

January 2020

Future Flood Risk: Hard Rock Stadium



The image above illustrates what Hard Rock Stadium could look like under 1.5 feet of water during a flood event at 6 feet above the local high tide line. Water could reach this level through a combination of sea level rise, tide, and storm surge. If emissions of heat-trapping gases continue to grow unchecked the Miami Gardens area has a 3% risk of experiencing at least one 6 foot or higher flood between today and 2050 and a 16% chance by 2100.

Methodology

Accelerating sea level rise has increased routine flood events in communities around the country. Quantifying flood risk allows individuals, businesses, and communities located along coastlines to plan for sea level rise and increased flooding risk from climate change.

Climate Central's proprietary **Portfolio Analysis Tool (PAT)** estimates future coastal flood threats to residential properties, commercial sites, ports, and infrastructure, computing the statistically expected number of flood events each decadal year, 2020, 2030, ... through 2100.

Our analysis combines sea level rise science with local flood history data to estimate the number of statistically-expected future coastal flood events at specific locations. Flood risk information from FEMA does not currently include future expected sea level rise.

The Portfolio Analysis Tool defines a flood event as the occurrence of coastal flood water height exceeding the elevation of the ground at a specific inland location (defined by latitude and longitude coordinates). Flood water height is statistically derived from local flood history combined with projected sea level rise. Ground elevation is determined from a NOAA database of LiDAR elevation data. Elevation of structures above the ground are not known or evaluated.

THIS REPORT DEFINES FLOOD RISK BY ANNUAL CHANCE OF OCCURRENCE, NOT FLOOD DEPTH:

OCCASIONAL FLOOD RISK



At least 0.01 expected flood event per year, corresponding to approximately a 1% annual chance of flood risk event. This is the level commonly used to establish flood hazard zones. One can statistically expect a 26% chance of a 100-year flood during a 30-year period.

FREQUENT FLOOD RISK



At least 0.1 expected flood risk event per year, corresponding to approximately a 10% annual chance of a flood risk event.

CHRONIC FLOOD RISK



At least 1 expected flood risk event per year, corresponding to approximately a 99%+ annual chance of a flood risk event.

Local flood history comes from the nearest NOAA tide station with at least 30 years' history of hourly water level data. Tide stations that have not experienced a hurricane in their recorded history may not adequately represent the risk of a future hurricane.

Projected sea level rise is derived from a sea level rise model. Inputs to the model include an assumption that carbon emissions continue unchecked in the so-called business-as-usual scenario.

