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Client	Comhairle nan Eilean Siar
Day, Date and Time	26 July 2010
Author	C Batstone
Subject	Results of causeway modelling scenarios

South Ford Extra Modelling Scenarios

This note describes the results of modelling scenarios carried out using the South Ford hydrodynamic model. The scenarios all simulate the 2005 storm, but vary in terms of the geometry of the South Ford causeway. They are designed to investigate the effect on sea-levels of incorporating an additional opening within the South Ford causeway that would allow relief flow through to the Minch. The scenarios differ by the size of the opening incorporated. The model scenarios for 'current causeway' (where the only opening is the existing north culvert) and 'no causeway' were produced for the first draft of the report. Six further simulations have been performed. These simulations incorporate 3 permutations for length of opening in the causeway (100m, 250m, 450m) and 2 permutations for depth of opening (down to the sea bed at approximately -0.7mOD and down to +2mOD, referred to as deep and shallow openings respectively). These openings are represented by one long opening as opposed to several short openings.

The maximum model water levels produced during the storm for each simulation at several geographical locations are given in table 1. Figures 1 to 7 show maps of these maximum model water levels and illustrate the extent of flooding associated with each simulation.

Table 1 - Maximum sea levels for 2005 storm for various causeway scenarios (values to mOD)

Location (BNG)	Location (description)	Current causeway	100m shallow opening	100m deep opening	250m shallow opening	250m deep opening	450m shallow opening	450m deep opening	No causeway
79530, 849291	Lionacleit B892	4.60	4.60	4.33	4.47	4.10	4.36	3.99	3.94
79777, 848170	Creag Ghoraidh A865	4.40	4.40	4.07	4.24	3.71	4.09	3.56	3.44
78473, 846922	South Uist north shore road	3.90	3.90	3.59	3.75	3.25	3.61	3.11	3.02
77636, 846623	South of Hebridean Jewellery	3.60	3.60	3.22	3.43	2.79	3.28	2.66	2.59

The model simulations indicate that increasing the size of an opening in the causeway leads to a reduction in the water that builds up to the west of the causeway during the simulation of the storm. Therefore, a larger gap in the causeway leads to less inundation around Iochdar and the south shore of Benbecula.

A shallow opening of 100m length in the causeway does not provide any significant alleviation of the flooding experienced to the west of the causeway during the storm. If this opening extends down to the sea bed then this leads to a reduction in the sea levels of 0.27-0.38m. The reduction in the spatial pattern of flooding around Iochdar for this case however is modest (Figure 3). A deep opening of 250m length leads to a reduction in maximum sea-levels of 0.50-0.81cm and a significant alleviation of flooding in Iochdar. A shallow opening of the same length does not provide significant flood alleviation. A deep opening of 450m provides a modest reduction in water levels from that of the 250m deep opening.

These model scenarios simulate flow through a single opening in the causeway. If the opening had been represented as the sum of several smaller openings the flow would have experienced greater friction from the sides of these multiple openings. It is therefore likely that the reduction in maximum sea levels would not have been as large.

From these results it appears that the flooding experienced to the west of the causeway during the January 2005 storm would only have been significantly alleviated had an opening of at least 250m extending down to the sea floor existed in the causeway.

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Figure 1: Maximum water level (January 2005) - No causeway opening

