they aligned with ordinances in place to protect against flooding damages.

Question 1 – How to elevate

Article 4 Provisions for Flood Hazard Reduction, Section A General Standards

> *(4) Elevated Buildings - All New construction or substantial improvements of existing structures that include ANY fully enclosed area located below the lowest floor formed by foundation and other exterior walls shall be designed so as to be an unfinished or flood resistant enclosure. The enclosure shall be designed to equalize hydrostatic flood forces on exterior walls by allowing for the automatic entry and exit of flood waters.*
>
> *(a) Designs for complying with this requirement must either be certified by a professional engineer or architect or meet the following minimum criteria:*
> *(i) Provide a minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding;*

What this means: All structures below base flood elevation must have at least two openings near the ground to allow water to flow through and relieve pressure from floodwater on the walls of the structure. This not only helps protect the building from being damaged but allows floodwaters to drain more quickly. It also means that structures at this level are expected to flood regularly and it should not be used as a living area or furnished as such.

Article 4 Provisions for Flood Hazard Reduction, Section F Coastal High Hazard Areas (V-Zones).

> *(2) All new construction and substantial improvements of existing structures shall be elevated on piles, columns, or shear walls parallel to the flow of water so that the bottom of the lowest supporting horizontal structural member (excluding pilings or columns) is located no lower than one foot above the base flood elevation level.*

What this means: Walls and supports of structures must be built parallel to the flow of floodwaters so water can pass by and through them with ease. It also means that the structures must be built at least one foot above base flood elevation.

Score your home for Question 1: 2 points for raised on piles/stilts, 2 points for raised with 2 solid walls allowing ocean breeze underneath, 1 point for raised with 2 solid walls blocking ocean wind from question 1. No points for other options.

Question 2

Article 4 Provisions for Flood Hazard Reduction, Section B Specific Standards. In ALL Areas of Special Flood Hazard designated as A1-30, AE, AH, A (with estimated BFE), the following provisions are required:

> *(1) New construction and substantial improvements - Where base flood elevation data are available, new construction or substantial improvement of any structure or manufactured home shall have the lowest floor, including basement, elevated no lower than one foot above the base flood elevation. Should solid foundation perimeter walls be used to elevate a structure, openings sufficient to facilitate the unimpeded movements of flood waters shall be provided in accordance with standards of Article 4, Section A(4), "Elevated Buildings."*

What this means: The lowest floor of any structure must be one foot above the projected height of base flood evaluation, generally the 1% annual exceedance probability. This lowers the likelihood that damage or injury will occur in the event of a flood.

Score your home for Question 2: 1 point for raised to a foot higher than the 1% annual exceedance probability from question 2. No points for other options.

Question 3

Article 4 Provisions for Flood Hazard Reduction, Section C Floodways.

> *(1) Floodway: Located within Areas of Special Flood Hazard established in Article 2, Section B, are areas designated as floodway. A floodway may be an extremely hazardous area due to velocity floodwaters, debris or erosion potential. In addition, the area must remain free of encroachment in order to allow for the discharge of the base flood without increased flood heights. Therefore, the following provisions shall apply:*
>
> > *(a) The community shall select and adopt a regulatory floodway based on the principle that the area chosen for the regulatory floodway must be designed to carry the waters of the base flood, without increasing the water surface elevation of that flood more than one foot at any point;*

What this means: In communities of high risk of flood, a floodway must be designed in the area to allow floodwater to flow through and exit the community. This will reduce flooding in homes and allow water to drain from the neighborhood more efficiently.

Score your home for Question 3: 1 point for leaving the drainage ditches from question 3. No points for other options.

