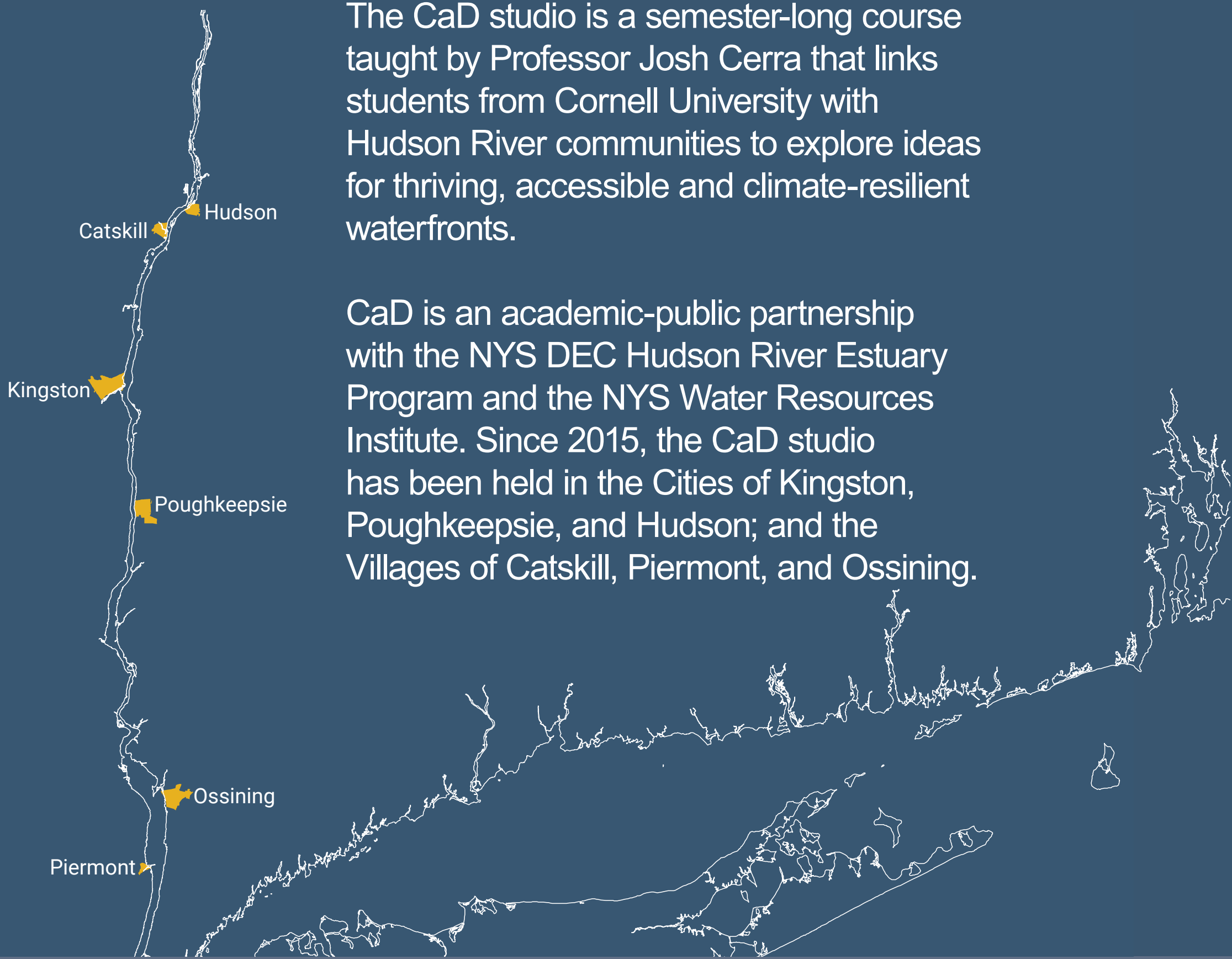


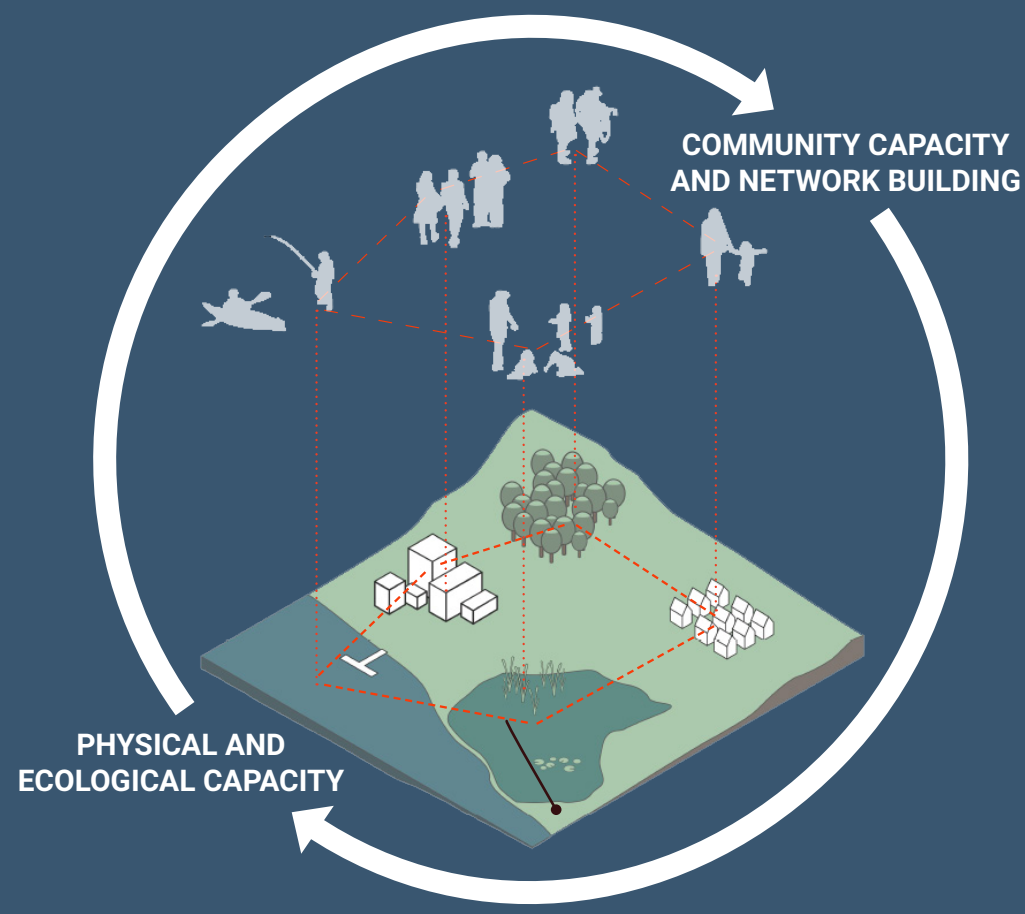
# WHAT IS THE CLIMATE-ADAPTIVE DESIGN STUDIO?

## Inspiring change for waterfront communities



The CaD studio is a semester-long course taught by Professor Josh Cerra that links students from Cornell University with Hudson River communities to explore ideas for thriving, accessible and climate-resilient waterfronts.

CaD is an academic-public partnership with the NYS DEC Hudson River Estuary Program and the NYS Water Resources Institute. Since 2015, the CaD studio has been held in the Cities of Kingston, Poughkeepsie, and Hudson; and the Villages of Catskill, Piermont, and Ossining.



# 1

The design process begins with an initial analysis including **site visits and meetings** with the community to understand their vision for a future waterfront. This analysis allows us to identify current and future challenges and opportunities.



# 2

We meet with **stakeholders and community members** during the design process to share our ideas and get feedback on our design concepts.



# 3

On our campus in Ithaca, NY we refine the **design concepts** based on the information and feedback gathered during our community and stakeholder meetings.



# 4

We share our **final designs** with the community to inspire further discussion about the value of vibrant and resilient waterfront communities.



## Partners



Department of  
Environmental  
Conservation

Hudson River  
Estuary Program



NEW YORK STATE  
WATER  
RESOURCES INSTITUTE  
Cornell University

Cornell **CALS**  
College of Agriculture and Life Sciences

## For More Information

For a brief video about CaD:

<https://trophic.design/cad/>  
[tinyurl.com/CornellCaD](https://tinyurl.com/CornellCaD)



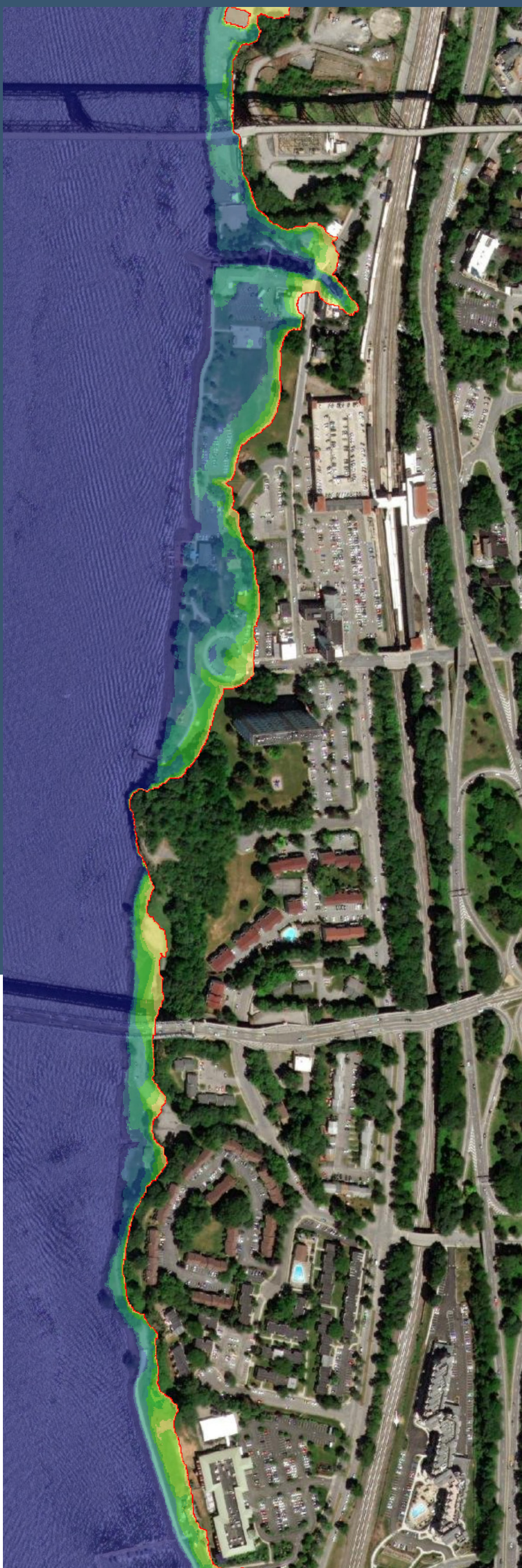
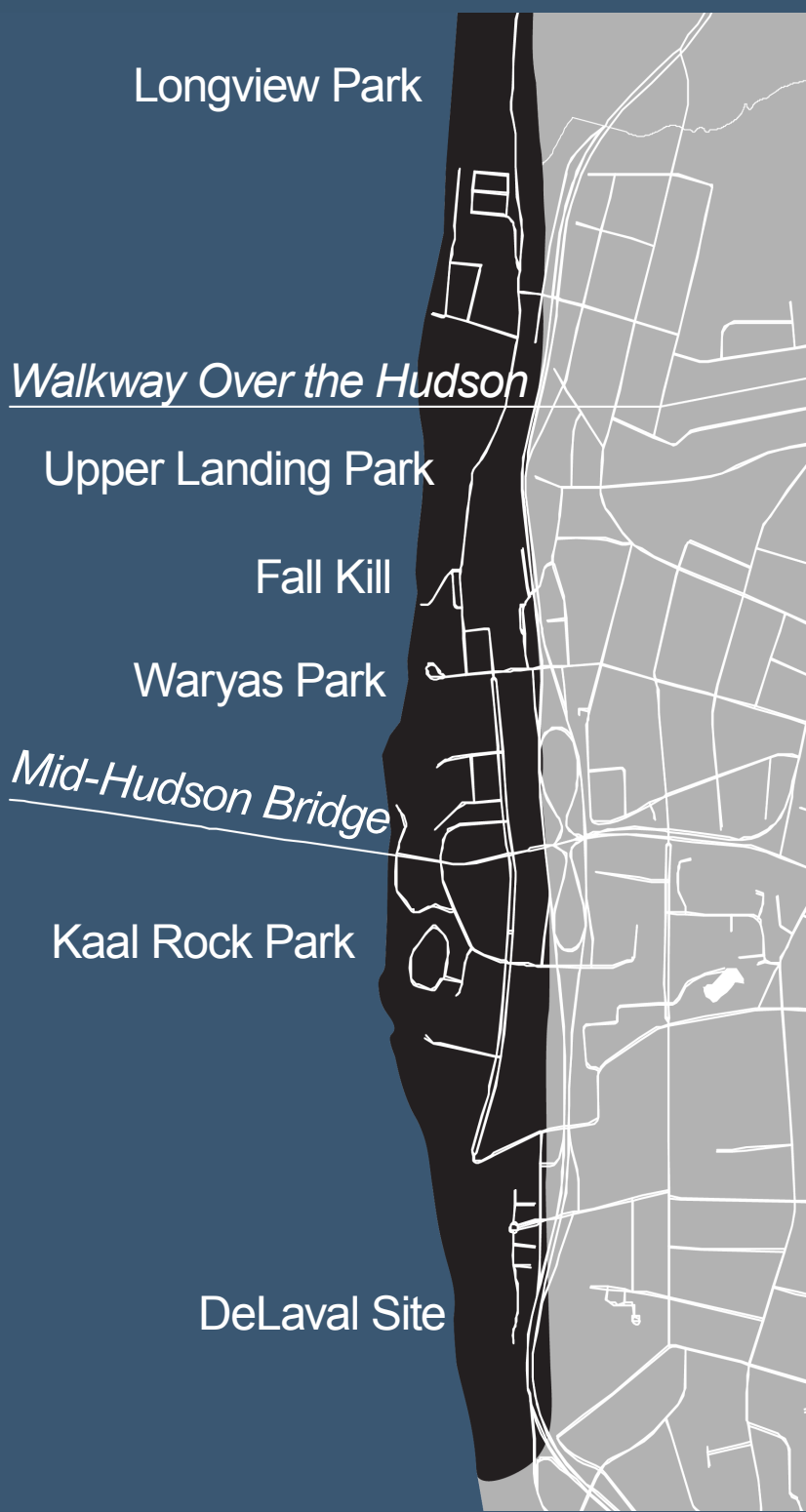
This exhibit was made possible through a partnership between Cornell University Landscape Architecture Department, Resilience Communications & Consulting, LLC, and the NYS Water Resources Institute, with funding from the Environmental Protection Fund through the NYS Department of Environmental Conservation Hudson River Estuary Program. These student projects are concepts that have not been assessed for regulatory implications, and will require further refinement before being considered for implementation.



