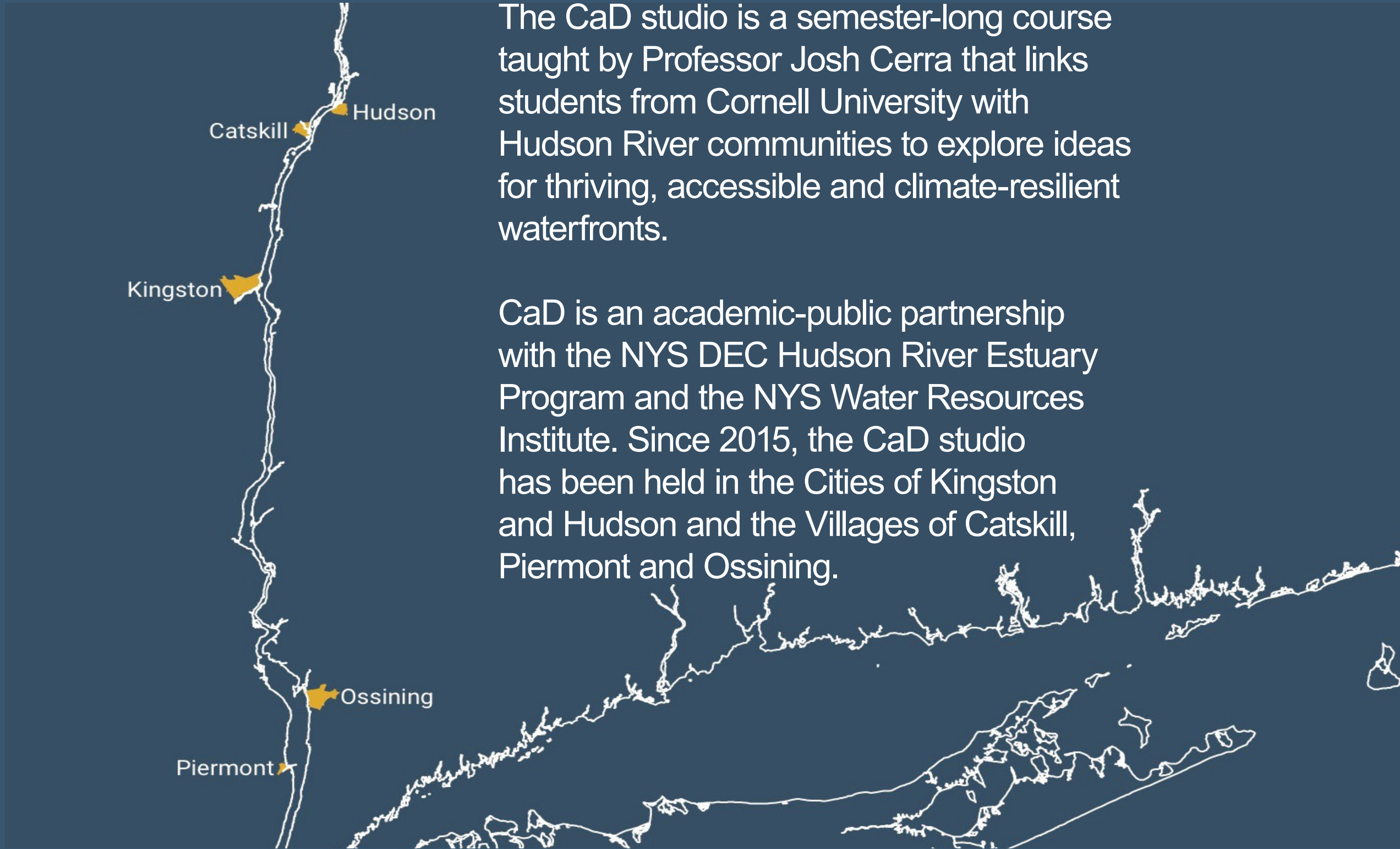


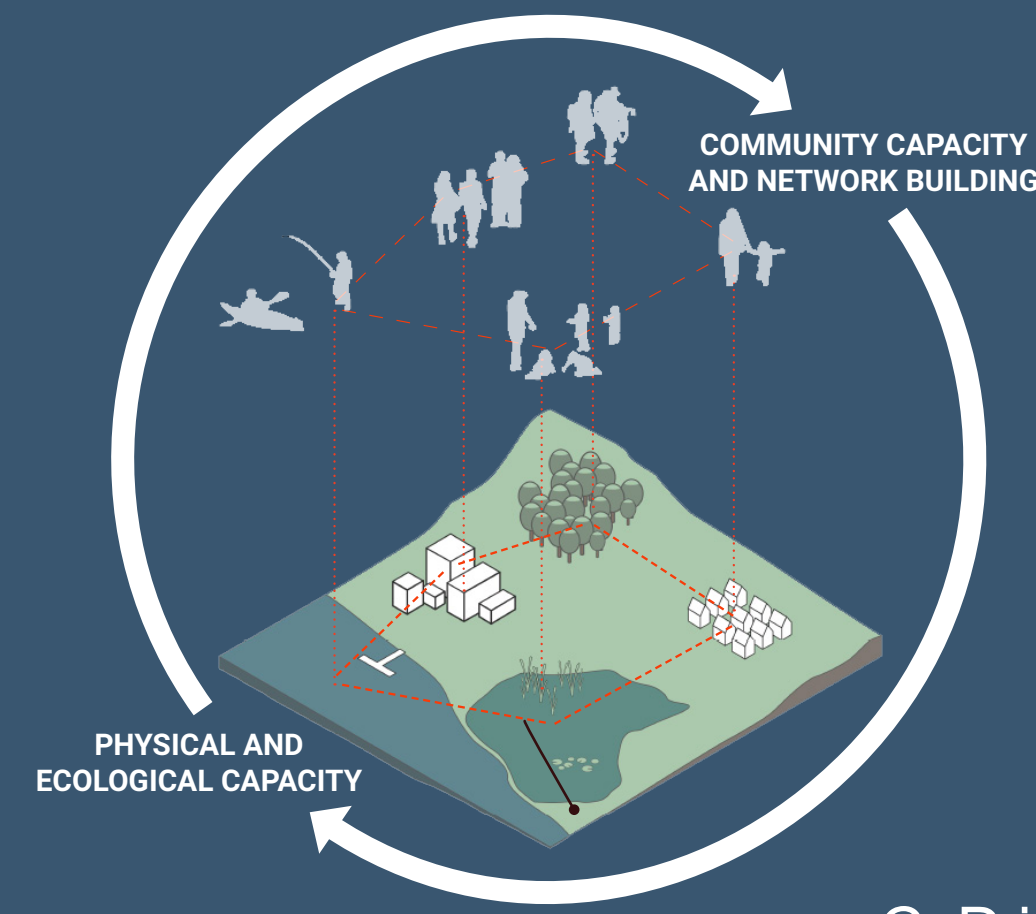
WHAT IS THE CLIMATE-ADAPTIVE DESIGN STUDIO?

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 and Hudson and the Villages of Catskill, Piermont and Ossining.



CaD is grounded in the idea that by working with both people and place, we can build physical, ecological and community capacity to adapt to change. CaD helps to start conversations about adapting to climate change now, so that long-term planning can begin.

