Coastal Flood Risk Breakout Session

September 17, 2024

Dr. Hannah Baranes, Coastal Scientist

Gulf of Maine Research Institute

Science. Education. Community.

Vertical Datums

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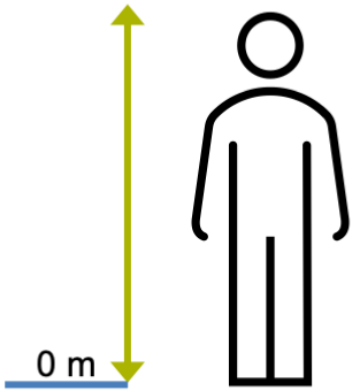
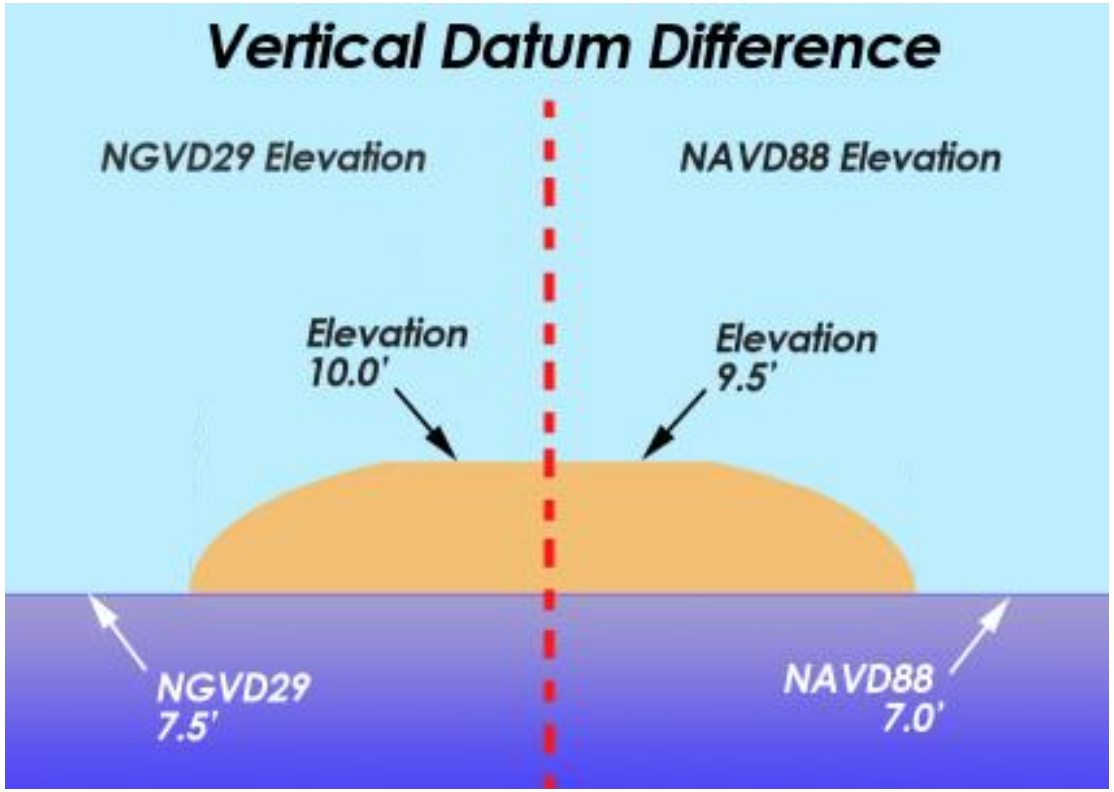
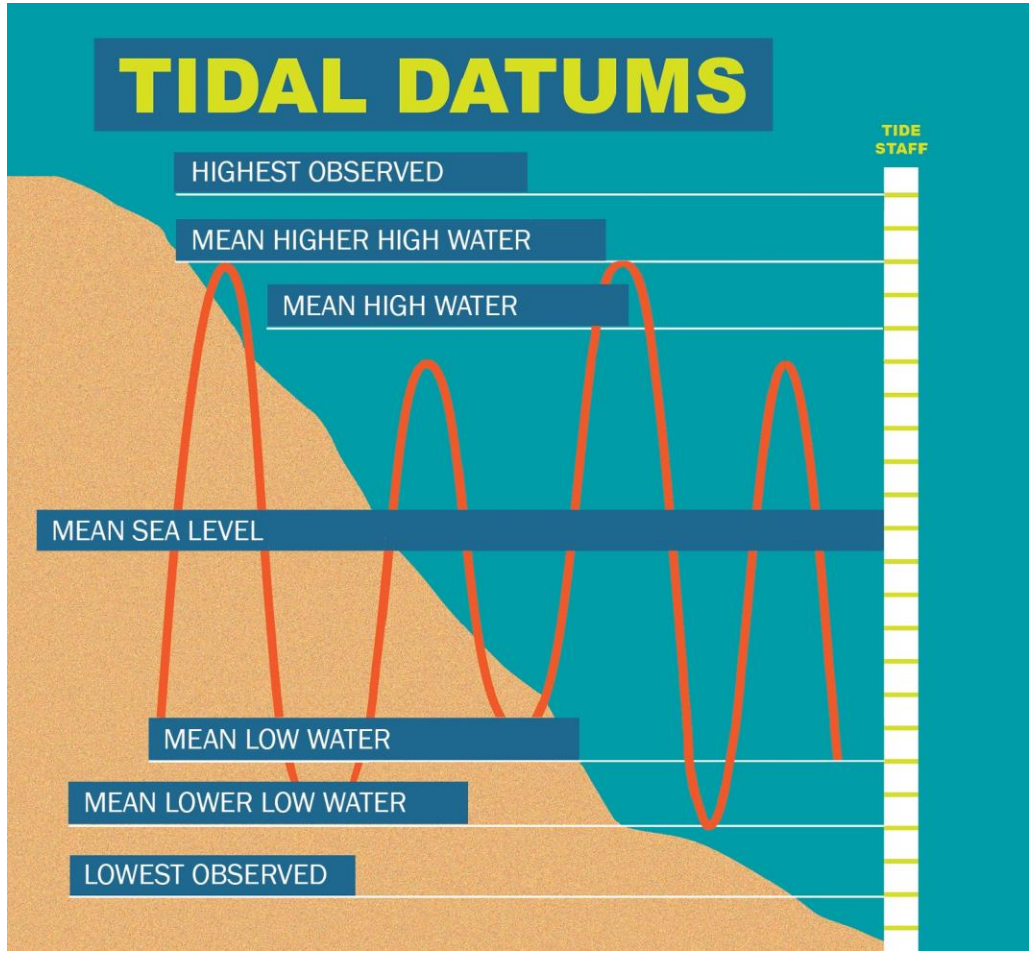