# CAD STUDIO IN POUGHKEEPSIE

## Exploring Future Waterfronts

The CaD studio study area stretched from Longview Park in the north to the DeLaval site to the south. Students envisioned a future Hudson River waterfront and imagined new connections to the city grid. The study area included Upper Landing, Waryas and Kaal Rock parks, as well as the Southern Waterfront and the mouth of the Fall Kill.



### Flooding & Sea-level Rise

The Hudson River experiences ocean tides for approximately half of its length, from New York Harbor to the Federal Dam at Troy. Due to this marine influence, the Poughkeepsie waterfront is affected by rising sea-levels resulting from climate change.

New York State officially adopted projections of how much sea-level may rise by the 2100s. Students used the NYS projections to envision how the future Poughkeepsie waterfront could look and perform in different design scenarios. Digital tools, such as Columbia University's Hudson River Flood Impact Decision Support Tool, were used to envision where the shoreline might be in the 2080s.

#### 2020s

The map shows flood depths at mean sea-level in the "100-year" flood zone, which is the area that has a 1% chance of flooding in any given year.

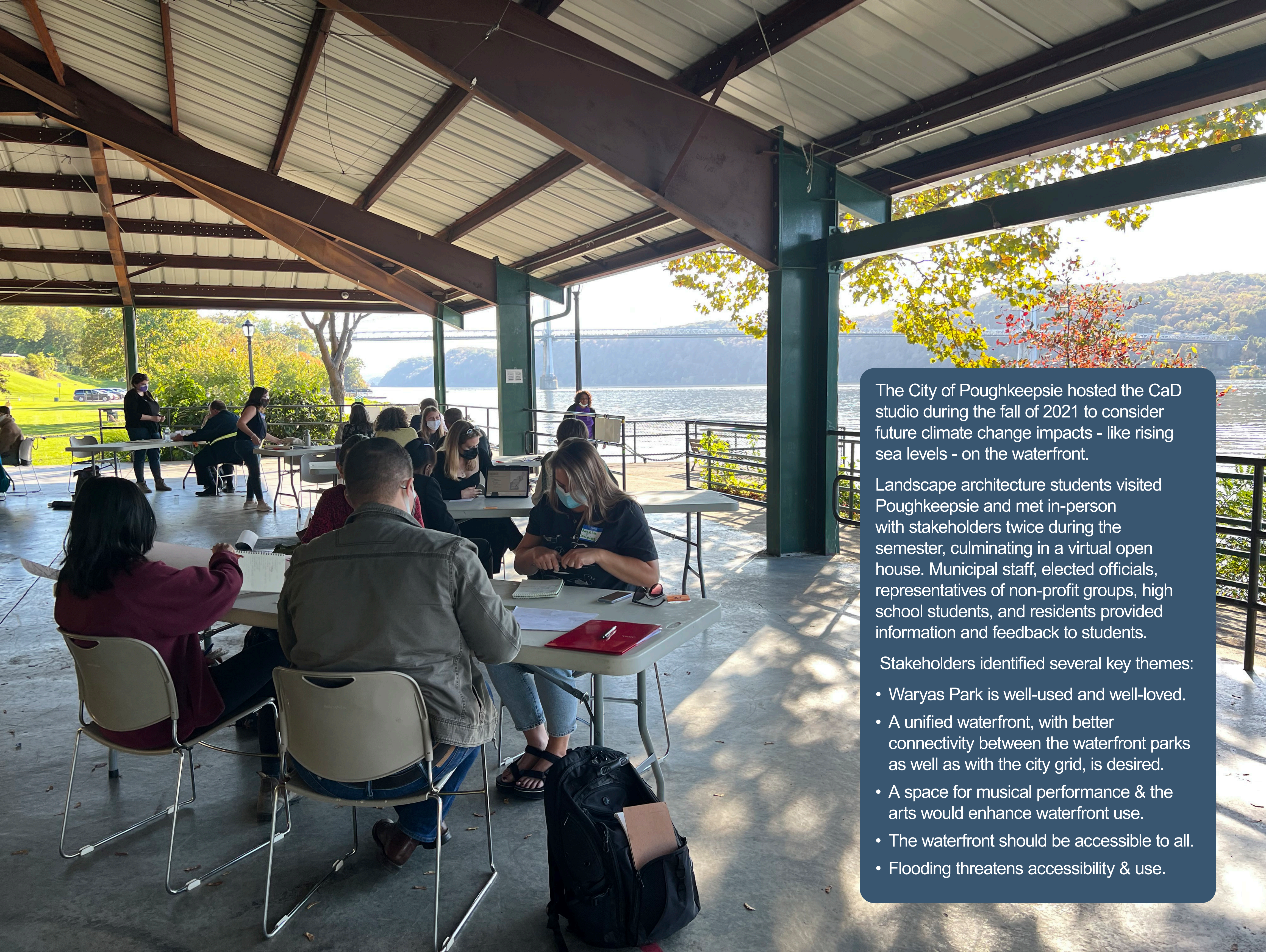
The yellow, green and blue on the 2020s map represent temporary flooding. Darker blue indicates permanent inundation.

#### 2080s

Future risk in the "100-year" flood zone, with 60 inches of sea-level rise, which NYS projects may occur as soon as the 2080s if global emissions are not curbed.

In the 2080s, the "100-year" flood zone is larger than in the 2020s. Green indicates temporary flooding; blue indicates areas that may be permanently underwater.

Data source: Columbia University Hudson River Flood Impact Decision Support System Version 2



The City of Poughkeepsie hosted the CaD studio during the fall of 2021 to consider future climate change impacts - like rising sea levels - on the waterfront.

Landscape architecture students visited Poughkeepsie and met in-person with stakeholders twice during the semester, culminating in a virtual open house. Municipal staff, elected officials, representatives of non-profit groups, high school students, and residents provided information and feedback to students.

Stakeholders identified several key themes:

- Waryas Park is well-used and well-loved.
- A unified waterfront, with better connectivity between the waterfront parks as well as with the city grid, is desired.
- A space for musical performance & the arts would enhance waterfront use.
- The waterfront should be accessible to all.
- Flooding threatens accessibility & use.



# CaD PRINCIPLES

## Five Principles Guide the Design Process

The CaD studio is built on five core principles for climate-resilient, ecologically-sensitive, and community-focused waterfront design. Students strive to envision waterfronts that are accessible, memorable and adapted to present and future flood conditions.

Twelve students completed designs for the Poughkeepsie waterfront. Students worked to address all five CaD principles in their projects, but some students featured certain design principles more prominently.

### Design A Waterfront



Maximize the value of what a waterfront can be by encouraging water-dependent and water-enhanced uses, like marinas, swimming beaches, picnic areas and restaurants.



“Flood//Land” Dom Malacaman

### Design For Flooding



Work with water instead of against it by pursuing strategies such as flood adaptation, reinforcement and strategic relocation.



“Permeable Connection” Kate Flaherty

### Design With Nature



Preserve and enhance natural areas on the waterfront and use nature-based techniques for erosion control and stormwater management.



“Restoration at Play” Yvette Pollack

### Design With Community

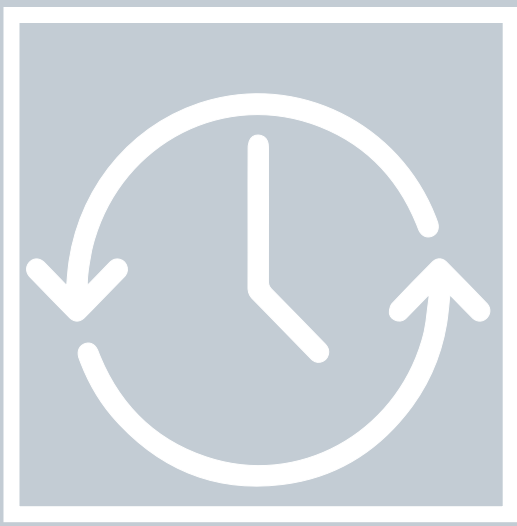


Waterfronts that are universally accessible can contribute to the prosperity and well-being of the entire community.



“Freeze, Thaw, Expand” Sophie Bellemare

### Design For Change



Create places that continually provide value under changing conditions. Phase projects over time in ways that are both practical and visionary.



“Metamorphic Hudson” Monica Rourke



# FREEZE, THAW, EXPAND

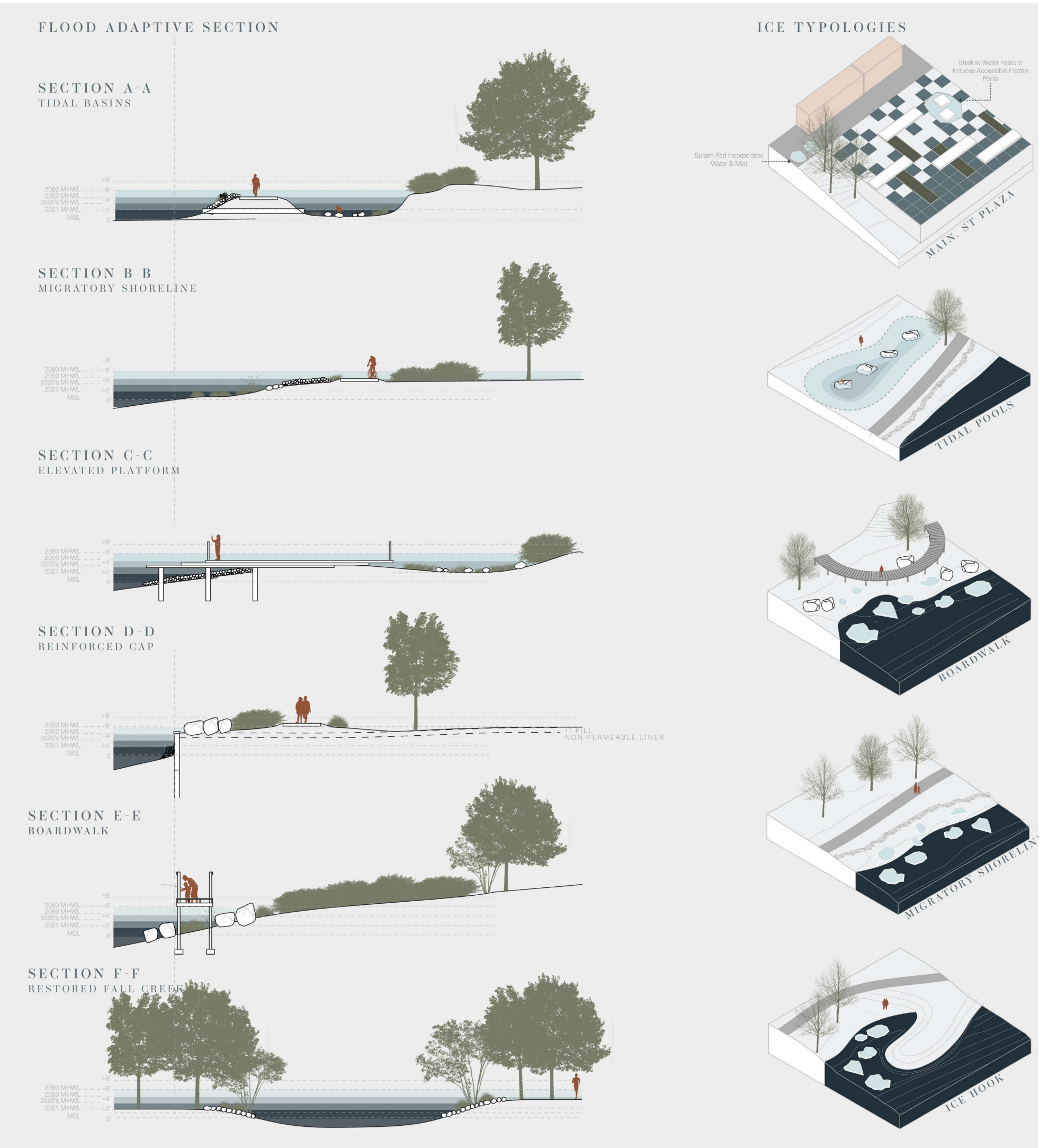
## Student Designer Sophie Bellemare

Throughout history the Poughkeepsie waterfront has proved to be dynamic – ebbing, flowing, and transforming through time. From the frozen glacier that formed the Hudson River, to the ice industry that later dominated the shoreline, the waterfront is now in a new transitional phase. With the increasing threats of climate change the waterfront

is in the process of expanding its critical climate-adaptive and community infrastructure. Freeze, Thaw, Expand identifies current blockages to waterfront access while harnessing processes that improve its resilience to transform the waterfront for a more climate-adaptive and equitable future.