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



For More Information

For a brief video about CaD:



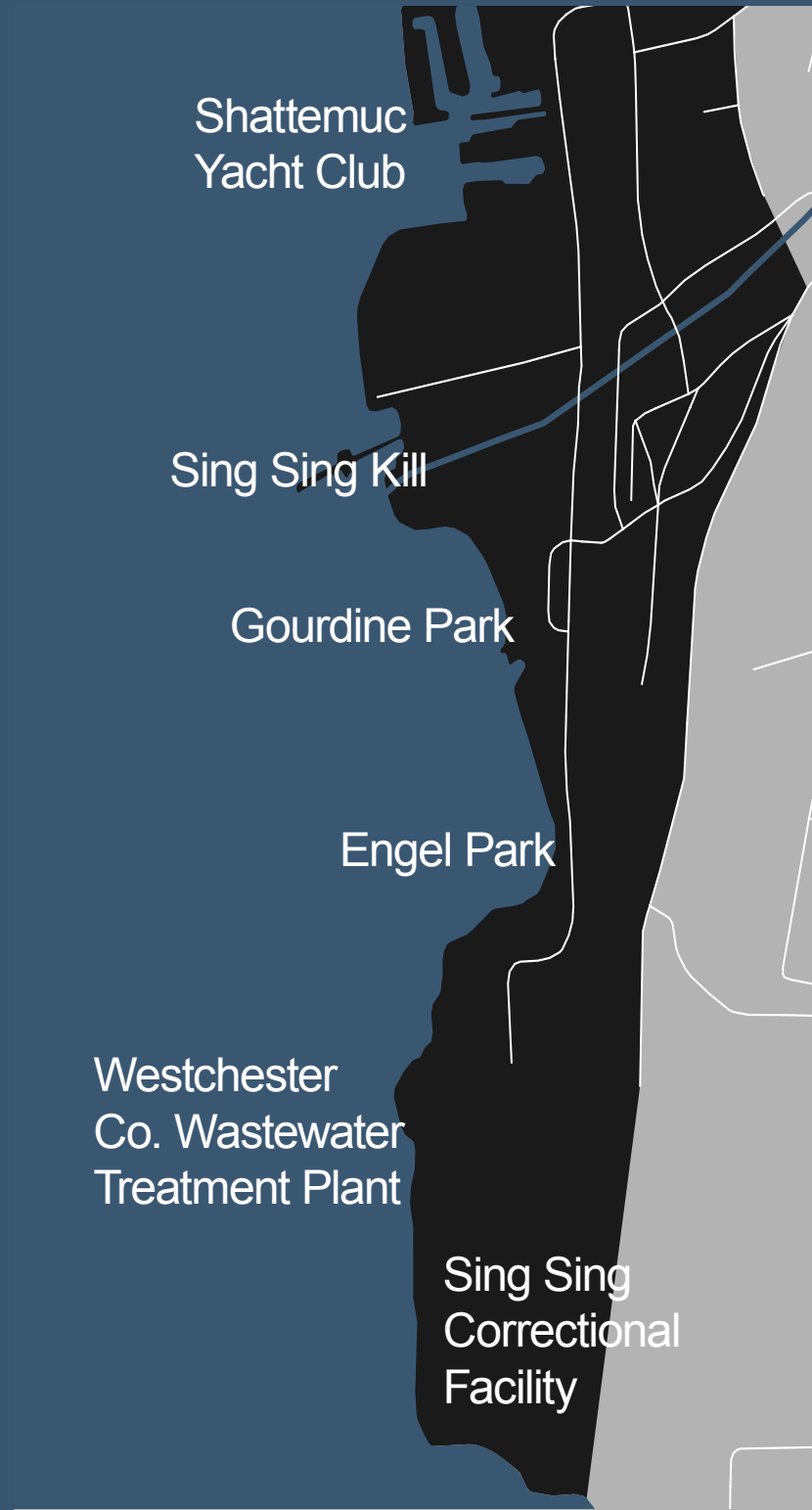
<https://trophic.design/cad/>
tinyurl.com/CornellCaD

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.

CAD STUDIO IN OSSINING

Exploring Future Waterfronts

The CaD studio study area stretched from Shattemuc Yacht Club in the north to the Sing Sing Correctional Facility to the south. Students envisioned a future Water Street and imagined new connections to downtown. The study area included the Village's Henry Gourdine Park, the Town's Louis Engel Park and Ossining Boat Club and the future Sing Sing Prison Museum.



2020's

The maps show changes in flood depths in the "100-year" flood zone, which is the area that has a 1% chance of flooding in any given year.

The blue on this map represents temporary flooding. Darker blue indicates deeper flood water.

2080's

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

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



Flooding & Sea-level Rise

The Hudson experiences ocean tides for approximately half of its length, so the Ossining waterfront is influenced by rising sea levels resulting from climate change.

New York State officially adopted projections of how much sea levels may rise by 2100. Students used the NYS projections to envision what the Ossining waterfront could look like in 2080. Digital tools, such as Scenic Hudson's Sea-Level Rise Mapper, were used to envision where the shoreline might be in 2080.

The Town & Village of Ossining hosted the CaD studio during the fall of 2019 to help consider future climate change impacts - like rising sea levels - on their shared waterfront.

Landscape architecture graduate students visited Ossining and met with stakeholders three times during the semester. 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:

- Reducing flood risk
- Enhancing waterfront access and circulation
- Improving connections between the waterfront and the Downtown Business District
- Assuring waterfront access to all



CaD PRINCIPLES

Five Principles Guide the Design Process

The CaD studio focuses 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.

Ten students completed designs for the Ossining waterfront. The student design projects are concepts that have not been assessed for regulatory implications, and require further refinement and engineering before implementation.

Students worked to address all five CaD principles in their projects, but some students featured certain design principles more prominently.

Design A Destination



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



Design For Flooding



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



Design With Nature



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



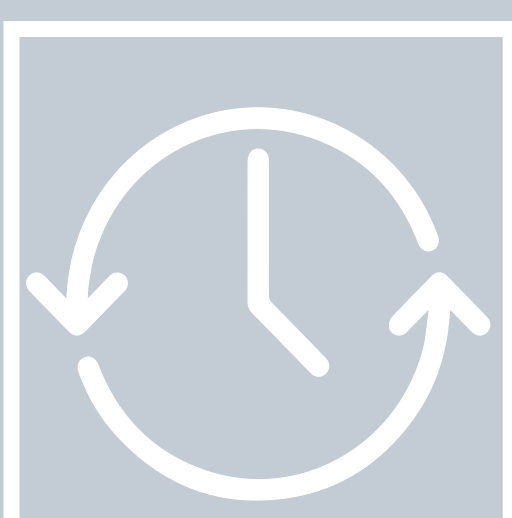
Design With Community



Engage the community in waterfront design. Waterfronts that are universally accessible create a sense of place and contribute to the prosperity and well-being of a community.



Design For Change



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



A LATENT BUFFER FOR OSSINING

Student Designer Lingyi Xu (MLA '20)



"A Latent Buffer for Ossining" views the Ossining waterfront at three levels - from waterfront to community - with a buffer corridor in between. As sea levels rise and flood frequency increases, this buffer zone becomes a combination of floodable public spaces, with critical

transportation infrastructure for rail and waterfront access raised above it. Key infrastructure is protected, while other susceptible locations are flood-adapted or relocated to higher ground over time.

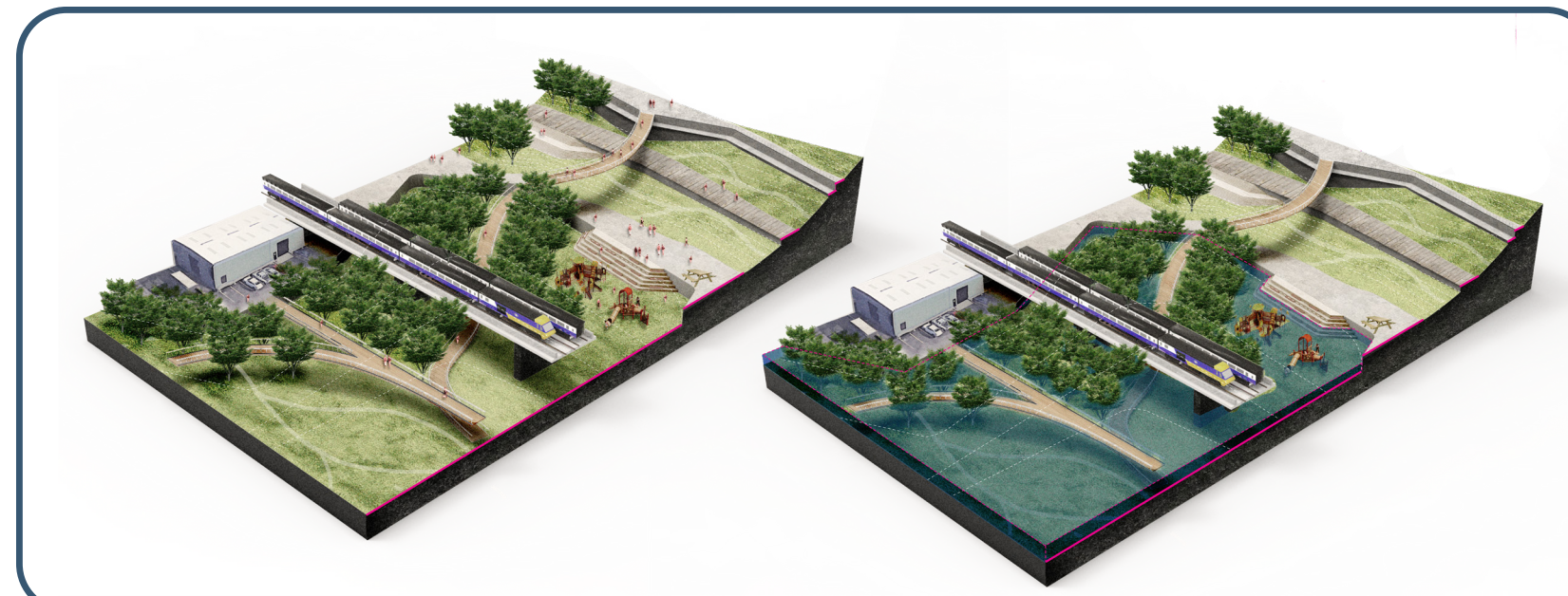
Lingyi Xu's project focused on **adaptation** as a flood resilience strategy. Roadways, the rail line and train station are elevated, and the flood-proofed first floor of Harbor Square apartments maintains current uses on-site while reducing vulnerability.



