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COMS 2026
COASTAL OFFSHORE MODELLING SYMPOSIUM

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Data driven wet-storage solutions for floating offshore wind in Ireland

A MaREI, ESB and SFPC Collaboration

COMS | 26 February 2026 | Dr. R O'Connell

UCC
Coláiste na hOllscoile Corcaigh
University College Cork, Ireland

MaREI
Energy · Climate · Marine

ESB
Energy for generations

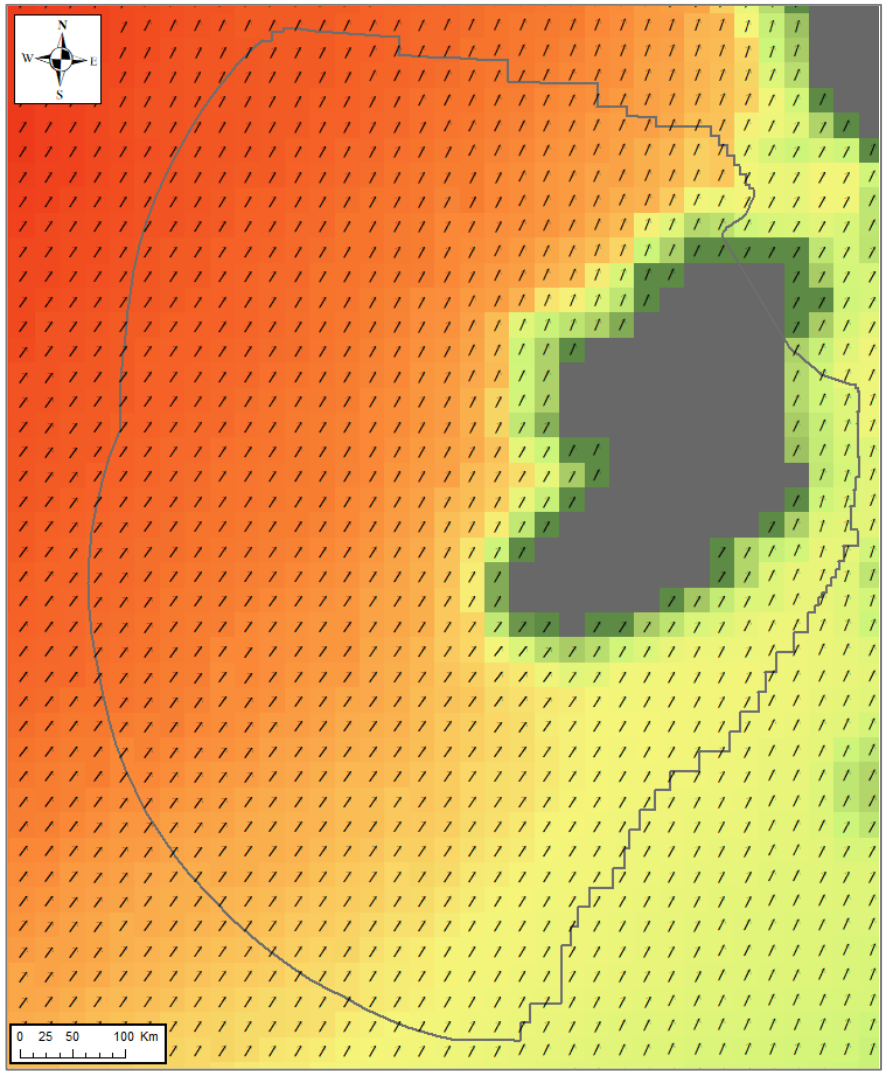
SHANNON FOYNES PORT

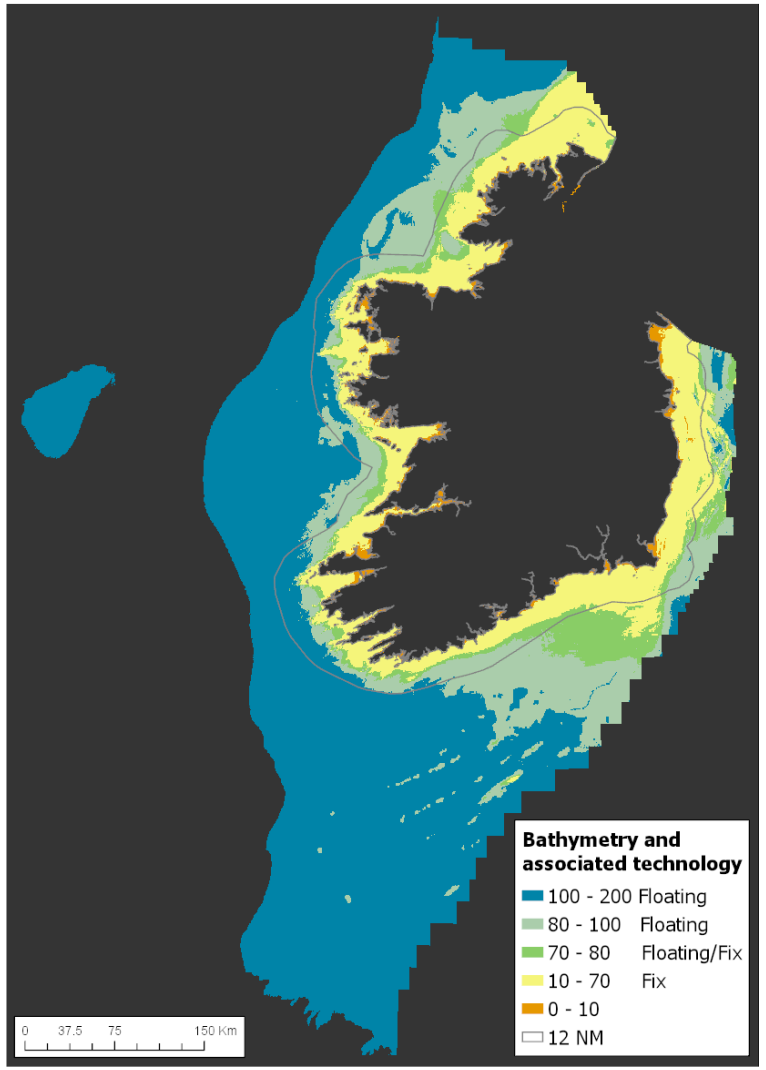
Contents

- Background and Rationale
- Data
- Methodology
- Results
- Conclusion

Ireland's Offshore Wind Opportunity

- Currently, Ireland is still reliant on fossil fuel imports. Nevertheless, recent policy shift are towards renewables. Fixed offshore wind development is now ramping up in the Irish Sea and Celtic Sea.
- The offshore wind energy potential arising from Ireland's Atlantic seaboard however is among Europe's leading renewable energy opportunities.
- With a maritime area more than seven times the size of its landmass, ideal wind conditions, and strategic location on the Atlantic Ocean's doorstep (greater depth), Floating Offshore Wind (FLOW) generation could deliver up to 30 gigawatts of energy by 2050 – six times more than current domestic electricity demand.





Maps: EirWind Project (MaREI, UCC)

What is wet storage for FLOW?

For large scale FLOW projects, it is anticipated that WTGs (and their associated sub-structures) will need to be temporarily stored in port until deployment becomes possible during an appropriate weather window.

Image: TUGDOCK (https://tugdock.com/technology/)

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Why is wet storage likely to be necessary for regions such as Ireland?

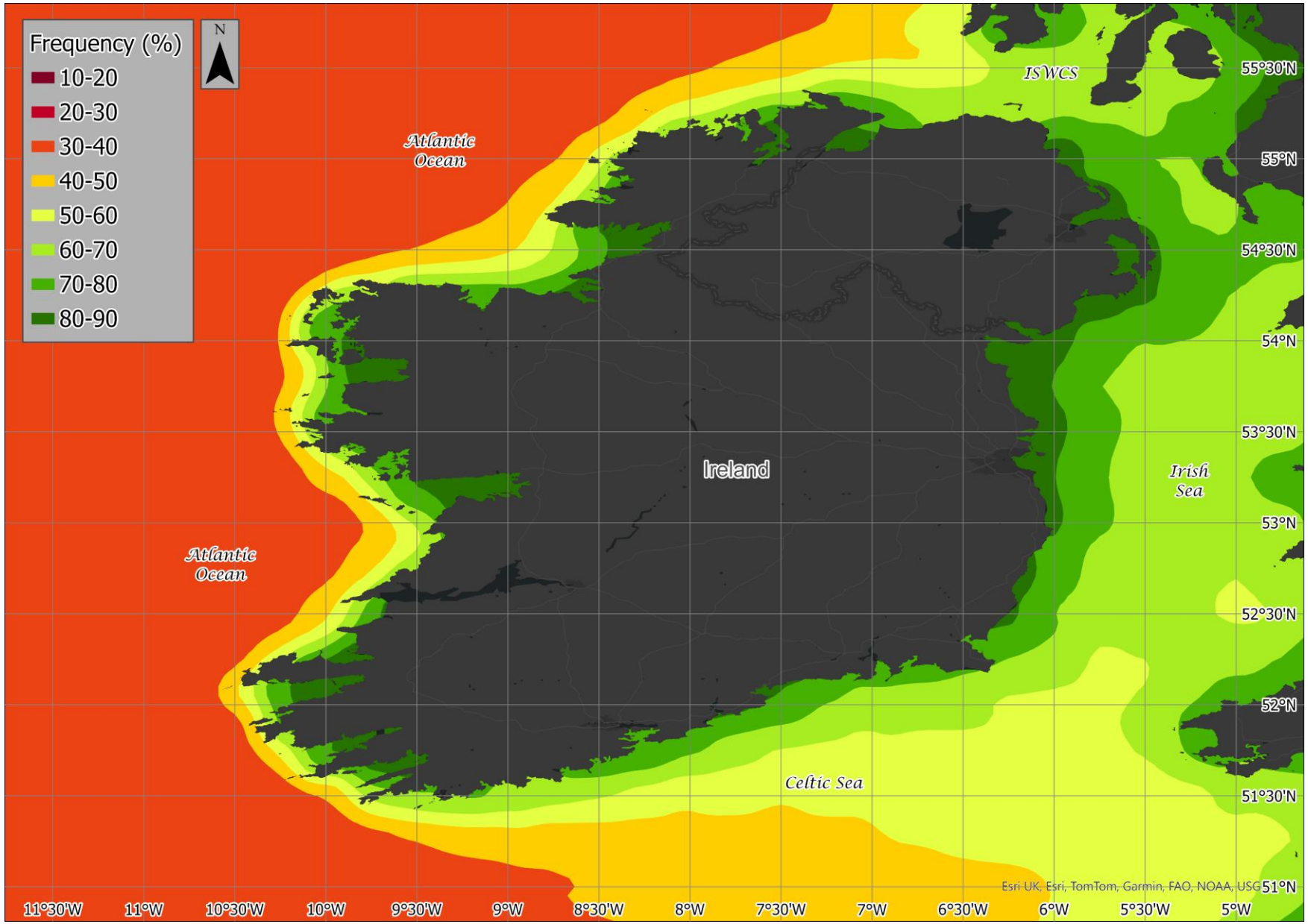
- The harsh wave climate off Ireland's west coast will result in narrow weather windows for FLOW installation.
- Locations with such weather restrictions will almost certainly require an additional lay-down area during installation.
- FLOWTs will need to be temporarily stored in port until deployment becomes possible during an appropriate weather window.

Image: AFLOAT (https://afloat.ie/)

Weather Window Availability (Apr to Oct)

Thresholds considered:

- Wave Height: 2m Hs
- Wind Speed: 10 m/s
- Duration: 06 Hrs

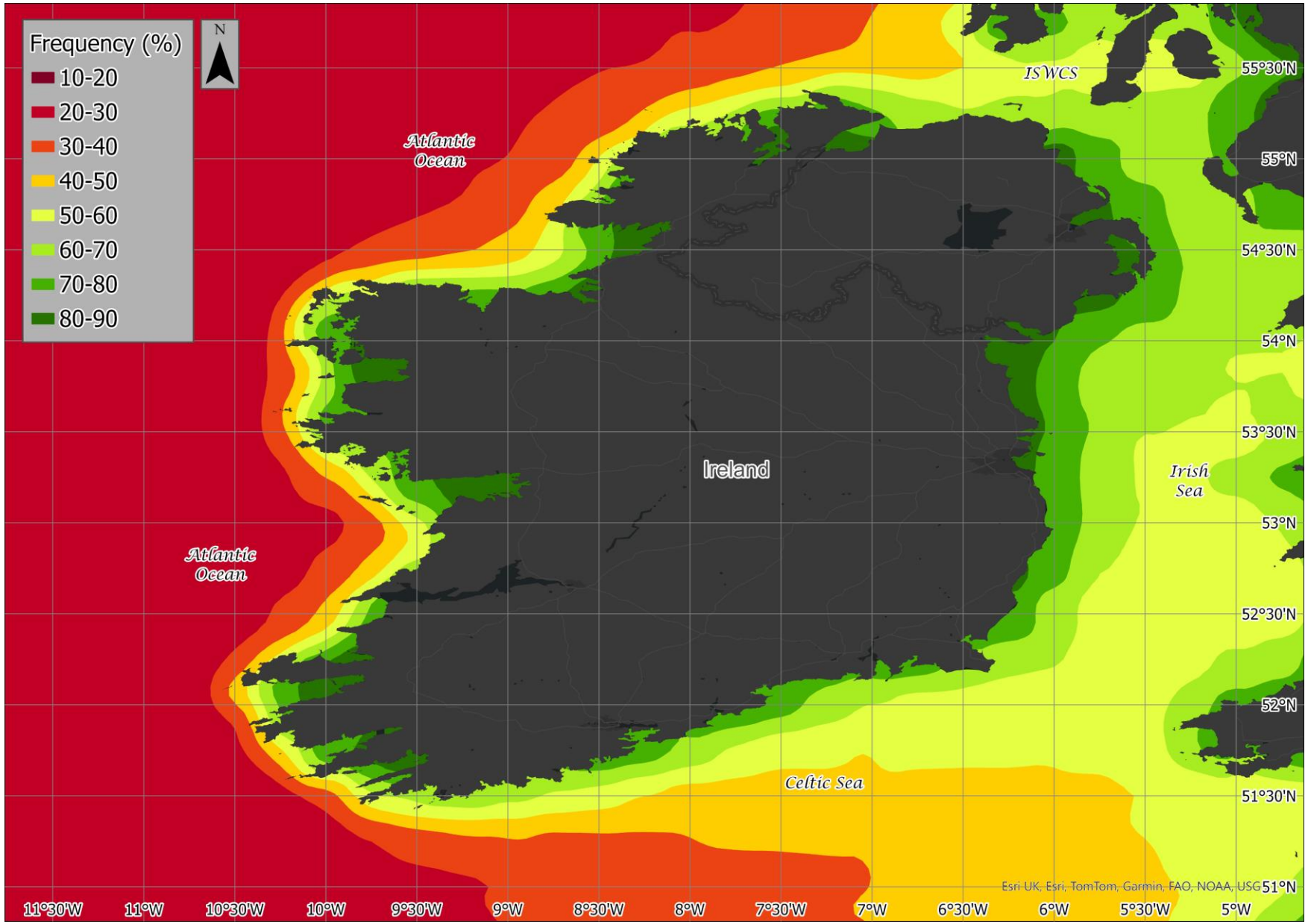


Maps generated using Python and ArcGIS Pro

Weather Window Availability (Apr to Oct)