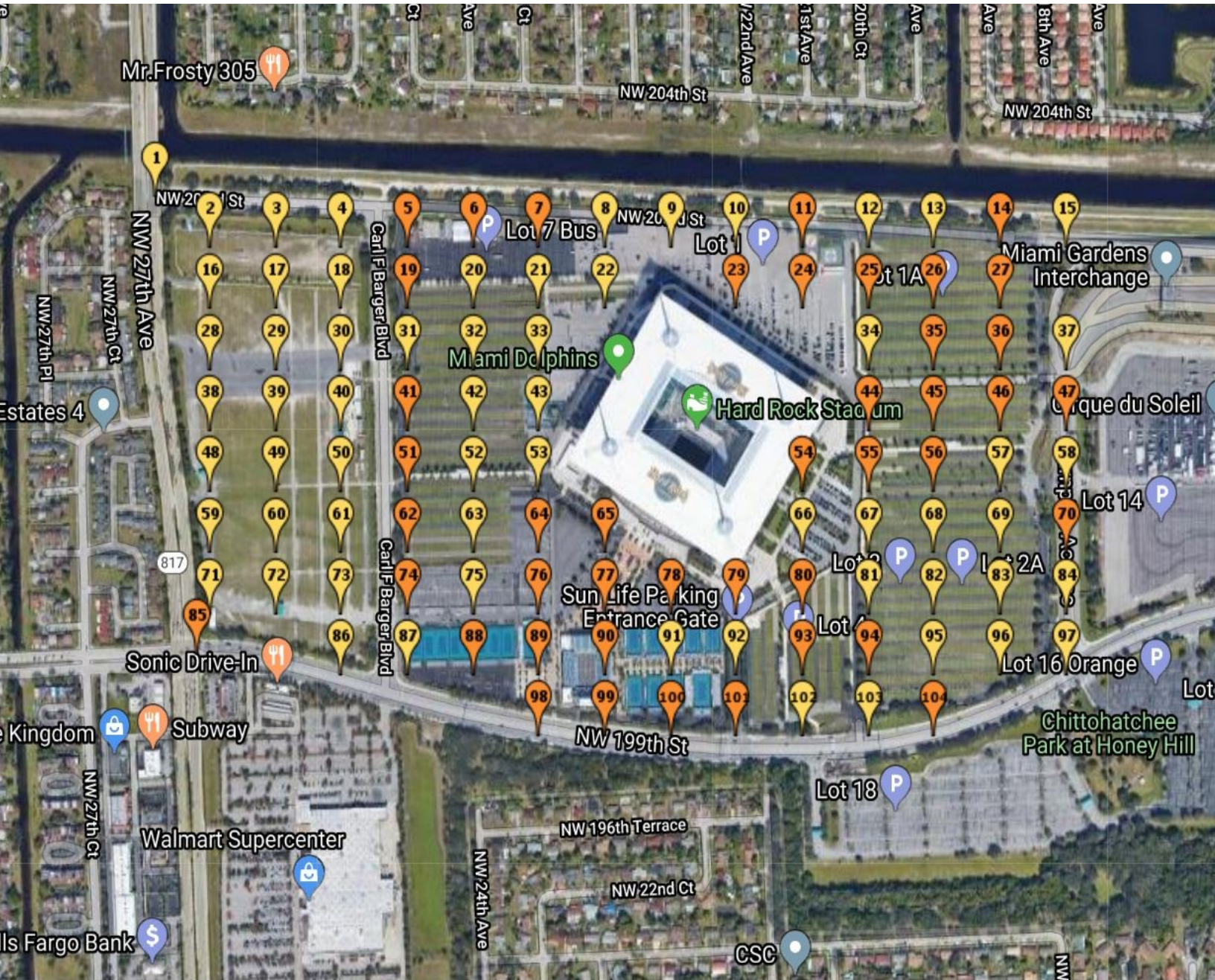
Our Portfolio Analysis Tool estimates the expected annual number of flood events each year and reports the results in decadal increments starting in 2020 through 2100. Our analysis is based on the statistically expected number of future flood events during the course of a year.



Hard Rock Stadium, Miami Gardens, Fla., showing areas below a water level of 6 feet above the local high tide line, which could occur through combinations of sea level rise, tide, and storm surge.

This water level has an estimated 3% chance of occurring by 2050 and a 16% chance by 2100.

LOCATIONS CONSIDERED



The pins in the above image are color coded to represent their coastal flood risk in 2090. Yellow represents occasional flood risk and orange represents frequent flood risk.

ELEVATION DATA

The table below provides the coordinates of all points evaluated, and what their elevation is relative to both the North American Vertical Datum 1988 (NAVD88) and Mean Higher High Water (MHHW; the high tide line).