Ossining on three levels - a walkway, plantings and flood-adapted buildings create a vibrant waterfront. A green buffer corridor connects to the Downtown Business District.



The first floor of Harbor Square Apartments is floodproofed, with residences above. A second-floor entrance provides easy access to the elevated train station.



Lingyi envisions a future when the rail line is elevated and a floodable public park is located below.

ECO-LINE

Student Designer Zikun Zhang (MLA '20)



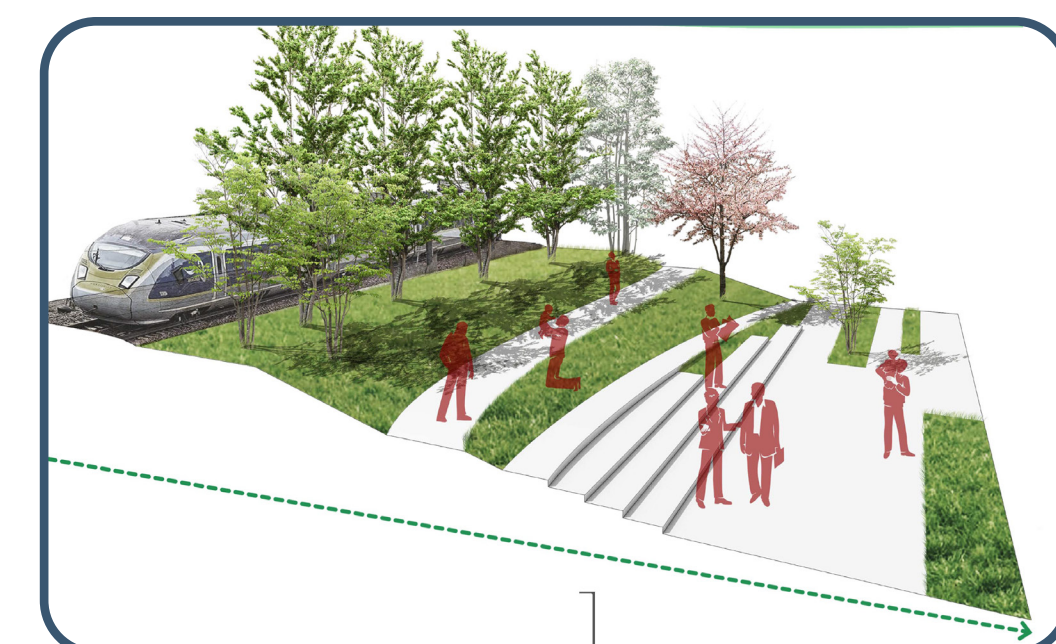
"Eco-line" elevates the existing rail line on a levee to reduce rail inundation and flooding risk while providing a measure of protection for inland waterfront locations. Areas especially susceptible to flooding or inundation on the waterfront side of the rail line

are transitioned inland to higher ground along with new development. A floodgate at Sing Sing Creek allows creek water to drain to the Hudson while protecting inland areas during storm surge.

Zikun Zhang embraced **reinforcement** as a flood resilience strategy, mixing hard infrastructure like levees and flood gates with nature-based solutions.

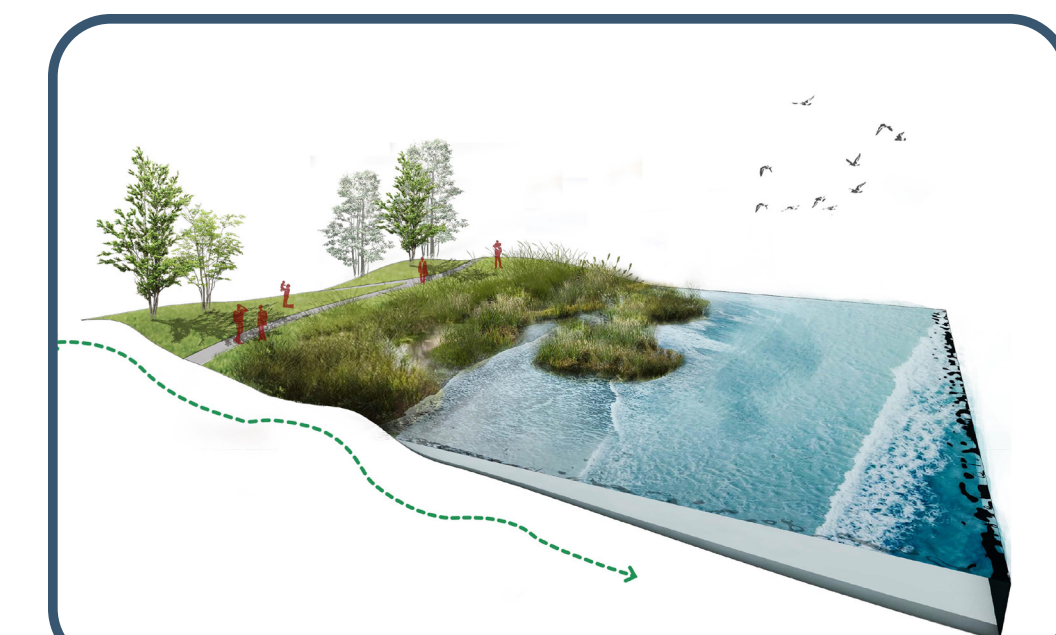
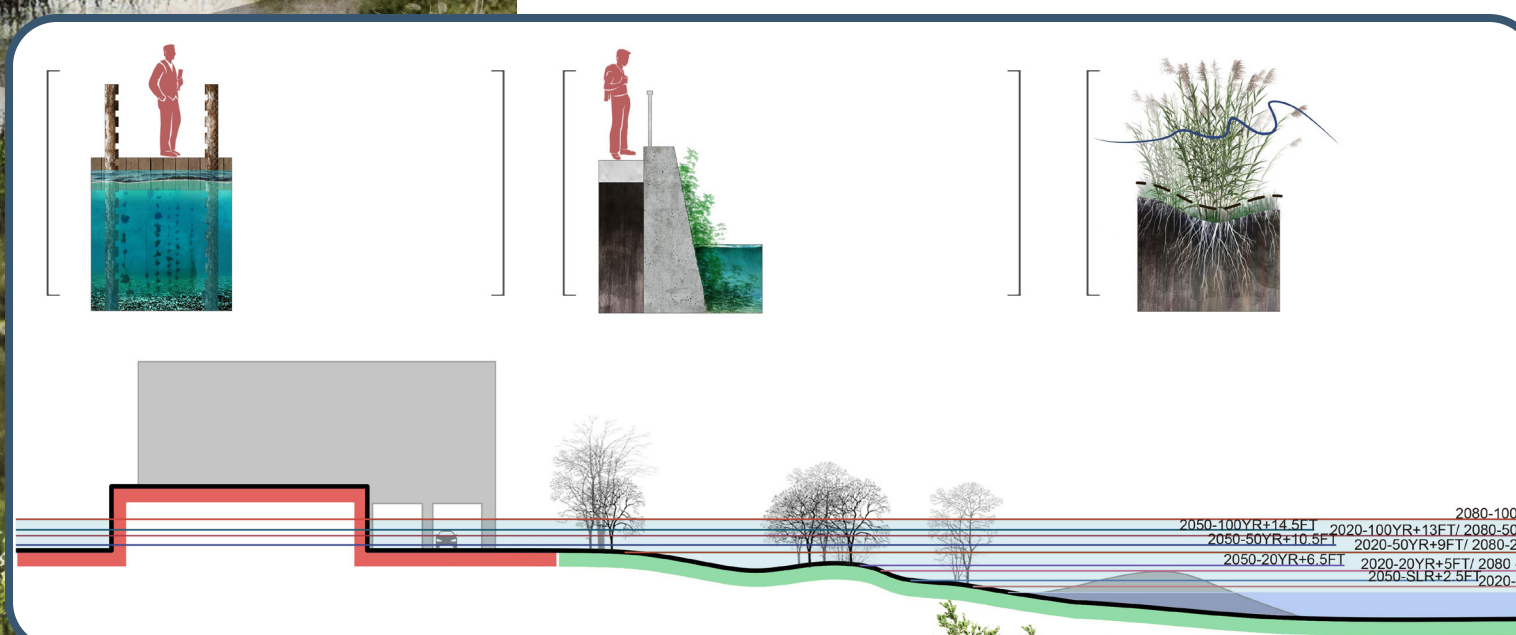


