AECOM

Engineering with Nature-based Solutions

October 2022: ULI Coastal Forum

Presenter: Taylor Nordstrom, PE

Delivering a better world

Credit: Erica Harris (AECOM)

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Coastal Design Considerations for Nature-based solutions

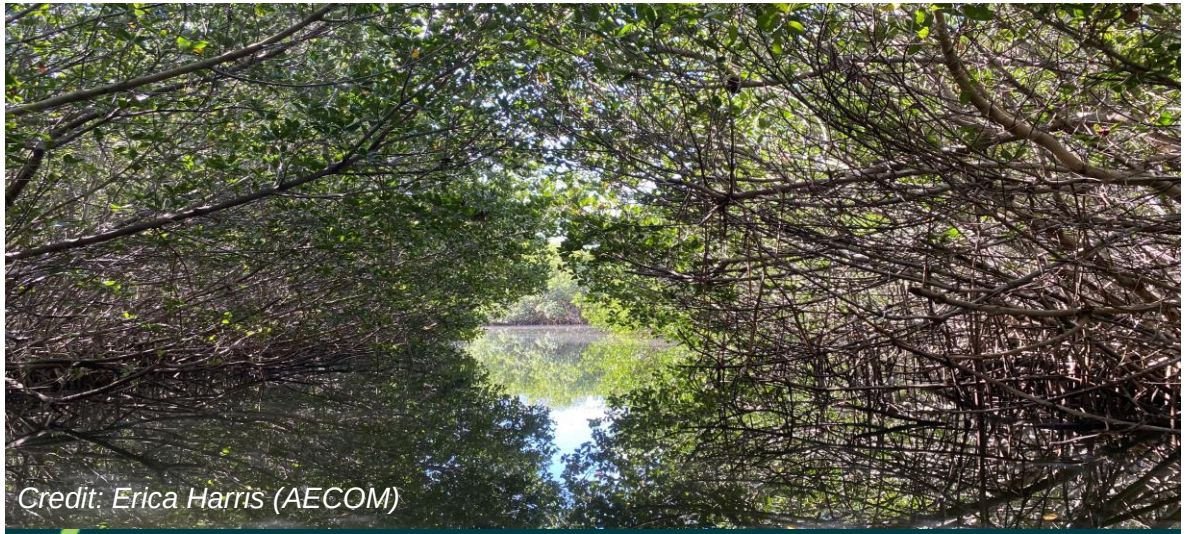
Coastal processes—storm surge, shoreline features, wave effects, and relative sea level rise

Compound flooding—compounded effects of riverine flooding and storm surge in coastal areas impacts coastal development

Sediment management—finding large quantities of sand is a big design factor that can dramatically affect cost

Permitting—environmental considerations, such as endangered species and protected habitats, can affect timelines and schedules

Freshwater inflow—poorly planned development can reduce FWI to the coast, leading to cascading effects on sediment management, water quality, and ecosystems


Credit: Erica Harris (AECOM)

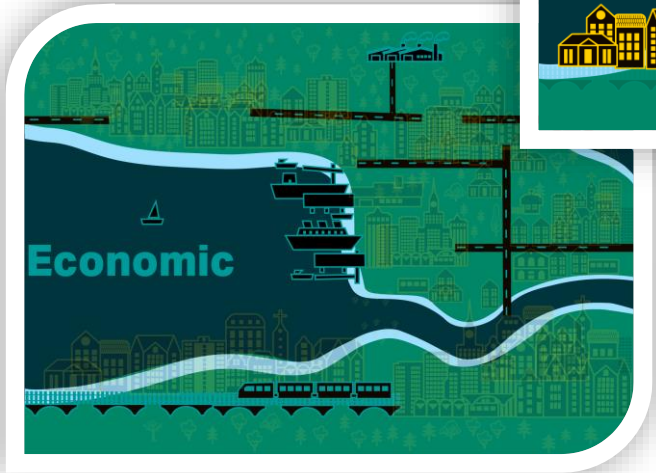
Strengthening Climate Resilience

Nature-based Solutions

We employ Nature-based Solutions (NbS) to identify, minimize, and recover from the impacts of climate change while working to create a more resilient, biodiverse, and sustainable world in which to thrive. Nature-based Solutions are actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits (from IUCN.org).

