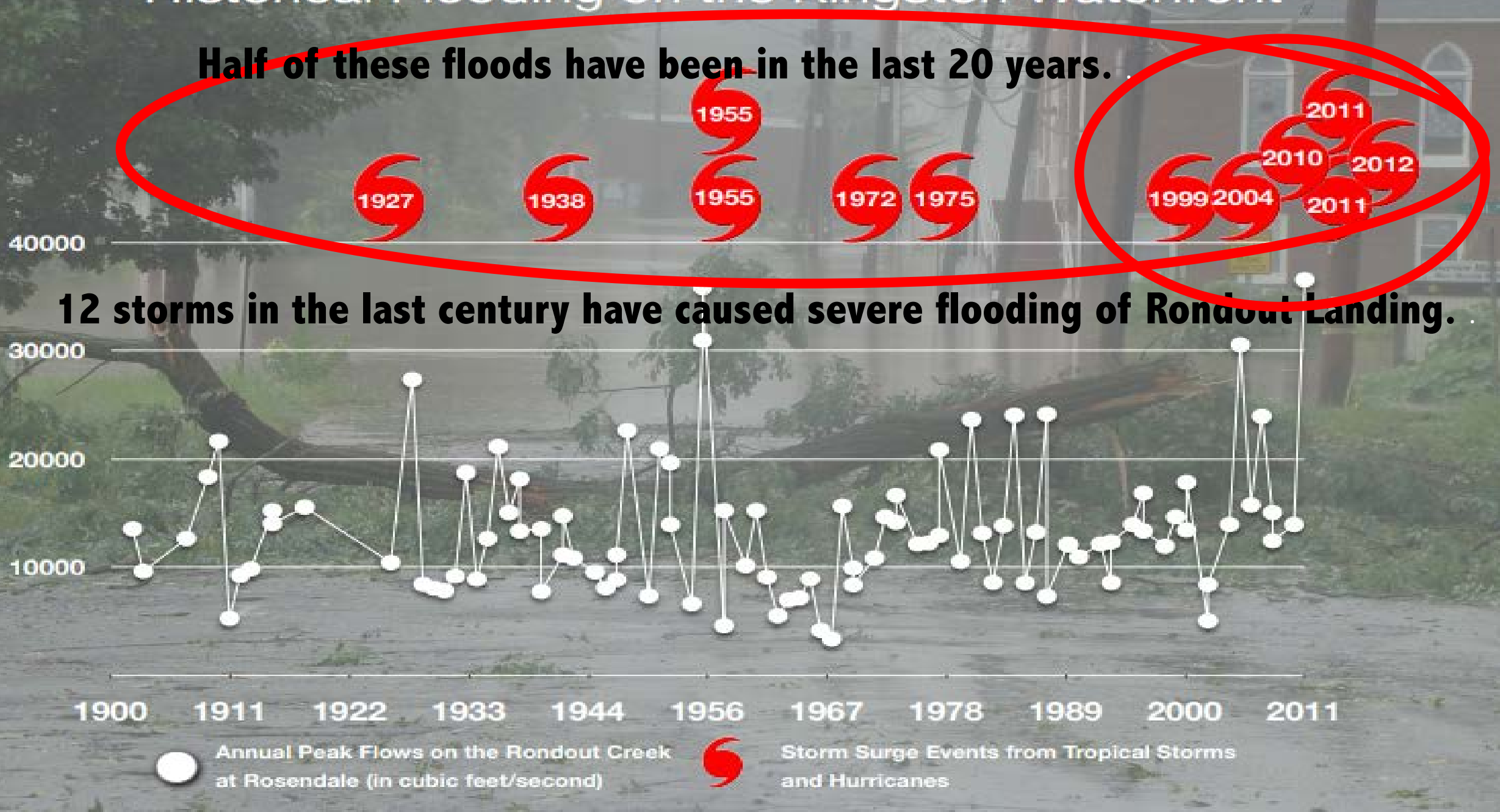
WHAT IS RESILIENCY?

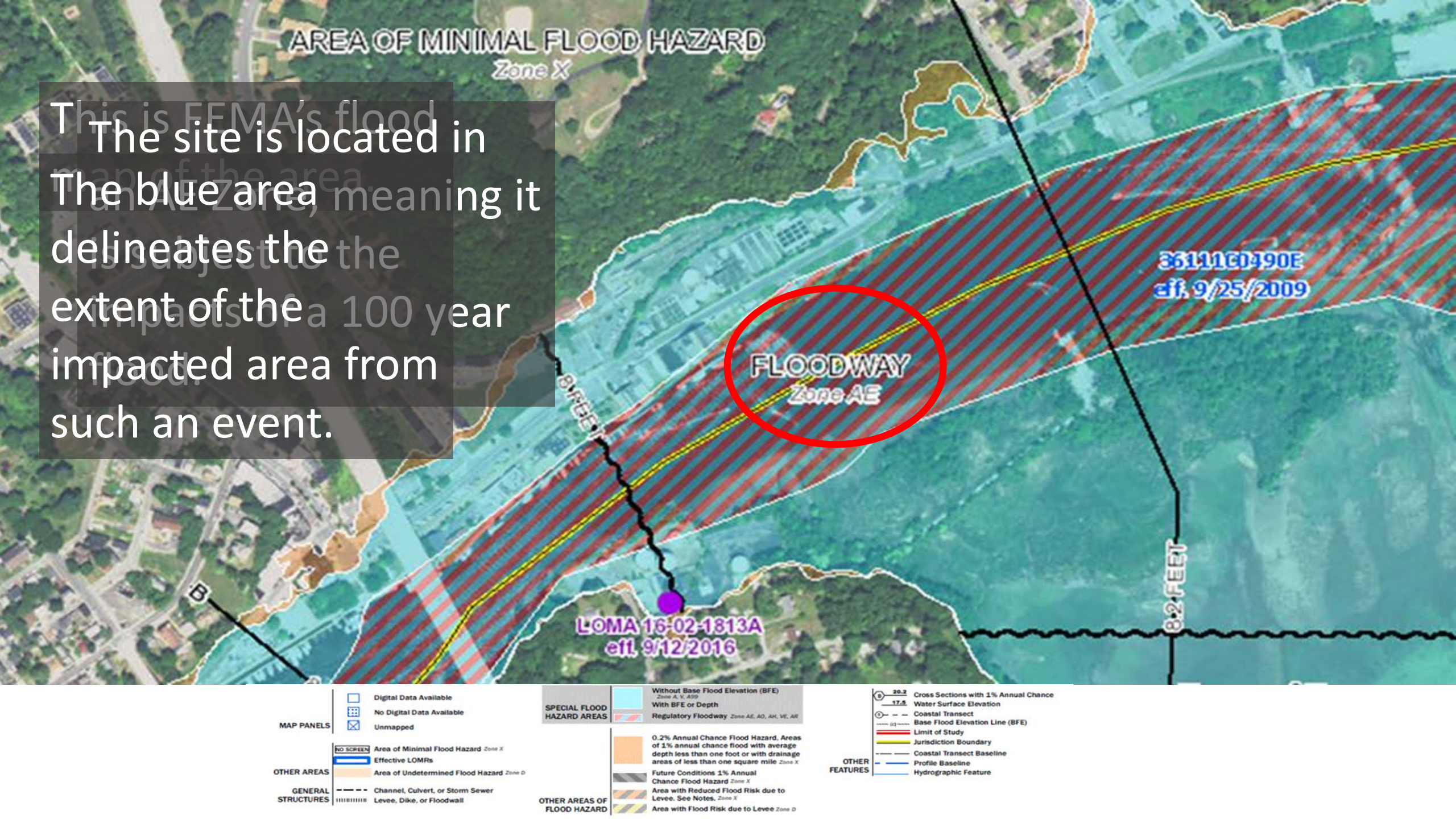
The ability of infrastructure to maintain its function and structural integrity when faced with stressors (storms, flooding, erosion).

