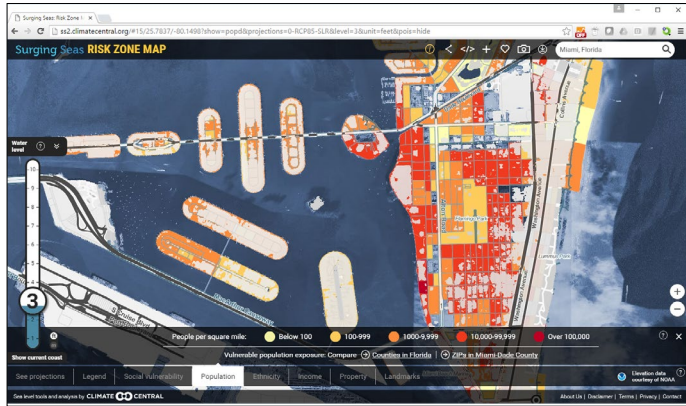


Surging Seas Web Tool and Downloads

- *Surging Seas* is a free web tool that allows you to view, customize, download, and share maps and analysis related to coastal flooding from storm surge, tides, and permanent submergence from sea level rise.
- Below are examples of the materials you can access at riskfinder.org and ss2.climatecentral.org.
- Questions/requests? Contact us at sealevel@climatecentral.org

INTERACTIVE SUBMERGENCE RISK MAPS



LOCAL FACT SHEETS AND REPORTS

COASTAL RISKS FOR MIAMI, FL

Selected water level: 3-foot. May occur from sea level rise, coastal flooding, or both.

What to look out for below 3 feet?

- Population: 13,000
- High social vulnerability population: 3,300
- Property value: \$1.1 Billion
- High social vulnerability population: 120

5 feet in historical context

- 5 feet is 100 years of coastal rise
- 5 feet is 100 years of sea level rise
- 5 feet is 100 years of coastal rise

Unnatural Coastal Floods

- 5 feet is 100 years of coastal rise
- 5 feet is 100 years of sea level rise
- 5 feet is 100 years of coastal rise

When could a 3-foot flood happen?

- 3 feet is 100 years of coastal rise
- 3 feet is 100 years of sea level rise
- 3 feet is 100 years of coastal rise

What causes climate change?

- The main activity causing climate change is the burning of fossil fuels, which send carbon pollution into the air.
- This pollution traps heat in the atmosphere, warming the planet.
- This warming causes sea level rise, which leads to coastal flooding.

Find more places, water levels and downloads at riskfinder.org

Land and population below 3 feet in Miami, FL

SEA LEVEL RISE AND COASTAL FLOODING

What causes sea level to rise?

- A warming ocean: Temperature and salinity changes cause the ocean to expand, pushing the surface up.
- Melting ice: As glaciers and ice sheets melt, the water they contain flows into the ocean, raising the sea level.
- Thermal expansion: As the ocean warms, the water molecules expand, pushing the surface up.

Does sea level rise affect flooding?

- Yes, sea level rise causes the starting point for waves, tides, and storm surges to rise, making them more severe and more frequent.
- A 3-foot rise in sea level could mean a 10-foot surge during a storm.
- A 6-foot rise in sea level could mean a 15-foot surge during a storm.

What does the future hold?

- Some future sea level rise is inevitable due to pollution levels in the atmosphere during some negotiations.
- However, the amount of future sea level rise could be reduced by cutting greenhouse gas emissions.
- A 3-foot rise in sea level could mean a 10-foot surge during a storm.
- A 6-foot rise in sea level could mean a 15-foot surge during a storm.

Can sea level rise be slowed?

- A major cause of sea level rise is global warming, which is caused by greenhouse gas emissions.
- Reducing greenhouse gas emissions can slow down global warming, which in turn can slow down sea level rise.
- This is why it's important to take action now to reduce greenhouse gas emissions.