The rail line is elevated on a levee, but the shoreline is restored to a more natural slope and land cover. A flood gate at the mouth of the creek is intended to prevent storm surge upstream. Floodgates may not be effective solutions, as floodwaters in the creek are blocked from the river and may flood upstream areas. Levees may block physical and visual access to the river and can make flooding worse if they are overtopped or breached.



A view of the elevated rail road. A terraced gathering area provides public access to the river.

Adjacent to the rail road levee, a vegetated shoreline with a gradual slope and wetland plantings makes the river more accessible for people and wildlife.



STEP BACK, STEP UP, MOVE FORWARD

Student Designer Mark Schrader (MLA '21)

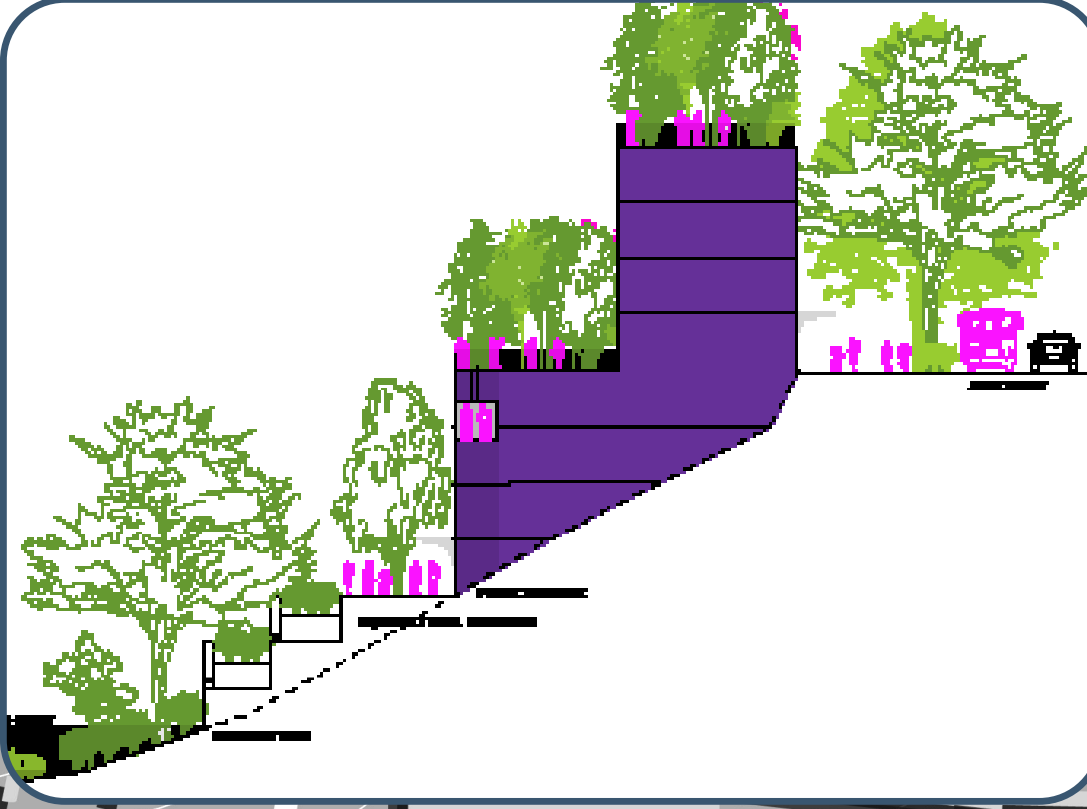


"Step Back, Step Up, Move Forward proposes a strategic relocation and cut-fill grading strategy to create waterfront open space while encouraging development upslope and facilitating marsh migration in certain locations. Notable moves include relocating the wastewater treatment plant to nearby

waterfront location, transitioning marina uses to the western prison property after facilities move to higher ground, and expanding downtown development toward the waterfront along Hunter Street. Rail access across the waterfront would be maintained by temporarily raising the rail until a future date.

Mark Schrader envisioned **strategic relocation** as a flood resilience strategy. In his design, the rail road and train station are moved uphill near Route 9. Sing Sing Correctional Facility and the Westchester County wastewater treatment plants are also moved to higher elevation locations.

This bird's-eye view shows the relocation of the marina to the site of the former correctional facility, and the greening of the flood-prone portions of the 2080 waterfront.



A detail of the design depicts a public elevator that connects Water Street to the Downtown Business District. The image also includes a plan to use green infrastructure to reduce stormwater flow into the Sing Sing Kill.



TRUE URBAN

Student Designer Juwan McIntyre (MLA '20)



"True Urban" focuses on creation of an accessible, flood-adapted park with a community focus. The rail is raised, and the area beneath serves as gathering place with a more urban feel while spaces near the waterfront are more open.

Park furniture, play spaces and other improvements that enhance people-based features transition to underwater habitat features benefitting the estuary as sea levels rise over time.

Juwan McIntyre combined **adaptation**, by elevating the rail line, **relocation** of parking areas and a flexible approach to **reinforcement** techniques like retaining walls to design a publicly-accessible waterfront. A park beneath the rail converts to aquatic habitat as portions of the waterfront are inundated.

