Tyndall Air Force Base
Installation of the Future

Jacobs
Challenging today.
Reinventing tomorrow.

U.S. AIR FORCE

Defining the Installation of the Future After a Natural Disaster - **Tyndall AFB Case Study**

AUGUSE 2021

U.S. AIR FORCE

ENVISION · REBUILD · PREVAIL

HURRICANE MICHAEL RECOVERY & REBUILD

TYNDALL AIR FORCE BASE

INSTALLATION OF THE FUTURE

F-35 AMU HANGARS

FLIGHT LINE PEDESTRIAN SPINE

AIREY ENTRY CONTROL FACILITY

MID BLOCK CROSSING

CAMPUS SPACE

COASTAL RESTORATION

F-35

AIRFIELD SUPPORT

WEG

FUTURE MISSION

AF NORTH

TYNDALL ECF

AIREY ECF

COMMERCIAL GATE

CE-LRS INDUSTRIAL

INDUSTRIAL

BASE ADMINISTRATION

DORMS

COMMUNITY SUPPORT

LODGING

COMMUNITY SUPPORT

FAMILY SUPPORT

MEDICAL

BASE ADMINISTRATION

NEW BUILDINGS

EXISTING BUILDINGS

PEDESTRIAN SPINE

TYNDALL AIR FORCE BASE: HURRICANE MICHAEL IMPACTS

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

INSTALLATION FACILITIES STANDARDS: PERFORMANCE STANDARDS

Design Wind Speeds & Building Envelope Protection Memo

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, DC

MEMORANDUM FOR AFCEC/CL

FROM: HQ USAF/A4C
1260 Air Force Pentagon
Washington, DC 20330-1260

SUBJECT: Tyndall AFB Design Wind Speeds and Building Envelope Protection

Based upon our AF Structural SME recommendations and in alignment with the SecAF directed Severe Weather Readiness Assessment recommendations, the Tyndall PMO will use the draft 2019 UFC and the following Tyndall design wind speeds based upon Risk Categories III-V:

	RC I (mph)	RC II (mph)	RC III (mph)	RC IV (mph)	RC V (mph)
Tyndall Design Wind Speeds	Not Permitted	Not Permitted	165	170	203

DESIGN WIND SPEED
Risk Category III 165mph
Risk Category IV 170mph
Risk Category V 203mph

Design Flood Elevation (DFE) Memo

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, DC

05 June 2019

MEMORANDUM FOR AFCEC/CL (Mr. Terry G. Edwards)

FROM: HQ USAF/A4C
1260 Air Force Pentagon
Washington, DC 20330-1260

SUBJECT: Tyndall AFB Design Flood Elevation (DFE)

Design Flood Elevation is defined as the minimum elevation to design assets considering not just the Base Flood Elevation (BFE), but other factors such as historic storm surge data, sea level change, regulatory mandates, state or local requirements, building code requirements, and an asset owner's risk tolerance. This memorandum established two DFE values for the Tyndall AFB design effort:

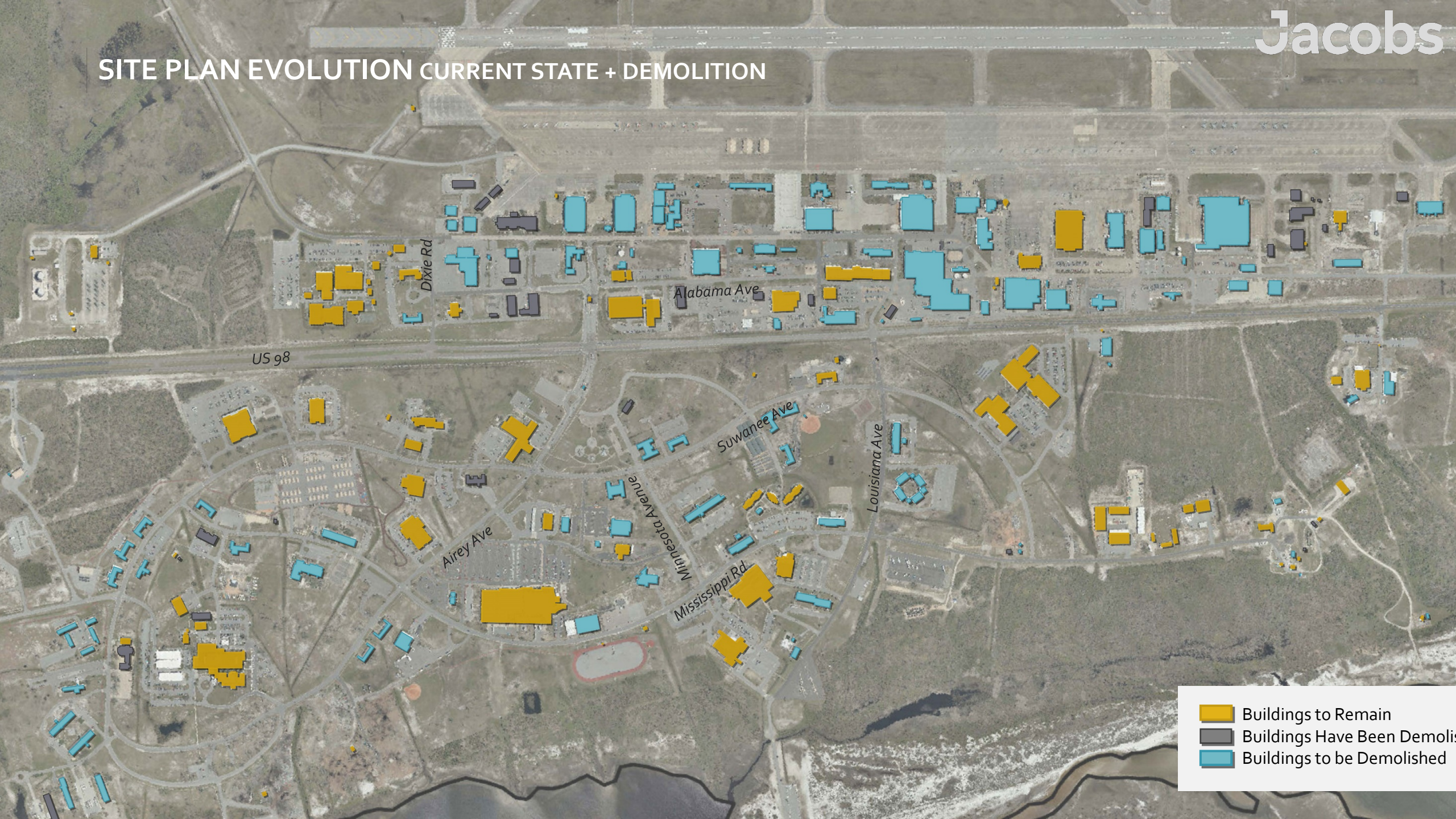
a. For the Gulf side (generally southwesterly of Highway 98) the DFE is 19' above today's mean sea-level (MSL); and