REDUCING YOUR RISK

Preparing yourself and your community

- Know your risk: Find out how much flooding you could experience.
- Learn about the actions you can take yourself, at school, at work, and at home.
- Help your neighbors: Share your knowledge and help them prepare.
- Bring your ideas to your community: Participate in local planning efforts.
- Contact your local government: Let them know about your concerns.
- Check for updates: Stay informed about the latest sea level rise projections.

Resources available for Florida

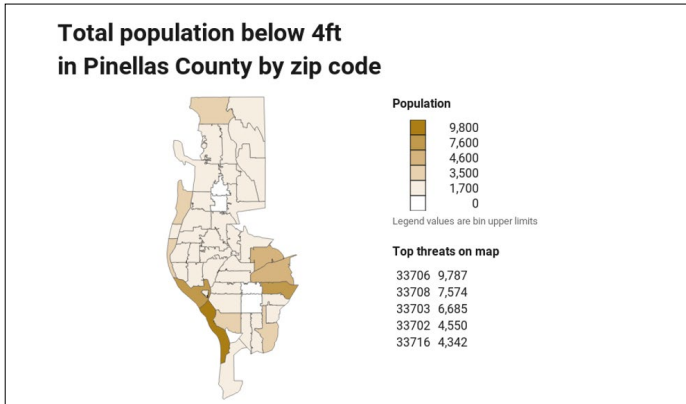
- Florida Sea Grant Coastal Planning
- Florida Department of Transportation
- Florida Department of Environmental Protection
- Florida Department of Health
- Florida Department of Banking and Finance
- Florida Department of Transportation
- Florida Department of Environmental Protection
- Florida Department of Health
- Florida Department of Banking and Finance

Climate Central

- We are a non-profit organization that provides independent, non-partisan information about climate change and its impacts.
- Our work is based on the best available science and is free of any commercial or political bias.
- We are committed to providing accurate, timely, and accessible information to the public.

Email sealevel@climatecentral.org to ask about tailored analysis

POWERPOINT SLIDES AND IMAGES



EXCEL SPREADSHEETS

TABLE: SEA LEVEL RISE AND COASTAL FLOOD EXPOSURE IN GALVESTON, TX ON LAND BELOW 1-10 FT	A	B	C	D	E	F	G	H	I	J	K	L
	Unit	< 1ft	< 2ft	< 3ft	< 4ft	< 5ft	< 6ft	< 7ft	< 8ft	< 9ft	< 10ft	
6 BY TOTALS												
7 High social vulnerability population	Count	15	43	270	863	1802	3135	5063	15483	20915	23217	
8 Medium social vulnerability population	Count	88	321	1335	2683	4512	6786	9387	11445	13246	14982	
9 Low social vulnerability population	Count	142	295	1097	2216	3162	4169	4717	5339	6144	6454	
10 Property value	\$Million	112	301	814	1491	2274	3285	4401	5133	5661	6011	
11 Population	Count	245	759	2701	5763	9496	14030	23168	32267	40304	44654	
12 Caucasian population	Count	223	653	2204	4457	7163	10238	15298	20815	26151	28990	
13 Population of color	Count	26	118	564	1177	2015	4180	8515	12255	15297	16652	
14 African-American population	Count	7	30	166	364	1147	1954	4613	6895	8317	9100	
15 Asian population	Count	9	32	106	220	341	497	724	998	1297	1518	
16 Hispanic population	Count	26	138	735	1621	2645	4081	7227	10170	12915	14346	
17 Native American population	Count	3	8	40	84	163	235	389	516	618	711	
18 Homes	Count	312	814	2388	4949	8106	11785	17761	23239	27570	30005	
19 Hospitals	Count	0	0	0	0	0	0	1	2	5	6	
20 Schools	Count	0	0	2	4	5	10	18	19	22	25	
21 Colleges and Universities	Count	0	0	0	0	0	0	0	2	2	2	
22 Libraries	Count	0	0	0	0	0	0	0	0	1	1	
23 Theater, music & arts buildings	Buildings	0	0	0	0	1	1	1	1	1	1	
24 Museums	Count	0	0	2	5	5	7	9	9	9	9	
25 Houses of worship	Count	0	0	7	14	38	54	83	97	106	107	
26 Government buildings	Count	0	0	0	1	3	4	5	5	5	5	
27 Roads	Miles	3	13	46	103	165	237	316	369	406	425	
28 Federal roads	Miles	0	0	0	0	0	2	3	3	4	4	
29 Local roads	Miles	3	12	44	100	160	228	300	353	389	407	
30 Primary roads	Miles	0	0	0	0	0	2	3	4	4	4	
31 Secondary roads	Miles	0	0	1	3	4	6	12	13	13	14	
32 State roads	Miles	0	0	1	3	4	6	12	13	13	14	
33 Railroads	Miles	0	1	3	6	8	10	10	11	12	12	

