Jacobs

Challenging today.
Reinventing tomorrow.

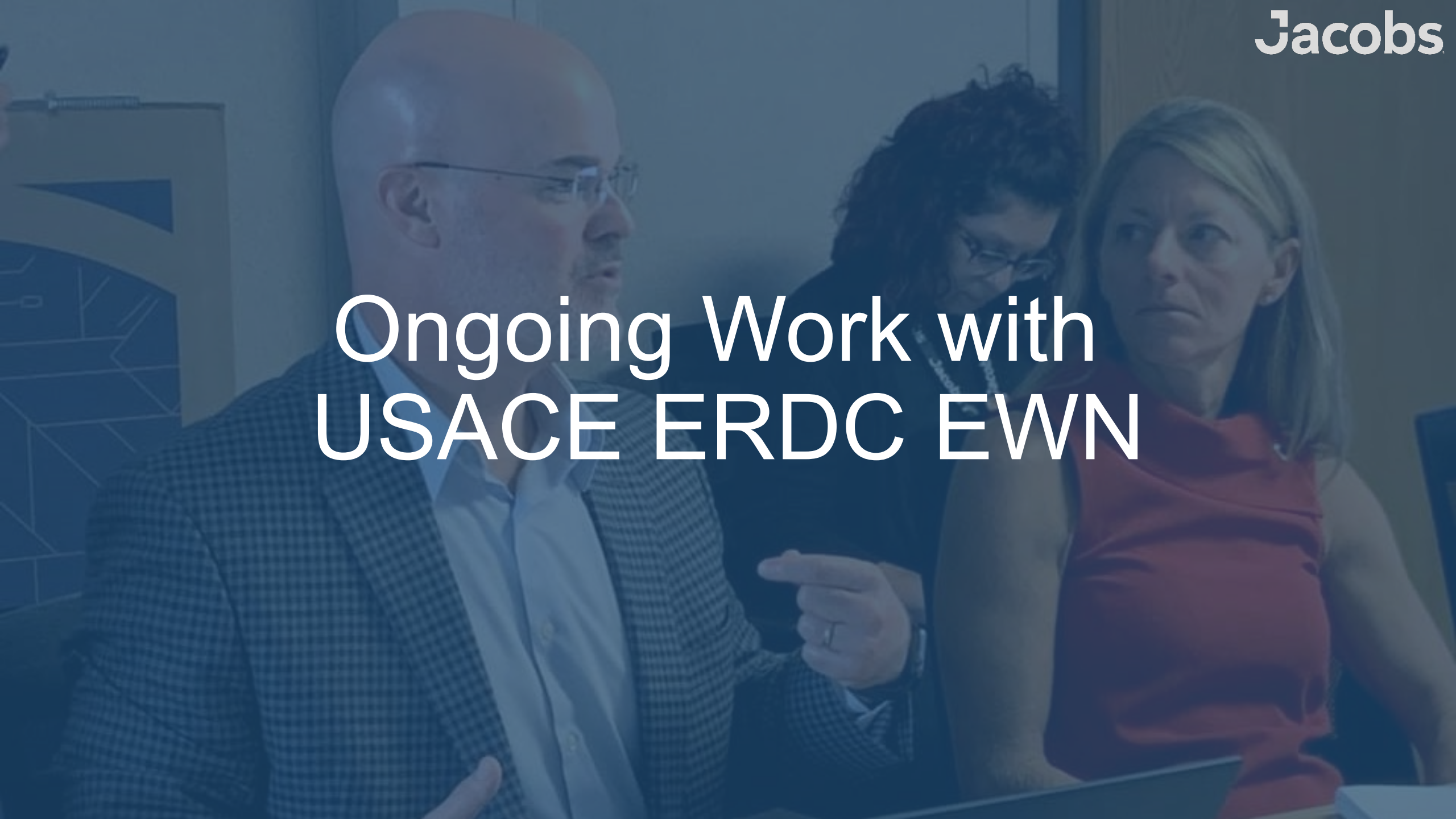
HOLLIE SCHMIDT

Director,
Resilience & Sustainability
Business Advisory,
Americas

JACOBS

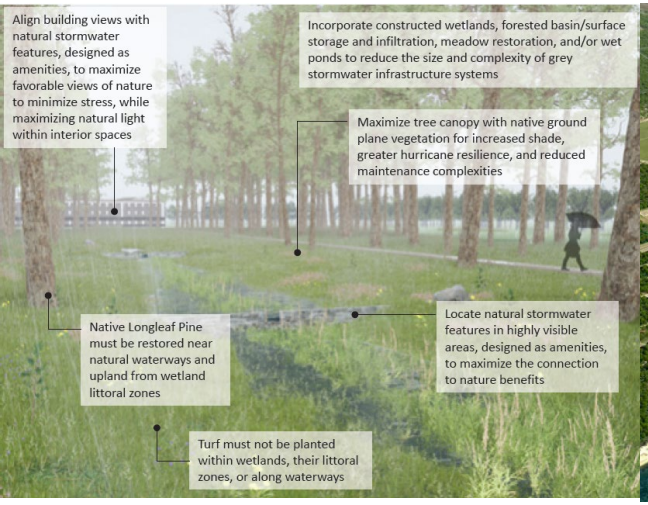
INTRODUCTION

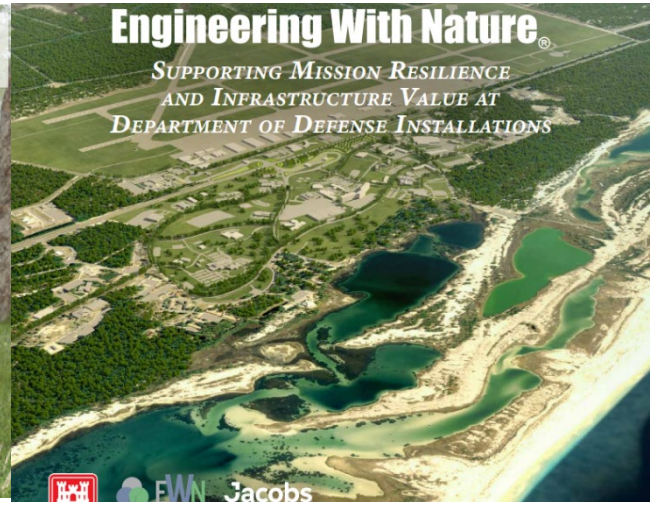
- Hollie Schmidt is the Director of the Resilience & Sustainability Business Advisory for the Americas.
- Landscape architect and master planner with 27 years experience.
- She led the infrastructure strategy, updates to the Installation Facilities Standards and the integrated land management approach for the reconstruction of Tyndall AFB.
- Leads large-scale, complex mega-projects for truly integrated teams.



Ongoing Work with USACE ERDC EWN

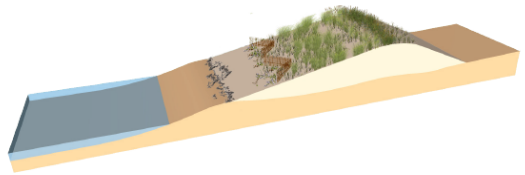
USACE ERDC EWN & JACOBS RELATIONSHIP



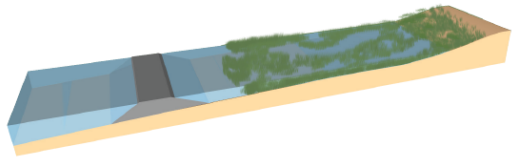


Nature-based Coastal Resilience Typologies

Numerous nature-based coastal resilience strategies and techniques are being implemented across the United States, exploring the emerging technologies of using nature's systems. Further analysis and study will ultimately determine appropriate recommendations for Tyndall AFB.



Dune Replenishment / Restoration



Jacobs About Us Solutions Careers Newsroom Investors

Company profile Stock information Filings and reports Webcasts and presentations Corporate Gover

Jacobs Wins Department of Defense Facilities Contract

10/13/2021

Contract to Deliver ESG Benefits Through Engineering with Nature® Approach

DALLAS, Oct. 13, 2021 /PRNewswire/ -- Jacobs (NYSE:J) was awarded a contract for planning and engineering services by the U.S. Army's Engineer Research and Development Center (ERDC) to integrate Engineering With Nature (EWN) approaches within Department of Defense (DoD) facilities.

Under the terms of the three-year contract, Jacobs will collaborate with ERDC's EWN program leadership and their strategic partners to achieve three primary objectives: engage the DoD facilities community on nature-based solutions for resilience; develop an EWN roadmap for DoD; and create technical guides for application of nature-based solutions for DoD facilities.

"Changing climate patterns and extreme weather events can have long-term impacts to mission assurance for our military," said Jacobs Federal & Environmental Solutions Senior Vice President and General Manager Tim Byers. "Integrating EWN principles into future DoD infrastructure projects results in more resilient and sustainable solutions that also deliver economic, social and environmental benefits while meeting military mission requirements."

As the top ranked global environmental consulting firm, Jacobs is leading efforts to mitigate the impacts of the climate emergency; advance the transition to a clean energy, net zero economy; optimize the complete water cycle through an integrated approach to water management (One Water); clean-up chemical contaminants and nuclear waste; restore ecosystems and reduce biodiversity loss; promote environmental justice and social equity; plan, design, build and operate resilient infrastructure that generates enduring social and environmental value; develop circular economy supply chains; and rapidly respond to natural disasters.

1	2	3	4
Tyndall Air Force Base Rebuild	**Co-Published EWN Atlas**	**Tyndall Coastal Resilience Strategy**	**EWN DoD Facility Adaptation Planning**
Integrated EWN design solutions for the natural and built environment	Supporting Mission Resilience and Infrastructure Value at Department of Defense Installations	Definition of Pilot Projects, Stakeholder Engagement, Funding Strategy, Implementation Plan	3-Year Contract for vulnerability assessments at DoD Installations that can be mitigated with EWN solutions