Question 4

Article 4 Provisions for Flood Hazard Reduction, Section D Building Standards for Streams Without Established Base Flood Elevations (Approximate A-Zones). Located within the Areas of Special Flood Hazard established in Article 2, Section B, where streams exist but no base flood data have been provided (Approximate A-Zones), the following provisions apply:

> *(2) No encroachments, including structures or fill material, shall be located within an area equal to the width of the stream or twenty-five feet, whichever is greater, measured from the top of the stream bank, unless certification by a registered professional engineer is provided demonstrating that such encroachment shall not result in any increase in flood levels during the occurrence of the base flood discharge.*

What this means: Structures must not be built too close to streams because if the water level in the stream were to rise up to the structure, the building could block some of the water flowing down the stream. Additionally, damage to the structure could occur.

Score your home for Question 4: 1 point if you built 25 feet away from the stream in question 4. No points for other options.

Question 5

Article 4 Provisions for Flood Hazard Reduction, Section F Coastal High Hazard Areas (V-Zones). Located within the areas of special flood hazard established in Article 2, Section B, are areas designated as Coastal High Hazard areas (V-Zones). These areas have special flood hazards associated with wave action and storm surge; therefore, the following provisions shall apply:

> *(1) All new construction and substantial improvements of existing structures shall be located landward of the reach of the mean high tide.*

What this means: No structures can be built within the area that is covered by the average high tide. They must be further inland. During storm surge, water levels can rise even higher than high tide, so this keeps buildings at a safer distance and height from storm surge.

Score your home for Question 5: 1 point if you built inland from the highest water level, and 2 points if you built behind the dunes in question 5. No points for option a.

Question 6

Article 4 Provisions for Flood Hazard Reduction, Section F Coastal High Hazard Areas (V-Zones).

> *(4) All pile and column foundations and the structures attached thereto shall be anchored to resist flotation, collapse, and lateral movement due to the combined effects of wind and water loads acting simultaneously on ALL building components, both (non-structural and structural). Water loading values shall equal or exceed those of the base flood. Wind loading values shall be in accordance with the most current edition of the Standard Building Code*

What this means: Structures must be anchored so they do not float away or blow away during times of flood or high winds. This helps prevent people from completely losing their home.

Score your home for Question 6: 1 point if you built a house with strong foundation to resist flooding from question 6. No points for other options.

Question 7

Article 4 Provisions for Flood Hazard Reduction, Section F Coastal High Hazard Areas (V-Zones).

> *(6) All space below the lowest horizontal-supporting member must remain free of obstruction. Open lattice work or decorative screening may be permitted for aesthetic purposes only and must be designed to wash away in the event of abnormal wave action without causing structural damage to the supporting foundation or elevated portion of the structure. The following design specifications are allowed:*
>
> > *(a) No solid walls shall be allowed, and;*
> >
> > *(b) Material shall consist of lattice or mesh screening only.*
> >
> > *(c) If aesthetic lattice work or screening is utilized, any enclosed space shall not be used for human habitation, but shall be designed to be used only for parking of vehicles, building access, or limited storage of maintenance equipment used in connection with the premises.*

What this means: The open space below an elevated building can be used for parking or storage but not for living space. Any decorative screening needs to wash away in flood water to prevent damage to the building.

Score your home for Question 7: 2 points if you elevate and use it for parking, 2 points if you decorated the piles with latticework from in question 7. No points for other options.

Question 8

Article 4 Provisions for Flood Hazard Reduction, Section F Coastal High Hazard Areas (V-Zones).

> *(10) There shall be no alteration of sand dunes or mangrove stands which would increase potential flood damage*

What this means: Natural barriers to floodwater such as sand dunes or mangroves shall not be removed in order to build a structure if it would risk increasing damage caused by flooding. These natural structures provide a buffer for communities, protecting them from water and wind.

Score your home for Question 8: 1 point if left the dunes as they were in question 8. No points for other options.

Total your score:

If your score was between 0-3. You are a student of community ordinances.

If your score was between 4-7. Not bad – you are a potential municipal government official.

If your score was between 8-10. Excellent – you are an expert floodplain manager.

Discuss with the students what their ranking was on their dream house. **Ask** how might they have made changes if they knew the ordinances from the beginning?

STUDENT PAGE | Flooding Pains and Dream House Gains

Floodplain management works to mitigate coastal hazards and respond to disasters. Students will explore the features on the www.gomsurge.org website, and work through problem sets for potential future scenarios.

