



Coastal Hazards & Sea-Level Rise Asset Vulnerability Assessment for Fort Pulaski National Monument

Summary of Results

NPS 348 189899, May 2023



PROGRAM FOR
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Fort Pulaski from the north

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Program for the Study of Developed Shorelines
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Executive Summary

This document presents the results of the **Coastal Hazards & Sea-Level Rise (SLR) Asset Vulnerability Assessment (VA)** completed by Western Carolina University at Fort Pulaski National Monument (FOPU) in 2019. In this VA, we evaluate the vulnerability (as a combination of exposure and sensitivity) of NPS buildings and transportation assets¹ to identified coastal hazards and climate change factors, approximately to the year 2050 (for full methodology, see Peek et al. 2022).

We assessed 27 buildings/structures (including comfort and entrance stations, a visitor center, maintenance buildings, cisterns, batteries, and other fortification features) and 20 transportation assets (roads, parking lots, a bridge, trails, ditches, and a pier) at FOPU. The majority (89%) of assets analyzed have high vulnerability to the evaluated coastal hazards and SLR, a factor of the high exposure of this location. Scoring details and results for all assets evaluated at FOPU are reported in the provided Excel sheets.

Exposure Results

Exposure is a measure of the character, magnitude, and rate of changes a target may experience (e.g., from the impacts of climate change or a natural hazard influenced by climate change; NPS 2021). In this VA, we evaluate the exposure of each asset to the following coastal hazard indicators: flooding potential, shoreline change, SLR, extreme event flooding, and reported coastal hazards (Table 1).

Table 1. Exposure indicators and hazard data sources used.

Exposure Indicator (Description)	FOPU Data (Citation)
Flooding potential (1% annual-chance)	Effective FEMA VE & A zones (FEMA 2018)
Shoreline change (coastal proximity)	35-m shoreline proximity buffer (Peek et al. 2022)
SLR inundation (2050)	NPS 8.5 RCP SLR model, 0.25 m rise (Caffrey et al. 2018)
Extreme event flooding (category 3 surge)	NPS storm surge inundation model (Caffrey et al. 2018)
Reported coastal hazards (historic flooding)	Questionnaire results & discussions (Peek et al. 2022)

Assets with high exposure are within at least four exposure indicator hazard zones. Assets with moderate exposure are within two or three exposure indicator hazard zones. Assets with low exposure are within only one exposure indicator hazard zone. The asset could still be seriously impacted by this hazard. Assets with minimal exposure are not in any exposure indicator hazard

¹ The NPS Facility Management Software System (FMSS) database defines assets as “...a physical structure or grouping of structures, land features, or other tangible property that has a specific service or function, such as a farm, cemetery, campground, marina, or sewage treatment plant. The term ‘asset’ shall also be applied to movable items, such as vehicles and equipment.”

zone. This does not mean that the asset has no exposure to coastal hazards, but it is not within the exposure hazard data used in this study.

All 47 assets analyzed at FOPU have high exposure to the evaluated coastal hazards (Table 2). These results are a factor of the park’s high exposure to coastal flooding, as indicated by the widespread Federal Emergency Management Agency (FEMA) VE zone (1% annual chance flood + wave velocity) and the modeled Category 3 storm surge inundation extent across the park. The entire park is within the FEMA VE zone, and therefore all FOPU assets were automatically assigned a high exposure score (see Peek et al. 2022).

Table 2. FOPU exposure results. Sum of percentages may not equal 100 due to rounding.

Assets	High Exposure		Moderate Exposure		Low Exposure		Minimal Exposure		Total
	#	%	#	%	#	%	#	%	#
Buildings	27	100%	0	0%	0	0%	0	0%	27
Transportation	20	100%	0	0%	0	0%	0	0%	20
All Assets	47	100%	0	0%	0	0%	0	0%	47

Sensitivity Results

Sensitivity reflects the degree to which a resource is affected by exposure (NPS 2021). In this VA, we assess the following sensitivity indicators: flood damage potential/elevated, storm resistance and condition, historic damage, and protective engineering. In general, assets with high sensitivity have unfavorable determinations for 3 or 4 of these indicators, moderate-sensitivity assets have unfavorable determinations for 2 indicators, and low-sensitivity assets have unfavorable determinations for 0 or 1 indicator.