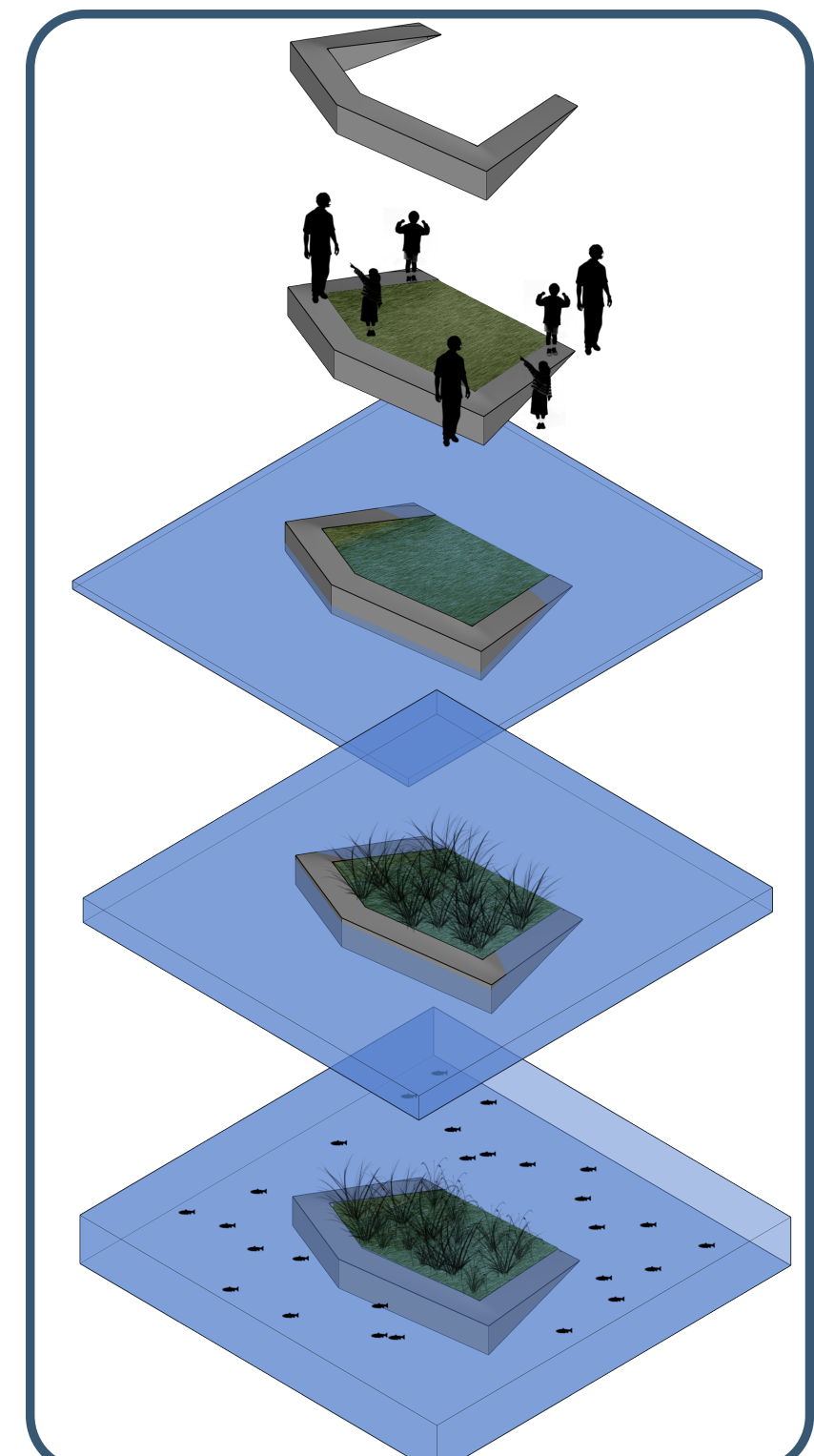
This is your park



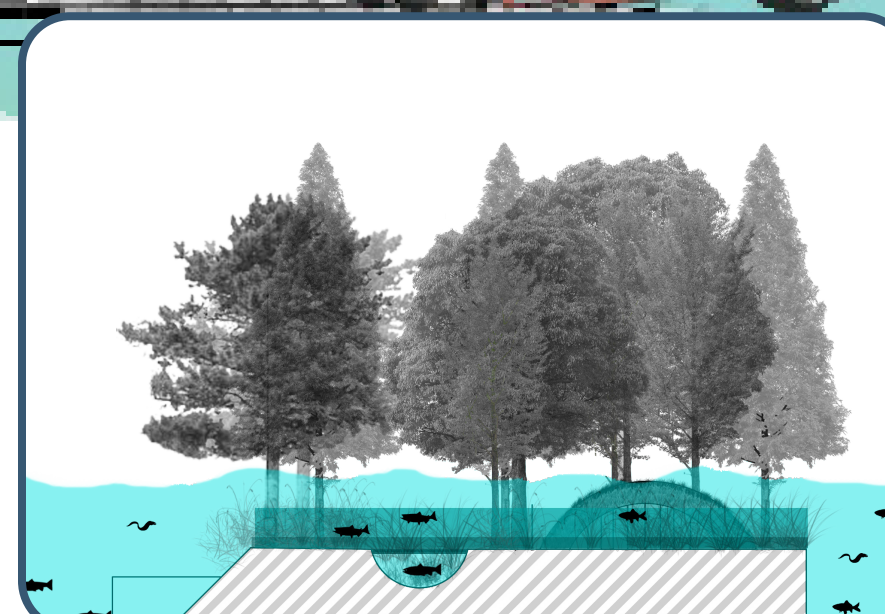
Bridge Axon



Resilient plantings, retaining walls and playscapes built with Eco Concrete provide recreational space under dry conditions. These features are designed to transition to habitat for aquatic species if the area becomes periodically or permanently inundated.



Juwan's project focused on community benefit and access-for-all, combined with elevated infrastructure and innovative ideas for multi-use and adaptable flood control structures. A major feature of Juwan's work is elevating the railway and creating public space below that is designed to transition into an underwater landscape as sea levels rise.

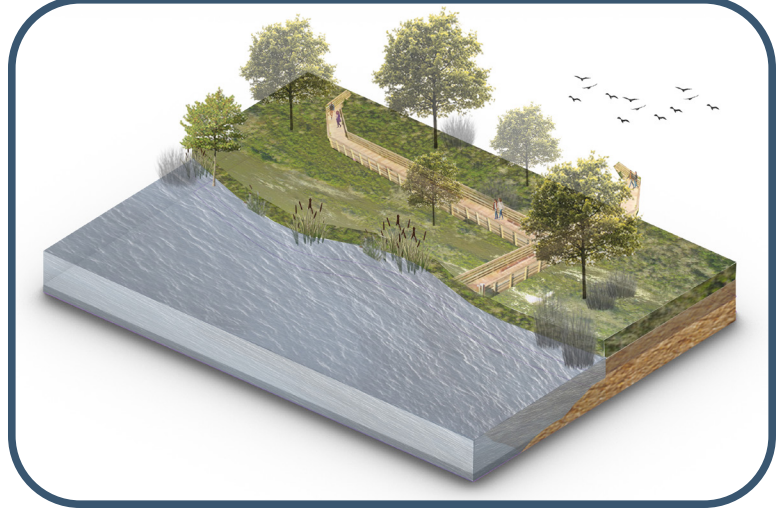
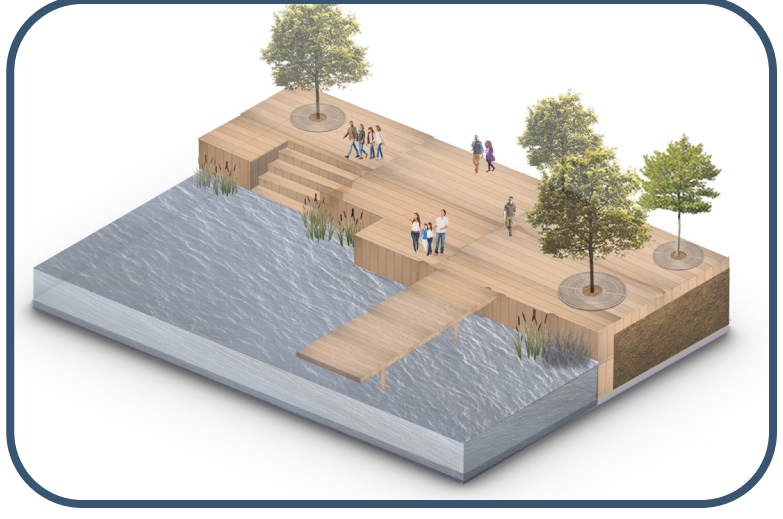


UNLOCKING THE OSSINING WATERFRONT

Student Designer Dean Yeh (MLA/MRP '21)



“Unlocking the Ossining Waterfront” proposes moving the rail line underground, elevating land to create a new park, and utilizing a complete streets strategy to enhance connectivity between downtown Ossining and the waterfront.



Two views of the proposed 2080's Ossining shoreline.

A “complete streets” approach includes pedestrian, bicycle and motorized traffic in roadway design. Shade trees help to cool the landscape and green infrastructure helps to absorb stormwater from paved surfaces.

Many students envision a greener waterfront because sea-level rise data predicts an increasing risk of flooded areas, which may force changes in land use. Most students choose to elevate or re-locate infrastructure to protect from flooding.

In Dean Yeh's future waterfront, some uses have been relocated, while the railroad is buried underground, allowing for an extensive shoreline park.