U.S. AIR FORCE

ENVISION · REBUILD · PREVAIL

HURRICANE MICHAEL RECOVERY & REBUILD

TYNDALL AIR FORCE BASE

INSTALLATION OF THE FUTURE

Hurricane Michael Recovery At Tyndall Air Force Base

F-35

AIRFIELD SUPPORT

WEG

FUTURE MISSION

TYNDALL ECP

COMMERCIAL GATE

BASE ADMINISTRATION

INDUSTRIAL

LODGING

MEDICAL

BASE ADMINISTRATION

NEW BUILDINGS

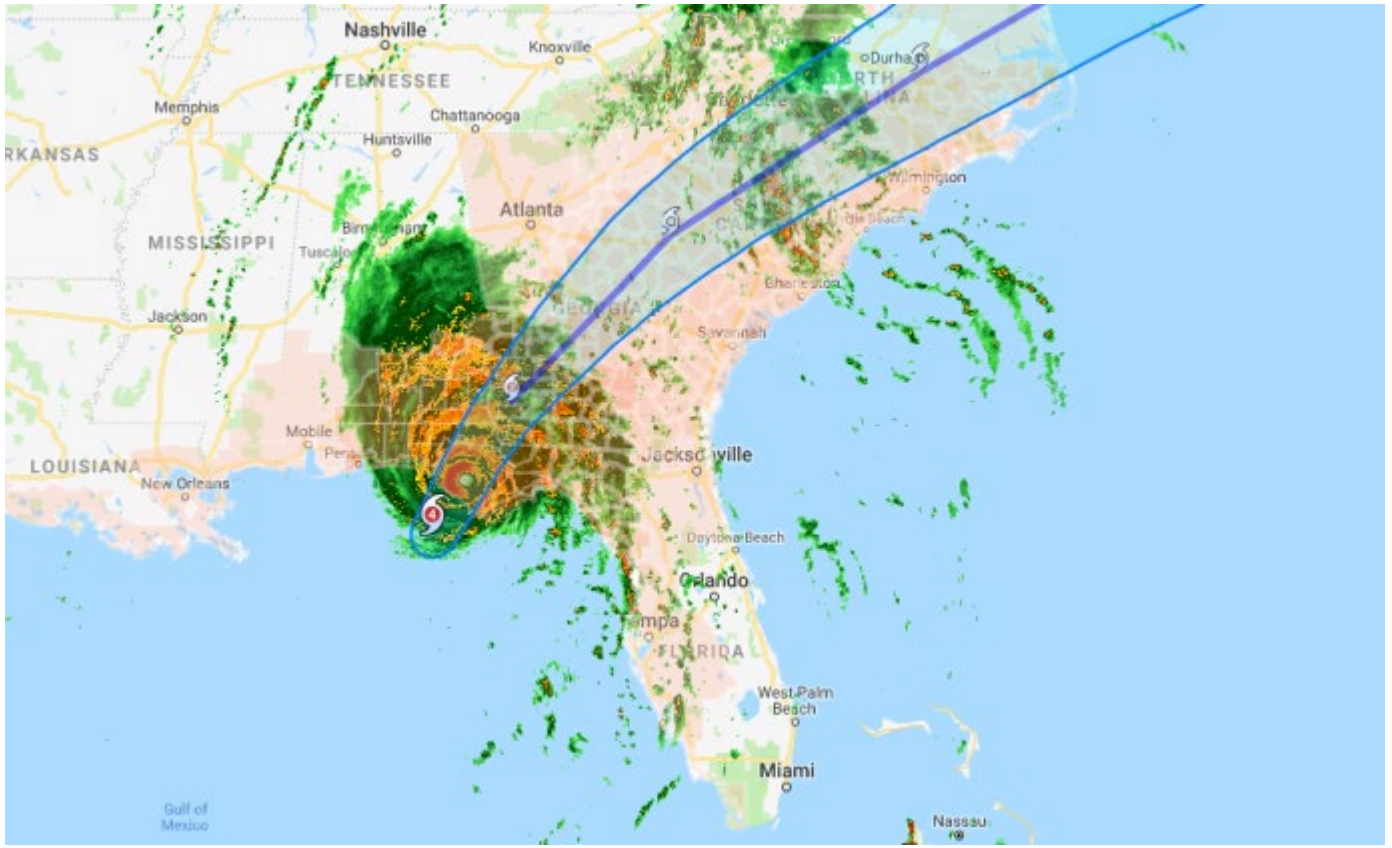
EXISTING BUILDINGS

PEDESTRIAN SPINE

EWN at TAFB

In October 2018, Tyndall Air Force Base was hit with a **category five hurricane** which resulted in **damage to 100% of its assets**.

The goal of this project was to rebuild the base to be more **resilient, sustainable**, and **smart** to be an **Installation of the Future**.



155 MPH
Sustained Winds

~14’
Storm Surge

Components of an Installation of the Past

BUILDINGS

Mission Critical

Mission Support

Buildings

Enabling Infrastructure

ENABLING INFRASTRUCTURE

Transportation + Mobility

Airspace Logistics

Access + Connectivity

Utilities + Technology

Public Works

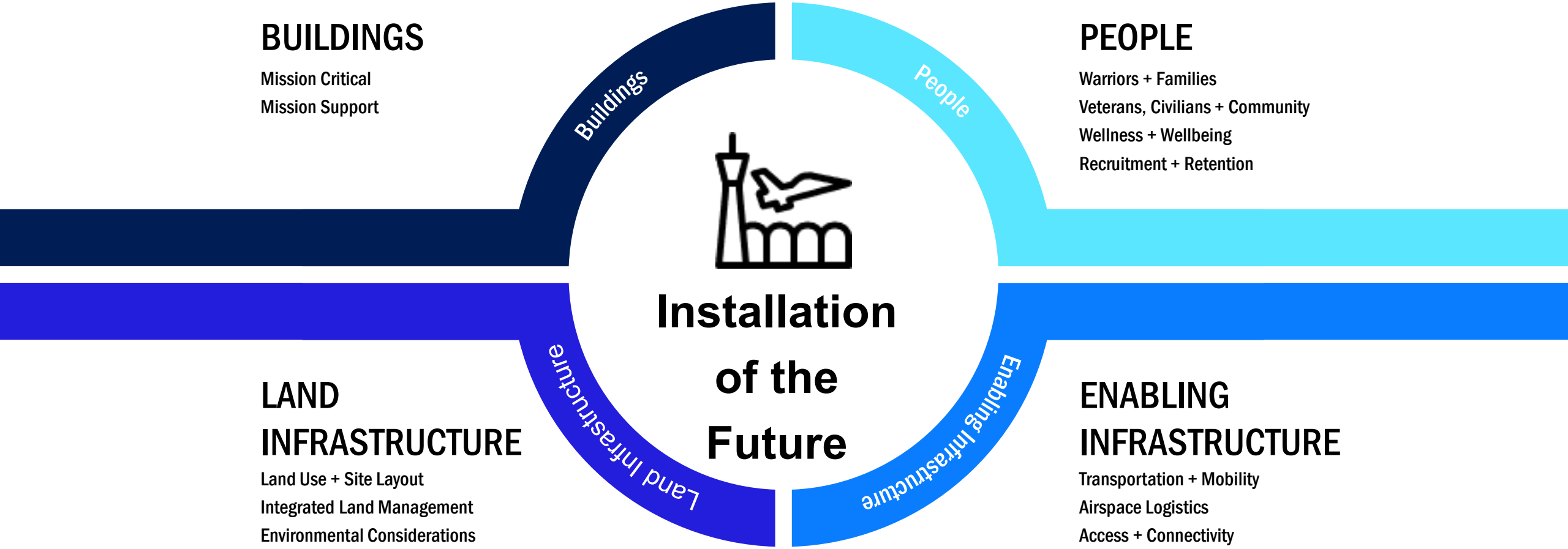
Components of an Installation of the Future

BUILDINGS

Mission Critical
Mission Support

PEOPLE

Warriors + Families
Veterans, Civilians + Community
Wellness + Wellbeing
Recruitment + Retention



LAND INFRASTRUCTURE

Land Use + Site Layout
Integrated Land Management
Environmental Considerations
Engineering With Nature
Natural Capital

ENABLING INFRASTRUCTURE

Transportation + Mobility
Airspace Logistics
Access + Connectivity
Utilities + Technology
Public Works

Jacobs

UPFRONT COST

PRE-MICHAEL
$303M

$214M *horizontal* | **$89M** *vertical*

CURRENT PROGRAM
$393M

$292M *horizontal* | **$101M** *vertical*

$90M
23% increase

Current Program:

BREAKEVEN POSSIBLE
Year 11 (2033)
given uncertainties

1.2%
higher over 30 yrs

Higher NPV Results

Lower Major Replacement Costs

$16M
lower over 30 yrs

Lower Annual O&M Costs

$3M *or* **$90M**
lower over 30 yrs

Doubling of Non-Financial Scoring Factors

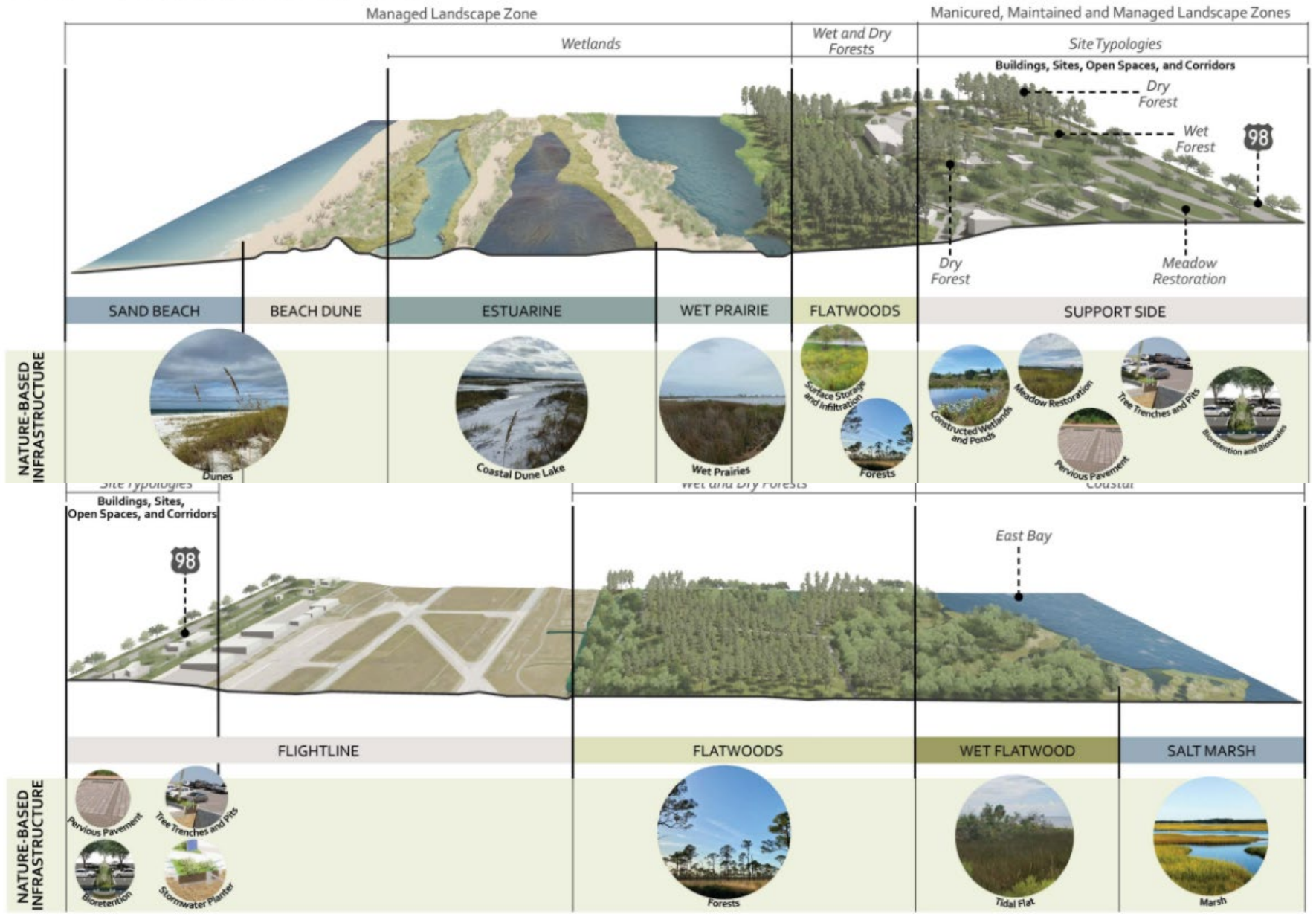
2X


Cultural Sites Buffer
NWI_HydricSoil
Estuarine and Marine Wetland
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Deepwater; Freshwater Pond; Lake
Restoration Sites 1
Restoration Sites 2
Restoration Sites 3
1391 RD Proposed Buildings
MILCON F-35 FAA
MILCON POST F-35 FAA
Sanitary Sewer
Fire Water
Potable Water
Electric
Natural Gas
Communications
Storm Water
Existing Building to Remain
Temporary Structure
AFFF Inspct Area
Solid; Dashed
NATURE BASED
INFRASTRUCTURE
REFORESTED AREA
FUTURE
FUTURE
FUTURE
FINGERS
TOWN CENTER
MODAL PATH
MULTI
DEV. PARCEL, TYP.
FOREST BASIN
DEV PARCEL TYP.
FOREST BASIN
REFORESTED AREA
FOREST BASIN
WET & MESIC FOREST
EX. OUTFALL
REALIGN MAIN OUTFALL TO HERE
PARK
DUNE WETLAND
HERITAGE PARK
DUNE WETLAND
SECOND LINE OF DEFENSE
EX. LAGOON OUTFALL
LAGOON OUTFALL
LAGOON
ACCESS
LAGOON
JANUARY 21 2020
TYNDALL HOLISTIC LAND MANAGEMENT
JACOBS