Six assets analyzed at FOPU have high sensitivity to coastal hazards and SLR, including the Maintenance Shop, Entrance Station, Comfort Station, Bally Building (to be removed), Cockspur Picnic Parking, and Lighthouse Overlook Trail (Table 3). The majority (77%) of assets analyzed have moderate sensitivity, and only five assets have low sensitivity. Most assets have not been damaged in the past by coastal floods and are in good condition, while only a few are significantly elevated above local ground level or storm resistant.

Table 3. FOPU sensitivity results. Sum of percentages may not equal 100 due to rounding.

Assets	High Sensitivity		Moderate Sensitivity		Low Sensitivity		Total Analyzed	Excluded
	#	%	#	%	#	%	#	#
Buildings	4	15%	20	74%	3	11%	27	0
Transportation	2	10%	16	80%	2	10%	20	0
All Assets	6	13%	36	77%	5	11%	47	0

Vulnerability Results

Vulnerability is a measure of the degree to which park resources and assets are “susceptible to harm from direct and indirect effects of climate change, including variability and extremes” (NPS 2021). In this VA, we evaluate the vulnerability of infrastructure assets as a simple combination of exposure and sensitivity ratings. It should be noted that the vulnerability of any asset can change with time (e.g., due to adaptation actions or the result of geomorphic change).

The majority (89%) of assets analyzed at FOPU have high vulnerability to coastal hazards and SLR (Table 4, and Figure 1). Only five assets have moderate vulnerability, including the Fort Moat, West End Magazine, Battery Hambright, South Channel Parking C & D, and MI-Bridge. Although these assets have a high exposure, they also have low sensitivity (primarily due to being in good condition, storm resistant, and having no record of flood damage in the past). Twenty assets at FOPU have high vulnerability and a high asset priority index (API ≥ 70, as reported in FMSS). This includes Fort Pulaski itself (API = 100), the Moat, Visitor Center, Comfort Station, Dike System, and Entrance Road.

Table 4. FOPU vulnerability results. Sum of percentages may not equal 100 due to rounding.

Assets	High Vulnerability		Moderate Vulnerability		Low Vulnerability		Minimal Vulnerability		Total #
	#	%	#	%	#	%	#	%	
Buildings	24	89%	3	11%	0	0%	0	0%	27
Transportation	18	90%	2	10%	0	0%	0	0%	20
All Assets	42	89%	5	11%	0	0%	0	0%	47

Reducing the vulnerability of assets at FOPU will likely need to focus on sensitivity changes. Relocation would not significantly decrease exposure, as all park lands have been previously flooded and are in the FEMA VE and storm surge hazard zones. Adaptation strategies to reduce sensitivity at FOPU could include elevating and improving the condition and storm resistance of non-historic buildings, elevating road grades where feasible, and maintaining and improving drainage ditches and engineering throughout the park.

