SALTY URBANISM

a design manual to address sea level rise and climate change for urban areas in the coastal zones

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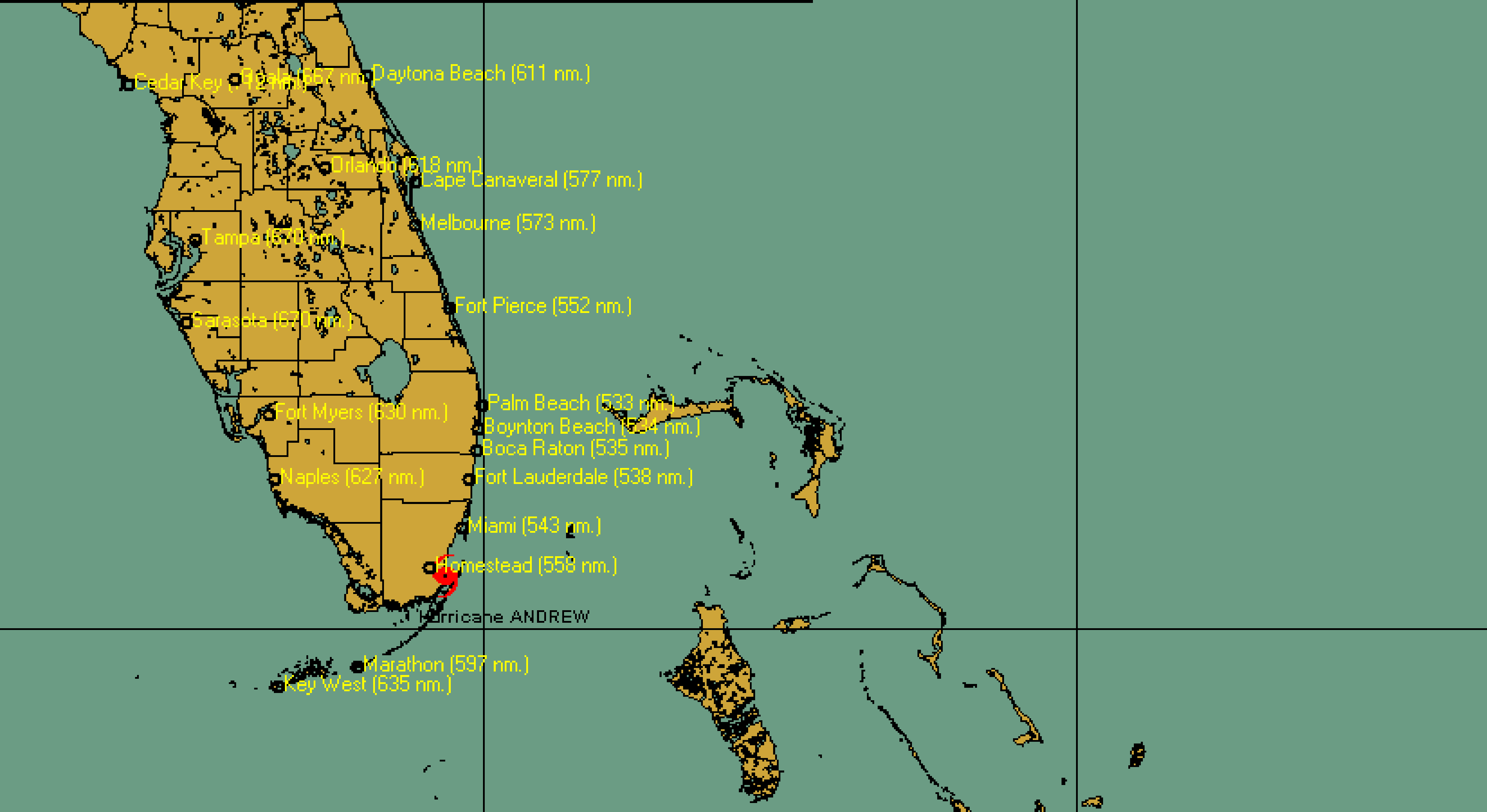
FAU Florida Atlantic University

FASA

BSH Brooks Scarpa Huber

Hurricane ANDREW 08/22/1992 20:00 UTC : 93 Knots




D.A.R.E.

Cities Most Vulnerable to Coastal Flooding Today

Top 25 cities and their populations at risk (thousands) within FEMA's 100-year coastal floodplain

1.	New York	245
2.	Miami	126
3.	Pembroke Pines, Fla.	116
4.	Coral Springs, Fla.	115
5.	Miramar, Fla.	93
6.	St. Petersburg, Fla.	88
7.	Davie, Fla.	87
8.	Fort Lauderdale, Fla.	85
9.	Miami Beach, Fla.	85
10.	Hialeah, Fla.	76
11.	Sunrise, Fla.	74
12.	Pompano Beach, Fla.	73
13.	Hollywood, Fla.	69
14.	Lauderhill, Fla.	66
15.	Charleston, S.C.	64
16.	Cape Coral, Fla.	59
17.	Tamarac, Fla.	58
18.	Margate, Fla.	50
19.	Tampa, Fla.	50
20.	Fountainebleau, Fla.	48
21.	Miami Gardens, Fla.	44
22.	Country Club, Fla.	43
23.	Atlantic City, N.J.	37
24.	North Lauderdale, Fla.	37
25.	Kendale Lakes, Fla.	37

CLIMATE CENTRAL

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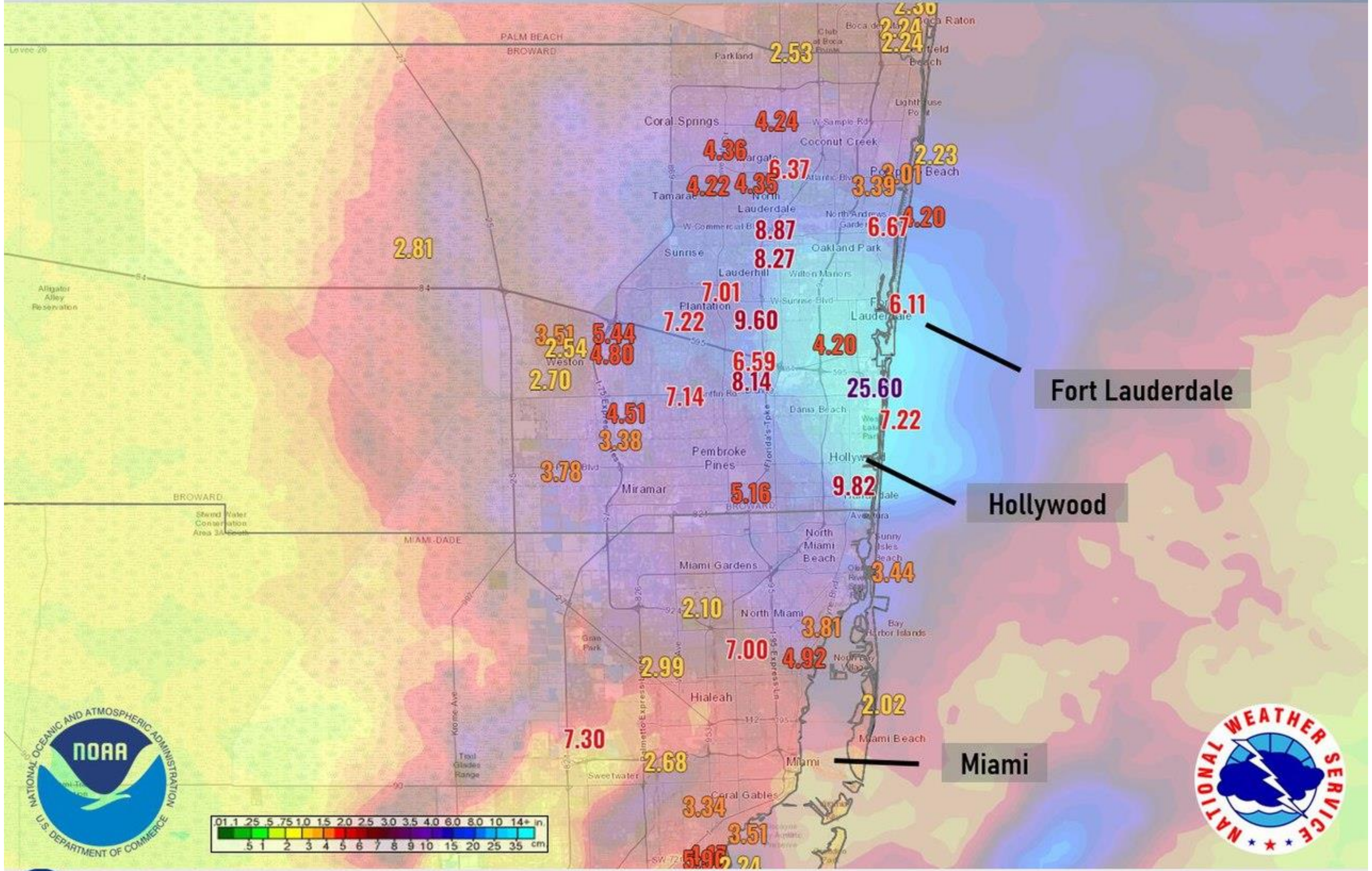
CLIMATE CENTRAL

NWS Preliminary 24-hr Estimated Rainfall, Observed Precipitation

April 12, 2023



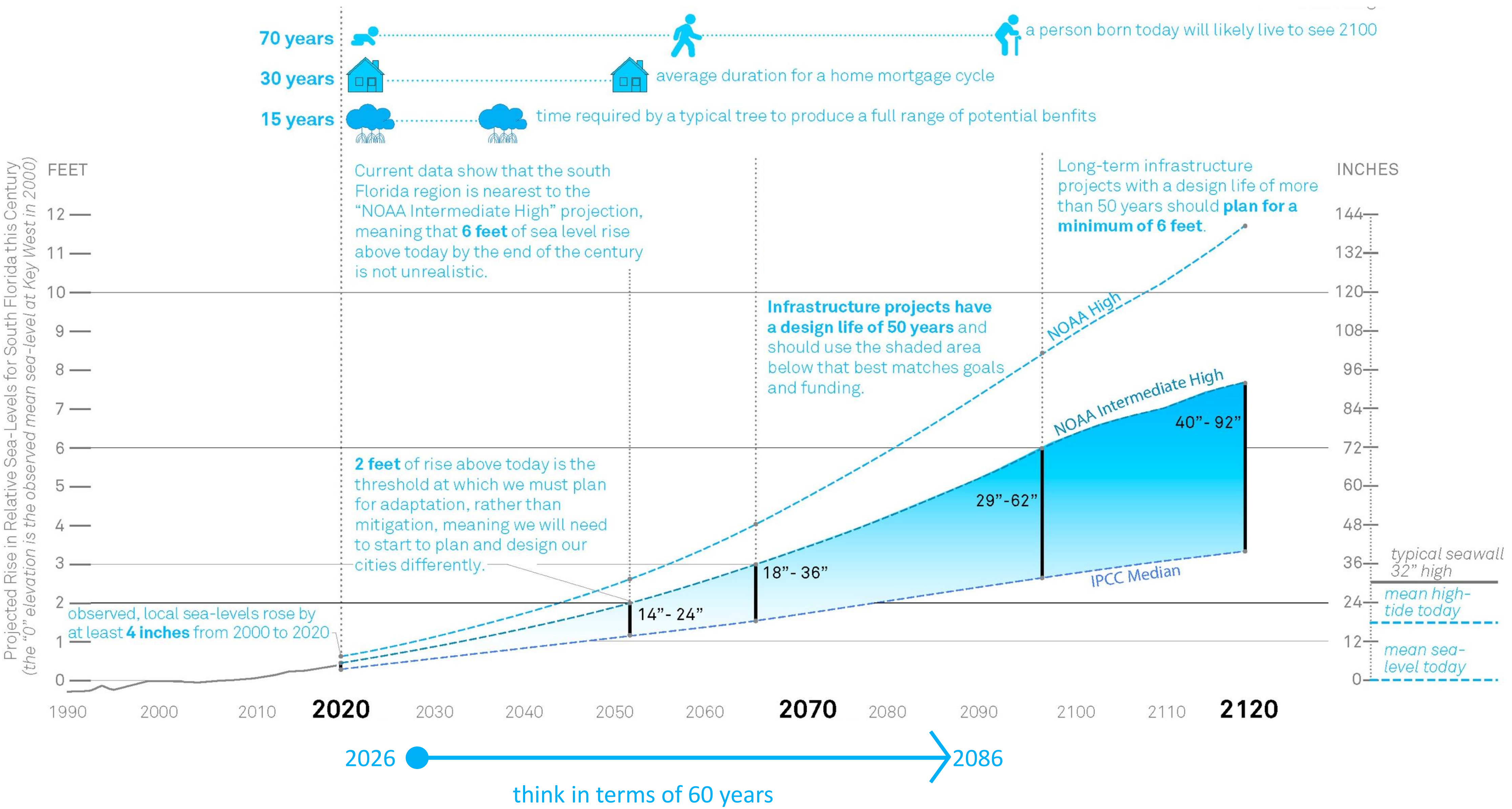
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

For more information go to:
www.wpc.ncep.noaa.gov and www.weather.gov

Weather Prediction Center
College Park, MD


FedEx

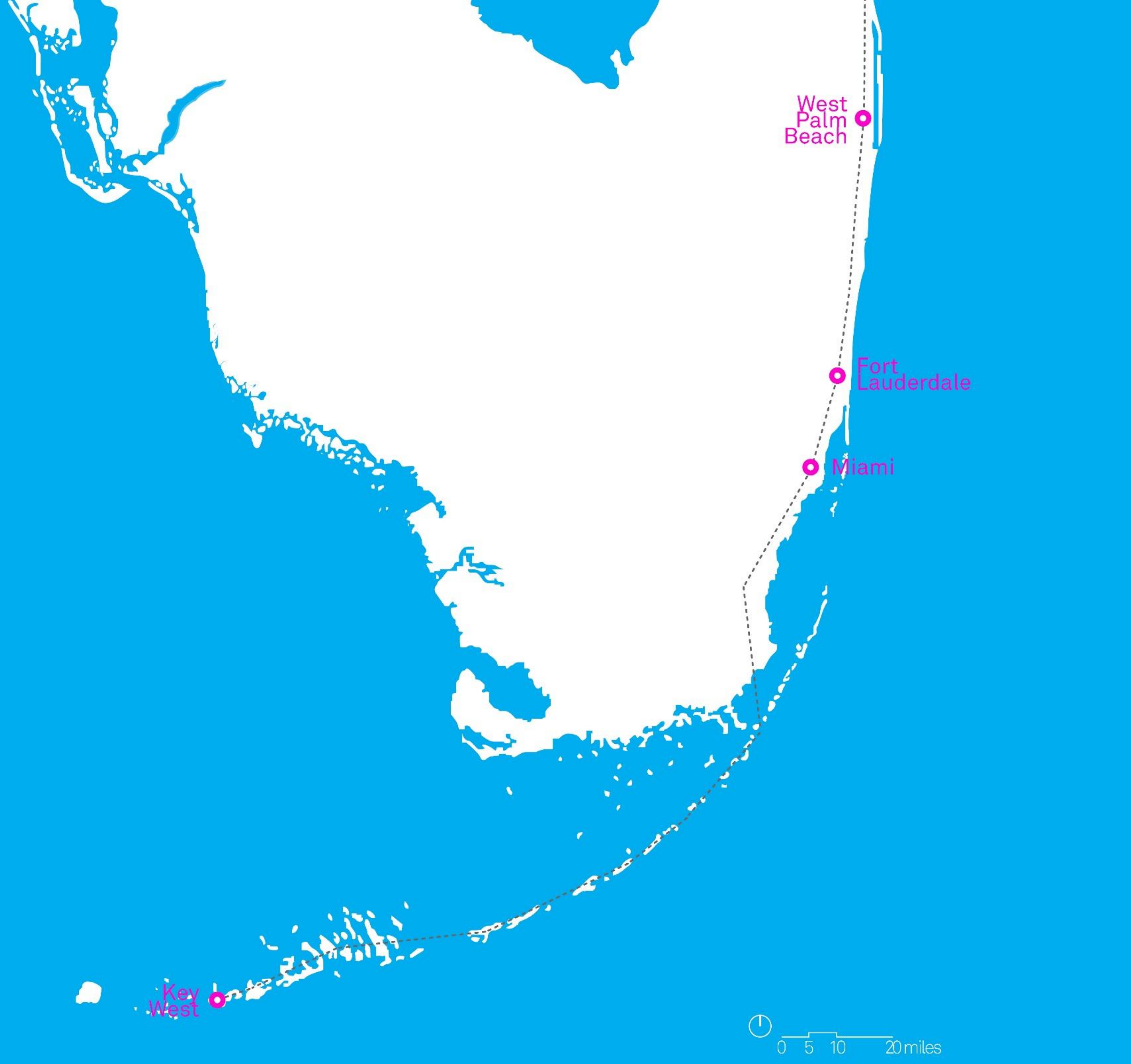

Just a casual ride down the
streets of Fort Lauderdale
Florida Atlantic University
Broward College
HIGHER EDUCATION COMPLEX
TikTok
@josiejo0101