Design a Waterfront



Ideas for maintaining river access while allowing for shoreline migration with sea-level rise



Sophie focused on the waterfront as a year-round destination, featuring a skating rink and sledding hill. Ice harvest and storage is part of the waterfront's industrial past, and ice floes remain as an important part of its winter character. She suggested a variety of techniques to address shoreline migration and ice-shear erosion. She imagined elevating some areas to maintain public use, while encouraging natural features like pocket marshes in low elevation locations.



# A LIVING SHORELINE FOR ALL

## Student Designer Xinyue Hope Shen

‘A Living Shoreline for All’ resolves boundaries between the city and its waterfront to create opportunities for reunion and reciprocity between humans and nature. Accentuating links between social resilience and ecological resilience, the project envisions several

waterfront ‘labs’ that garner both environmental and social benefits. A Fall Kill lab provides a space for study and learning about the Hudson’s marshes and tributary habitats. A Living Shoreline lab accesses daily tidal fluctuation as an opportunity to restore shallow-water

habitats at Waryas Park in ways that are accessible to users. A Carbon lab in Kaal Rock Park enhances forested areas. An Ecological-Urban lab on the Southern Waterfront protects from erosion and creates recreational space for activities and events.

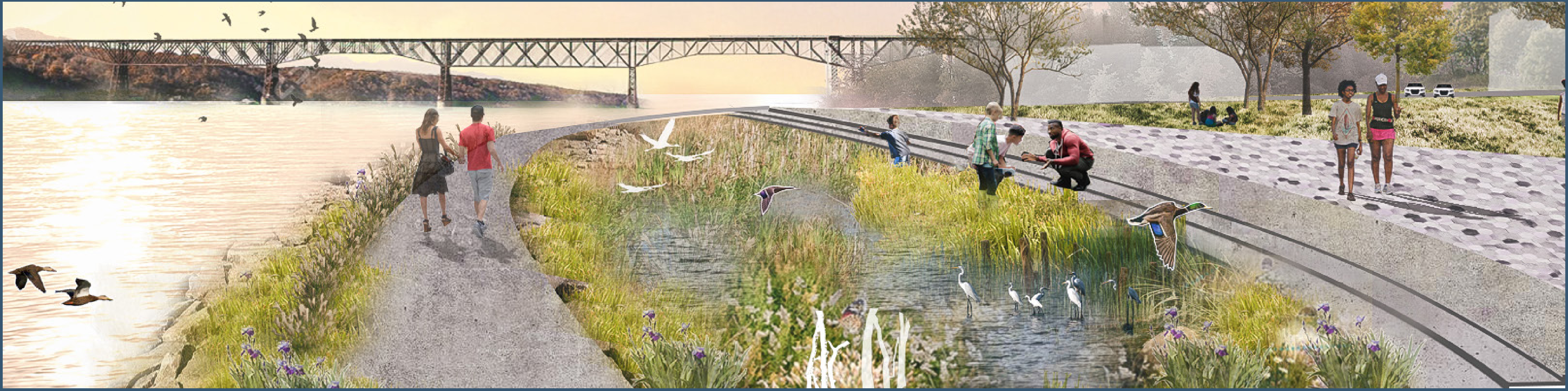


Design with Nature



A teaching platform overlooks the mouth of the Fall Kill

Xinyue's vision for the waterfront includes a combination of hard features, like rip rap, and natural features to create safe spaces for families and youth to explore the shoreline. The design features use of materials like permeable concrete to enhance rainwater infiltration and reduce runoff from the plaza and walkway areas.





# FLOOD//LAND

## Student Designer Dominic Malacaman

On many Hudson waterfronts, land that is currently flood-susceptible and projected to be inundated in the future often sits on historical fill that was added to make room for past industry and other development.

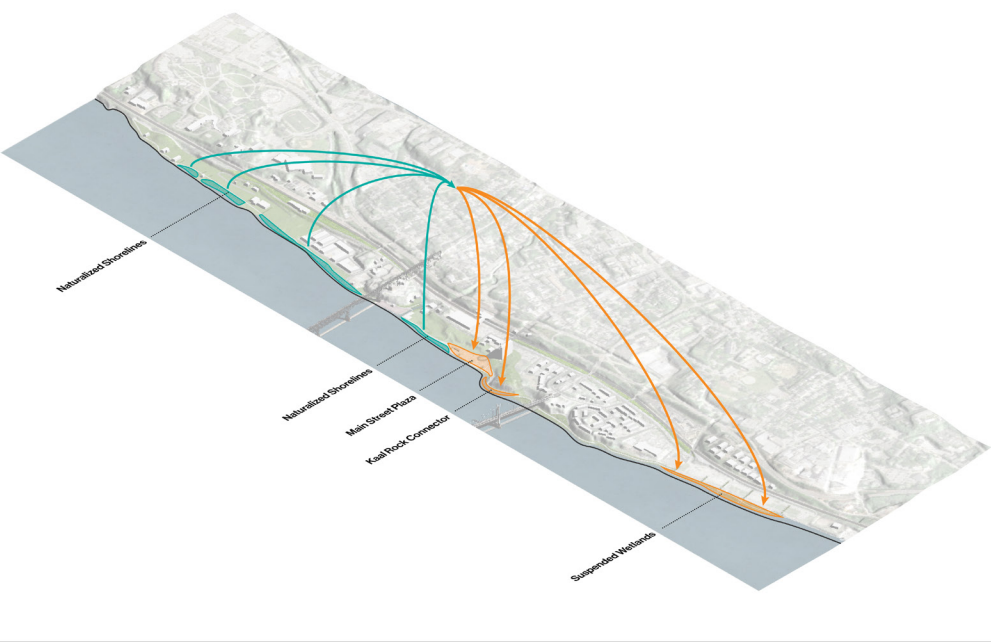
Though past fill activities have historically led to many issues that affect today's waterfronts, land-shaping can also be used to prepare Poughkeepsie's waterfront for climate risks including sea-level rise and increased flooding.

Flood//Land uses strategic cut and fill operations to creatively make way for projected inundation while grading for new usable upper-elevation spaces outside of today's and tomorrow's floodplain.

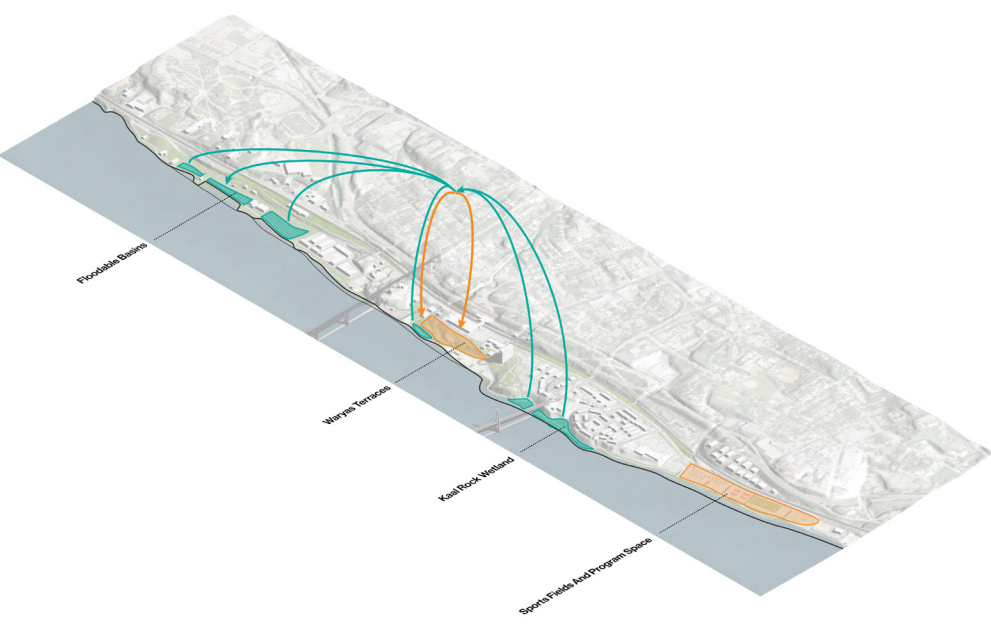


Design for Flooding

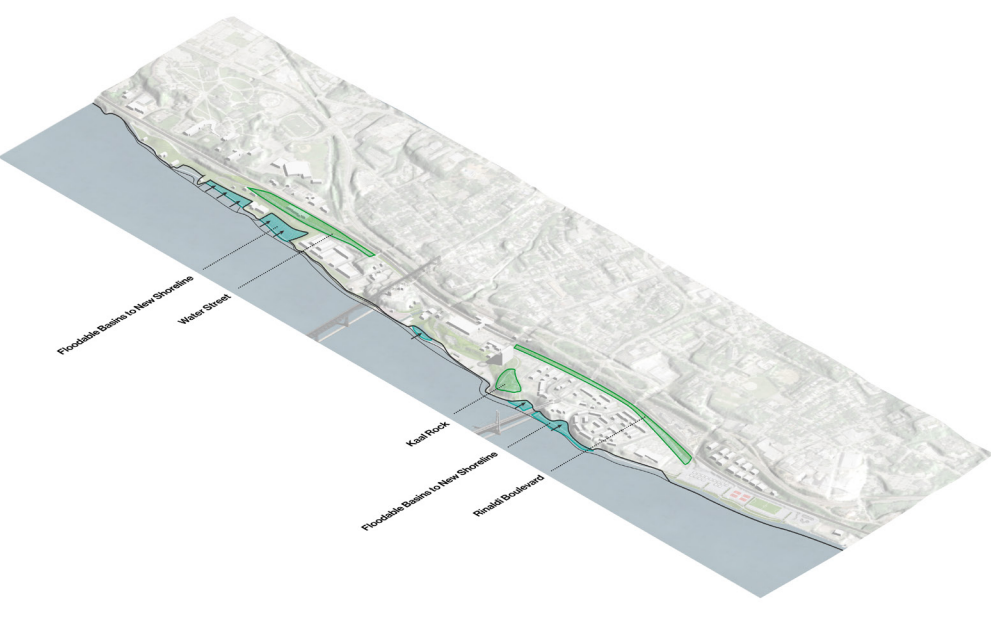
Phase 1: Reconciling Past Landmaking (2020s)



Phase 2: Preparing for Unmaking (2050s)

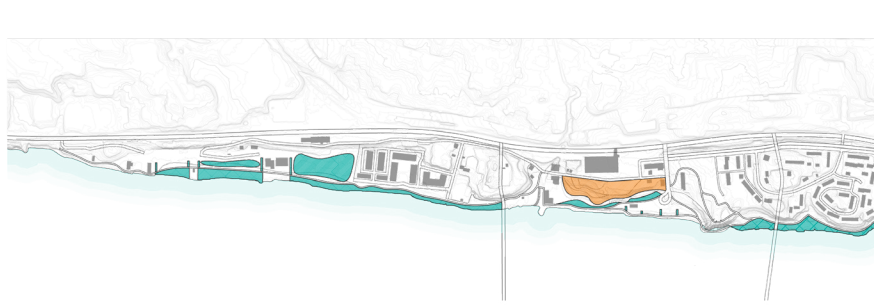


Phase 3: Land Unmaking (2080s)