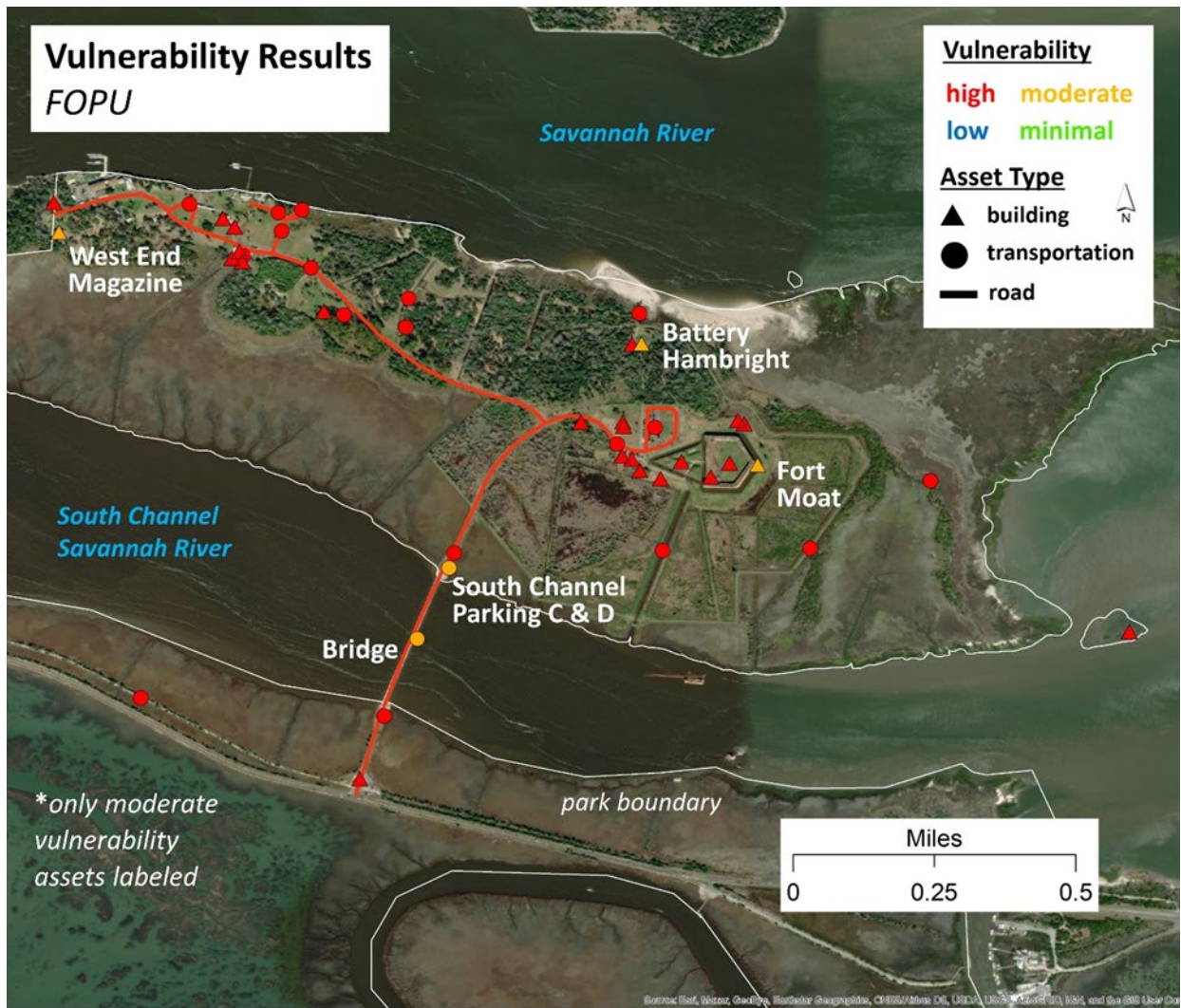


Figure 1. FOPU vulnerability results summary. Only moderate vulnerability assets are labeled. Background is ESRI streaming imagery.

FOPU Unique Considerations

Shoreline change: United State Geological Survey (or other) shoreline erosion rate data are not available for FOPU, which has non-oceanfront coastlines. As a result, we used a simple coastal proximity buffer of 35 meters, which accommodates an erosion rate up to 1 meter/year and assumes that infrastructure near the coast is likely to experience multiple coastal hazards within the 35-year (approximately 2050) timeframe of this analysis (see Peek et al. 2022).

Linear assets: NPS-owned roads and trails at FOPU were not segmented, as most are relatively short features (all are equal to or less than 1 mile in length). Therefore, each road or trail has only one score for exposure, sensitivity, and vulnerability. Any statistics or estimates of value represent the entire road, even if only a small portion has high exposure or vulnerability.

References

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