Bayside Conceptual Adaptation Strategy Designs Captiva, FL

Captiva Community Panel Meeting

January 11, 2022

integral consulting inc.

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Sponsors

- Captiva Erosion Prevention District
- Sanibel Captiva Conservation Foundation
- Captiva Civic Association
- Jay and Cindy Brown
- Robin and Lisolotte Vince
- Surinder and Edda Sehgal

Bio – Dr. Cheryl Hapke

- Ph.D. in Coastal Geology, UC Santa Cruz
- 22 years with U.S. Geological Survey studying coastal change hazards and vulnerabilities (early retirement in 2019)
- Integral Consulting: Coastal Resilience lead, East and Gulf Coasts
  - Working with communities and coastal facilities to understand and model coastal hazards, conduct vulnerability and risk assessments, and develop adaptation plans to address storm and sea level rise hazards
- Research Professor at USF College of Marine Science
- 2021 AEG Jahn's Distinguished Lecturer, also awarded a 2021 Presidential Citation from AEG
- Over 80 peer-reviewed papers, book chapters and technical reports
- Served as coastal science subject matter expert to numerous local, state and federal agencies

Background and Scope

- Project initiated following Integral's completion of a baseline sea level rise (SLR) vulnerability assessment (1, 2, and 4 ft of SLR)
- Vulnerability assessment *only included SLR*, not storms: have submitted 3 grant proposals to conduct full assessments of both Captiva and Sanibel that include storm modelling as well as SLR
- Captiva SLR committee identified 5 priority areas on bayside of island
- Committee funded Integral to develop conceptual adaptation designs for 2 ft of SLR for each of 5 bayside priority areas
- Integral presented designs to SLR committee (iterative process); currently working on a technical memorandum that will be available to the community

Steps to Create Adaptation Plans

1. Communities can follow this roadmap of steps to create an adaptation plan.

tation Planning Guidebook

Vulnerability Assessment 2 ft SLR

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Legend

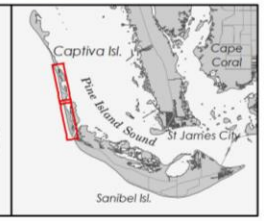
Coastal Hazard Zones

Rising Tide (feet)

2'

Boat Ramp

Roads



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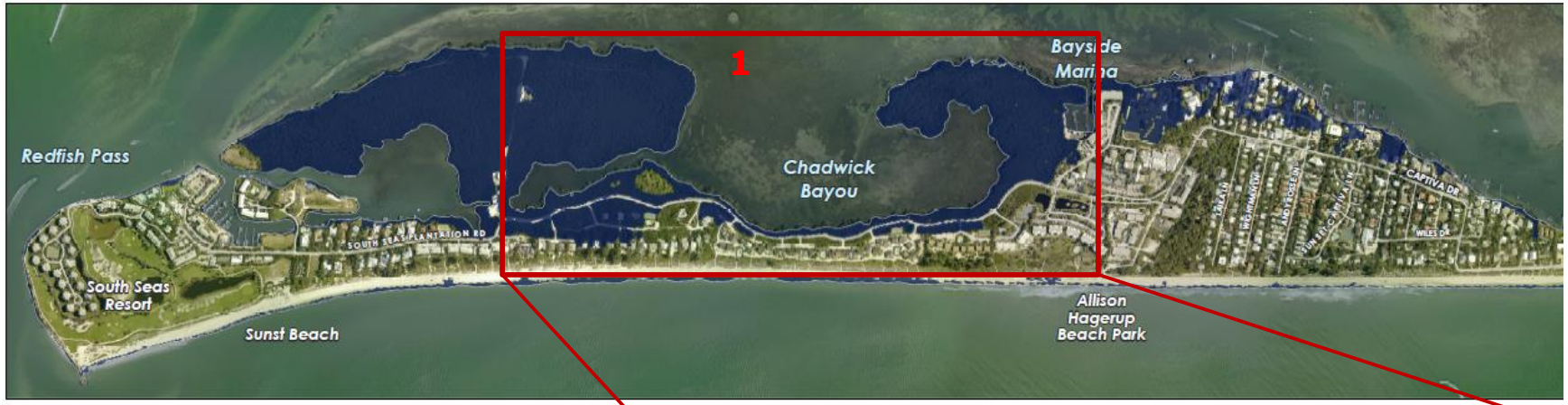
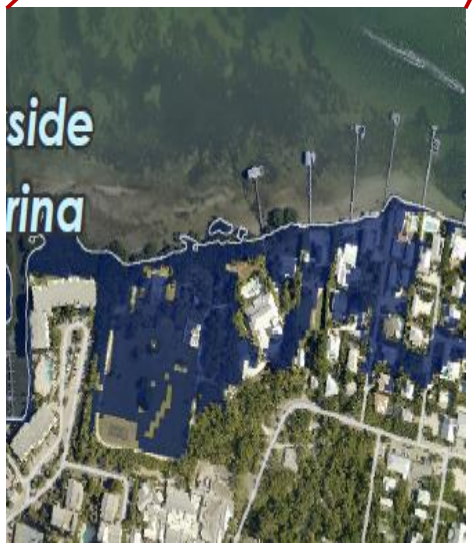