Thresholds considered:

- Wave Height: 2m Hs
- Wind Speed: 10 m/s
- Duration: <u>12 Hrs</u>

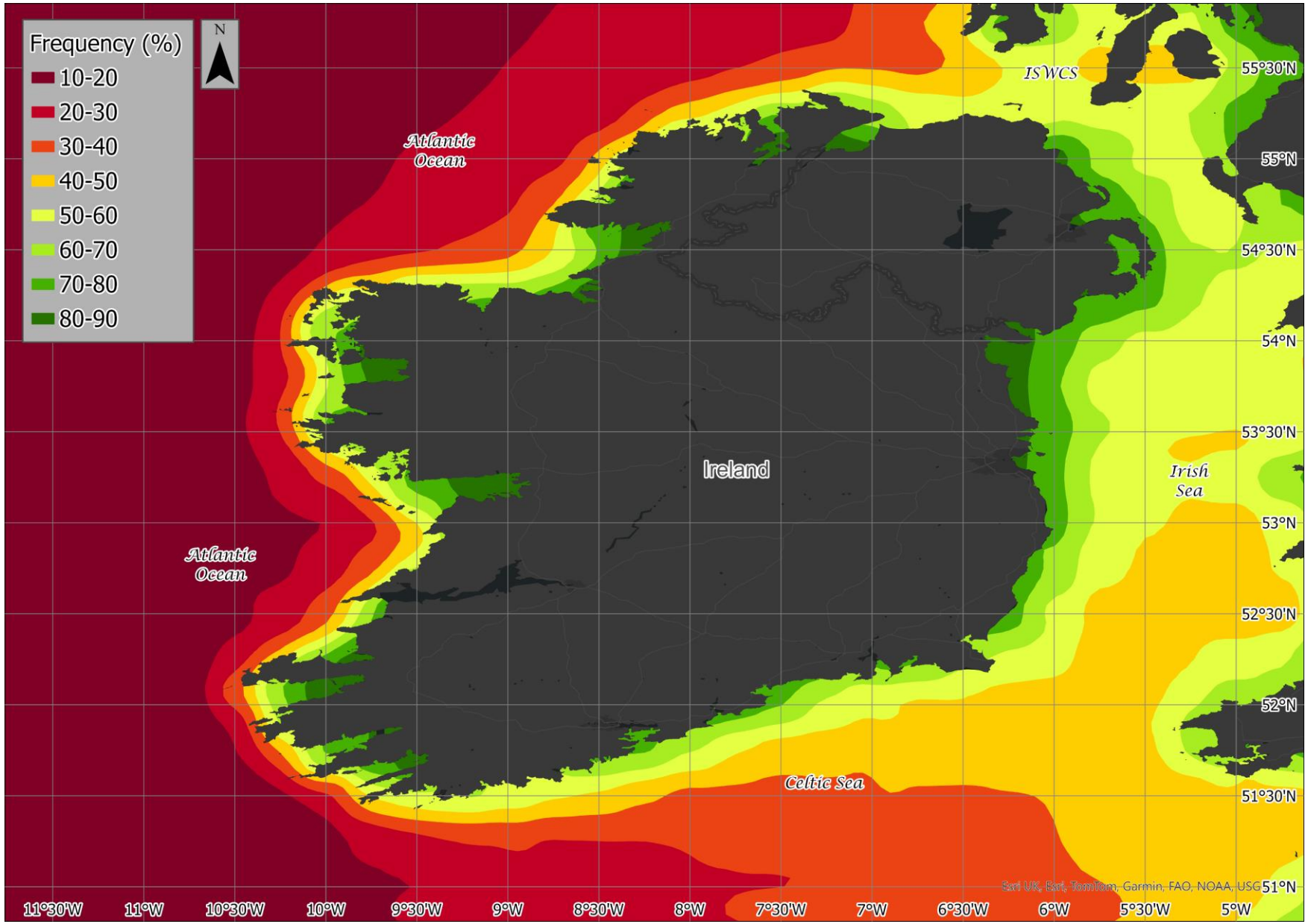


Maps generated using Python and ArcGIS Pro

Weather Window Availability (Apr to Oct)

Thresholds considered:

- Wave Height: 2m Hs
- Wind Speed: 10 m/s
- Duration: <u>24 Hrs</u>



Maps generated using Python and ArcGIS Pro

Wet-Storage Project Elements

- Literature Review
- GIS Study
- Stakeholder Engagement
- Layout and Mooring Study
- Cost Analysis

Wet-Storage Project Elements

- Literature Review
- GIS Study
- Stakeholder Engagement
- Layout and Mooring Study
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Study Assumptions

- Floating wind project scale and location – 800MW off the Irish coast
- Foundation size – L: 85-125m, W: 75-120m, H: 35-50m (with catenary mooring system)
- WTG size – Max. Rotor Diameter: 270m, Max. hub height : 165m, Max. tip height: 300m
- Met-Ocean – Integrated: Hs: <2m, U: 30m/s, Current: <2m/s
- Min. depth required for wet storage – Integrated: 13m
- Seabed – ≠ to ‘Rock or other substrata’ (as per the Folk-5 classification system)
- Quantity in wet storage – Integrated: 5-10 units
- Area required for wet storage – Integrated: 725-1,290 ha (with 250m buffer around spread)
- Installation period: Apr.–Oct.

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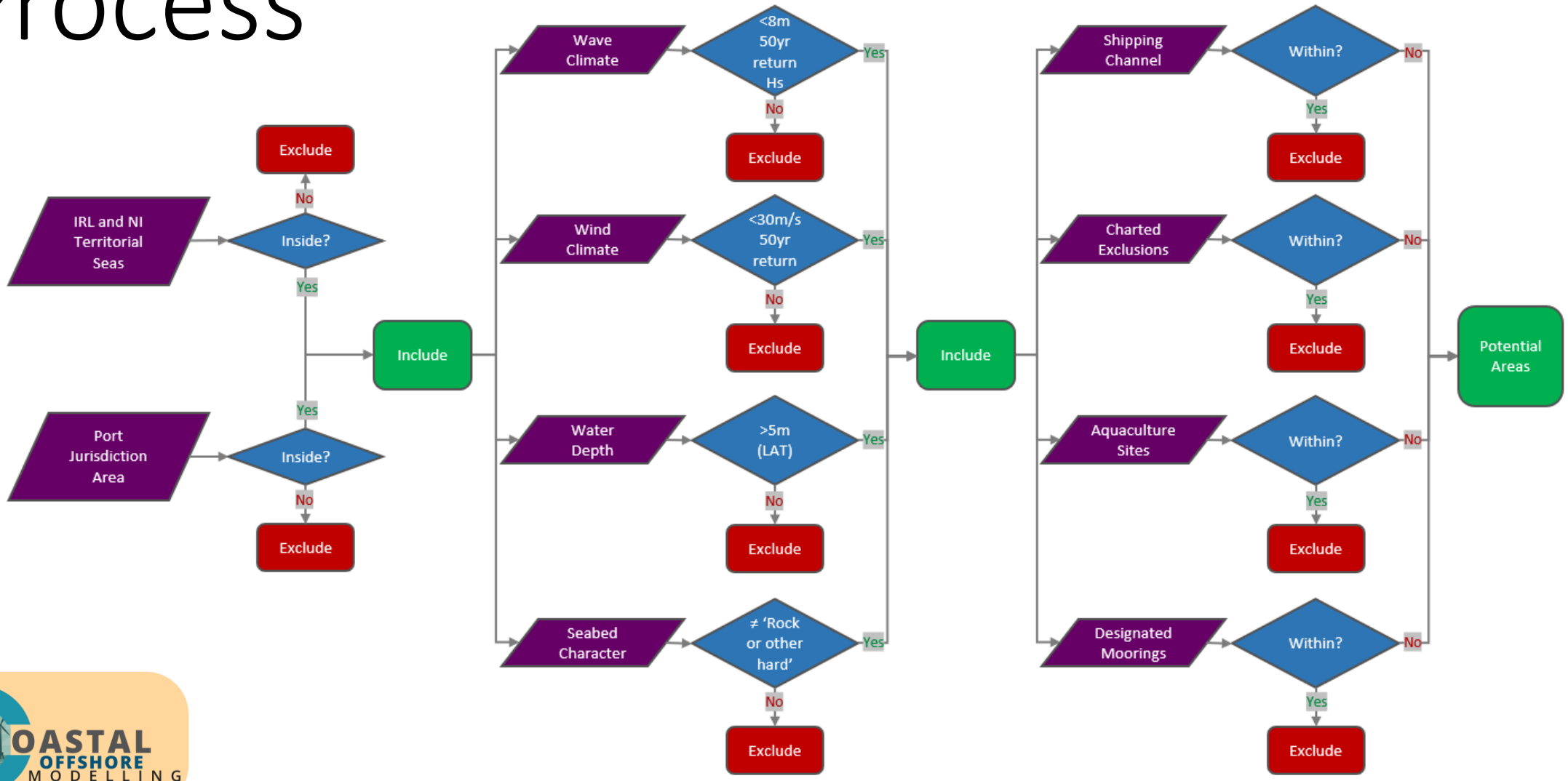
Process



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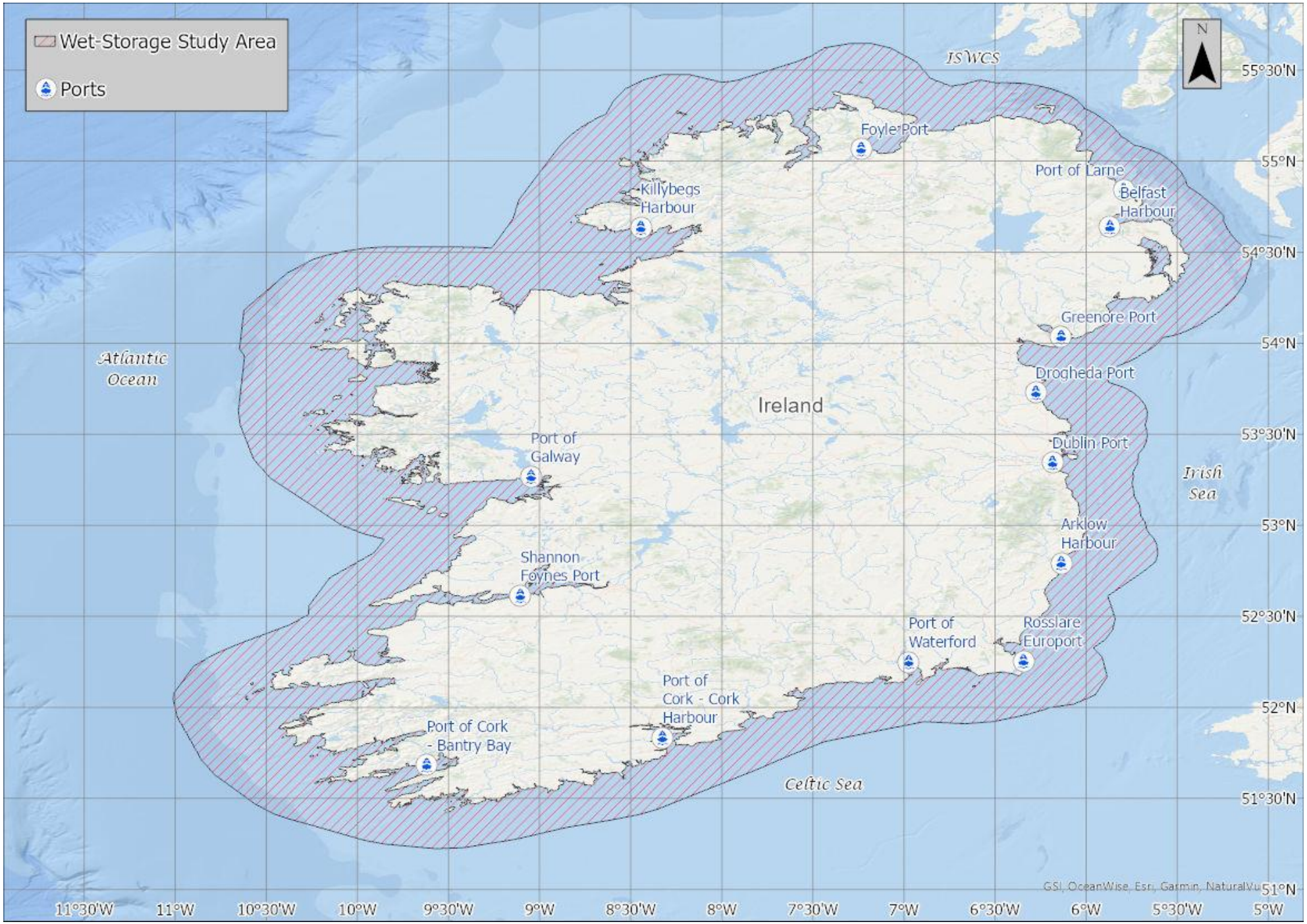

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Study Area
- Irish Territorial Seas