2080's Ossining



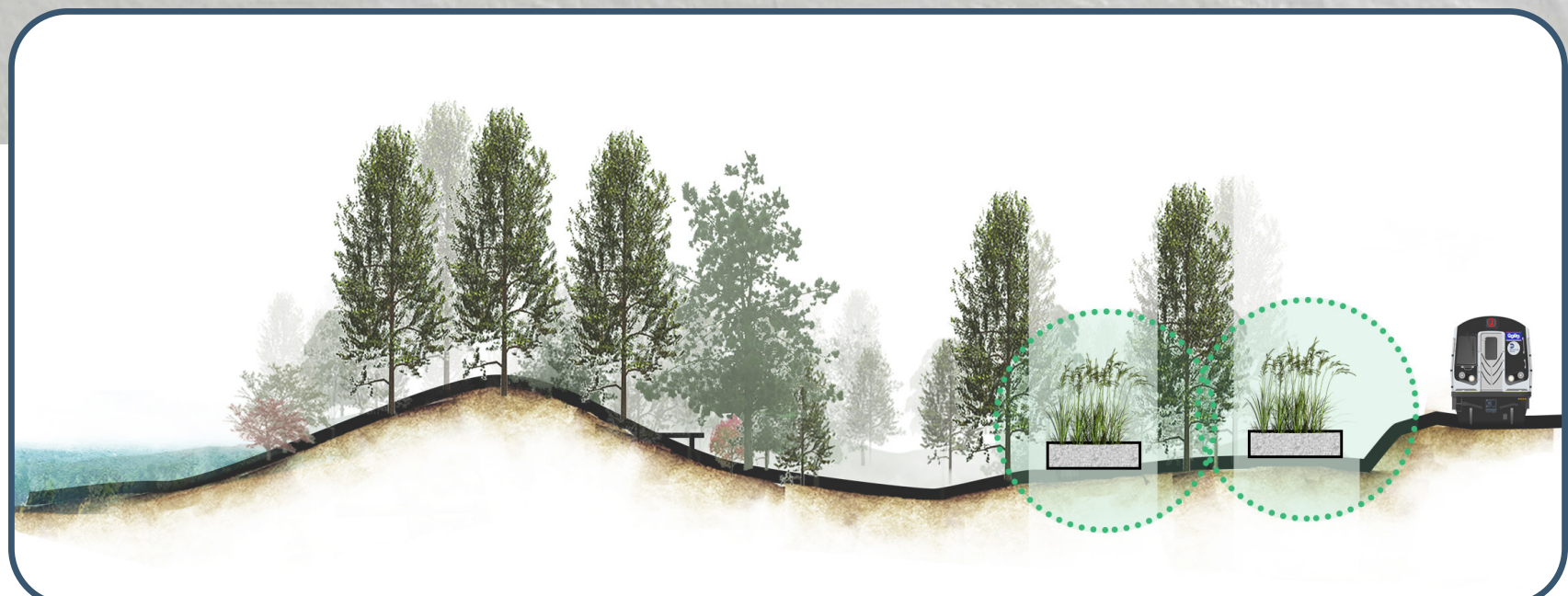
REMIX OF GREEN INFRASTRUCTURE

Student Designer Yuyao Liu (MLA '20)



“Remix of Green Infrastructure” considers how nature-based features like green roofs, rain gardens and open space can be part of a waterfront strategy for Ossining.

Yuyao Liu's project emphasized the potential for green infrastructure in Ossining. Green infrastructure includes natural features that provide multiple benefits including cooling neighborhoods, helping to manage stormwater, enhancing quality of life and increasing property values.



In Yuyao's design, many uses on the present-day shoreline have been relocated, but the railroad remains in the same location in 2080 as it is today. Sections of the tracks are protected by a combination of berms and nature-based shoreline techniques.

Yuyao envisions a network of green corridors that connect parts of the Village of Ossining to the waterfront. A carefully engineered network of green corridors could reduce stormwater flooding during rain events. Yuyao also imagines a much greener shoreline in the future.

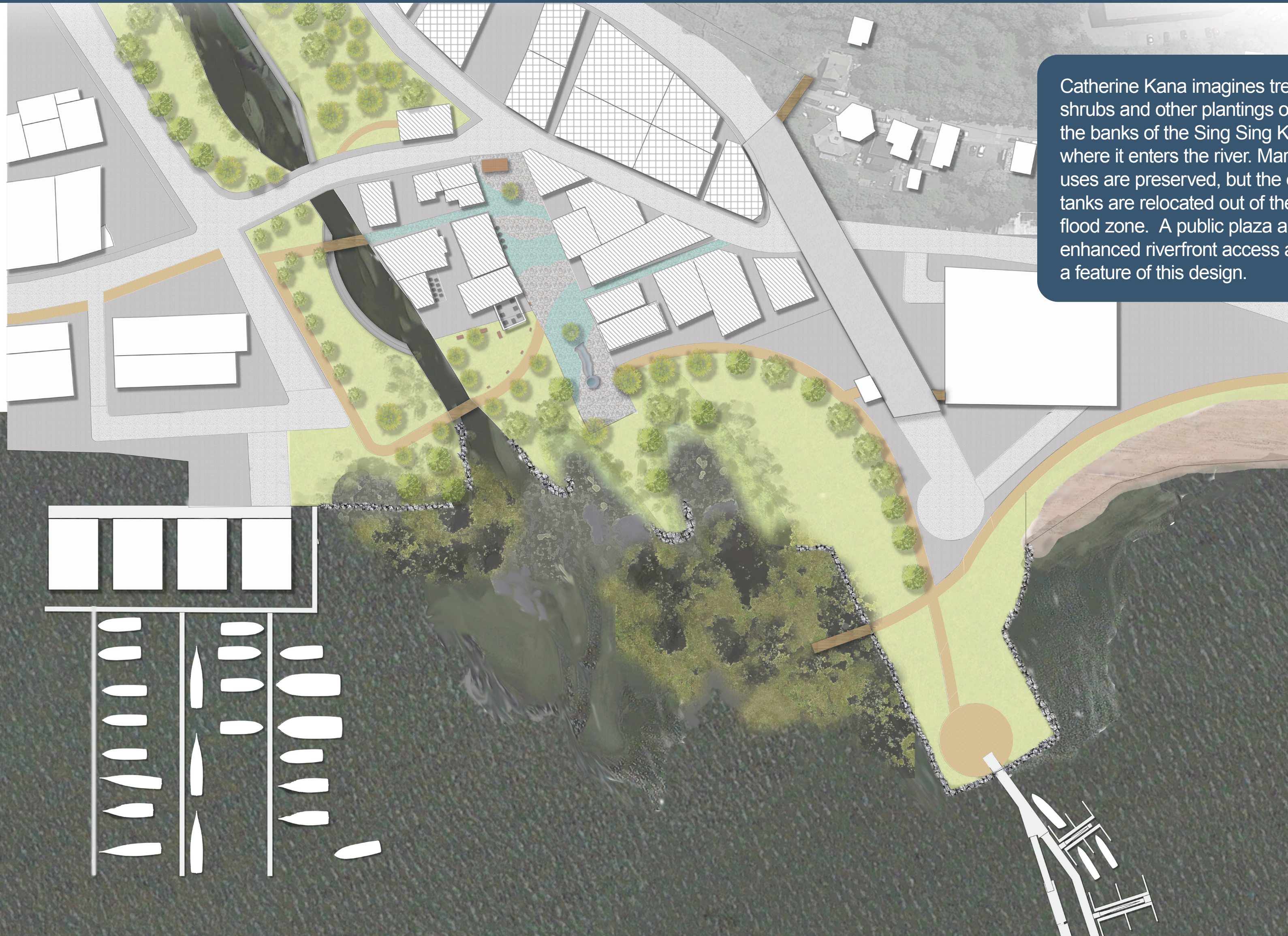
RIVER GUARDS

Student Designer Catherine Kana (MLA '20)