MAP PIN	LATITUDE	LONGITUDE	ELEVATION RELATIVE TO NAVD88, FEET	ELEVATION RELATIVE TO MHHW (HIGH TIDE), FEET
1	25.96067	-80.2464	8.43	8.43
2	25.96009	-80.2456	3.18	5.74
3	25.96009	-80.2447	2.92	5.74
4	25.96009	-80.2438	2.72	5.74
5	25.96009	-80.2429	5.12	5.12
6	25.96009	-80.242	4.92	4.92
7	25.96009	-80.241	5.28	5.28
8	25.96009	-80.2401	4.82	5.74
9	25.96009	-80.2392	4.59	5.74
10	25.96009	-80.2383	4.89	5.74
11	25.96009	-80.2374	5.15	5.15
12	25.96009	-80.2365	4.53	5.74
13	25.96009	-80.2355	4.59	5.74
14	25.96009	-80.2346	5.09	5.09
15	25.96009	-80.2337	6.76	6.76
16	25.9594	-80.2456	3.38	5.74
17	25.9594	-80.2447	3.61	5.74
18	25.9594	-80.2438	3.61	5.74
19	25.9594	-80.2429	5.18	5.18
20	25.9594	-80.242	4.53	5.74
21	25.9594	-80.241	4.63	5.74
22	25.9594	-80.2401	4.36	5.74
23	25.9594	-80.2383	5.68	5.68
24	25.9594	-80.2374	5.38	5.38

MAP PIN	LATITUDE	LONGITUDE	ELEVATION RELATIVE TO NAVD88, FEET	ELEVATION RELATIVE TO MHHW (HIGH TIDE), FEET
25	25.9594	-80.2365	4.99	4.99
26	25.9594	-80.2355	5.02	5.02
27	25.9594	-80.2346	5.22	5.22
28	25.9587	-80.2456	3.77	5.74
29	25.9587	-80.2447	3.71	5.74
30	25.9587	-80.2438	3.38	5.74
31	25.9587	-80.2429	5.81	5.81
32	25.9587	-80.242	4.33	5.74
33	25.9587	-80.241	4.43	5.74
34	25.9587	-80.2365	4.92	5.74
35	25.9587	-80.2355	4.95	4.95
36	25.9587	-80.2346	5.12	5.12
37	25.9587	-80.2337	6.50	6.50
38	25.95801	-80.2456	3.64	5.74
39	25.95801	-80.2447	3.67	5.74
40	25.95801	-80.2438	3.31	5.74
41	25.95801	-80.2429	5.02	5.02
42	25.95801	-80.242	4.46	5.74
43	25.95801	-80.241	4.49	5.74
44	25.95801	-80.2365	5.18	5.18
45	25.95801	-80.2355	5.18	5.18
46	25.95801	-80.2346	4.95	4.95
47	25.95801	-80.2337	5.38	5.38
48	25.95731	-80.2456	3.64	5.74
49	25.95731	-80.2447	3.35	5.74
50	25.95731	-80.2438	3.51	5.74
51	25.95731	-80.2429	5.12	5.12
52	25.95731	-80.242	4.53	5.74
53	25.95731	-80.241	4.72	5.74

MAP PIN	LATITUDE	LONGITUDE	ELEVATION RELATIVE TO NAVD88, FEET	ELEVATION RELATIVE TO MHHW (HIGH TIDE), FEET
54	25.95731	-80.2374	5.48	5.48
55	25.95731	-80.2365	5.02	5.02
56	25.95731	-80.2355	5.12	5.12
57	25.95731	-80.2346	4.89	5.74
58	25.95731	-80.2337	5.77	5.77
59	25.95661	-80.2456	4.59	5.74
60	25.95661	-80.2447	4.13	5.74
61	25.95661	-80.2438	3.97	5.74
62	25.95661	-80.2429	5.09	5.09
63	25.95661	-80.242	4.92	5.74
64	25.95661	-80.241	4.99	4.99
65	25.95661	-80.2401	5.64	5.64
66	25.95661	-80.2374	4.89	5.74
67	25.95661	-80.2365	4.82	5.74
68	25.95661	-80.2355	4.59	5.74
69	25.95661	-80.2346	4.56	5.74
70	25.95661	-80.2337	5.02	5.02
71	25.95592	-80.2456	5.91	5.91
72	25.95592	-80.2447	4.17	5.74
73	25.95592	-80.2438	4.27	5.74
74	25.95592	-80.2429	5.09	5.09
75	25.95592	-80.242	4.79	5.74
76	25.95592	-80.241	5.15	5.15
77	25.95592	-80.2401	5.28	5.28
78	25.95592	-80.2392	5.02	5.02
79	25.95592	-80.2383	5.35	5.35
80	25.95592	-80.2374	4.95	4.95
81	25.95592	-80.2365	4.89	5.74
82	25.95592	-80.2355	4.66	5.74

