

# PUERTO RICO COASTAL STUDY

## Managed Coastal Retreat Recommended through Consideration of Comprehensive Benefits

### Stacey Roth

Chief, Coastal Navigation Plan Formulation Section, Planning Division  
U.S. Army Corps of Engineers, Jacksonville District

### Will Reilly, P.E.

Chief, Waterways Branch, Engineering Division  
U.S. Army Corps of Engineers, Jacksonville District

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U.S. ARMY







# PUERTO RICO COASTAL STUDY

## STUDY OVERVIEW



2







## PROBLEMS



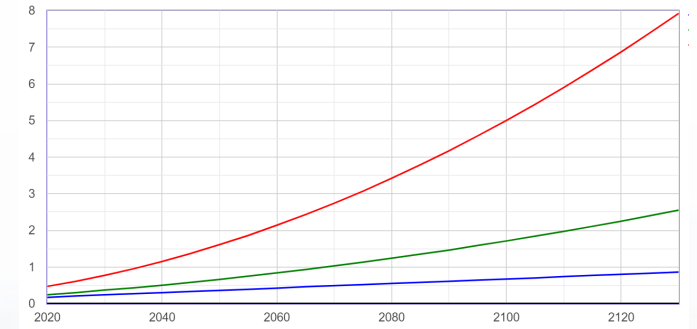
Coastal flooding



Wave attack



Severe erosion



Sea Level Rise

## OBJECTIVES

### NATIONAL ECONOMIC DEVELOPMENT (NED)

Reduce storm damages; Maintain recreational use of coastal areas and non-coastal areas.

### ENVIRONMENTAL QUALITY (EQ)

Maintain or increase environmental quality.

### REGIONAL ECONOMIC DEVELOPMENT (RED)

Maintain tourism or allow it to rebound more quickly after coastal storms.

### OTHER SOCIAL EFFECTS (OSE)

Improve access to roads in the inland areas after coastal flooding events and/or social benefits.