b. For the East Bay side, generally northeasterly of Highway 98, the DFE is 14' above MSL.

MINIMUM
DESIGN FLOOD ELEVATION
19' Support District (S of HW 98)
14' Flightline District (N of HW 98)


Jacobs
REBUILD PROGRAM

SITE PLAN EVOLUTION CURRENT STATE + DEMOLITION



SITE PLAN EVOLUTION MASTER PLAN

LEGEND:

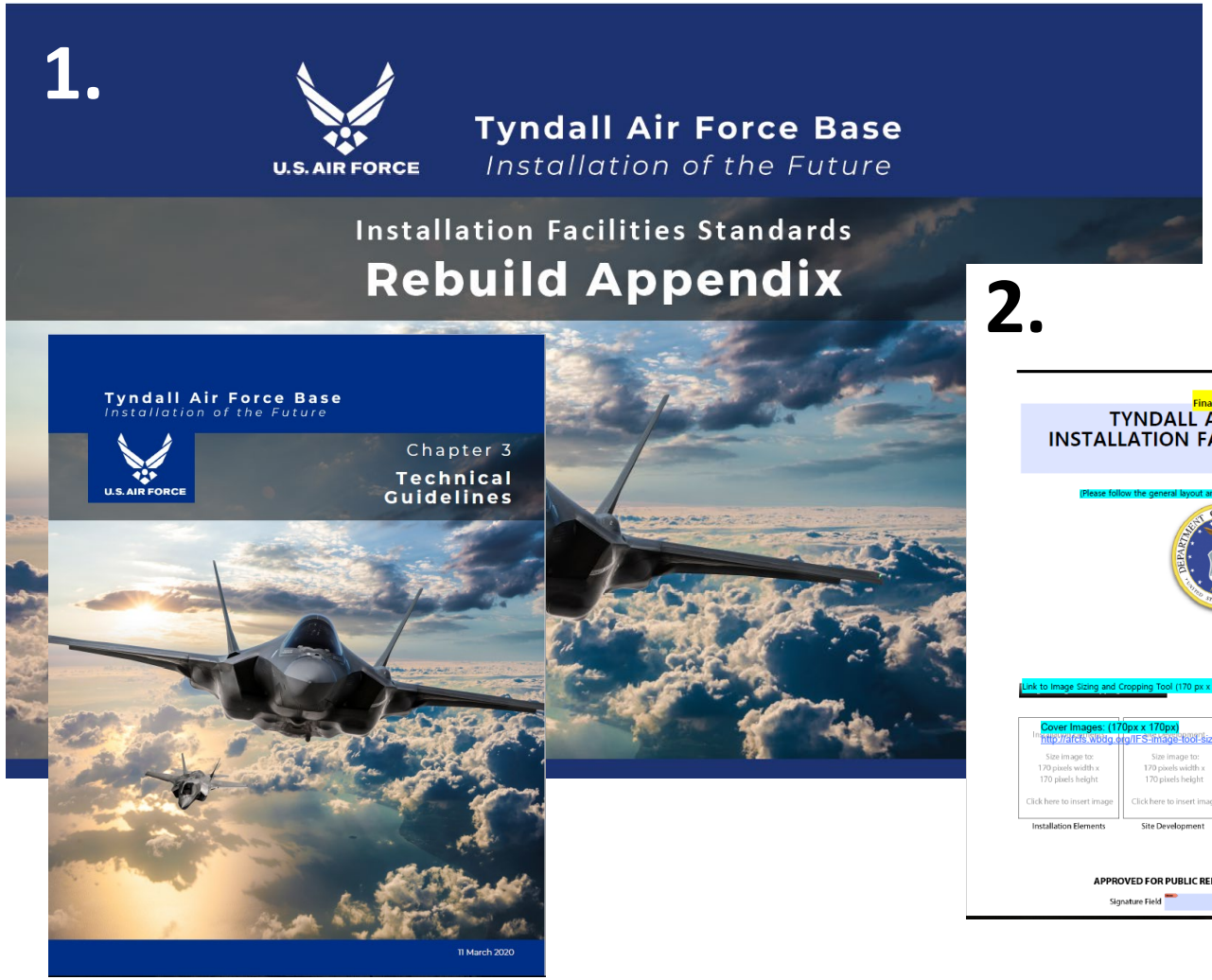
- Existing to Remain Buildings
- Hurricane Rebuild & Progra
- Future Mission
- Future

INSTALLATION FACILITIES STANDARDS

IFS UPDATE

1. **IFS REBUILD APPENDIX**
2. **IFS PARENT UPDATE**
3. **LANDSCAPE MASTER PLAN**

1.



2.

3.

