



Pwllheli Groyne

Technical Note – Hydrodynamic pathways Assessment

CML1909



Document Control Sheet

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Reviews

Name	Title	Date	Version
Owain Ellis Griffith	Principal Engineer (Environment)	29/10/2019	0.02

Approvals

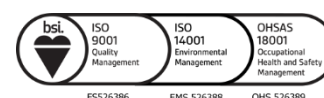
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Distribution

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1.0 Introduction

The crib groyne to the south of Pwllheli harbour entrance (shown in Figure 1) was constructed to prevent sediment build up being carried around the coast and deposited in the inner harbour. The report by CEUK in 2017 stated that the sediment levels to the south of the groyne increased following construction, suggesting it was effective at trapping material before it entered the harbour. However, there has been little change over the last decade, indicating that the volume of sediment trapped by the groyne has reached its capacity and further sediment being transported by currents or waves is now able to move over around the structure. The purpose of this technical note is to show the location of the groyne construction in proximity to the Llyn a'r Sarnau SAC and likely new hydrodynamic pathways due to the structures extension.

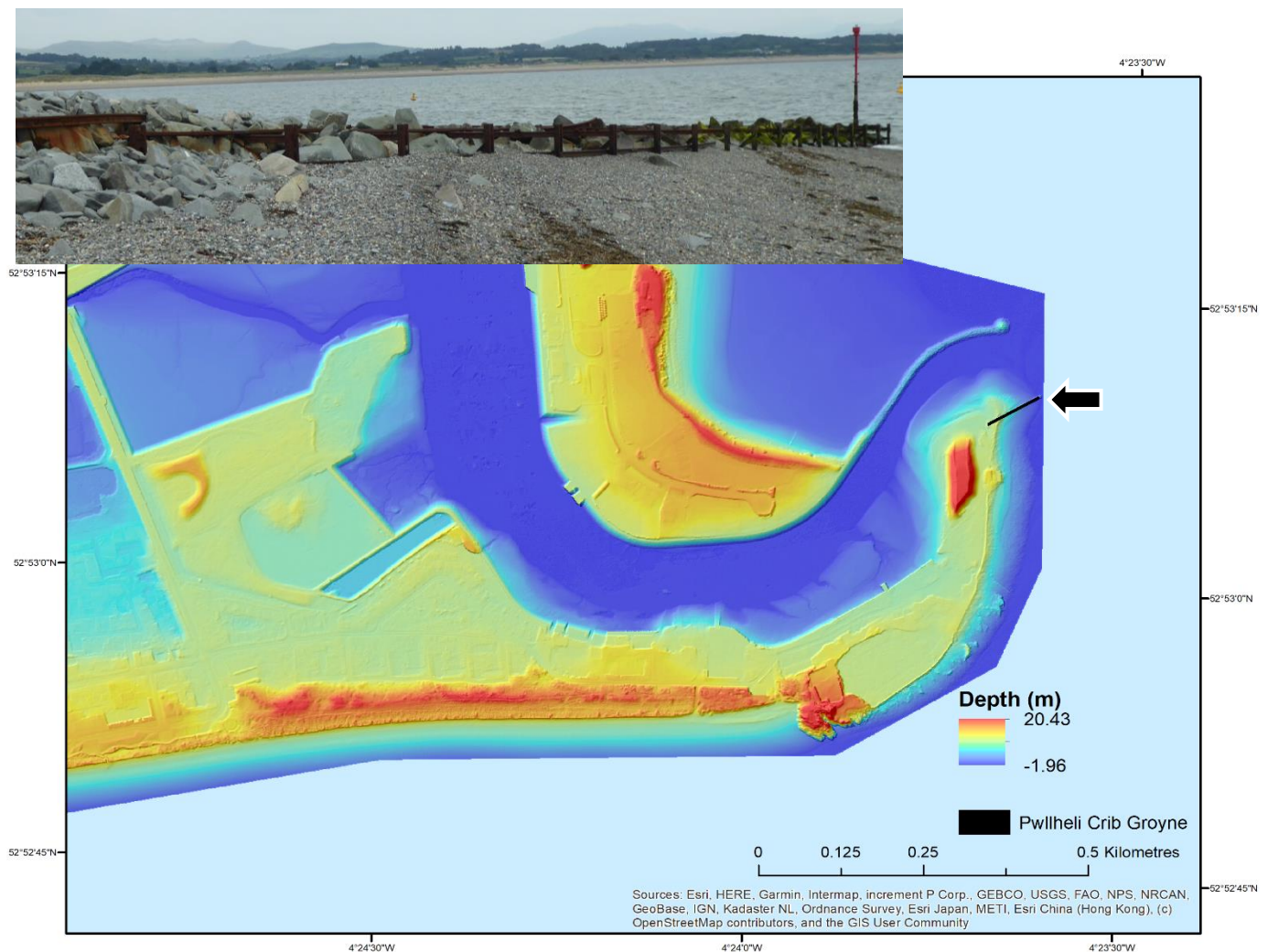


Figure 1. Shows the location and length of the existing crib groyne structure to the south of Pwllheli harbour entrance and a picture of its current condition in the top left.