Nature Based Hazard Mitigation

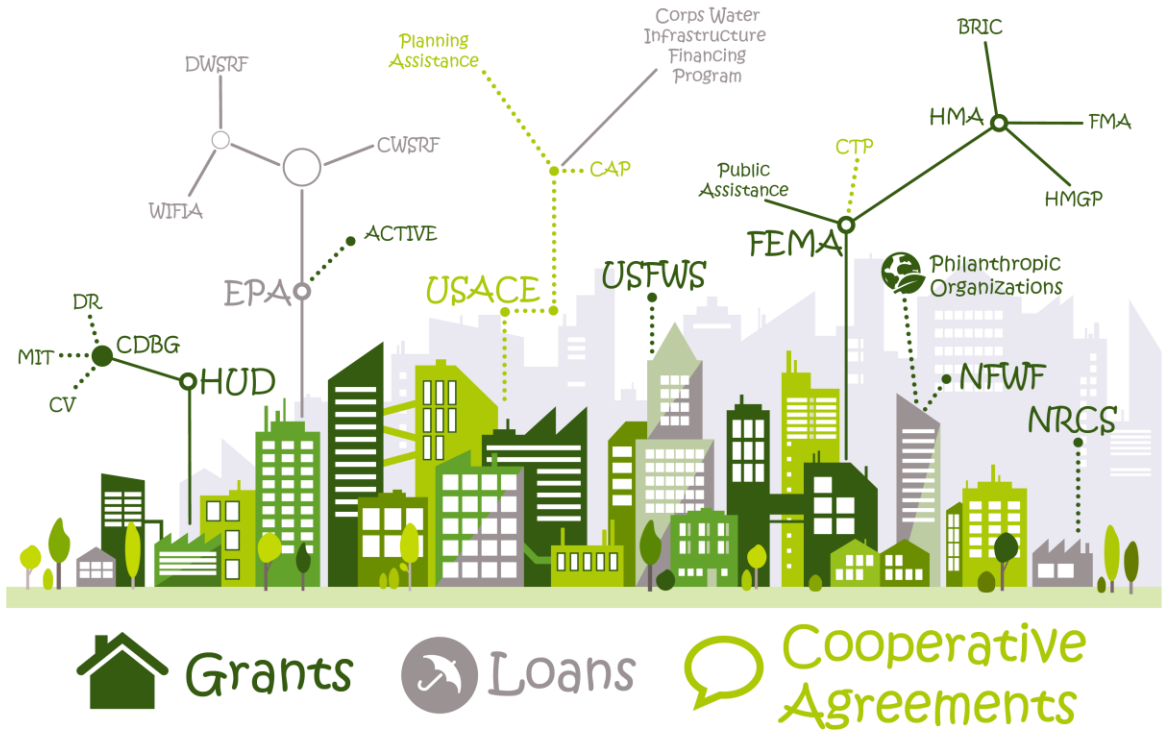
Building consensus amongst stakeholders to align environmental, societal, and economic needs in development of climate-aware and resilient hazard mitigation solutions can lead to more comprehensive solutions.



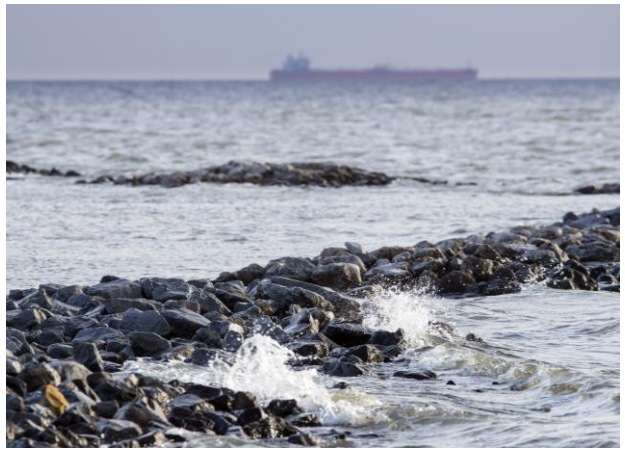
Nature Based Hazard Mitigation Funding Opportunities