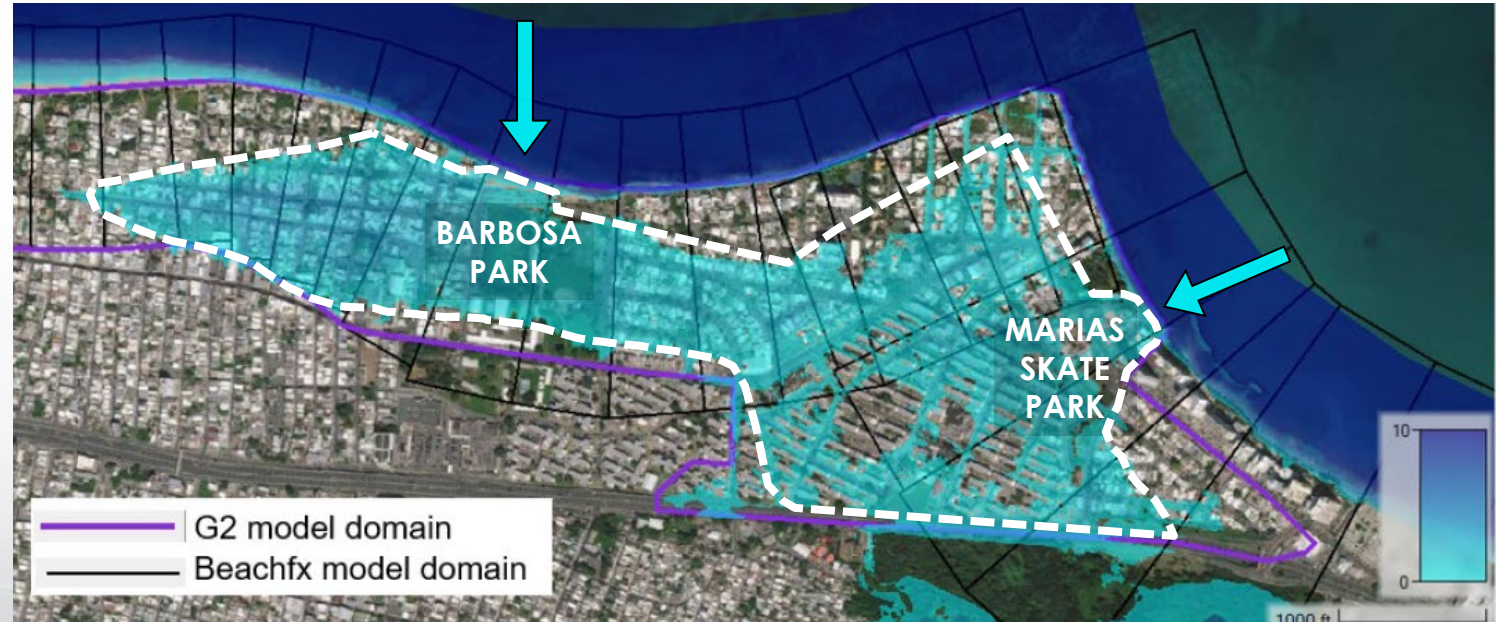


## PUBLIC PERCEPTIONS



- “Hot spots” created from seasonal/episodic shifting sands
- Costs to address erosion (e.g. beach nourishment) outweighed the benefits
- Modeled erosion damages were low compared to coastal flooding damages

## ENVIRONMENTAL



- High habitat quality and diversity (e.g. SAV beds and ESA listed corals)
- Sand placement would result in high mitigation costs





# OCEAN PARK

## PLAN FORMULATION

- Alt 1: No Action
- Alt 2: Floodwall
- Alt 3: Floodwall and Beach/Dune
- Alt 4: Floodwall
- Alt 5: Floodwall + Acquisition

The storm of most concern has not yet happened to-date (high surge and sea level rise).  
Need proactive project to avoid these damages.