2.0 Special Areas of Conservation

This area is included in the Pen Llyn a'r Sarnau SAC and there are concerns from the marine licensing authority relating to any negative impacts on the biogenic reef features from construction activities. Figure 2 shows the location of the nearest biogenic reef features to Pwllheli harbour is approximately 6.5km around the coastline to the northeast and is unlikely to be impacted by the construction works to extend the groyne.

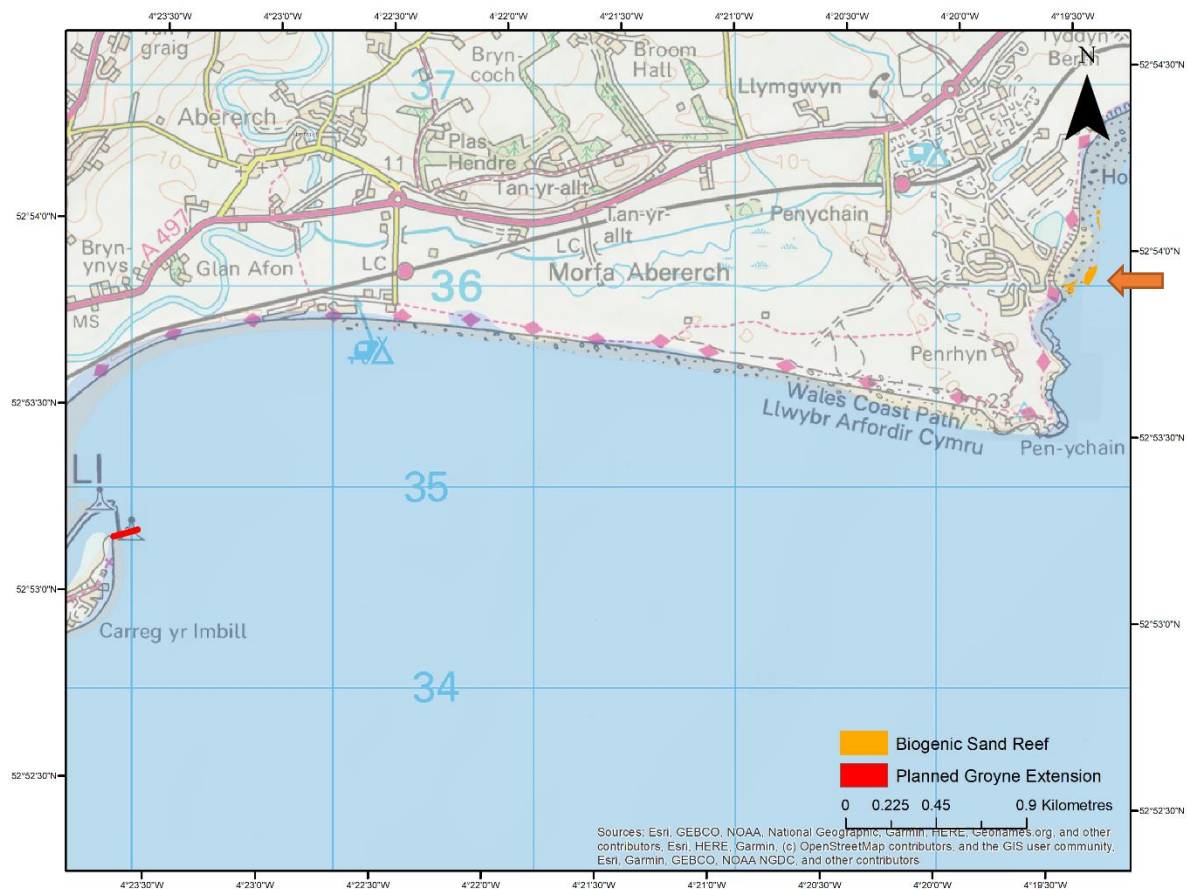


Figure 2. Showing the location of the nearest biogenic reefs in relation to the existing groyne structure at Pwllheli harbour.

The following figure shows the full features included in the Llyn a'r Sarnau SAC around the site of the planned Pwllheli groyne extension. There are multiple sites of various fauna and algae communities spread out along the coastline, although given that the harbour has regular dredging works and a crib groyne has already been constructed on the site, there is no evidence that these works are detrimental to these species. Figure 4 and 5 show the wider coverage of subtidal and intertidal reef zones in relation to the SAC that are of interest and made primarily of made up rocky and stony reefs or sandy and muddy sediments.