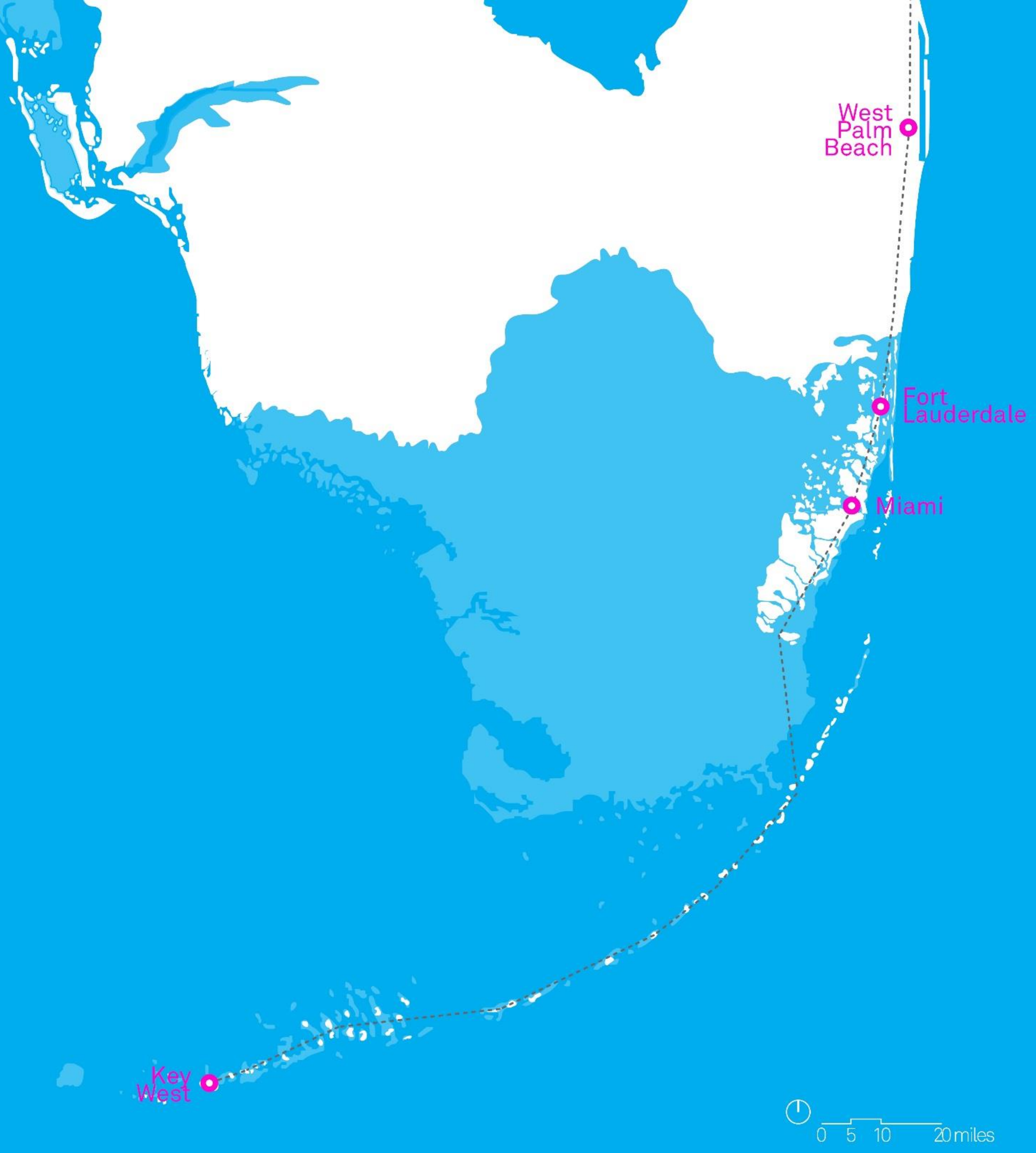
70 years
30 years
15 years
a person born today will likely live to see 2100
average duration for a home mortgage cycle
time required by a typical tree to produce a full range of potential benfits
FEET
INCHES
Projected Rise in Relative Sea-Levels for South Florida this Century
(the "0" elevation is the observed mean sea-level at Key West in 2000)
Current data show that the south Florida region is nearest to the "NOAA Intermediate High" projection, meaning that 6 feet of sea level rise above today by the end of the century is not unrealistic.
Infrastructure projects have a design life of 50 years and should use the shaded area below that best matches goals and funding.
Long-term infrastructure projects with a design life of more than 50 years should plan for a minimum of 6 feet.
2 feet of rise above today is the threshold at which we must plan for adaptation, rather than mitigation, meaning we will need to start to plan and design our cities differently.
observed, local sea-levels rose by at least 4 inches from 2000 to 2020
NOAA High
NOAA Intermediate High
IPCC Median
14"- 24"
18"- 36"
29"-62"
40"- 92"
typical seawall 32" high
mean high-tide today
mean sea-level today
12
11
10
9
8
7
6
5
4
3
2
1
0
144
132
120
108
96
84
72
60
48
36
24
12
0
1990
2000
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100
2110
2120
2026
2086
think in terms of 60 years

"The most important line on this planet is the coastline, and we mistake it as something static, but understandably so because throughout recorded human history it has relatively remained the same, but it's now shifting and we need to adapt."

-John Englander, Oceanographer-



Just **six feet of sea level rise** will inundate the region, drastically changing the environment. Essentially South Florida will become the Upper Keys.



What if future development in the region served as a **flood adaptive asset**, rather than an environmental liability in the face of rising seas and climate change?

FAU
SCHOOL OF ARCHITECTURE
Florida Atlantic University

KU
SCHOOL OF ARCHITECTURE, DESIGN & PLANNING
The University of Kansas

USC School of Architecture

BSH
BROOKS SCARPA HUBER

CITY OF FORT LAUDERDALE

FAU
SCHOOL OF URBAN & REGIONAL PLANNING
Florida Atlantic University

FAU
COLLEGE OF ENGINEERING & COMPUTER SCIENCE
Florida Atlantic University

FAU
FLORIDA CENTER FOR ENVIRONMENTAL STUDIES
Charles E. Schmidt College of Science
Florida Atlantic University

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

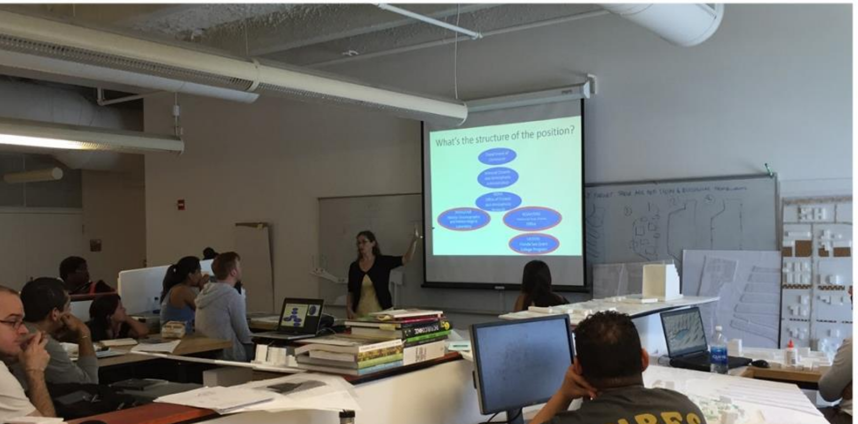
Sea Grant
Florida

NATIONAL ENDOWMENT FOR THE ARTS
A great nation deserves great art.








What's the structure of the position?


eco-
types

Maritime Hammock Guild
gumbo limbo (*Bursera simaruba*)
cocoplum (*Chrysobalanus icaco*)
seagrape (*Coccoloba uvifera*)
silver palm (*Coccothrinax argentata*)
sevenyear apple (*Genipa clusiifolia*)
firebush (*Hamelia patens*)
erect pricklypear (*Opuntia stricta*)
cabbage palm (*Sabal palmetto*)
thatch palm (*Thrinax radiata*)

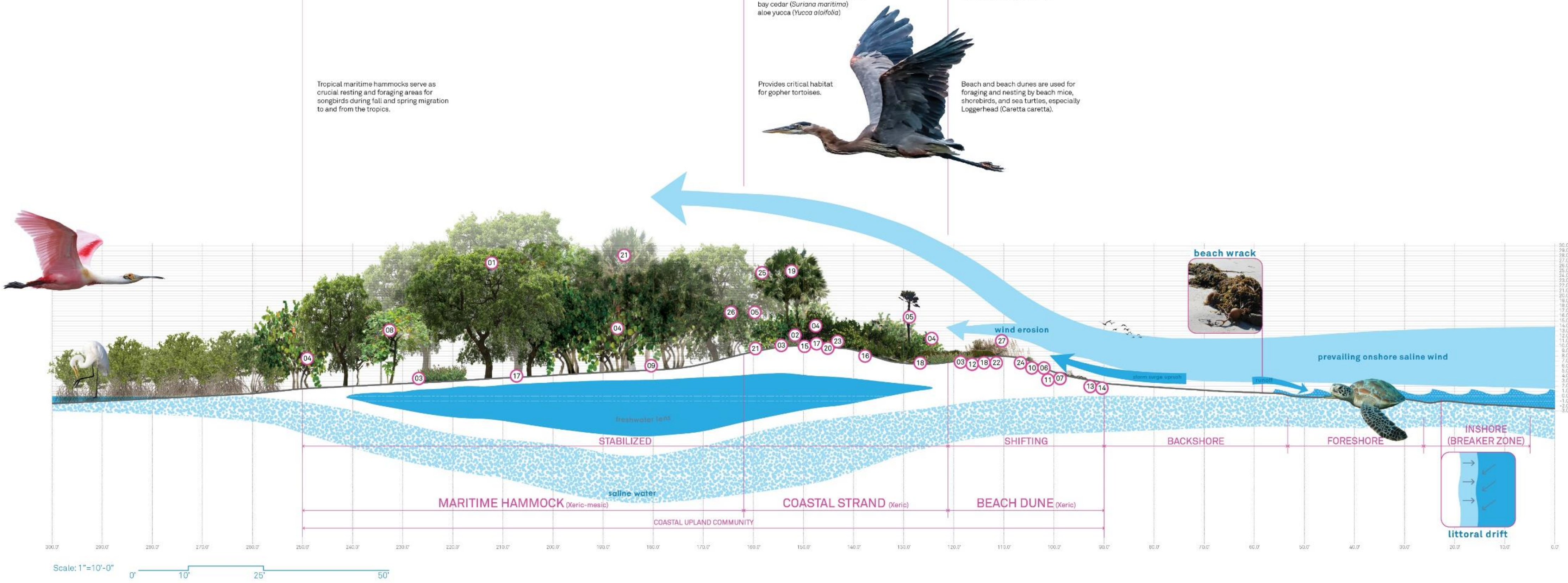
Tropical maritime hammocks serve as crucial resting and foraging areas for songbirds during fall and spring migration to and from the tropics.

Coastal Strand Guild
beach bean (*Canavalia maritima*)
cocoplum (*Chrysobalanus icaco*)
seagrape (*Coccoloba uvifera*)
silver palm (*Coccothrinax argentata*)
sea lavender (*Heliotropium gnaphalodes*)
wild sage (*Lantana involucrata*)
beach peanut (*Okenia hypogaea*)
erect pricklypear (*Opuntia stricta*)
bitter panicgrass (*Panicum amarum*)
cabbage palm (*Sabal palmetto*)
inkberry (*Scaevola plumieri*)
saw palmetto (*Serenoa repens*)
necklace pod (*Sophora tomentosa*)
bay cedar (*Suriana maritima*)
aloe yucca (*Yucca aloifolia*)

Provides critical habitat for gopher tortoises.

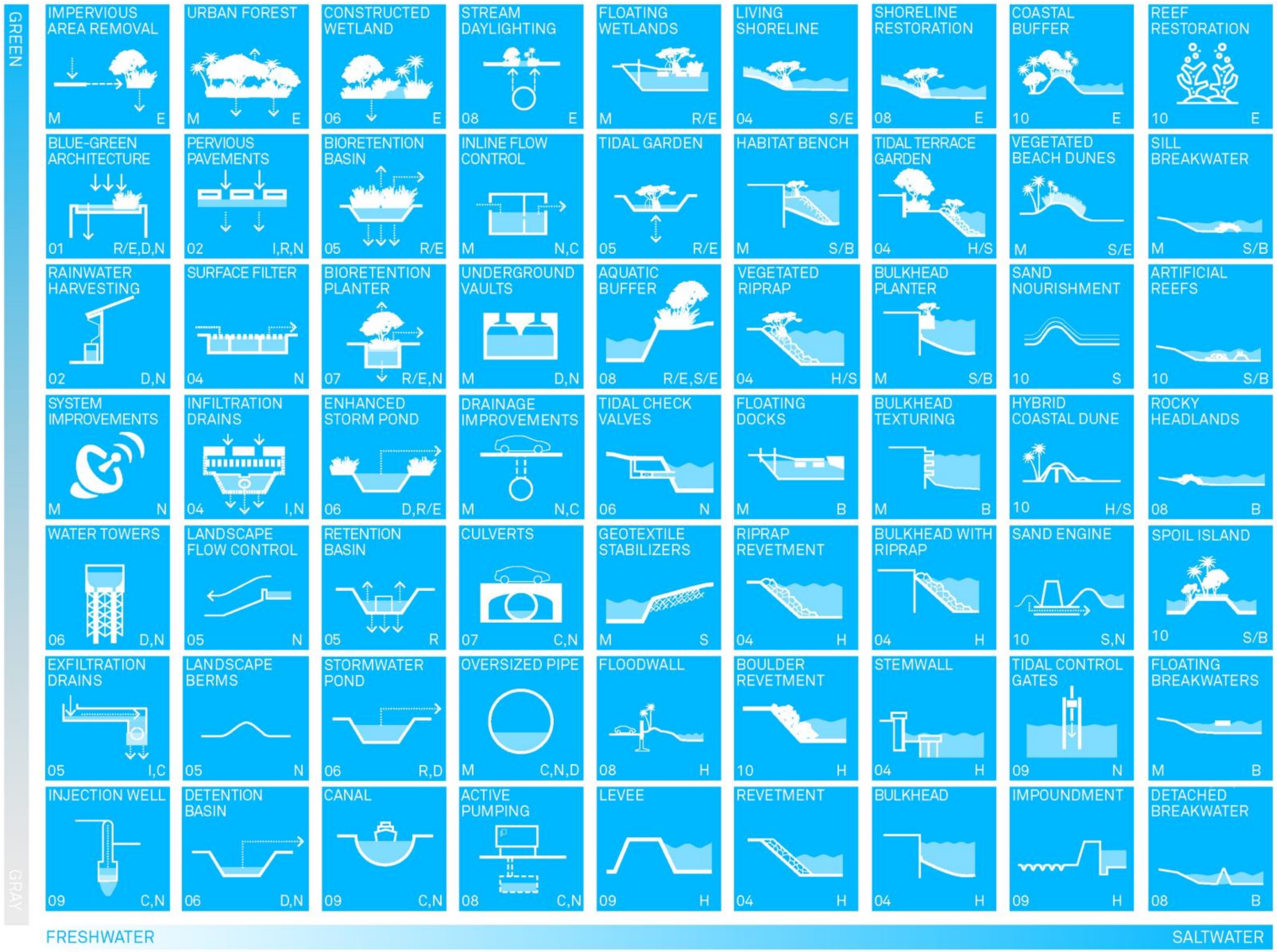
Beach Dune Guild
cocoplum (*Chrysobalanus icaco*)
seagrape (*Coccoloba uvifera*)
beach croton (*Croton punctatus*)
blanketflower (*Gaillardia pulchella*)
beach sunflower (*Helianthus debilis subsp. debilis*)
sea lavender (*Heliotropium gnaphalodes*)
spiderlily (*Hymenocallis latifolia*)
railroad vine (*Ipomoea pes-caprae*)
beachelder (*Iva imbricata*)
bitter panicgrass (*Panicum amarum*)
shoreline purslane (*Sesuvium portulacastrum*)
saltmeadow cordgrass (*Spartina patens*)
sea oats (*Uniola paniculata*)

Beach and beach dunes are used for foraging and nesting by beach mice, shorebirds, and sea turtles, especially Loggerhead (Caretta caretta).