AECOM serves as a leader in connecting nature-based solutions with hazard mitigation funding and supporting a broad group of stakeholders in developing comprehensive projects that focus on climate responsible approaches. Under these efforts AECOM has developed:

- FEMA BRIC Application Best Practices and Recommendations for Environmental Defense Fund
- Hazard Mitigation Funding Opportunity Approach for Coastal Resilience Project with Ecosystem Services Methodology for Texas General Land Office
- Promoting Nature-Based Hazard Mitigation Through FEMA Mitigation Grants for The Nature Conservancy
- A contributing author to the Practical Guide to Implementing Green-Gray Infrastructure by Conservation International
- Practical User's Guide for the NNBF Guidelines, an AECOM developed compliment to the USACE Engineering With Nature International Guidelines on Natural and Nature-Based Features for Flood Risk Management



Texas Living Shoreline Design and Construction



Location: Texas Coastwide

Client: Texas General Land Office, Scenic Galveston, Galveston Bay Foundation, The Nature Conservancy, and Texas Audubon

ESG Focus: Reef engineering and restoration to enhance the coastline's resilience to climate change and strengthen its capacity for adaptation

AECOM has led design and construction of many award winning and innovative living shoreline projects along the Texas coastline. These projects include unique design aspects to promote reef restoration, bird nesting, sediment accretion, and other resilience features in addition to traditional shoreline restoration. Recent project sites include:

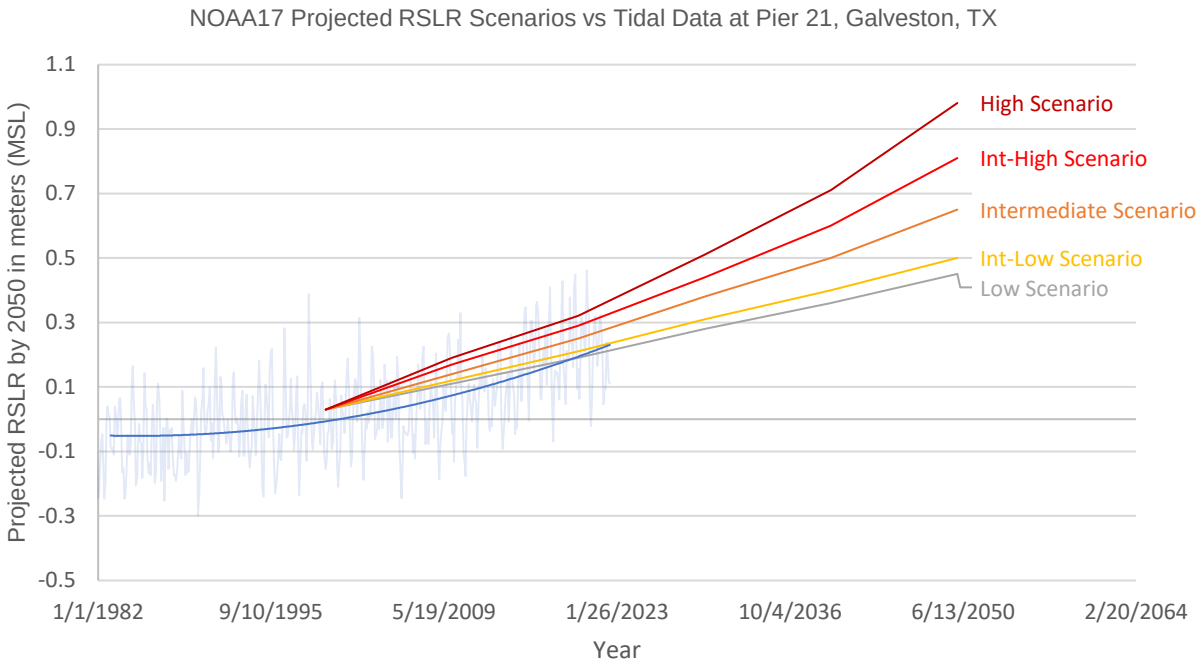
- Virginia Point Coastal Prairie Living Shoreline
- Moses Lake Wetland Restoration
- Laguna Vista Rookery Island Restoration
- Brown Ranch Living Shoreline
- Little Bay Oyster Reef Creation and Shoreline Protection