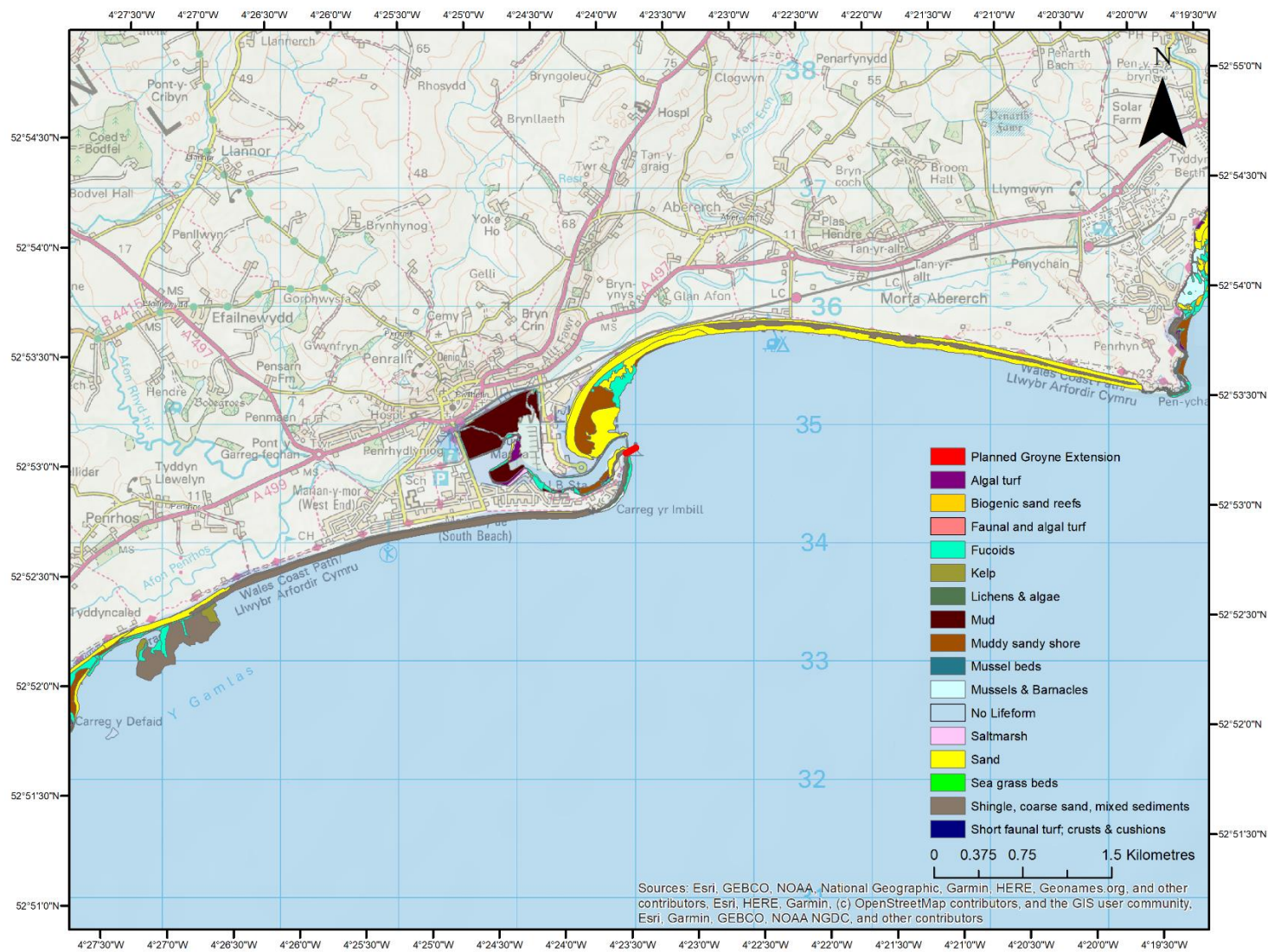


Figure 3. The extent and features of the Llyn a'r Sarnau SAC surrounding the Pwllheli harbour.