infra- **structure**

infrastructural menu



00 X legend

00. relevant scale(s)
01 - buildings only
02 - buildings to blocks
03 - parcels only
04 - parcels/shorelines
05 - parcels to neighborhoods
06 - blocks to neighborhoods
07 - street/shore to blocks
08 - street/shore to neighborhoods
09 - sub-regional to regional
10 - coast region only
M - modular

X. infrastructural focus
E - ecological
D - detention
R - retention
C - conveyance
I - infiltration/exfiltration
R/E - bioretention
S - soft stabilization
H - hard stabilization
H/S - hybrid stabilization
S/E - nature-based stabilization
B - breakwater
S/B - hybrid breakwater
N - network enhancement

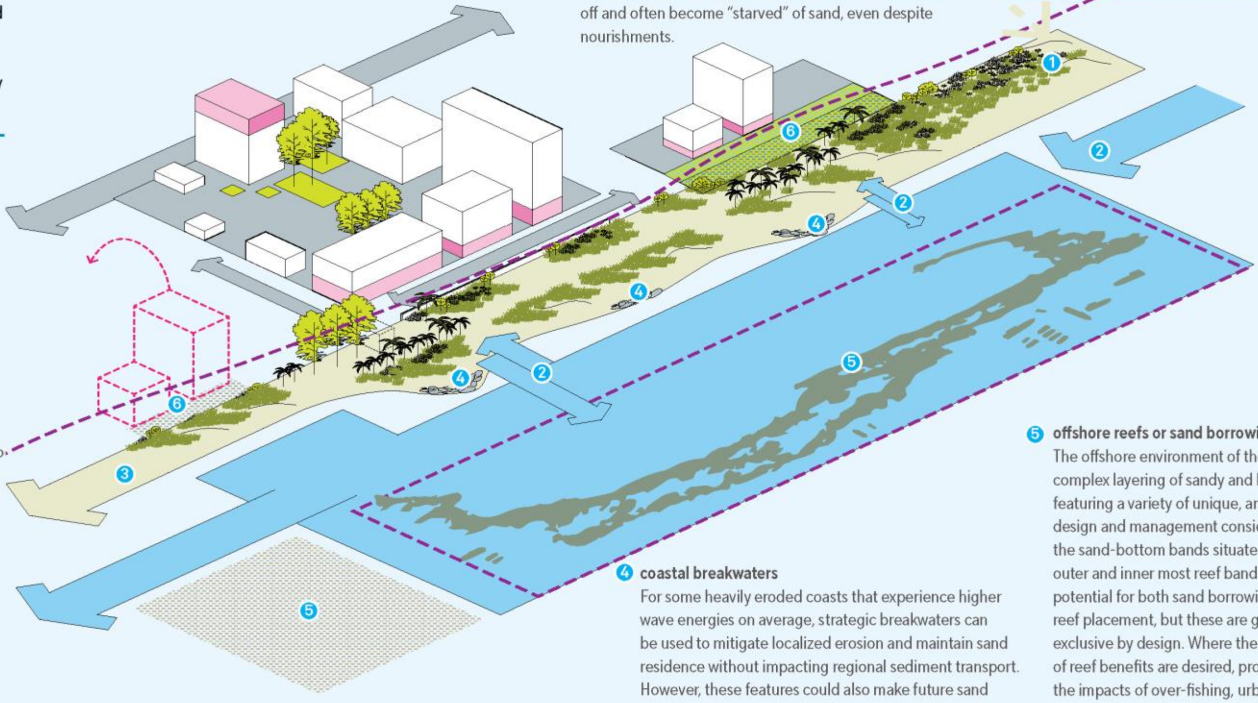
coastal corridor design

Nearly all of the sandy coastline separating urban south Florida from the Atlantic is considered "critically eroded" today. While sand "nourishments" have successfully mitigated local erosion rates in Florida for many decades, the practice is not without contention. Some experts claim it will continue to be an effective adaptation strategy against rising seas, while others point to the extreme costs associated with the apparent need to source ever increasing amounts of sand. "Sand borrowing" for nourishments from limited offshore reserves comes with many negative environmental costs, especially concerning sedimentation of reefs. Sand sourced from inland mines must be trucked to the beach overland at great expense, and these sources are not infinite. While an integrated system of sand nourishment and borrowing could theoretically result in a "closed loop" - with any eroded sand carried south by prevailing longshore currents relocated north again through future nourishments - in reality, this practice is not so simple. However, this kind of system may explain why observed rates of erosion in south Florida have not reflected observed rates in sea level rise. Reefs provide far more value than simply breakwaters, but continued nourishments are likely required to maintain the existing coast. Managers must consider the socio-ecological trade-off related to these choices carefully. Armoring of the coast is not a good solution either. While taller floodwalls may be effective at protecting areas from surge, such features could also worsen rates of beach erosion. Many of the Coastal Construction Control Line (CCCL) program's mandates are expressly concerned with mitigating this potential, limiting the amount of armoring that can occur on the coast, including that from building foundations. Ultimately, management of the coastline will require the holistic design coordination of a regional corridor, one that integrates management offshore, onshore, and inland, across stakeholders, design scales, and political boundaries.

1 sand nourishment & vegetated beach dunes
Sand inputs are encouraged to integrate closely with dune restorations, as covering beach sands with densely planted, native vegetation can enhance outcomes of nourishment.

2 the regional "sand budget"
Waves and currents shape and reshape sandy coastlines, with lower energy waves tending to build up beaches and higher energy waves tending to relocate sand offshore and/or move it south – this ideally results in a balanced "sand budget," with eroded sand on any given beach being replaced by new sand seasonally.

3 man-made erosion
The main cause attributed to the presently eroded condition of south Florida's coast is urbanization, not sea level rise, as the dredging/armoring of inlets combined with the covering of dunes by impervious surfaces has collectively hindered the region's sand budget – beaches immediately south of jetties and inlets are especially bad off and often become "starved" of sand, even despite nourishments.



6 the CCCL, buildings, & coastal realignment
The main regulating component of the CCCL is the Coastal Construction Control Line itself, a semi-political geographic boundary running roughly parralell to the coast. The Line's exact distance from the ocean varies from location to location, determined by a variety of site-specific and political criteria and enforced by the FDEP. Generally, the CCCL seeks to reduce the impacts of construction activities and built features on coastal erosion and vulnerable coastal organisms, such as sea turtles. A newer but related state effort managed by the FDEP, the Sea Level Impact Projection Study Tool, or "SLIP Study," mandates that new construction in the coastal zone consider low-impact alternatives. While mitigating some of the most harmful types of development, both of these regulations still allow new construction in highly vulnerable areas. Climate change is expected to increase hurricane intensities by as much as 50 percent over the next century, and by the year 2100, a single category 5 hurricane could erode up to 47 percent of the beach area. Future managers should look to considering stronger setback regulations.

4 coastal breakwaters
For some heavily eroded coasts that experience higher wave energies on average, strategic breakwaters can be used to mitigate localized erosion and maintain sand residence without impacting regional sediment transport. However, these features could also make future sand nourishments more challenging.

5 offshore reefs or sand borrowing
The offshore environment of the southeast coast is a complex layering of sandy and hard-bottom "bands," featuring a variety of unique, and often conflicting, design and management considerations. Generally, the sand-bottom bands situated between the outer and inner most reef bands have the greatest potential for both sand borrowing and artificial reef placement, but these are generally mutually exclusive by design. Where the enhancement of reef benefits are desired, protecting reefs from the impacts of over-fishing, urban runoff pollution, and sand borrowing/dredging is paramount.

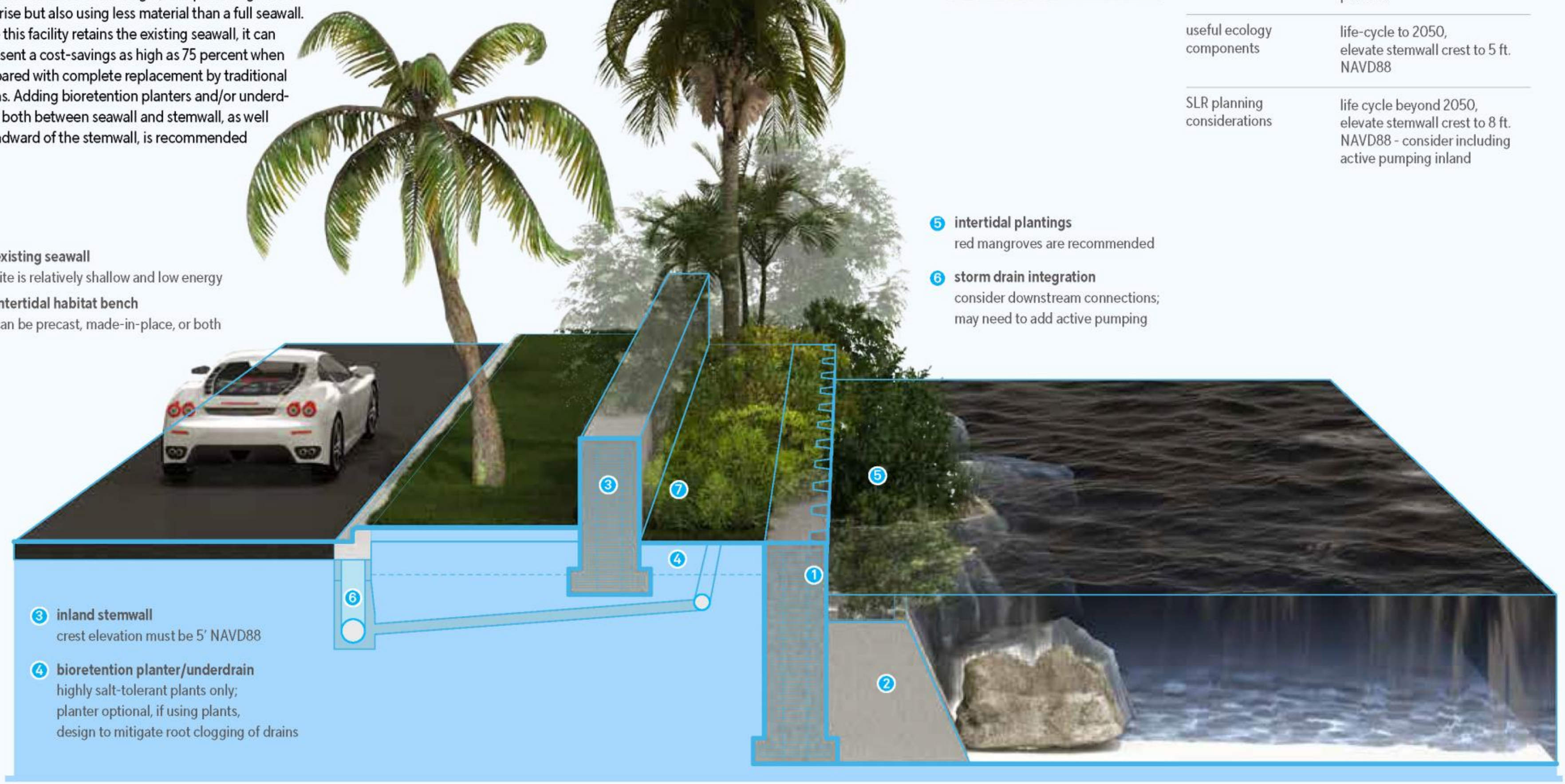
stemwall stair planter

enhancing estuarine seawalls

Space and funds-limited hybrid designs that wish to maximize more engineering-oriented outcomes should focus on improving the longevity and performance of any existing armor. For urban shorelines with an aging seawall, likely the most cost-effective hybrid improvement is to combine an intertidal planter, habitat bench, or riprap feature seaward of the existing wall, and a "stemwall" inland of it. The seaward planter/bench/riprap provides long-term support and protects the toe area from erosion, while the stemwall adds elevation to the shoreline's overall height, compensating for sea level rise but also using less material than a full seawall. Since this facility retains the existing seawall, it can represent a cost-savings as high as 75 percent when compared with complete replacement by traditional means. Adding bioretention planters and/or underdrains, both between seawall and stemwall, as well as landward of the stemwall, is recommended to improve drainage and reduce the potential for inland erosion/pressure while adding co-benefits, such as cooling through shade (where shade trees are used).

summary

problem areas addressed	tidal flooding, erosion, storm surge, (heat)
recommended scales - sites	lots, streets - space constrained sites
infrastructural goals/outcomes	mitigate erosion, elevate shoreline, reduce adaptive costs, reduce impact guides - 2a,2b,2c, palettes -
useful ecology components	life-cycle to 2050, elevate stemwall crest to 5 ft. NAVD88
SLR planning considerations	life cycle beyond 2050, elevate stemwall crest to 8 ft. NAVD88 - consider including active pumping inland



1 **existing seawall**
site is relatively shallow and low energy

2 **intertidal habitat bench**
can be precast, made-in-place, or both

3 **inland stemwall**
crest elevation must be 5' NAVD88

4 **bioretention planter/underdrain**
highly salt-tolerant plants only;
planter optional, if using plants,
design to mitigate root clogging of drains

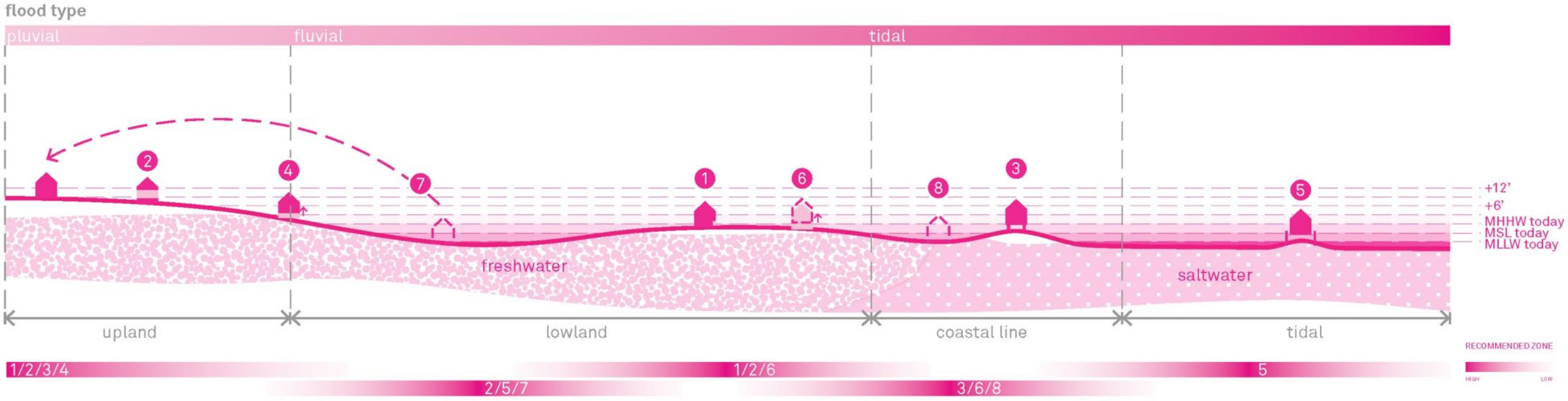
5 **intertidal plantings**
red mangroves are recommended

6 **storm drain integration**
consider downstream connections;
may need to add active pumping

Birch Avenue becomes
Birch Eco-Boulevard.
New permeable median of bioswales and rain gardens create oases within the street corridor.

archi- **tecture**

flood-adaptive architecture menu



1. Dry flood-proofing: utilizes water-resistant materials and panel systems at openings to prevent water intrusion.

2. Wet flood-proofing: utilizes flood vents or breakaway walls to allow flooding to pass through.

3. Or increase the floor to ceiling dimension at ground level and raise floor.

Structure is built to accomdate retreat over time by abandoning lower-floor levels.

Building is raised above bfe on stilts. Keep in mind that nfip criteria does not account for future land development, coastal erosion and subsidence, or sea level rise. These would have to be factored in to ensure lifespan considerations. Consideration of what happens under the building should be addressed.

Structure is bulit on the raised platform. The raised platform can increase in elevation over time as adaptation demands.

Structure is built to float on water and tethered to a mooring or anchoring device while allowing the building to move freely in multiple directions

Structure is built to float on elevated flood water. The piles anchor the structure in place while the buoyant base floats up and down. The building rests atop the ground during non-flood events.

Relocation of buildings to higher elevations where flooding is less likely to occur. This could be a few hundred feet or miles.