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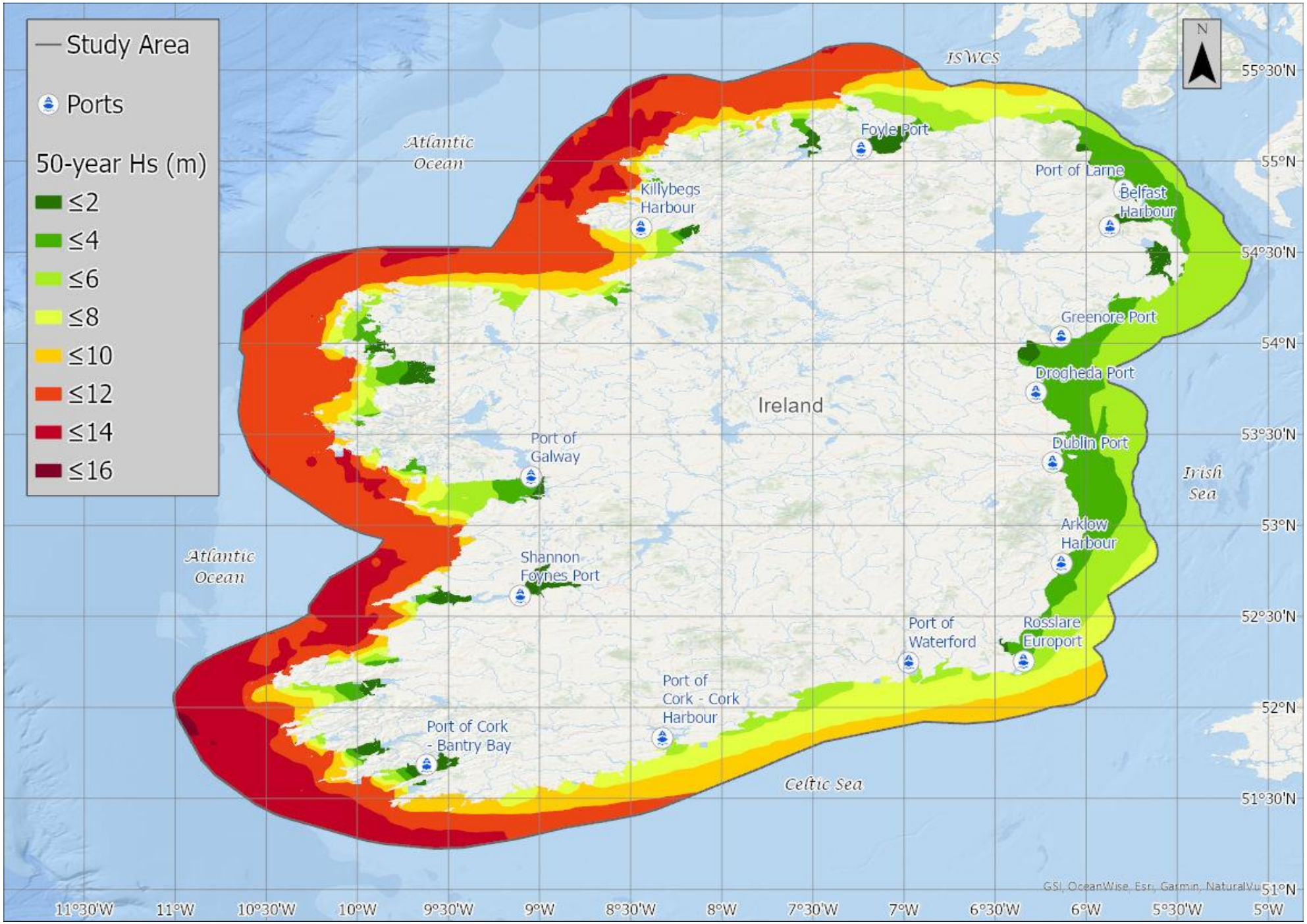

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Wave Climate (CMS)
- 50 year RP Hs*

*subjective

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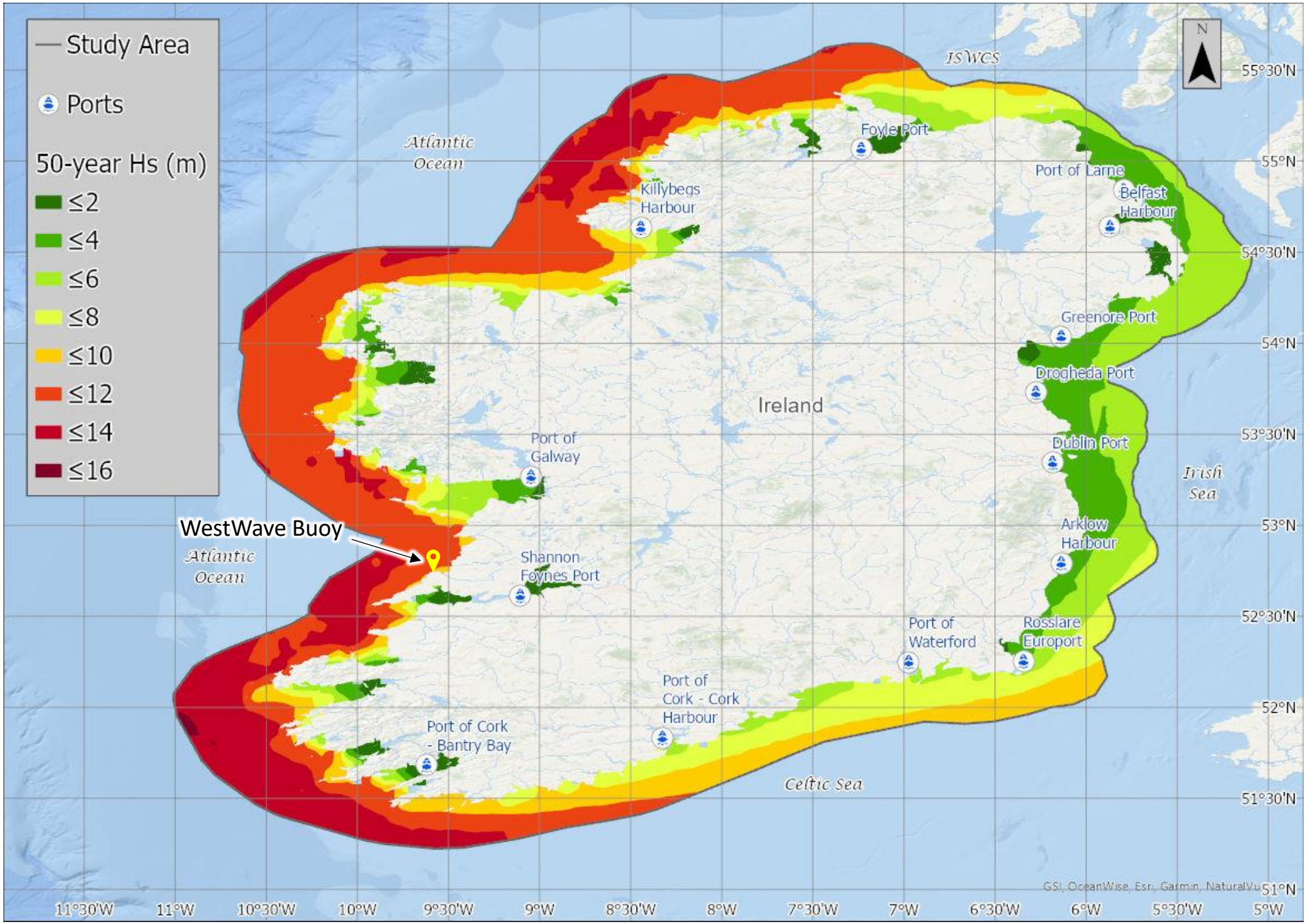

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Validation - Location and Parameters

$$Bias = \frac{1}{N}\sum_{i=1}^{N} e_i$$

$$RMSE = \sqrt{\frac{1}{N}\sum_{i=1}^{N} e_i^2}$$

$$SI = \frac{RMSE}{U}$$

$$R = \frac{1}{\sigma_U \sigma_u (N-1)} \sum_{i=1}^{N} (U_i - U)(u_i - u)$$

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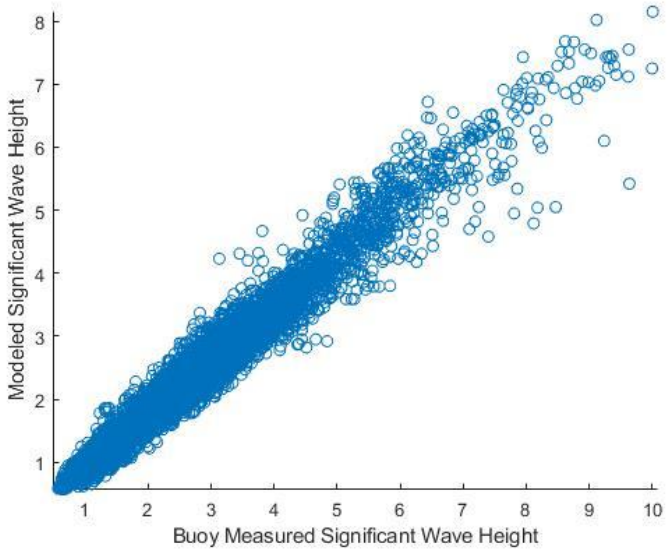
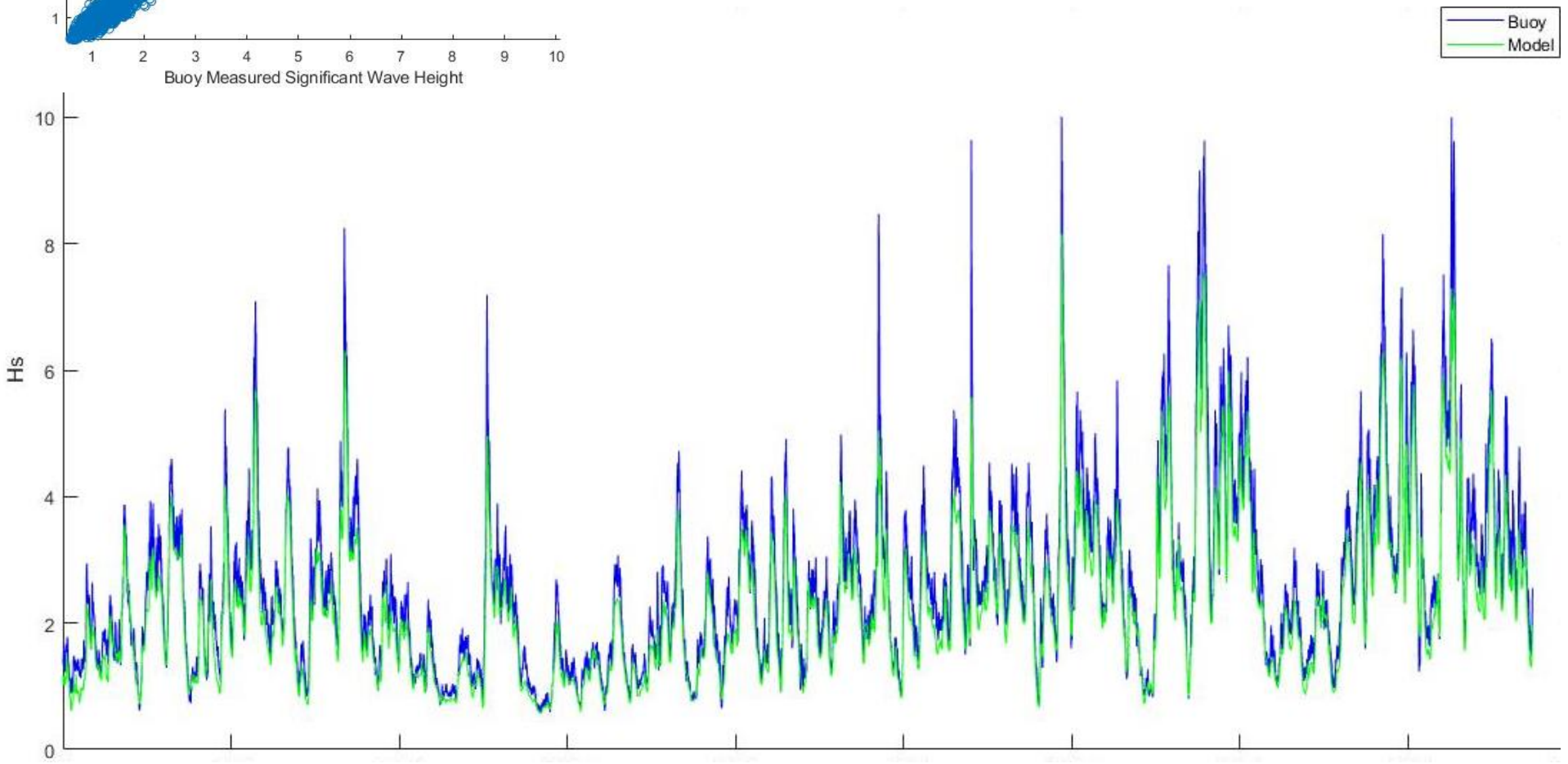


Significant Wave Height					
Buoy	$\bar{x}$ (m)	Bias (m)	RMSE	SI	R
WestWave	2.2447	0.3459	0.4773	0.2126	0.9807



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Validation
- Results

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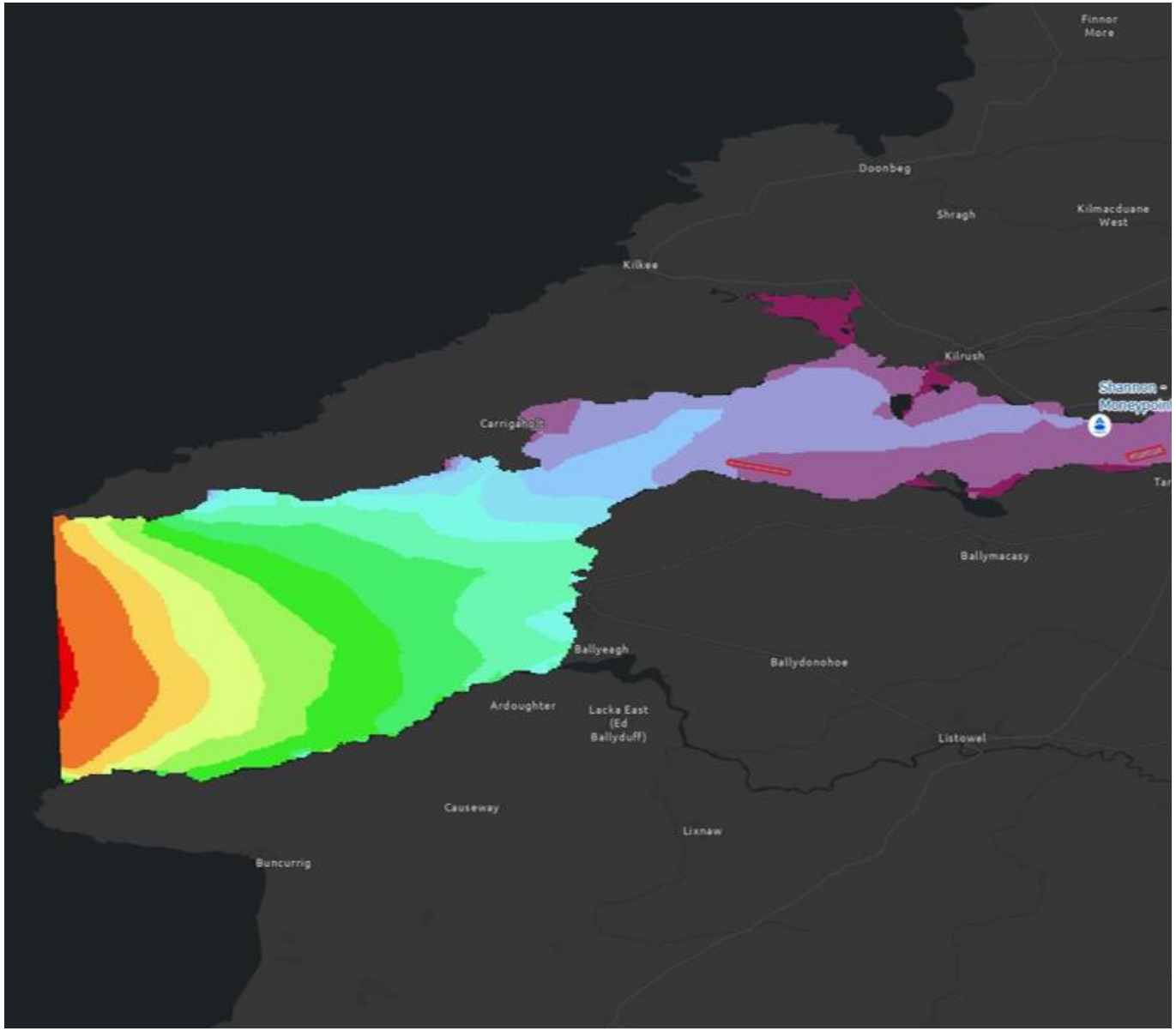

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Wave Climate (CMS)
- 50 year RP Hs

- Extension of wave model into some enclosed areas (i.e. ports) required use of DHI's MIKE-21 software for downscaling.