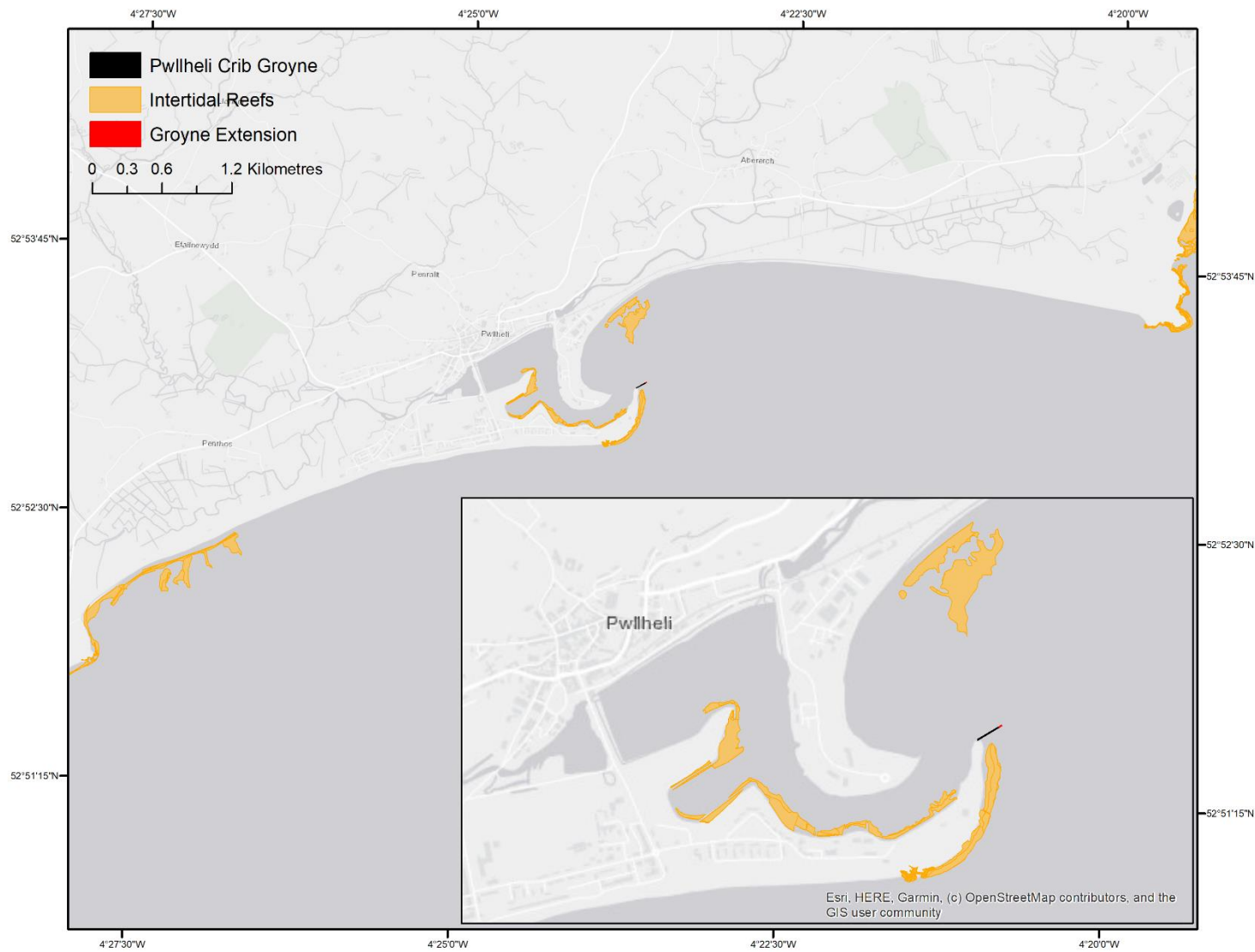


Figure 4. The intertidal rocky reefs around the Pwllheli coastline.

