



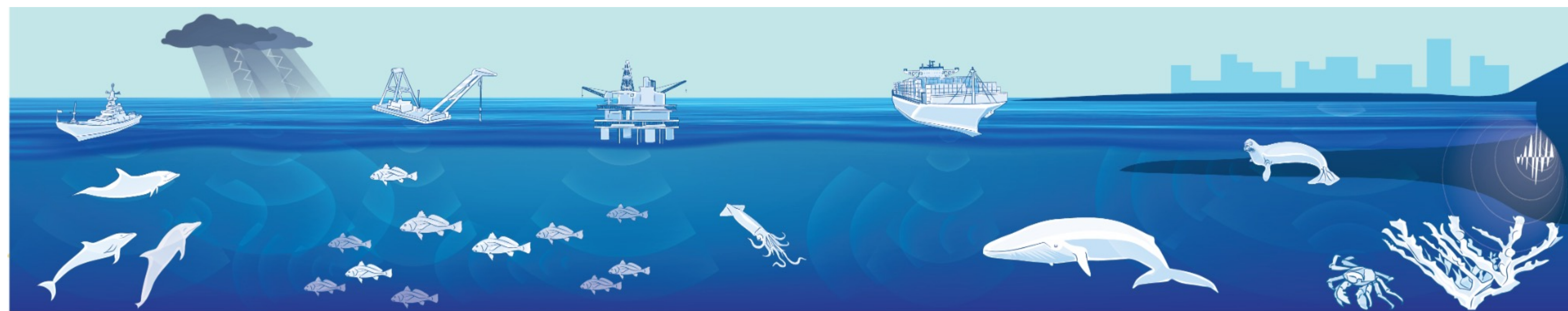
# PMEL Research Facilitates Marine Renewable Energy Development

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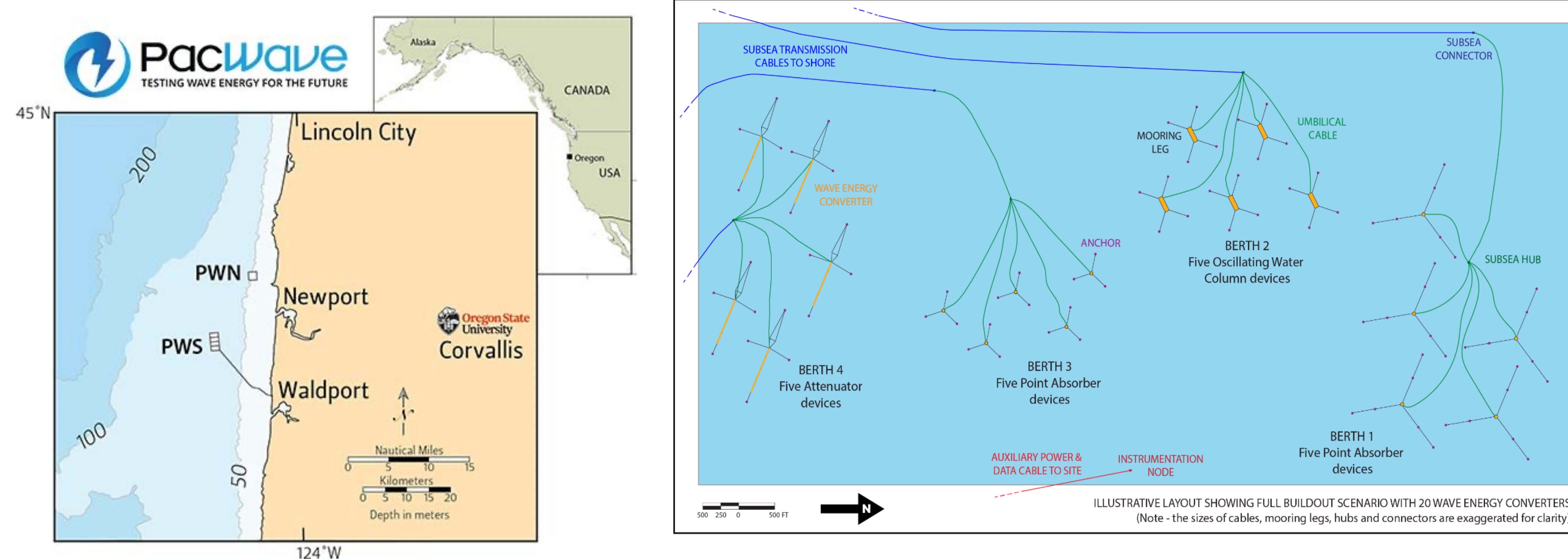


## Overview:

- NOAA plays a key role in providing scientific and technical expertise to assess potential environmental impacts of marine renewable energy development, in support of national de-carbonization efforts.
- Marine energy installations may generate significant underwater radiated noise (URN), adversely impacting marine ecosystems.
- Concerns of URN have been a barrier to licensing & permitting of projects.
- To help address this issue, PMEL has developed real-time and autonomous underwater noise monitoring technologies, including the Coastal Real-Time Acoustic Buoy (CRAB) system, and seafloor hydrophones.