IFS UPDATE Rebuild Appendix Ch 01, 02

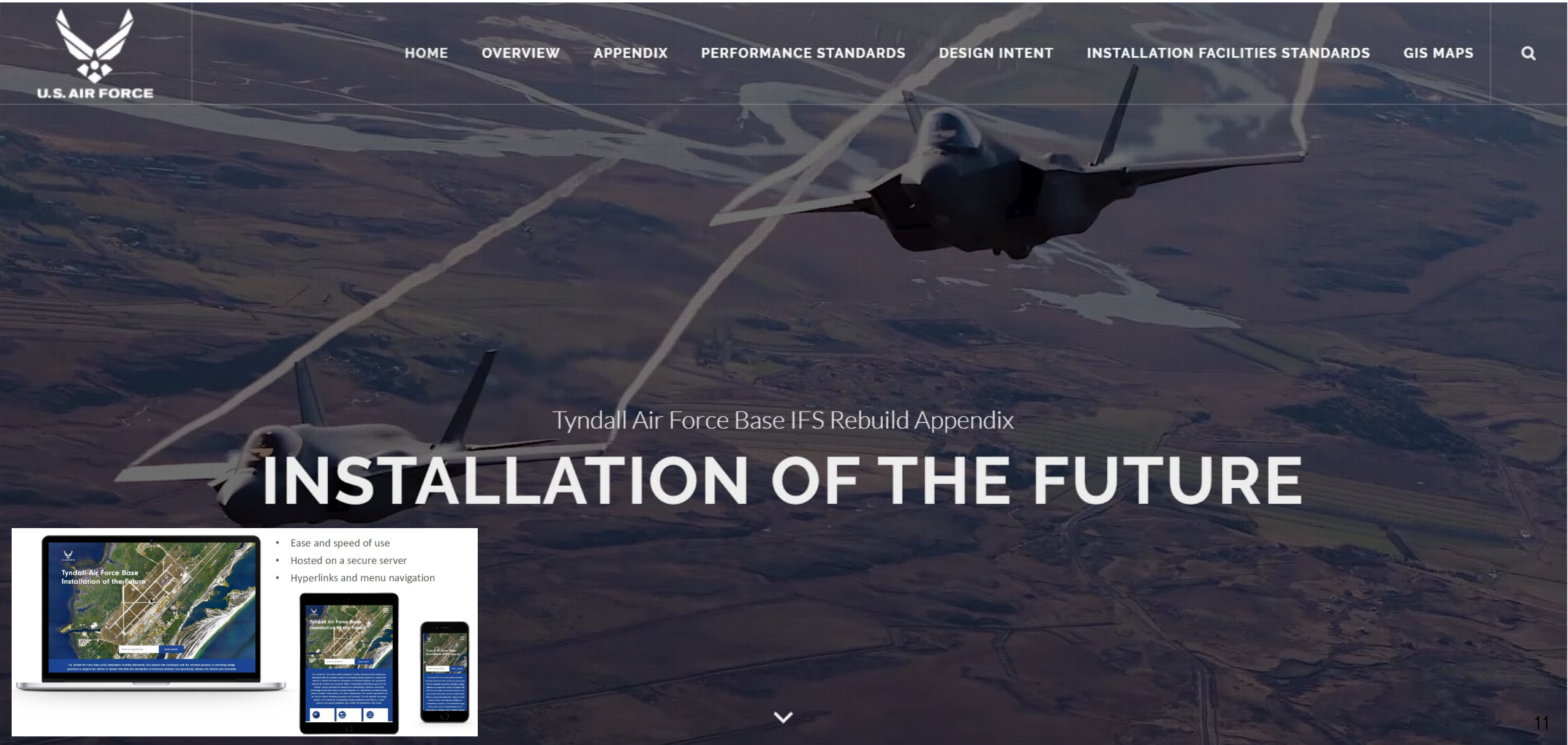
1. **Architecture**
Image and character for the vertical environment, which includes all enclosed and open structures. This section is limited to new construction and does not include renovation of buildings to remain.

2. **Site and Land Management**
Image and character for the horizontal maintained and manicured environment, which includes roads, parking, pathways, site furnishings, site lighting, landscape, and hardscape.

3. **Coastal Resiliency**
Image and character for the horizontal maintained and manicured environment, which includes roads, parking, pathways, site furnishings, site lighting, landscape, and hardscape.

IFS UPDATE Rebuild Appendix Digital Delivery

https://www.tyndallifs.com/



NATURE BASED INFRASTRUCTURE + LANDSCAPE MASTER PLAN

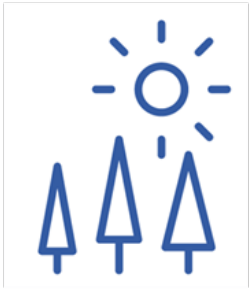
NBI Myth Busting

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

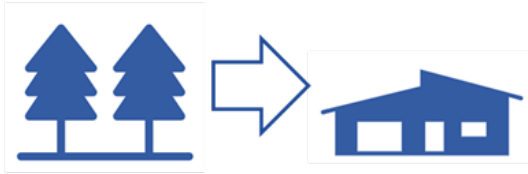
The base will not maintain NBI solutions