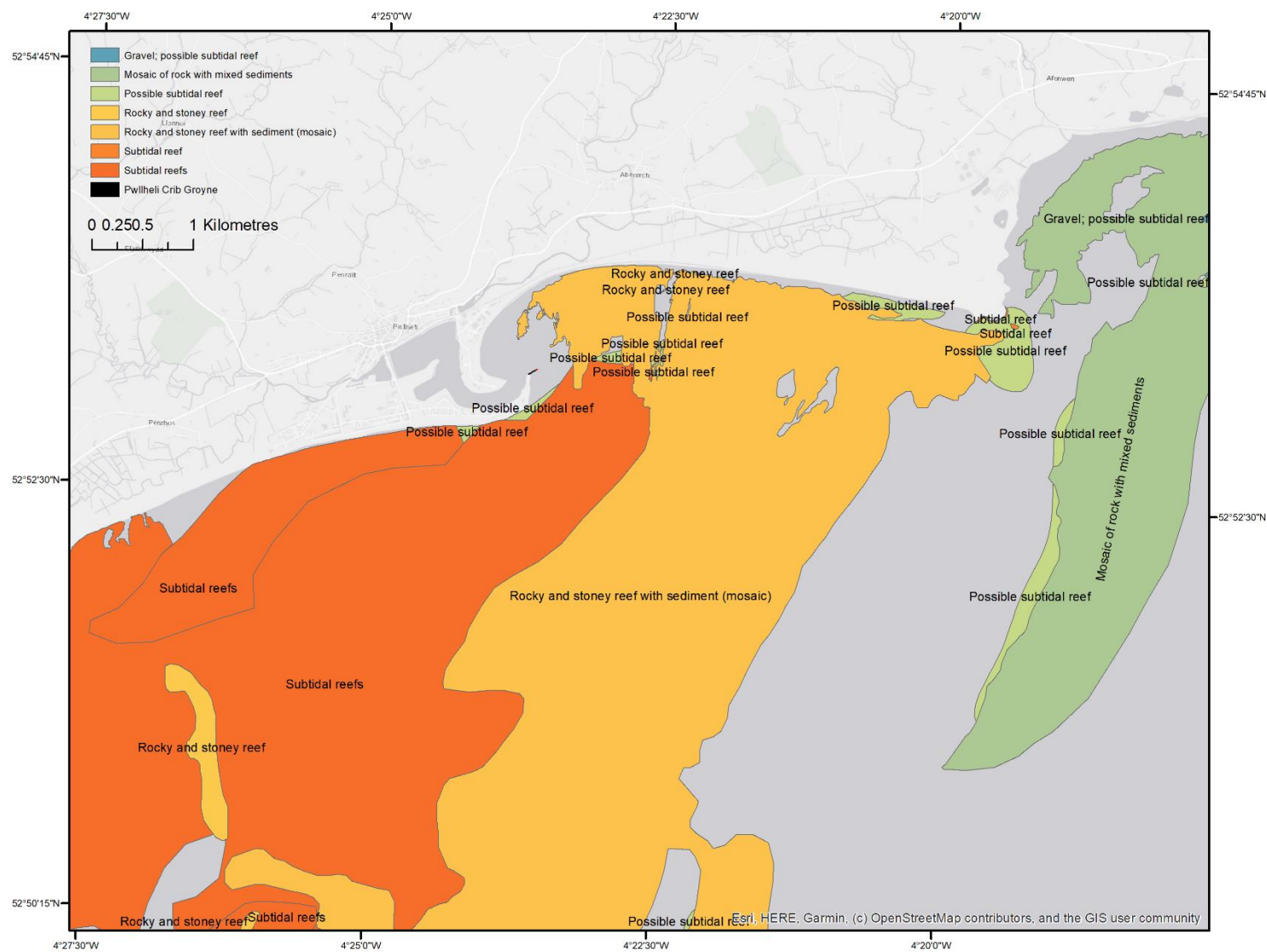


Figure 5. The designated subtidal areas of the SAC.

3.0 Hydrodynamics

The previous technical report submitted showed the hydrodynamic flows under tidal conditions from Halcrow (2006) and as shown in Figure . A Halcrow (2005), report modelled the hydrodynamics of wave driven currents from a number of different directions, as shown in Figure .

In all of these figures, the predominant flow direction is along the coastline from west to east, either into or passed the harbour entrance. Wave driven currents coming around the coast from east to west also go directly passed the harbour entrance, often creating an eddy system in the harbour mouth.