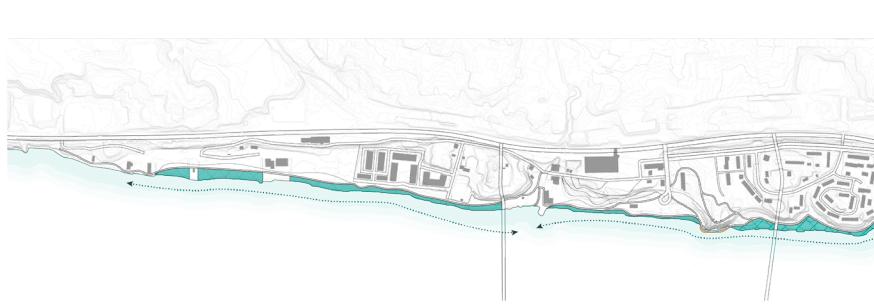


The cut & fill landmaking strategy is phased over time

Cut // Fill



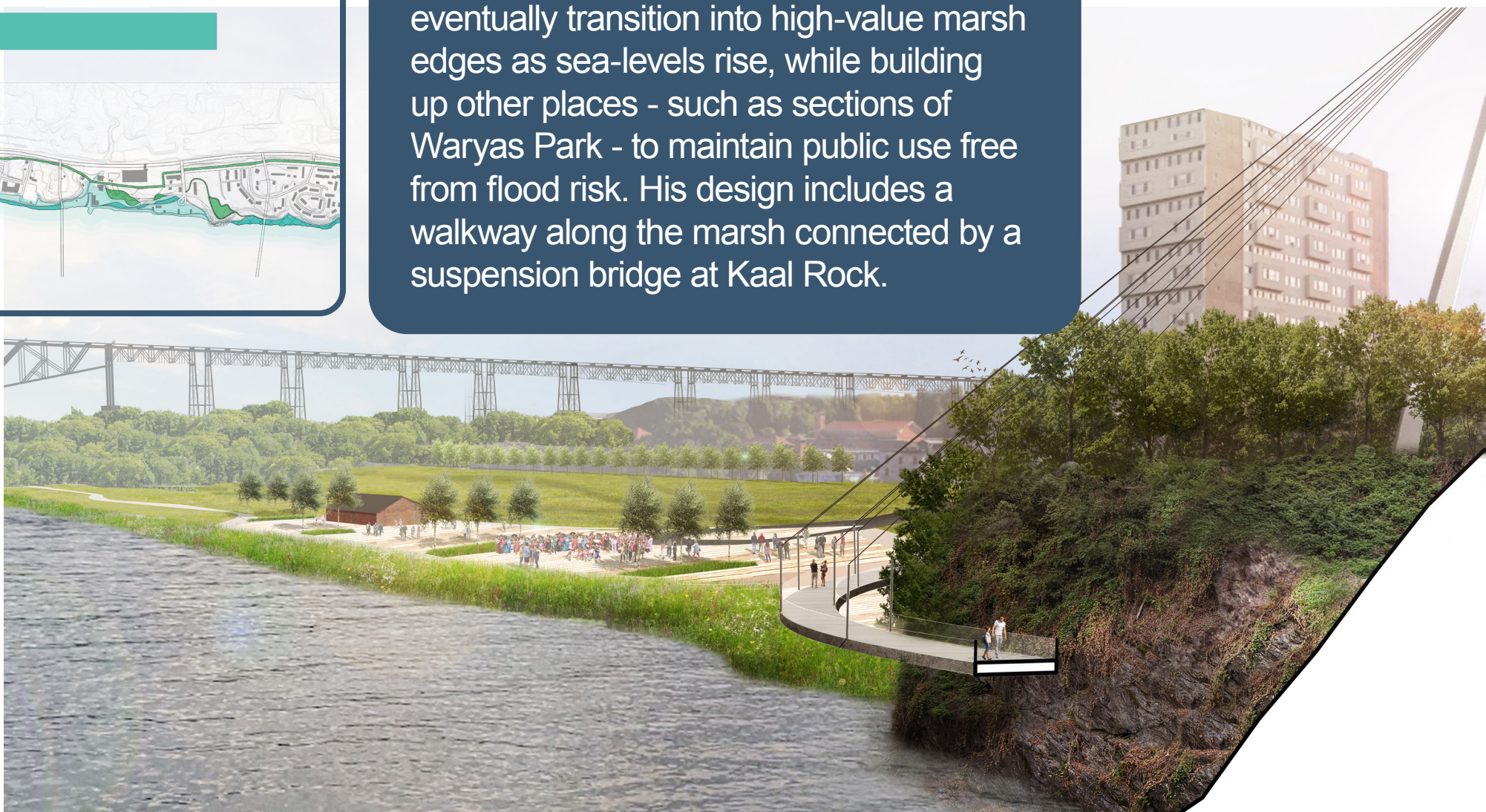
Natural Shorelines and Sediment Flows



Flooded Park



Dom suggested a technique called 'cut & fill' to remove soil from low-lying areas and use it to elevate the land in other locations. His phased plan allows some areas to eventually transition into high-value marsh edges as sea-levels rise, while building up other places - such as sections of Waryas Park - to maintain public use free from flood risk. His design includes a walkway along the marsh connected by a suspension bridge at Kaal Rock.



# INTERTWINING POUGHKEEPSIE & ITS RIVER

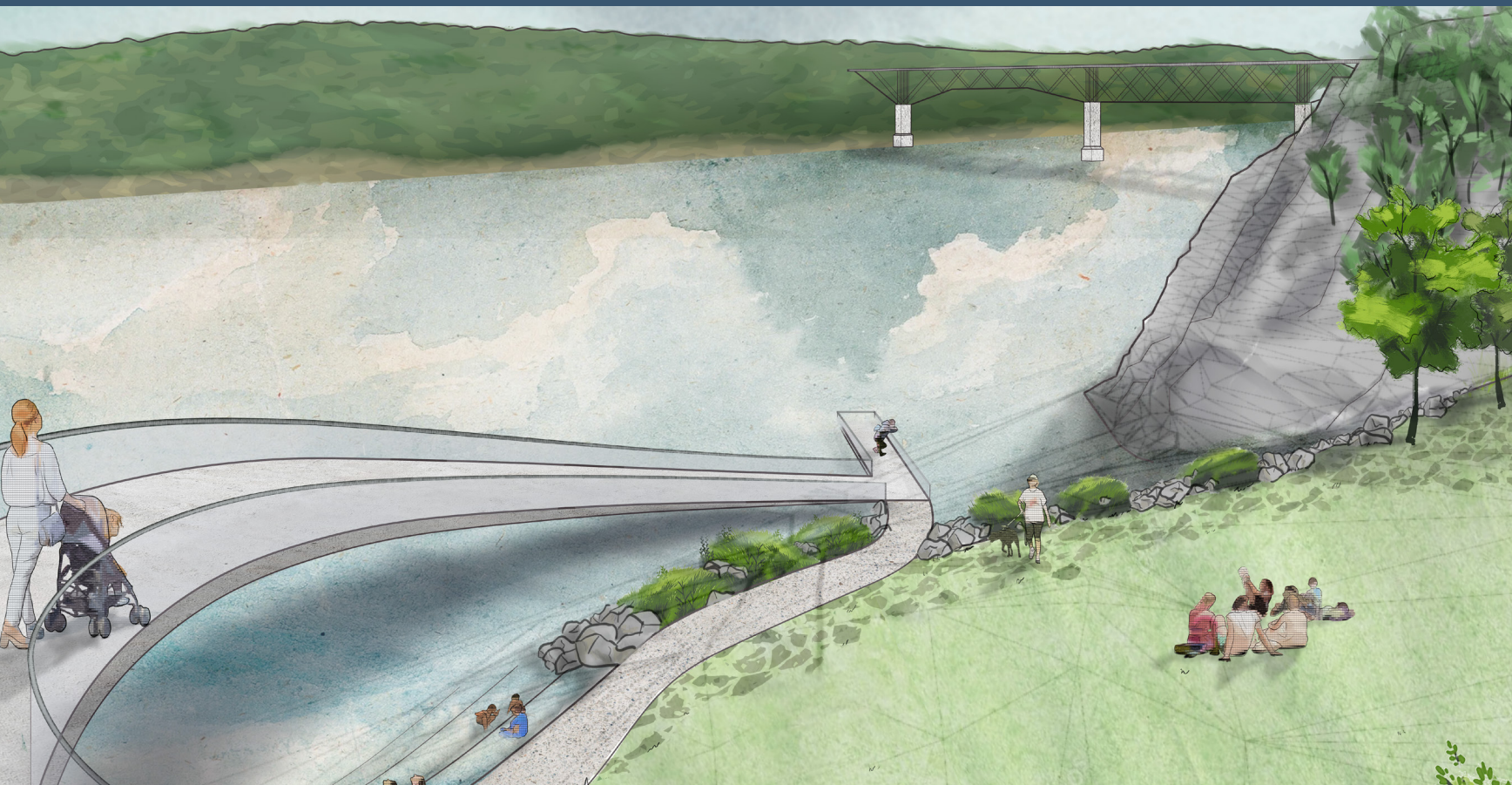
## Student Designer Kelly Zhan

This project amplifies what people love about the waterfront while embracing, instead of retreating from, the changing climate conditions and river forces of the Hudson to create a unified and intertwined park for the people of Poughkeepsie and the river.

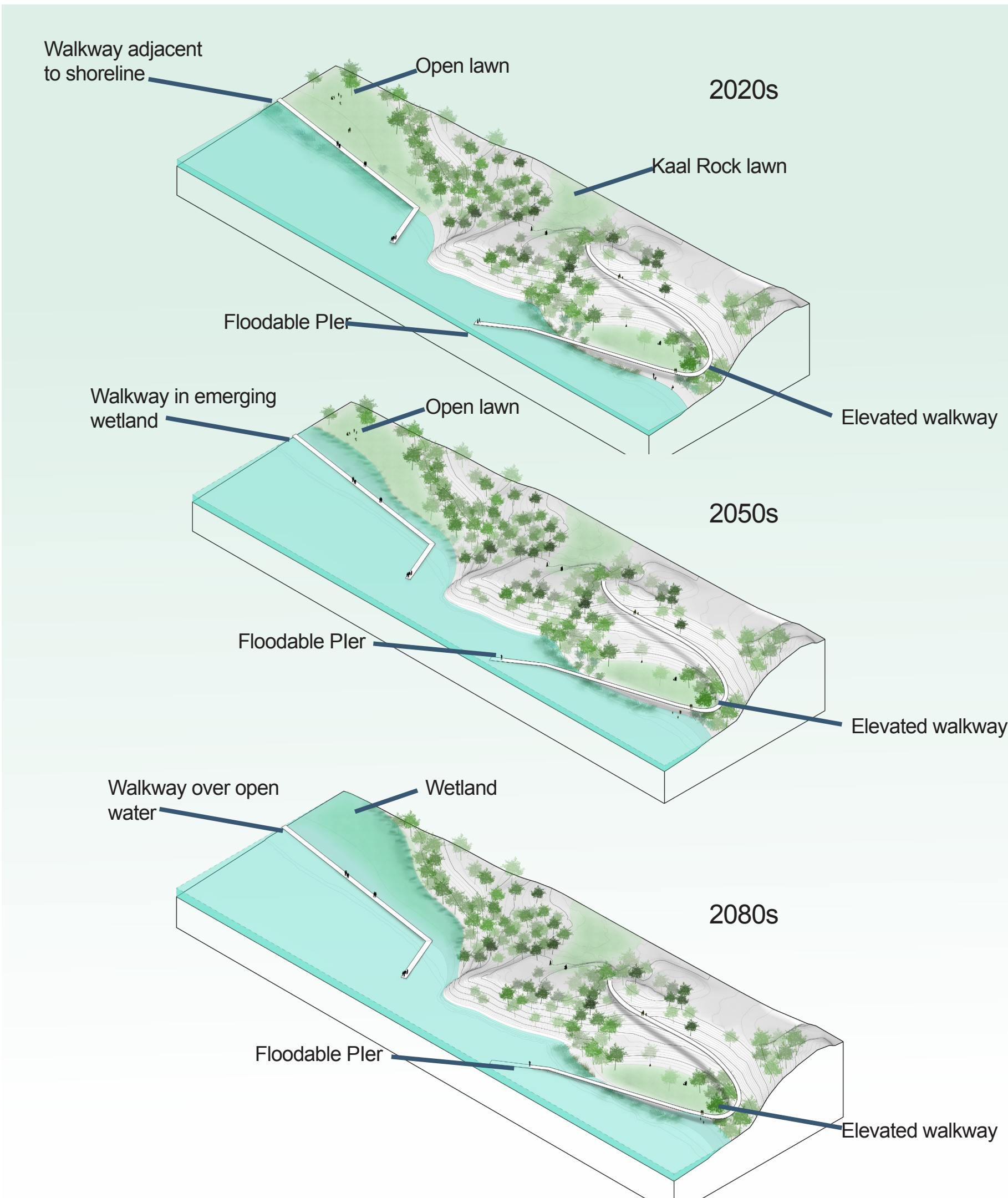
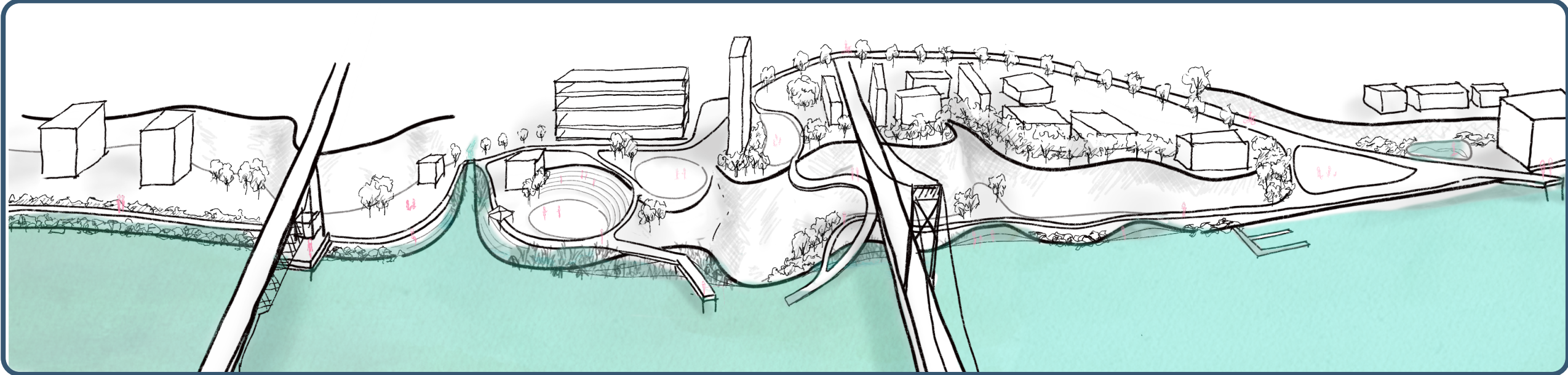
To generate greater community attachment to and ownership of the river, this project strengthens the physical, cultural, and spiritual connection to the Hudson by reacting to projected climate risks while enhancing the waterfront.