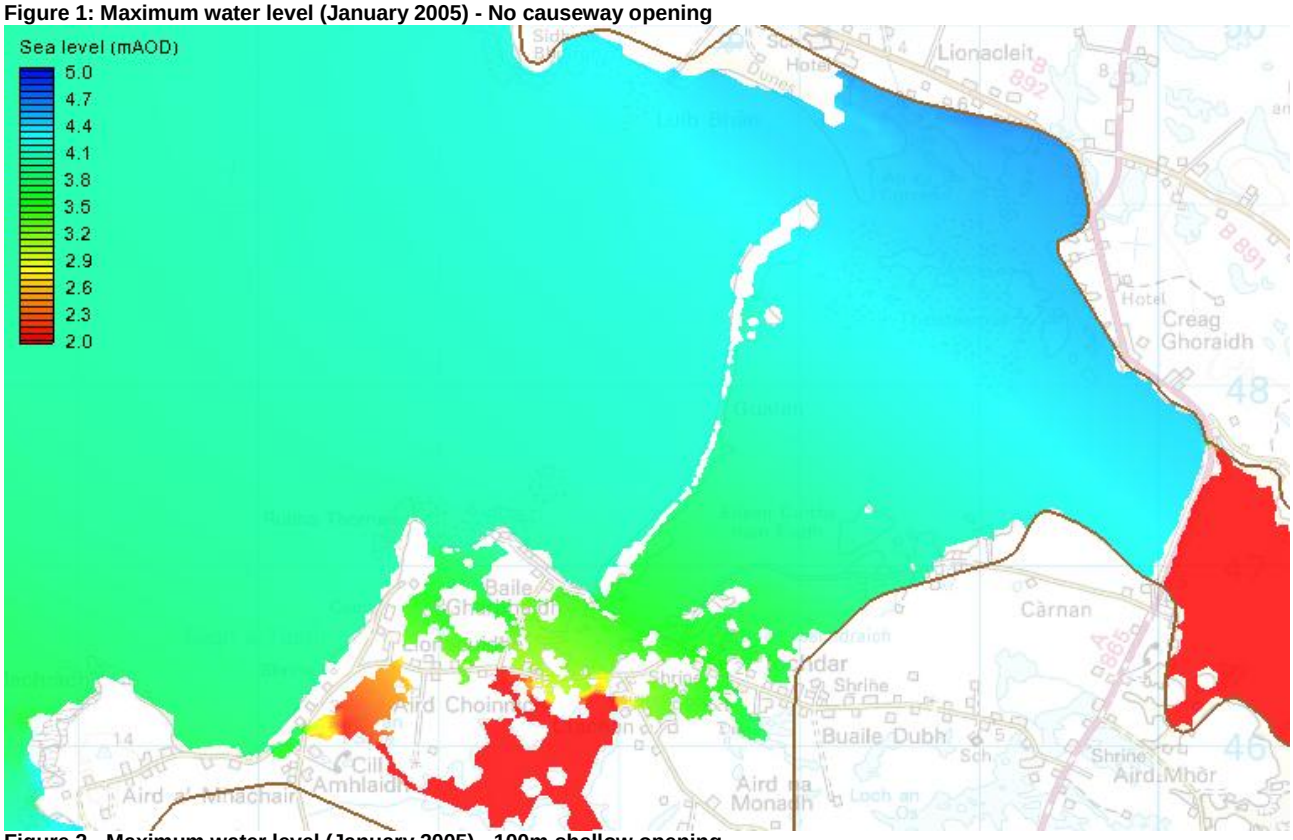

Figure 2 - Maximum water level (January 2005) - 100m shallow opening

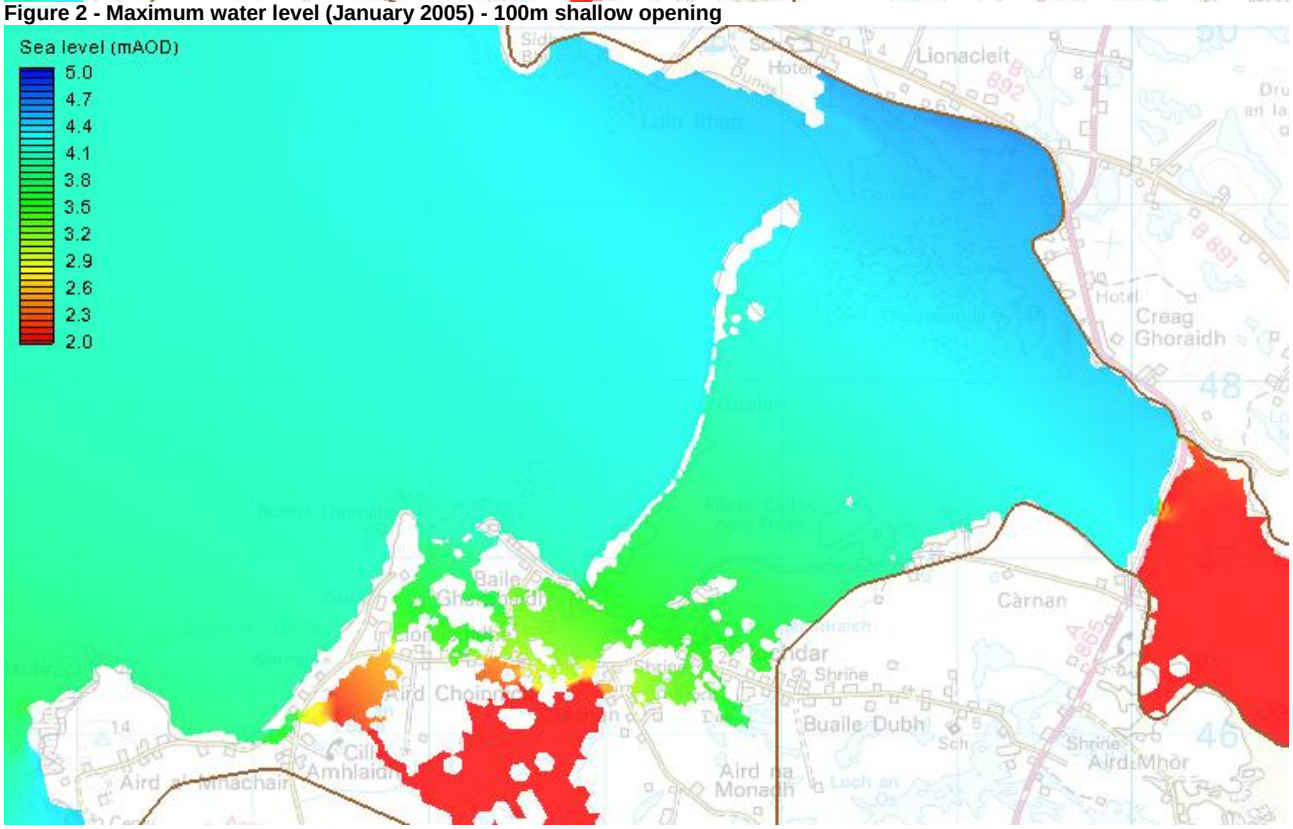

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Figure 3: Maximum water level (January 2005) - 100m deep opening