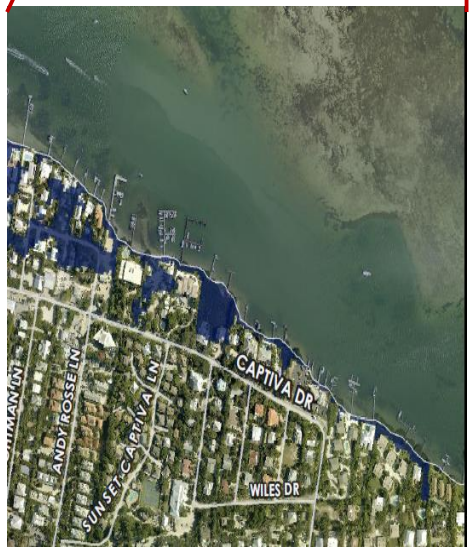
Site characteristics

- Low wave exposure
- Large accommodation space
- Low gradient
- Low tidal flow
- Protective seagrass beds/shoals

Site characteristics

- High potential exposure to waves
- Moderate accommodation space
- Some tidal flow impacts
  - (3>2)
- Depth variations
- Different orientations





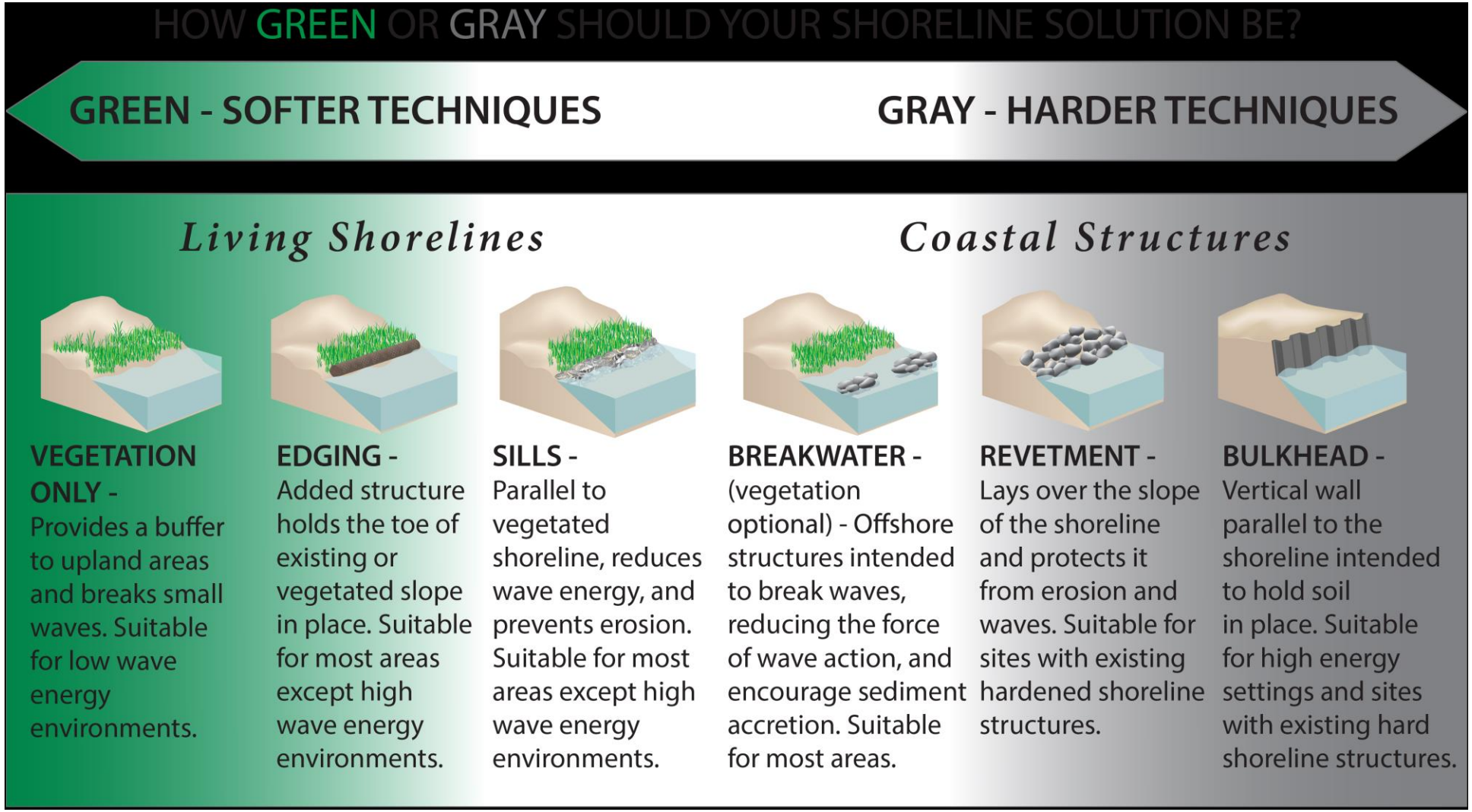
Site characteristics

- No exposure to waves
- Tidal flow impacts
- Little accommodation space

Site characteristics

- Moderate exposure to waves
- Large tidal flow impacts
- Little accommodation space