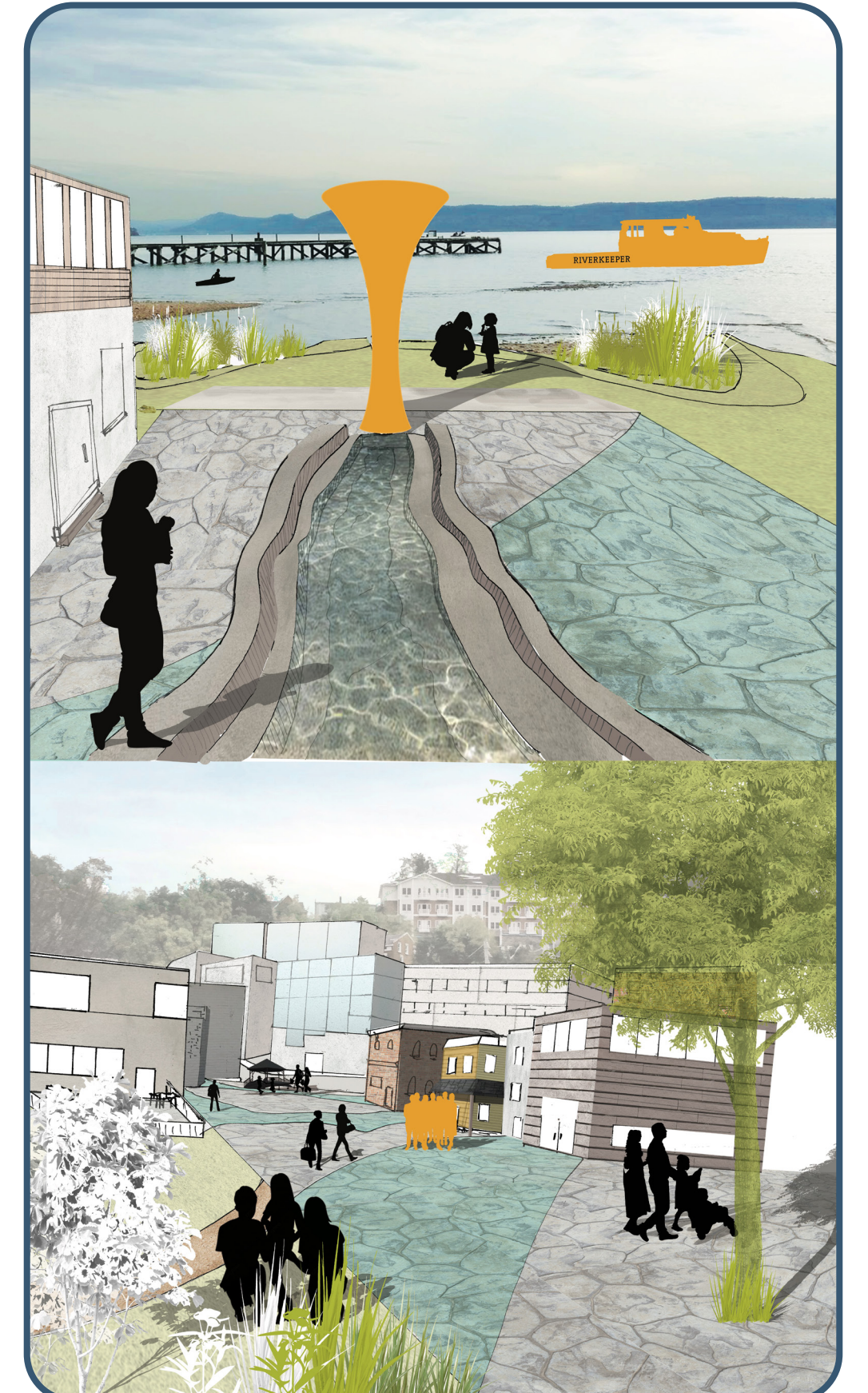


"River Guards" seeks to bring people together to raise awareness of climate change and waterfront assets. A new plaza where Water Street crosses Sing Sing Creek encourages interaction between residents, businesses and NGO's like Riverkeeper while encouraging citizen

science, community engagement, and water-based activities. By transitioning development out of the current and future floodplain but still nearby, the waterfront maintains important ties to the city while providing public waterfront access.



Catherine Kana imagines trees, shrubs and other plantings on the banks of the Sing Sing Kill where it enters the river. Marina uses are preserved, but the oil tanks are relocated out of the flood zone. A public plaza and enhanced riverfront access are a feature of this design.



Two views of the proposed public plaza.

TRACING PLACE, SHIFTING SHORES

Student Designer Marco Rangel (MLA '20)



"Tracing Place, Shifting Shores" uses land contouring, materials, and planting strategies to create waterfront places that are memorable, attractive, and enhance ecosystems while anticipating projected sea level rise. User specific places like

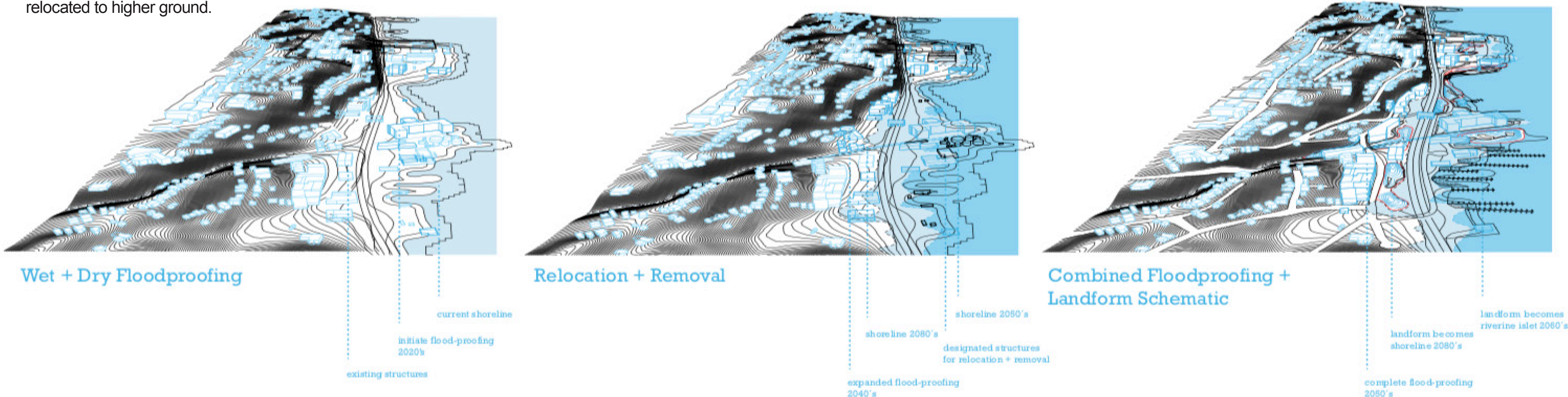
'The Reverie,' which creates a 'green jobs' training opportunity for those incarcerated at Sing Sing, enhance access for diverse types of visitors. This concept is based on a 2050's climate projection only.

Marco envisions a mix of approaches to reduce vulnerability to flooding. New and existing buildings in the flood zone are elevated and flood-proofed and some uses, especially those that are not water-dependent, are relocated to higher ground.

Marco Rangel proposed the possibility that Sing Sing Correctional Facility may have to relocate out of the flood zone, consolidating uses at higher elevation locations. He imagined new community uses for the former correctional facility, including serving as expanded grounds for the Sing Sing Prison Museum, a green jobs training program for formerly incarcerated people, and waterfront public access.

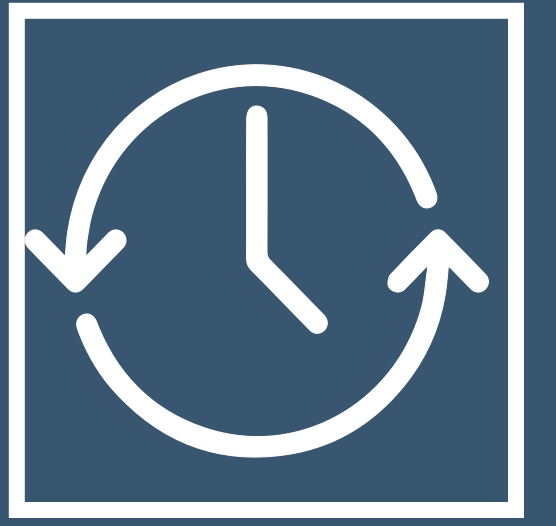


View of a sustainable shoreline that mixes vegetation with large boulders to prevent erosion, enhance habitat and provide aesthetic value.