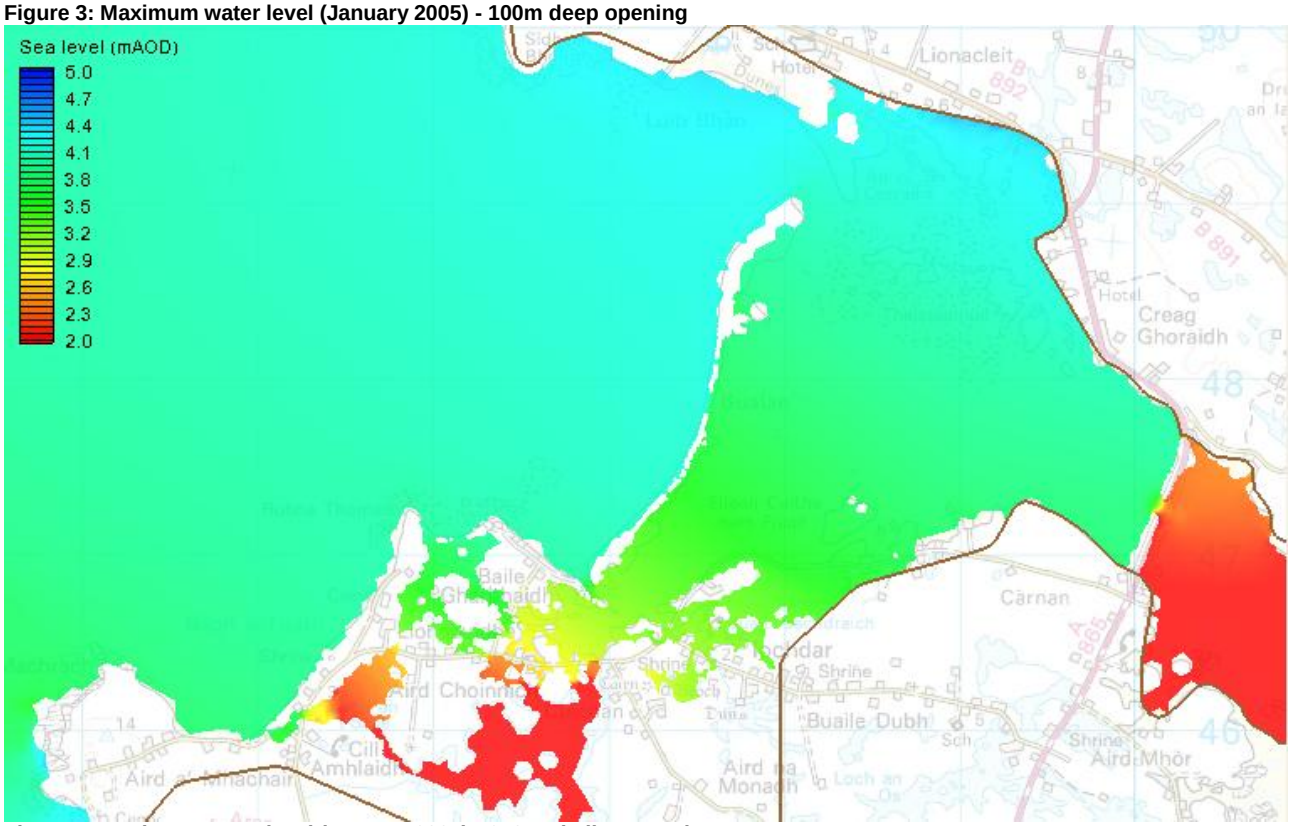

Figure 4: Maximum water level (January 2005) - 250m shallow opening

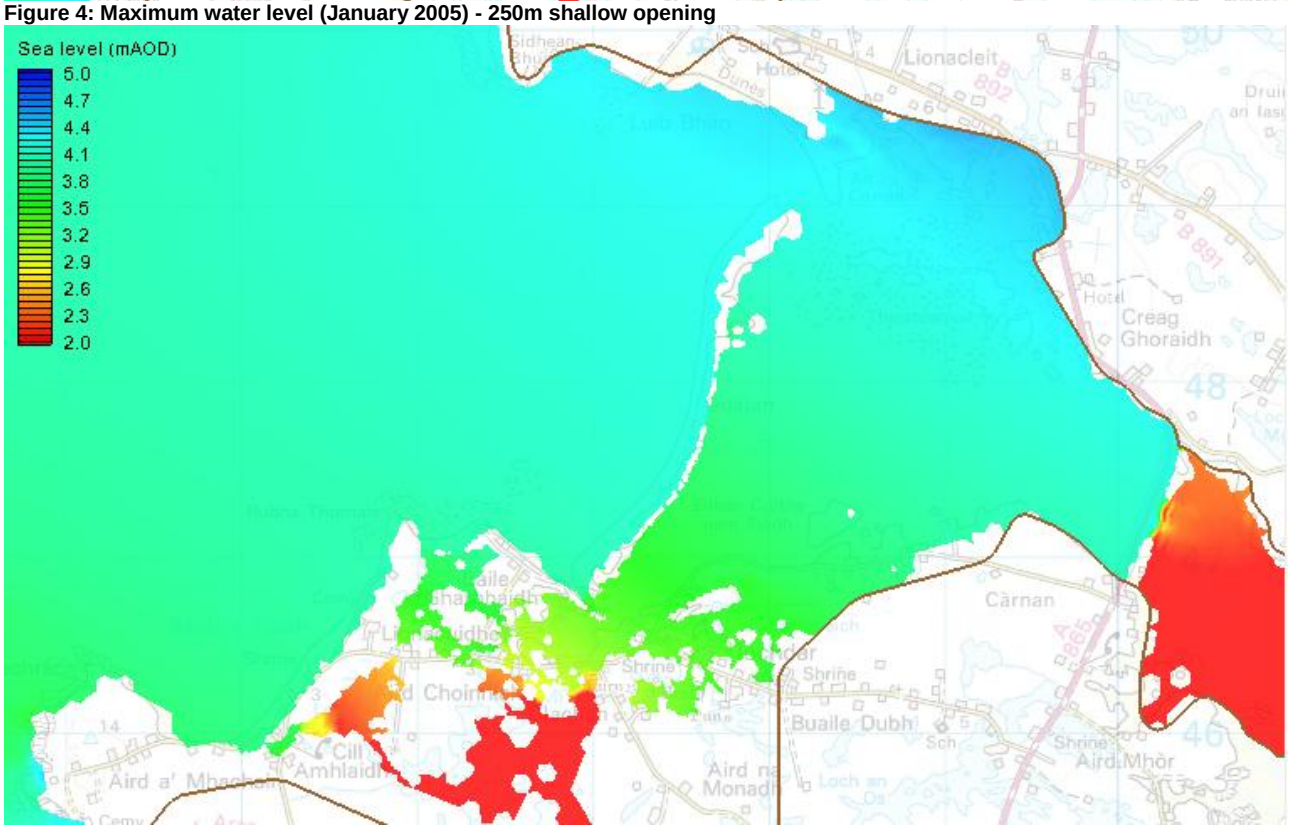

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Figure 