Gray vs. Green Adaptation Solutions



Conceptual Designs

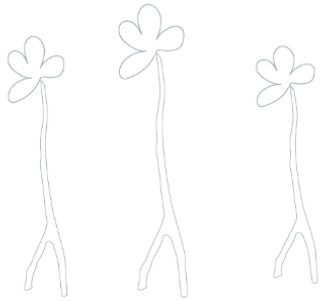
- Considered green and gray options (living shorelines through seawalls)
- Evaluated designs/design elements based on:
  - Efficacy
  - Economics
  - Sustainability
  - Impacts on nature
  - Consistency with Captiva Plan
  - Permitable in an aquatic preserve
- Elements are interconnected, designed to be used together and complement one another
- All adaptation strategies will require maintenance through time

Design Elements

Mangrove seedling = individual mangrove seedlings

Purpose: inexpensive approach to encourage mangrove recovery and propagation

Where: locations with low exposure to waves and tidal flow or that are protected from waves and flow by other features (i.e. sediment berms)



Young mangrove = small but established mangrove trees

Purpose: restores mangroves and encourages propagation

Where: locations where mangroves have been removed or heavily cropped/thinned; locations where tidal flow is too high for mangrove seedlings; to enhance and encourage seedlings to propagate

Design Elements

Salt tolerant vegetation = landscaping option

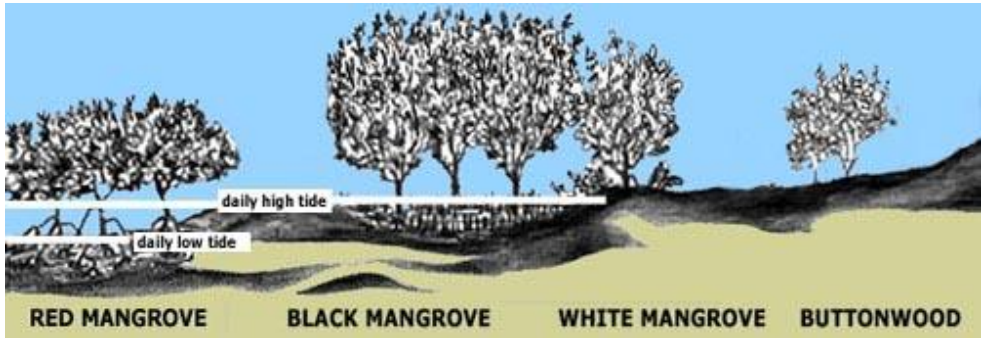
Purpose: provides root system to hold elevated fill in place; provides aesthetics landward of seawalls

Where: landward locations to where no plantings exist or where land surface has been elevated with fill

Upland (black) mangroves = mangrove varietals that exist higher in the intertidal zone

Purpose: restores natural landward mangrove fringe; creates more diverse mangrove forest

Where: landward locations where mangroves have been removed or heavily cropped/thinned

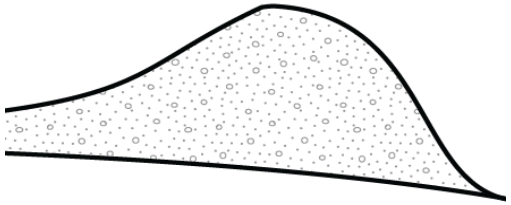


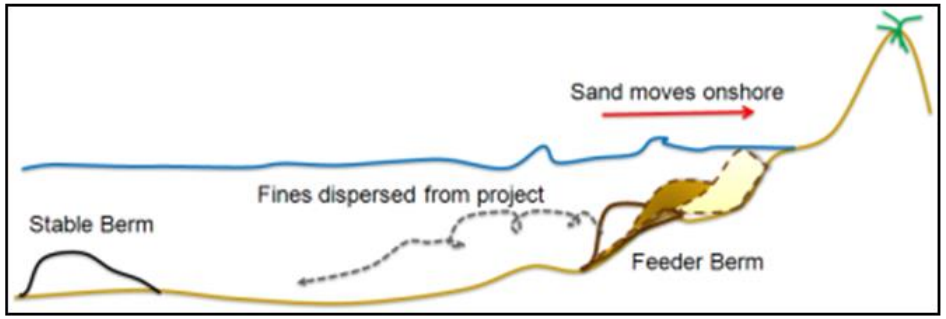
Design Elements

Protective berm or feeder berm = sand or silt dependent on its purpose

Purpose: provide protection of living shoreline components (i.e. mangrove seedlings), and acts as feeder berm to provide additional sediment to encourage mangrove propagation landward of the berm

Where: applicable in all types of environments except for where there is strong tidal flow (i.e. Blind Pass)

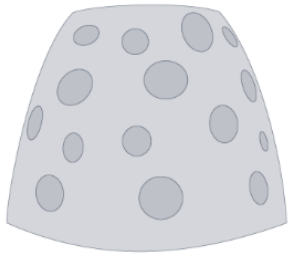




Reef balls = portable fiberglass mold, filled with concrete

Purpose: protection from erosion; supports marine life, recruitment

Where: areas of high tidal flow and medium wave exposure

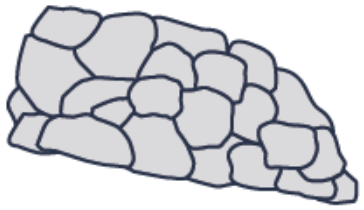


Design Elements

Rock sill = cobbles

Purpose: provide protection for sediment berm from wave and current erosion

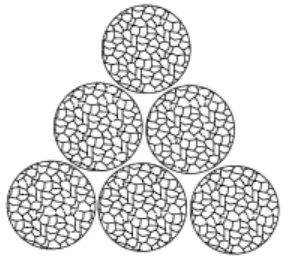
Where: locations where exposure to waves and tidal flow is medium to high