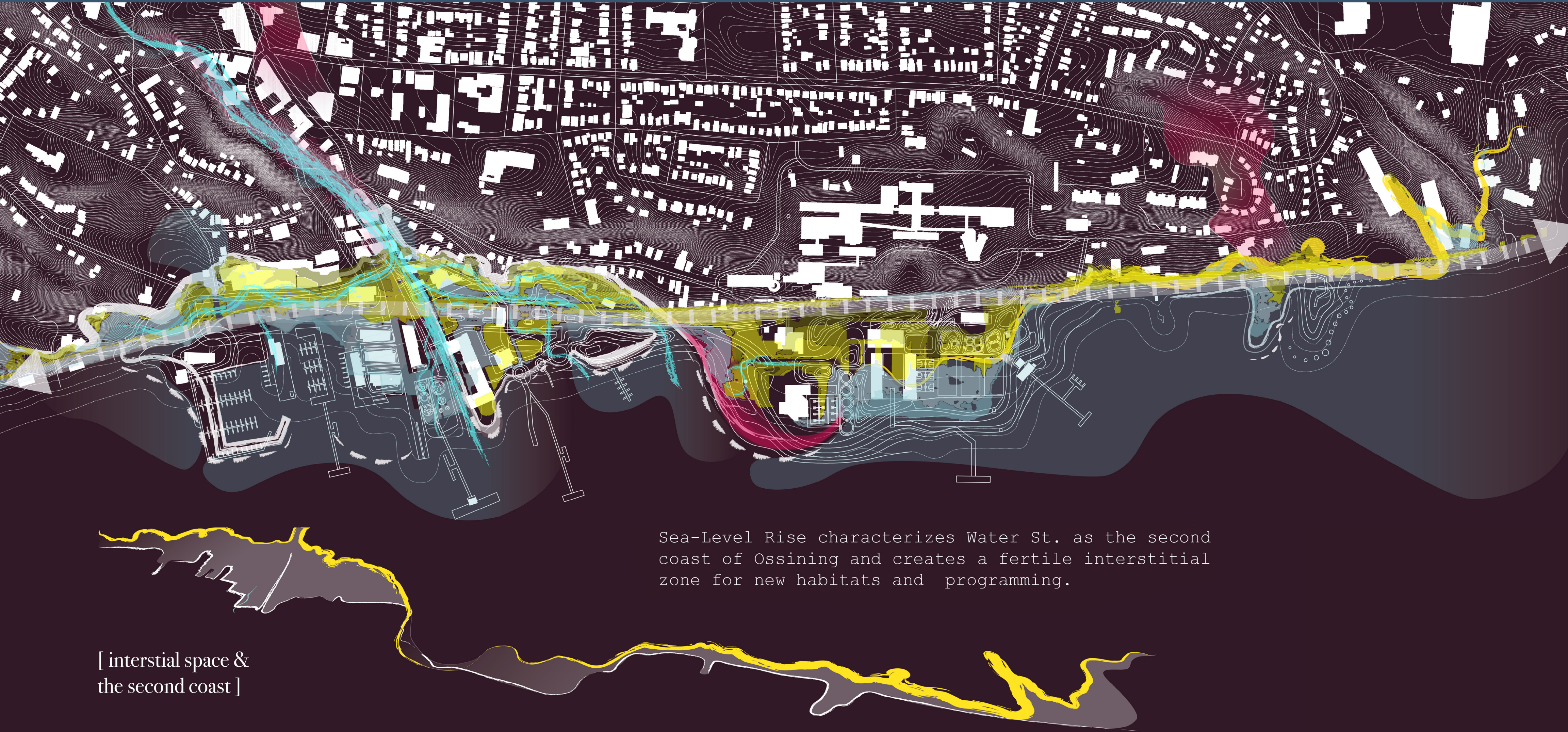
SING SING FUGUE

Student Designer Jihany Hassun (MLA '20)



“Sing Sing Fugue” generates a string of dynamic experiences along the waterfront to link seemingly disparate aspects of Ossining’s future waterfront to one another and the city. Amongst other ways the project works with water, this design concept anticipates the popularity of

the future Sing Sing Prison Museum to propose additional waterfront attractions including a wetland research facility nearby the Museum after the western portion of the prison transitions upland due to increasing flood risk.



Sea-Level Rise characterizes Water St. as the second coast of Ossining and creates a fertile interstitial zone for new habitats and programming.

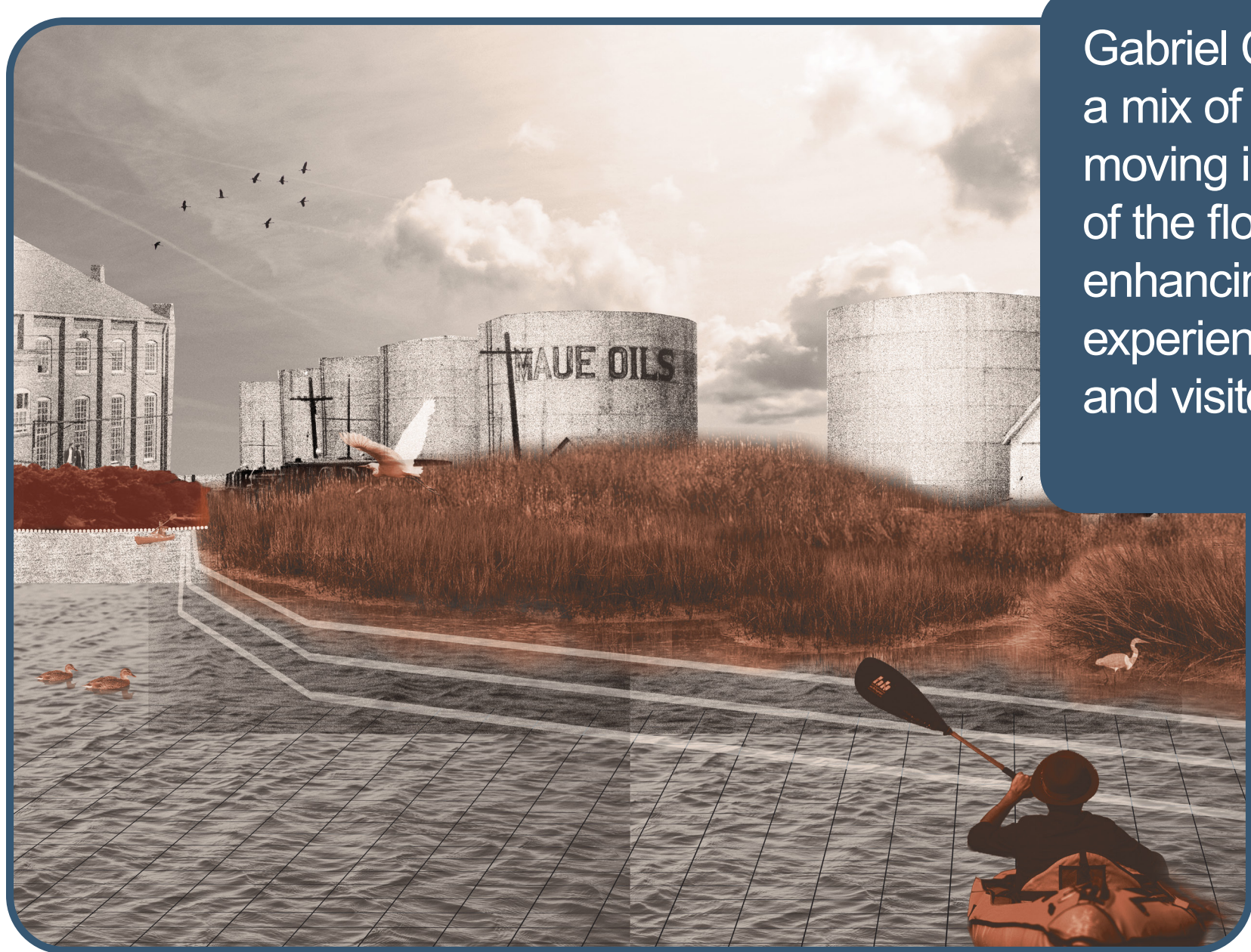
[interstitial space & the second coast]

SHIFTING LINES, RISING TIDES

Student Designer Gabriel Curran (MLA/MRP '20)



“Shifting Lines, Rising Tides” strives to embrace change by encouraging nature-based uses of flood-prone areas, while relocating vulnerable infrastructure and increasing public access to the waterfront.



Gabriel Curran envisions a mix of waterfront uses, moving infrastructure out of the flood zone and enhancing the waterfront experience for residents and visitors.

Views of kayaking in wetlands adjacent to former industrial sites and the proposed swimming beach near the Ossining Boat & Canoe Club.



2080