## PacWave South Test Site:



- Site is 4 km North-South, and 2 km East-West, divided into 4 test berths
- Each berth can accommodate up to 5 wave energy converters
- Up to 20 devices, for a total of 20 MW permitted generation capacity
- One dedicated subsea power cable per berth
- Water depth is 60 – 80 m MLLW with prevailing WNW waves
- Sea states in the range of  $1\text{ m} < H_{m0} < 3.5\text{ m}$  and  $7\text{ s} < T_E < 11\text{ s}$



Shoreside Utility Connection and Monitoring Facility for grid integration research

## Assessing Impacts from Wave Energy Converters:

### Converters:

- Noise generated by:
  - Moving parts of the converters
  - Mooring components (i.e. chain and shackle noise)
  - Wind and wave interaction on converter structures
- Device noise *might* exceed NMFS threshold for harassment =  $120\text{ dB}_{\text{rms}}$  re  $1\text{ }\mu\text{Pa}^2$  @ 1-10 m
- Not thought to exceed levels for temporary/permanent injury

1. Oregon State University / CIMERS, Newport, OR
2. NOAA / Pacific Marine Environmental Laboratory, Seattle, WA
3. Pacific Northwest National Laboratory, Sequim, WA
4. Living Ocean Systems, Inc.
5. NOAA / PMEL, Newport, OR

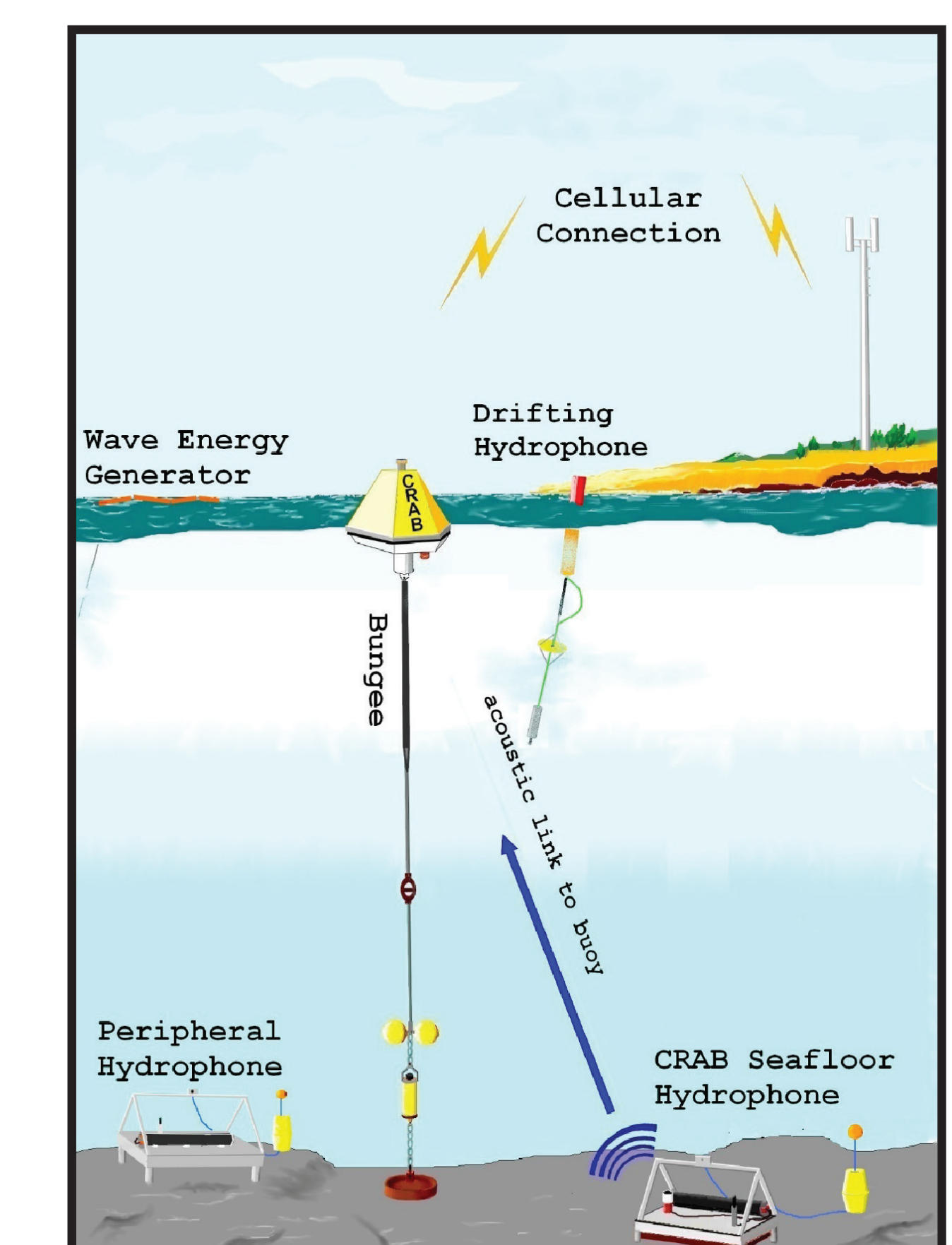
## PMEL Acoustic Systems for Noise Monitoring at the PacWave Facility:

1. **Coastal Real-Time Acoustic Buoy** – data digest transmission from site to shore
2. **Peripheral Hydrophones** – continuous recording of ambient noise levels
3. **Drifting Hydrophones** – rapid localized deployment for in-situ spot monitoring

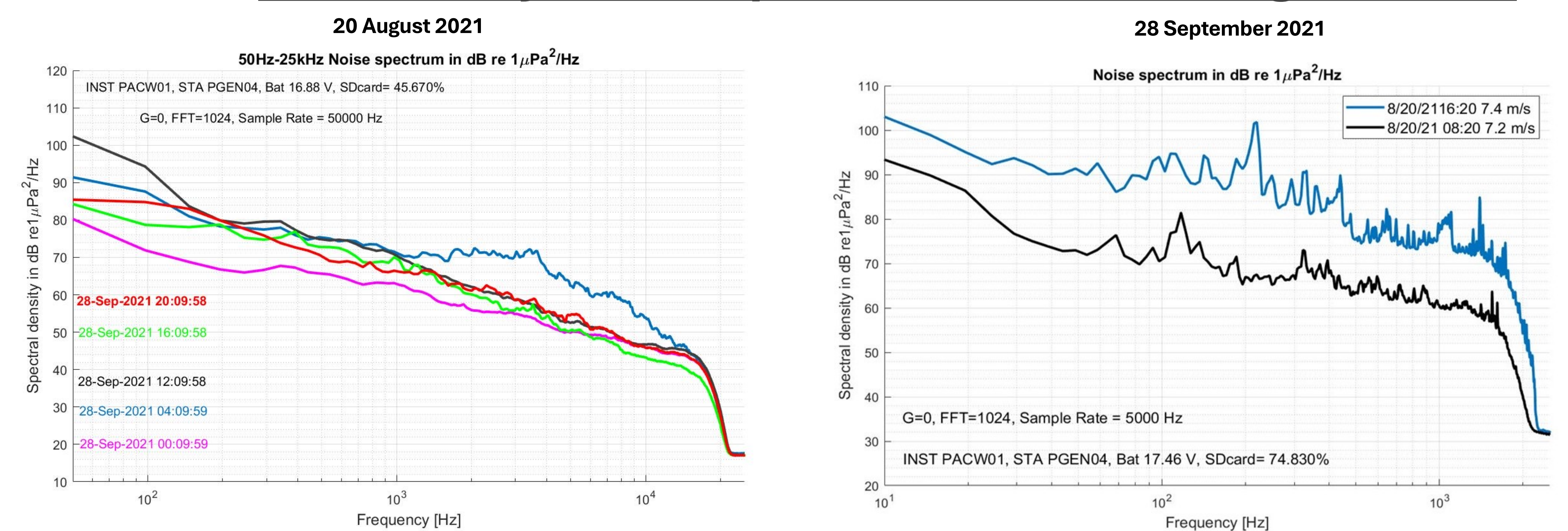
### PMEL – CRAB development milestones:

- 07 / 2020 – Design and fabrication started
- 09 / 2021 – Prototype testing in Lake Washington
- 01 / 2022 – Design iterations and refinement
- 06 / 2022 – Prototype testing in Puget Sound
- 09 / 2023 – In-water test at PacWave South site
- 11 / 2023 – CRAB system recovered