MAP PIN	LATITUDE	LONGITUDE	ELEVATION RELATIVE TO NAVD88, FEET	ELEVATION RELATIVE TO MHHW (HIGH TIDE), FEET
83	25.95592	-80.2346	4.56	5.74
84	25.95592	-80.2337	4.69	5.74
85	25.95545	-80.2458	5.48	5.48
86	25.95522	-80.2438	4.66	5.74
87	25.95522	-80.2429	4.79	5.74
88	25.95522	-80.242	5.31	5.31
89	25.95522	-80.241	5.25	5.25
90	25.95522	-80.2401	5.18	5.18
91	25.95522	-80.2392	4.72	5.74
92	25.95522	-80.2383	4.72	5.74
93	25.95522	-80.2374	4.99	4.99
94	25.95522	-80.2365	5.18	5.18
95	25.95522	-80.2355	4.79	5.74
96	25.95522	-80.2346	4.89	5.74
97	25.95522	-80.2337	6.00	6.00
98	25.95453	-80.241	5.38	5.38
99	25.95453	-80.2401	5.12	5.12
100	25.95453	-80.2392	5.09	5.09
101	25.95453	-80.2383	5.58	5.58
102	25.95453	-80.2374	4.46	5.74
103	25.95453	-80.2365	4.86	5.74
104	25.95453	-80.2355	5.22	5.22

OUR FINDINGS

Our analysis of Miami Garden’s Hard Rock Stadium finds that almost all areas of the stadium property may experience occasional flood risk by 2070. Climate Central examined 105 locations on the local access roads, the new training complex, the tennis center, and 100+ acres of parking lots. By 2070, 95% of those locations are expected to experience occasional flood risk (or a 1%+ annual chance of exposure to flooding). By 2090, 42% of the locations examined are expected to experience frequent flood risk (or a 10% annual chance of exposure).

The Hard Rock Stadium is the home stadium for the Dolphins and the University of Miami’s Hurricanes. The overall property is relatively flat, between 4 and 6 feet above sea level. A \$135 million training facility is currently being built adjacent to the stadium; points sampled in this area indicate a risk of occasional flooding by 2070. A number of points on the northern and southern perimeters of the property, including along the entrance and exit routes 203rd Street and 199th Street, are estimated to experience occasional flood risk by 2070 and frequent flood risk by 2090.

Finally, it is worth noting that our analysis does not take into account the possibility of rain-induced flooding, or water finding other ways into low lying areas below a given flood level, but protected by higher land. Thus, this analysis may underestimate how soon flood risks will threaten Hard Rock Stadium. Elevation data indicate the area includes extensive depressions that could make it vulnerable to seepage or water backing up through storm drains.

HOW TO READ THE NUMBERS IN THIS REPORT:

Climate Central’s **Portfolio Analysis Tool (PAT)** utilizes a sea level rise model, local elevation data from the U.S. government, and local tide flood data from the U.S. National Oceanic and Atmospheric Administration (NOAA) to compute the statistically expected number of flood events at a given location, or the Expected Annual Event (“EAE”). If the projected water level at the nearby shoreline is higher than the land elevation of a location, we count this as a flood event at the location. Not all such events will cause flooding at the location, but each event poses a risk. Also, we do not include precipitation in our analysis, but coastal high water impedes runoff and increases the risk of freshwater flooding inland.