Design with Community



Kelly's project compared the movement of water and people, and created space for both to gather, drift, linger and flow. In her design, the mouth of the Fall Kill is naturalized and an amphitheater is created for performances in Waryas Park. The design also features two elevated walkways that will register how water levels are changing over time, and help to maintain access as sea-level rises.





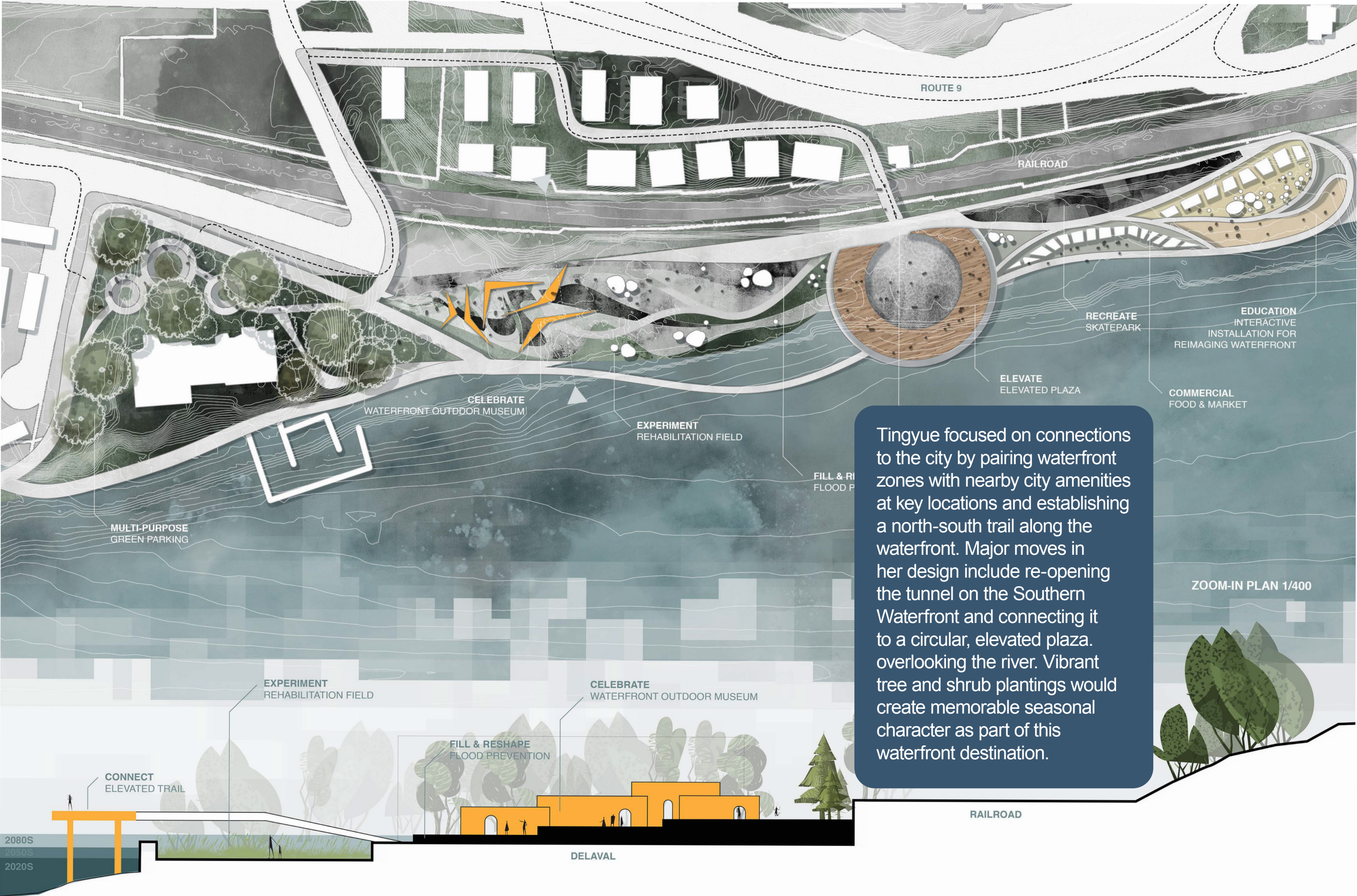
# LIGHTNESS, CONNECTION & FOLDING MEMORIES

## Student Designer Tingyue Tan



Every place is a product of its history, building up in layers over time. This project sought to illuminate certain histories as a way to link the city with its waterfront past, present and future. The current Poughkeepsie waterfront consists of

three major obstacles: extreme climate events, inconsistency of connectivity and insufficient representation of the historical importance of the city. To cope with these problems, three concepts are introduced: Lightness, Connectivity and Memory.



# STRAND FORMS

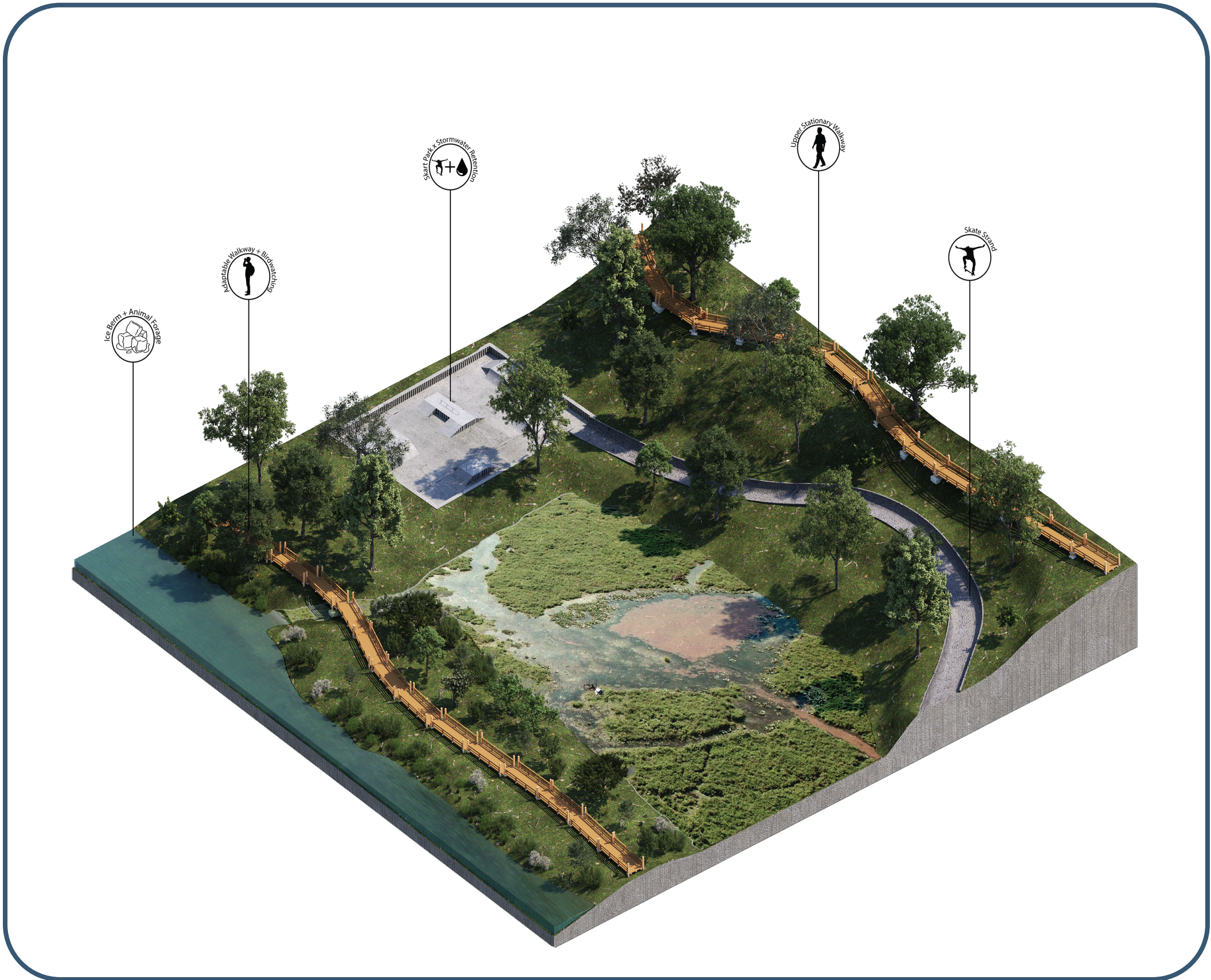
## Student Designer Dustin Smith



A ‘strand’ is defined as a thin length of material, usually intertwined with other strands. Strand Form is just that – a series of intertwined strands that weave the Poughkeepsie waterfront. Three strand forms - the eco-strand, skate-strand and the kinetic strand - intertwine

in this project to address issues of sea-level rise, changing environmental conditions and disconnectedness along the waterfront. The skate strand is both a skate park and a stormwater management feature that extends across the site, providing stormwater and social

benefits. The kinetic strand is a walkway that is designed to respond to changing water levels. The eco-strand seeks to address the threat of loss of biodiversity that climate change poses, as well as providing a dynamic buffer to prevent ice shear erosion in the winter.



A bird's eye view of Waryas Park in 2050. The kinetic strand, skate strand and eco strand function together to enhance park services and access, while considering changing water levels.

- Eco strand - An assembly of waterfront habitats coupled with a walkway to provide access for wildlife viewing and nature study.
- Skate strand - A linear skate park provides a recreational amenity with stormwater management benefits.
- Kinetic strand - This wooden walkway starts as a simple ground-level platform, but as water levels rise, modular posts and railings can be adjusted to change the deck elevation as needed.





# WARYAS PARK

## CaD Student Design Ideas

Waryas Park is currently at high risk for flooding and shoreline erosion, and the problem is expected to increase as water-levels rise in the tidal Hudson and heavier storms affect the region.

By the 2080s portions of Waryas Park may be permanently underwater due to sea-level rise. The accessibility and usability of this public recreation area will be impacted, so we must plan now to maintain future use of the park.

Students envisioned a variety of approaches to this problem, including allowing the water to flood low-lying areas while elevating some uses above the flood zone. Other ideas include using hard structures to prevent some areas from being inundated and building walkways that maintain shoreline access, even as water levels rise.

Which ideas to you like?