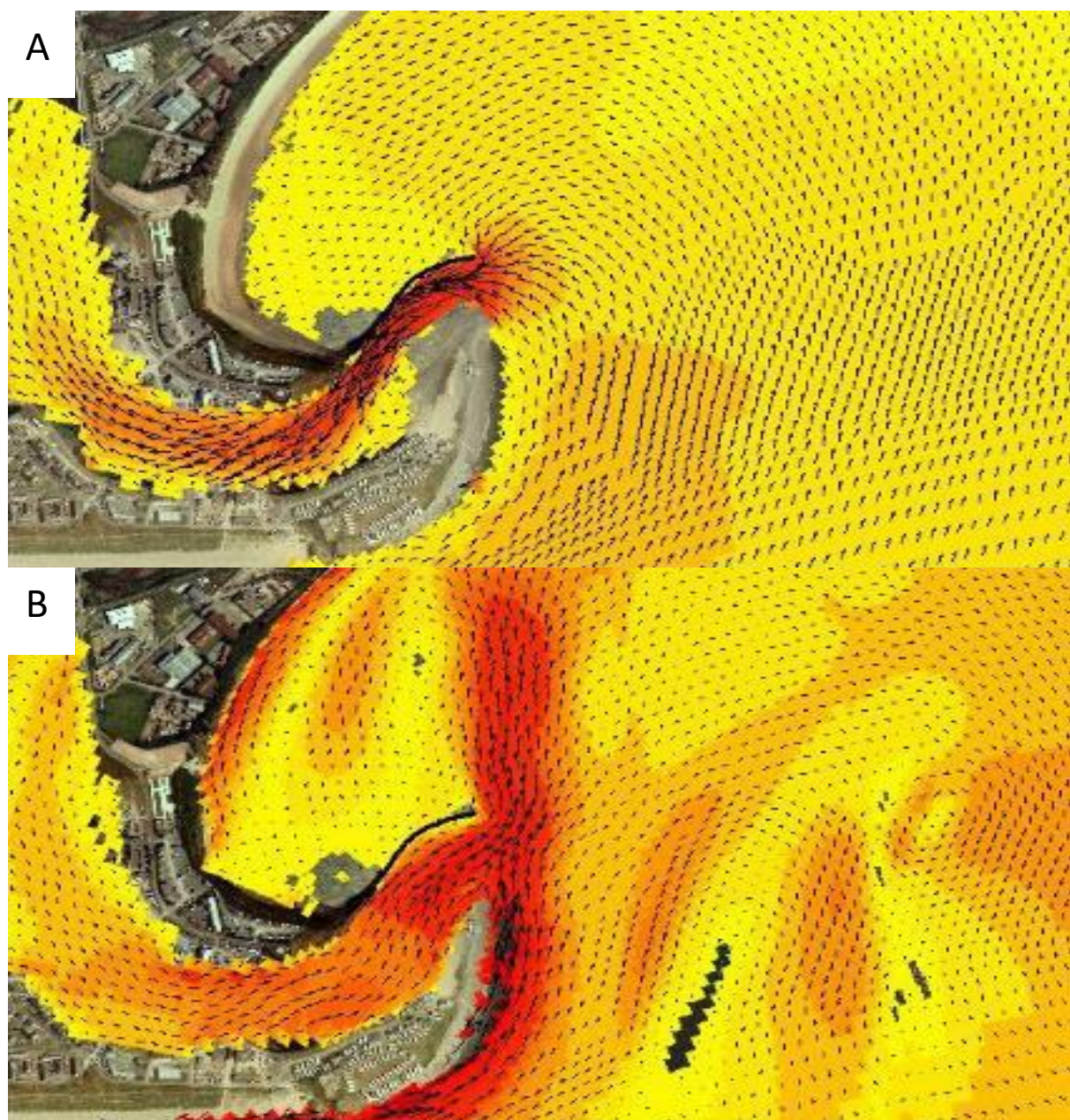


Figure 6. Shows the modelled tidal behaviour around Pwllheli harbour for A) normal tidal flows with a maximum speed of 0.2m/s and B) peak water levels during a 1 in 10 year storm surge event. (Halcrow, 2006)

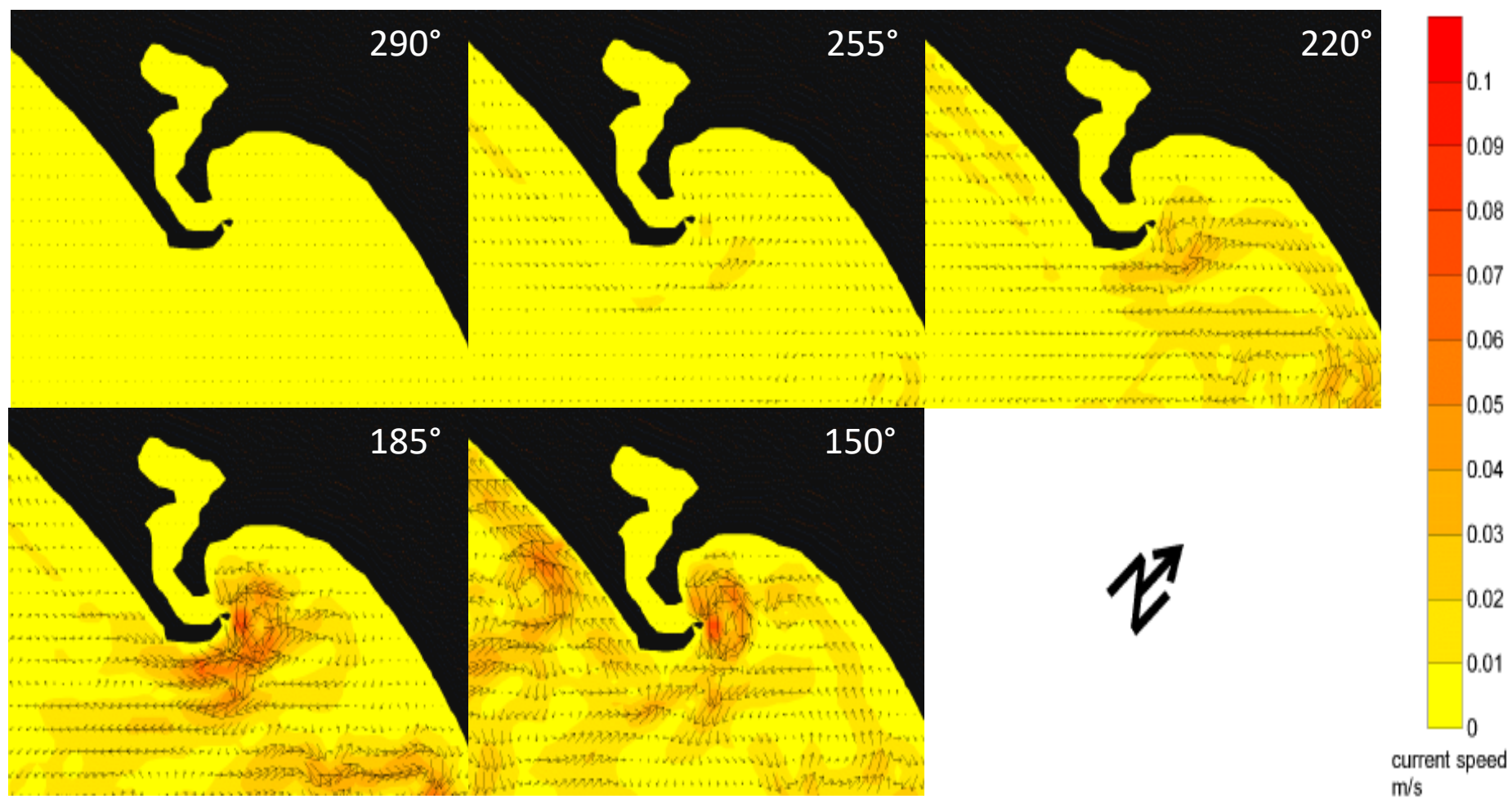


Figure 7. The hydrodynamics around Pwllheli harbour under wave driven currents from different directions; taken from Halcrow, (2005) report.