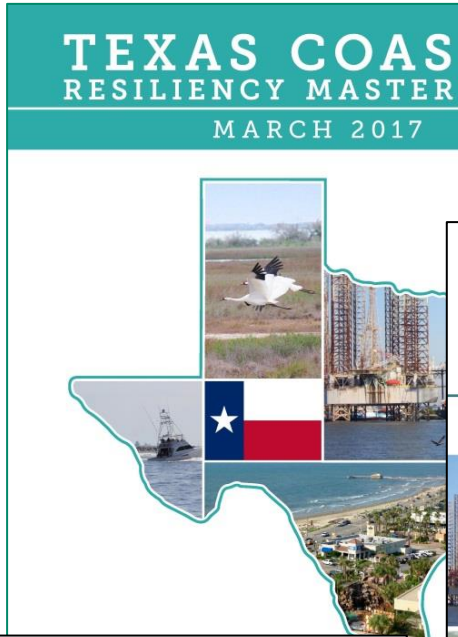
Relative Sea Level Rise in the Texas Coastal Resiliency Master Plan

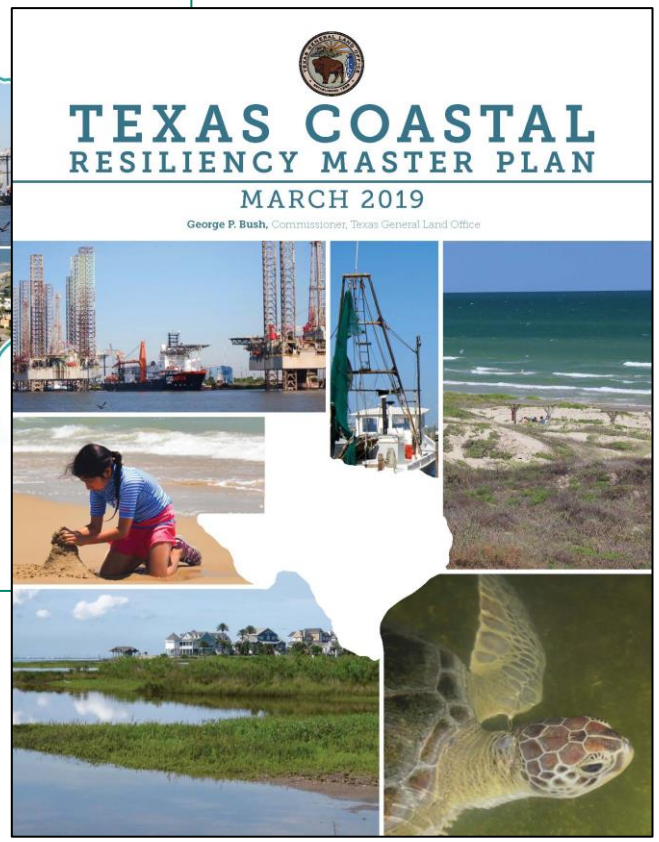
Location: Texas Coastwide

Client: Texas General Land Office

ESG Focus: Development of an approach to align community and ecological goals for resilience through climate aware concepts







2019 Resiliency Plan RSLR Planning Values Since Year 2000

Region	2020	2050	2100
1*	+0.2' – +0.9'	+0.7' – +2.5'	+2.5' – +6.0'
2	+0.8'	+2.1'	+5.2'
3	+0.7'	+1.9'	+5.0'
4	+0.6'	+1.7'	+4.6'