Nature Based Infrastructure costs more and requires more maintenance



Landscaped areas attract snakes, bears and mosquitoes

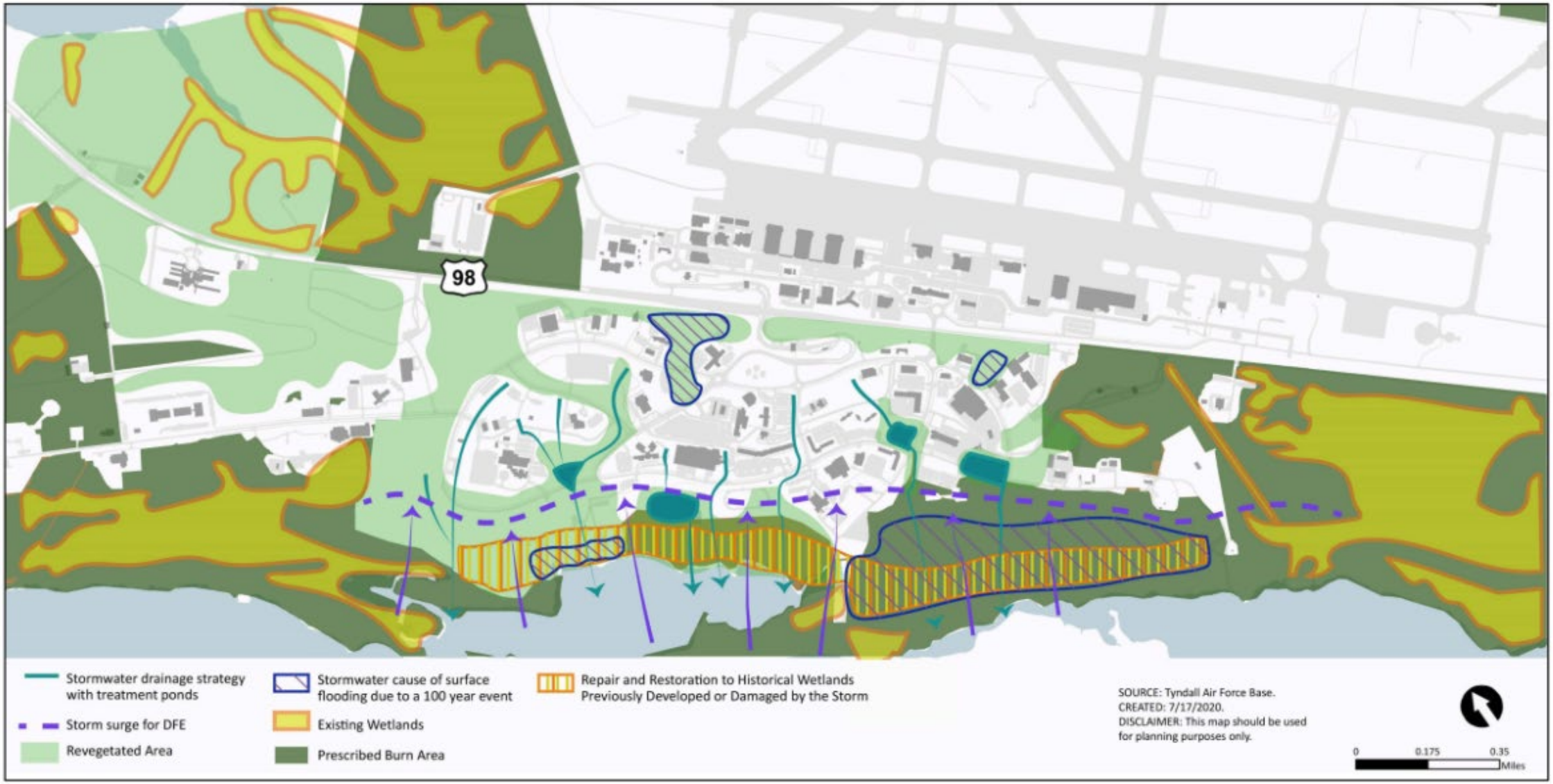
Landscaped areas are a security concern



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

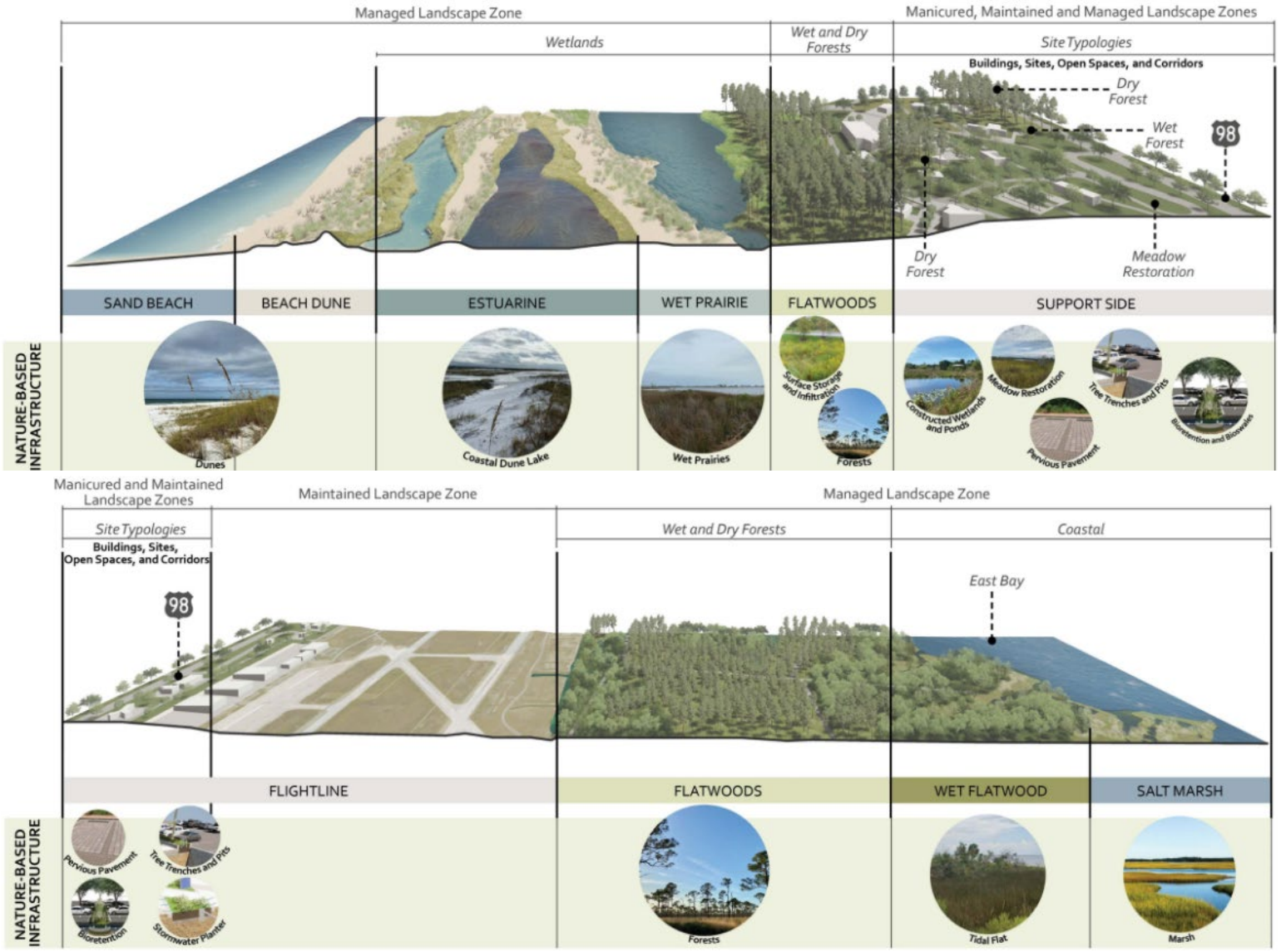
NATURE BASED INFRASTRUCTURE (NBI)