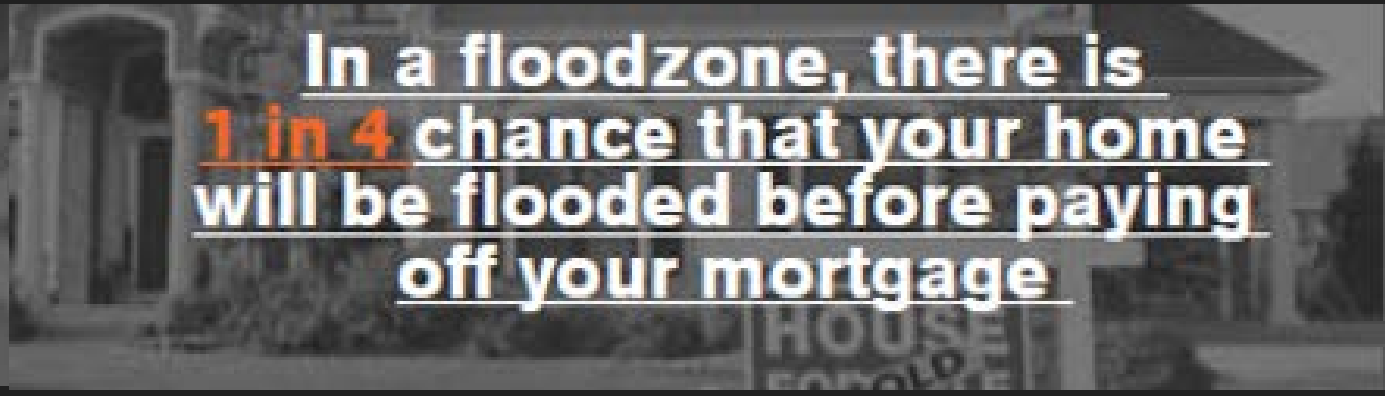
Historical Flooding on the Kingston Waterfront

Half of these floods have been in the last 20 years.

12 storms in the last century have caused severe flooding of Rondout Landing.

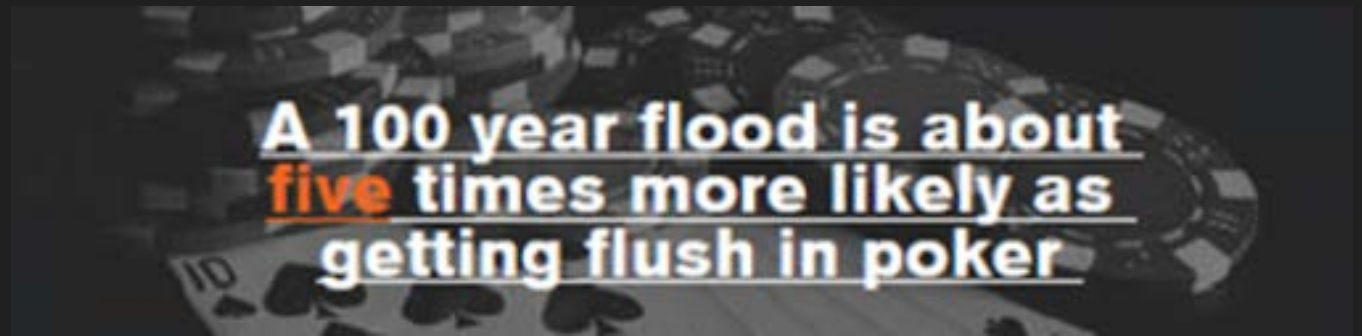



AREA OF MINIMAL FLOOD HAZARD
Zone X
This is FEMA's flood map of the area. An AE zone, meaning it is subject to the impacts of a 100 year flood.
The site is located in The blue area ing it delineates the extent of the impacted area from such an event.
FLOODWAY
Zone AE
8 FEET
36111C0490E
eff. 9/25/2009
LOMA 16-02-1813A
eff. 9/12/2016
8.2 FEET
B
MAP PANELS
Digital Data Available
No Digital Data Available
Unmapped
OTHER AREAS
Area of Minimal Flood Hazard Zone X
Effective LOMRs
Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES
Channel, Culvert, or Storm Sewer
Levee, Dike, or Floodwall
SPECIAL FLOOD HAZARD AREAS
Without Base Flood Elevation (BFE) Zone A, V, A99
With BFE or Depth
Regulatory Floodway Zone AE, AO, AH, VE, AR
OTHER AREAS OF FLOOD HAZARD
0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
Future Conditions 1% Annual Chance Flood Hazard Zone X
Area with Reduced Flood Risk due to Levee. See Notes. Zone X
Area with Flood Risk due to Levee Zone D
OTHER FEATURES
20.2
17.5
Cross Sections with 1% Annual Chance
Water Surface Elevation
Coastal Transect
Base Flood Elevation Line (BFE)
Limit of Study
Jurisdiction Boundary
Coastal Transect Baseline
Profile Baseline
Hydrographic Feature