Abandoned structures can be reclaimed or re-purposed, for example, the building could become an artificial reef or breakwater once materials that can pollute waterways are removed.

floating structure

description

Offer an innovative approach to flood adaptation. Instead of being firmly anchored to the ground, these structures are designed to float on water or be buoyant during flood events. This design concept allows buildings to rise and fall with changing water levels, minimizing the risk of damage and providing a resilient solution to flood-prone areas.

summary

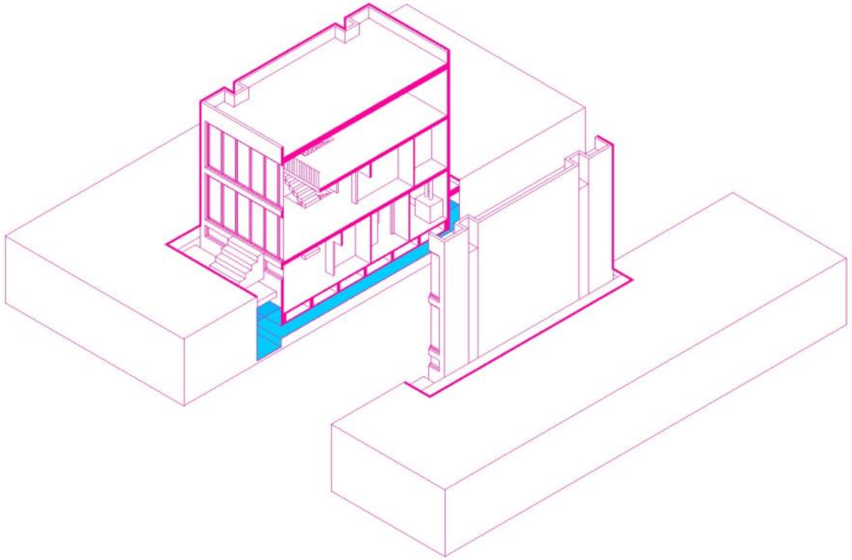
cost	\$\$
building type	single family, townhouses
locations	coastal or open water areas

opportunities & challenges

Floating structures typically consist of buoyant materials and are engineered to withstand the forces exerted by water. They can be constructed using materials like reinforced concrete, steel, or specialized buoyant materials such as foam or hollow pontoons. The buoyancy is carefully calculated to ensure stability while accommodating variations in water levels.

design considerations

Considerations include infrastructure integration, stability, and accessibility.



raised solid foundation

description

Stemwalls or a solid foundation is another approach to flood adaptation. Stemwalls are short walls constructed around the perimeter of a building, typically made of reinforced concrete, which elevate the structure above the ground. This method provides a raised platform for the building while maintaining a solid foundation.

summary

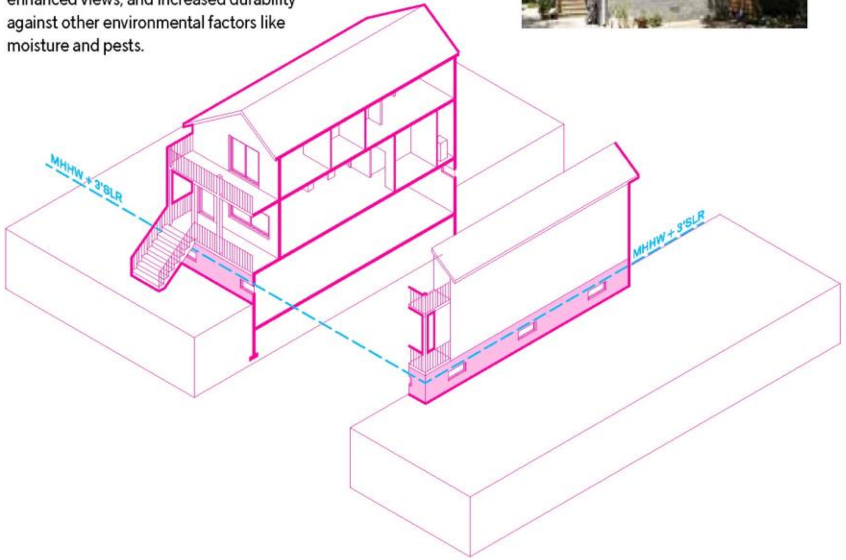
cost	\$\$
building type	single family mostly
locations	coastal and low-lying areas

opportunities & challenges

Consider the specific site conditions and the potential impact of floodwaters on the surrounding area. Adequate drainage systems should be implemented to ensure that water does not accumulate around the stemwalls or beneath the raised structure.

design considerations

Several advantages are it allows for a more secure and stable structure, providing a level of protection against both shallow and deep floods. It also enables easier access to the building during flood events, as well as facilitates post-flood cleanup and recovery efforts. Additional benefits include improved ventilation, enhanced views, and increased durability against other environmental factors like moisture and pests.



“A salty future will require plants adapted to saltier conditions. The following palettes are appropriate to south Florida and other areas can take a similar approach with regionally appropriate plants that will be better adapted to local conditions.”

plant palettes

large trees

These are large landscape trees useful as hedgegrow screens, specimens, wide avenue plantings and/or for providing urban canopy and shade cover.

All grow taller than thirty feet at maturity and so must be set back at least thirty feet away from the nearest powerlines.

growth rate: slow, moderate, fast

preferred sun exposure: full sun, part shade, full shade

phenology:
- Pr - long-lived perennial
- pr - short-lived perennial
- An - annual
- Ev - evergreen
- D - deciduous

red maple Pr/D
Acer rubrum

45'-50' FL
lime rock, sand, muck

willow bustic Pr/Ev
Sideroxylon salicifolium

30'-50' FL
loam, lime rock

false mastic Pr/Ev
Sideroxylon foetidissimum

40'-70' FL
lime rock, sand

royal poinciana Pr/D
Delonix regia

30'-70'
loam, lime rock, sand, clay

Japanese fern tree Pr/Ev
Filicium decipiens

20'-35'
loam, sand, clay

silk floss tree Pr/Ev
Chorisia speciosa

30'-50'
loam, sand, clay

red mulberry Pr/D
Morus rubra

35'-70' FL
loam, sand

avocado Pr/Ev
Persea americana

30'-65'
loam, lime rock, sand

persimmon Pr/D
Diospyros virginiana

35'-60' FL
loam, sand, clay

bridalveil tree Pr/Ev
Caesalpinia granadillo

25'-35'
loam, sand, clay

slash pine Pr/Ev
Pinus elliottii

80'-100' FL
loam, lime rock, sand

bald cypress Pr/D
Taxodium distichum

50'-100' FL
loam, muck, sand, clay

queen crape myrtle Pr/Ev
Lagerstroemia speciosa

35'-60'
loam, sand, clay

banyans Pr/Ev
Ficus spp.

40'-60'
loam, muck, sand, lime rock

live oak Pr/Ev
Quercus virginiana

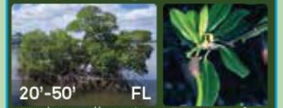
40'-80' FL
loam, sand

West Indies mahogany Pr/D
Swietenia mahagoni

30'-70' FL
loam, lime rock, sand, clay

paradise tree Pr/Ev
Simarouba glauca

30'-50' FL
loam, sand, clay

red mangrove
Rhizophora mangle

20'-50' FL
marine sediments, lime rock

wild tamarind Pr/Ev
Lysiloma latisiliquum

30'-40' FL
loam, lime rock, sand

Jamaican dogwood Pr/D
Piscidia piscipula

15'-50' FL
lime rock, sand

black mangrove Pr/Ev
Avicennia germinans

20'-40' FL
marine sediments, sand

mango Pr/Ev
Mangifera indica

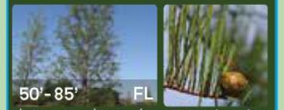
30'-60'
sand, loam, clay

Florida soapberry Pr/Ev
Sapindus saponaria

30'-40' FL
loam, sand, lime rock, clay

pitch apple Pr/Ev
Clusia rosea

25'-50' FL
lime rock, sand

pond cypress Pr/D
Taxodium ascendens

50'-85' FL
loam, muck, sand

yew podocarpus Pr/Ev
Podocarpus macrophyllus

20'-60'
loam, sand, clay

eastern red cedar Pr/Ev
Juniperus virginiana

25'-40' FL
loam, muck, sand

monkey apple Pr/Ev
Mimusops coriacea

20'-40'
loam, sand, lime rock

green buttonwood Pr/Ev
Conocarpus erectus

30'-50' FL
lime rock, sand

seagrape Pr/Ev
Coccoloba uvifera

25'-50' FL
sand

low salt tolerance → high salt tolerance

preferred soil moisture: xeric, mesic, hydric

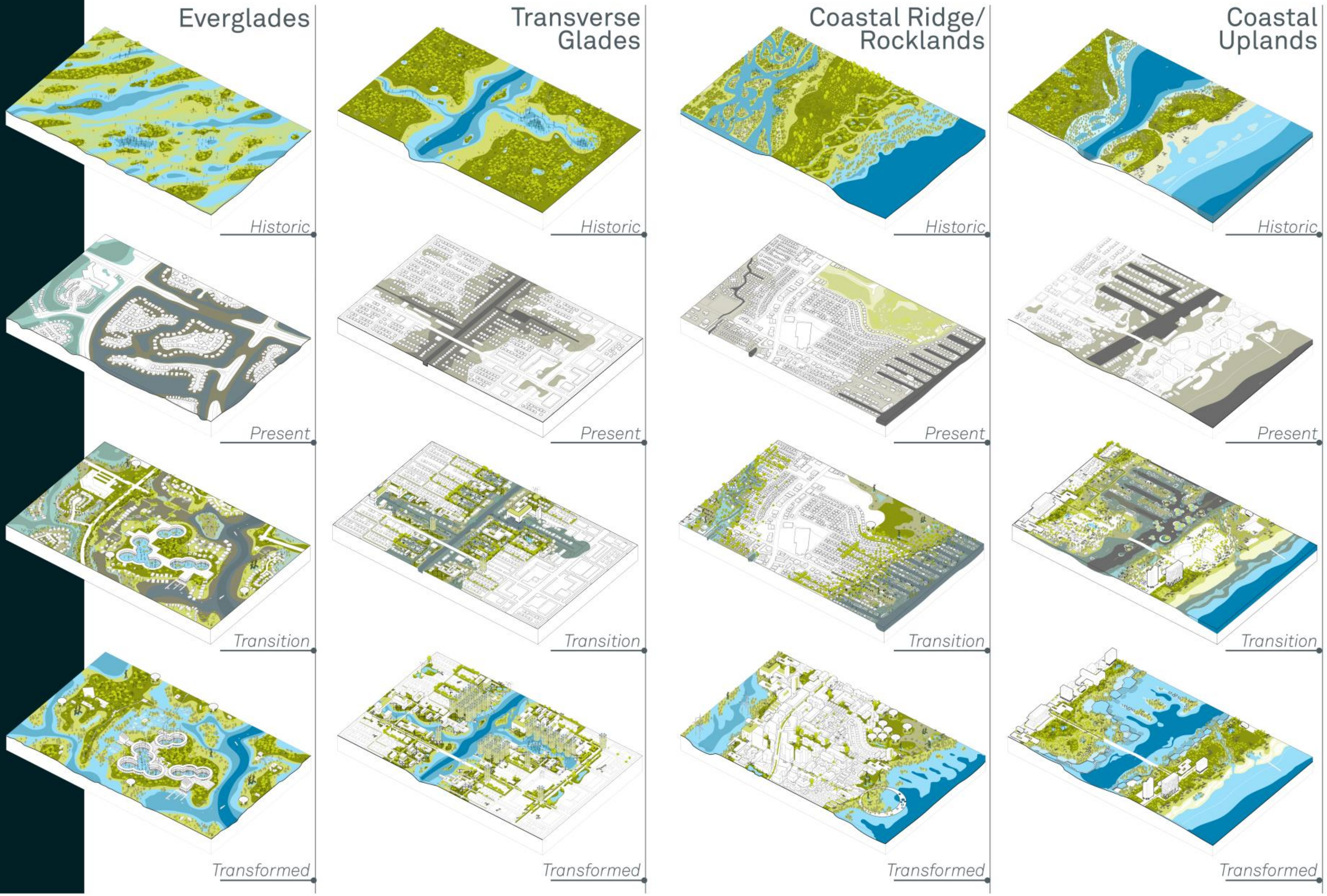
- caution advised siting near structures
- CAUTION - weedy exotic species
- caution - weedy native species
- #'-#' species mature height range
- FL indicates Florida native species

growth forms: sprawling canopy, rounded canopy, vase-like canopy, irregular canopy, upright conifer, thicket forming

urban design

Ecotypic Response Matrix

Basic services and economies organized around a decentralized network tooled for salty and desert-like conditions creates novel approaches to tourism (ruin porn), agriculture, and scientific research. Water would be produced through harvesting and cleaning rainwater, as well as desalination. Waste would be collected and metabolized through phytoremediation networks. Power would be generated with wave, wind, waste, and solar as a distributed and redundant system. Food would be grown within localized networks to service and provide sustenance farming for residents and visitors. Automated and autonomous vehicles would be placed into service to aide in clean up and detoxifying previously developed areas and waters. Abandoned structures become scaffolding for transitional and transformed ecologies.



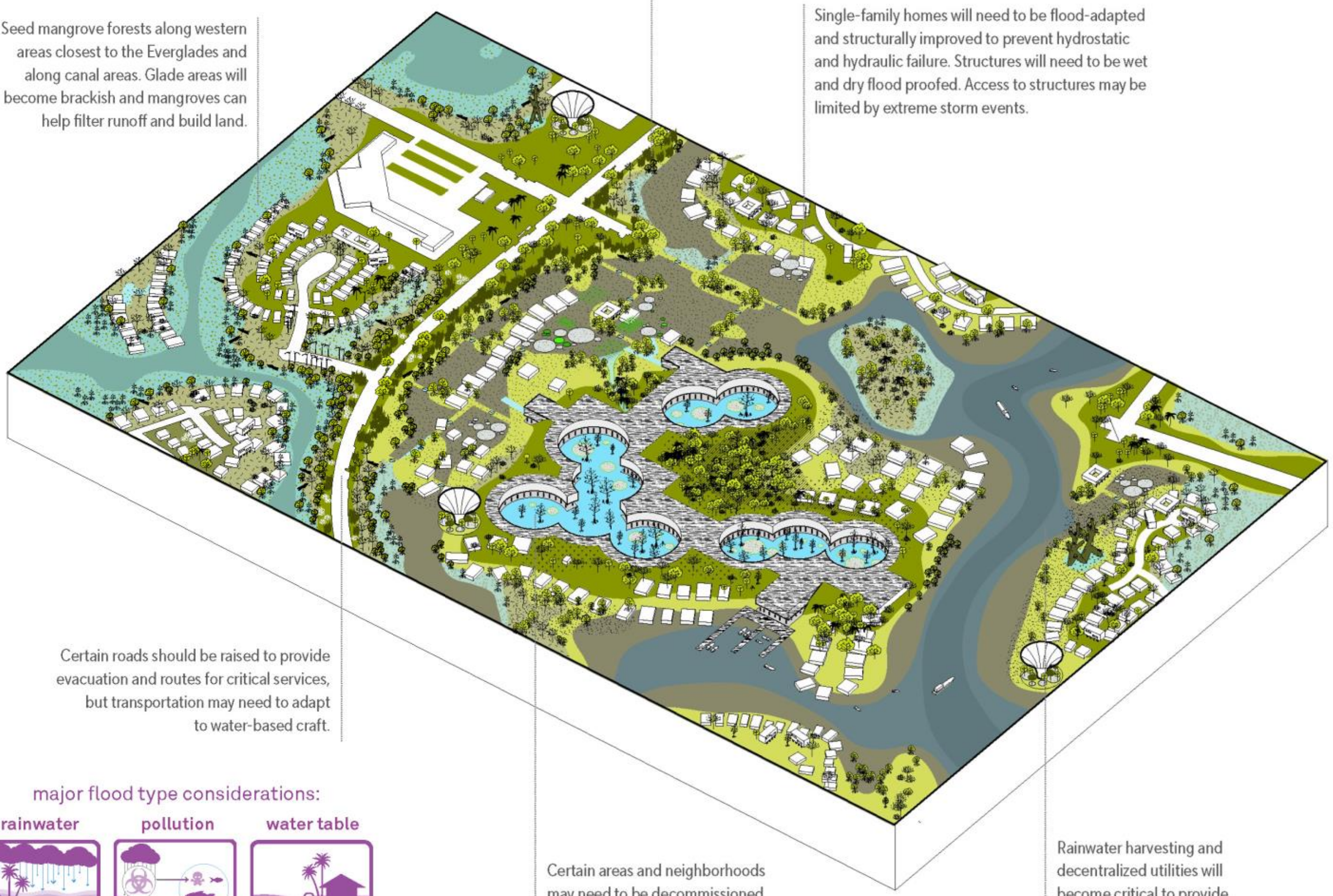
glades adaptation

By combining these approaches, the glades can be better prepared to handle flooding events.

Biomounds and bioswales can be installed to help with evapotranspiration rates. Vegetation will need to be installed that is salt tolerant or halophytic.

Seed mangrove forests along western areas closest to the Everglades and along canal areas. Glade areas will become brackish and mangroves can help filter runoff and build land.