Procedure:

1) Go to www.gomsurge.org and scroll down to the "Stillwater Storm Surge" section.
    a. These images indicate 1% annual chance probability of storm surge inundation, showing the area where water pushed in by a hurricane will go.
2) The slider bar in the middle of the page can be moved to display two different sea-level rise projections, the Low and the Intermediate-High projections, for 1% annual chance probability of storm surge inundation in 2100. The right side of the screen displays the Intermediate-High projection of 1.2 meters, or 3.9 feet, increase of sea-level rise from 2000. The left side of the screen displays the Low projection of 0.2 meters, or 0.7 feet. Deeper water is indicated by brighter purple color.
3) Enter the following location into the search bar: 1815 Popps Ferry Road, Biloxi, MS. Zoom out until the colored inundation is visible. Answer the following questions about the area:
    a. **Does water reach the specific building**? (marked by a blue square on the left panel).

    b. **What changes in water do you observe in the area? Does the water reach new areas? Do existing areas have deeper water?**

4) Searching on the map **find a location with a river leading to the Gulf of Mexico**. Answer the following questions:
    a. **What changes in water do you observe in the river inland and the river where it meets the Gulf of Mexico?**
    Claim (write a sentence that states what happens along the river)

    Evidence (provide data that supports your claim about what happens along the river)

    Reasoning (write a statement that connects your evidence to your claim about what happens along the river)

5) Search the map for **a location with a large city close to the coast**. Answer the following questions:
    a. **What changes in water do you observe in the city compare to areas outside of the city?**
    Claim (write a sentence that states what happens to water in the city)

    Evidence (provide data that supports your claim about what happens to water in the city)

    Reasoning (write a statement that connects your evidence to your claim about what happens to water in the city)

6) Compare the differences in water inundation area and depth change from the river location to the city location. **Why might you observe these differences?**

    Claim (write a sentence that states what happens to water inundation area and depth in the city compared to the river)

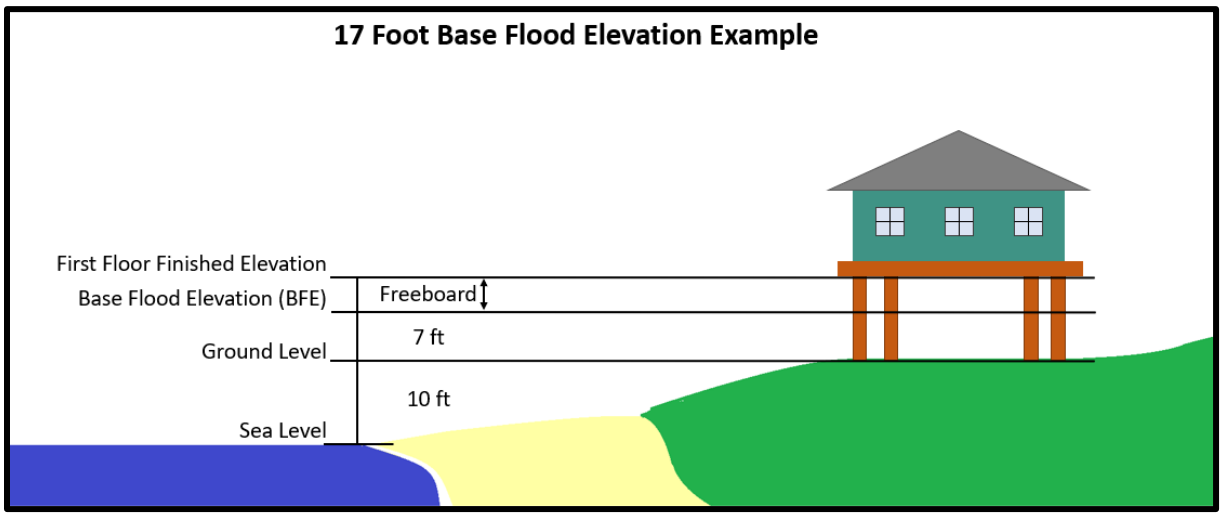
    Evidence (provide data that supports your claim about what happens to water inundation area and depth in the city compared to the river)

    Reasoning (write a statement that connects your evidence to your claim about what happens to water inundation area and depts in the city compared to the river)

Build your (dream) home! You are now the proud owner of property along the Gulf coast and now you get to design the home you hope to live in for many years. Your home is in the perfect location for outdoor recreation, being close to the beach and bayous. Make a choice between the options given for each step. Once you have selected all the option make a sketch of your home.