Coir logs (natural material)

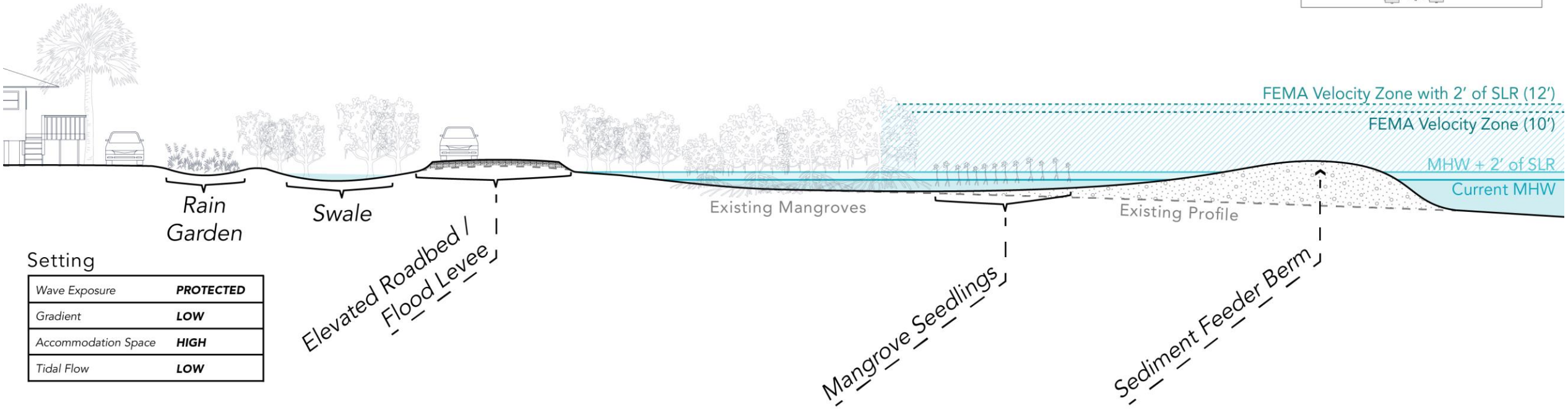
Purpose: provide core reinforcement to protective sediment berm or feeder berm

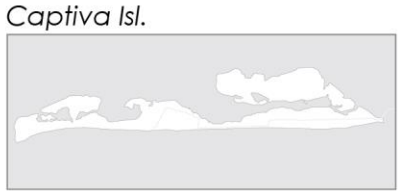
Where: locations where exposure to waves and tidal flow is medium to high

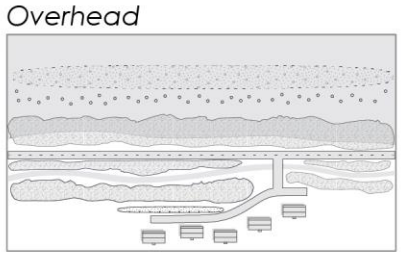


Conceptual Designs - Section A

Section A







Setting

Wave Exposure	***PROTECTED***
Gradient	***LOW***
Accommodation Space	***HIGH***
Tidal Flow	***LOW***

