Hebridean Beach Geomorphology – Baseline Study

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I. KEYWORDS

Coastal Erosion, Sediment Deposition, RTK Surveying, Wave Monitoring, X-band Radar.

II. ABSTRACT

A significant proportion of Europe's wave energy resource exists in seas to the west of the Outer Hebrides [1], off the northwest coast of Scotland. Currently, two wave energy array projects are proposed in seas to the west of the area, including the 40 MW Oyster wave array at Shader [2], reported to be the world's largest fully consented wave energy project [3].

Large areas of low lying ground along the western coast of the Outer Hebrides are subject to coastal erosion and in coastal flooding terms are considered "Potentially Vulnerable Areas" [4]. However, the likely impacts of wave arrays on the erosion / deposition cycle and the distinction of changes to the oceanographic processes induced by marine energy developments from other root causes such as climate change have not yet been quantified.

The work described here is gathering baseline data at a number of locations along the west coast of Lewis, the most northern Island in the Outer Hebrides.

Considerable seasonal variation has been observed at beaches in the Outer Hebrides, including Dalmore on the west coast of Lewis. This is apparent from comparison of Figures 1 and 2 which show the beach at Dalmore before and after the winter 2011/12 season.

Fig. 1 Dalmore Beach, before winter 2011/12

Without baseline data it will be very difficult if not impossible to quantify any changes to the existing seasonal variation, post energy development, and to attribute these to individual causes. The data obtained will be very useful for regulators, developers and coastal protection agencies to monitor and quantify the impact of wave energy extraction on the coastline.

Fig. 2 Dalmore Beach, after winter 2011/12

This study builds on previous work on wave energy extraction and coastal protection undertaken at this location [5] and gives an overview of the ongoing monitoring programme based on real time kinematics (RTK) surveys of beach levels and near shore bathymetry at a number of locations in proximity to proposed wave power development sites.

Changes of beach profiles are correlated to the wave conditions during the monitoring period to establish relationships between key parameters such as wavelength, height, period, direction and beach elevation. These changes will be quantified using digital terrain models, and regression analysis performed to identify correlations between beach profile change and wave action. Waves are currently monitored by a wave measurement buoy and this will shortly be supplemented with an X-band radar installation at the Butt of Lewis (to be commissioned in spring 2015).

This paper will set out the objectives of the study, methodologies used, and present early findings.

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