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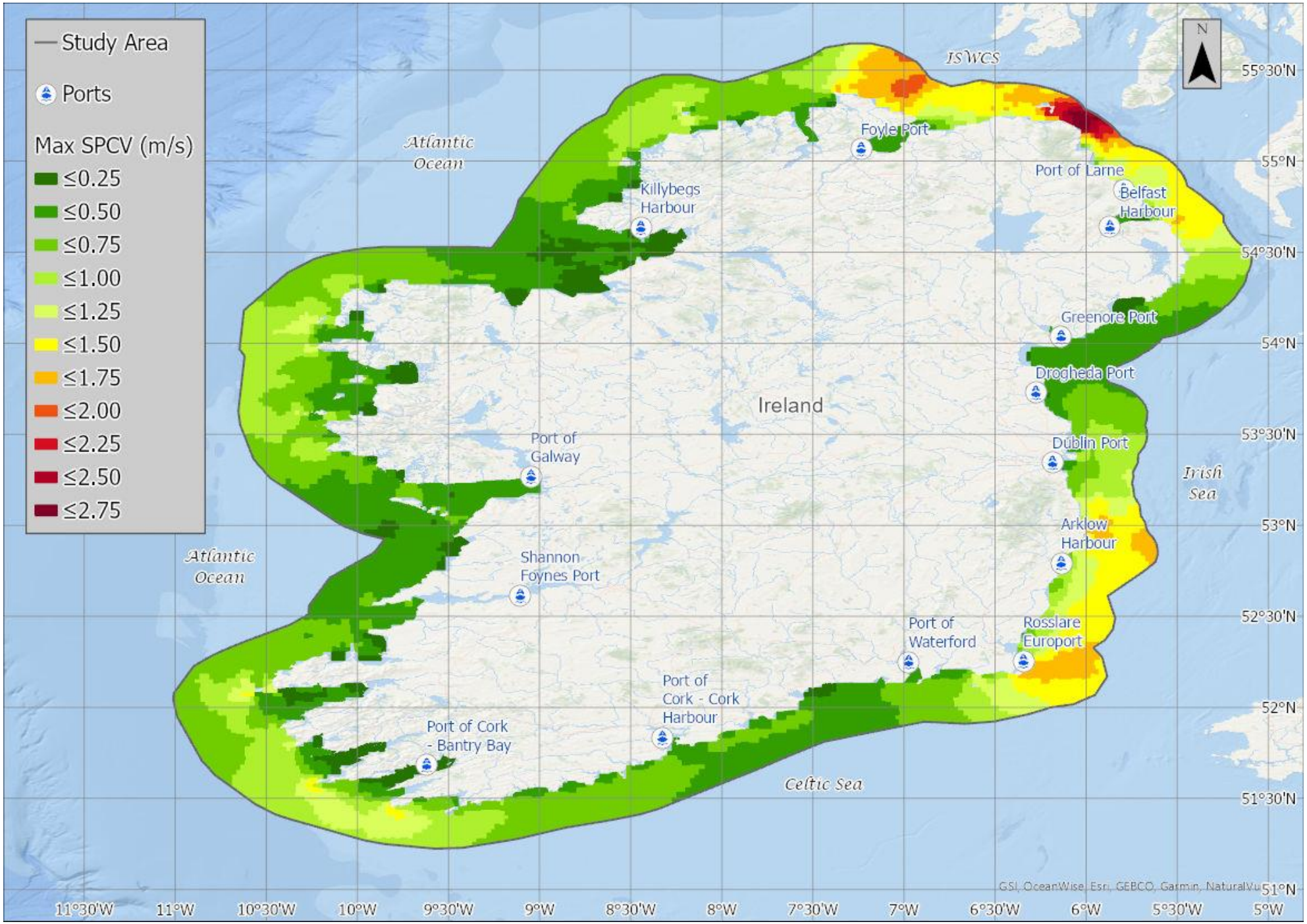

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Max Current Speed (Marine Institute) - Spring Peaks

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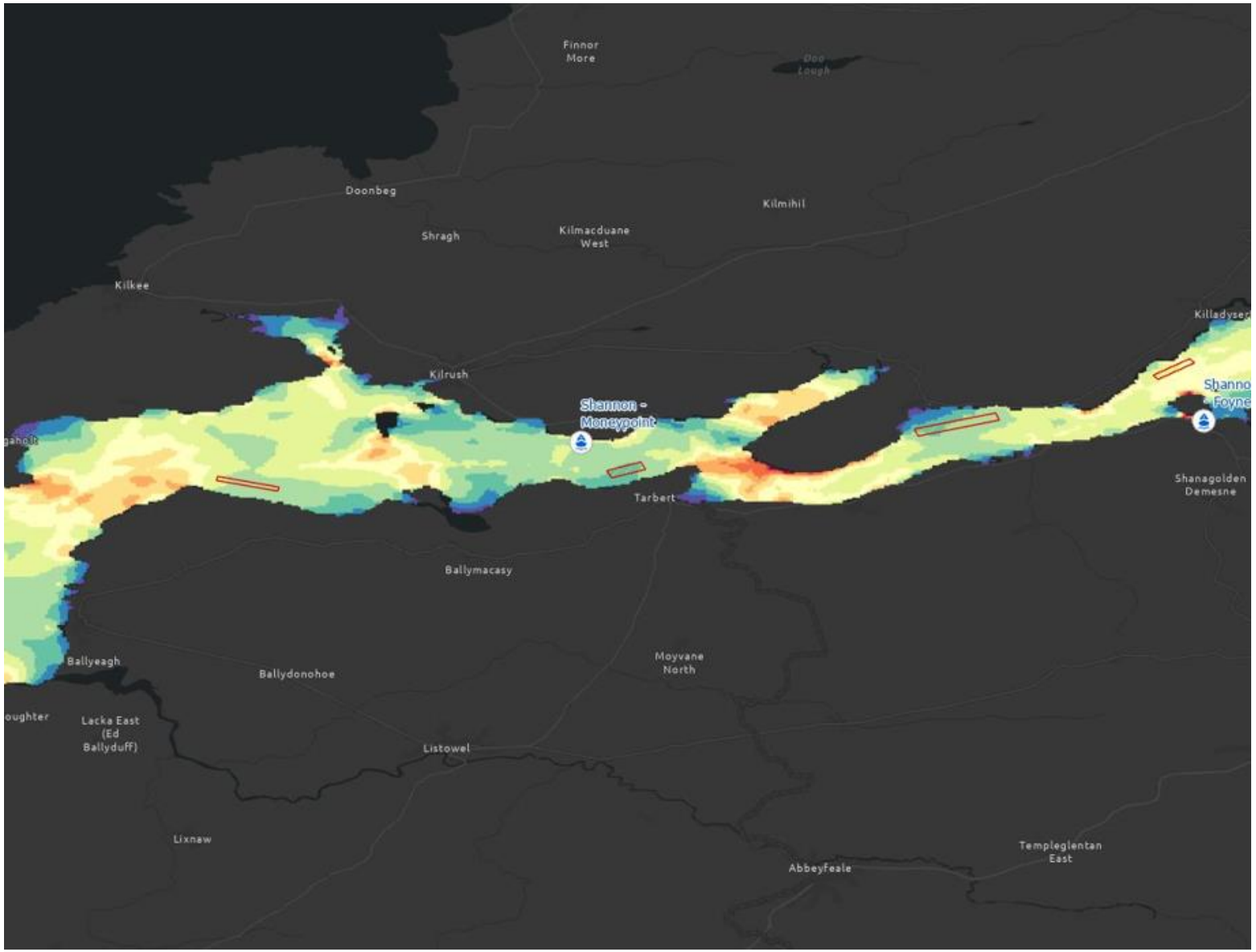

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Max Current Speed (Marine Institute)
- Spring Peaks

- Extension of current speed model into some enclosed areas (i.e. ports) required use of DHI's MIKE-21 software for downscaling.

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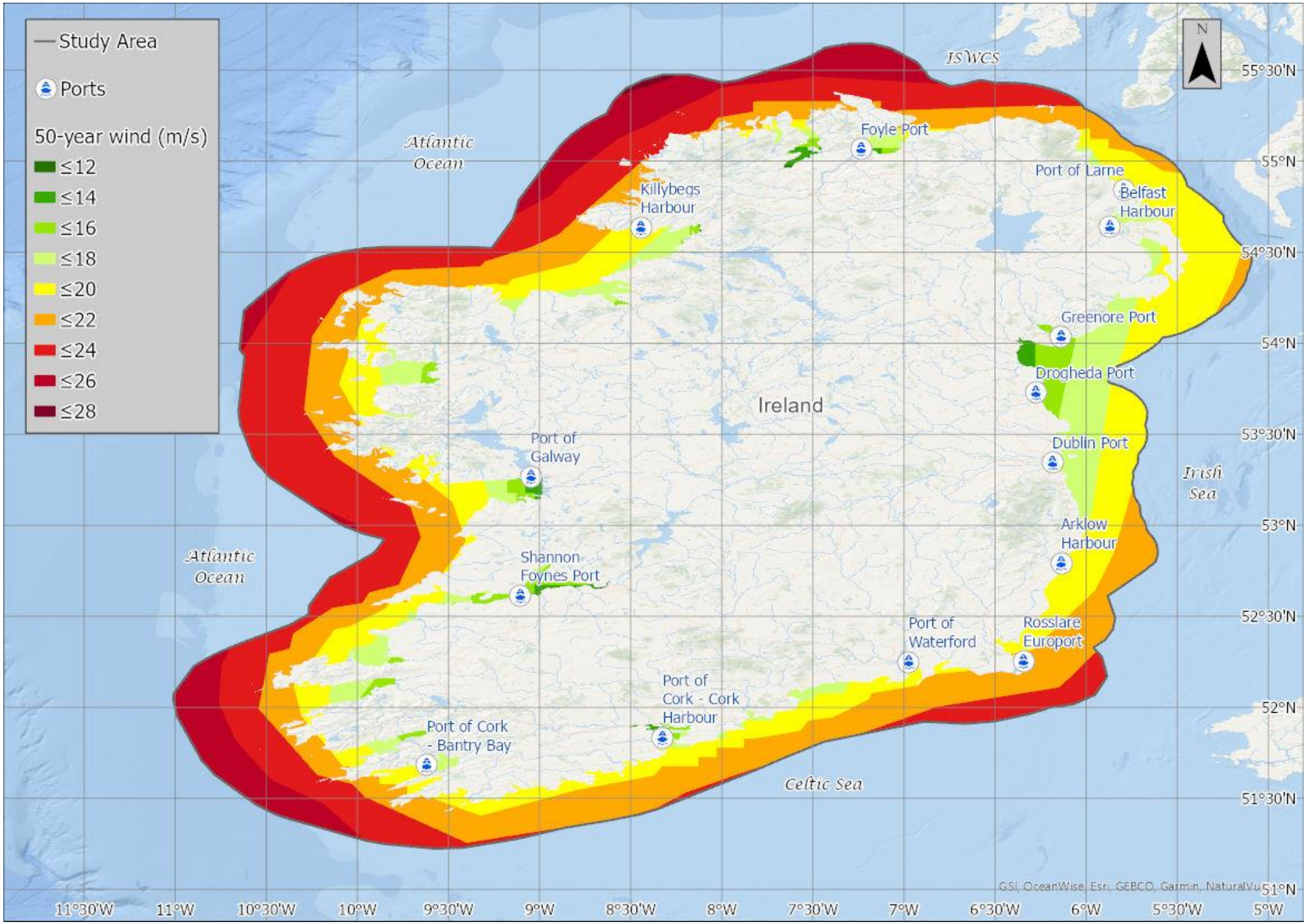

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Wind Climate (ERA5)
- 50 year RP Wind Speed