**Region 1 RSLR values are spatially variable based on a subsidence rate grid, and represent an average from tide gauge data. Refer to the Technical Report for full detail.*

NASA Shoreline Management Study

Location: Kennedy Space Center, Florida

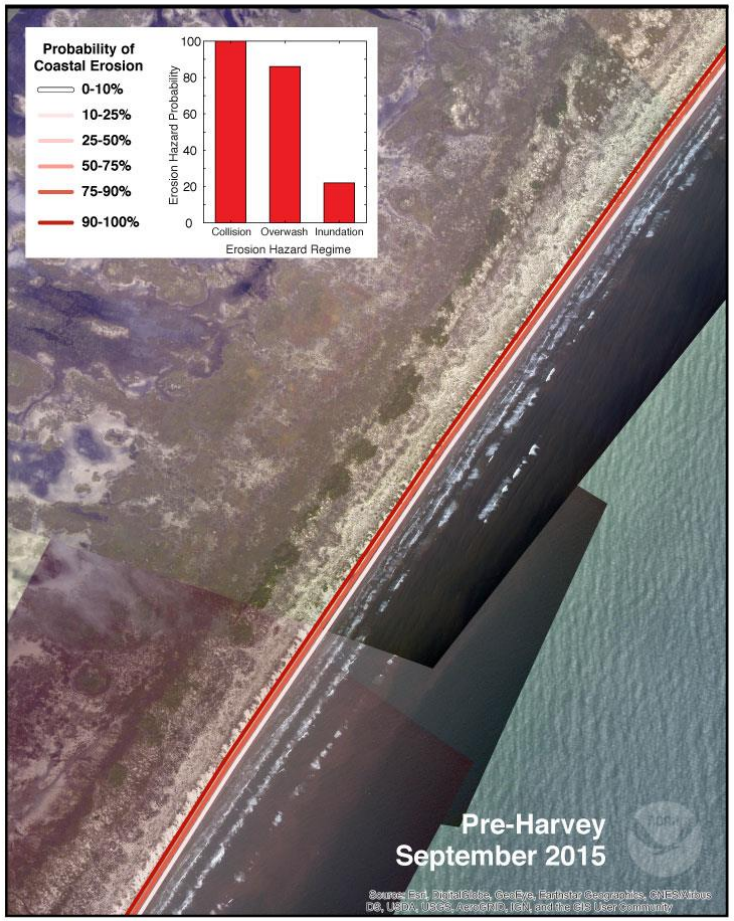
Client: NASA

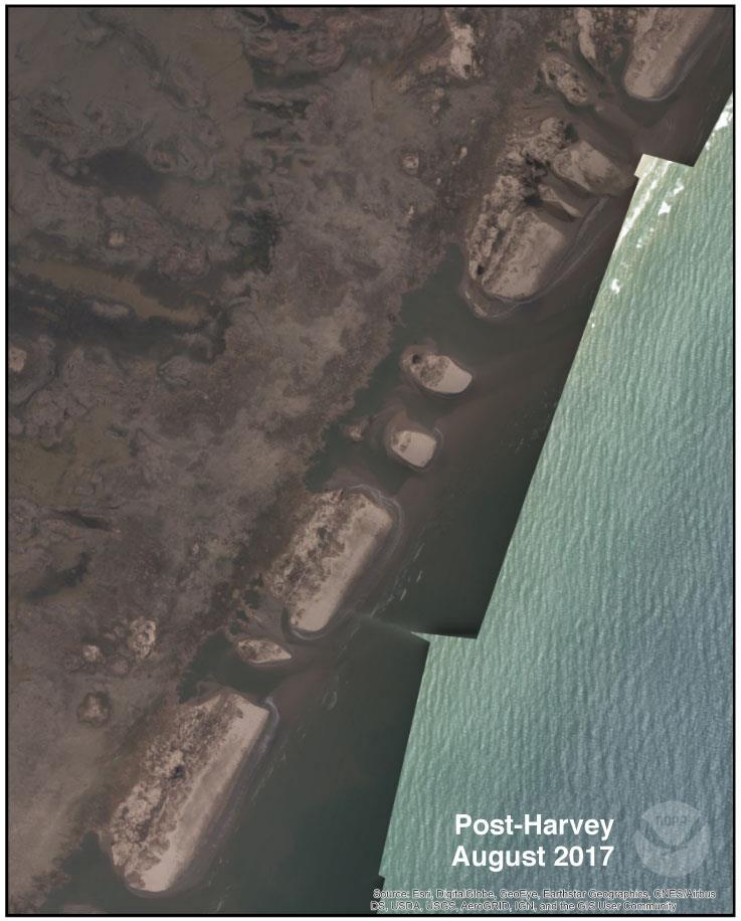
ESG Focus: Assess the long-term vulnerabilities of the Kennedy Space Center critical infrastructure due to coastal shoreline changes resulting from sea level rise, erosion, and other hazards.