1. How do you want to elevate your home, if at all?
    a. No elevation
    b. Raised on piles/stilts
    c. Raised with 2 solid walls allowing ocean breeze underneath
    d. Raised with 2 solid walls blocking ocean wind
    e. Raised with 4 solid walls

2. How high do you want to elevate your home?
    a. No elevation
    b. Raised to the level of the 1% annual exceedance probability
    c. Raised to a foot higher than the 1% annual exceedance probability (Freeboard)



3. There are drainage ditches on the road leading to your home.
    a. You fill these in
    b. You leave them

4. How close do you build your home to your small backyard stream?
    a. Right next to it so you can easily access it for fishing, boating, or swimming
    b. You want a little space, so you build 25 feet away
5. How close to the beach do you build your home?
    a. Right at the lowest water level
    b. Inland from the highest water level
    c. Behind the dunes



6. You want to protect your home and belongings from floods. So you:
    a. Build a floating house, when water level rises your house floats up and away.
    b. Build a house with strong foundation to resist flooding impacts.
7. What do you use the underneath of your house for?
    a. You didn't elevate so there is no underneath
    b. You elevated and use it for parking
    c. You elevated and set up the space as a spare bedroom
    d. You decorated the pilings with latticework
    e. You decorated the pilings with rustic wooden beams that also help support the overall structure




8. You can almost see the beach from your house, but there are sand dunes with beach grass in the way.
    a. You cut an access path and build a boardwalk from your house to the beach through the dunes
    b. You leave the dunes as they are and map out the quickest road to access the beach

Using the "Flood Damage Prevention Ordinance" for Coastal Communities your teacher will share the ordinances in place to protect against flooding damages.

Score your home for Question 1:

2 points for raised on piles/stilts, 2 points for raised with 2 solid walls allowing ocean breeze underneath, 1 point for raised with 2 solid walls blocking ocean wind from question 1. No points for other options.

Score your home for Question 2:

1 point for raised to a foot higher than the 1% annual exceedance probability from question 2. No points for other options.

Score your home for Question 3:

1 point for leaving the drainage ditches from question 3. No points for other options.

Score your home for Question 4:

1 point if you built 25 feet away from the stream in question 4. No points for other options.

Score your home for Question 5:

1 point if you built inland from the highest water level, and 2 points if you built behind the dunes in question 5. No points for option a.

Score your home for Question 6:

1 point if you built a house with strong foundation to resist flooding from question 6. No points for other options.

Score your home for Question 7:

2 points if you elevate and use it for parking, 2 points if you decorated the piles with latticework from in question 7. No points for other options.

Score your home for Question 8:

1 point if left the dunes as they were in question 8. No points for other options.

Total your score:

If your score was between 0-3: You are a student of community ordinances.

If your score was between 4-7: Not bad – you are a potential municipal government official.

If your score was between 8-10: Excellent – you are an expert floodplain manager.

100-Year Flood

Sea-level rise impacts ways in which water interacts with our coastal communities. With increased sea-level rise, the number of days we experience nuisance flooding increases and storm surge can travel farther inland and flood areas with deeper water. One term used to describe large flood events is the 100-year flood. Many federal, state, and local laws and ordinances are designed around the 100-year flood. To better understand this term, it is helpful to understand the history of the National Flood Insurance Program.