2020s

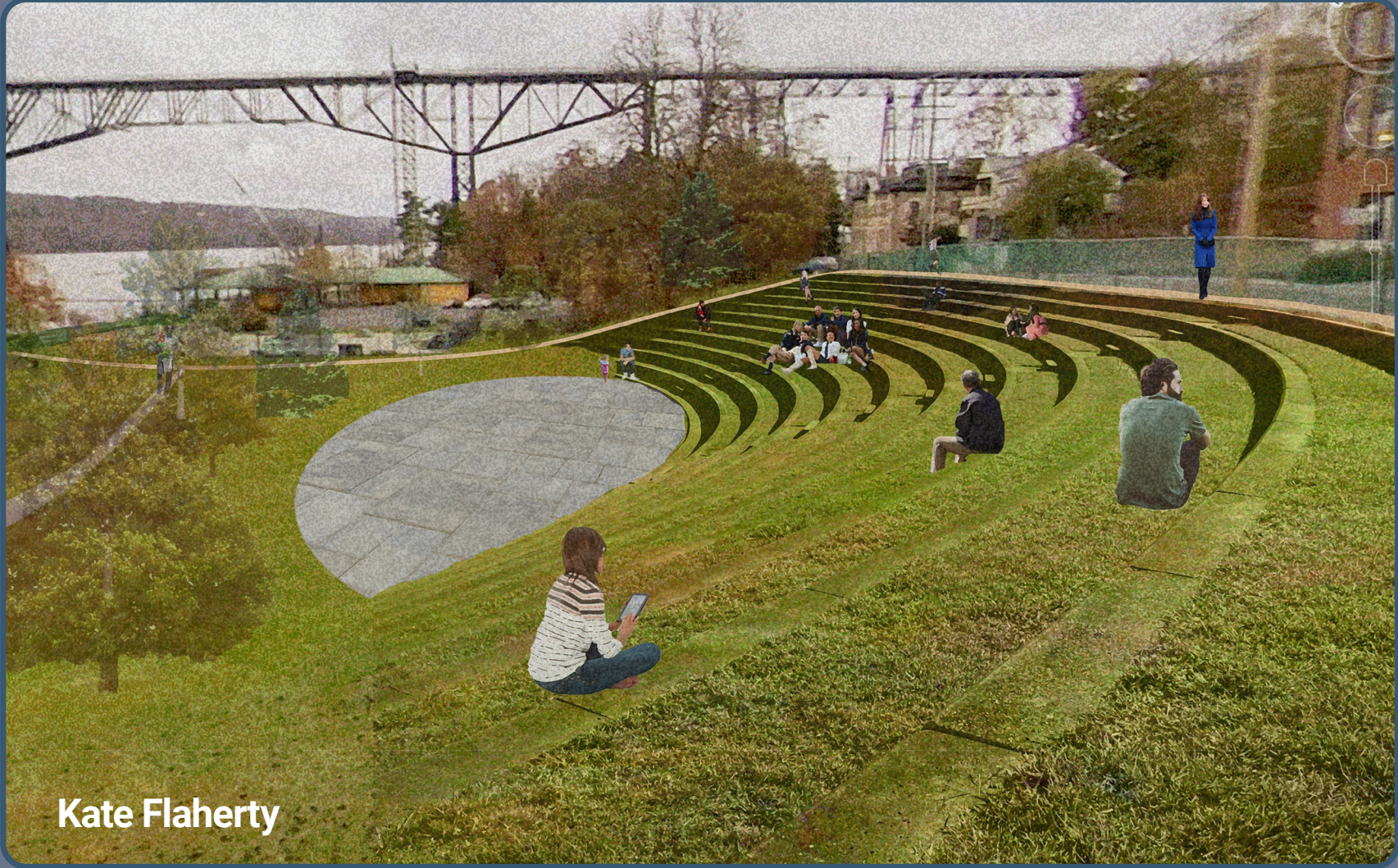
This map shows Waryas Park in the 2020s during a 100-year flood. The yellow and green on the map represent temporary flooding during large storms. Blue indicates areas that may be permanently underwater.



2080s

This map shows Waryas Park with 60" of sea-level rise, in the 2080s during a 100-year flood. Green indicates temporary flooding; blue indicates areas that may be permanently underwater.

### Elevate parts of the park to reduce flood risk



Kate Flaherty

An elevated terrace creates a river-side performance space.



Xinyue Hope Shen

An elevated platform over the Fall Kill for education & exploration.



Dom Malacaman

Upland areas are elevated and wetlands are created in low-lying spots.



Sophie Bellemare

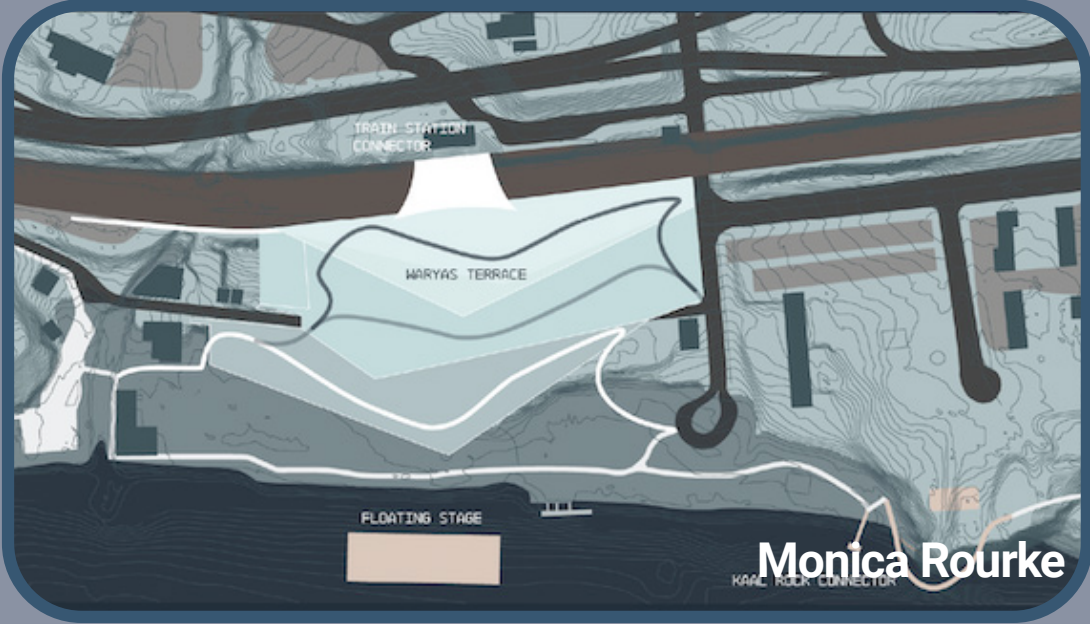
An ice rink is built on an elevated section of Waryas Park.

### Allow low-lying areas to flood and create naturalized shorelines



Yvette Pollack

Naturalized shorelines provide enhanced habitat and safe water access.



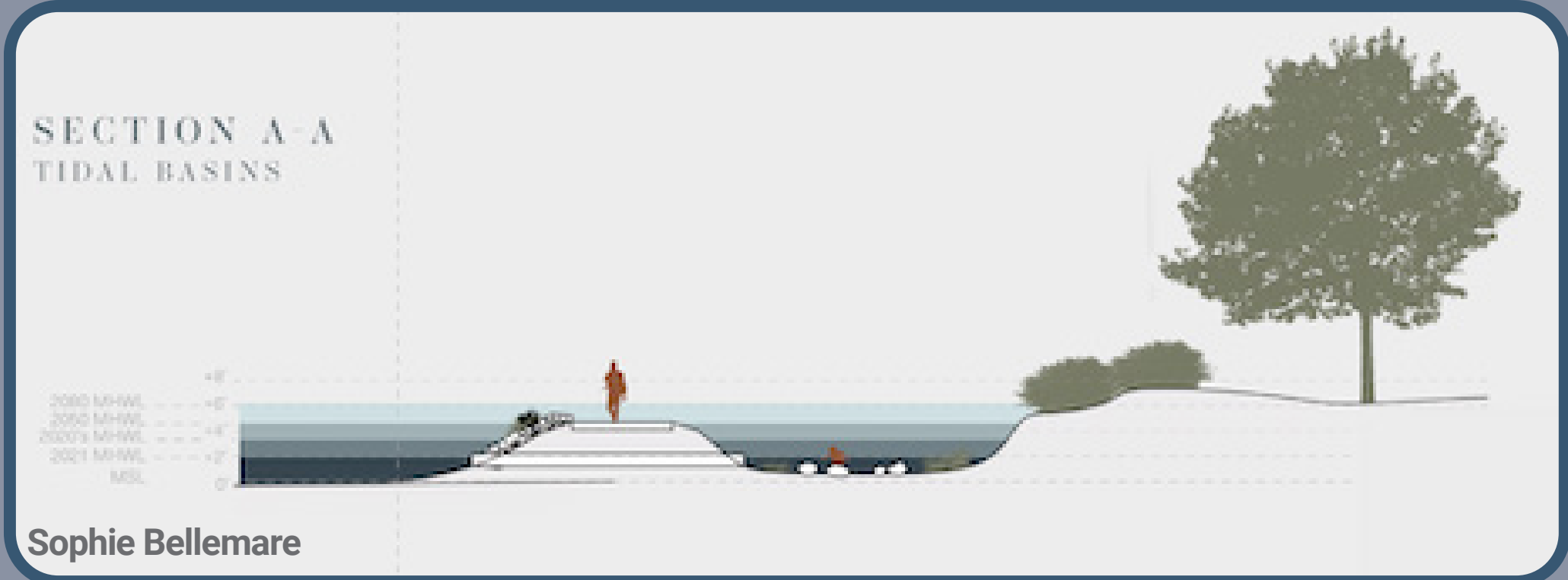
Monica Rourke

A terraced hillside and floating stage maintain use of Waryas Park as water levels rise.



Dom Malacaman

A floodable park can be used for recreation during dry periods.



Sophie Bellemare

A berm prevents ice shear erosion while providing an elevated walkway. The low spot inland of the berm becomes a tidal basin as water levels rise.



Xinyue Hope Shen

This shoreline is a mix between rock fill and plantings to prevent erosion, enhance habitat and provide access to the water.

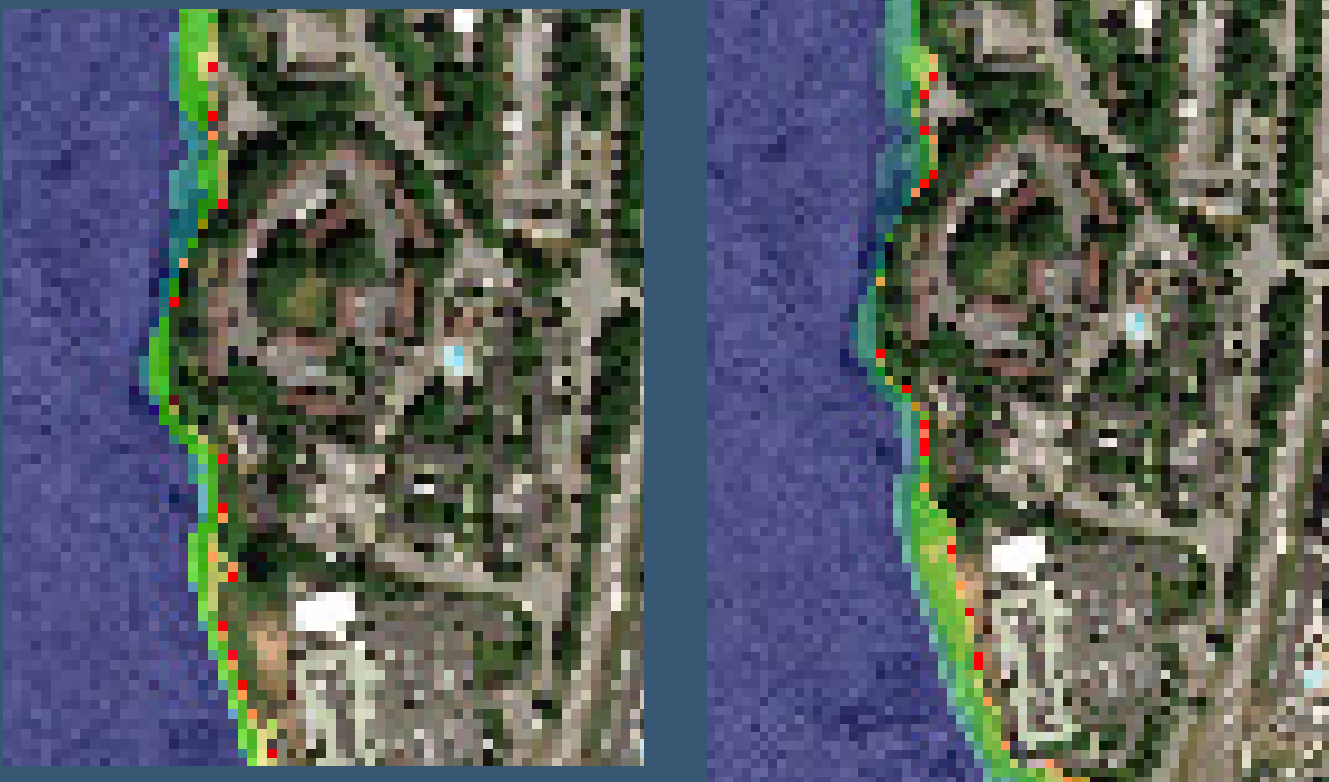


# KAAL ROCK PARK

## CaD Student Design Ideas

Kaal Rock Park is not as vulnerable as Waryas Park to sea-level rise in the short-term. But some areas of the shoreline may be inundated with 30 inches of sea-level rise, which could happen as soon as the 2050s, according to official NYS projections. Flood impacts are more severe at higher sea-levels, with much of Kaal Rock Park at risk of flooding, and some areas could be permanently underwater with 60" inches of sea-level rise, which could happen by the 2080s.