Exhibit B01-2. Integrated Land Management Framework

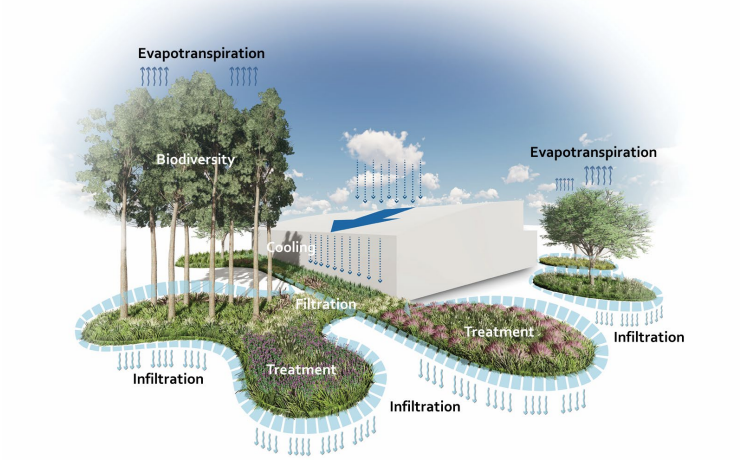


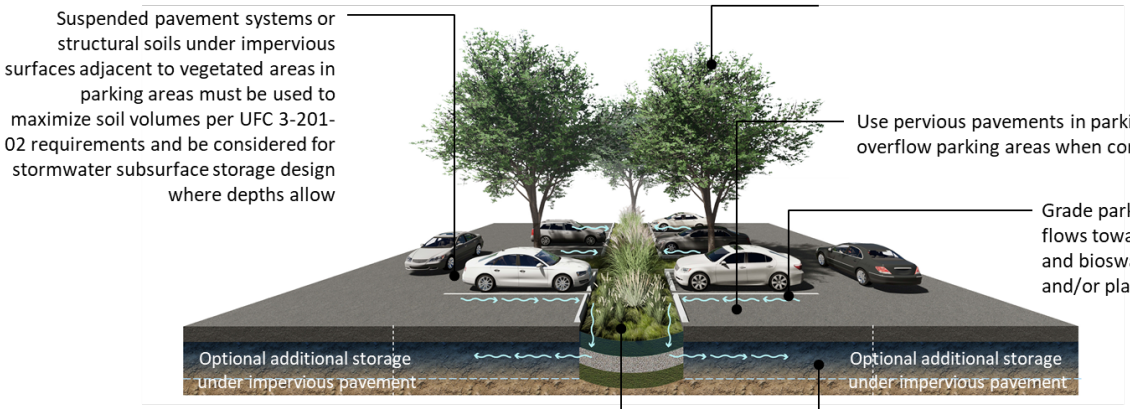
NATURE BASED INFRASTRUCTURE (NBI)

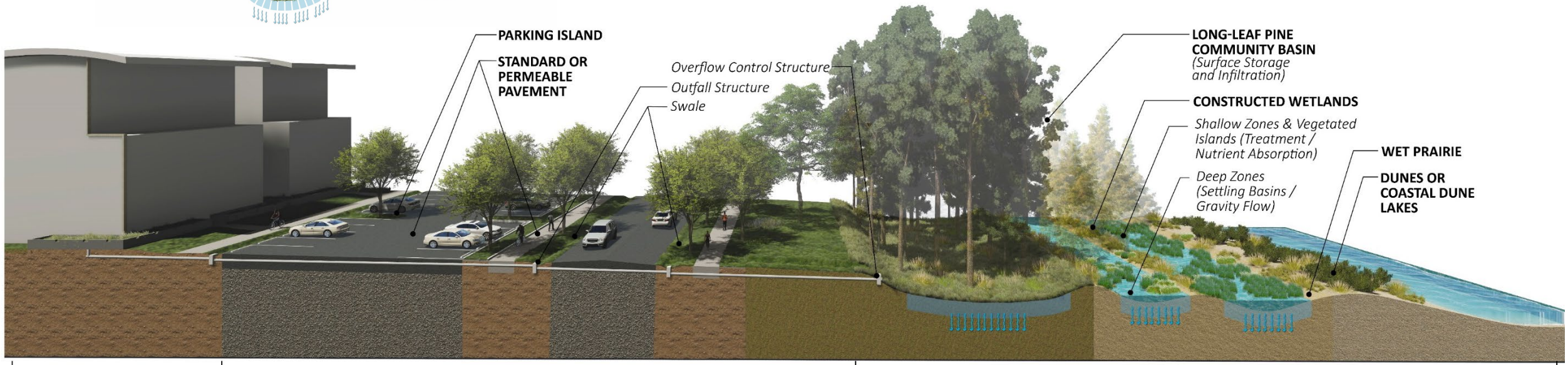
Exhibit B04-6. Best Management Practices in the Support District