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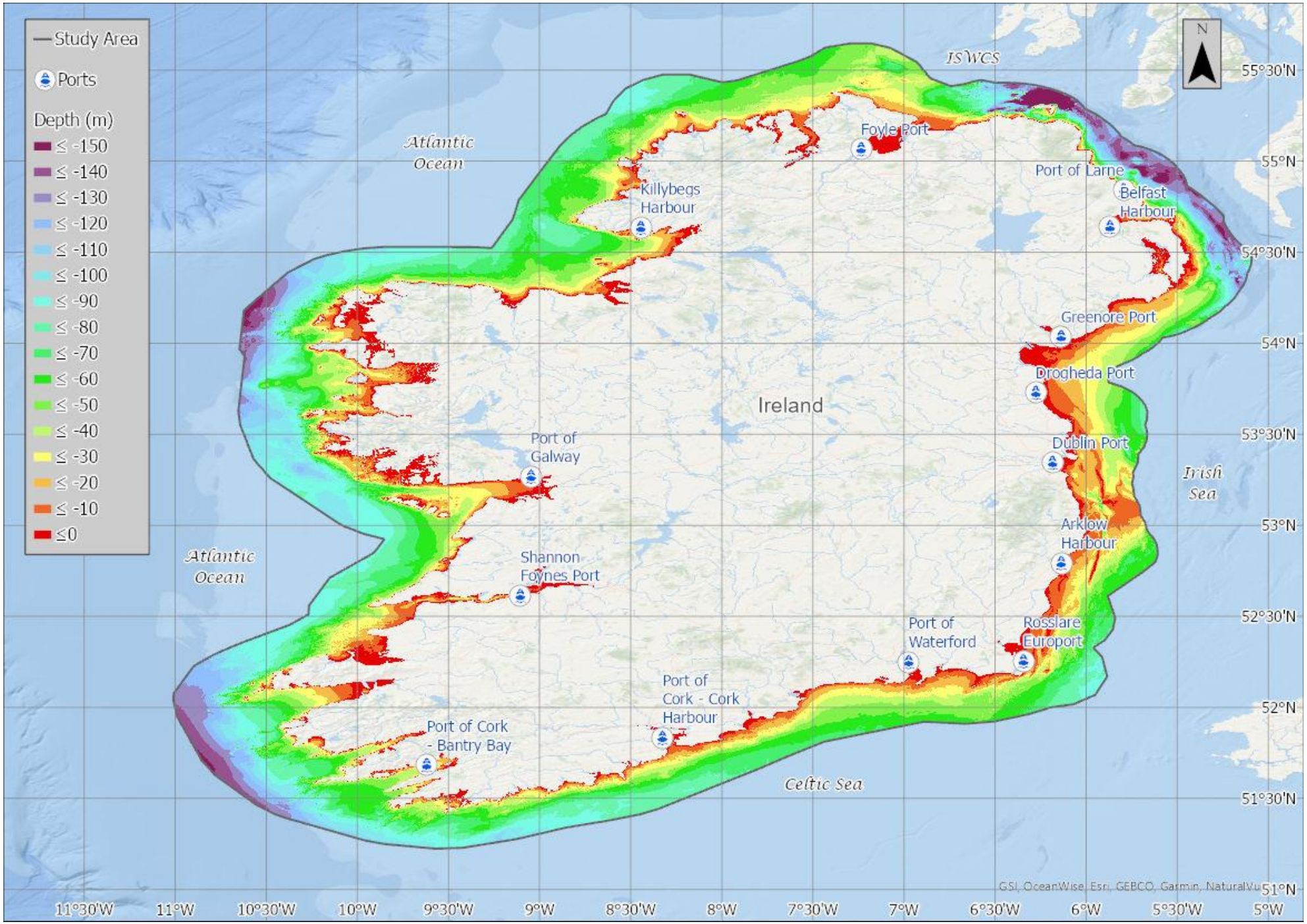

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Bathymetry (m - LAT)

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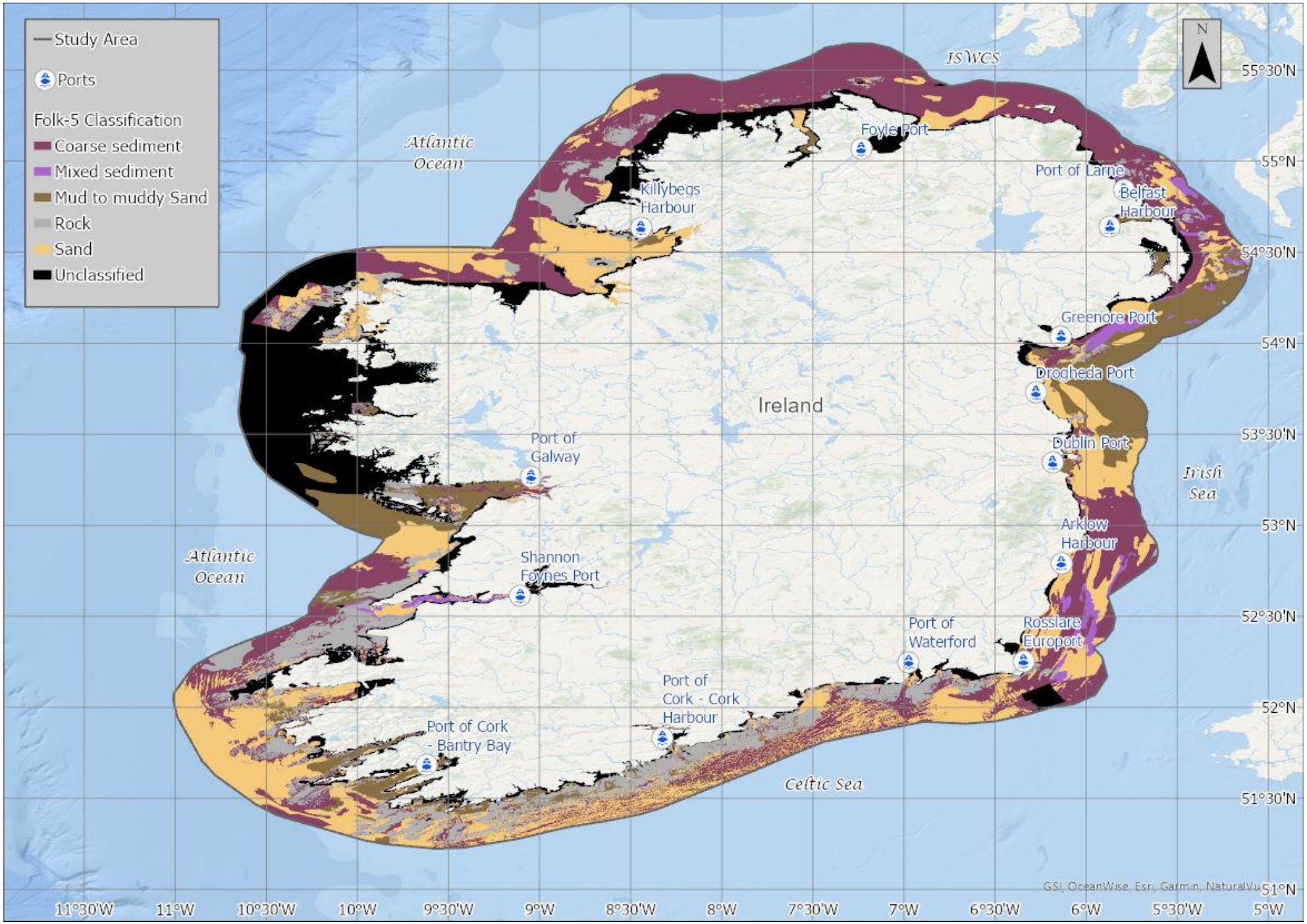

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Seabed Character
- Folk 5 Scale

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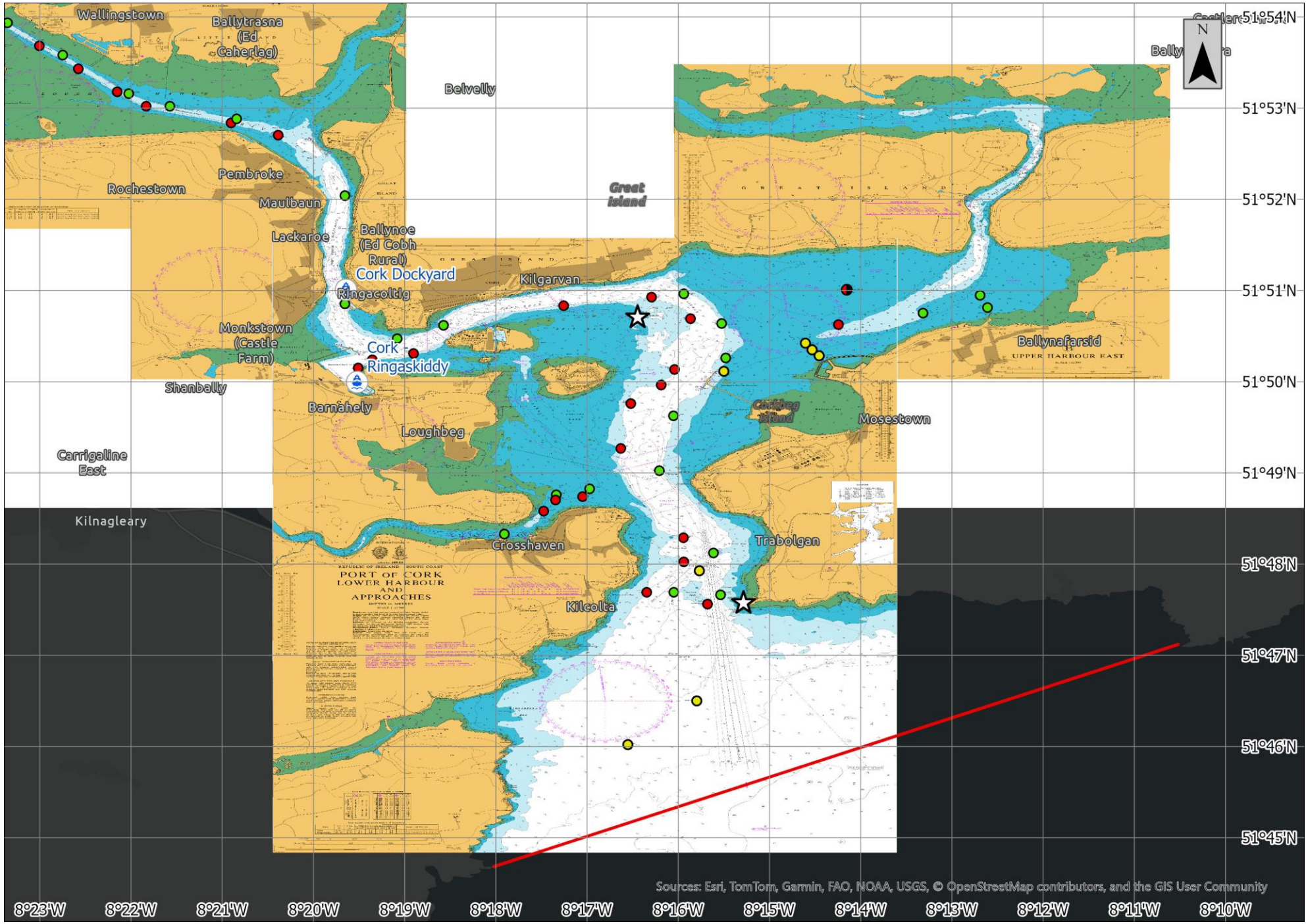

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Surface buoys have been digitised from chart data.

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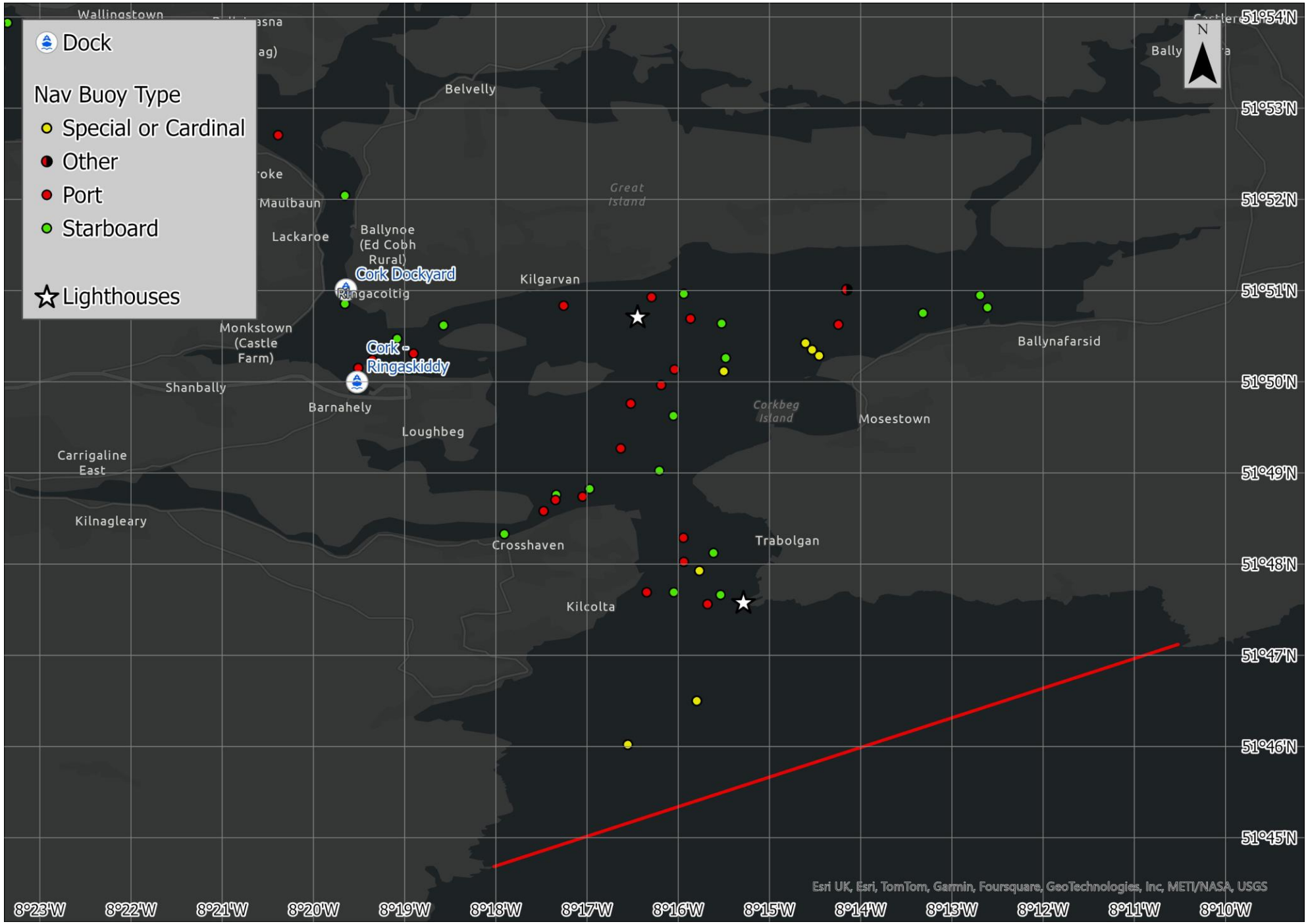