A surface assigned an elevation of 0, to which other elevation measurements are referenced.

Land-based elevations are commonly measured relative to NAVD88 or NGVD29.



Vertical Datums



https://tidesandcurrents.noaa.gov/datum-updates/ntde/

Water surface elevations: often measured relative to **mean tidal characteristics**

- When people talk about water levels ("there's a 14-foot tide"), the commonly-use datum is Mean Lower Low Water (MLLW)
- These datums are measured over a common 19-y period called the National Tidal Datum Epoch (NTDE). The current NTDE is 1983-2001, and it will be updated next year.

Constructing design inundation water levels

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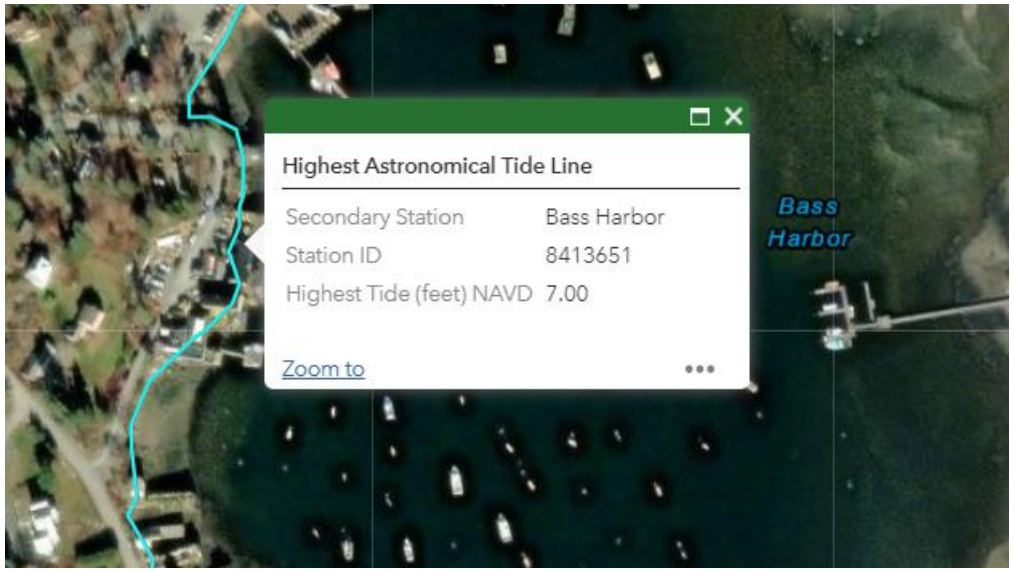
End goal:

- Water surface elevations for present-day and future routine and extreme inundation
- All referenced to NAVD88 (so can compare to land surface elevations)

Present-day routine inundation

1) Get Highest Astronomical Tide (HAT) from MGS Viewer:
https://www.maine.gov/dacf/mgs/hazards/highest_tide_line/index.shtml



HAT = 7.00 ft NAVD88

2) Convert from 1983-2001 mean sea level to “present-day” mean sea level using recent measured rate of sea level rise (Fig. D1, p. 222 of 2025 STS Report)

7.0 ft + [(2024 – 1992) * 0.012 ft/year] = 7.38 ft NAVD88

Present-day extreme inundation

FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 2 OF 2

HANCOCK COUNTY, MAINE
(All Jurisdictions)

Step 1: Get 1% annual chance stillwater elevation from FEMA Flood Insurance Study

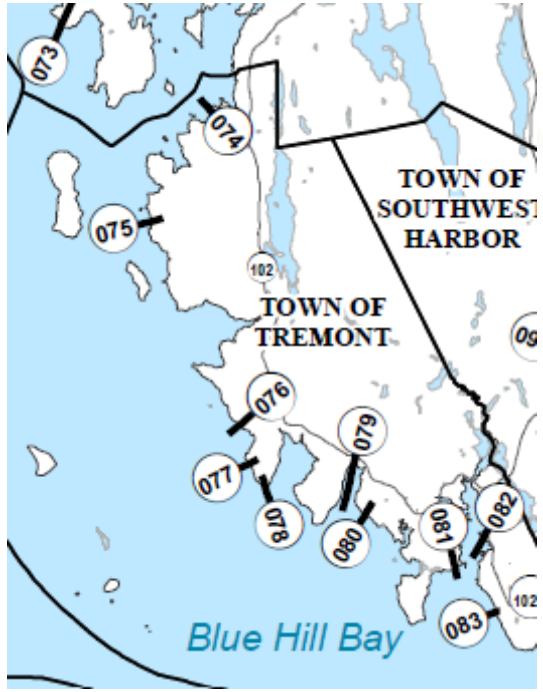


Table 17: Coastal Transect Parameters – continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Atlantic Ocean	HC-080	4.7	5.2	8.5	*	9.0	9.2	9.8
Atlantic Ocean	HC-081	5.4	7	8.5	*	9.0	9.2	9.8
Atlantic Ocean	HC-082	5.4	7	8.5	*	9.0	9.2	9.7
Atlantic Ocean	HC-083	5.4	7	8.5	*	9.0	9.2	9.7