LOCAL REPORTS

Sea level rise and coastal flood risk: Summary for Virginia Beach, VA

This document is meant as a one-stop summary and brief guide that integrates key findings, methods, interpretation and data from Climate Central's *Surging Seas Risk Finder* into one narrative. It stands alone or as a jumping-off point.

Sea level rise and flood forecast

Even small amounts of sea level rise make sea floods more common by adding to tides and storm surge. Climate Central has estimated risk by combining local sea level rise projections with historic flood statistics from the NOAA water level station at Chesapeake Bay Bridge-Tunnel, VA, 11 miles from the center of Virginia Beach. For reference, our average relative sea level rise since the "100 year" flood height, is 4.9 feet above local Mean Higher High Water (high tide line). The highest observed sea level rise in this location, in records from 1973 to 2013, reached 4.4 feet MHHW in 2009. Taken and together these values suggest that floods above 1.5 feet likely pose significant concerns.

Based on the National Climate Assessment Intermediate High sea level rise scenario, [see page 23](http://nca2012.org/sea-level-rise) of the report for 100, 150, and 200 percent risk by 2100. Our sea level rise projections are based on the 2018 sea level rise and 100 percent risk by 2100. Our sea level rise projections are based on the 2018 sea level rise and 100 percent risk by 2100. Our sea level rise projections are based on the 2018 sea level rise and 100 percent risk by 2100.

Map and exposure analysis

Understanding exposure to sea level rise and floods requires a good map. Climate Central combined local sea level rise projections with historic flood statistics from the NOAA water level station data from FEMA, to identify both fully exposed and potentially protected land from sea level rise above the local high tide line.

Climate Central's [interactive, downloadable Risk Zone Map](http://riskfinder.org) shows exposed areas and how they increase with population density, social vulnerability, property value, and more.

Risk Finder also shows [exposure](http://riskfinder.org) at each water level for dozens of variables, based on data from over ten federal agencies. Here are a few values for Virginia Beach on land below 1.5 foot MHHW in 2018 and estimated land area by exposure to levels of submergence:

Variable	Total Exposure	Exposure below 1.5 feet
Home count	49,106	20,211
Population	24,612	10,211
High social vulnerability pop.	2,116	844
Medium social vulnerability pop.	11,716	5,029
Low social vulnerability pop.	10,780	4,358
Property value	\$2.7	\$1.1
Population of color	2,116	844
Hispanic population	2,116	844
Black population	2,116	844
Asian population	2,116	844
Native American population	2,116	844

At 1.5 feet, 47,009 people (19.8 percent of the total population in Virginia Beach) and 817,384 homes are exposed to risk.

Risk Finder offers comprehensive downloads of exposure data as well as lists of facilities that may be affected, and data sources and methods descriptions for each variable. See Methods section below for more discussion of the current research approach used and important guidance on how to interpret results.

Comparison

There are very few places to place "With best case and worst case" risk. Risk Finder's [comparative tool](http://riskfinder.org) compares local sea level rise projections with other sea level rise projections for other locations. However, we did not compare any single comparison for Virginia Beach, because there are no other reported data in the Virginia Beach area.