PMEL's expertise enabled PacWave's 2023 field campaign to be highly successful



## CRAB Daily Noise Spectra: Test in the Puget Sound

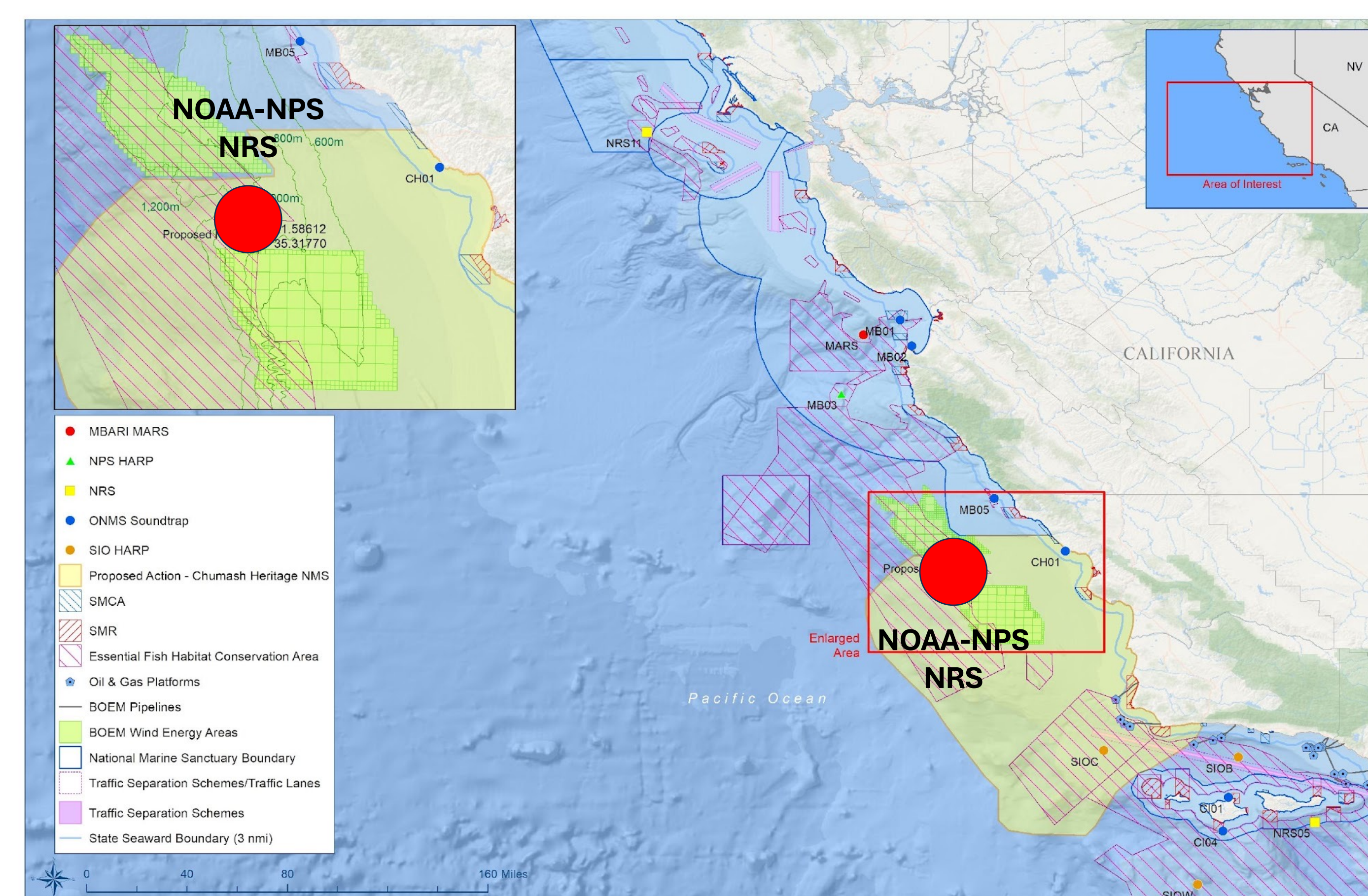


Puget Sound Daily ambient noise conditions: Generally lower noise levels in early mornings, likely due to lower marine traffic