Present-day extreme inundation

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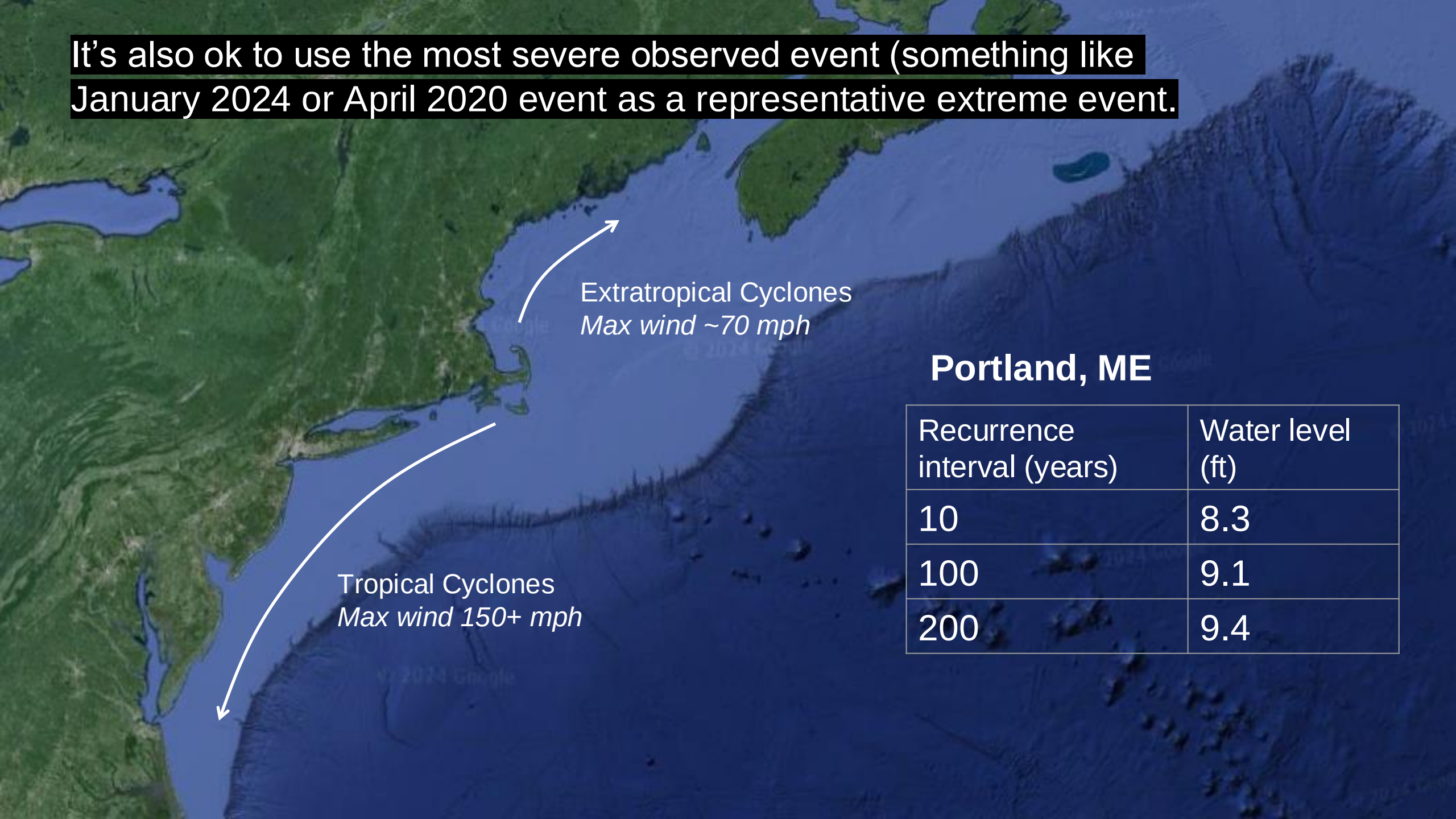
<u>Step 2</u>: Convert from 1983-2001 sea level to 2024 sea level

9.2 ft + [(2024 – 1992) * 0.012 ft/year] = 9.6 ft NAVD88

It’s also ok to use the most severe observed event (something like January 2024 or April 2020 event as a representative extreme event.