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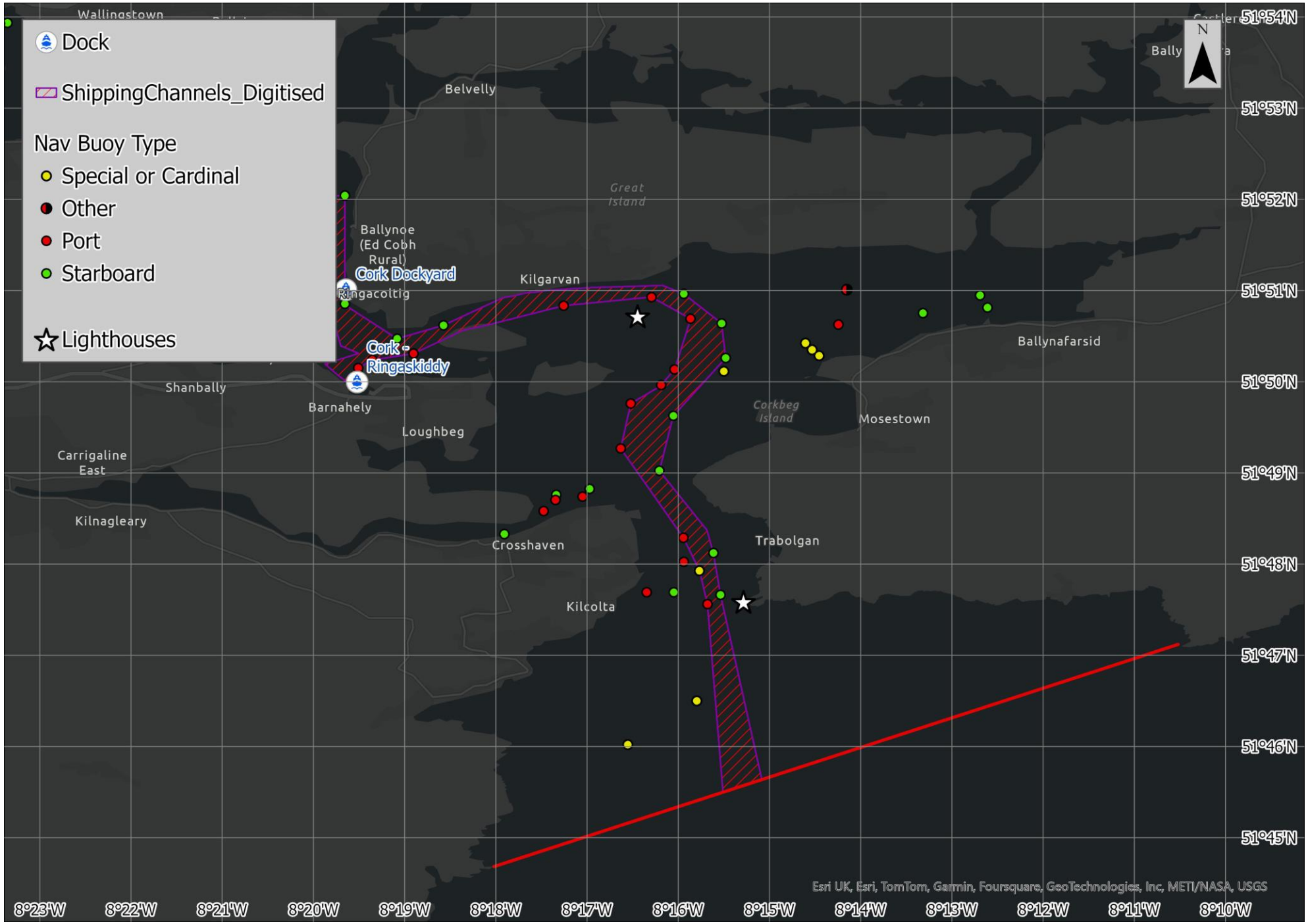

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Shipping channels have been digitised from the later marker buoys.

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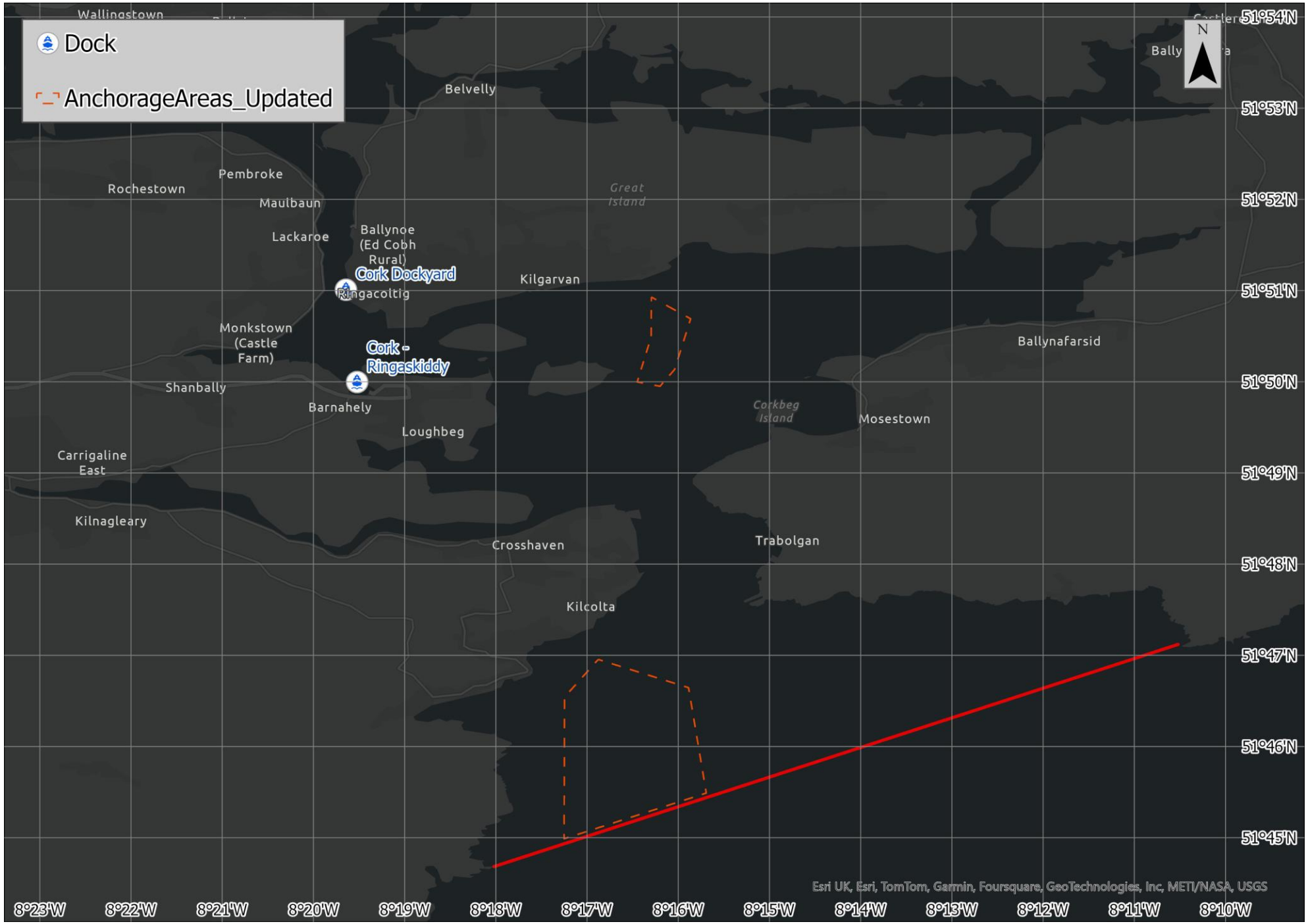

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Anchorage Areas* - digitised from chart data.

*subjective (on/off)

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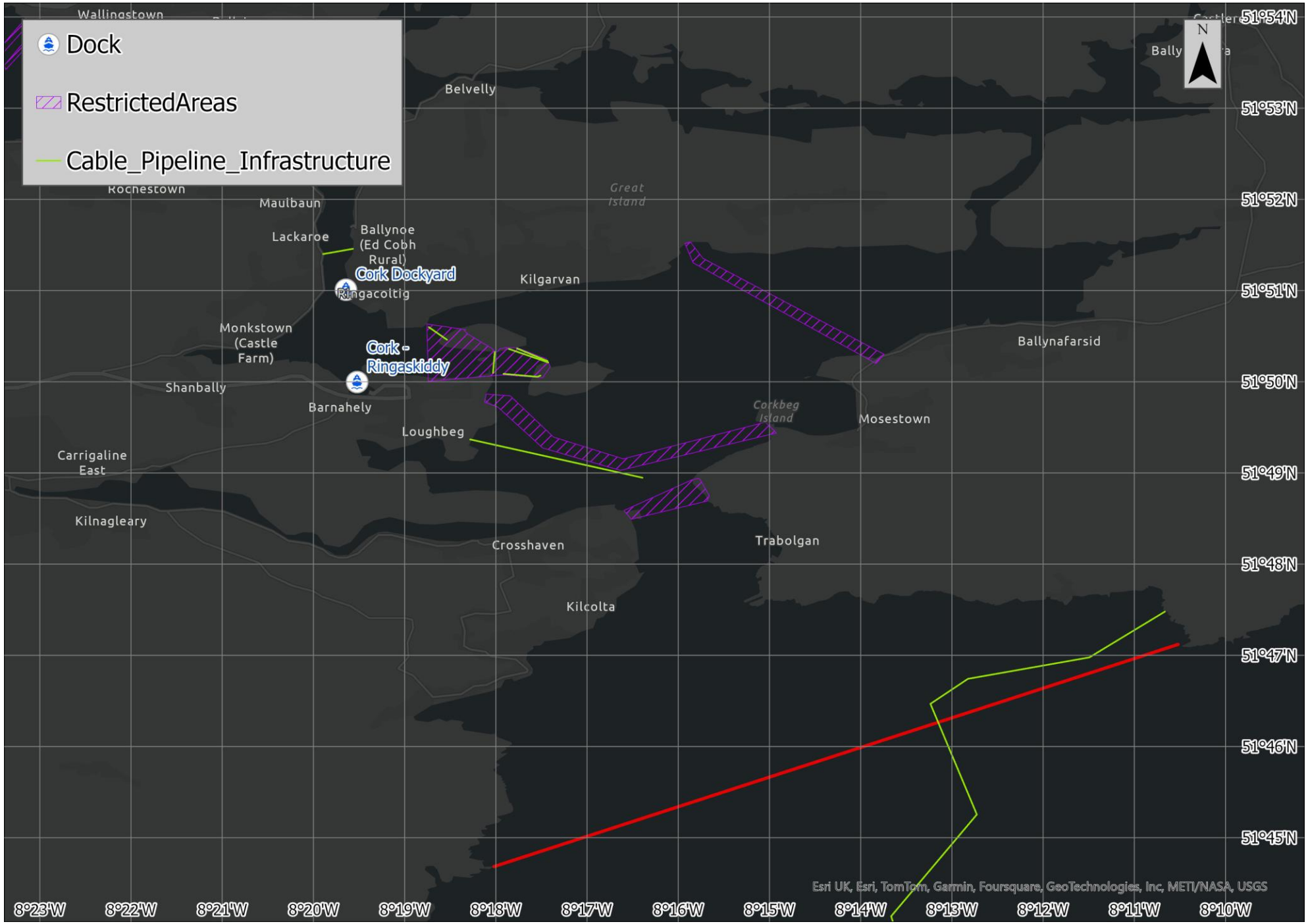

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Cables/Pipelines and Restricted Areas - digitised from chart data.

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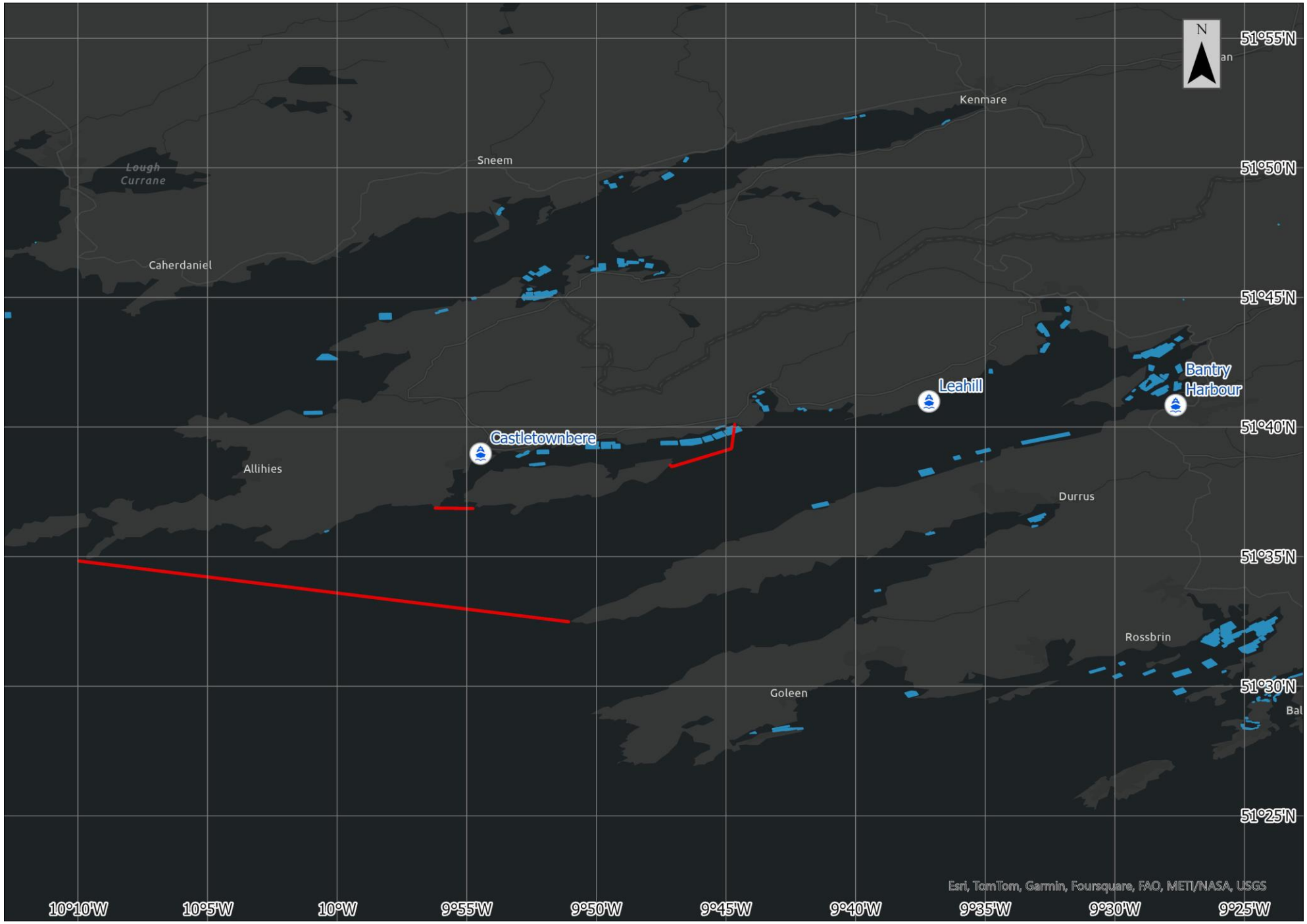