The effects of the increased erosion are expected to worsen as future sea level rise (SLR) along the Atlantic shoreline exposes upland facility, launch, and operations infrastructure to higher water levels during storm conditions. AECOM undertook two studies for NASA, an Atlantic Coastal Sustainability Study and an Estuarine Shoreline Sustainment Study.

- For the Atlantic shoreline study, the technical assessments included long-term sediment transport modeling to look at beach and dune shoreline responses for with- and without-project scenarios, considering waves, SLR impacts over the 50-year planning period, and extreme storm events.
- For the Estuarine shoreline study, assessments included establishing shoreline change rates, assessing wave climates of inland water bodies, classifying shorelines by level of risk, evaluating the effects of SLR to wetland migration, and low-frequency storm-induced flooding at the KSC.

Example Nature-based Response on San Jose Island

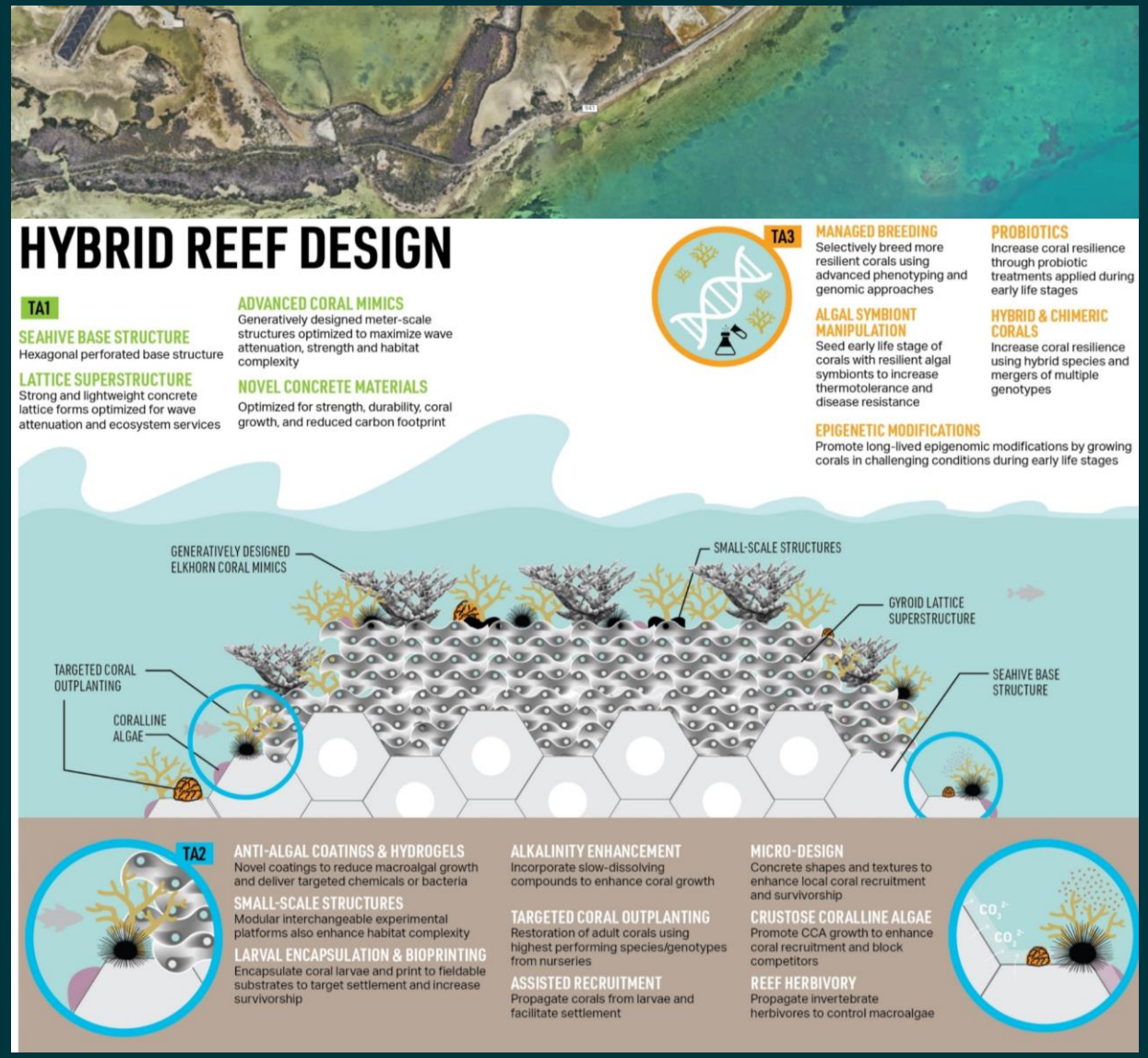




Source: USGS

Source: Google Maps (2022)

Reefense – Accelerating the Protection of Vulnerable Coastal Regions



Location: Confidential Site, Florida

Client: Department of Defense (DoD) Defense Advanced Research Projects Agency (DARPA)

ESG Focus: Development of self-healing, hybrid biological and engineered reef-mimicking structure to mitigate the effects of coastal flooding, erosion, and storm damage

- Development of an innovative hybrid biological and engineered reef structure designed to accelerate the protection of vulnerable coastal regions in Florida and the Caribbean.
- The program's goal is to create, test, and deploy a coral-reef-mimicking structure that provides immediate protection from waves and is also self-building, self-repairing, and resilient to climate change.