Portland, ME

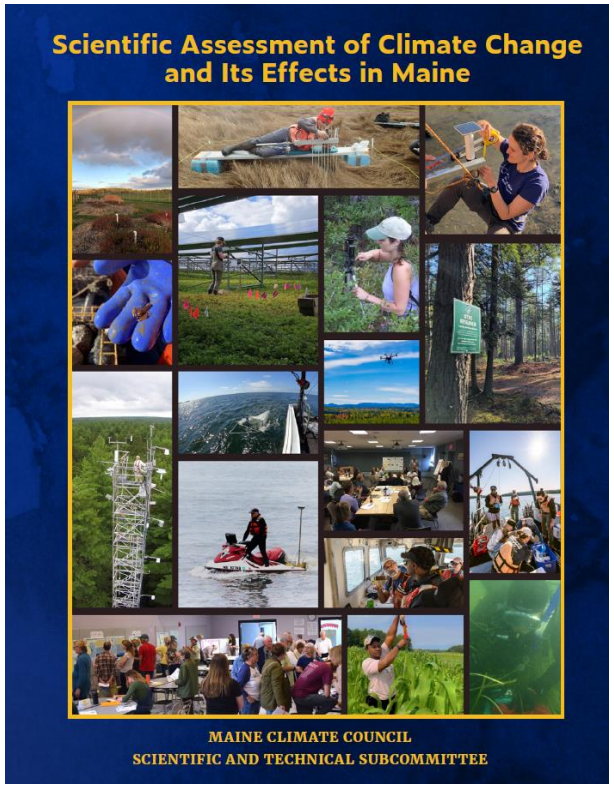
Recurrence interval (years)	Water level (ft)
10	8.3
100	9.1
200	9.4

Adding Sea Level Rise

- What is the end year you care about? → select a year (interpolate if needed)
- What is the criticality of the asset/infrastructure you are evaluating? → select Intermediate or High Scenario
- Adjust from 2000 baseline to 2024 baseline

Sea level rise projections relative to 2000 mean sea level

	Lincolnville to Gouldsboro	
	Intermediate	High
2030	0.61 (0.42, 0.81)	0.64 (0.42, 0.88)
2040	0.88 (0.64, 1.15)	1.00 (0.67, 1.40)
2050	1.18 (0.87, 1.52)	1.47 (1.04, 1.99)
2060	1.52 (1.15, 1.94)	2.11 (1.52, 2.75)
2070	1.90 (1.47, 2.40)	2.92 (2.14, 3.73)
2080	2.38 (1.84, 2.94)	3.87 (2.83, 4.92)
2090	2.95 (2.28, 3.60)	4.93 (3.57, 6.22)
2100	3.58 (2.66, 4.36)	6.03 (4.39, 7.46)
2110	4.31 (3.10, 5.36)	7.19 (5.15, 8.90)
2120	4.97 (3.50, 6.64)	8.25 (5.90, 10.36)
2130	5.59 (3.89, 8.35)	9.34 (6.51, 12.50)
2140	6.11 (4.25, 10.48)	10.14 (7.01, 14.69)
2150	6.65 (4.58, 13.02)	10.85 (7.56, 16.97)



Baselines

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Me: Can you believe the doctor said I grew 3 FEET?!?!?!

You: Yeah. Since when?

US Interagency Sea Level Rise Task Force: Sea level will rise 1.1 ft in Portland in 2050 under the Intermediate Scenario.

You: 1.1 feet above what baseline year?

US Interagency Sea Level Rise Task Force: So glad you asked! The 19 years centered on 2000. You can use the 1993-2023 measured mean sea level rise rate of **0.012 ft/year** to convert to another baseline year.

Adding Sea Level Rise

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- What is the end year you care about? → select a year (interpolate if needed)
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Example:
2050 sea level will be 1.18 ft above 2000 sea level.
How high will it be above 2024 sea level?

1.18 – [(2024 – 2000) * 0.012 ft/year] = **0.89 ft**

Putting it all together

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1) Determine whether site needs more detailed coastal modeling for waves or freshwater impacts

2) Determine design stillwater levels and map onto topography (all in ft NAVD88)

	2024	2050 (Intermediate)	2050 (High)
Highest Astronomical Tide	7.0 + 0.4 = **7.4**	7.4 + (1.2 – 0.3) = **8.3**	7.4 + (1.5 – 0.3) = **8.6**
Extreme Stillwater Level	9.2 + 0.4 = **9.6**	9.6 + (1.2 – 0.3) = **10.5**	9.6 + (1.5 – 0.3) = **10.8**

3) Identify areas behind tidal restrictions, flood control structures, or coastal geometry might affect flooding

4) Assess specific vulnerabilities where appropriate