EWN at TAFB

Beyond Business As Usual

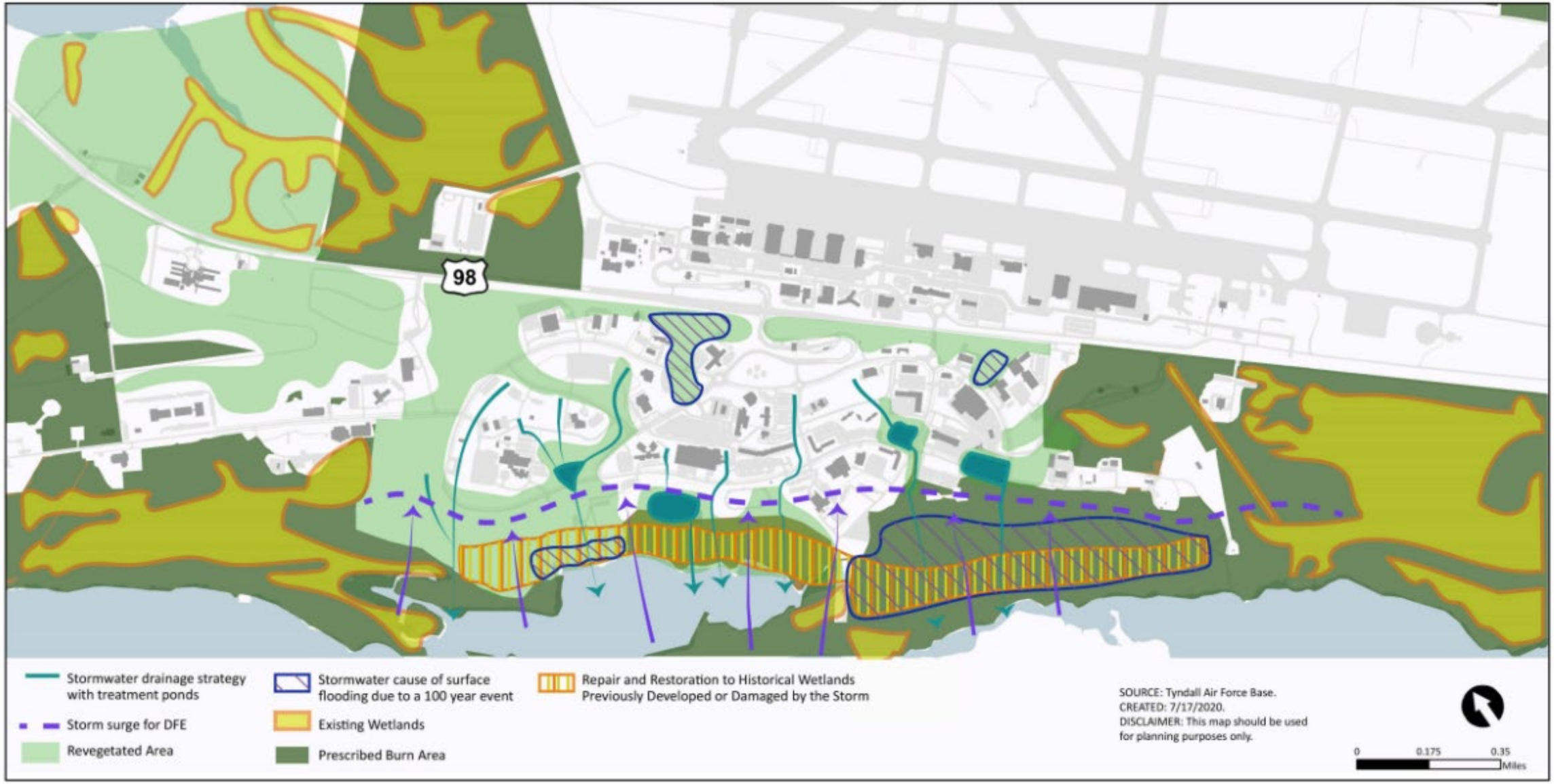
Exhibit B04-6. Best Management Practices in the Support District



EWN at TAFB

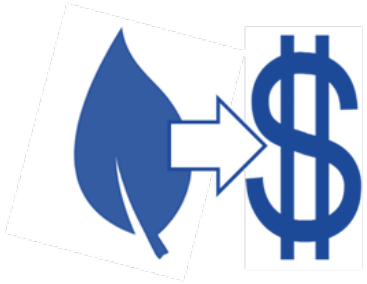
Beyond Business As Usual

Exhibit B01-2. Integrated Land Management Framework



NBI Myth Busting

MILCON will not pay for landscape, it will never get installed



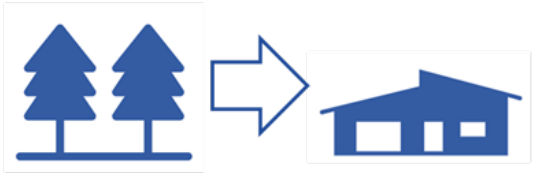
Landscape is “nice to have” and should not be installed at sacrifice to the mission, it has no value

The base will not maintain NBI solutions

Nature Based Infrastructure costs more and requires more maintenance

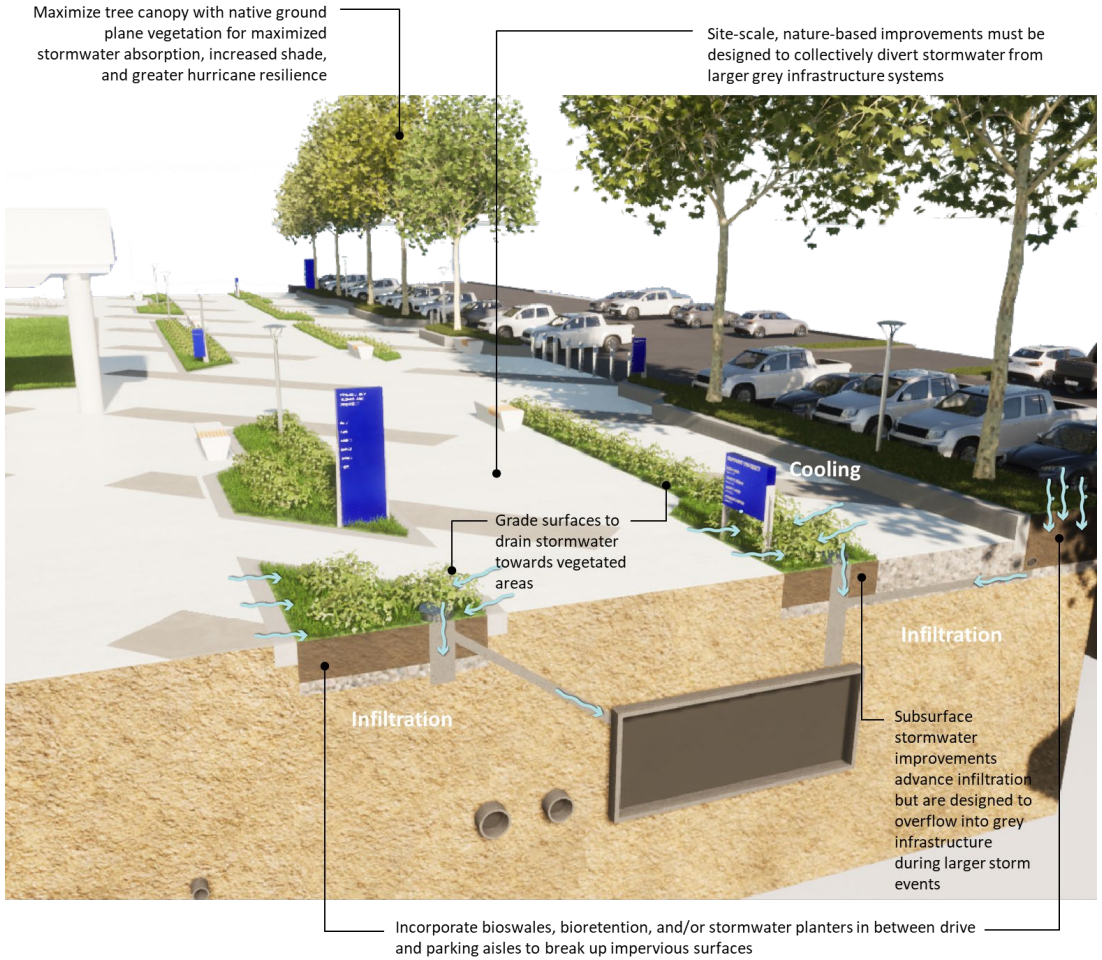
Landscaped areas attract snakes, bears and mosquitoes