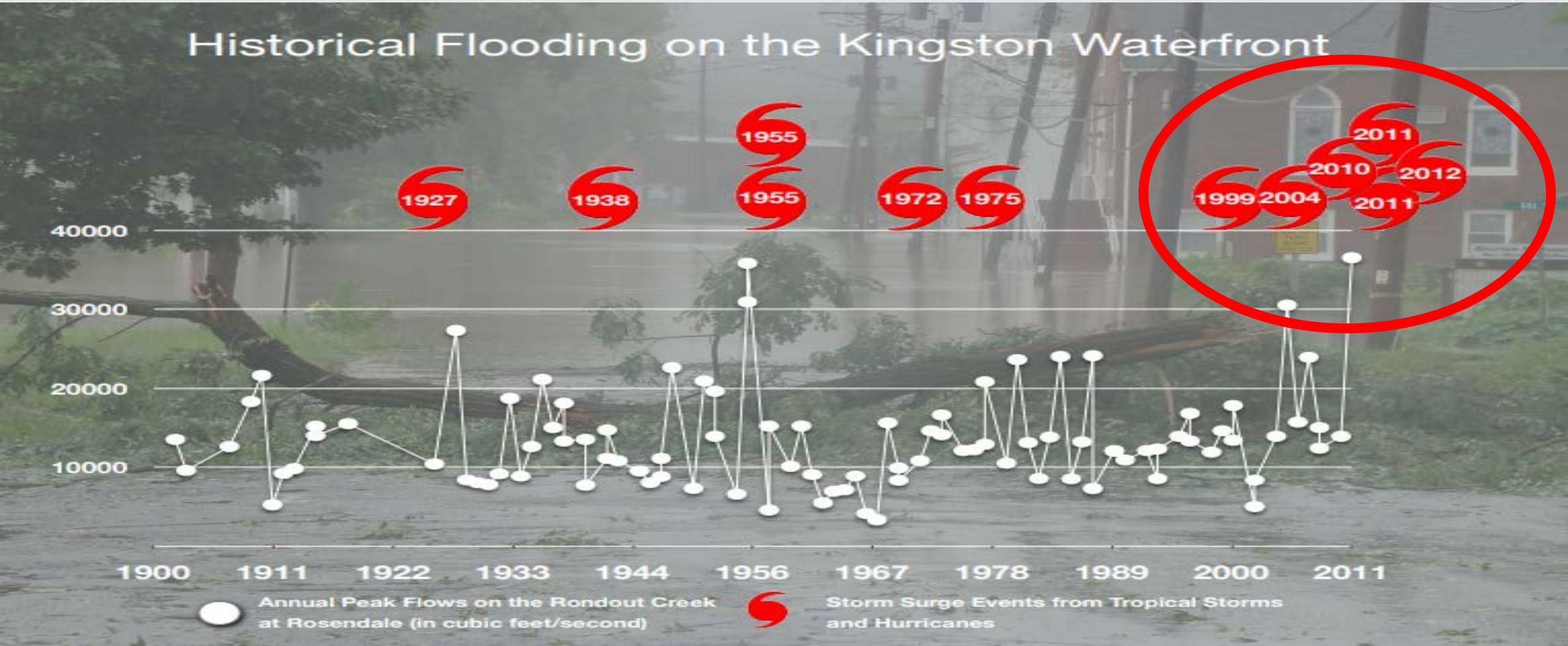


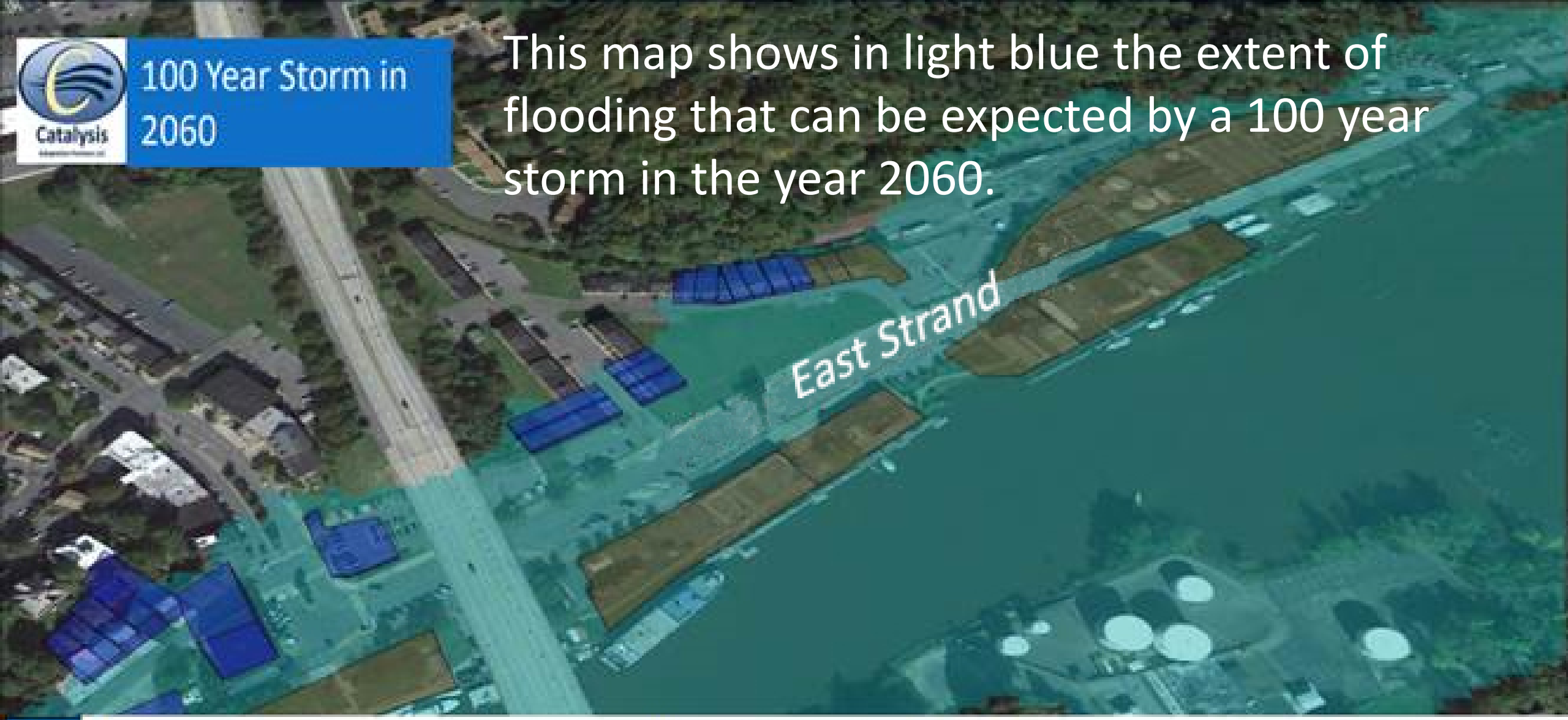
WHAT IS A 100 YEAR FLOOD?

A 100 year flood is not one that occurs every 100 years, but rather a flood that has a 1% chance of occurring each year.



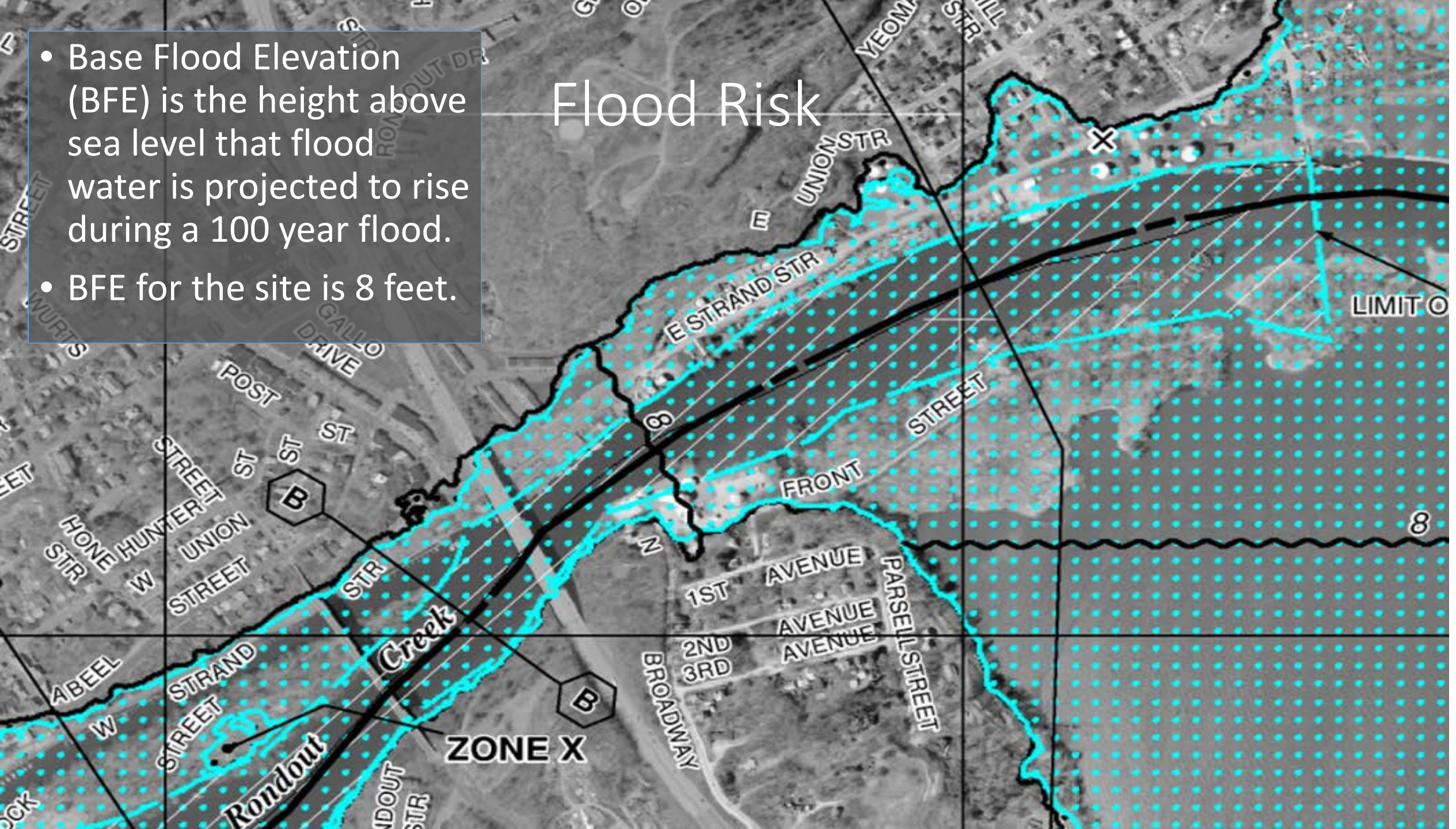
The probability and intensity of 100 year flood events can change over time as sea level rise and climate change affects precipitation patterns. This is evident by the 6 storms that occurred in the last 2 decades versus the 6 floods that occurred in the nearly 1 century long period before that.




100 Year Storm in 2060
Catalysis
This map shows in light blue the extent of flooding that can be expected by a 100 year storm in the year 2060.
East Strand
Buildings damaged by storm surge from this single event (height of bar indicates relative damage amount)
Buildings permanently inundated due to sea level rise by 2060, if no action is taken
Extent of flooding from this event

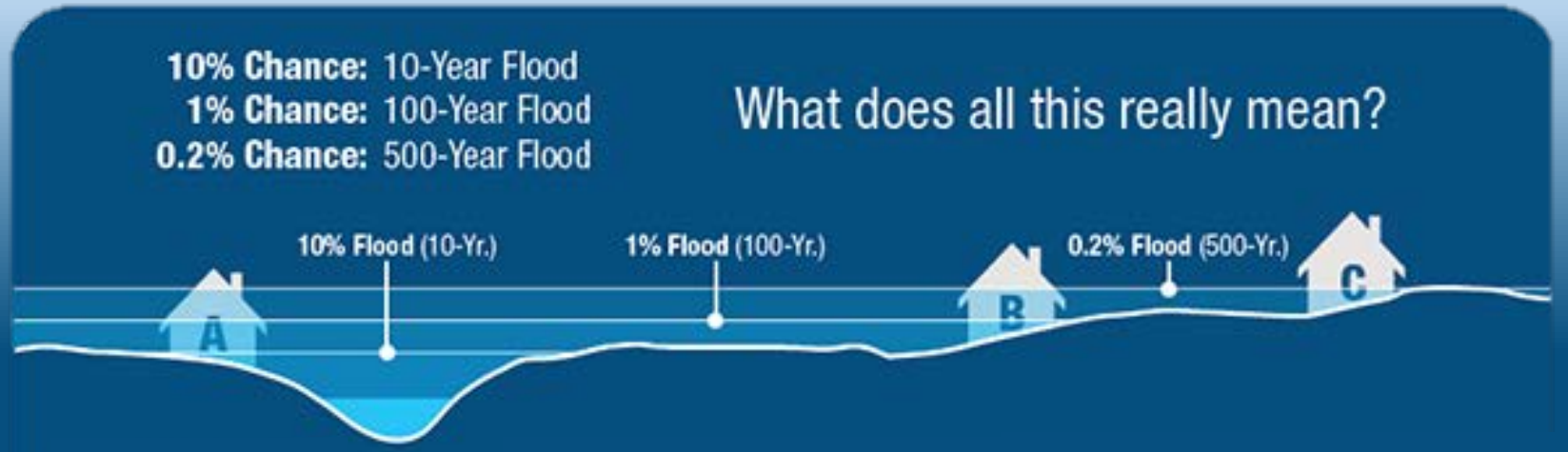
Flood Risk

- Base Flood Elevation (BFE) is the height above sea level that flood water is projected to rise during a 100 year flood.
- BFE for the site is 8 feet.