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Aquaculture Sites (Dept. of Agriculture food and the Marine)

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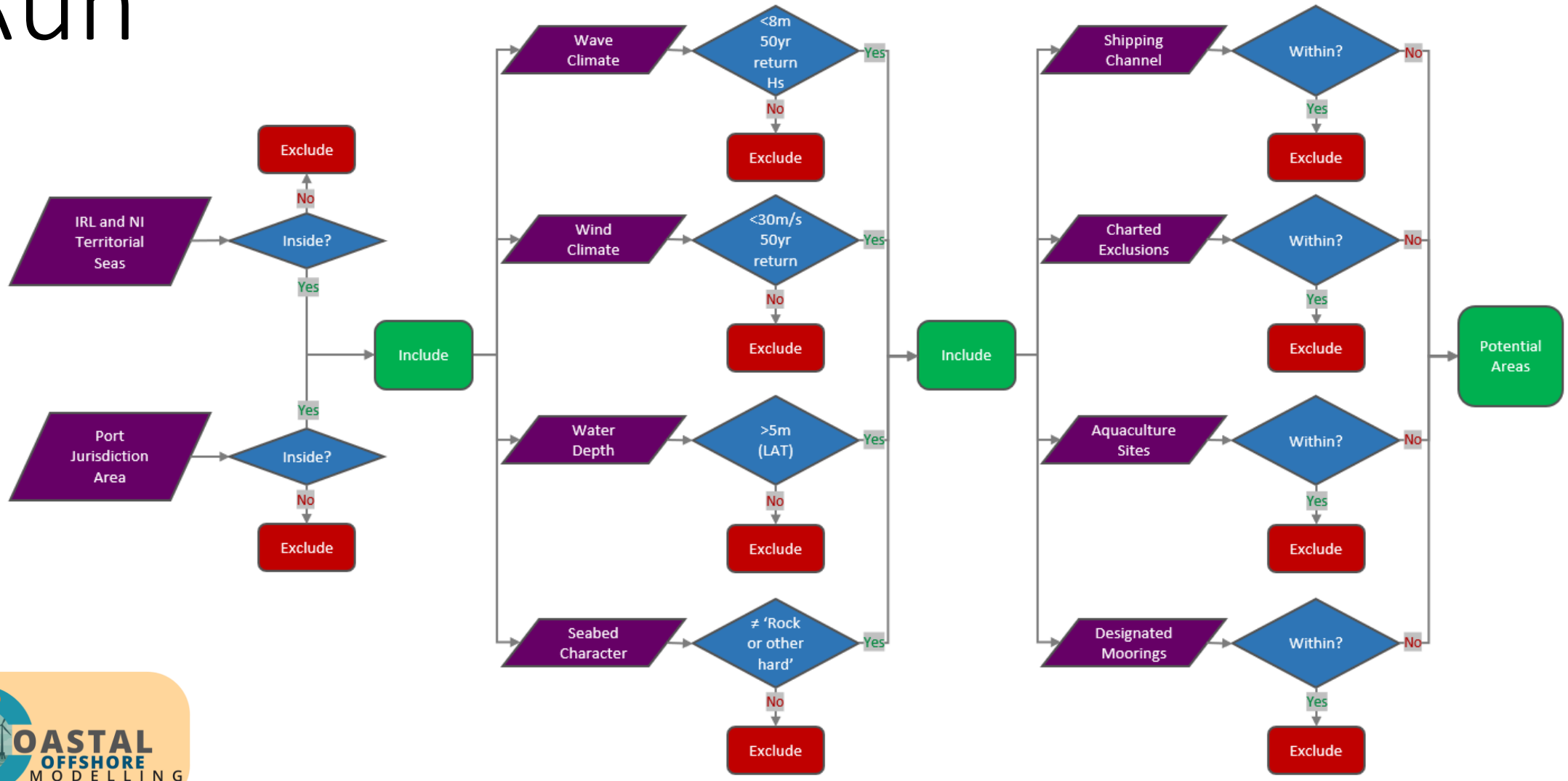
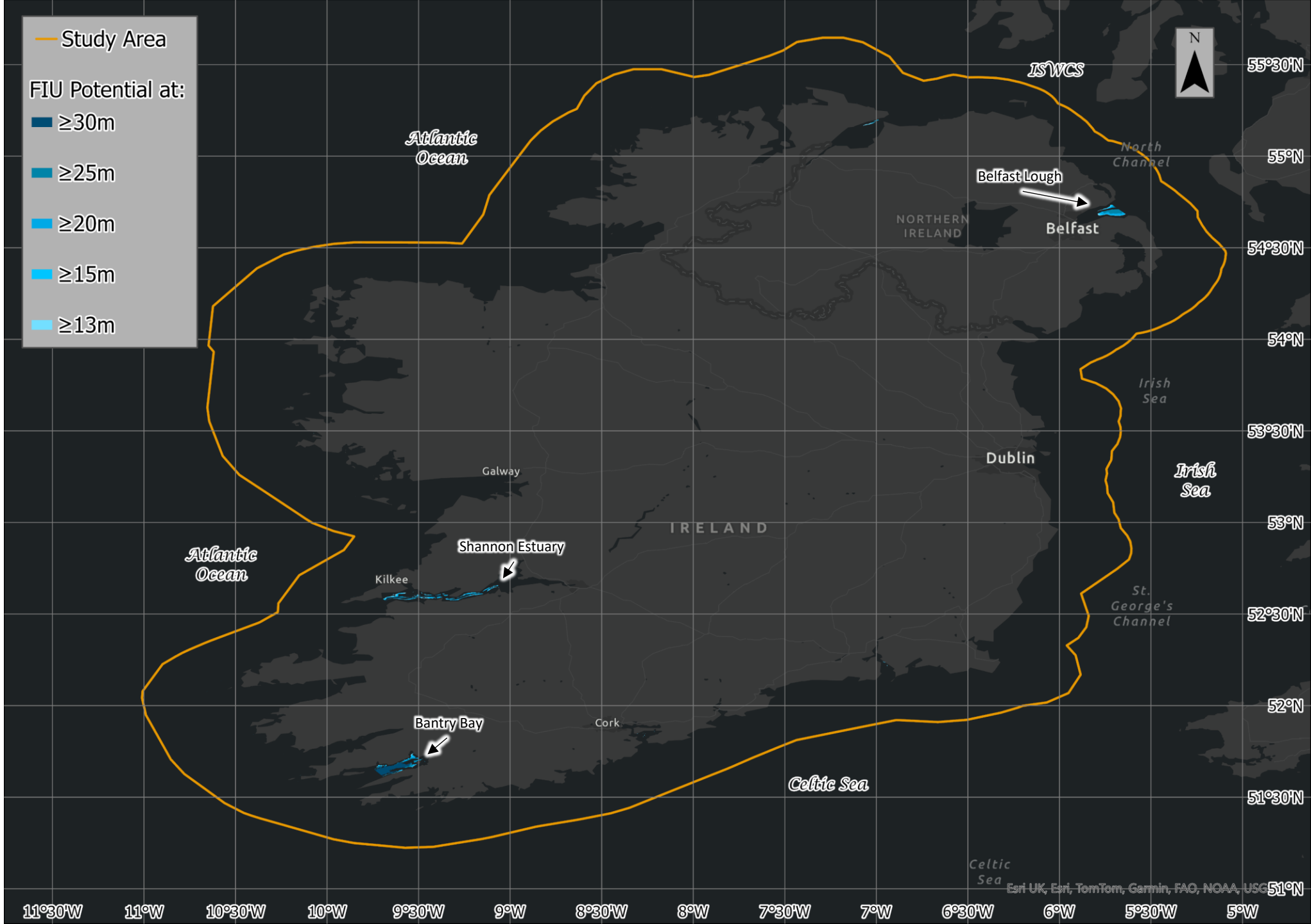
Run


IRL and NI Territorial Seas
Inside?
No
Exclude
Yes
Port Jurisdiction Area
Inside?
Yes
No
Exclude
Include
Wave Climate
<8m 50yr return Hs
Yes
No
Exclude
Wind Climate
<30m/s 50yr return
Yes
No
Exclude
Water Depth
>5m (LAT)
Yes
No
Exclude
Seabed Character
≠ 'Rock or other hard'
Yes
No
Exclude
Include
Shipping Channel
Within?
No
Yes
Exclude
Charted Exclusions
Within?
No
Yes
Exclude
Aquaculture Sites
Within?
No
Yes
Exclude
Designated Moorings
Within?
No
Yes
Exclude
Potential Areas

Results

Potential areas at different depth thresholds for the standalone floater



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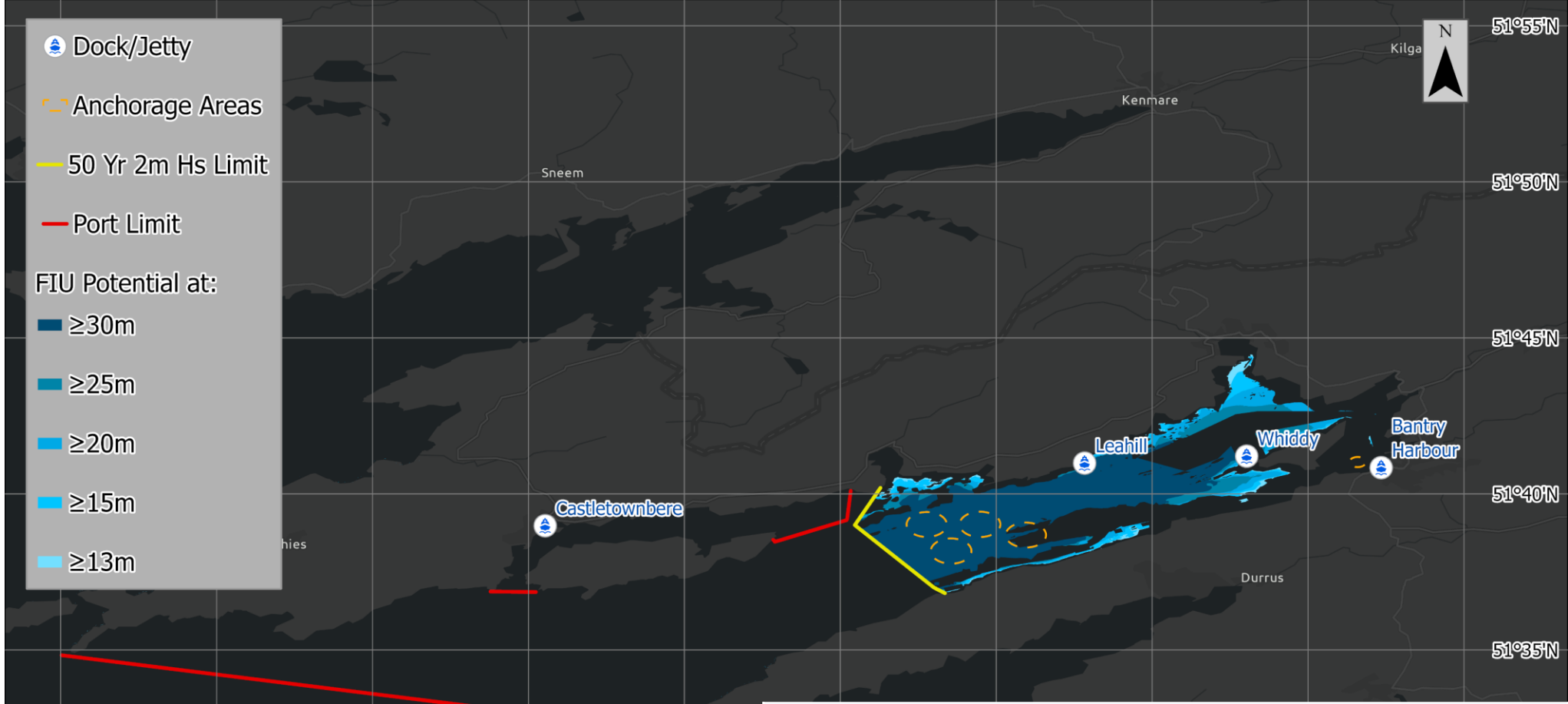
Results

Potential areas at different depth thresholds for the fully integrated unit – Bantry Bay



FIU wet storage criteria: Bantry Bay	
Wet storage potential	Extensive
Wet storage area theoretically available	5,540 Ha
Designated anchorage areas	Included
Max. depth available for wet storage	>30m
Within 30km of Airport	No
Within SPA (at potential area)	No
Within SPA (at potential area)	No
Access channel min. width (at 13m min. depth)	4.7km
Other constraints	Visually sensitive area

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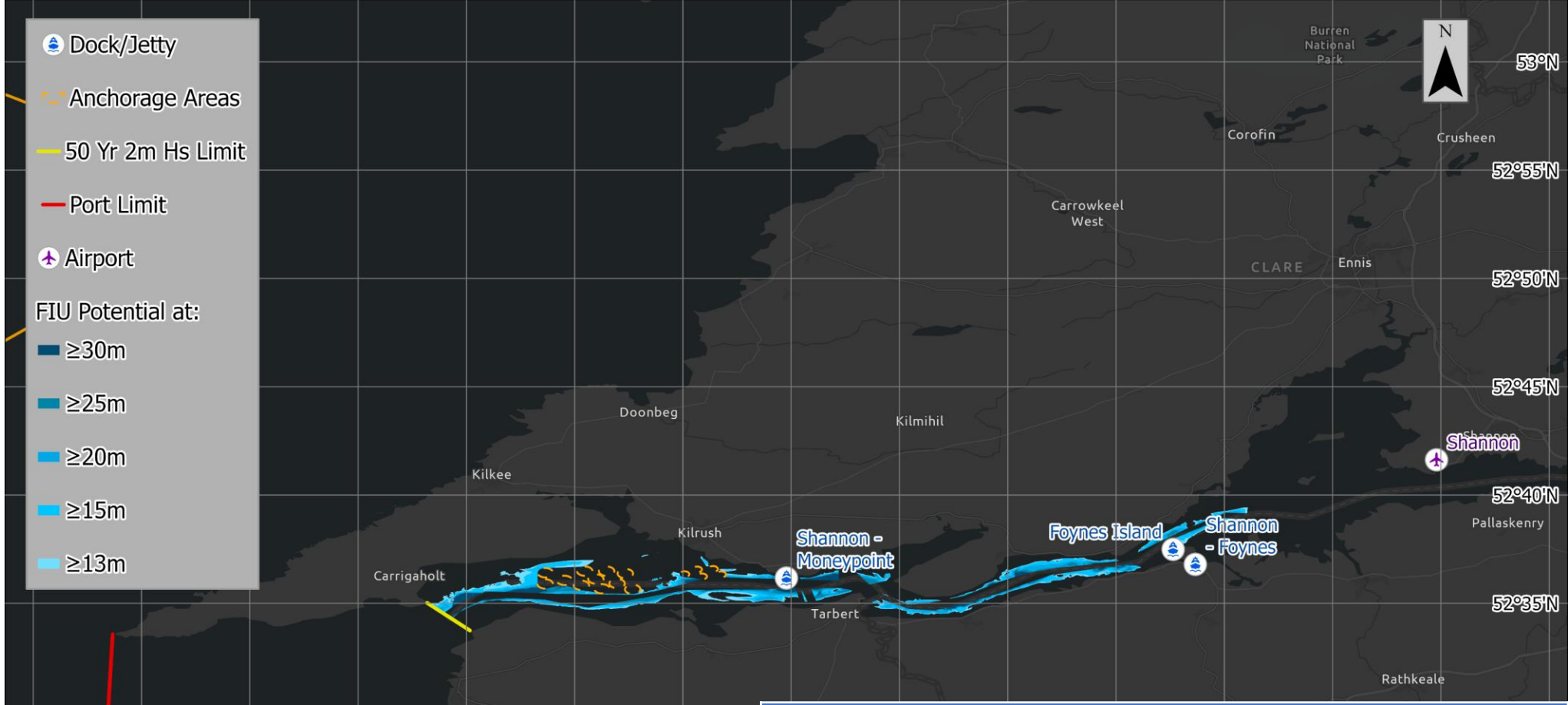
Results