Single-family homes will need to be flood-adapted and structurally improved to prevent hydrostatic and hydraulic failure. Structures will need to be wet and dry flood proofed. Access to structures may be limited by extreme storm events.



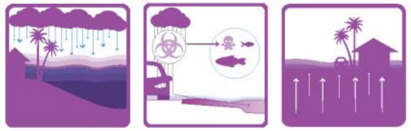
Certain roads should be raised to provide evacuation and routes for critical services, but transportation may need to adapt to water-based craft.

Certain areas and neighborhoods may need to be decommissioned to allow for more room for water, especially to ensure freshwater recharge is maintained.

Rainwater harvesting and decentralized utilities will become critical to provide services to residents in these areas as infrastructure becomes too costly to serve entire areas.

major flood type considerations:

rainwater | pollution | water table



transverse glades adaptation

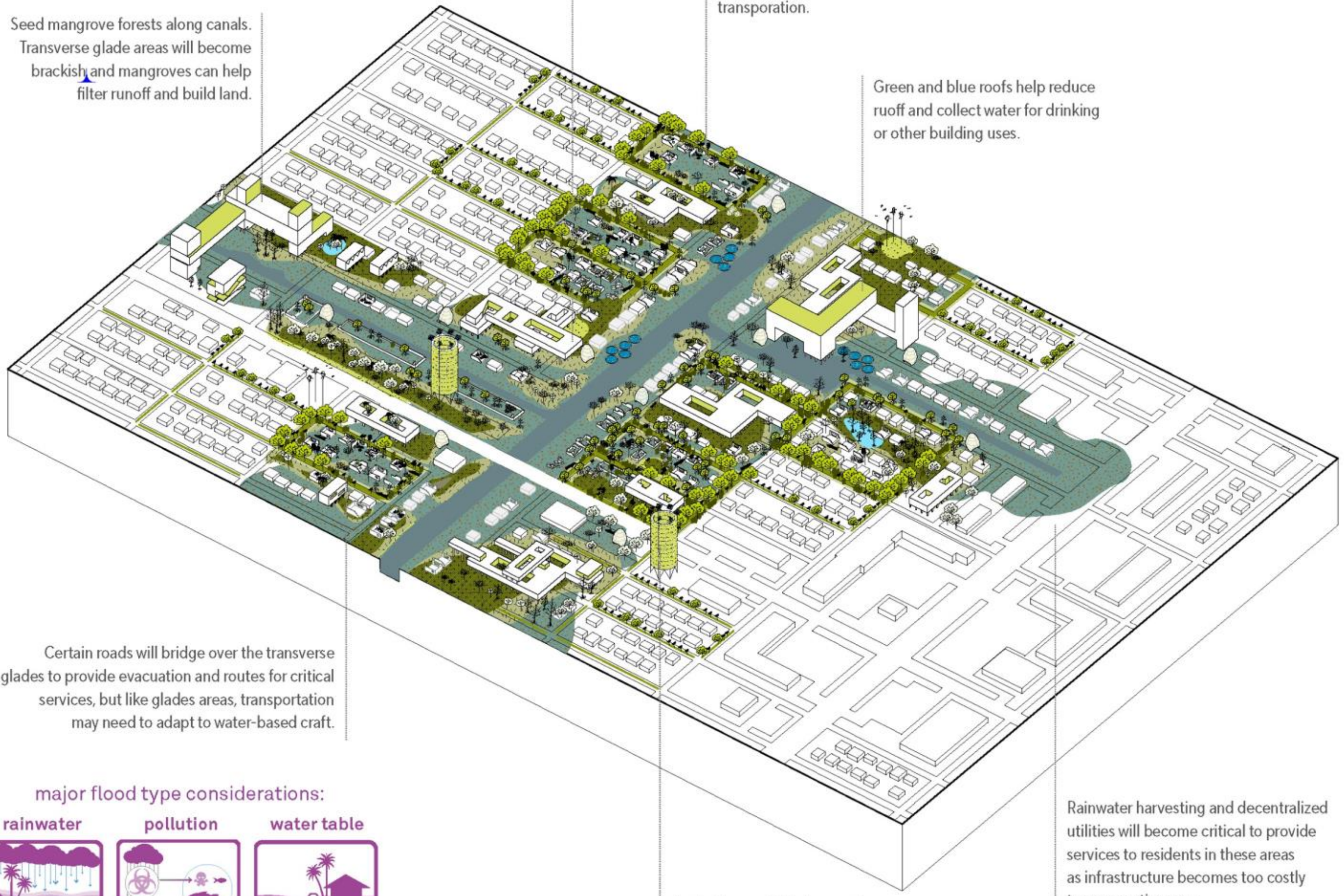
importantly, will regulate freshwater supply and flooding in the future and should be designed appropriately. A clear development edge that makes room for water must be implemented.

New development opens up the ground for ecological functioning and provides elevated spaces for recreation and outdoor activites. These rooftops can be linked to other developments to form a new elevated ground.

Expanded canal zones will require removal and decommissioning of built areas. These areas can allow for intensified development that is flood-adapted and offers access to water-based transporation.

Seed mangrove forests along canals. Transverse glade areas will become brackish and mangroves can help filter runoff and build land.

Green and blue roofs help reduce ruoff and collect water for drinking or other building uses.



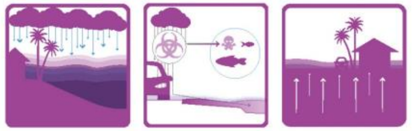
Certain roads will bridge over the transverse glades to provide evacuation and routes for critical services, but like glades areas, transportation may need to adapt to water-based craft.

Agriculture and plant nurseries will provide needed f resources.

Rainwater harvesting and decentralized utilities will become critical to provide services to residents in these areas as infrastructure becomes too costly to serve entire areas.

major flood type considerations:

rainwater | **pollution** | **water table**



coastal ridge and uplands adaptation

way that does not alienate, nor push out those populations that have occupied the land for generations—climate gentrification is an issue that will need to be solved at the neighborhood and community scale.

Transfer of development rights can be a powerful tool to incentivize development to the coastal ridge.

Transfer of development rights or TDR allow for intensification of development at the higher elevations. New development should still plan for flooding and design to integrate green and blue roofs, living walls, and green infrastructure.

Neighborhoods should implement green and blue streets and redevelop with flood-adpative architecture.

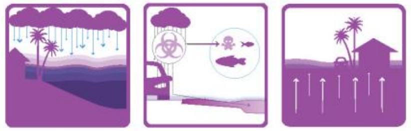
Allow for transportation to adapt to water-based craft and have new development provide access to public waterways.

Certain areas and neighborhoods may need to be decommissioned to allow for more room for water, especially to ensure freshwater recharge is maintained.

Vulnerable properties along the intracoastal waterways should be decommissioned or redeveloped. Access should be converted to water-based transportation only.

major flood type considerations:

rainwater **pollution** **water table**

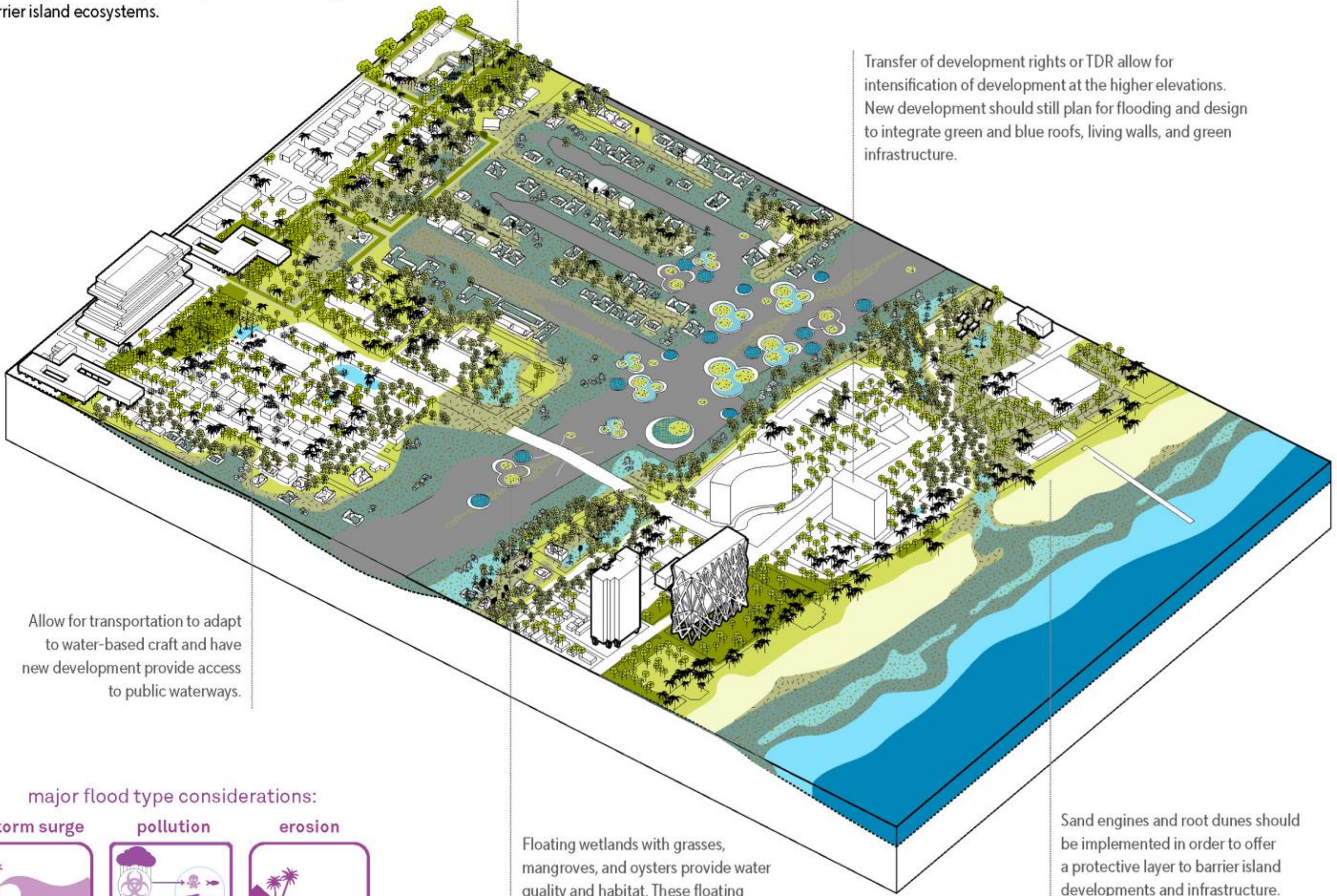


coastal uplands-esturaine adaptation

and early warning systems, and public education. By combining these approaches, barrier islands can enhance their resilience to flooding, protecting coastal communities and infrastructure from the impacts of storm surge and wave action. Collaboration among stakeholders is vital to implementing these measures effectively and ensuring the long-term sustainability of barrier island ecosystems.

Low-lying areas should implement green and blue streets and redevelop with flood-adpative architecture. Repetitive loss properties in the finger islands should consider decommissioning or take extreme action to make them flood adaptive. Transportation should go to water-based.

Transfer of development rights or TDR allow for intensification of development at the higher elevations. New development should still plan for flooding and design to integrate green and blue roofs, living walls, and green infrastructure.



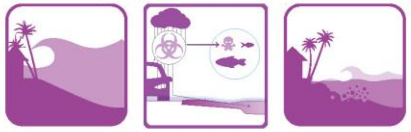
Allow for transportation to adapt to water-based craft and have new development provide access to public waterways.

Floating wetlands with grasses, mangroves, and oysters provide water quality and habitat. These floating biodiversity mats will provide critical habitat that will not be able to keep up with rising seas.

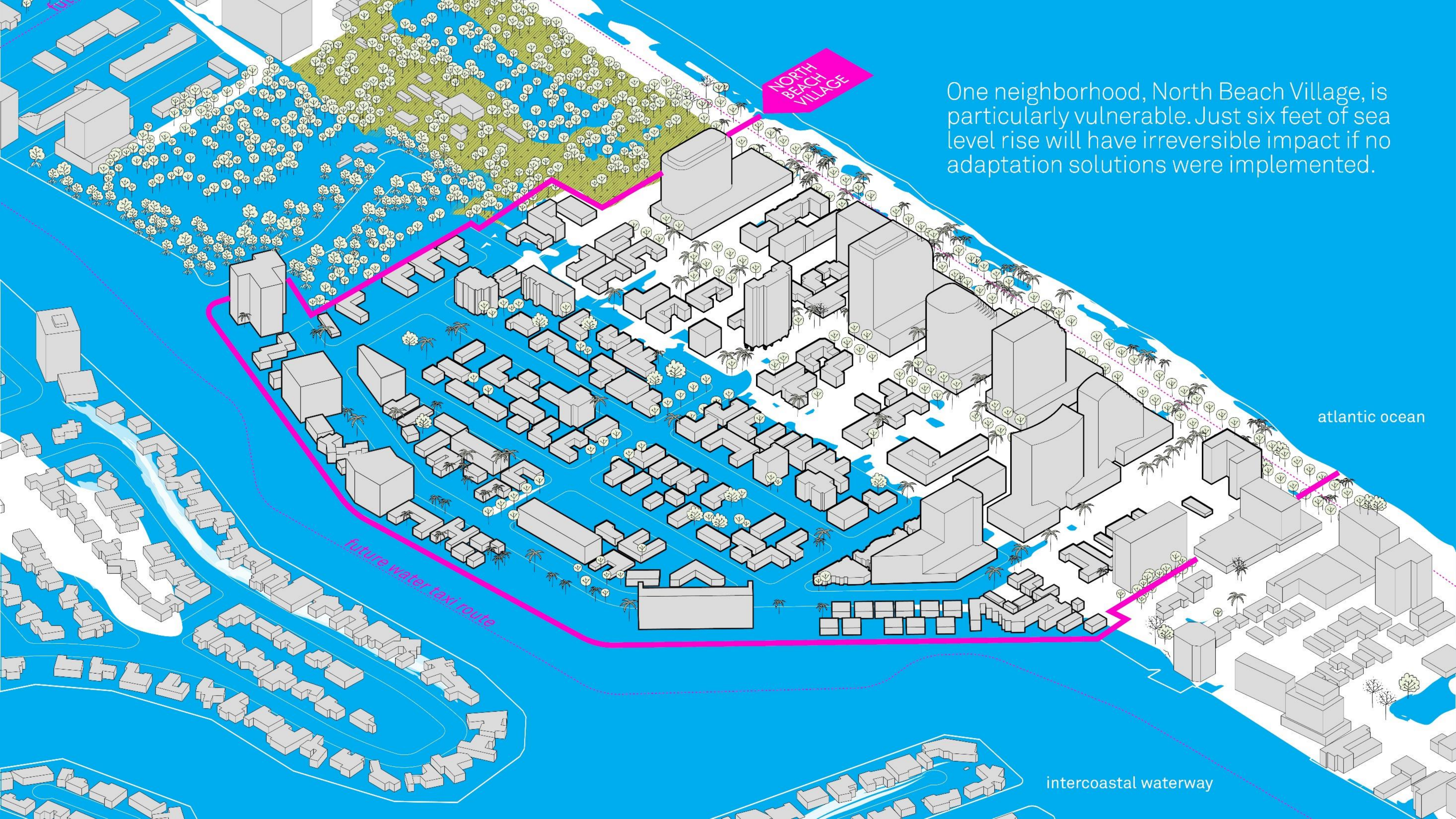
Sand engines and root dunes should be implemented in order to offer a protective layer to barrier island developments and infrastructure. Sand and saltwater should be considered in any design.