6 townhomes

Barbosa Park

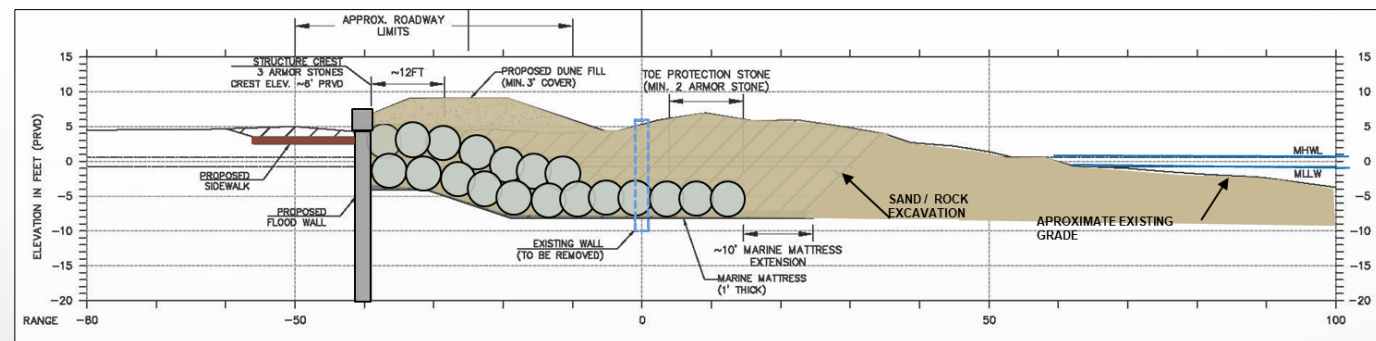


Floodwall with  
toe protection



Acquisition

### TYPICAL CROSS-SECTION







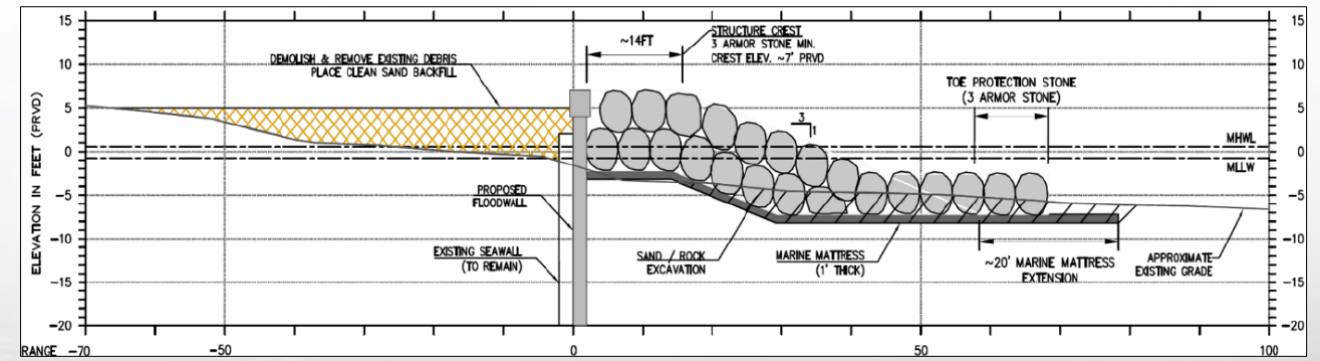


# MARIAS SKATE PARK



 Floodwall with toe protection  Acquisition

TYPICAL CROSS-SECTION









# OCEAN PARK | DESIGN, BENEFITS AND RISK




NOT TO SCALE

## LEGEND

 Key pathways of coastal flooding

 Coastal Flooding Risk Reduced Area Previously at Risk

## MEASURE TO REDUCE PROBLEMS

 Acquisition

 Floodwall with toe protection

## BENEFITS

- Reduces risk of damages to taxpayer from coastal flooding from ocean (blue outline)
- Reduces life loss
- Reduces business disruption
- Reduces impacts to low-income communities
- Integrates function with continued recreation
- Reduces life loss
- Supported by agencies - no environmental mitigation is required

## RISK MESSAGING

***“Monitoring and Adaptive Management-***  
If thresholds are exceeded, it is recommended that a re-evaluation study is initiated to reformulate alternatives”





## VISUAL AIDS - RENDERING



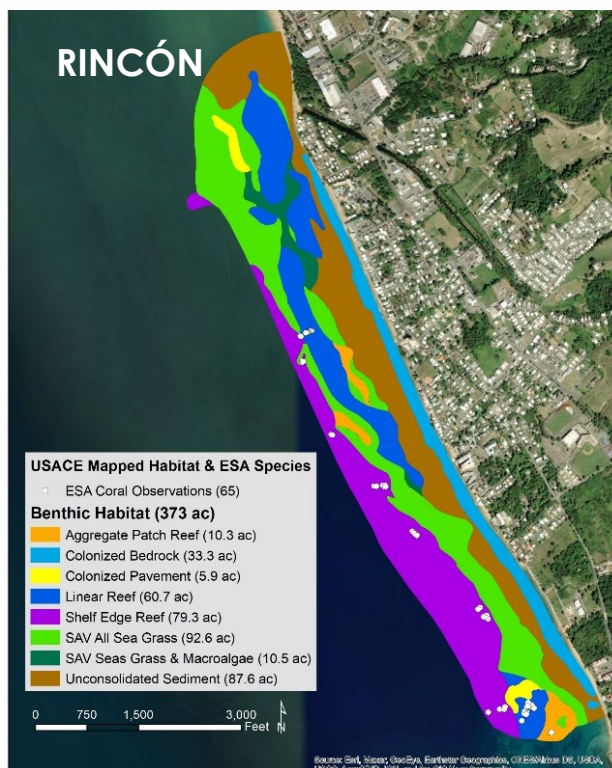
## ENGAGEMENT 2022-2024

- 3 public open houses/public meetings
- 3 meetings with San Juan municipality
- 3 meetings with homeowners
- 1 meeting with GOV PR

- Facebook, radio, newspaper presence with consistent messaging
- Website with FAQs
- Email with weekly engagement and responses
- Continuous sponsor engagement
- All meetings, posters, and presentations in Spanish and English



## ENVIRONMENTAL



- High habitat quality and diversity (e.g. SAV beds and ESA listed corals)
- Sand placement would result in high mitigation costs

## PLAN FORMULATION



- Alt 1: No Action
- Alt 2: Rock Revetment
- Alt 3: Beach/Dune with Groins
- Alt 4: Acquisition