Students imagined enhanced amenities at Kaal Rock Park, including an amphitheater, tree plantings and a floodable pier that maintains access despite rising water levels. Kaal Rock provides stunning views of the Hudson River, but the rock blocks the route between the northern and southern waterfront. Students envisioned a number of ideas for a walkway around or over Kaal Rock. In the designs, the walkways around Kaal Rock are elevated above today and tomorrow's flood zones.



2020s

This map shows Kaal Rock Park in the 2020s during a 100-year flood. The yellow and green on the map represent temporary flooding during large storms. Blue indicates areas that may be permanently underwater.

2080s

This map shows Kaal Rock Park with 60" of sea-level rise, in the 2080s during a 100-year flood. Green indicates temporary flooding; blue indicates areas that may be permanently underwater.

### Ideas for the Kaal Rock Connector



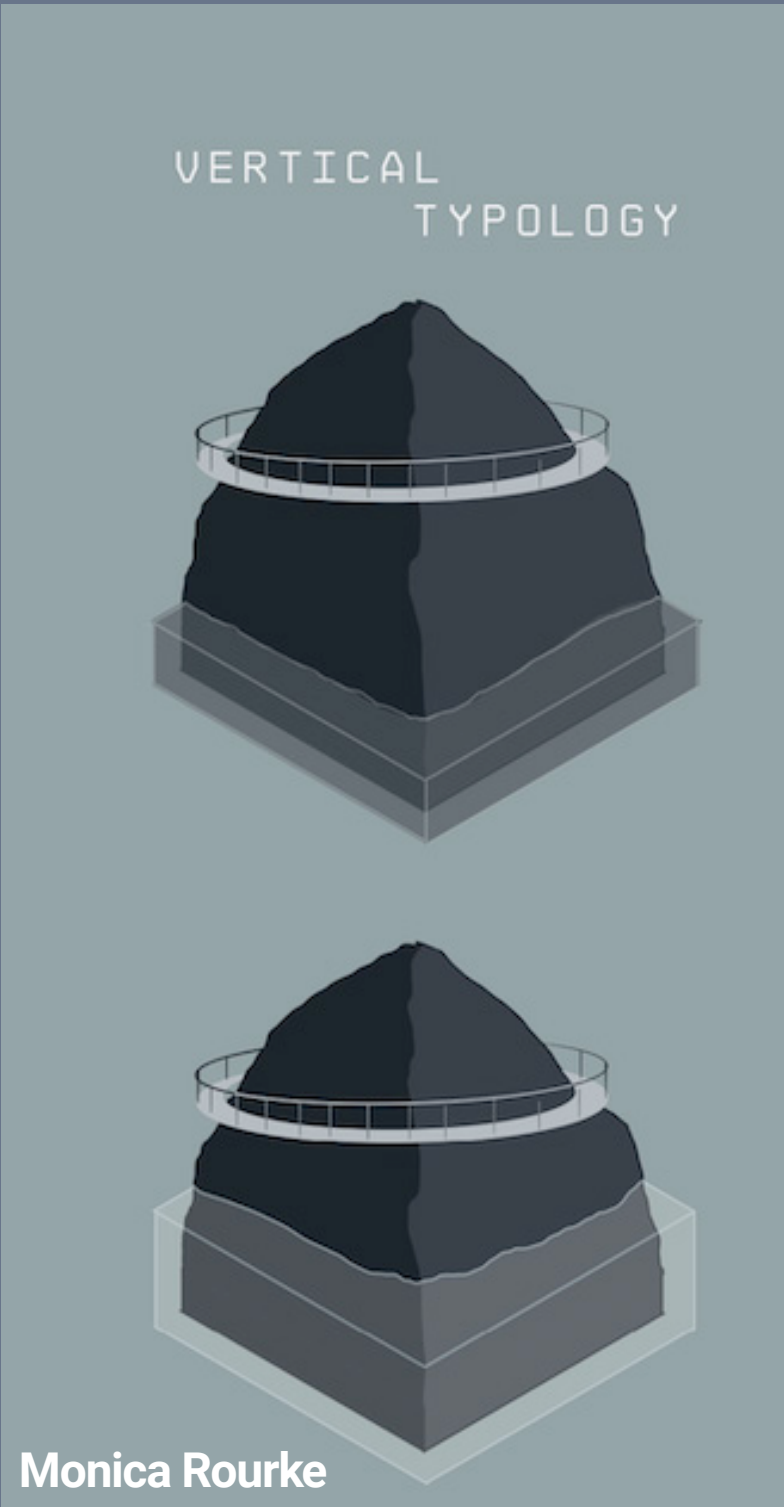
A suspension walkway goes around Kaal Rock.



A raised path connects the northern & southern waterfronts



A switch-back boardwalk to the top of Kaal Rock.



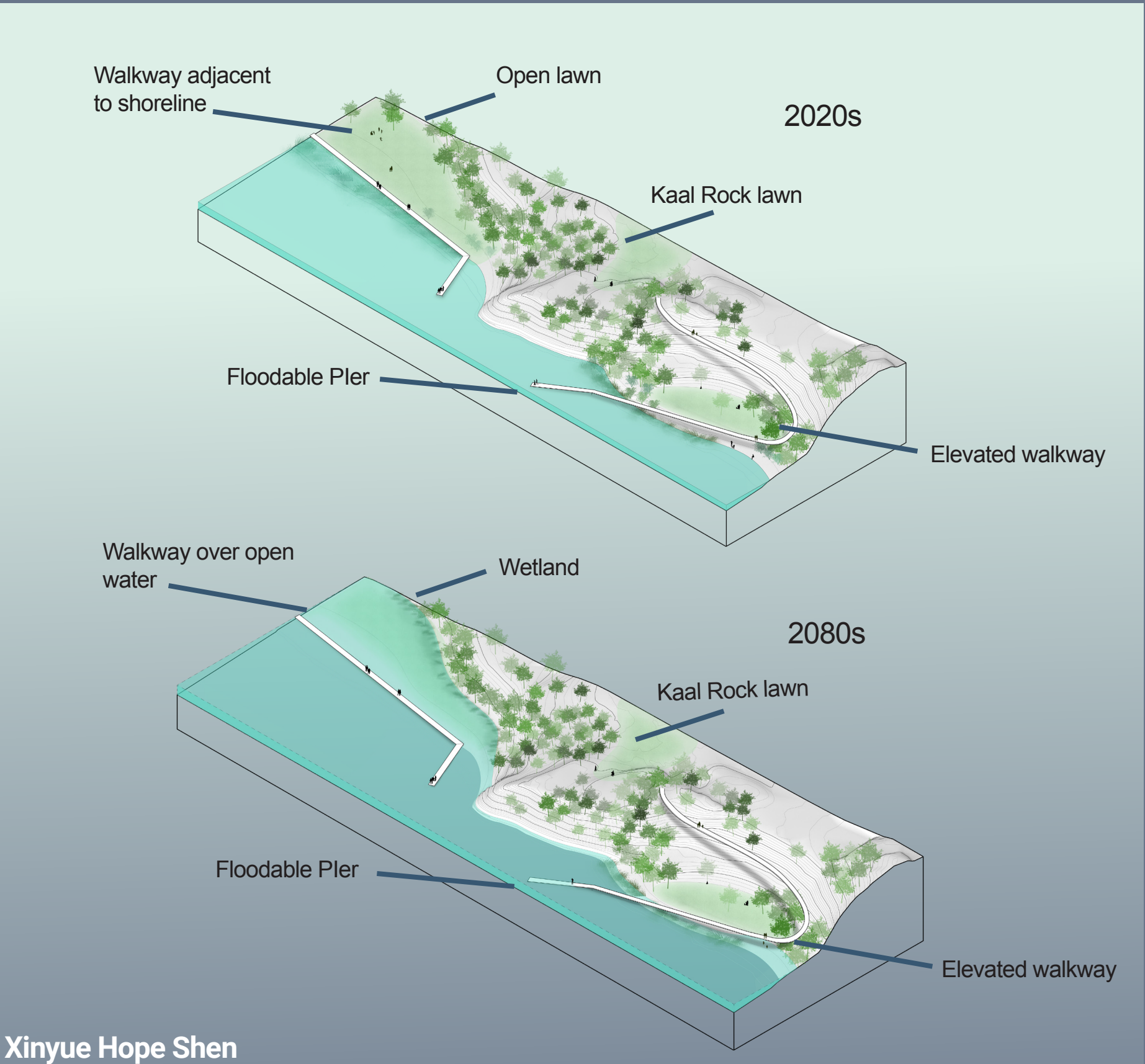
An illustration showing how an elevated path around Kaal Rock would remain useful as sea-level rises.

### Ideas for Kaal Rock Park



This design envisioned enhancing the forest in Kaal Rock Park for carbon sequestration, habitat and recreation.

An ampitheater that utilizes the natural bowl of the slope is created for performance and gathering. A lookout provides views of the river.



A curved walkway sweeps down from the top of Kaal Rock. Built on land, by 2080 the path extends over the water, maintaining access despite sea-level rise.

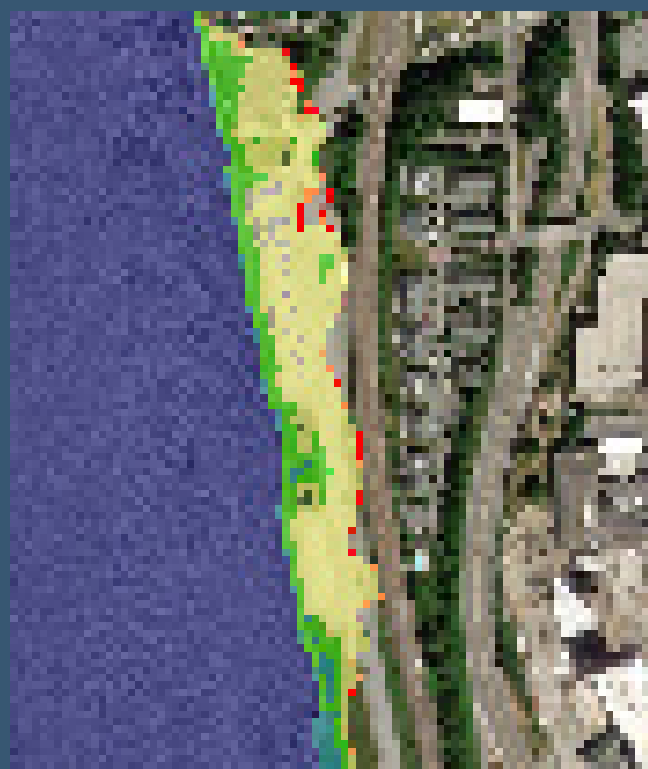


# SOUTHERN WATERFRONT

## CaD Student Design Ideas

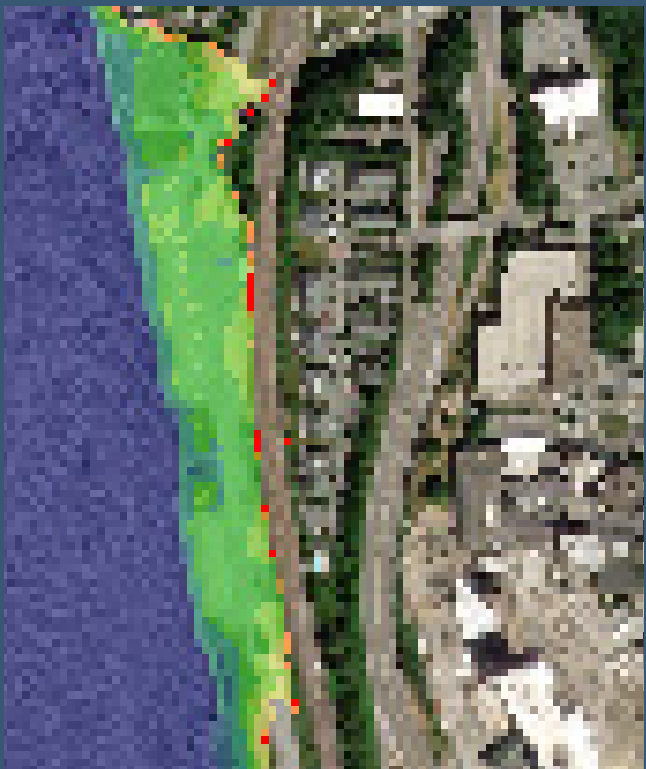
The Southern Waterfront has a lower risk of inundation in the short term. But rising sea-levels will increase the size of the flood zone, and floodwaters will cover a larger area during major storm events. Re-development of former industrial sites, such as the DeLaval property, could provide important public river access as other waterfront parks become inundated. Development of the public access portion of the DeLaval property should be carefully designed to assure resilient and universal access for all.