Priority Area 1: Chadwick Bayou

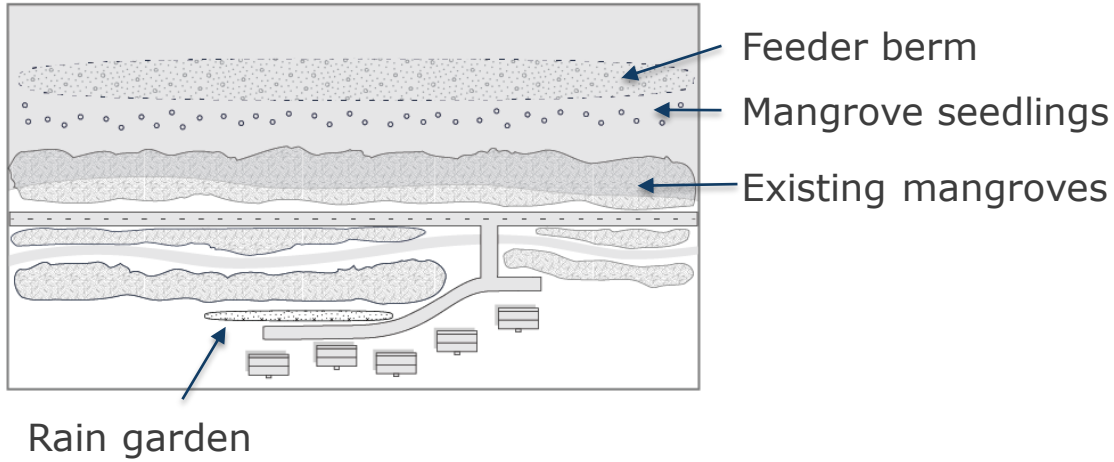
Conceptual Designs - Section A

Priority Area 1: Chadwick Bayou

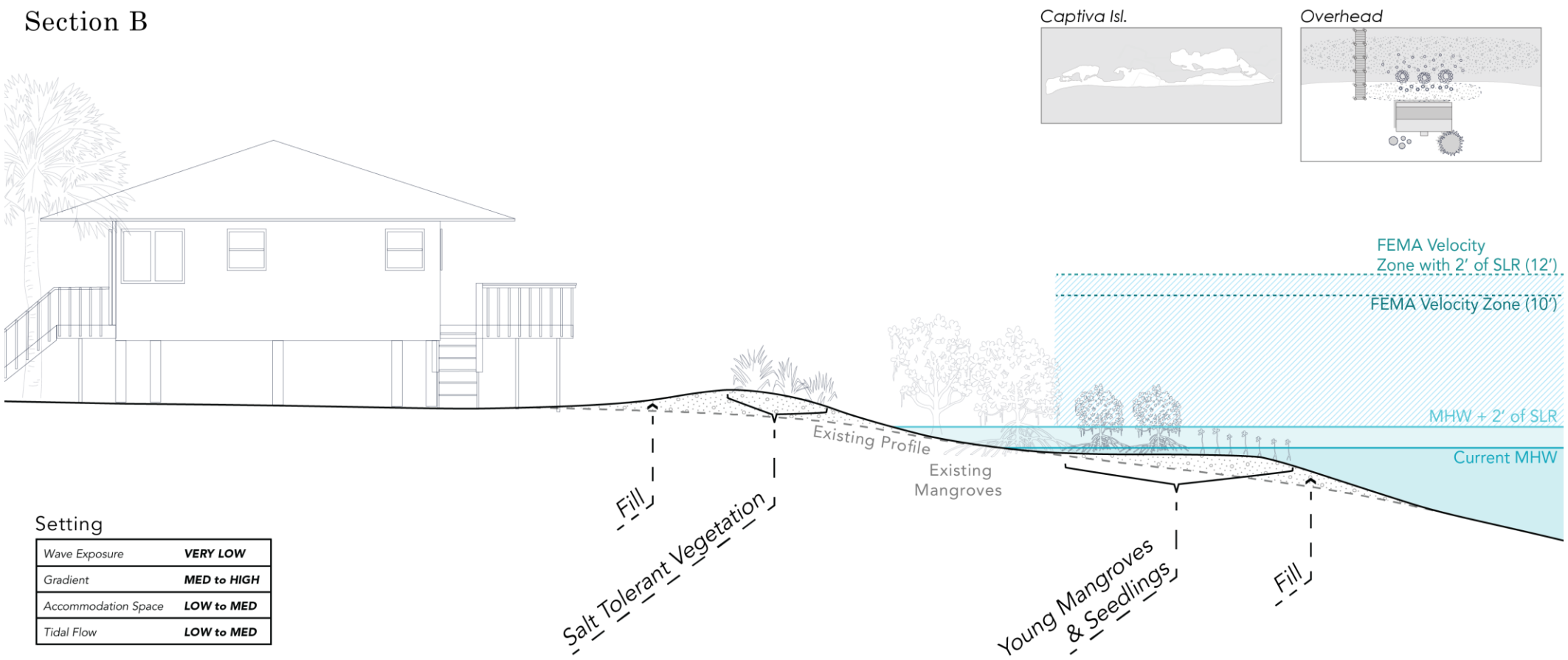
Setting

Wave Exposure	***PROTECTED***
Gradient	***LOW***
Accommodation Space	***HIGH***
Tidal Flow	***LOW***

Overhead



Conceptual Designs - Section B



Setting

Wave Exposure	**VERY LOW**
Gradient	**MED to HIGH**
Accommodation Space	**LOW to MED**
Tidal Flow	**LOW to MED**