500 Year Flood

- Floods can also be classified as 500 year events, which by the same logic as the hundred year flood have a 0.2% chance of occurring each year.
- A rule of thumb for approximating the 500 year flood elevation is to use 1.25 times the BFE.
- Thus, the 500 year flood elevation for the Kingston Waterfront is 10 feet.



The bulkhead at the site is currently approximately 5 feet above sea level.

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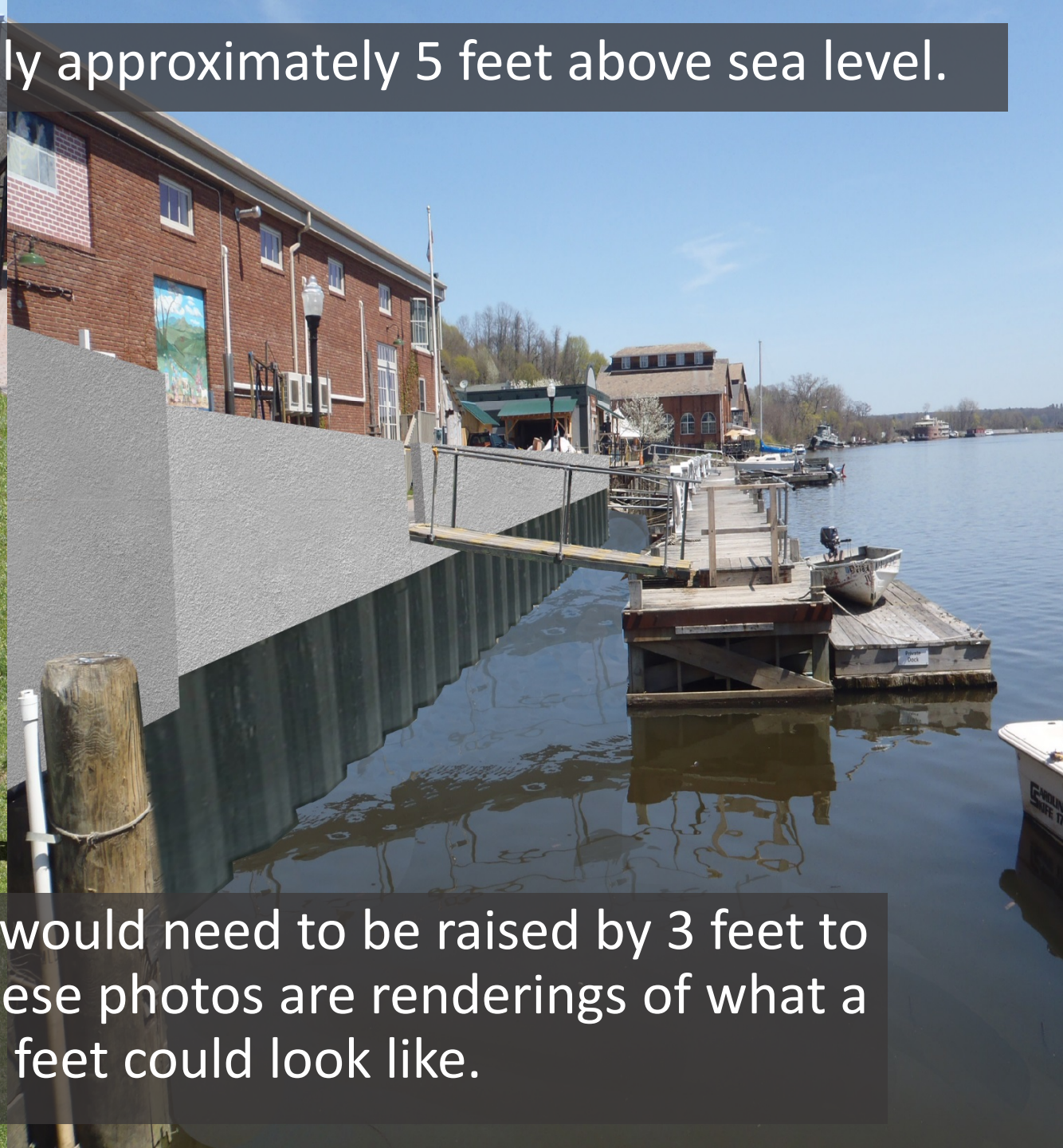
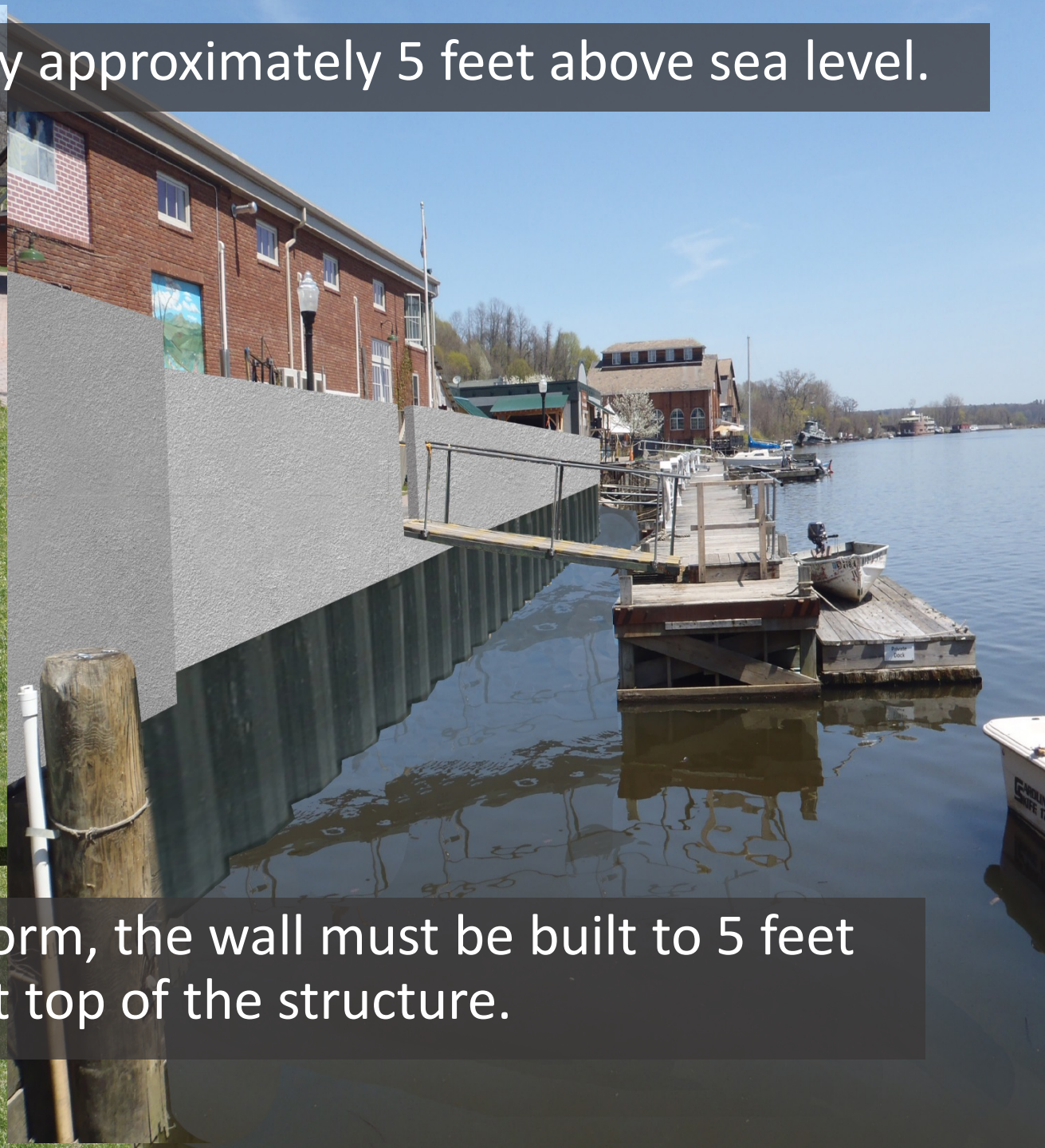
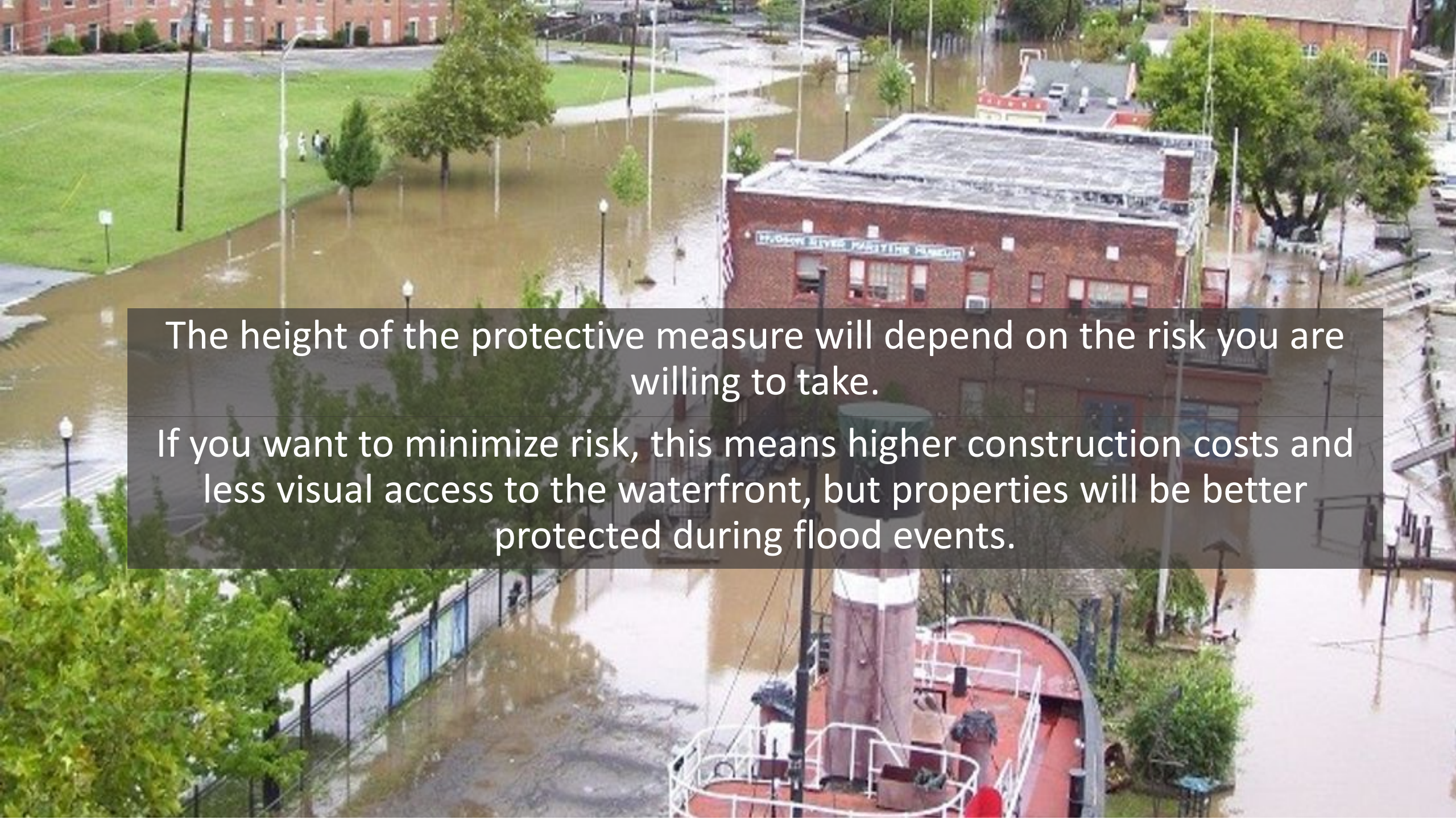