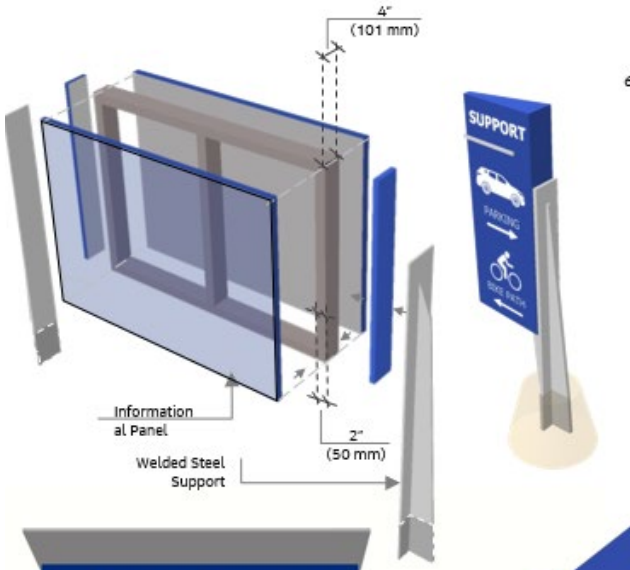
Stormwater Management







Pedestrian Level Signage

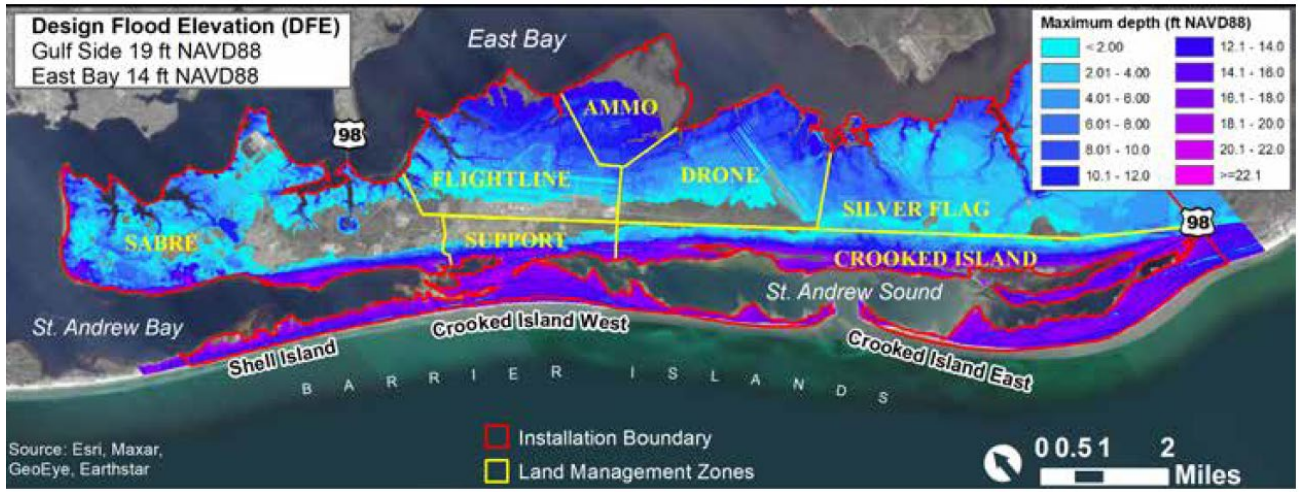


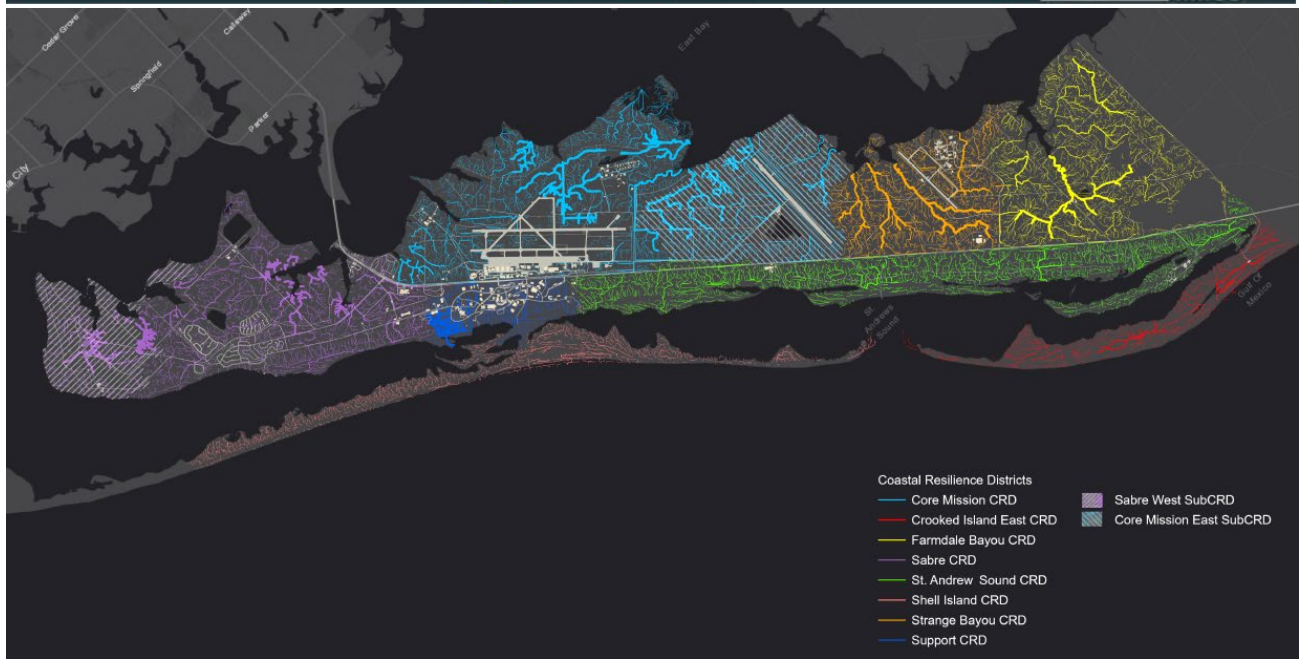
Coastal Zone Site Furnishings

- Use interpretive signage to include educational and directional information, such as cultural & historical content, coastal & environmental conservation, wildlife habitat & dune restoration, installation of the future reconstruction.
- Minimize disturbance by limiting the use of lighting, using turtle friendly lighting, elevating boardwalk to allow wildlife, water and air pass through.
- Revegetated dunes help to reduce flood and erosion risk, provide wildlife habitat.

ENVIRONMENTAL + COASTAL RISK

COASTAL RESILIENCE OTHER TRANSACTIONAL AUTHORITY (OTA)





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.