For each point analyzed on the map, the latitude and longitude of the point were determined and the EAE for those coordinates was calculated. A cell shaded in **yellow** indicates “occasional risk” of floods. A cell shaded in **orange** indicates “frequent risk” of regular floods. A **red-shaded** cell indicates “chronic risk” of frequent floods. For example, Pin 6 is at occasional risk of annual flood events in 2070, and at frequent risk of annual flood events in 2090.

This report presents statistical expectations, not forecasts or predictions, and should be used for scoping and general planning purposes only. Climate Central accepts no responsibility for any damage to property, death or bodily injury, or other loss arising in any way from the use of this report for any purpose.

Pin	EAE_2020	EAE_2030	EAE_2040	EAE_2050	EAE_2060	EAE_2070	EAE_2080	EAE_2090	EAE_2100
6	0.002	0.002	0.002	0.003	0.007	0.025	0.080	0.273	0.788
35	0.002	0.002	0.002	0.003	0.006	0.024	0.077	0.263	0.757
46	0.002	0.002	0.002	0.003	0.006	0.024	0.077	0.263	0.757
80	0.002	0.002	0.002	0.003	0.006	0.024	0.077	0.263	0.757
25	0.001	0.002	0.002	0.003	0.006	0.024	0.074	0.252	0.727
64	0.001	0.002	0.002	0.003	0.006	0.024	0.074	0.252	0.727
93	0.001	0.002	0.002	0.003	0.006	0.024	0.074	0.252	0.727
26	0.001	0.002	0.002	0.003	0.006	0.023	0.071	0.241	0.697
41	0.001	0.002	0.002	0.003	0.006	0.023	0.071	0.241	0.697
55	0.001	0.002	0.002	0.003	0.006	0.023	0.071	0.241	0.697
70	0.001	0.002	0.002	0.003	0.006	0.023	0.071	0.241	0.697
78	0.001	0.002	0.002	0.003	0.006	0.023	0.071	0.241	0.697
14	0.001	0.002	0.002	0.003	0.006	0.022	0.065	0.22	0.637
62	0.001	0.002	0.002	0.003	0.006	0.022	0.065	0.22	0.637
74	0.001	0.002	0.002	0.003	0.006	0.022	0.065	0.22	0.637
100	0.001	0.002	0.002	0.003	0.006	0.022	0.065	0.22	0.637
5	0.001	0.002	0.002	0.002	0.005	0.021	0.062	0.21	0.607
36	0.001	0.002	0.002	0.002	0.005	0.021	0.062	0.21	0.607
51	0.001	0.002	0.002	0.002	0.005	0.021	0.062	0.21	0.607
56	0.001	0.002	0.002	0.002	0.005	0.021	0.062	0.21	0.607
99	0.001	0.002	0.002	0.002	0.005	0.021	0.062	0.21	0.607
11	0.001	0.002	0.002	0.002	0.005	0.02	0.059	0.199	0.576
76	0.001	0.002	0.002	0.002	0.005	0.02	0.059	0.199	0.576
19	0.001	0.002	0.002	0.002	0.005	0.02	0.056	0.188	0.546
44	0.001	0.002	0.002	0.002	0.005	0.02	0.056	0.188	0.546
45	0.001	0.002	0.002	0.002	0.005	0.02	0.056	0.188	0.546
90	0.001	0.002	0.002	0.002	0.005	0.02	0.056	0.188	0.546
94	0.001	0.002	0.002	0.002	0.005	0.02	0.056	0.188	0.546
27	0.001	0.001	0.002	0.002	0.005	0.019	0.053	0.178	0.516
104	0.001	0.001	0.002	0.002	0.005	0.019	0.053	0.178	0.516
89	0.001	0.001	0.002	0.002	0.005	0.018	0.050	0.167	0.486
7	0.001	0.001	0.002	0.002	0.004	0.018	0.048	0.161	0.469
77	0.001	0.001	0.002	0.002	0.004	0.018	0.048	0.161	0.469
88	0.001	0.001	0.002	0.002	0.004	0.017	0.047	0.156	0.452
79	0.001	0.001	0.002	0.002	0.004	0.017	0.045	0.15	0.435
24	0.001	0.001	0.002	0.002	0.004	0.016	0.043	0.144	0.418
47	0.001	0.001	0.002	0.002	0.004	0.016	0.043	0.144	0.418
98	0.001	0.001	0.002	0.002	0.004	0.016	0.043	0.144	0.418
54	0.001	0.001	0.001	0.002	0.003	0.015	0.038	0.127	0.368
85	0.001	0.001	0.001	0.002	0.003	0.015	0.038	0.127	0.368
101	0.001	0.001	0.001	0.002	0.003	0.013	0.033	0.110	0.317