major flood type considerations:

storm surge **pollution** **erosion**

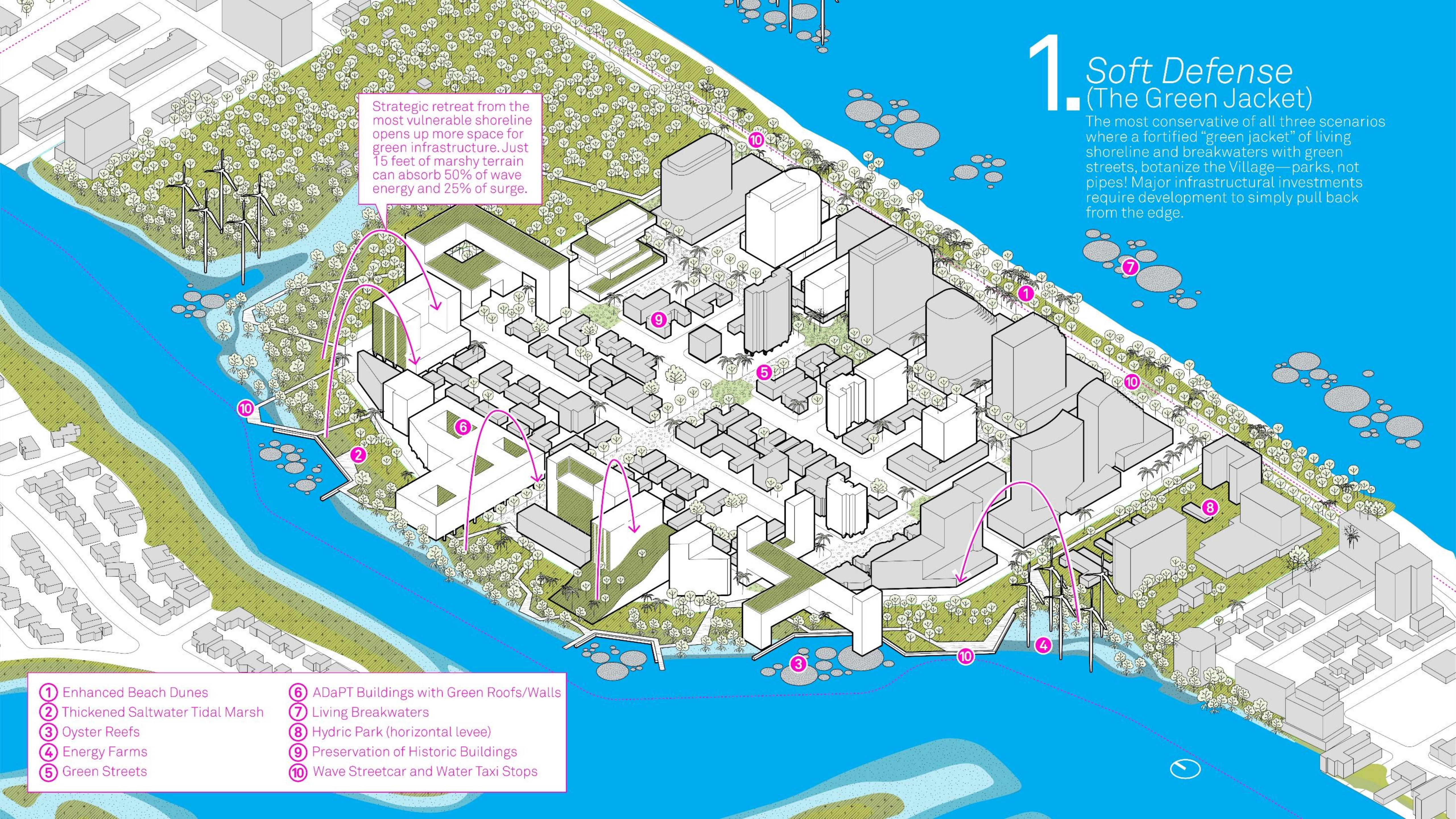


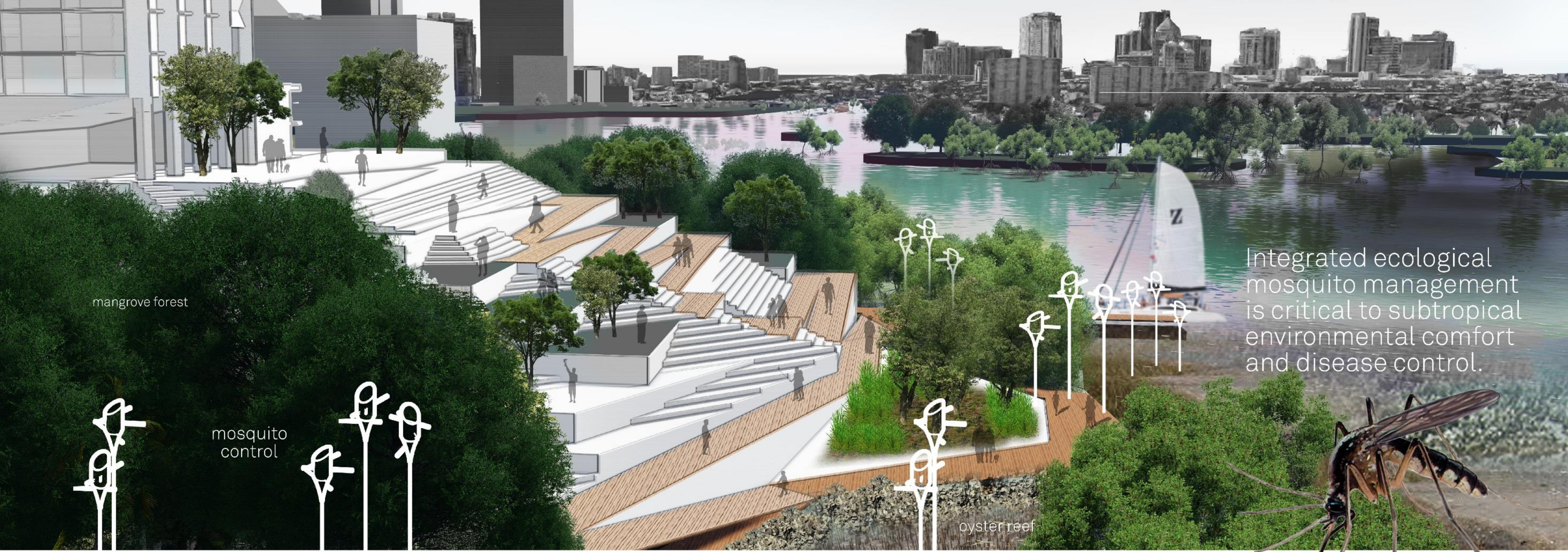
One neighborhood, North Beach Village, is particularly vulnerable. Just six feet of sea level rise will have irreversible impact if no adaptation solutions were implemented.



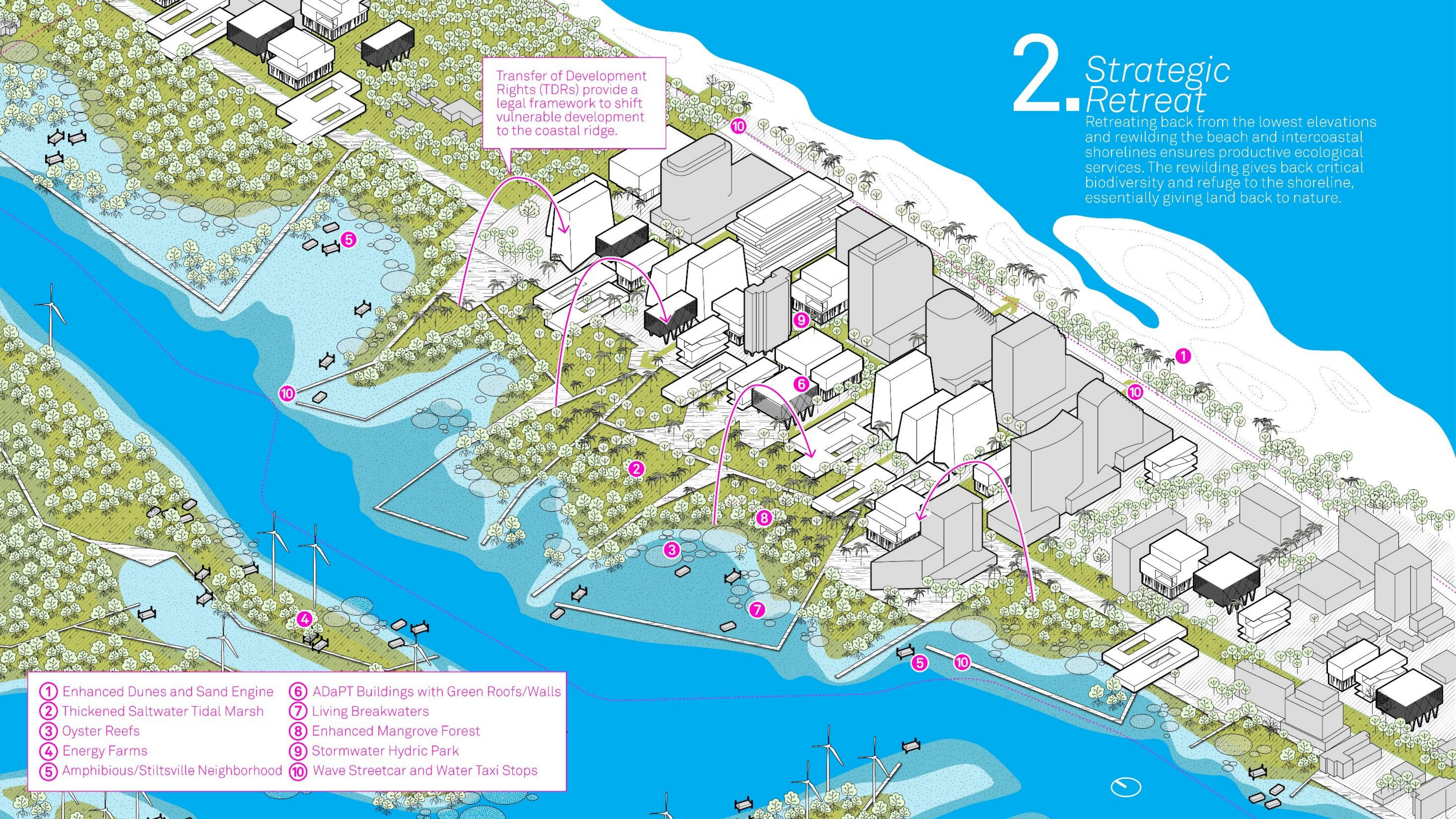
1. *Soft Defense* (The Green Jacket)

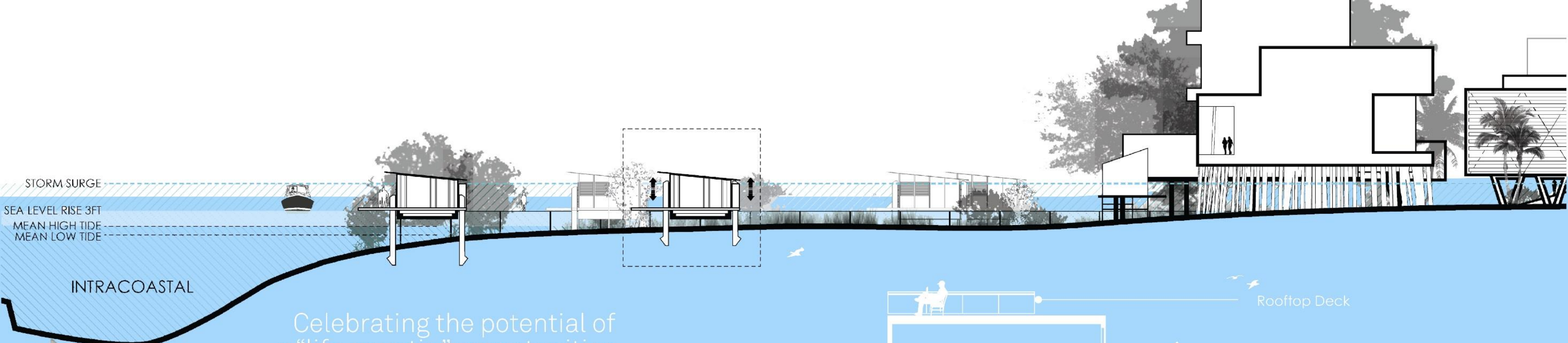
The most conservative of all three scenarios where a fortified “green jacket” of living shoreline and breakwaters with green streets, botanize the Village—parks, not pipes! Major infrastructural investments require development to simply pull back from the edge.



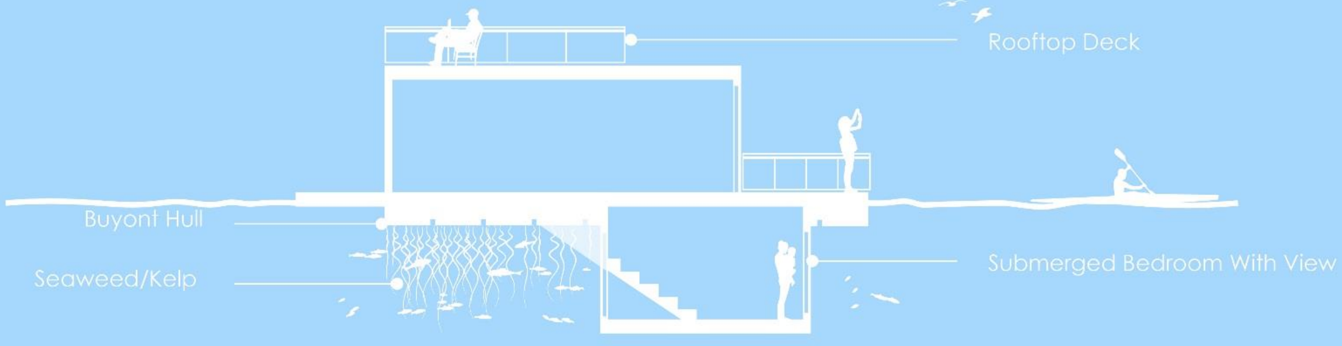

mangrove forest
mosquito control
oyster reef
Integrated ecological mosquito management is critical to subtropical environmental comfort and disease control.


The beach is enhanced with "root" dunes and sand engines.

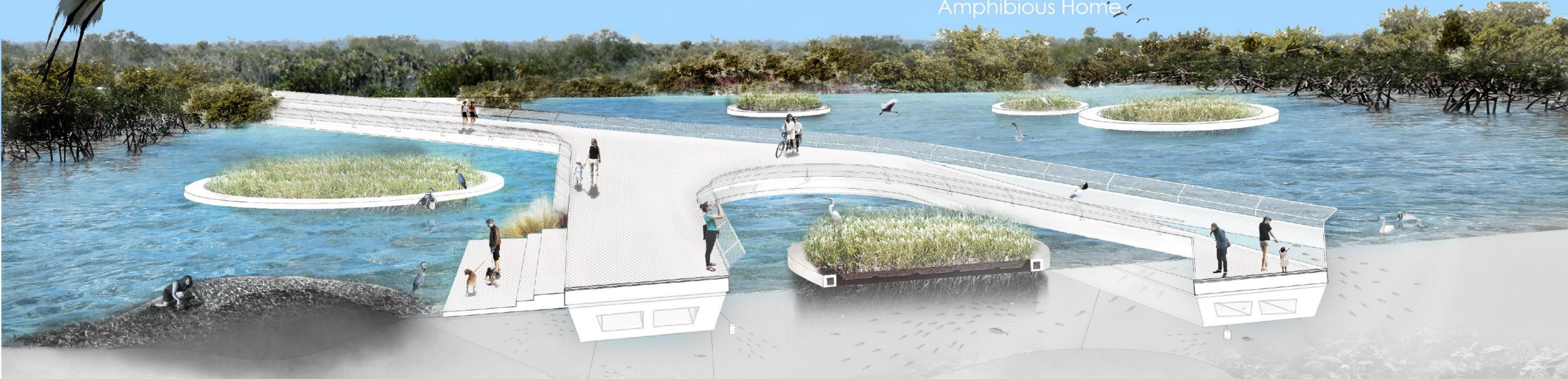

2. Strategic Retreat
Retreating back from the lowest elevations and rewilding the beach and intercoastal shorelines ensures productive ecological services. The rewilding gives back critical biodiversity and refuge to the shoreline, essentially giving land back to nature.
Transfer of Development Rights (TDRs) provide a legal framework to shift vulnerable development to the coastal ridge.
1 Enhanced Dunes and Sand Engine
2 Thickened Saltwater Tidal Marsh
3 Oyster Reefs
4 Energy Farms
5 Amphibious/Stiltsville Neighborhood
6 ADaPT Buildings with Green Roofs/Walls
7 Living Breakwaters
8 Enhanced Mangrove Forest
9 Stormwater Hydric Park
10 Wave Streetcar and Water Taxi Stops



Celebrating the potential of a "life aquatic," opportunities for residents and tourists alike engage the water. New amphibious structures for living and recreation can be a form of adaptation eco-tourism.