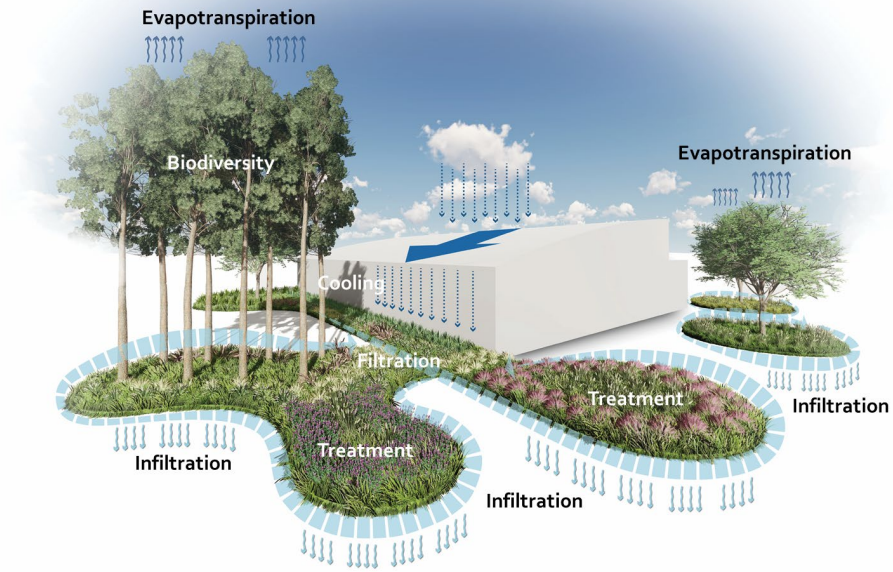
Landscaped areas are a security concern

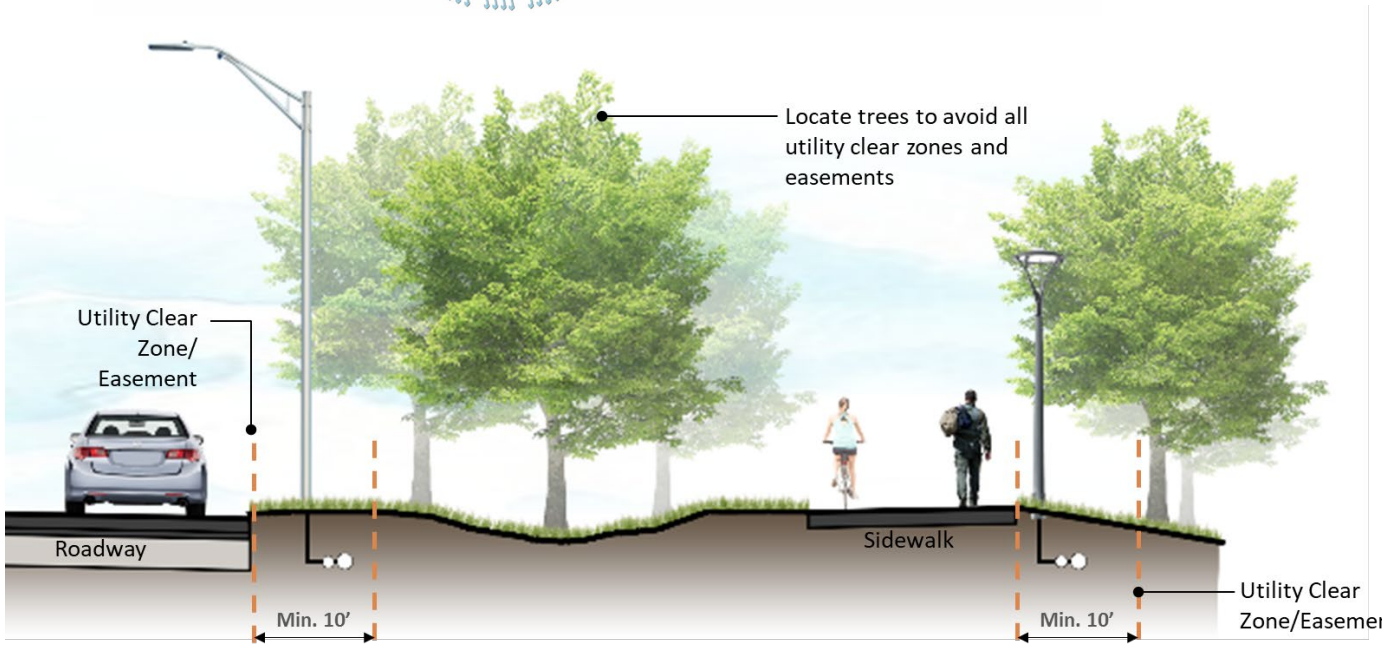


Proposed solutions will restrict or constrain future development and pose a threat to mission

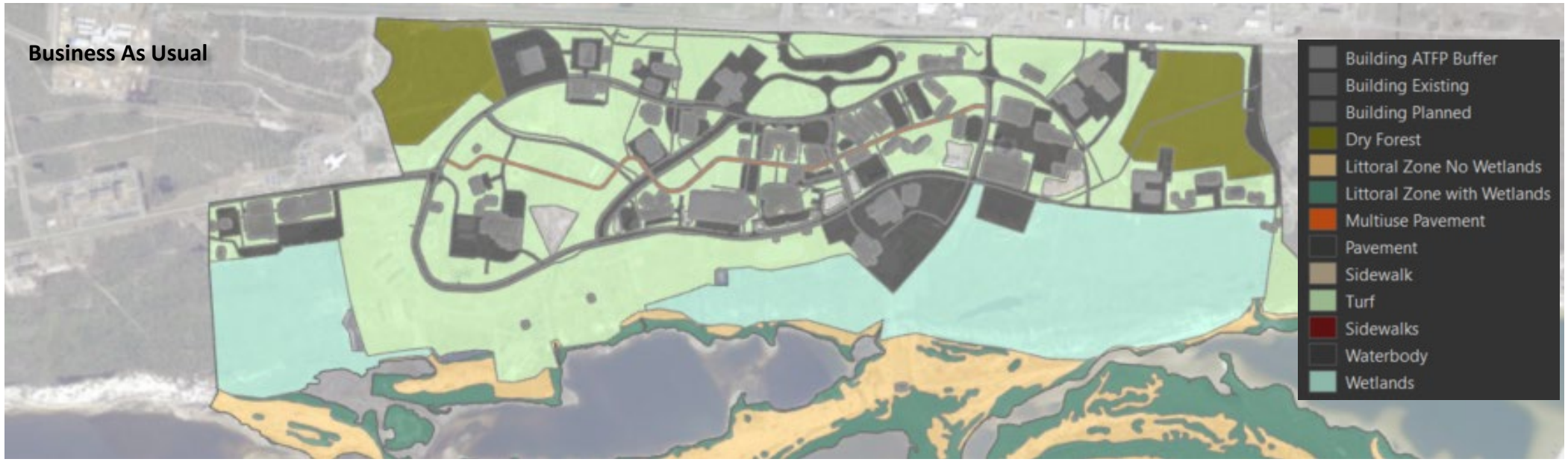
Utilities & Stormwater







Beyond Business As Usual



Beyond Business As Usual

Transform one or more of the existing drainage ditches to naturalized a channel. This could support native longleaf pines restoration and include native groundcover. The naturalized channel and banks will promote lower flow velocity, reduce peak flow, increase infiltration rate, as well as provide additional ecosystem services, aesthetics and quality of life.

Current State

Potential State –Sunny Day

Potential State –Rainy Day

Beyond Business As Usual

Current State

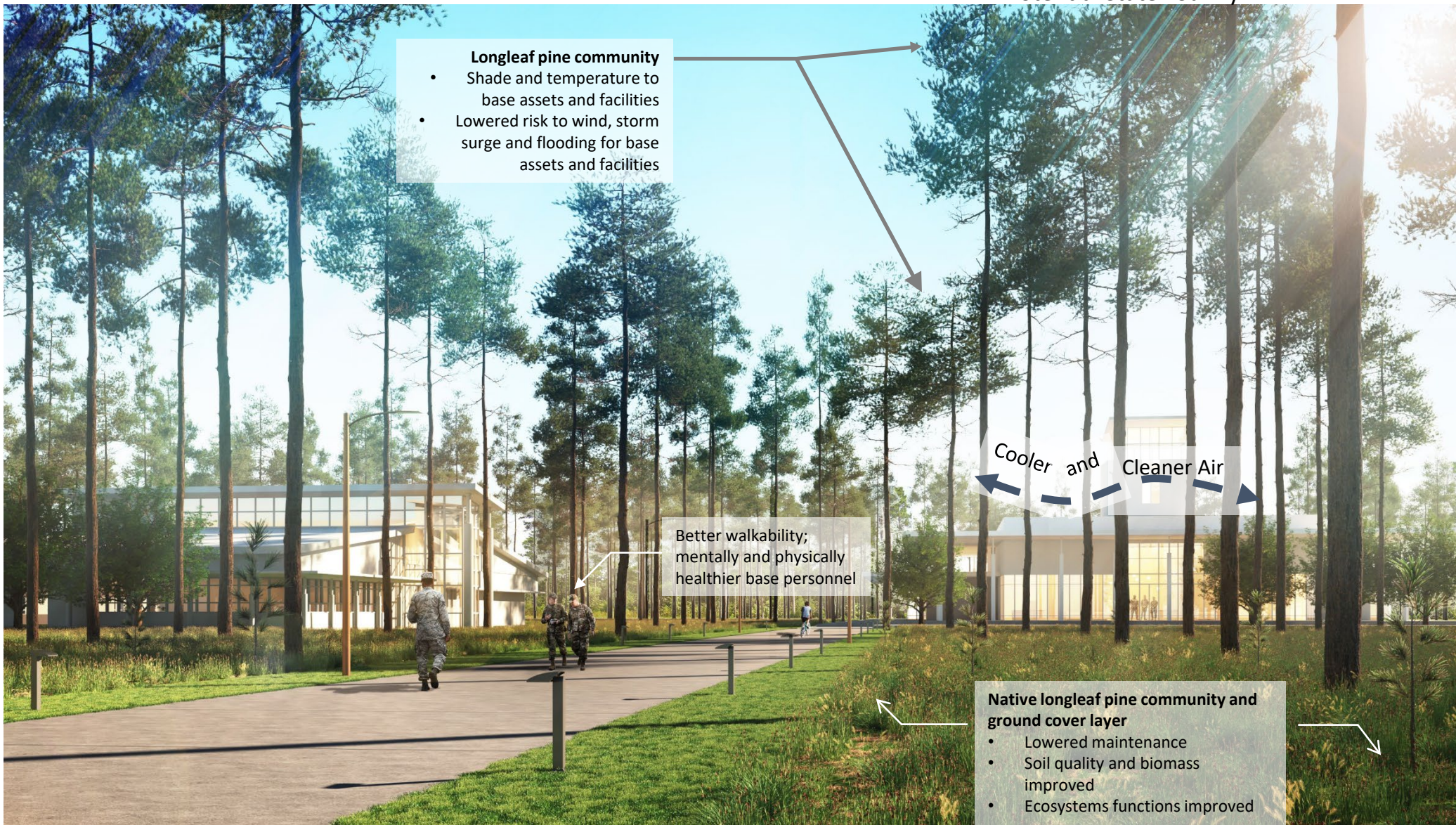
Current State

EWN at TAFB

Beyond Business As Usual

- **Larger aggregates of land turned over to native ecosystem**
- **Longleaf pine forests, grass savannahs, wet prairies, wetlands, and dune landscapes**
- **Approaches that are natural or combine nature, design, and engineering to mimic natural processes**
- **A combination of approaches designed as a larger ecologically-based system to achieve regional benefits**
- **Designed with maintenance in mind to achieve "known" maintenance**