Students proposed a number of public amenities for the Southern Waterfront, including an open-air museum, elevated plaza and education center. Some students considered options for creating more connections between the waterfront and downtown, including enhanced multi-modal street corridors and even bold moves to re-route major roads that divide the city. Many students envisioned a pathway that connects the northern and southern waterfront districts, including elevated or adjustable boardwalks that will help maintain connectivity despite changing conditions.



2020s

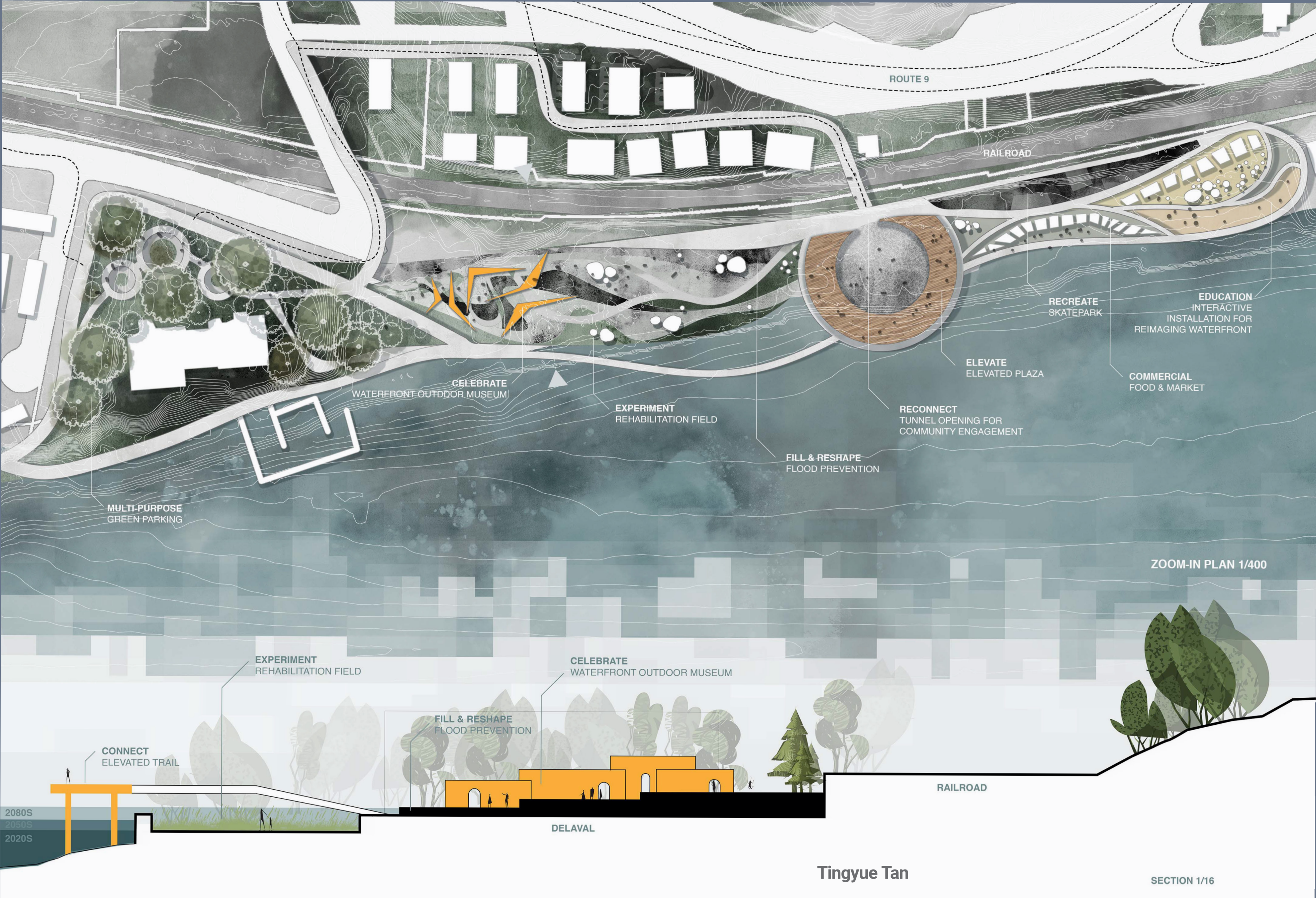
This map shows the Southern Waterfront in the 2020s during a 100-year flood. The yellow and green on the map represent temporary flooding.



2080s

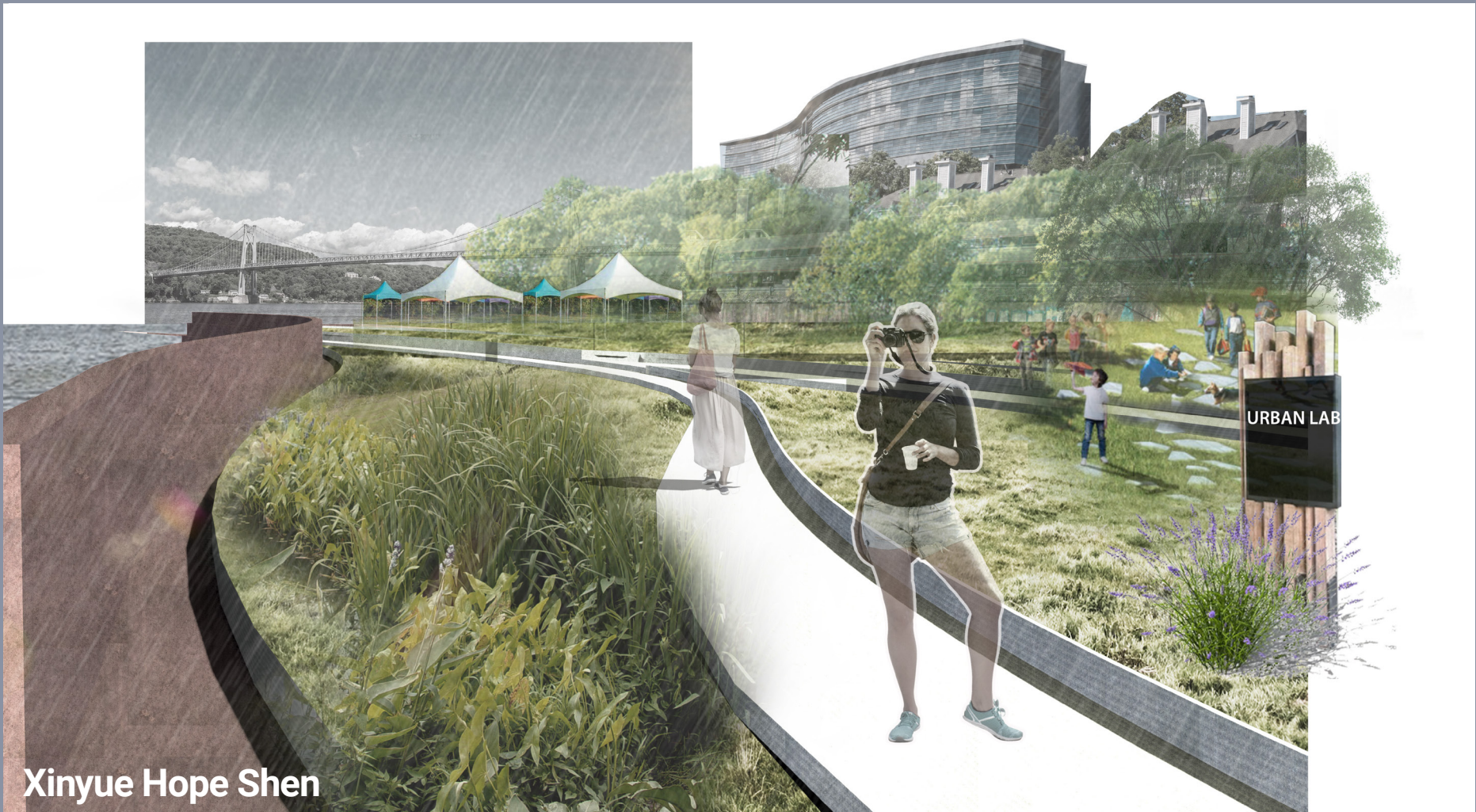
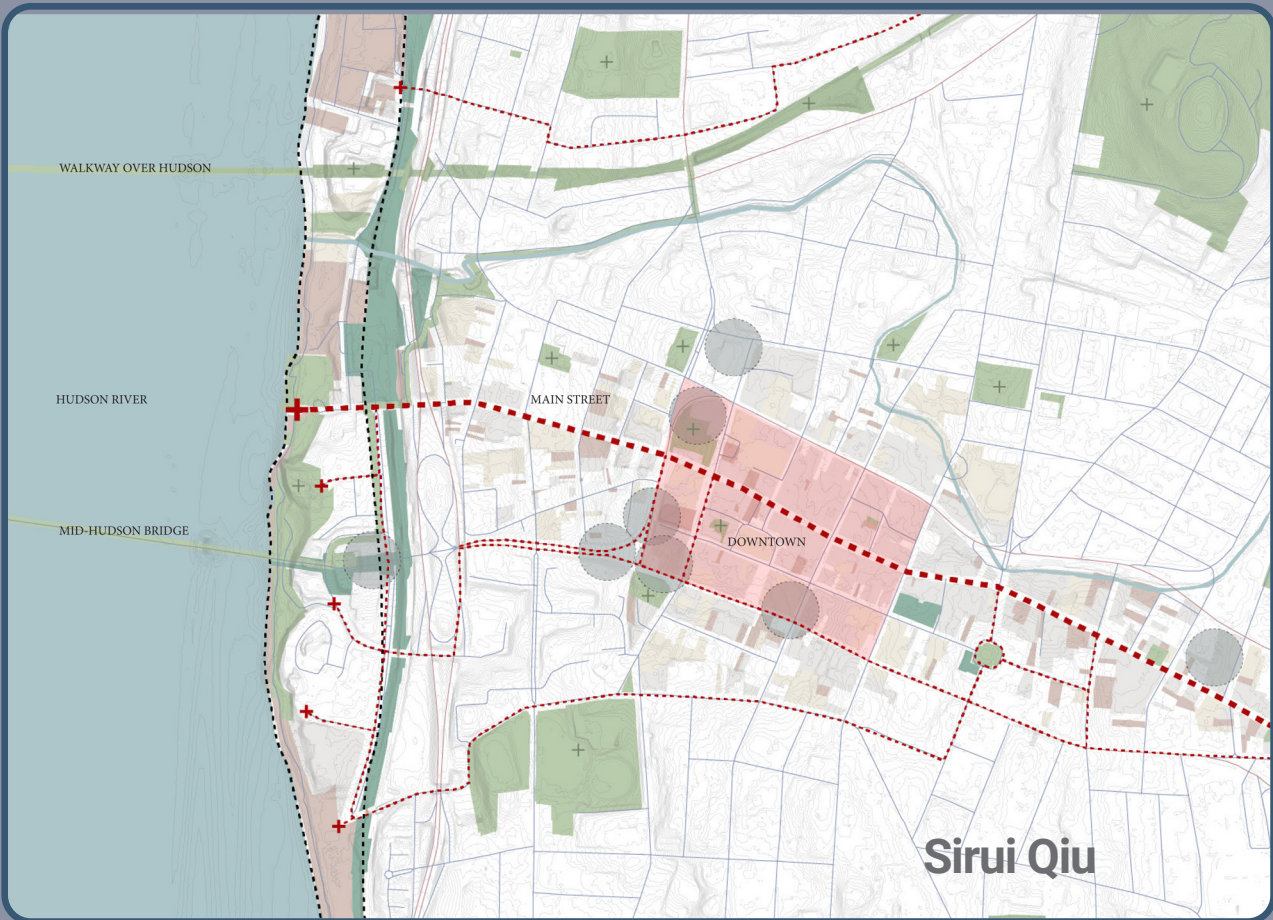
This map shows the Southern Waterfront with 60" of sea-level rise, in the 2080s during a 100-year flood. Green indicates temporary flooding; blue indicates areas that may be permanently underwater.

### Expanding public access at the DeLaval site



A dynamic design for the Southern Waterfront includes the re-opening of an unused tunnel and connecting it to a raised, circular plaza overlooking the river. The design includes an outdoor museum, educational and recreational amenities, as well as flood control structures.

### Creating a trail system to connect the waterfront and the city



Students considered options for more connections between the waterfront and downtown, including enhanced multimodal street corridors and even bold moves to re-route major roads that divide the city. Many students envisioned pathways connecting the waterfront from north to south.