4.0 Planned Construction

The plan is to extend the existing crib groyne a further 15m (as shown in Figure 8 below, and in the GA plan included in Appendix A) and restore the rock armour over the structure and increase the crest level. The ground level has increased approximately 2 metres from the planning of the initial structure and this is the height to be regained by the new plans. This will reduce the amount of material overtopping the existing structure and being washed into the harbour. The extended section will also prevent more suspended sediments travelling via longshore transport or wave driven currents into the harbour primarily from a south and south-west direction.

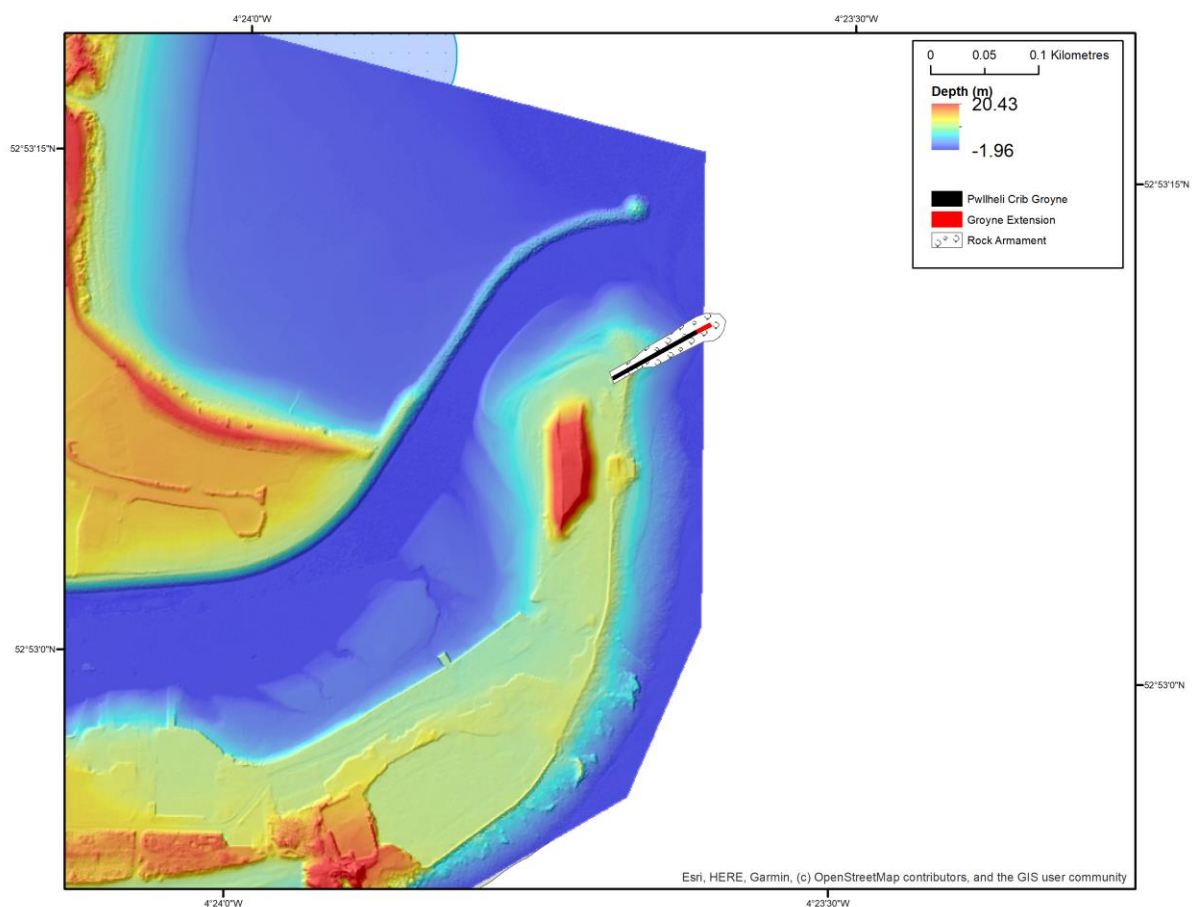


Figure 8. The planned extension of the Pwelli harbour crib groyne.

The following figure represents the predicted hydrodynamic flow around the extended structure under normal conditions mid flood for a typical spring tide as seen in figure 6. Over a wider area the hydrodynamic regime is going to experience little to no change, with the majority of changes occurring at the groyne structure flow is constricted in front of and around the eastern edge.