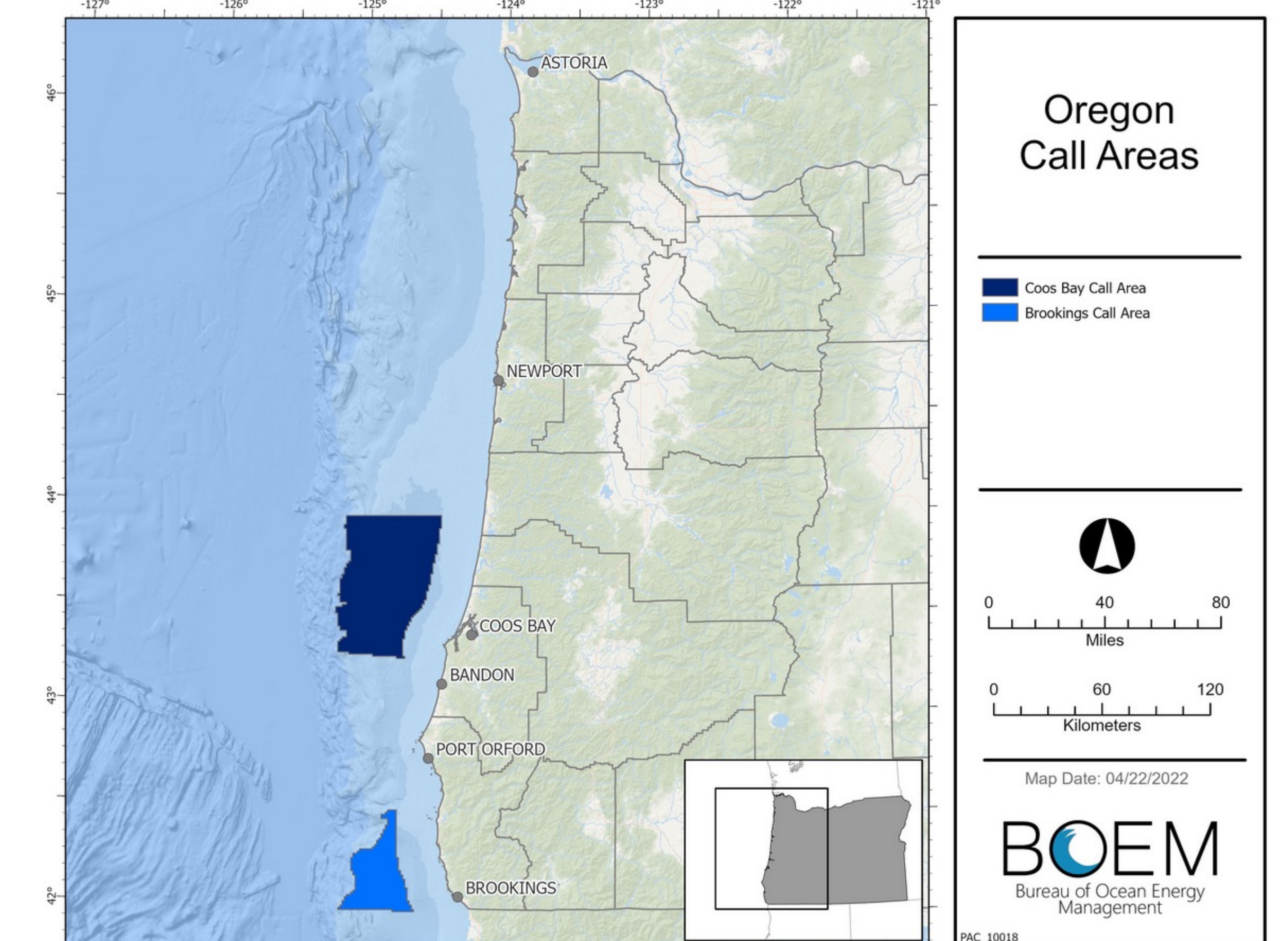
## Planned Deployments at Offshore Wind Energy Sites

Morrow Bay, CA: BOEM OSW & Chumash NMS

Southern OR: BOEM call sites Coos Bay and Brookings



PMEL Hydrophone mooring deployed on 13 March 2023



Possible mooring deployment by Fall 2024

We are also in the early stages of deploying hydrophone moorings at offshore **wind** energy sites.

Left image shows the Morro Bay, California **wind** energy facility, near the Chumash National Marine Sanctuary. This deployment occurred on March 13<sup>th</sup> 2023.

Image on the right shows the location of two wind energy sites ~40 miles offshore southern Oregon (blue polygons). These sites were proposed by BOEM and are in the early developmental phase. We are working with the OSU Marine Mammal Institute to deploy a hydrophone mooring at the northern site to evaluate marine mammal presence in support of renewable energy development.