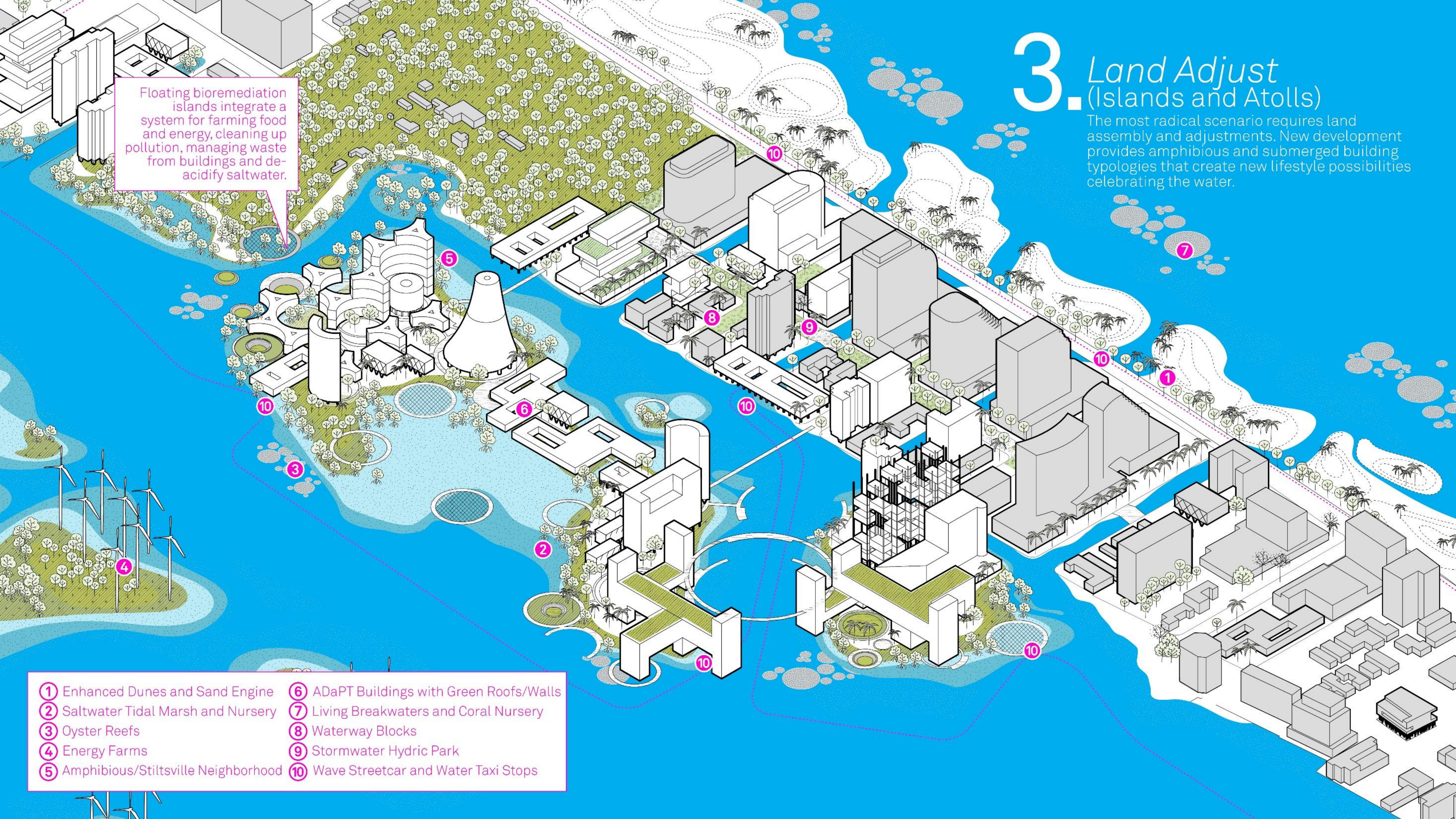


Amphibious Home



3. *Land Adjust* (Islands and Atolls)

The most radical scenario requires land assembly and adjustments. New development provides amphibious and submerged building typologies that create new lifestyle possibilities celebrating the water.




seed
hammock veil
pollinator
adaptive reuse
CO_2
H_2CO_3
refuge/ orchidarium
CH_4
land building/wave attenuation
rubber dunes
carbonic acid scrubber

Miami Beach, Florida
139 units of Senior Affordable Housing

Vista 49 units

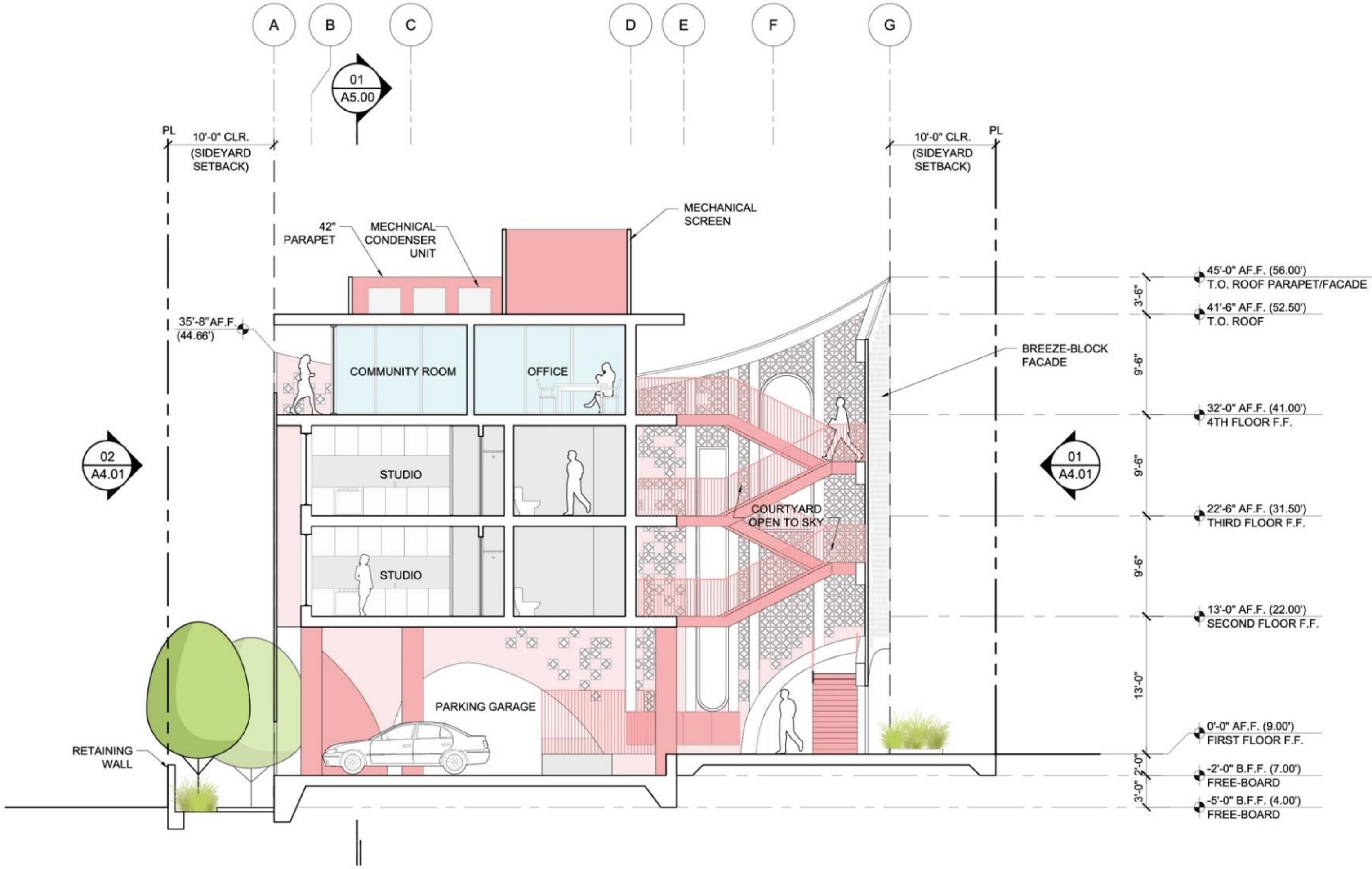
Breeze 70 units

The Heron 20 units

SITE LOCATION / MAP 01

SITE LOCATION / MAP 03


the Heron



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PL
10'-0" CLR.
(SIDEYARD SETBACK)
10'-0" CLR.
(SIDEYARD SETBACK)
PL
MECHANICAL SCREEN
42" PARAPET
MECHNICAL CONDENSER UNIT
35'-8" AF.F. (44.66')
COMMUNITY ROOM
OFFICE
BREEZE-BLOCK FACADE
02
A4.01
01
A4.01
STUDIO
STUDIO
COURTYARD OPEN TO SKY
PARKING GARAGE
RETAINING WALL
45'-0" AF.F. (56.00')
T.O. ROOF PARAPET/FACADE
41'-6" AF.F. (52.50')
T.O. ROOF
32'-0" AF.F. (41.00')
4TH FLOOR F.F.
22'-6" AF.F. (31.50')
THIRD FLOOR F.F.
13'-0" AF.F. (22.00')
SECOND FLOOR F.F.
0'-0" AF.F. (9.00')
FIRST FLOOR F.F.
-2'-0" B.F.F. (7.00')
FREE-BOARD
-5'-0" B.F.F. (4.00')
FREE-BOARD
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9'-6"
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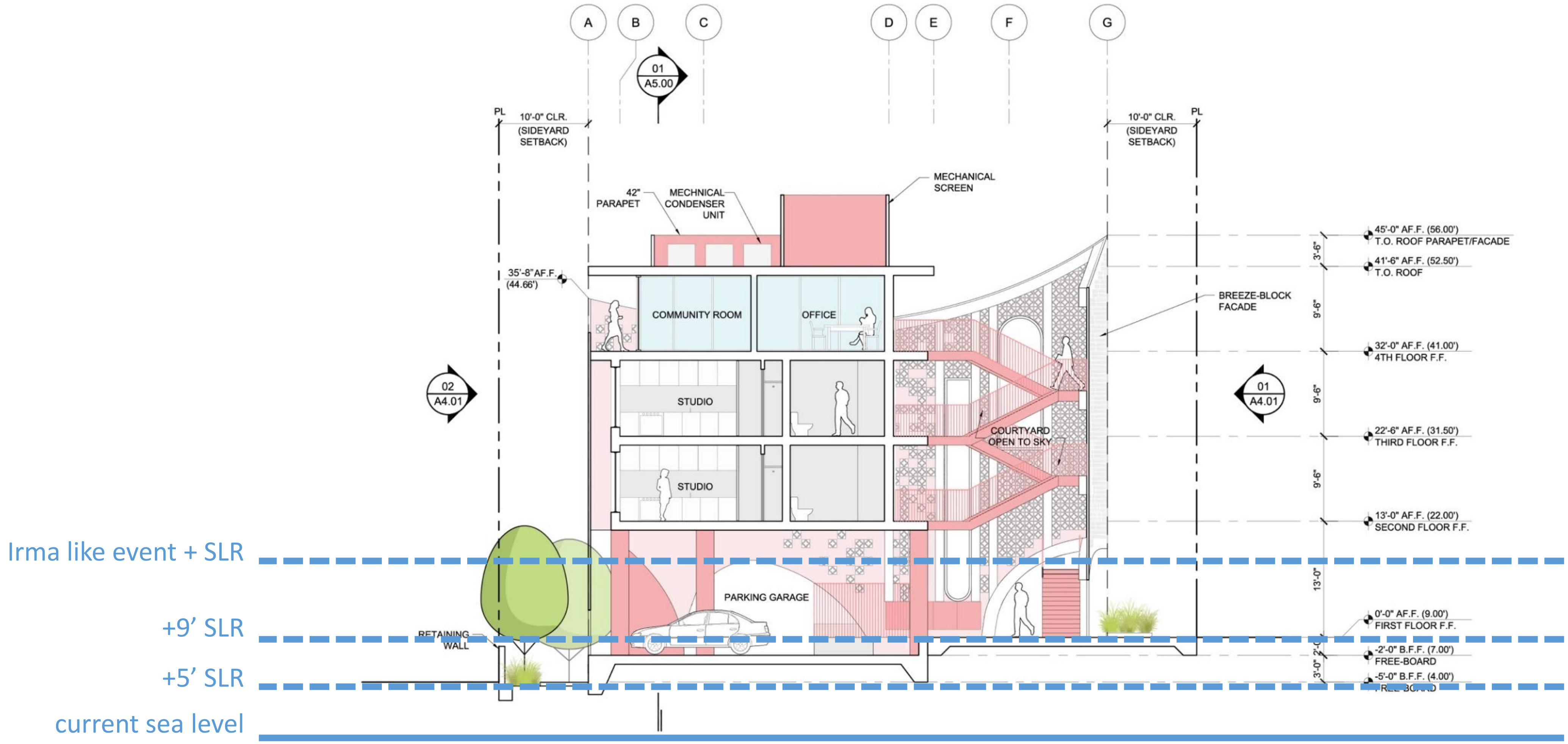

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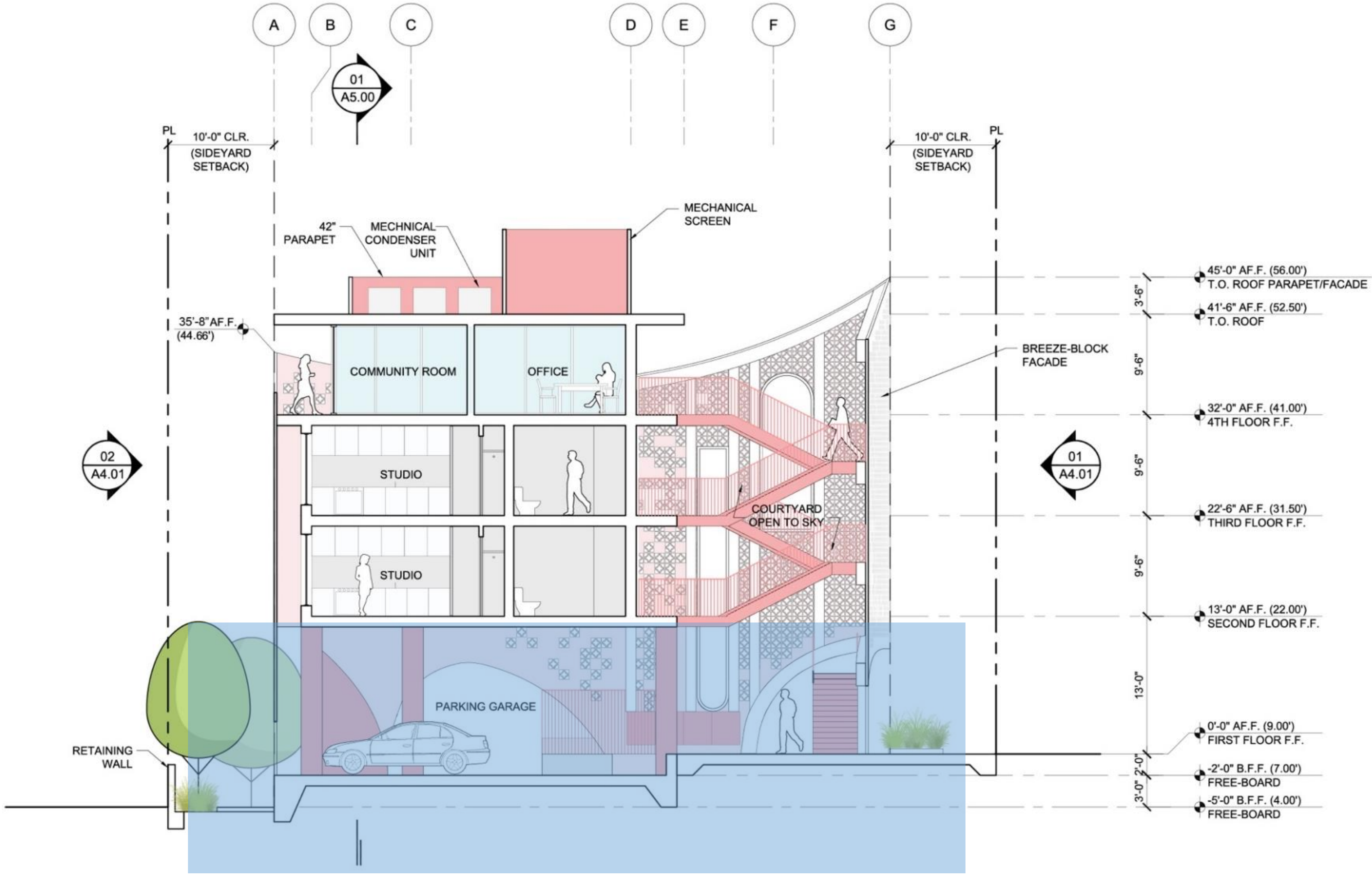
3'-0"
02
A4.01
01
A4.01
STUDIO
STUDIO
COURTYARD OPEN TO SKY
PARKING GARAGE
RETAINING WALL
Irma like event + SLR
+9' SLR
+5' SLR
current sea level


MIAMI-DADE FIRE RESCUE
STATE LAW ENFORCEMENT
FWC


XYPEX
ADMIX C-1000
Concrete Waterproofing
By Crystallization
NET 60 lb./27.2 kg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13'-0"
2'-0"
3'-0"

DESIGN/ FLOOR PLANS

SECOND FLOOR
SCALE: 1/16"=1'-0"