COASTAL RESILIENCE TYPOLOGIES

Coastal Scrub

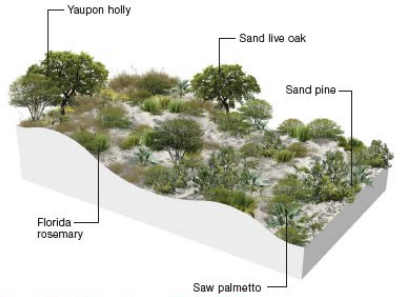
General Description and Location at Tyndall AFB

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.

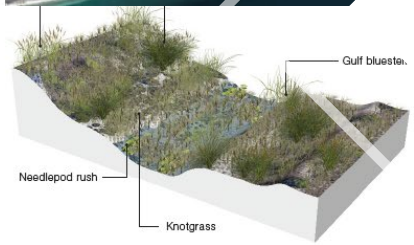
Scrub habitats also support a wealth of species endemic to Florida, many of which are considered rare. Scrub acts as an important habitat for several varieties of beach mice, scrub lizard, scrub-jay, and gopher tortoise.



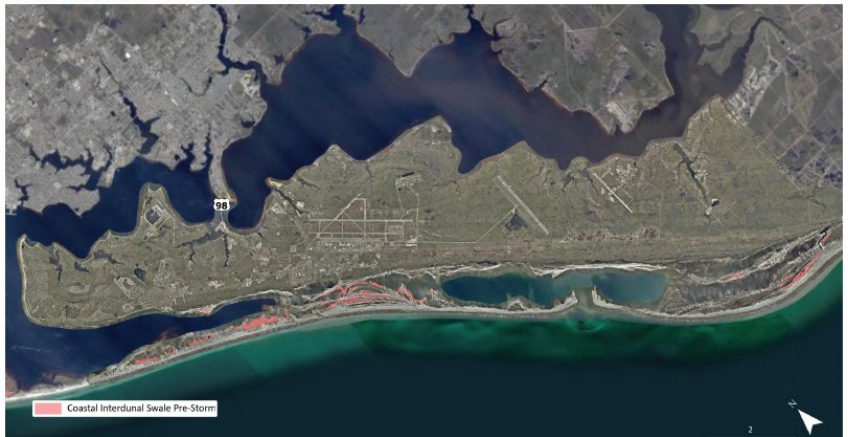
Coastal Scrub Locations at Tyndall AFB

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
Lyonia ferruginea	rusty staggerbush



Coastal Interdunal Swale Locations at Tyndall AFB



19
set th
waves m
plain (Johns
communities.

The base's coastal int
as umbrella sedge (*Fuire*
and milkworts (*Polygala* spp.,
with salt water, after which they
species such as needle rush. Loos
the spread of cordgrass, which tolerat
(Johnson et al. 2000).

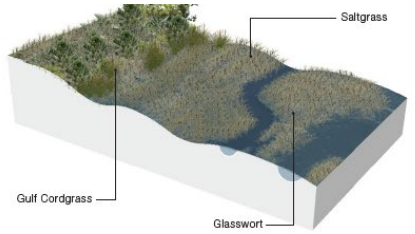
Role in Resilient Landscapes

Interdunal swale habitat has the potential to assist in
helping to dissipate waves and reduce sediment erosion.
flooding and dry conditions, and can hold stormwater run-o
This habitat is important part of the broader dune complex.

Interdunal swales provide wildlife foraging and refuge habitat as well a
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



Marsh 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 spartinae	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
Spartina alterniflora	smooth cordgrass

fronting
ore winds can
s may overtop,
island dunes may
d by repeated storm
d beaches that front dunes
t in dissipating wave energy

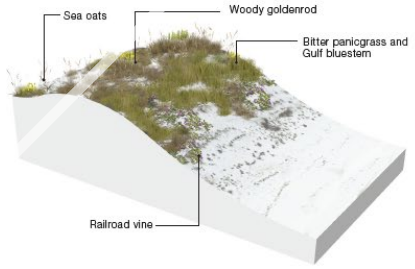
y of wide-ranging coastal specialist
d foredune, usually built by sea oats
natous grass whose stems trap the sand
oast marshelder (*Iva imbricata*), a succulent
ward base of the foredune. These species occupy the
backdunes and areas where sand has not stabilized.

Landscapes

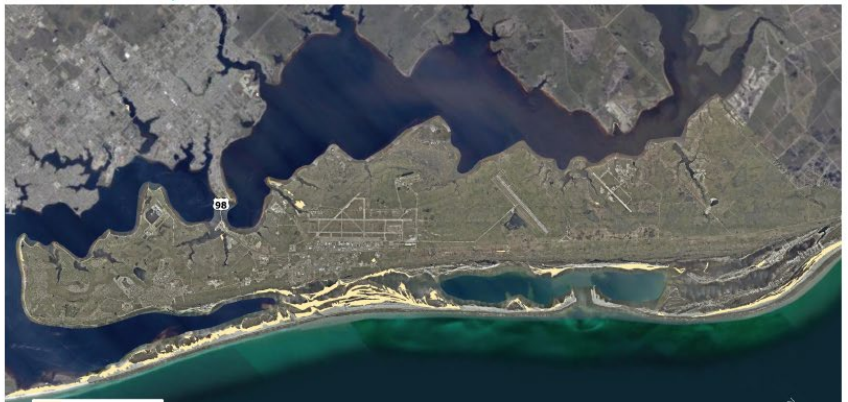
can act as barriers to storm-generated waves and high water
cting the assets behind them. Dune vegetation helps reduce
ng and erosion. Dunes vary in size and extent over time, with sand
g from dunes to beaches and back. Dune and beach habitats are home to
e and protected species, including migratory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