Pin	EAE_2020	EAE_2030	EAE_2040	EAE_2050	EAE_2060	EAE_2070	EAE_2080	EAE_2090	EAE_2100
65	0.001	0.001	0.001	0.002	0.003	0.012	0.031	0.103	0.296
23	0.001	0.001	0.001	0.002	0.003	0.012	0.031	0.1	0.286
2	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
3	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
4	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
8	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
9	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
10	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
12	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
13	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
16	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
17	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
18	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
20	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
21	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
22	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
28	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
29	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
30	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
32	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
33	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
34	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
38	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
39	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
40	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
42	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
43	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
48	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
49	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
50	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
52	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
53	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
57	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
59	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
60	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
61	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
63	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
66	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
67	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
68	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
69	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265

Pin	EAE_2020	EAE_2030	EAE_2040	EAE_2050	EAE_2060	EAE_2070	EAE_2080	EAE_2090	EAE_2100
72	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
73	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
75	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
81	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
82	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
83	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
84	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
86	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
87	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
91	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
92	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
95	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
96	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
102	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
103	0.001	0.001	0.001	0.002	0.002	0.011	0.029	0.093	0.265
58	0.001	0.001	0.001	0.001	0.002	0.011	0.028	0.09	0.255
31	0.001	0.001	0.001	0.001	0.002	0.01	0.027	0.086	0.244
71	0.001	0.001	0.001	0.001	0.002	0.009	0.025	0.076	0.213
97	0.001	0.001	0.001	0.001	0.002	0.008	0.023	0.07	0.193
37	0.001	0.001	0.001	0.001	0.001	0.004	0.017	0.042	0.116
15	0.001	0.001	0.001	0.001	0.001	0.003	0.014	0.033	0.091
1	0	0	0	0	0	0.001	0.003	0.013	0.025

ABOUT CLIMATE CENTRAL

[Climate Central](#) is an independent organization of leading scientists and journalists researching and reporting the facts about our changing climate and its impact on the public. Climate Central surveys and conducts scientific research on climate change and informs the public of key findings. Our scientists publish and our journalists report on climate science, energy, sea level rise, wildfires, drought, and related topics. Climate Central is not an advocacy organization. We do not lobby, and we do not support any specific legislation, policy or bill. Climate Central is a qualified 501(c)3 tax-exempt organization.

Climate Central's Program on Sea Level Rise strives to provide accurate, clear, and granular information about sea level rise and coastal flood hazards both locally and globally, today and tomorrow. Anchored in rigorous primary research, our work distinguishes itself by its user-friendly maps and tools, extensive datasets, and high-quality visual presentation. The program dedicates its efforts to helping citizens, communities, businesses, organizations, and governments at every level to understand the consequences of different carbon pathways and to navigate the shifting waters of our warming world.

You can [search or navigate our interactive tools](#) to see maps of areas below different amounts of sea level rise and flooding, down to neighborhood scale, matched with area timelines of risk. Our tool also provides statistics of population, homes, and land affected by city, county, and state, plus links to fact-sheets, data downloads, action plans, embeddable widgets, and more.

If you are interested in a customized report using Climate Central's proprietary Portfolio Analysis Tool (PAT), contact us at portfolio@climatecentral.org.