As such, a new protective measure would need to be raised by 3 feet to protect against a 100 year flood. These photos are renderings of what a bulkhead built up 3 feet could look like.

The bulkhead at the site is currently approximately 5 feet above sea level.



To protect against a 500 year storm, the wall must be built to 5 feet above the current top of the structure.

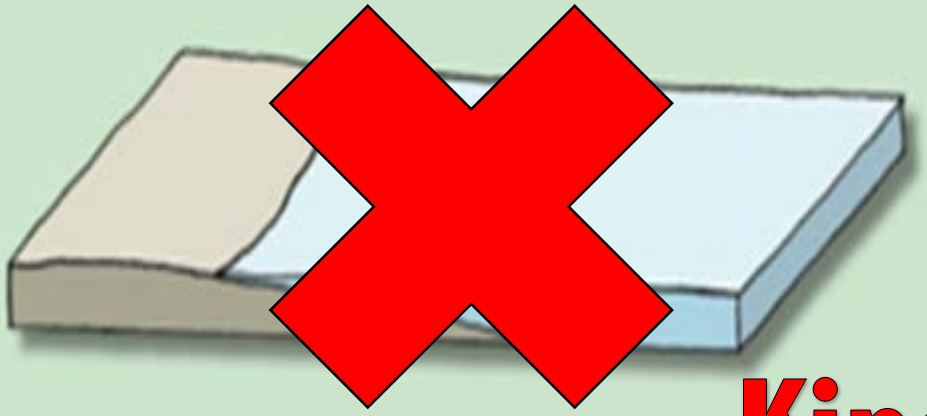


The height of the protective measure will depend on the risk you are willing to take.

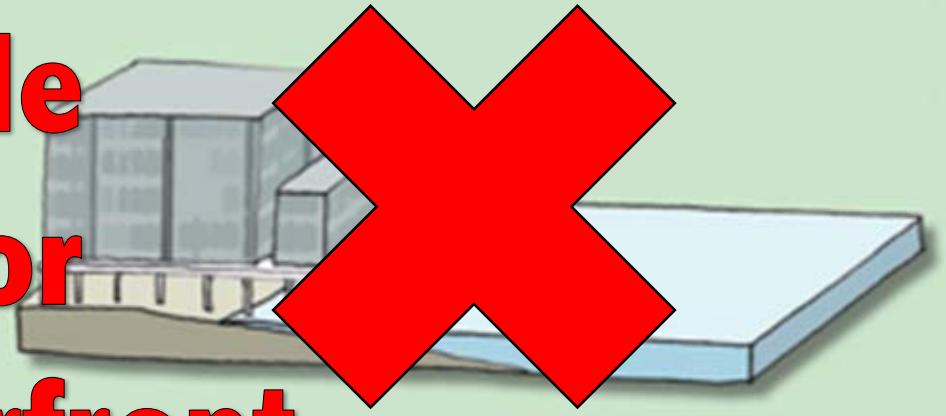
If you want to minimize risk, this means higher construction costs and less visual access to the waterfront, but properties will be better protected during flood events.


How can we make the Kingston waterfront resilient?