SIDEWALK CLOSED
DETOUR


Genie


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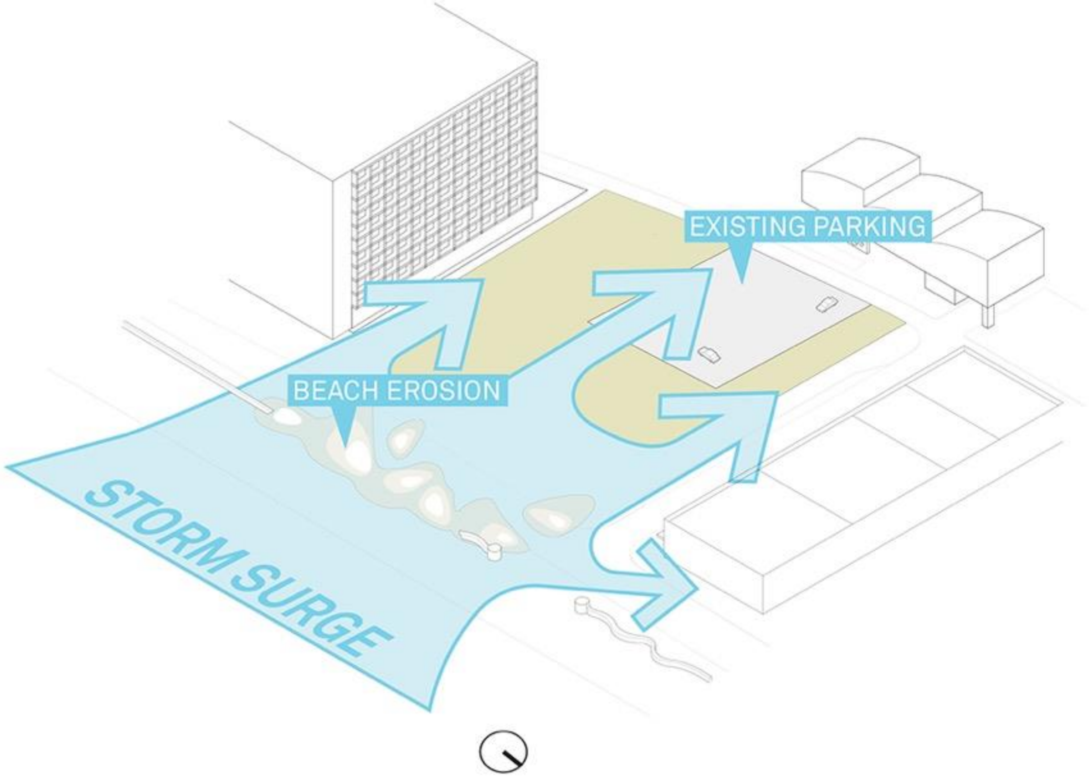
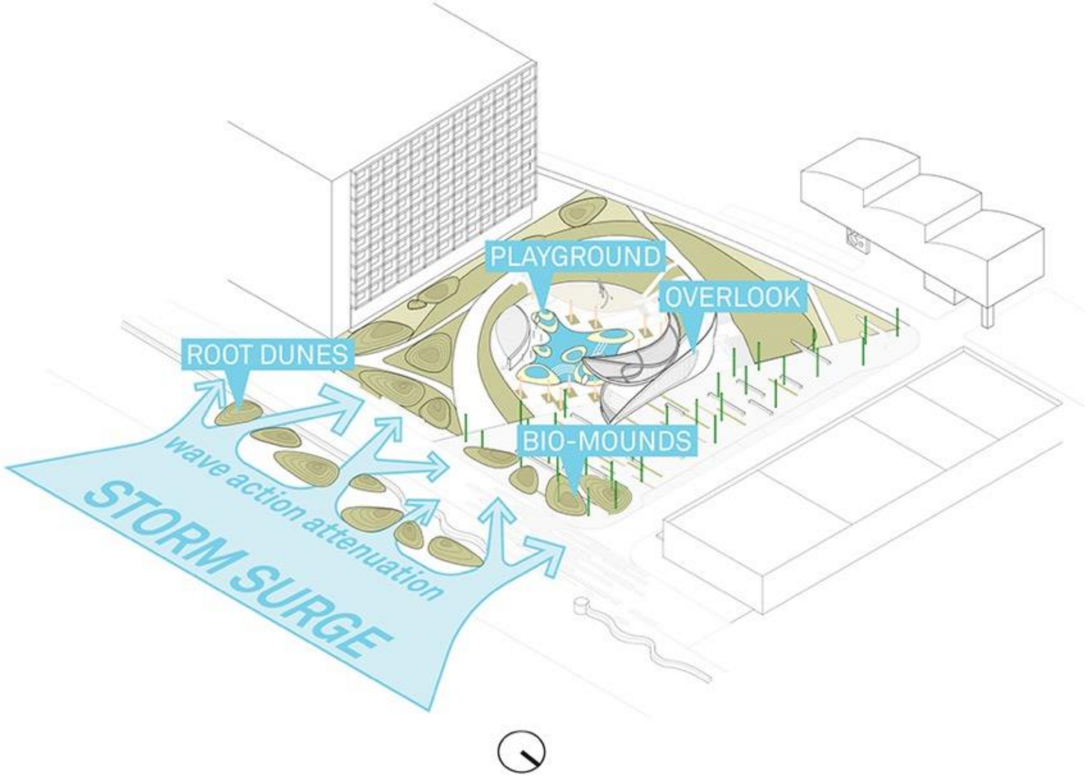
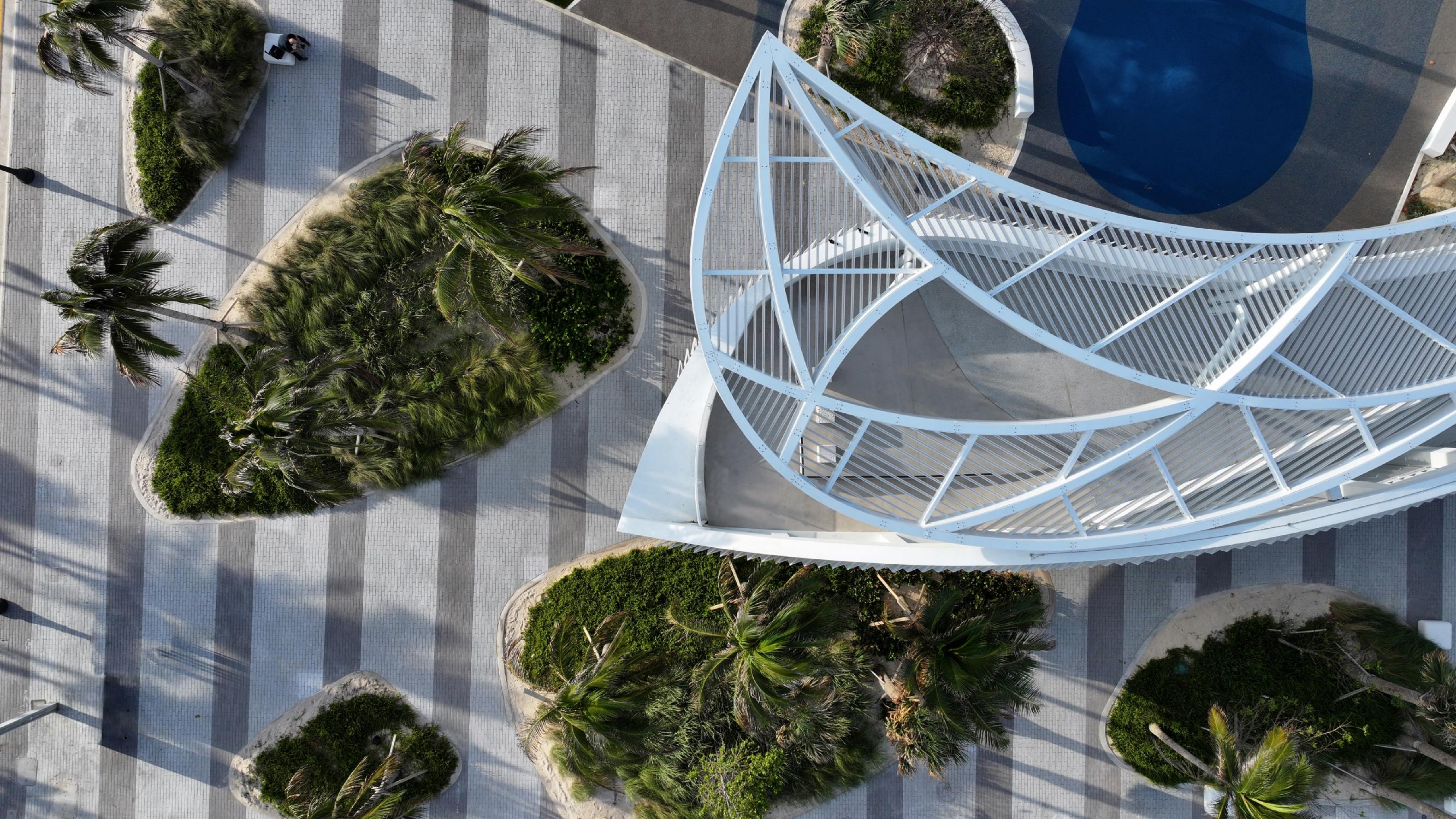


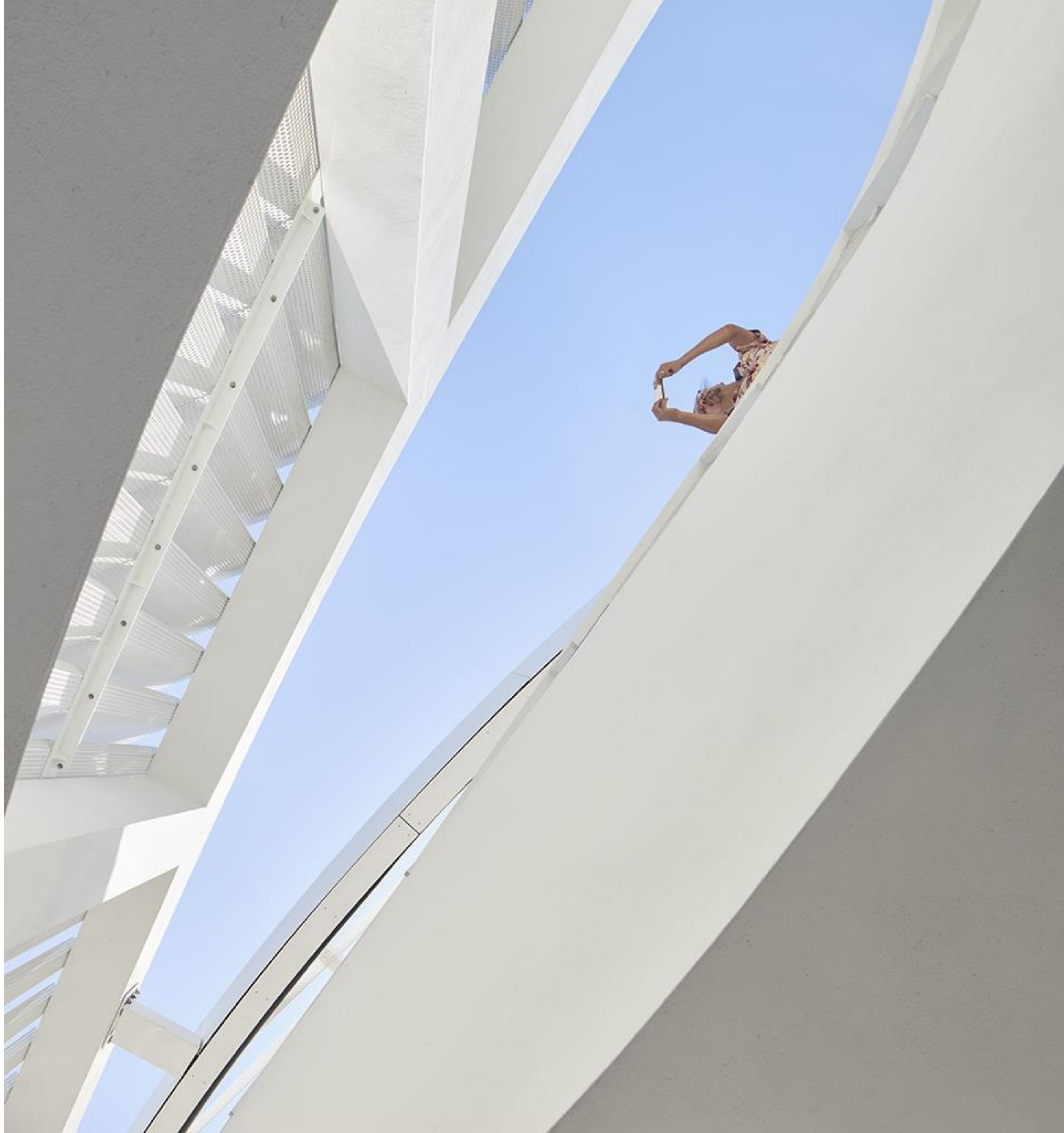
EXISTING
PARK



PROPOSED
PARK

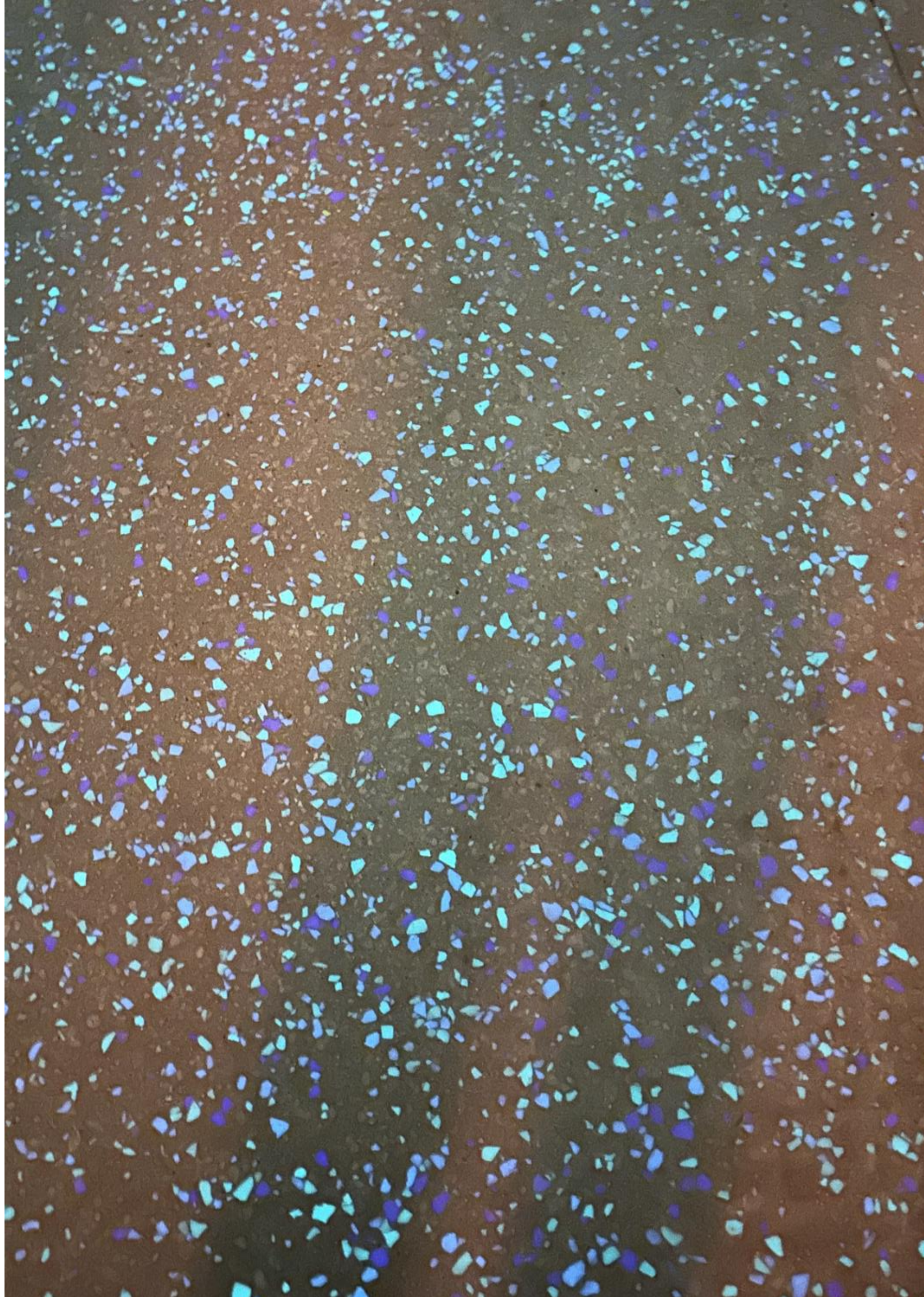

MAREN




MARKEN





"Supply creates its own demand." Jean-Baptiste Say, French Economist

Jeffrey Huber, FAIA, ASLA, LEEDap, NCARB, WEDG
huberj@fau.edu or huber@bsharchitects.com