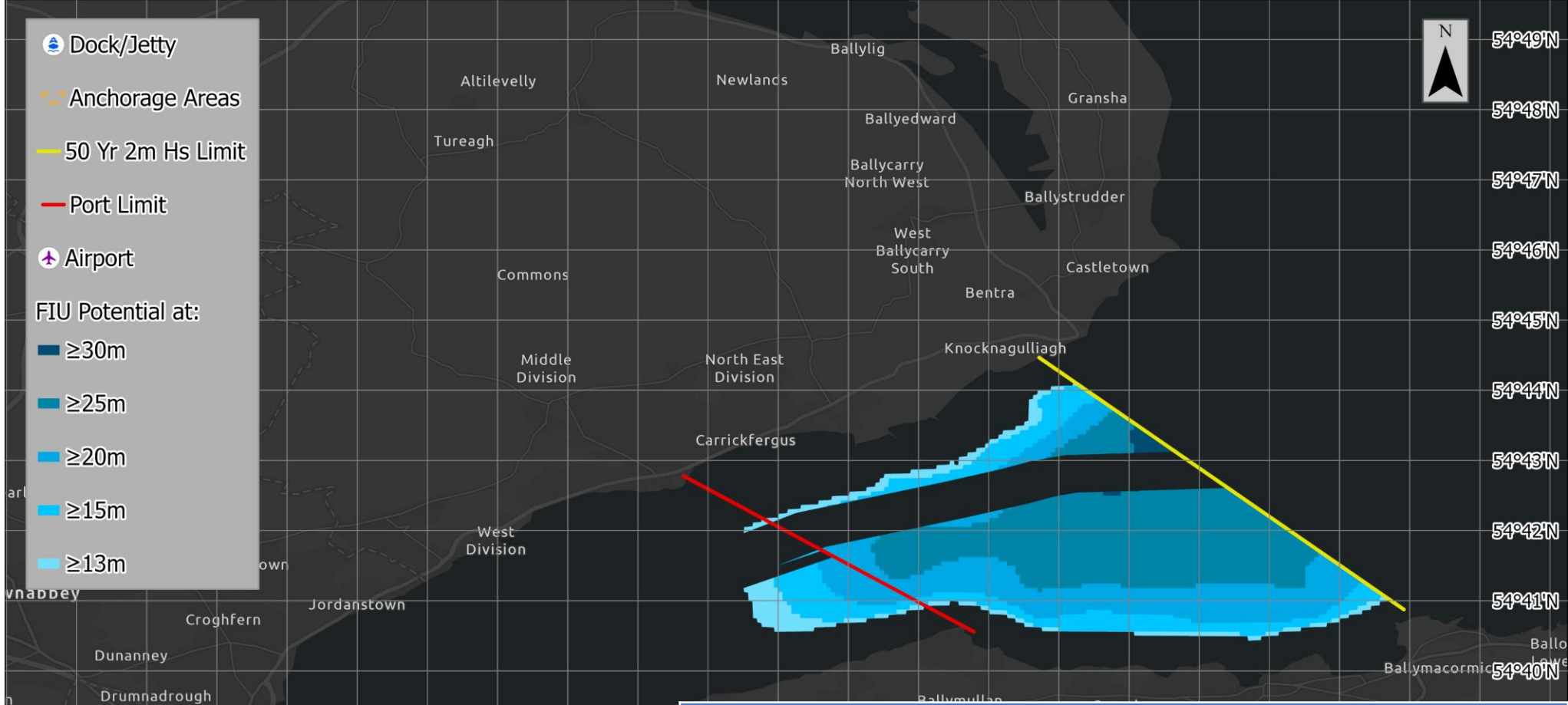
Potential areas at different depth thresholds for the fully integrated unit – Shannon Estuary



FIU wet storage criteria: Shannon Estuary	
Wet storage potential	Extensive
Wet storage area theoretically available	3,529 Ha
Designated anchorage areas	Excluded
Max. depth available for wet storage	~30m
Within 30km of Airport	Partially
Within SAC (at potential area)	Yes
Within SPA (at potential area)	Yes
Access channel min. width (at 13m min. depth)	320m
Other constraints	N/A

Results

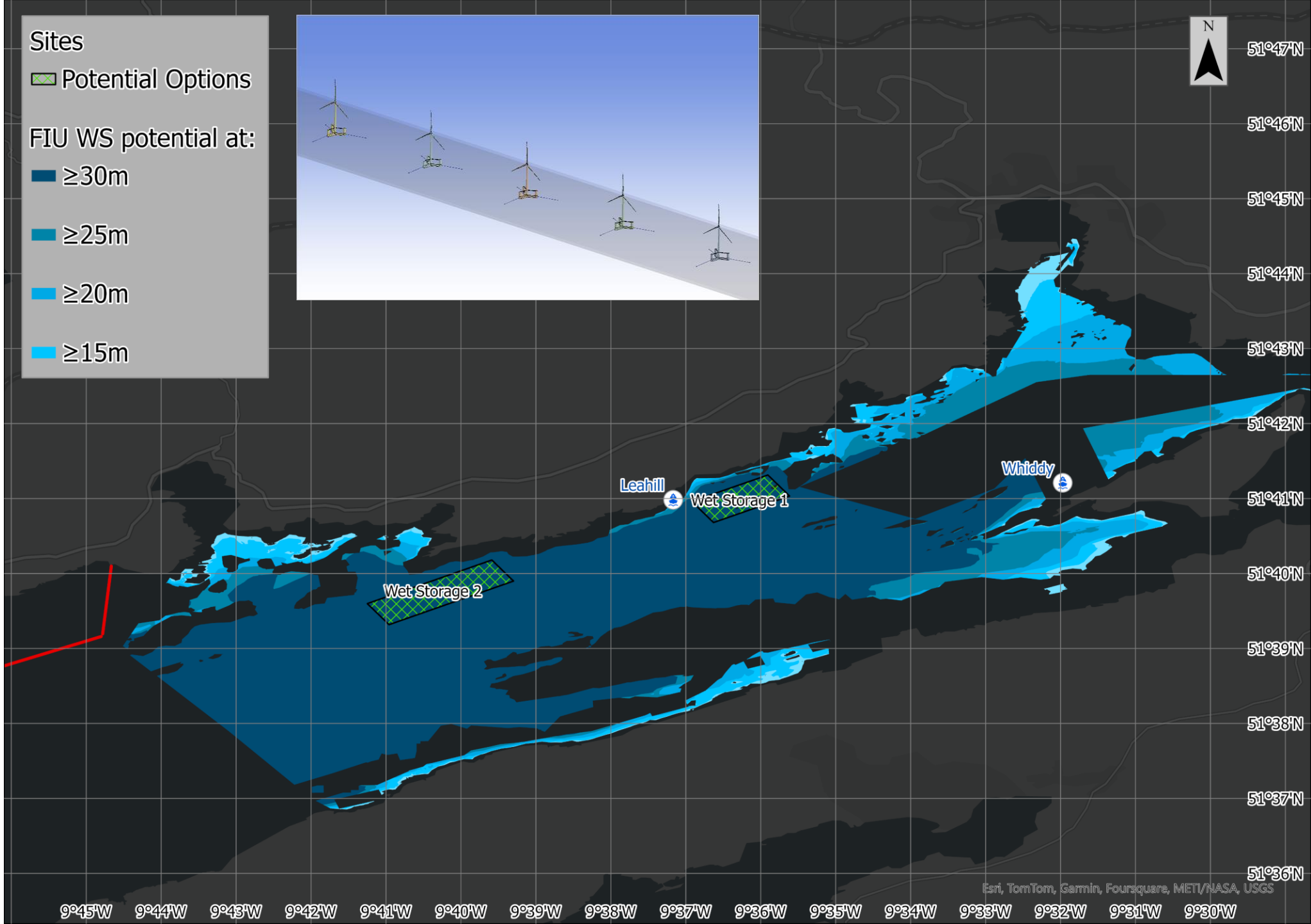
Potential areas at different depth thresholds for the fully integrated unit – Belfast Lough



FIU wet storage criteria: Belfast Lough	
Wet storage potential	Limited inside PJA, significant outside PJA
Wet storage area theoretically available	334 Ha (inside PJA), 2,697 Ha (outside PJA)
Designated anchorage areas	N/A
Max. depth available for wet storage	~30m
Within 30km of Airport	Yes
Within SAC (at potential area)	No
Within SPA (at potential area)	Partially
Access channel min. width (at 13m min. depth)	7.43km
Other constraints	Air draft a major concern inside PJA

Results

Bantry Bay: Wet Storage Site Options



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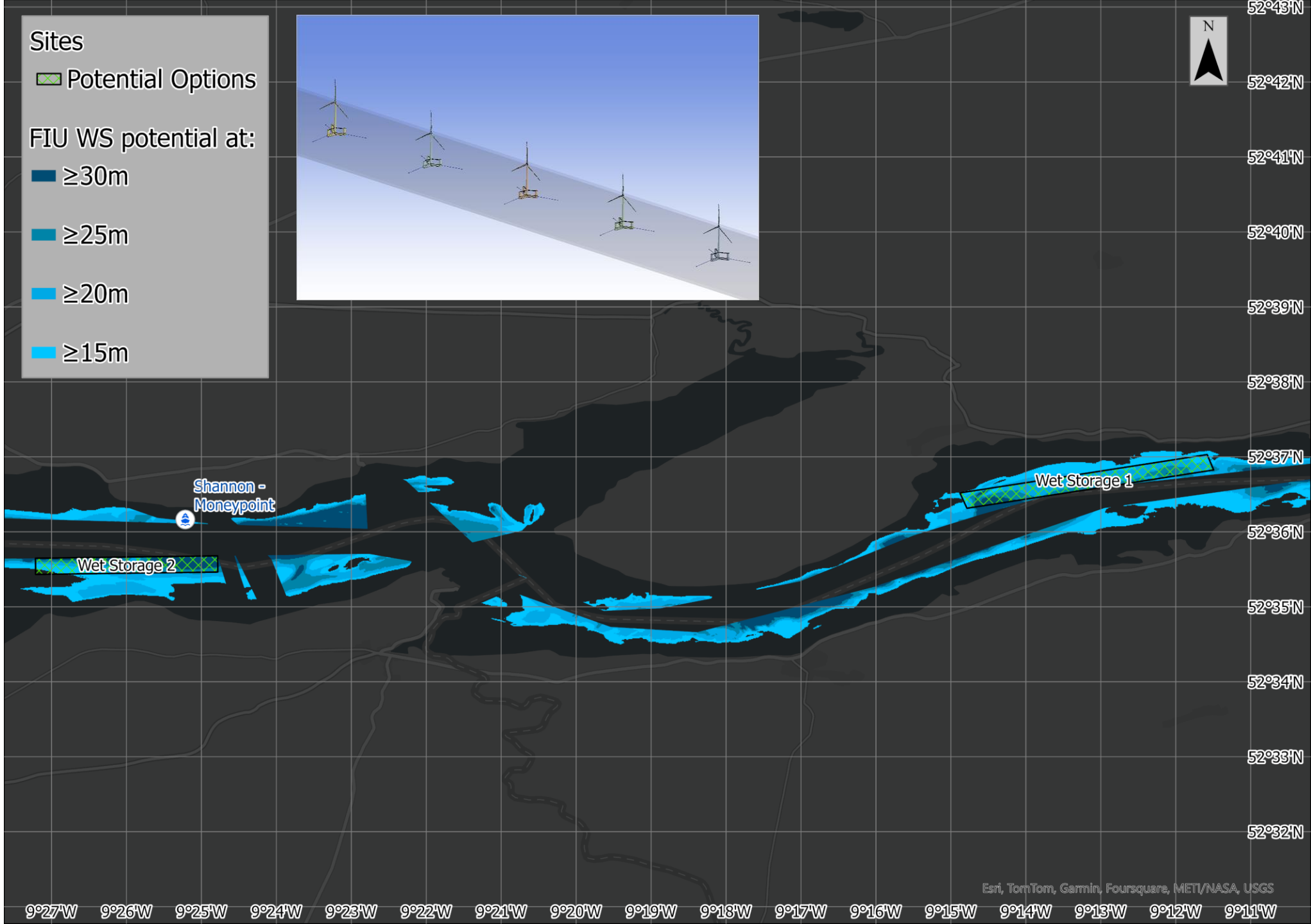
Results

Shannon Estuary: Wet Storage Site Options



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Conclusion

- The interpretation of values for the multitude of geospatial criteria relevant to the assessment of wet storage site suitability is often subjective and varies between port authorities or developers (e.g. use of anchorage areas, importance of port boundaries, Hs limits, etc.). Decision should hence be on a case-by-case basis.
- Wave models from the Copernicus Marine Service correlate well with in-situ/buoy data in the region of interest, but extension into enclosed areas/ports may require downscaling.
- Despite it's long and indented coastline, there are a limited number of ports geographically suited to wet storage in Ireland (3).
- Future work: apply data/method (or similar) to other countries/regions on course for FLOW.

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Thank you!

Contact: ross.oconell@ucc.ie

Image: DOCK90 (https://www.principlepower.com/windfloat/)

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