Not Feasible Methods For Kingston Waterfront

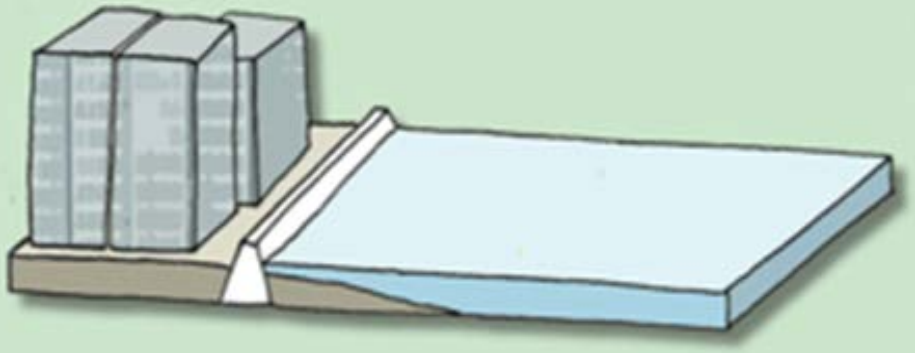


Move infrastructure out of floodplain

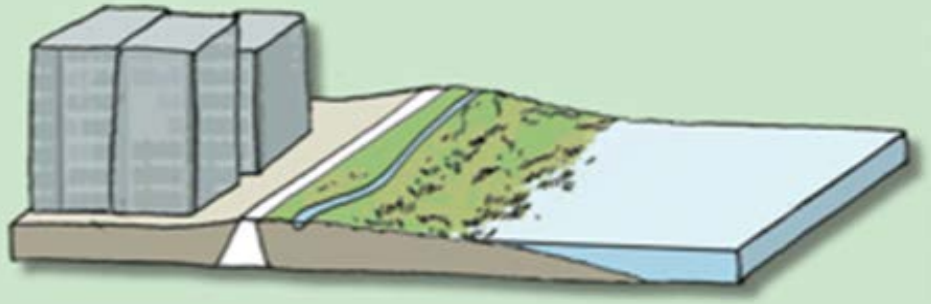


Flood-proof Infrastructure

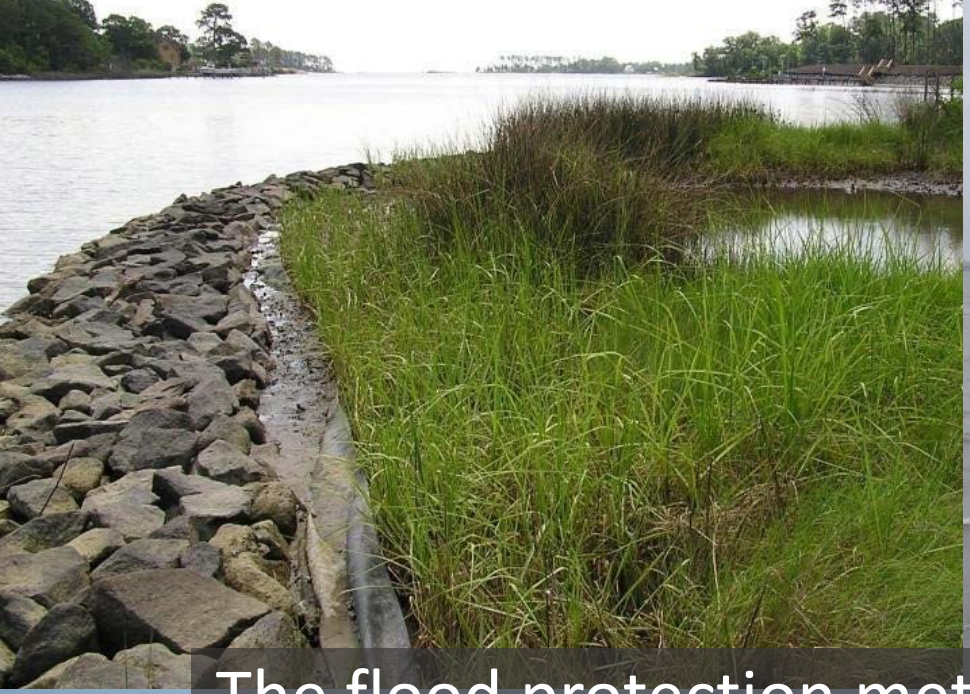
Flood Protection Methods



Build Protective Infrastructure

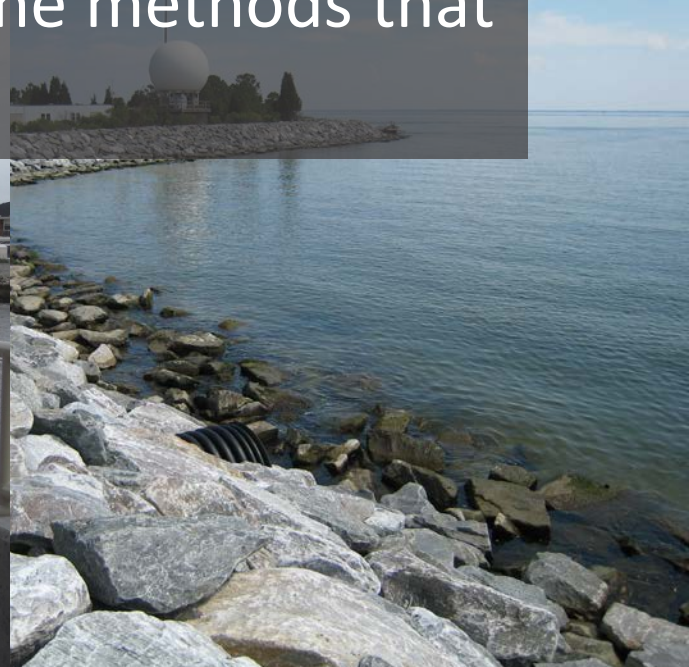


Restore Natural Protective Features

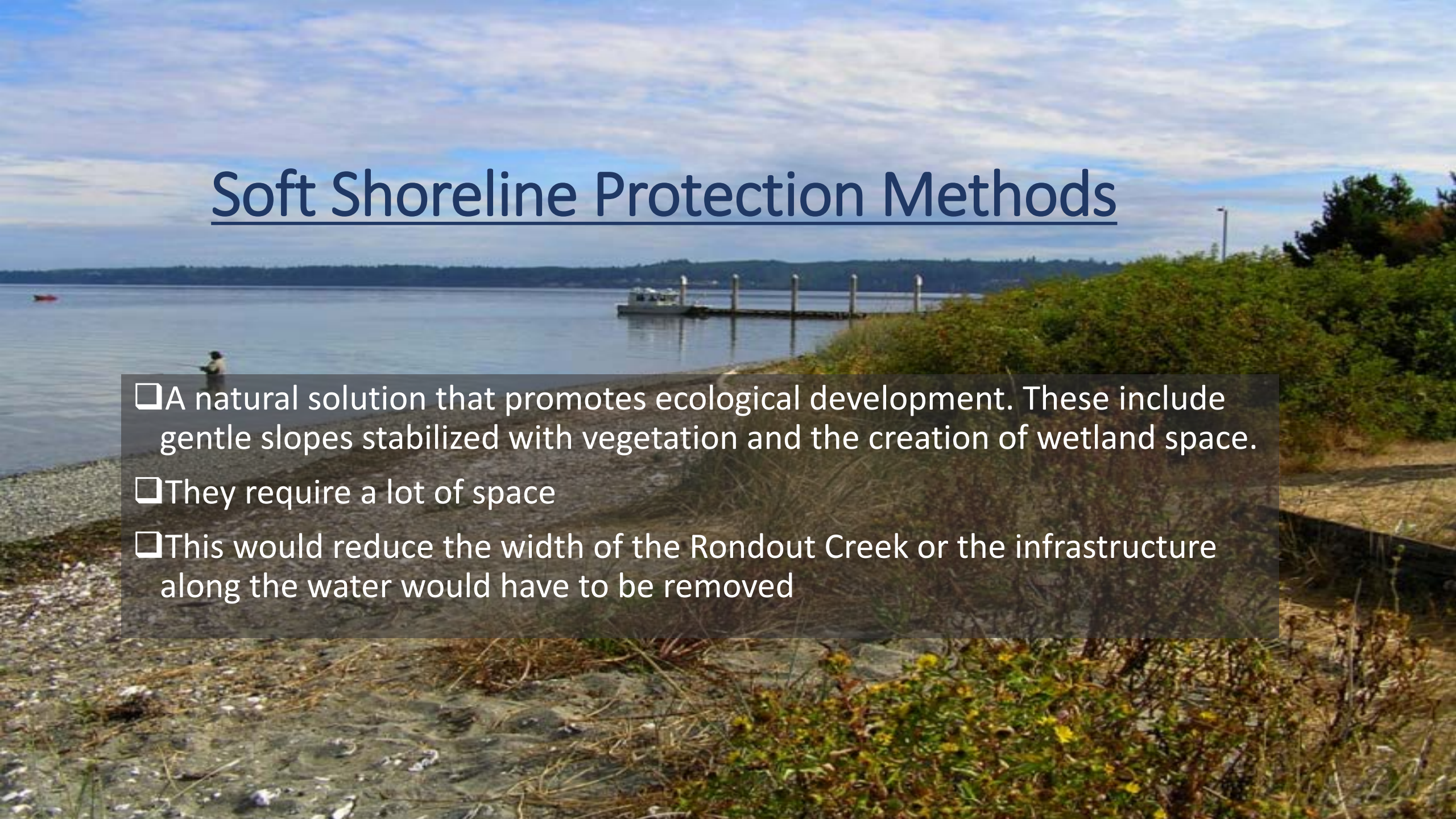


The flood protection methods we will explore range from soft shoreline methods that are more natural options to hard shoreline methods that include coastal structures.