The comparison tool simply offers a different presentation of exposure analysis. Therefore, the same methods and interpretive notes apply.

Methods and interpretation

Sea level rise and flood forecast

The projections described here and in *Surging Seas Risk Finder* are based on sea level rise projections for a specific location in Virginia Beach. Local sea level rise projections are generally similar across neighboring areas. Flood risks can vary greatly across the region, due to details of local topography and bathymetry and regional water levels. For details on "What are the Risks?" and other information, see the [Risk Finder](http://riskfinder.org) website.

The best methods for this analysis follow [Tridell et al. \(2012\)](http://tridell.org), plus simple extensions for comparing cumulative flood risk. Furthermore, the current analysis improves local accuracy by

FACILITY LISTS

SEA LEVEL RISE AND COASTAL FLOOD EXPOSURE OF HAZARDOUS WASTE SITES IN CALIFORNIA ON LAND BELOW 10FT: LIST	A	B	C	D	E	F
LEVEL	ID	NAME	LAT	LONG		
86	3F	110000876864	KAISER FOUNDATION HOSPITALS	37.87053	-122.30325	
87	3F	110002146641	ADVALLOY INCORPORATED	37.42197	-122.10323	
88	3F	110002931720	J S ENTERPRISES	33.66111	-117.95526	
89	3F	110002790230	ATHENA NEURO SCIENCES INC	37.506177	-122.25063	
90	3F	110002709631	DUTHIE WALTER R ELECTRIC CORP	33.78174	-118.23305	
91	3F	110002678666	MARCOR OF CALIFORNIA INC	37.65222	-122.14229	
92	3F	110002647958	ASSOCIATED FREIGHT LINES	37.82006	-122.29059	
93	3F	110009545769	CALIFORNIA AUTOMOTIVE SEALING	37.61889	-122.05726	
94	3F	110002663207	UTAH INTERNATIONAL INC	37.40919	-122.02337	
95	3F	110002915267	HYDRO AGRI NORTH AMERICA	37.942485	-121.334951	
96	3F	110009536127	COSTELLI & PARDINI AUTO BODY	37.549167	-122.308355	
97	3F	110002926807	OAK HARBOR FREIGHT LINES	37.76152	-122.21895	
98	3F	110002165741	WARTSILA NORTH AMERICA, INC	33.7905	-118.22138	
99	3F	110002797867	OAKLAND SCAVENGER HAYWARD YARD	37.64989	-122.14404	
100	3F	110002766668	LA PUMPING PLANT #72	33.78247	-118.24006	
101	3F	110002643088	MORGAN ENVIRONMENTAL SERVICES	37.818142	-122.286411	
102	3F	110006481869	A 1 CLEANERS	33.74323	-118.10034	
103	3F	110002831892	CALIFORNIA ADVANCED ENV TECH CORP	37.658683	-122.139813	
104	3F	110006473583	ARNESON MARINE INC	37.91754	-122.01753	
105	3F	110009547044	RAVEN RENEWAL COMPANY	37.91923	-122.36009	
106	3F	110041611983	CHEVRON #92239	32.74947	-117.20579	
107	3F	110002614715	J L SHELTON TRUCKING	37.49461	-122.21963	
108	3F	110002873734	P G AND E BURLINGAME SUBSTATION	37.58953	-122.3636	
109	3F	110004342225	SOLANO BODY SHOP II	38.13667	-122.25624	
110	3F	110004360667	ENVIRONMENTAL CORPORATION	37.42667	-122.36667	

Do you implement NFIP / FEMA's Community Rating System (CRS) for your coastal community?

Download our free *Surging Seas CRS Guide* to learn how our public web tools can support many CRS activities and help you earn points that could lead to a reduction in your community's flood insurance rates. Visit sealevel.climatecentral.org/crs