Priority Area 4: Buck Key

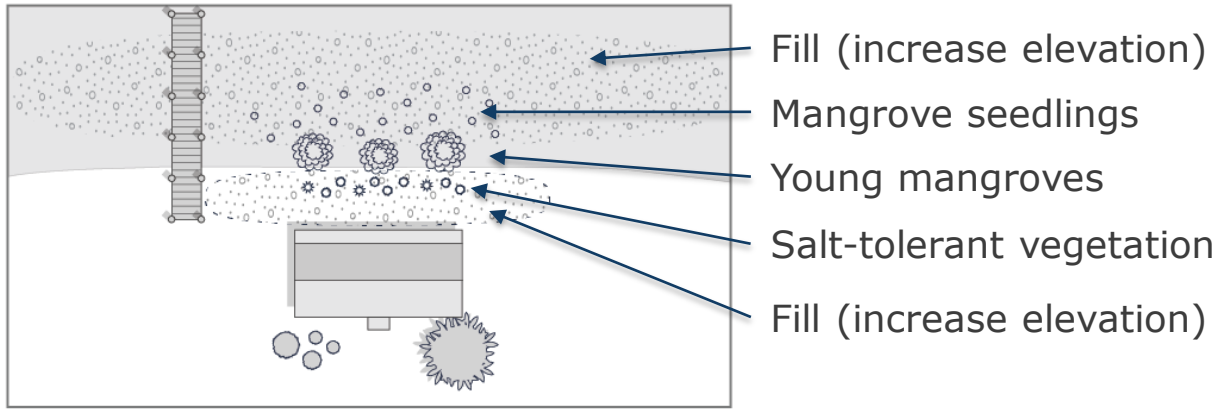
Conceptual Designs - Section B

Priority Area 4: Buck Key

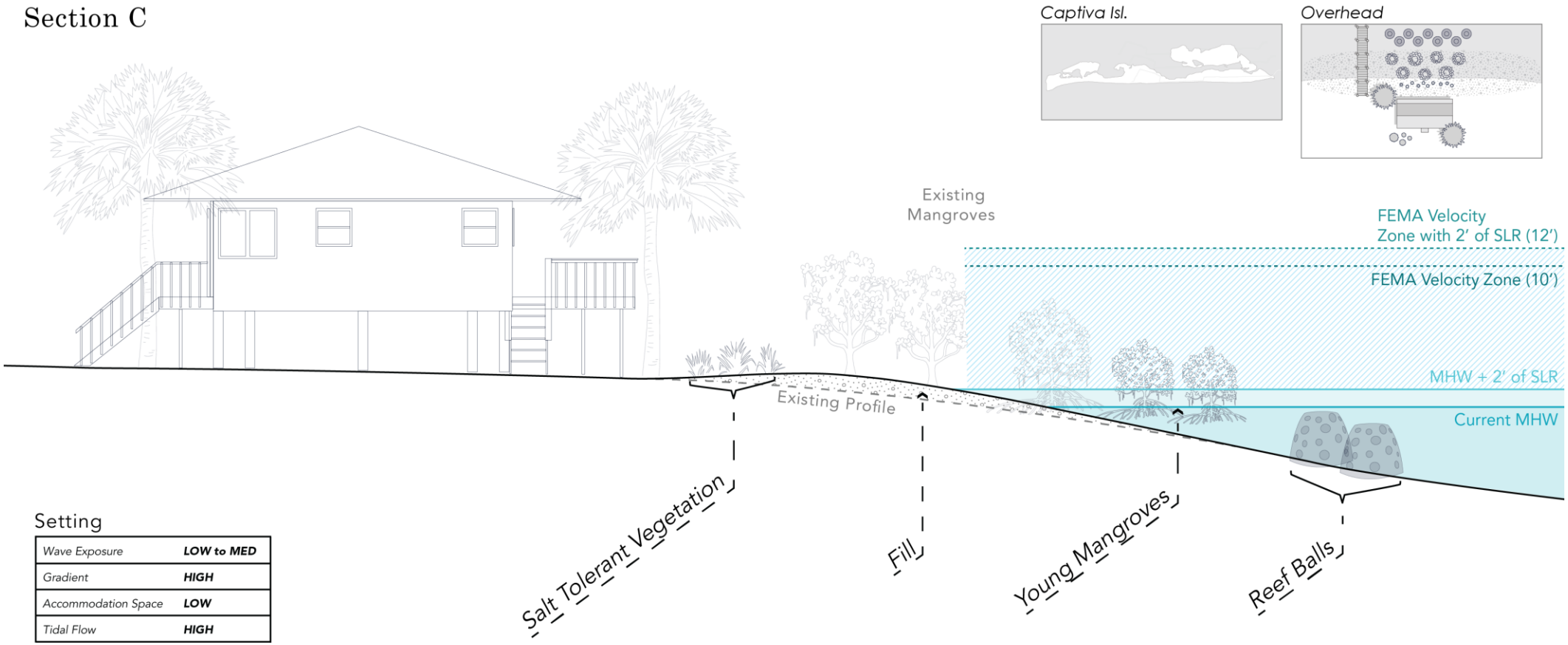
Setting

Wave Exposure	***VERY LOW***
Gradient	***MED to HIGH***
Accommodation Space	***LOW to MED***
Tidal Flow	***LOW to MED***

Overhead



Conceptual Designs - Section C



Setting

Wave Exposure	***LOW to MED***
Gradient	***HIGH***
Accommodation Space	***LOW***
Tidal Flow	***HIGH***