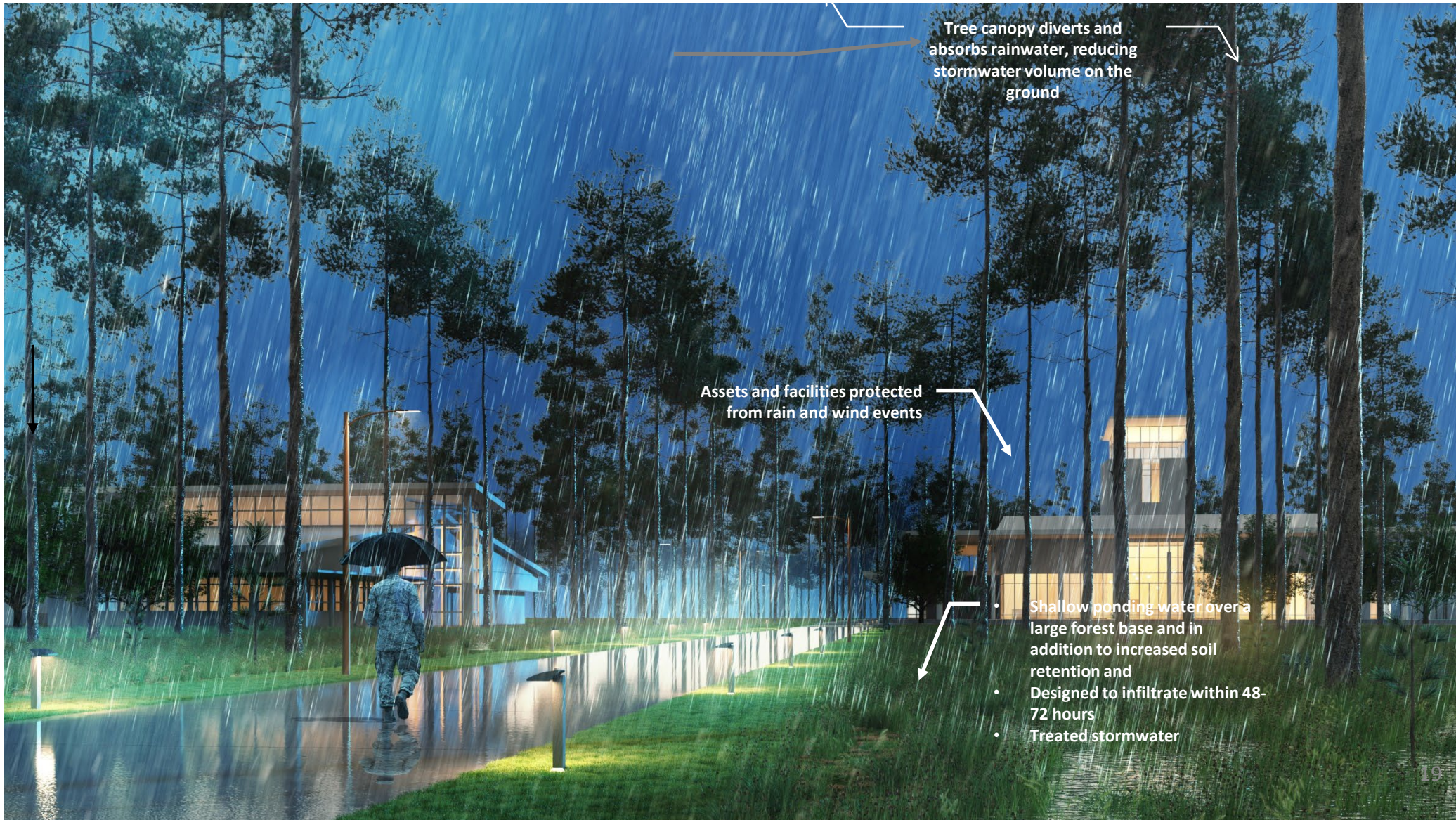
Potential State –Sunny



Beyond Business As Usual

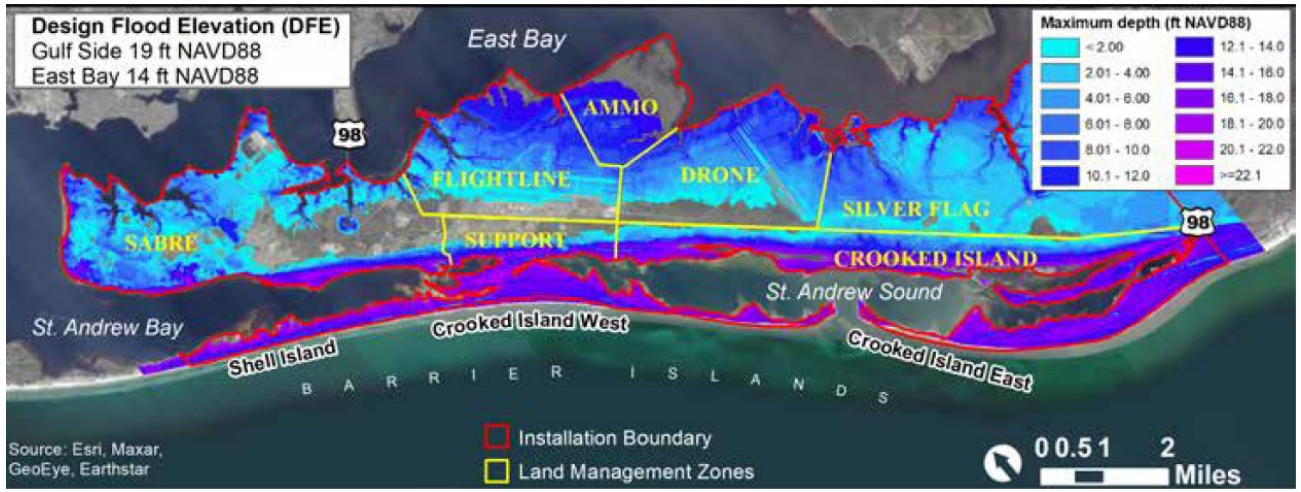
- **Greater climate resilience that creates conditions which are flexible, reversible, and adaptive to changing conditions versus grey infrastructure alone**
- **More cost effective and simpler maintenance over built grey infrastructure such as water treatment facilities and pipes alone**
- **Improved health and quality of life as Biophilic approaches reduce stress, improve health, mental restoration, and reduced fatigue for greater recruitment and retention**

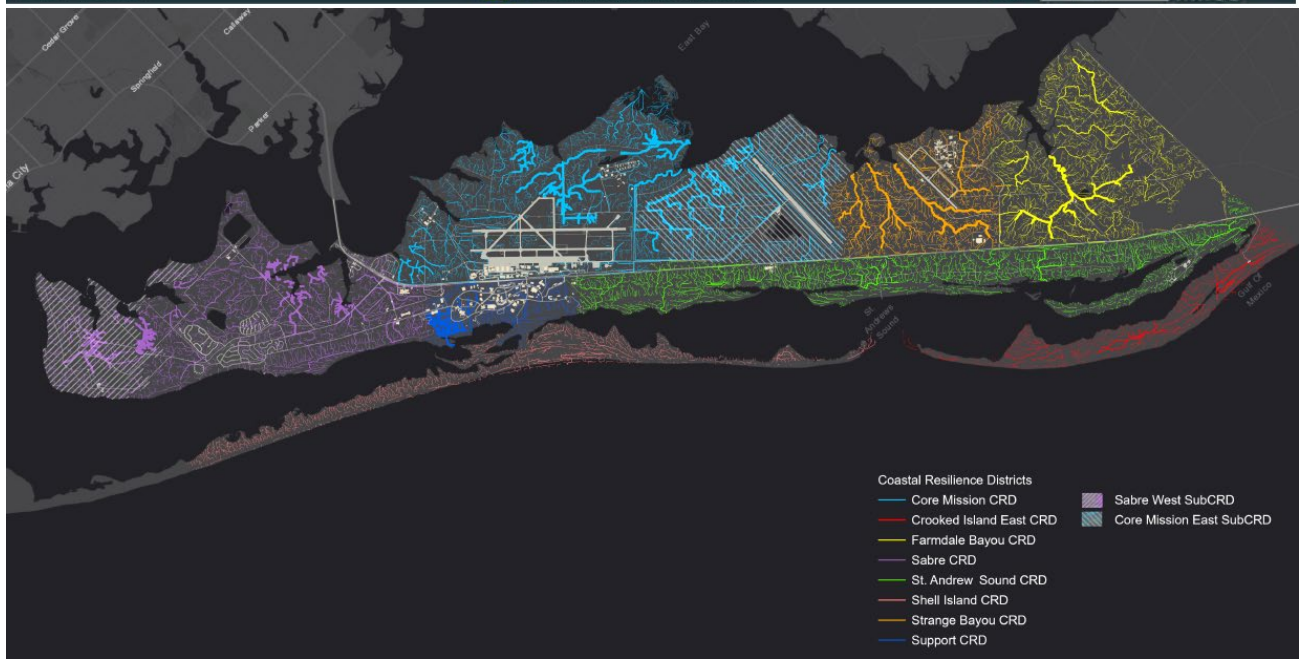
Potential State – Rainy



ENVIRONMENTAL + COASTAL RISK

EWN at TAFB





Pilot 1: Constructed Defenses Construction Project – Gulf Side

- **Dune Construction.** Dune construction trial, located in Zone 4 along St. Andrew Bay just south of the support district, with onshore sand source.
- **Additional Measures.** The potential also exists to pilot the construction of either a living breakwater or oyster reef adjacent to Buck Beach in St. Andrew Sound to reduce coastal erosion. These alternatives would be subject to Air Force and regulatory approvals, further technical feasibility studies, stakeholder buy-in, and funding availability.

Pilot 2: Sand Trapping Construction Project – Gulf Side

- **Sand Fencing.** Trial sand fencing on relic dunes on Crooked Island West. This could be an ideal volunteer event.
- **Vegetation Planting.** Trial plantings on relic dunes on Crooked Island West. This could be an ideal stakeholder engagement event.
- **Woody Debris.** Trial woody debris placement on relic dunes on Crooked Island West.

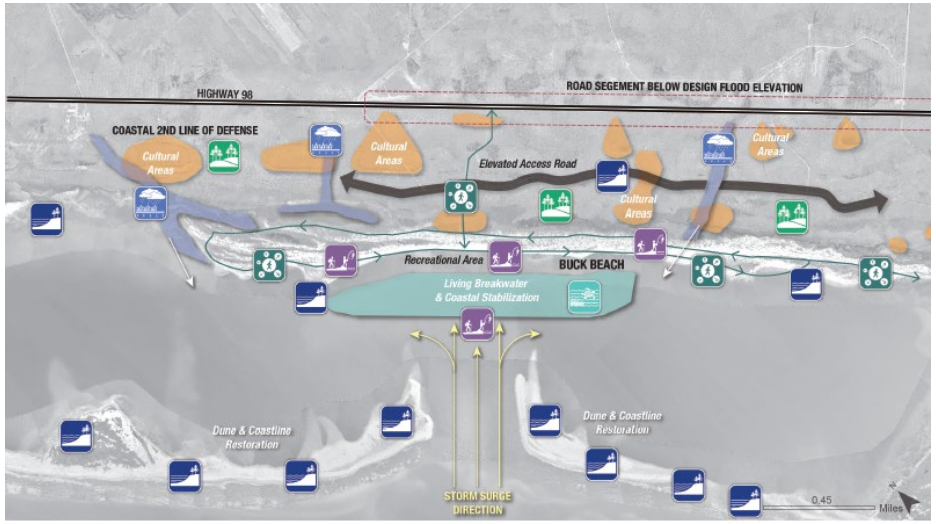
Pilot 3: Back Bay Feasibility Study – East Bay & Gulf Side

- Evaluation the strategic placement of subtidal sediments in the East Bay and sand placement off the Gulf Coast to enhance natural environments.

Pilot 4: Back Bay Feasibility Study – East Bay

- Evaluation of marsh enhancement, horizontal levees and other potential nature based coastal defense strategies.
- **Additional Measures.** The potential also exists to pilot the construction of marsh enhancement and/or horizontal levees. These alternatives would be subject to USAF and regulatory approvals, further technical feasibility studies, stakeholder buy-in and funding availability.

EWN at TAFB



DEMONSTRATION AREAS

Coastal Flood Risk Reduction	Revegetation/ Sustainable Landscape	Stormwater Management/ Wetland Mitigation	Wildlife Habitat Enhancement/ Ecosystem Restoration	Recreation (MWR)/ Education	Pedestrian & Commuter Mobility
Specific Actions					
▪ Dune restoration ▪ Revegetation/ marshland restoration ▪ Coast line protection ▪ Living shoreline	▪ Establish plantings on islands and first line of defense ▪ Establish plantings in all open areas and barrier islands ▪ Plant native species ▪ Upland landscape and revegetation	▪ Capture small rain events locally versus base-wide ▪ Provide larger base-wide retention/detention ponds ▪ Regrade vulnerable areas ▪ Naturalize channels	▪ Create wetlands and marshes ▪ Create dunes ▪ Preserve habitats	▪ Provide passive recreation areas via paths and boardwalks ▪ Provide educational signs and markers ▪ Provide observation areas ▪ Provide activity areas such as volleyball nets and play structures	▪ Include bike lanes on roads ▪ Provide direct point-to-point transportation network ▪ Connect to multimodal facilities
Resulting Benefits					
▪ Protects missions ▪ Protects investments	▪ Complies with INRMP ▪ Improves water absorption ▪ Reduces impacts to storm surge ▪ Increases biodiversity ▪ Improves water quality ▪ Creates and preserves habitats ▪ Provides erosion protection ▪ Reduces urban heat island effect ▪ Creates shade and reduces energy	▪ Controls flooding ▪ Filters pollutants ▪ Reduces peak flow in stormwater system ▪ Protects wetland habitat ▪ Provides erosion protection ▪ Reduces surge and loading on coastal areas ▪ Complies with stormwater permit	▪ Protects coastal habitat ▪ Protects upland habitat ▪ Provides erosion protection	▪ Expands educational opportunities ▪ Improves mental health ▪ Improves physical health ▪ Provides leisure opportunities	▪ Reduces "big infrastructure" needs ▪ Provides nature-based tertiary pathways ▪ Improves mental health ▪ Improves physical health

COASTAL RESILIENCE TYPOLOGIES

Coastal Scrub

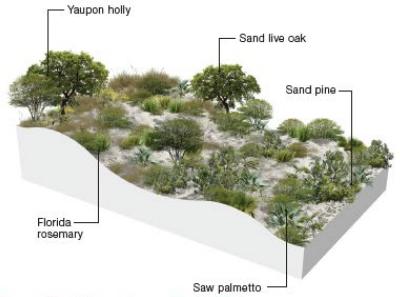
General Description and Location at Tyndall AFB

Coastal scrub is the most imperiled ecosystem in Florida and is found on older stabilized dunes that consist of dry, infertile soils within sandy ridges. It consists of dense shrubland of shorter tree canopy, shrubs, and sometimes taller pine species. Open sandy areas among thickets of vegetation are common to coastal scrub. These open sandy areas provide corridors for wildlife. The signature scrub species—three species of shrubby oaks, Florida rosemary (*Ceratiola ericoides*), and sand pine (*Pinus clausa*)—are common to scrubs throughout the state. The dominance of these species, however, varies from site to site. Oaks form a dense cover interspersed with patchy openings that consist of bare sand with a sparse cover of herbs and ground lichens. Coastal scrub is a prevalent upland habitat at Tyndall AFB, found broadly along the coast of the peninsula and in small patches on the barrier islands.