- AECOM is providing overall project management, marine ecosystem expertise, coastal engineering, environmental permitting, technical economic assessment, and lead technology transfer.

Prioritizing Nature-based Solutions with Ecosystem Services

Ecosystem service valuations are used to validate the cost-benefit of nature-based solutions for mitigating coastal hazards (flooding events, storm surge damage, etc.).

- **Provisioning Services**—food, raw materials, medicinal resources
- **Regulating Services**—regulating air quality, water quality, heat, ecosystems
- **Supporting Services**—supporting wildlife and plant growth, development, and biodiversity
- **Cultural Services—**recreational value of ecosystems, like aesthetics, tourism, and ecotourism

Areas of Expertise

Climate Vulnerability

Understanding climate vulnerability through climate vulnerability assessments and adaptation planning

Physical Resilience

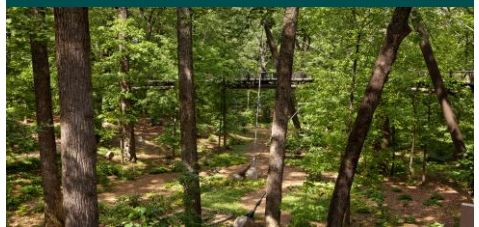
Using physical resilience and infrastructure through the design and planning of living shorelines, flood resilience, hazard mitigation and recovery, wildfire hardening, wildlife crossings, and advance mitigation

Natural Capital Accounting

Conducting economic assessments of landscape assets to determine the best dollar for effort future alternatives

Natural Climate Solutions

Understanding the voluntary carbon market and to provide opportunities and avenues for sustainability investment towards a Net Zero carbon future



Remedial Solutions

Providing remedial solutions that are cost-effective, nature-based, and sustainable, including socially inclusive redevelopment strategies