Priority Area 5: Blind Pass

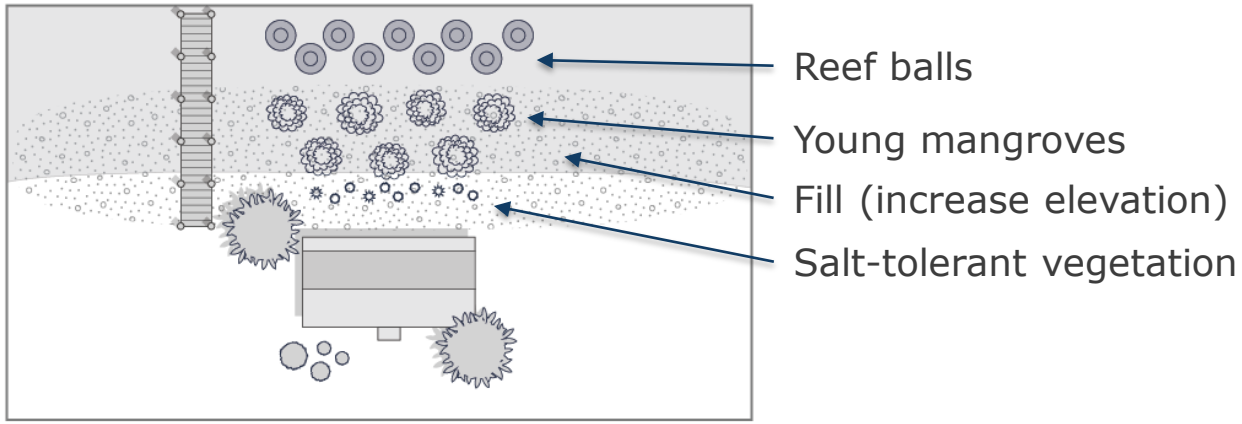
Conceptual Designs - Section C

Priority Area 5: Blind Pass

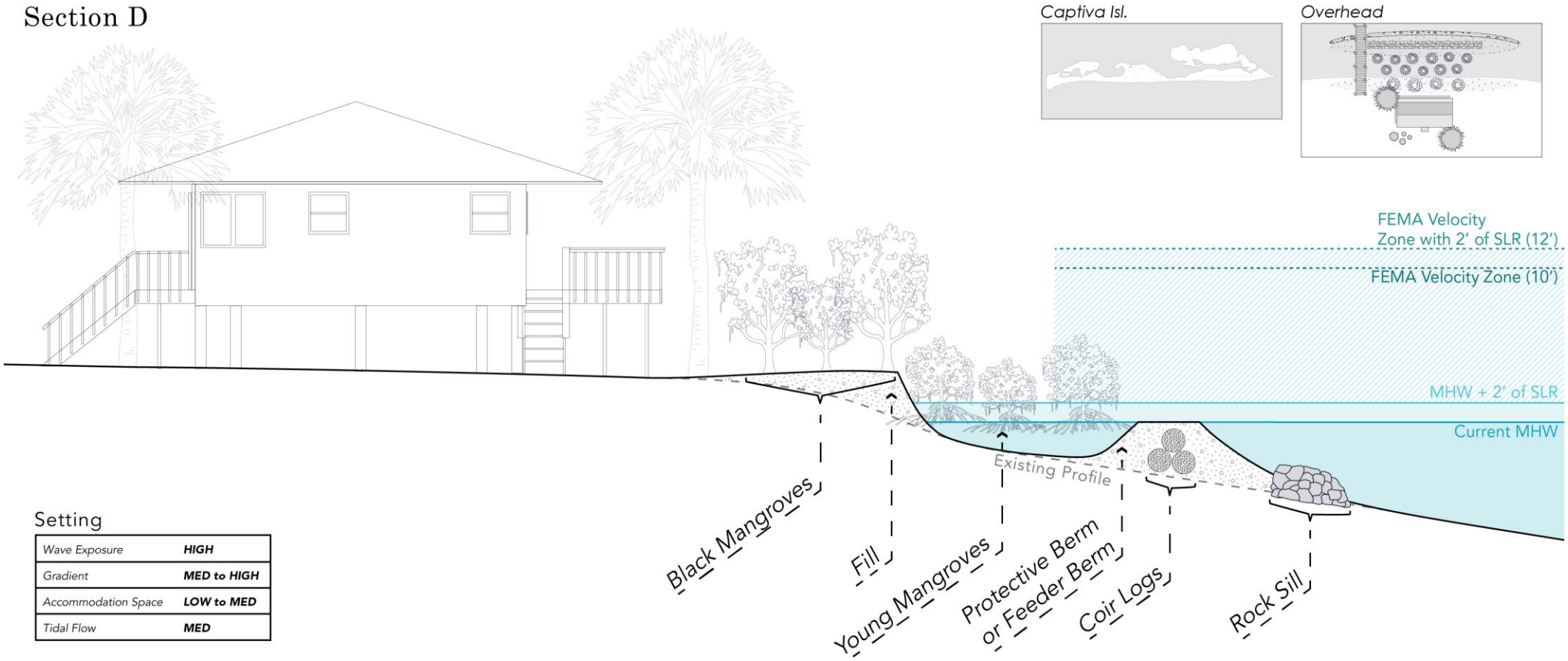
Setting

Wave Exposure	***LOW to MED***
Gradient	***HIGH***
Accommodation Space	***LOW***
Tidal Flow	***HIGH***

Overhead



Conceptual Designs - Section D



Setting

Wave Exposure	***HIGH***
Gradient	***MED to HIGH***
Accommodation Space	***LOW to MED***
Tidal Flow	***MED***