Soft Shoreline Protection Methods



- A natural solution that promotes ecological development. These include gentle slopes stabilized with vegetation and the creation of wetland space.
- They require a lot of space
- This would reduce the width of the Rondout Creek or the infrastructure along the water would have to be removed

Living shoreline

Pros

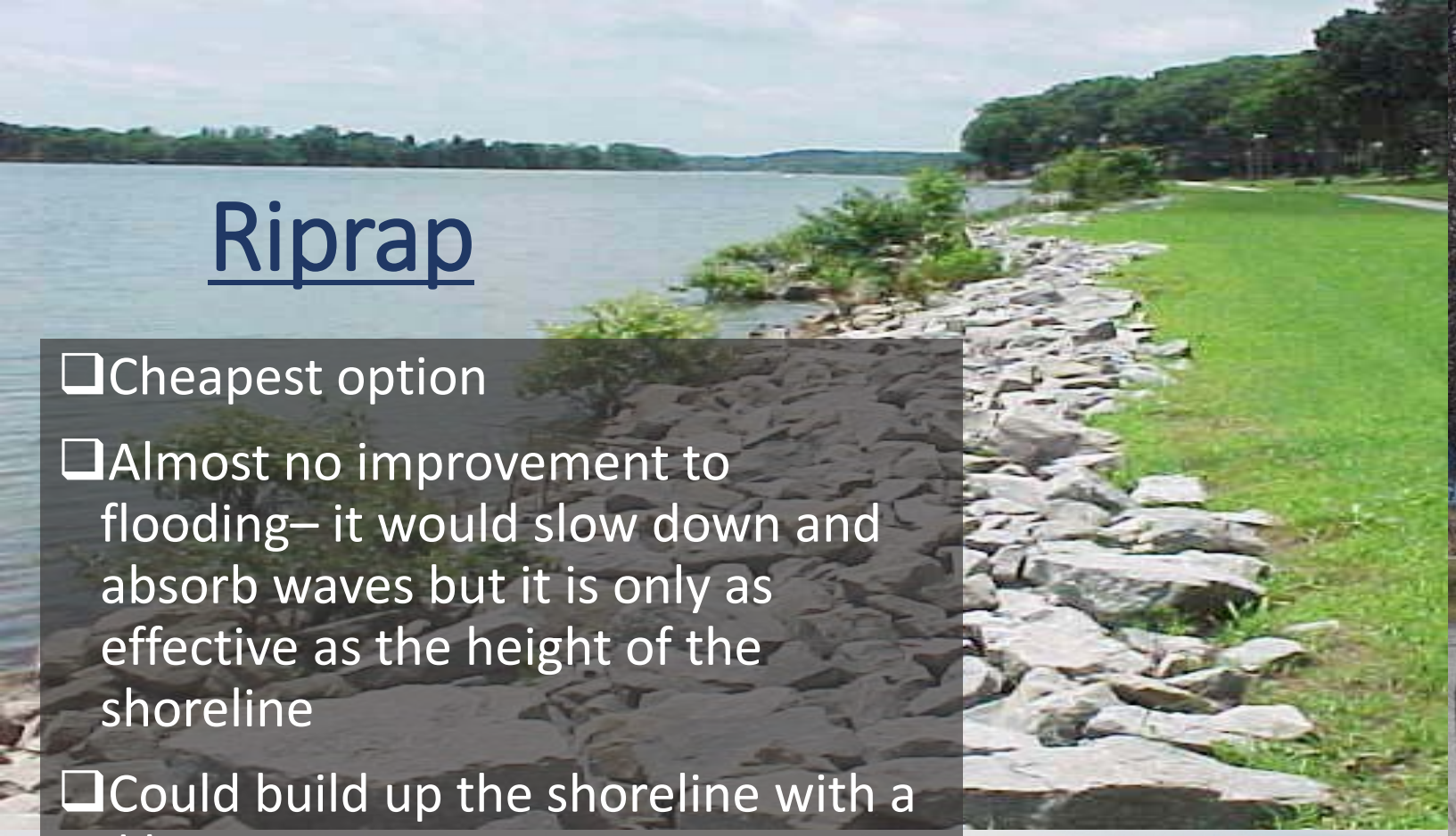
- ❑Natural shoreline
- ❑Little to no maintenance
- ❑Cost effective

Cons

- ❑Vegetation will take a while to properly establish and require monitoring for the first few years
- ❑Could interfere with boating activities
- ❑Almost no improvement – it would slow down and absorb waves but it is only as effective as the height of the shoreline

Riprap

- Cheapest option
- Almost no improvement to flooding– it would slow down and absorb waves but it is only as effective as the height of the shoreline
- Could build up the shoreline with a dike
- Integrate plantings into the riprap