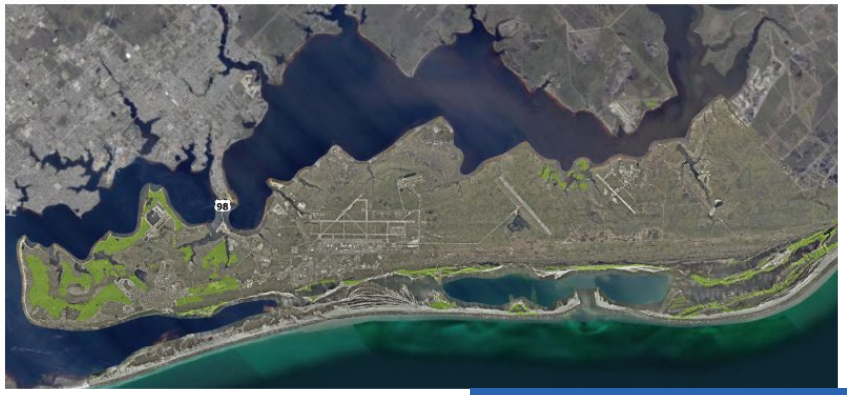
Role in Resilient Landscapes

Scrub habitat has the potential to assist in reducing coastal flooding by providing additional dissipation of waves and reducing the erosion of sediments. These features could help preserve the integrity of dunes which act as a barrier to flood waters.

Scrub habitats also support a wealth of species endemic to Florida, many of which are considered rare. Scrub acts as an important habitat for several varieties of beach mice, scrub lizard, scrub-jay, and gopher tortoise.

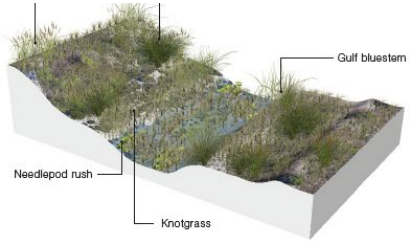


Coastal Scrub Locations at Tyndall AFB

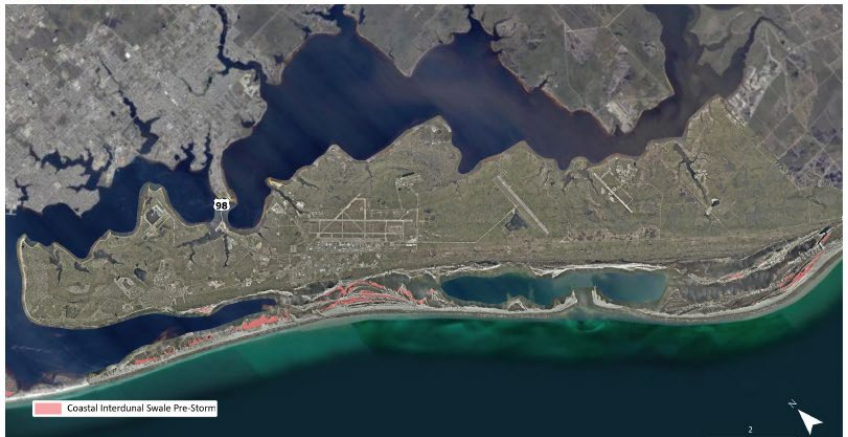


Coastal Scrub Plant Palette and Successional Species

Botanical Name	Common Name
Ceratiola ericoides	Florida rosemary
Pinus clausa	sand pine
Quercus germinata	sand live oak
Sabal minor	dwarf palmetto



Coastal Interdunal Swale Locations at Tyndall AFB



Coasta
flats in
islands
separa
from bl
species
1997).
set this
waves
plain (J
commu

The ba
as umb
and mil
with sa
species
the spread of cordgrass, which tolerates burial better than the other grass species (Johnson et al. 2000).

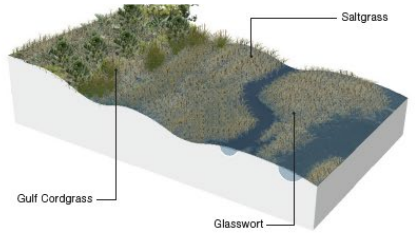
Role in Resilient Landscapes

Interdunal swale habitat has the potential to assist in reducing coastal flooding by helping to dissipate waves and reduce sediment erosion. Swales tolerate both flooding and dry conditions, and can hold stormwater run-off and storm surge. This habitat is important part of the broader dune complex.

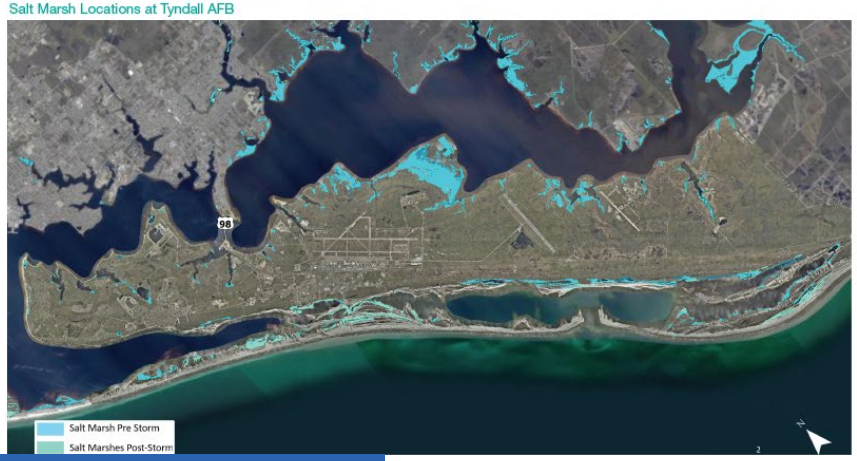
Interdunal swales provide wildlife foraging and refuge habitat as well as water quality benefits through filtering pollutants and sediments.

Coastal Interdunal Swale Plant Palette and Successional Species

Botanical Name	Common Name
Paspalum distichum	knotgrass
Fimbristylis castanea	marsh fimbry
Eragrostis elliottii	Elliott's lovegrass
Dichanthelium aciculare	needleleaf witchgrass
Fuirena scirpoidea	southern umbrellasedge
Andropogon virginicus	broomsedge
Muhlenbergia capillaris	muhly grass
Centella asiatica	Asiatic pennywort
Panicum amarum	bitter panicum
Schizachyrium maritimum	Gulf bluestem
Hyrocotyle bonariensis	beach pennywort
Juncus scirpoides	needlepod rush



Salt Marsh Locations at Tyndall AFB



Dunes
ur on
ting
ds can
rtop,
may
m
dunes
ergy

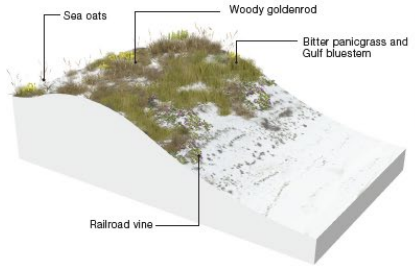
Beach dunes are a herbaceous community of wide-ranging coastal specialist plants on the vegetated upper beach and foredune, usually built by sea oats (*Uniola paniculata*), a perennial rhizomatous grass whose stems trap the sand grains blown off the beach. Seacoast marshelder (*Iva imbricata*), a succulent subshrub, is found at the seaward base of the foredune. These species occupy the seaward face and crests of backdunes and areas where sand has not stabilized.

Role in Resilient Landscapes

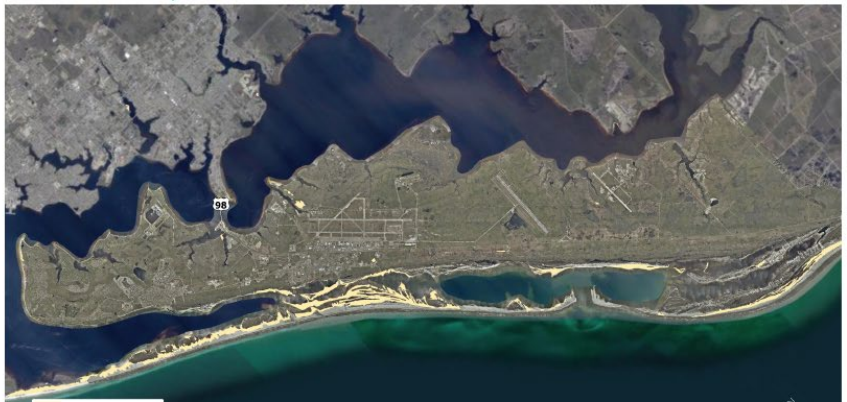
Coastal dunes can act as barriers to storm-generated waves and high water levels, protecting the assets behind them. Dune vegetation helps reduce overtopping and erosion. Dunes vary in size and extent over time, with sand moving from dunes to beaches and back. Dune and beach habitats are home to rare and protected species, including migratory birds, endangered beach mice, and imperiled sea turtles.

Beach Dune Plant Palette and Successional Species

Botanical Name	Common Name
Uniola paniculata	sea oats
Panicum amarum	bitter panicum
Schizachyrium maritimum	Gulf bluestem
Balduina angustifolia	Coastalplain honeycombhead
Chrysoma pauciflosculosa	woody goldenrod
Chrysopsis godfreyi	Godfrey's goldenaster
Crocanthemum arenicola	coastal sand frostweed
Ipomoea stolonifera	beach morning glory
Ipomoea pes caprae	railroad vine
Iva imbricata	seacoast marsh-elder
Oenothera humifusa	seabeach evening primrose



Beach Dune Locations at Tyndall AFB



and the tidal range. Salt marshes may have distinct vegetation zones dominated by a single species of grass or rush. Salt marsh cordgrass (*Spartina alterniflora*) dominates seaward edges and borders of tidal creeks and areas often inundated by tides. Needle rush (*Juncus roemerianus*) dominates higher, less frequently flooded areas. Marshes can accrete sediment (organic and mineralogic) and increase their elevation to keep pace with sea level rise. However, marshes may fail to keep up with rapid sea level rise, leading to a progressive drowning and a decrease in area. Tyndall AFB's salt marshes are found extensively around East Bay and around coastal areas of the peninsula and barrier islands facing St. Andrew Bay and St. Andrew Sound.