Priority Area 2 or 3: Village, no existing seawall

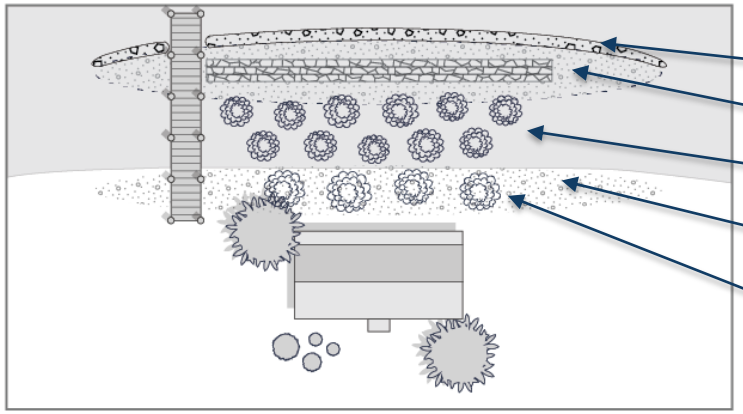
Conceptual Designs - Section D

Priority Area 2 or 3: Village, no existing seawall

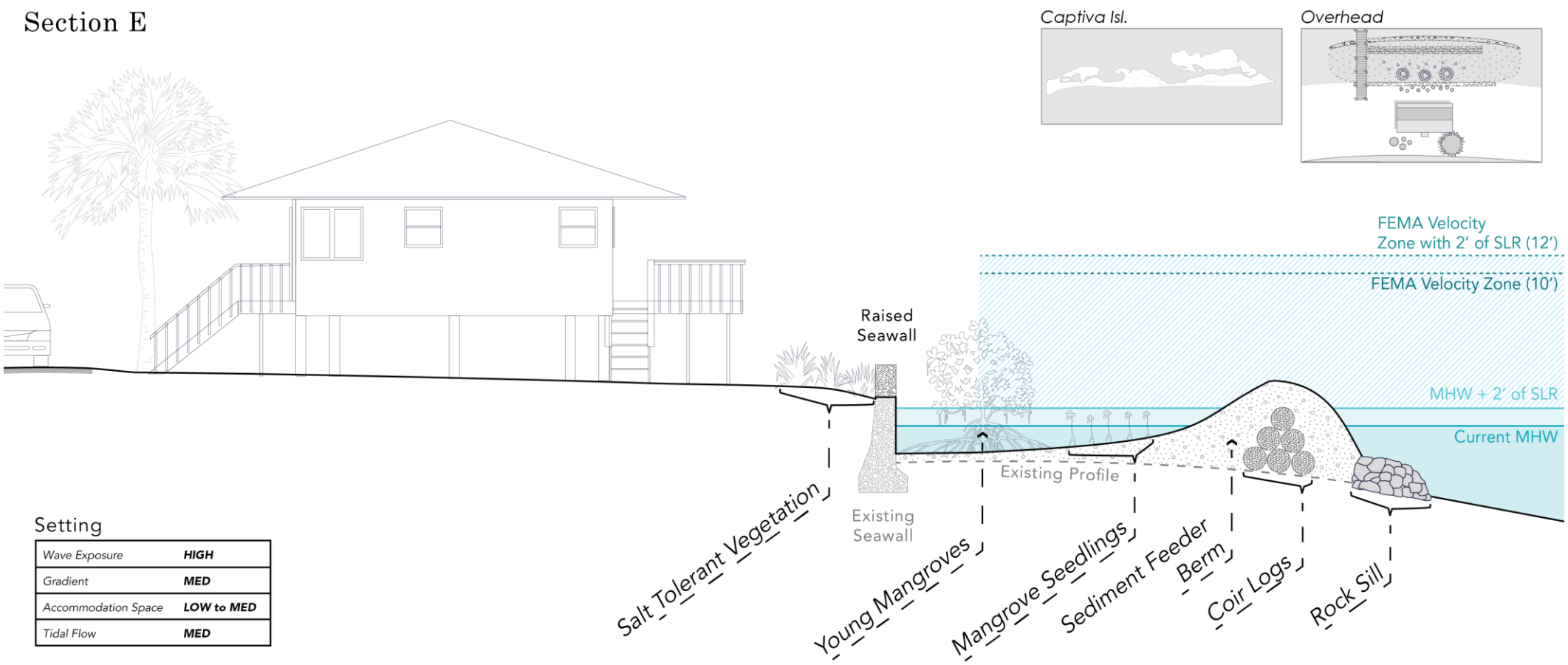
Setting

Wave Exposure	***HIGH***
Gradient	***MED to HIGH***
Accommodation Space	***LOW to MED***
Tidal Flow	***MED***

Overhead



Conceptual Designs - Section E



Setting

Wave Exposure	***HIGH***
Gradient	***MED***
Accommodation Space	***LOW to MED***
Tidal Flow	***MED***

Priority Area 2 or 3: Village, seawall

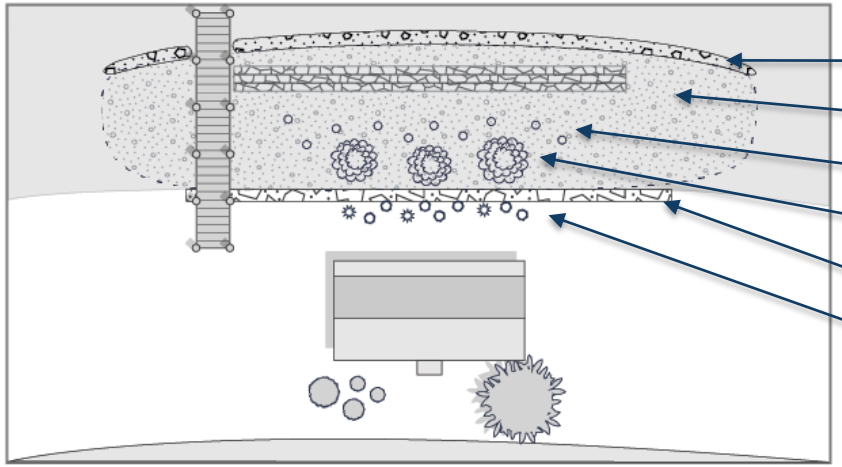
Conceptual Designs - Section E

Priority Area 2 or 3: Village, seawall

Setting

Wave Exposure	***HIGH***
Gradient	***MED***
Accommodation Space	***LOW to MED***
Tidal Flow	***MED***

Overhead



Summary

- Conceptual designs to evaluate a variety of adaptation options
- Intended to be interconnected – the elements work together for best success
- Consideration of what would be permitable in an aquatic preserve
- Intended to address SLR of 2 ft, but designs do incorporate some storm protection features
- Maintenance will be required throughout history of project, similar to Gulf beach nourishment