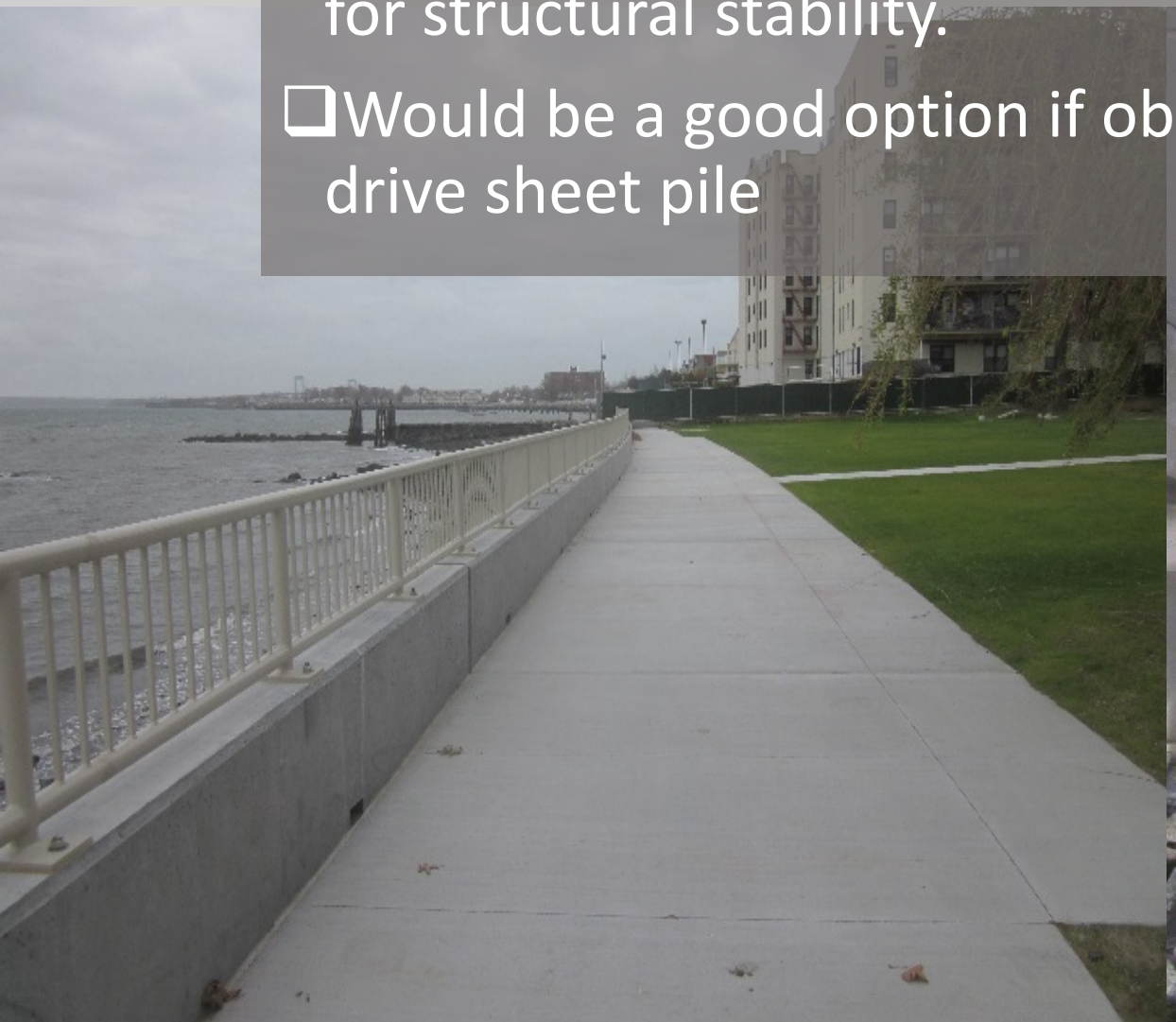


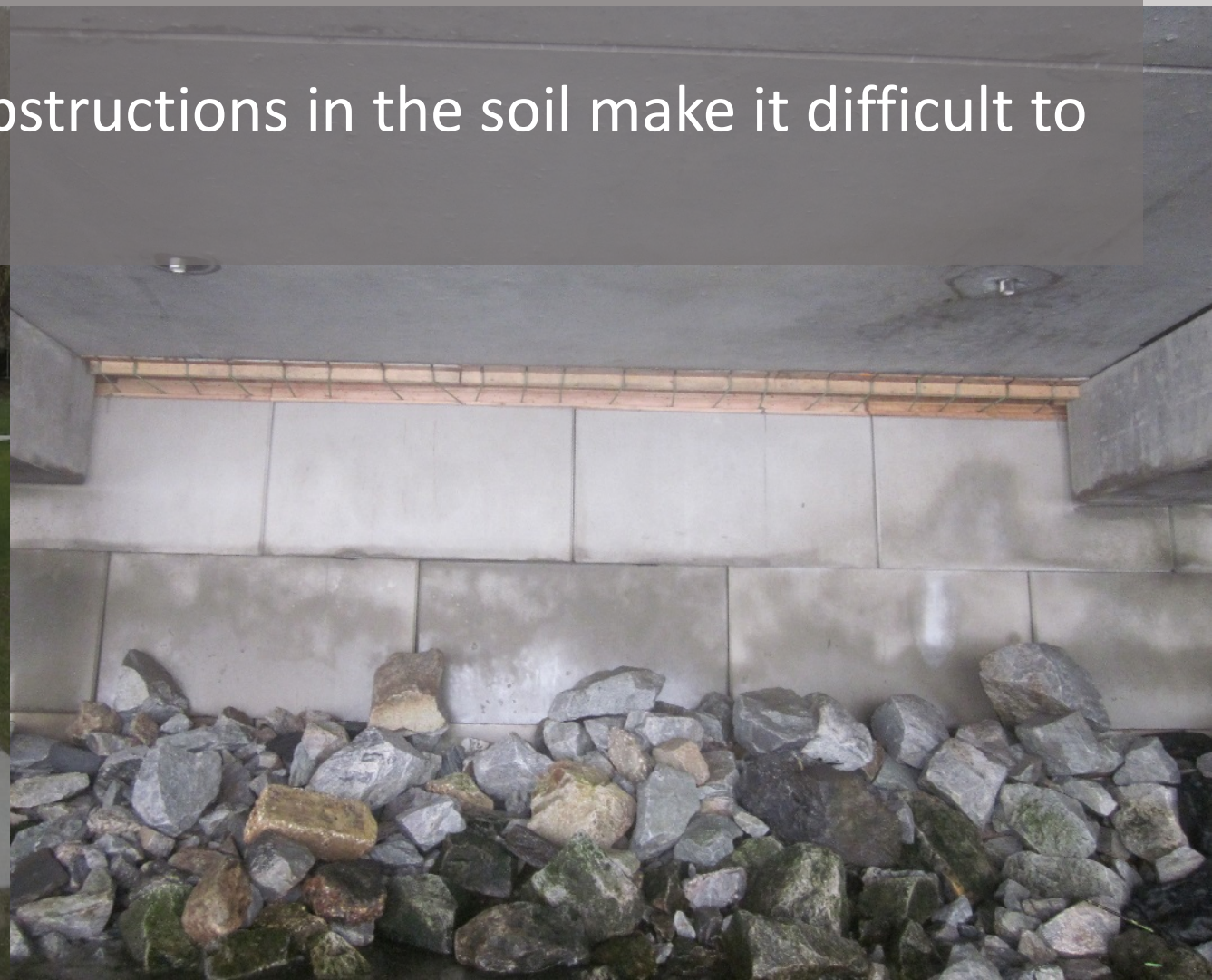
Hard Shoreline Protection Methods

- Offer greater protection because they can be built higher than the natural shoreline
- Typically a more costly option
- May block visual or physical access to the waterway

Gravity Wall

- Typically constructed of concrete or masonry. Depends on its weight for structural stability.
- Would be a good option if obstructions in the soil make it difficult to drive sheet pile



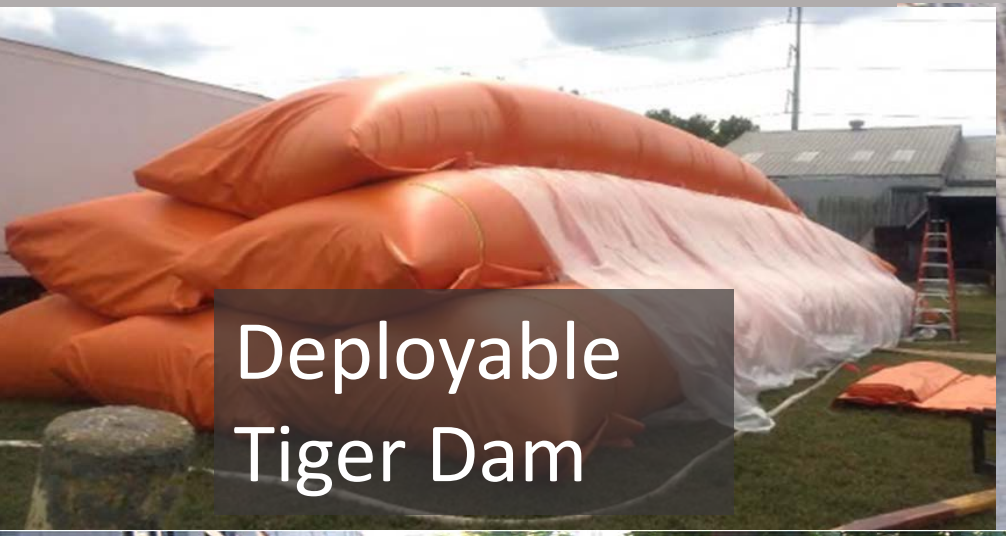


Sheet Pile Bulkhead

- Most resilient option. You can build it as high as is necessary
- Minimum amount of fill in the waterway, which is a concern for permitting agencies
- Will require tie backs, which means excavating upland
- Driving sheet pile into the ground could be difficult depending on the type of soil at the site
- More height = more cost = less aesthetically pleasing

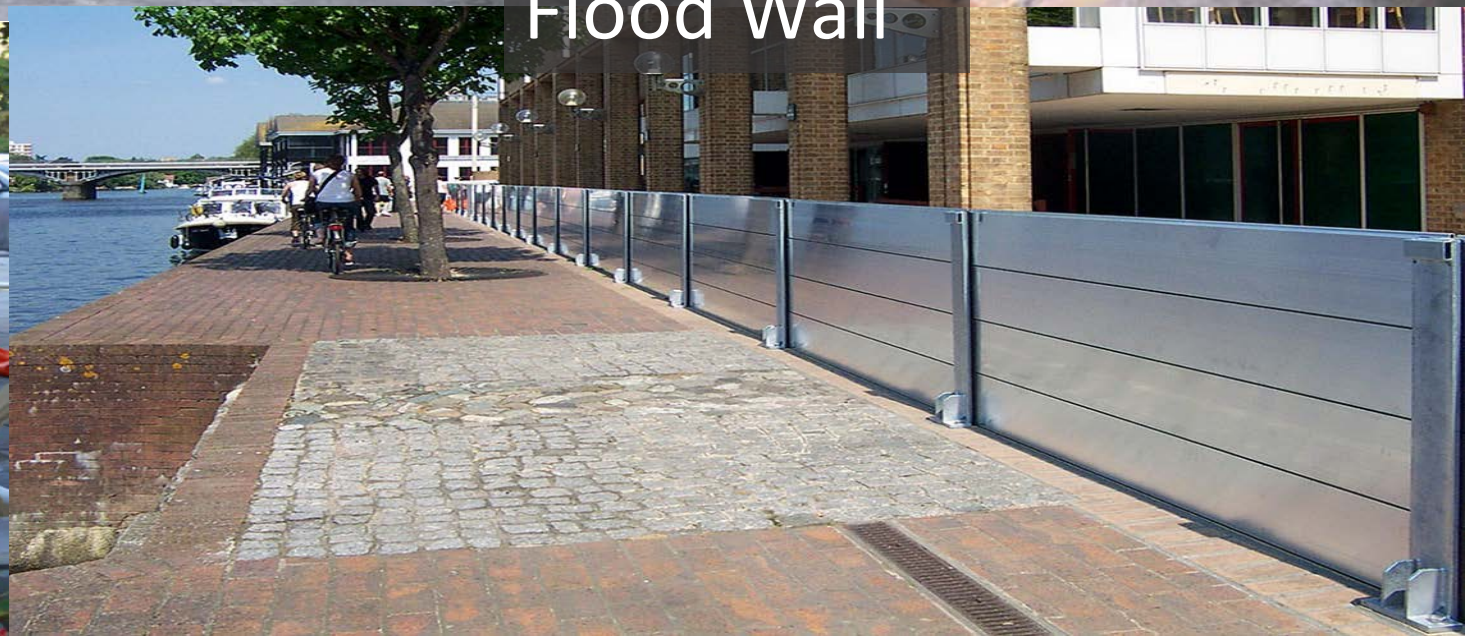
Deployable Methods

Deployable protection methods can also be used to provide protection without permanently obstructing views and waterfront access.



Deployable Tiger Dam

Deployable Flood Wall



Mechanical Methods

maintain access to the waterfront without the hassle of installation and disassembly.

Lift/Swing Gate

Lift/Swing Gate

Pivot Gate

Lift/Swing Gate

Flip-Up Gate

What design is best?

Not one continuous solution is best for the entire waterfront.

An optimal design will likely combine several of these options, as more than one solution can be used for different sections of the shoreline.