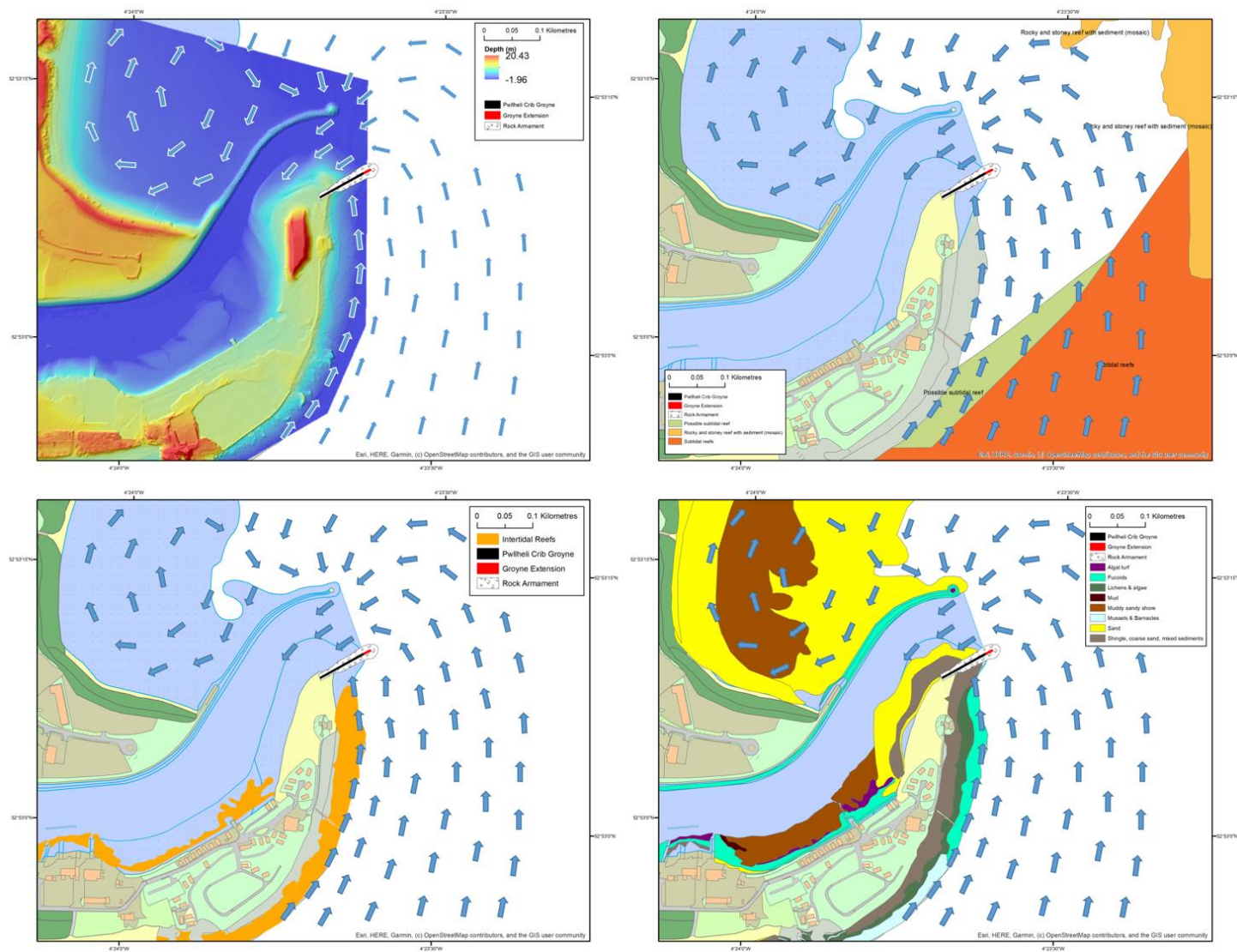


Figure 9. Showing how the direction of flow under normal conditions mid tidal flood event on top of A) MBES of Pwllheli, B) Subtidal reef features, C) intertidal reef feature and D) SAC features surrounding Pwllheli harbour.

The above figure shows that the SAC reef features in the vicinity of the groyne are subtidal reef to the south and east, a small section of possible subtidal reef >200m to the south and a rocky and stoney reef with sediment further to the east and north. There are strips of intertidal reef along the coastline to the south and the southern edge within the harbour, the closest of which is at a distance of 30m from the site. Section D shows that the SAC has large areas of sand and mud in direct contact with the groyne and to the north of the harbour entrance. To the south in the intertidal zone are areas of fucoids, lichens and algae and within the harbour some small areas of algal turf.

5.0 Conclusion

As stated above and in the technical note by CEUK (2019), the new extended crib groyne design will not alter the hydrodynamic regimes in the area and therefore should have no detrimental effects on the SAC. The only 2 features within the SAC that are in direct contact of the groyne site are areas of sand and mud, however those areas to the north are within the harbour mouth and will experience no change in flow behaviour. To the south the mud layer is in the intertidal zone and will only experience a change in flow behaviour during mid to high tide when the obstructed toward the groyne if forced to move around the structure which is likely to constrict flow and therefore increase flow speed slightly. However, given that the average flow velocities are less than 0.2m/s, it is very unlikely for flow to induce enough stress on the muddy sediment to reach the threshold for motion of such a viscous material.

6.0 References

- CEUK, 2017. Pwllheli Harbour Crib Groyne Review
- CEUK, 2019. Hydro-morphological Impact Assessment
- Halcrow 2005. Abererch and Afon Erch Tidal Flood Modelling Report
- Halcrow, 2006. Abererch Phase II Preliminary Studies Report

Appendix A – General Arrangement Plan