The National Flood Insurance Program provides flood insurance to homeowners, renters, and businesses, works at the community level to improve floodplain management regulations, and develops maps of flood hazard zones. A floodplain is a nearly flat area of land that is naturally subject to flooding. Communities use floodplain management to reduce the risk of current and future flooding by taking corrective and preventative measures to increase their resilience. In the 1960's there was widespread flooding along the Mississippi River but there was a lack of private flood insurance and the standard homeowner insurance policy does not cover flood damage. This led to large amounts of flood losses to communities and increases in federal disaster assistance needed. In response to this the United States government added the National Flood Insurance Program to be managed by the Federal Emergency Management Administration (FEMA). To designate the areas at high-risk for flooding and therefore most in need of flood insurance, the National Flood Insurance Program used the 1% annual exceedance probability (AEP) floodplain. The annual exceedance probability floodplain is a measure of chance that flooding will be at least that high/far each year. The 1% annual exceedance probability floodplain describes the areas that have a 1 in 100 chance, or 1% probability, of being flooded each year. The phrase 1-percent annual exceedance probability leads to the term 100-year flood.

The 100-year floodplain has a 1% chance of flooding every year but, like flipping a coin, you could get heads three times in a row. When you look at the risk of something in the 1% annual exceedance probability floodplain over multiple years, the risk increases. For example, there is a 26% chance a house will flood over the course of a typical 30-year mortgage. If a high school senior has lived in the same house in the 100-year floodplain for their entire life, there is a 16% chance that they would experience flooding at least once. These values (26% and 16%) are based on the probability theory that accounts for each of the mentioned years having a 1% chance of flooding. The estimates for the 1% AEP floodplain come from measurements by scientists and engineers measuring the height and flow of water. However, the accuracy of 1-percent annual exceedance probability depends on the data available, any changes in land use, river drainage, or climate change.

As our communities talk more about larger floods and increasing their protection from flooding, they may use the term 500-year flood. The corresponds to an annual exceedance probability of 0.2% or 1 in 500 chance of a flood happing each year.

With the growing need to prepare for flooding there is also the need for clear communication regarding risk. Hydrologists (the scientists that study distribution, circulation, and physical properties of water, at the United States Geological Survey) are transitioning away from the terms 100-year and 500-year flood to define floods in terms of the annual exceedance probability, such as the 1% annual exceedance probability. This helps communicate that the occurrence of a large flood does not mean that you are flood-free for the next 99 years.

FEMA identifies flood hazards on floodplain maps for community members to understand their specific risk. Special Flood Hazard Area (SFHA) is the area that will be inundated by the 1% annual exceedance probability flood. Special Flood Hazard Areas are labeled as: Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30. The areas between the 1% annual exceedance probability flood and the 0.2% annual exceedance probability flood are moderate flood hazard areas and labeled as Zone B or Zone X (shaded). The areas outside of the special flood hazard area are at minimal flood risk and are labeled as Zone C or Zone X (unshaded).

Base Flood Elevations (BFEs) are the elevation to which floodwater is anticipated to rise during the 1% AEP flood for your location. The Base Flood Elevation is a regulatory requirement for the elevation and floodproofing of structures. Some states require building to at least Base Flood Elevation as defined by FEMA, but some municipalities go above and beyond and require building higher than Base Flood Elevation, known as freeboard. Federal, state, and local governments use the 1% AEP floodplain as the regulating standard for flood insurance and building codes. It can also be considered in zoning, and other policies and practices.

With our changing climate and sea-level rise coupled with changes in land use and impervious surfaces, our historic flood patterns are changing. The 1% annual exceedance probability is including a larger area and deeper water as sea levels rise. By understanding our risk, we are able to prepare our communities, homes, and businesses for current and future flooding.

Source: Robert R. Holmes, Jr. and Karen Dinicola, US Geological Survey, 100-Year Flood – It's All About Chance. April 2010. General Information Product 106

STUDENT PAGE | Flooding Pains and Dream House Gains

DO NOW:

How can you narrow down sea-level rise scenarios to focus on when starting a construction project?

EXIT TICKET:

What is a 100-year flood?