Salt marshes are commonly fronted by intertidal flats—low-gradient non-vegetated intertidal areas of mud or sand. Often, salt marshes evolve from the gradual siltation of tidal flats. This increases the marsh's elevation and allows vegetation to colonize. Intertidal flats help dissipate wave and current energy in front of salt marshes and, during storms, can supply sediment to the marsh surface that increases its elevation.

Role in Resilient Landscapes

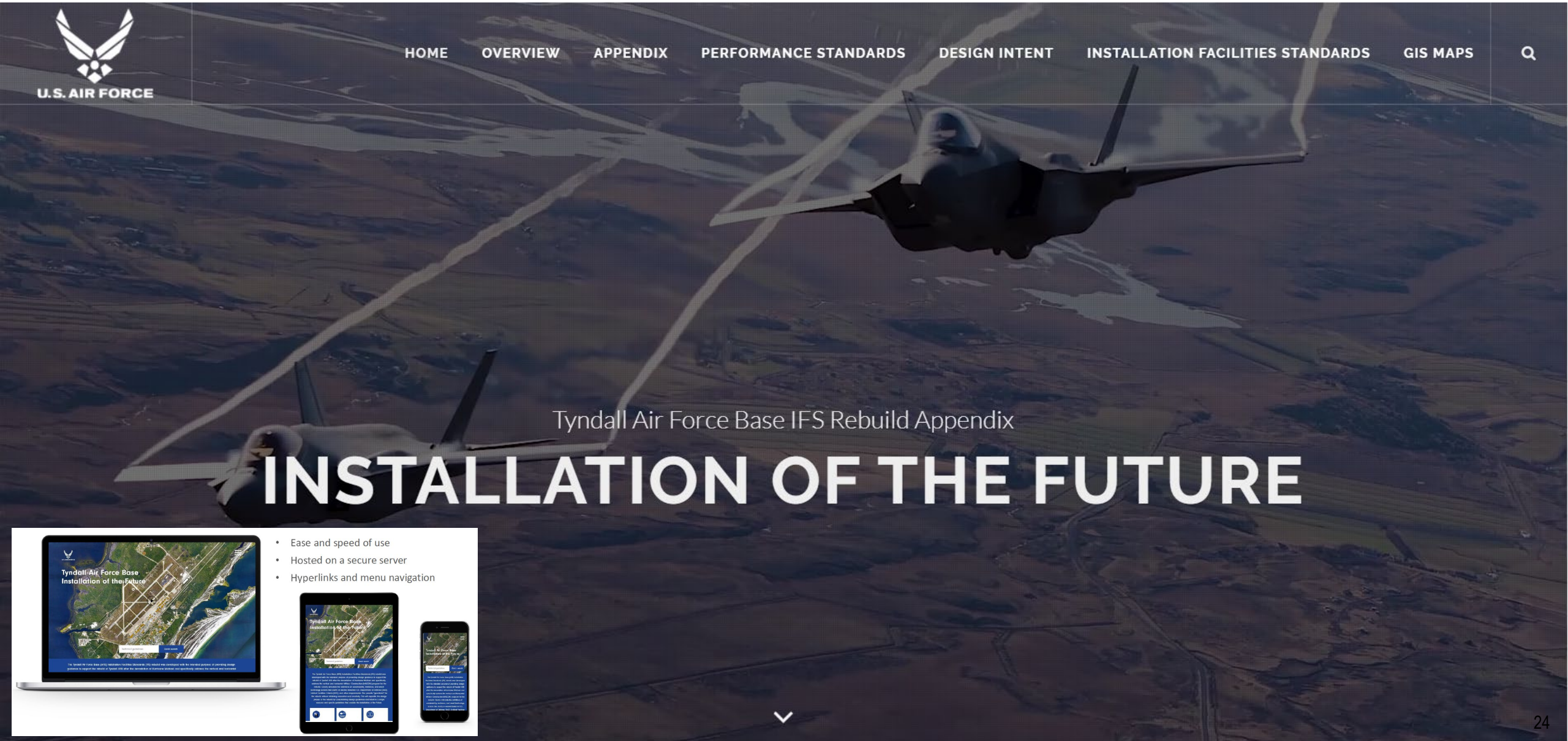
Salt marsh vegetation is highly effective at reducing wave energy. Large salt marshes can help reduce surge water levels in some settings. Although wave reduction is lower under high water levels, salt marshes can help protect landwards areas even during storm conditions (Möller et al. 2014; Narayan et al. 2017). Salt marshes encourage sediment build-up, reduce erosion, filter for nutrients, remove carbon dioxide from the atmosphere, maintain water quality, and provide critical habitat for wildlife. Tidal flats help dissipate wave energy and reduce erosion to landward habitats. Intertidal flats support complex estuarine food webs for invertebrates and fish and provide resting and feeding areas for indigenous and migratory birds.

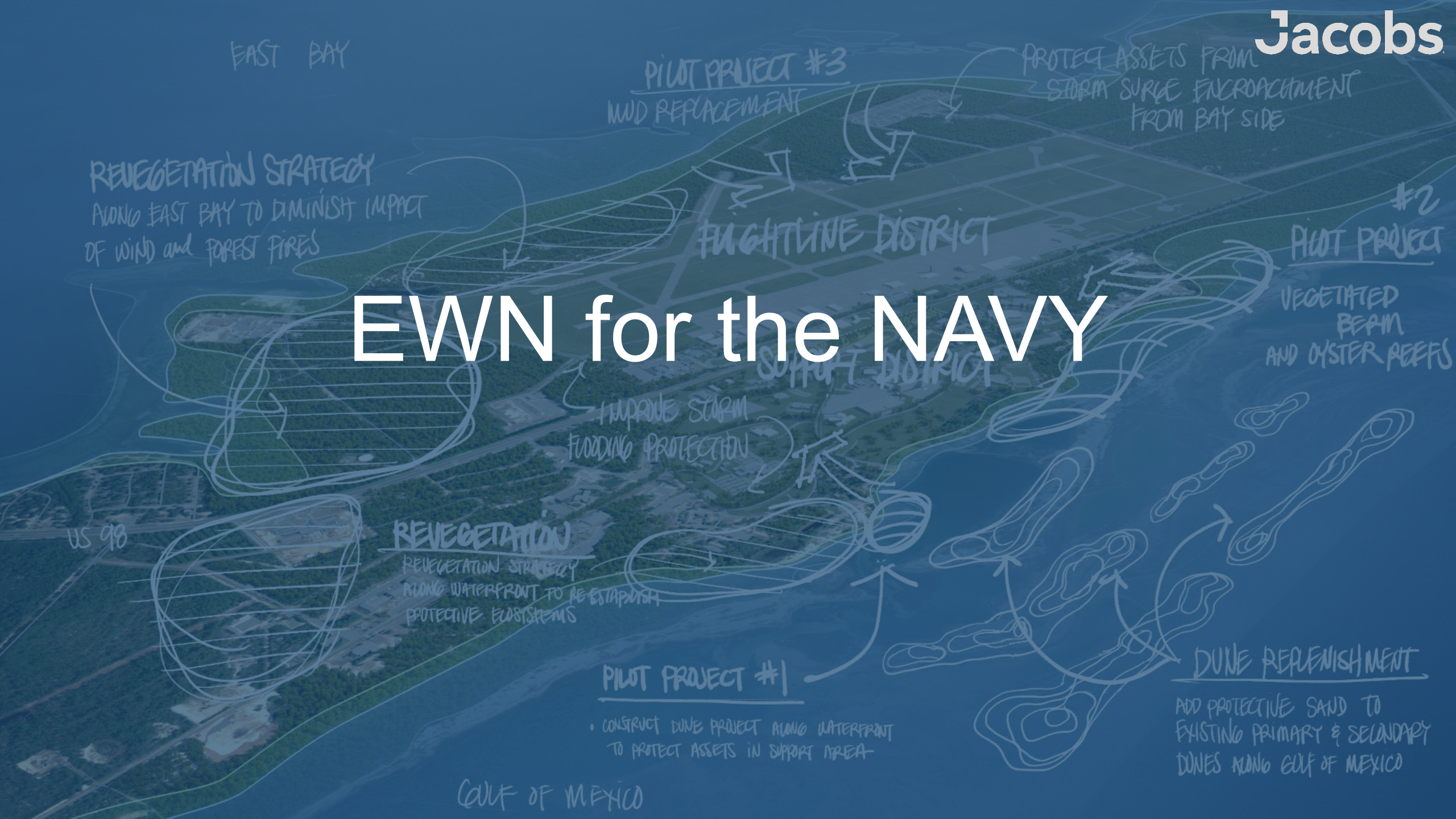
Salt Marsh Plant Palette and Successional Species

Botanical Name	Common Name
Juncus roemerianus	black needle rush
Spartina sparthae	Gulf cordgrass
Baccharis halimifolia	groundsel tree
Iva frutascens	marsh elder
Sarcocornia ambigua	glasswort
Spartina patens	saltmarsh cordgrass
Distichlis spicata	salt grass
Symphyotrichum tenuifolium	saltmarsh aster
Sesuvium portulacastrum or maritimum	sea purslane
Sporobolus virginicus	seashore dropseed