Beach Dune Plant Palette and Successional Species

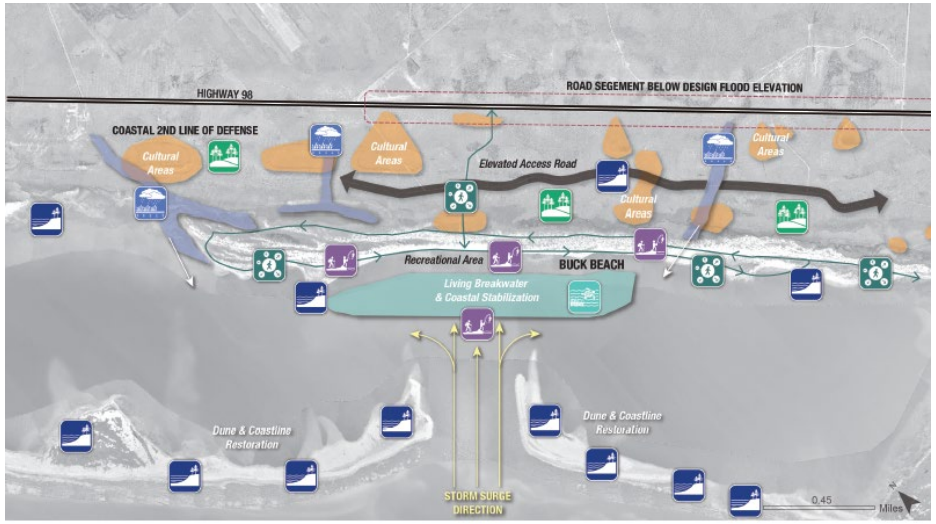
Botanical Name	Common Name
Uniola paniculata	sea oats
Panicum amarum	bitter panicum
Schizachyrium maritimum	Gulf bluestem
Buduina angustifolia	Coastalplain honeycombhead
Chrysoma pausifloscusosa	woody goldenrod
Chrysopsis godfreyi	Godfrey's goldenaster
Crocanthemum arenicola	coastal sand frostweed
Ipomoea 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



COASTAL RESILIENCE OTHER TRANSACTIONAL AUTHORITY (OTA)



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 OTHER TRANSACTIONAL AUTHORITY (OTA)

ENVIRONMENTAL REQUIREMENTS

Law or Regulation	Description	Applicability to Coastal Projects at Tyndall AFB	Timeline for Compliance
National Environmental Policy Act (NEPA)	▪ Requires federal agencies to examine the need for, alternatives to, and environmental consequences of major federal actions they propose. ▪ Multiple levels analysis range from categorical exclusions, to Environmental Assessments (EAs), to Environmental Impact Statements (EISs).	▪ Required for the coastal resilience pilot projects and the demonstration areas because the actions have never occurred or been analyzed on base. ▪ Two NEPA analyses are proposed: 1. EA for Coastal Resilience Pilot Project Implementation to analyze the environmental impacts from the four pilot projects. 2. Programmatic EA for Demonstration Areas to analyze the environmental impacts from proposed actions in the five demonstration areas.	▪ 8-12 months
CFR Title 32 Part 989, *Environmental Impact Analysis Process (EIAP)*	▪ Identifies the U.S. Air Force's (USAF's) procedures for implementing NEPA requirements.	▪ Because the coastal resilience initiatives will be implemented on an Air Force Base, the USAF is the lead Federal Agency and will follow USAF's NEPA requirements.	▪ 8-12 months, concurrent with NEPA
Clean Water Act (CWA) Section 404	▪ Regulates the discharge of dredge or fill material into waters of the U.S., including wetlands. ▪ USACE Jacksonville Regulatory Division requires a CWA permit if proposed activities involve placing fill into waters of the U.S. ▪ Florida Department of Environmental Protection (FDEP) and Florida's five water management districts jointly regulate wetlands and surface waters through the Environmental Restoration Program (ERP).	▪ The coastal resilience pilot projects and demonstration areas are proposed in potential jurisdictional waters of the U.S./regulated state waters and must be delineated. ▪ If waters of the U.S. are impacted, a Section 404 permit will be required. ▪ If regulated state waters are impacted, an ERP permit will be required.	▪ 3-9 months, concurrent with other CWA permitting requirements
CWA Section 401	▪ Ensures material discharged pursuant to a Section 404 permit meets the State of Florida water quality standards. ▪ The State will issue a Water Quality Certification if no violations are expected.	▪ The coastal resilience pilot projects and demonstration areas will require Water Quality Certifications.	▪ 3-6 months, concurrent with other CWA permitting requirements
CWA Section 402	▪ Establishes the requirements for the National Pollutant Discharge Elimination System (NPDES). ▪ Certain construction activities are required to obtain a Generic Permit for Stormwater Discharges from Large and Small Construction Activities (FDEP Form 62-621.300(4)(a)) under Florida's NPDES stormwater program.	▪ The coastal resilience pilot projects and demonstration areas will require NPDES permits.	▪ 3-6 months, concurrent with other CWA permitting requirements
Rivers and Harbors Act of 1899	▪ Regulates activities in navigable waters of the U.S. ▪ Any proposed activities that involve placing fill into navigable waters of the U.S. require permitting through the USACE Jacksonville Regulatory Division under the Rivers and Harbors Act.	▪ If waters of the U.S. are impacted, a Rivers and Harbors Act permit will be required.	▪ 3-6 months, concurrent with other CWA permitting requirements
Endangered Species Act (ESA), as amended	▪ Provides a means for conserving endangered and threatened species and the ecosystems in which they live. ▪ Implemented jointly by the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) Fisheries Office of Protected Resources. ▪ Level of consultation depends on the project's potential to impact listed species or designated critical habitat	▪ Consultation with USFWS and NOAA Fisheries is required under ESA Section 7. ▪ Consultation is required even if the effects of an action are expected to be beneficial. ▪ Consultation with USFWS and/or NOAA Fisheries may include either informal or formal consultation.	▪ Informal consultation: 2 months, concurrent with NEPA ▪ Formal consultation: 4-5 months, concurrent with NEPA

COASTAL RESILIENCE OTHER TRANSACTIONAL AUTHORITY (OTA)

STAKEHOLDER ENGAGEMENT

STAKEHOLDER ENGAGEMENT MEETINGS

- **3** virtual meetings
- **30** organizations represented
- **130** participants
- **10+** regional programs with synergies
- **10+** potential grant programs

ONE COMMON THEME - CONTINUE TO PURSUE PILOTS AND FUNDING

http://tyndallcoastalresilience.com/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Reinventing tomorrow.
THANK YOU