## RETREAT CONCEPT



GOOD EXAMPLE OF WHAT THE OUTCOME WOULD LOOK LIKE

- Homeowners have time and incentive to move before structural failure of home due to erosion
- Coordinated effort to remove structures and restore natural beach setback area, rather than ad hoc reactive approach as structures fail over time and devastation of community
- Natural beach restores and enhances habitat and revives cultural identity

## ONE AREA, TWO COMMUNITIES



- Community was not homogenous in their views and perspectives for solutions
- Many front row homes are second vacation homes
- Much of the long-term local community lives inland





## TOTAL BENEFITS ANALYSIS FOR THE FINAL ARRAY OF ALTERNATIVES

Alternative	Total Cost (Present Value)	NED			RED			OSE	EQ
		Cost	Net Benefits	Benefit to Cost Ratio (BCR)	Tourism	Local Property Tax Revenue	# Jobs	Forced Relocation (due to structural failure) Prevented	Habitat Unit Created
1 - No action	\$ -		\$ -	N/A	\$ -	0	0	0	0
2 - Revetment	\$110,000	\$3,910	(\$2,855)	0.27	\$ -	\$8	488	55	0
3 - 20' Beach/dune w/groin @ 5 yr	\$194,277	\$6,850	(\$5,641)	0.18	\$3,455	\$7	565	43	0
4 - Acquisition	\$110,848	\$3,715	(\$2,620)	0.29	\$3,548	\$5	0	46	4.14

All Dollar Figures are in \$1,000 AAEQ dollars, except Total Cost which is in \$1,000 Present Value dollars

- Rincon does not have any economically justified alternatives
- Other four accounts were used to evaluate and compare alternatives.
- Alternative 4 is the recommended plan, due to garnering to fullest extent of total net benefits, with qualitative **OSE** being the primary focus.
- The team submitted an NED exception to the ASA(CW

### OSE

- Benefits low-income communities
- Proactive management
- Community cohesion
- Reduces unsightly conditions and restores access to the beach





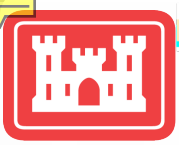
## DESIGN

- Acquisition of property and structures most vulnerable to structural failure in the near future due to erosion
- After acquisition, homeowners are provided assistance with relocation to new properties
- Structures would be removed on acquired land, and it would be graded to return it to natural sandy state;
- Native vegetation plantings are included in this plan to increase habitat and resiliency
- All acquisitions will be necessary
- Recommending the project occur over a single phase

## RISK MESSAGING

***“Monitoring and Adaptive Management*** – If thresholds outlined are exceeded, it is recommended that a re-evaluation study is initiated to reformulate alternatives”