EWN at TAFB

https://www.tyndallifs.com/



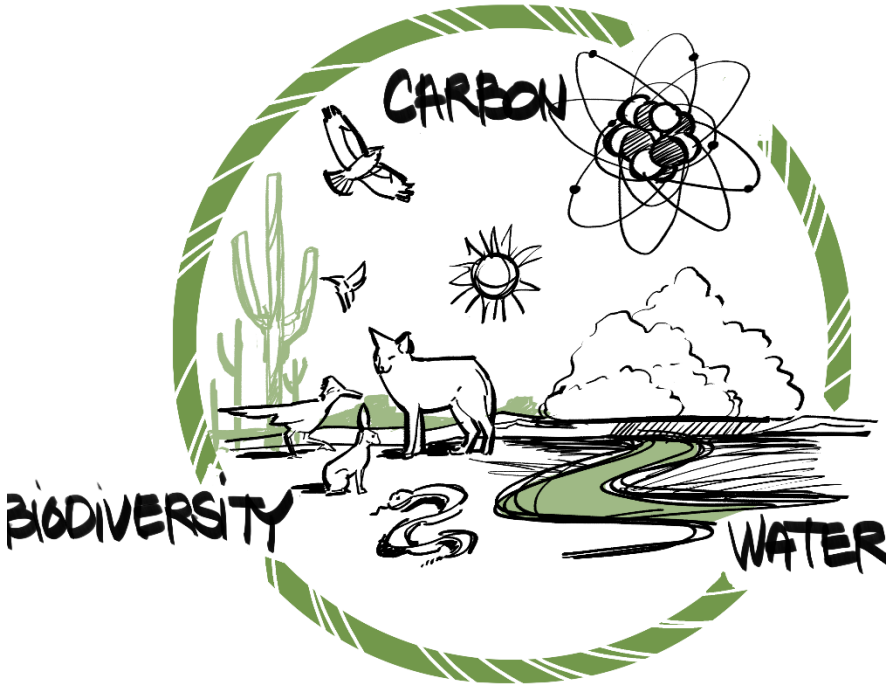


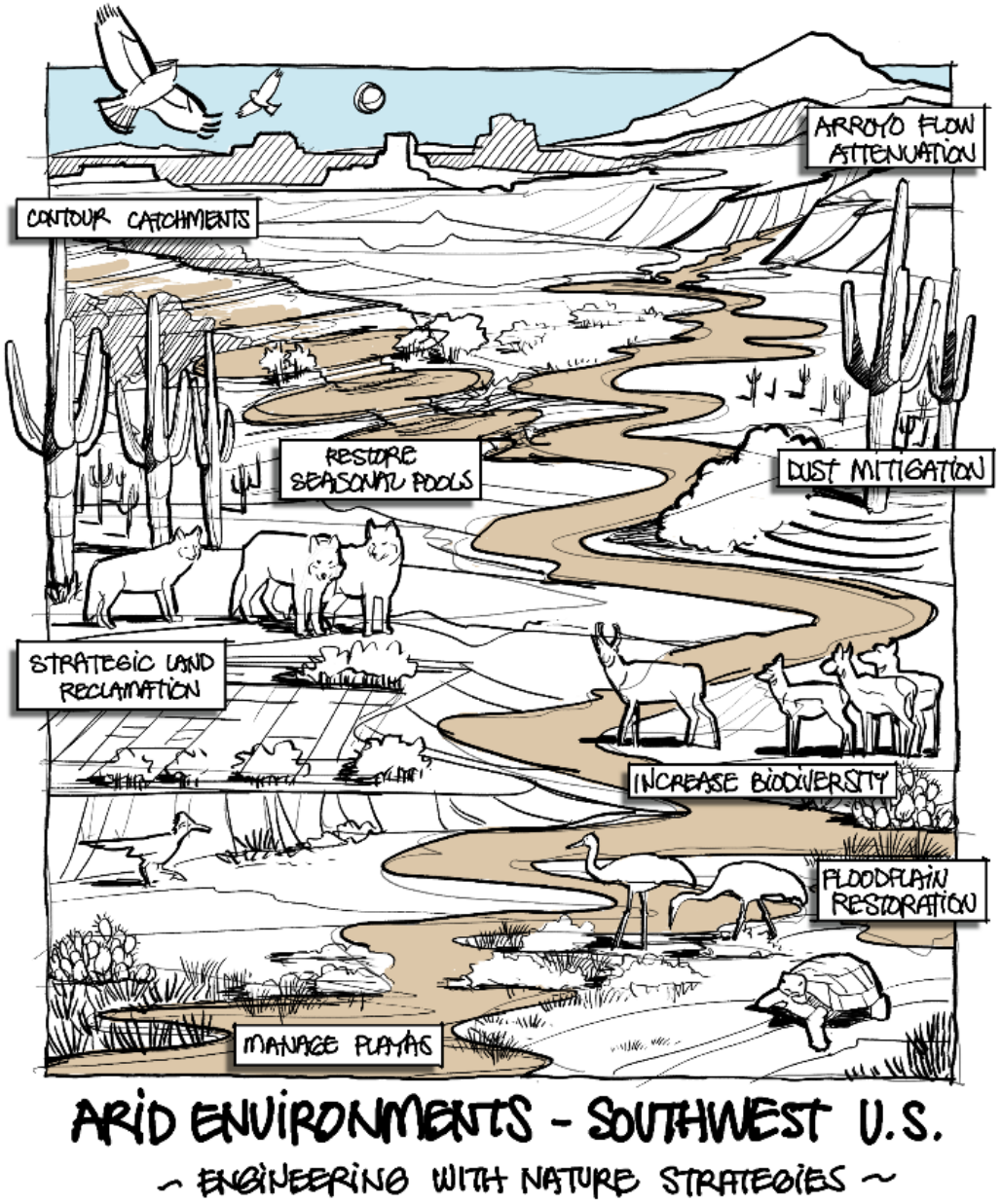
EWN for the NAVY

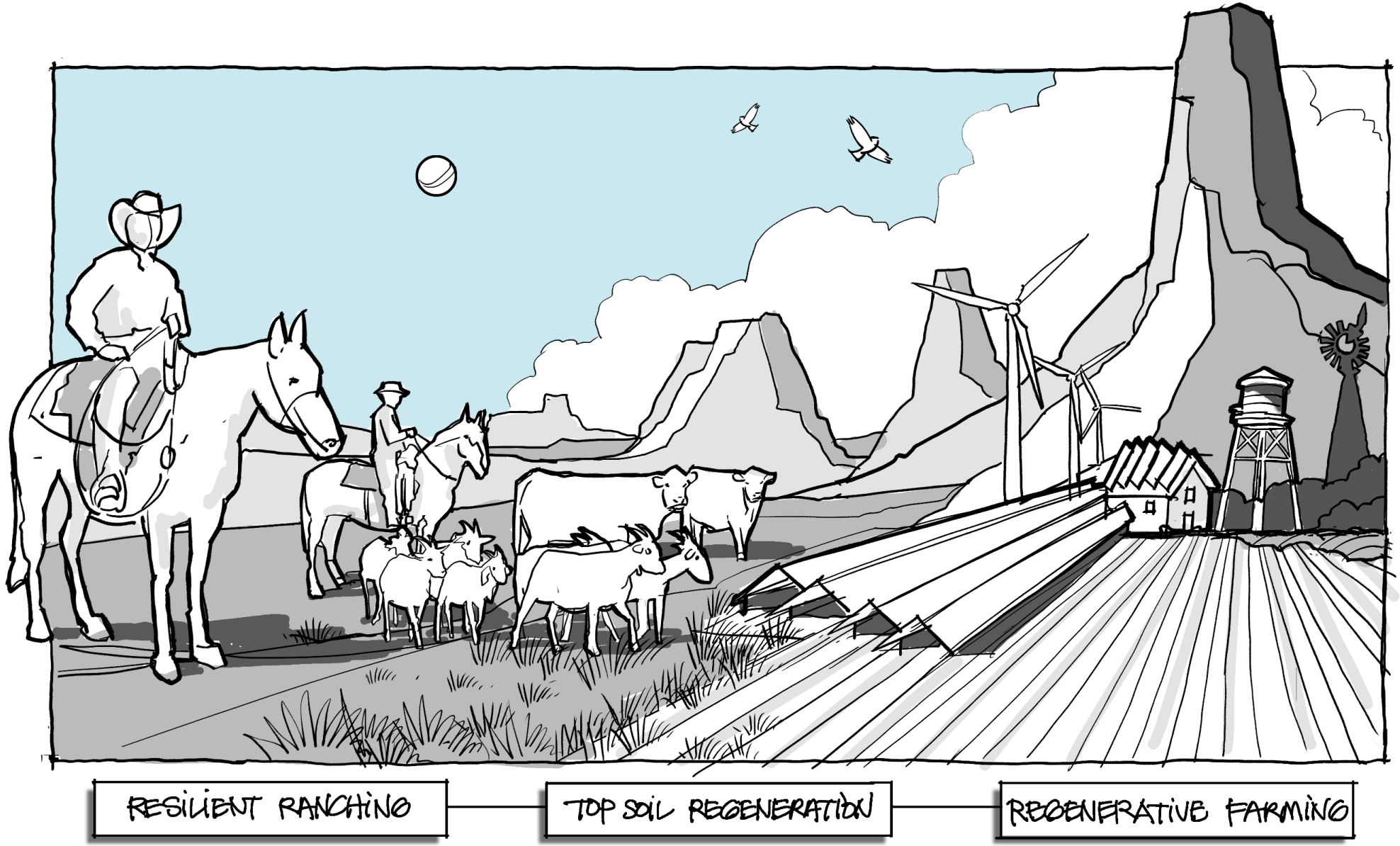
Installation Briefings

Focused Breakout Groups

Specific Project Definition

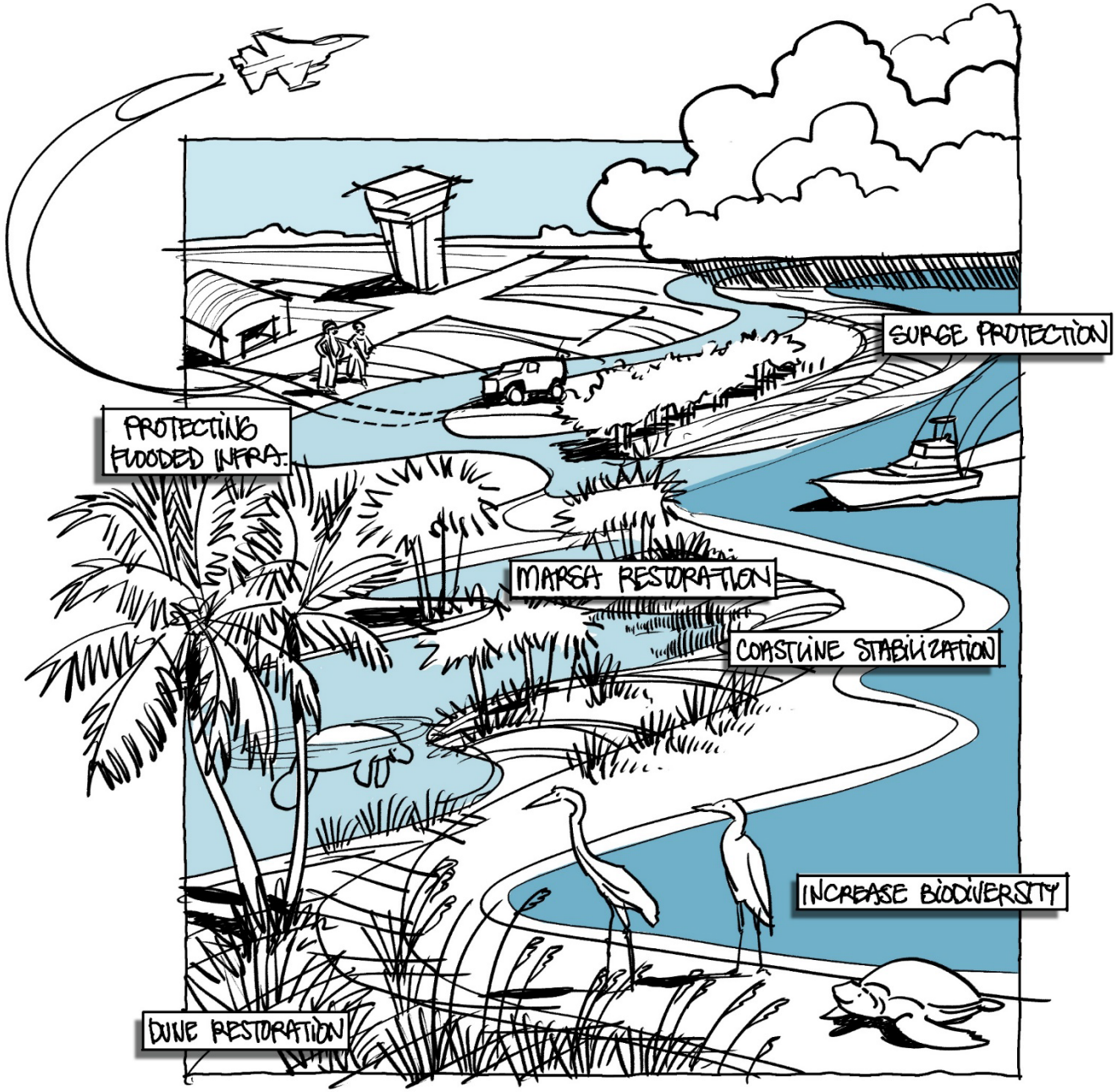






ARID ENVIRONMENTS - SOUTHWEST U.S.

~ ENGINEERING WITH NATURE STRATEGIES ~



COASTAL ENVIRONMENTS - SOUTHEAST U.S.

~ ENGINEERING WITH NATURE STRATEGIES ~


Jacobs
Challenging today.
Reinventing tomorrow.
THANK YOU