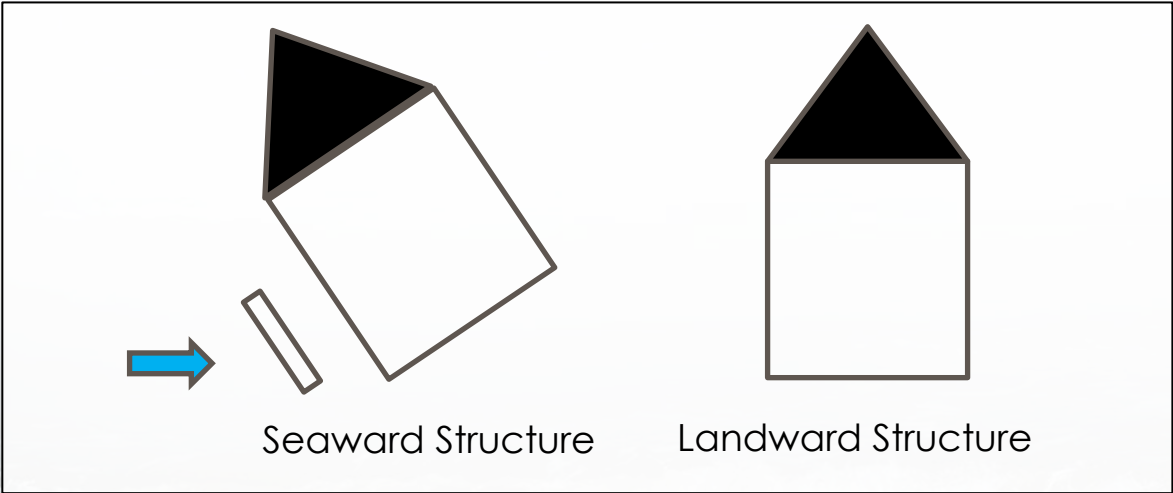




# RINCÓN | RESIDUAL RISK

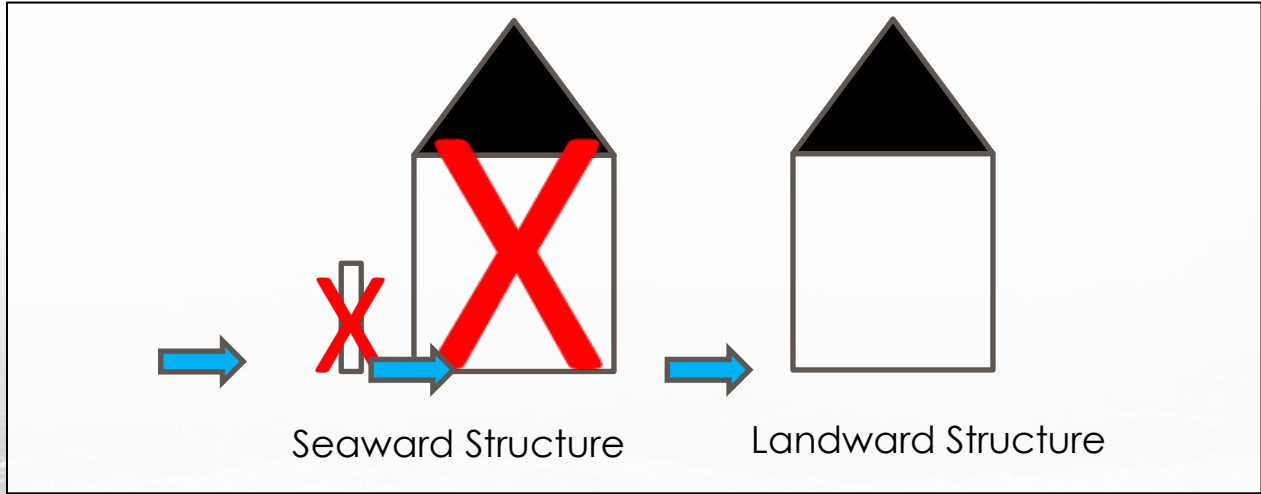
## FUTURE WITHOUT PROJECT (FWOP)

- Condemned homes left in place
- Condemned homes inherently act as armor for next landward structure





## FUTURE WITH PROJECT (FWP)


- Condemnations of ~69 parcels removed (structure and armor)
- Second row condemnation begins
  - Low erosion estimated: as early as 39 years
  - Mid erosion estimated: as early as 14 years (chosen for FWP)
  - High erosion estimated: as early as 9 years




**LEGEND**

 Erosion

 Removal

 Armoring

 Structures

**Second Row Condemnations**  
(overall average is ~35 years)







## VISUAL AIDS



**The Vision:** *Reset of the Rincón coastline*

## ENGAGEMENT 2022-2024

- 4 public open houses/public meetings
- 3 meetings with Mayor of Rincon
- 3 meetings with homeowners
- 1 meeting with GOV PR

- Facebook, radio, newspaper presence with consistent messaging
- Website with FAQs
- Email with weekly engagement and responses
- Continuous sponsor engagement
- All meetings and posters, presentations in Spanish & English



- Take public perceptions seriously
- Expect constant and consistent communication through various means and methods (visual, verbal, written)
- Use every engagement as an opportunity to message the science and rationale
- Plan for visual renderings
- Consider real estate challenges when developing alternatives
- Have early and often in-person meetings in the local community gathering areas and allow verbal and written options for feedback
- Make every effort to understand cultural dynamics and bridge the communication gap, as well as bilingual experts (including local experts)