5: Maximum water level (January 2005) - 250m deep opening

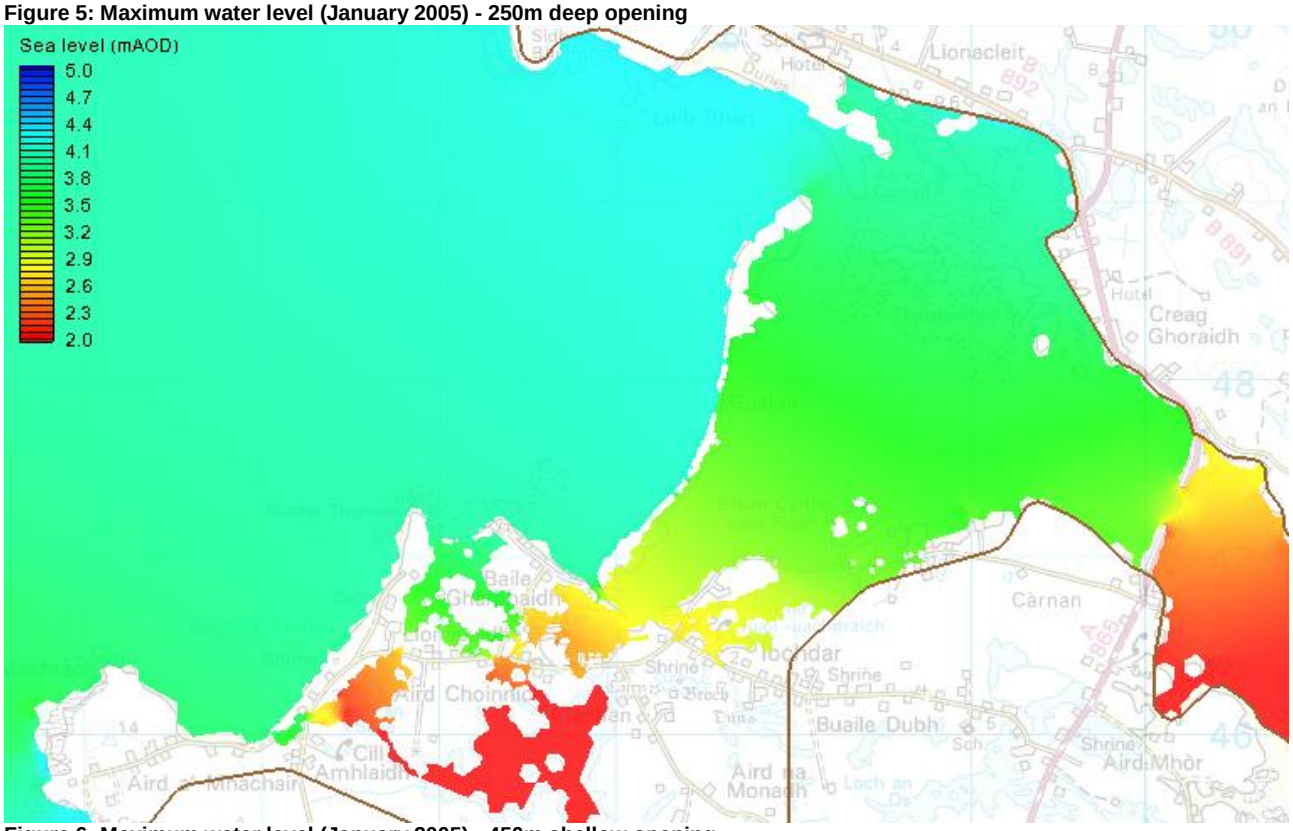

Figure 6: Maximum water level (January 2005) - 450m shallow opening

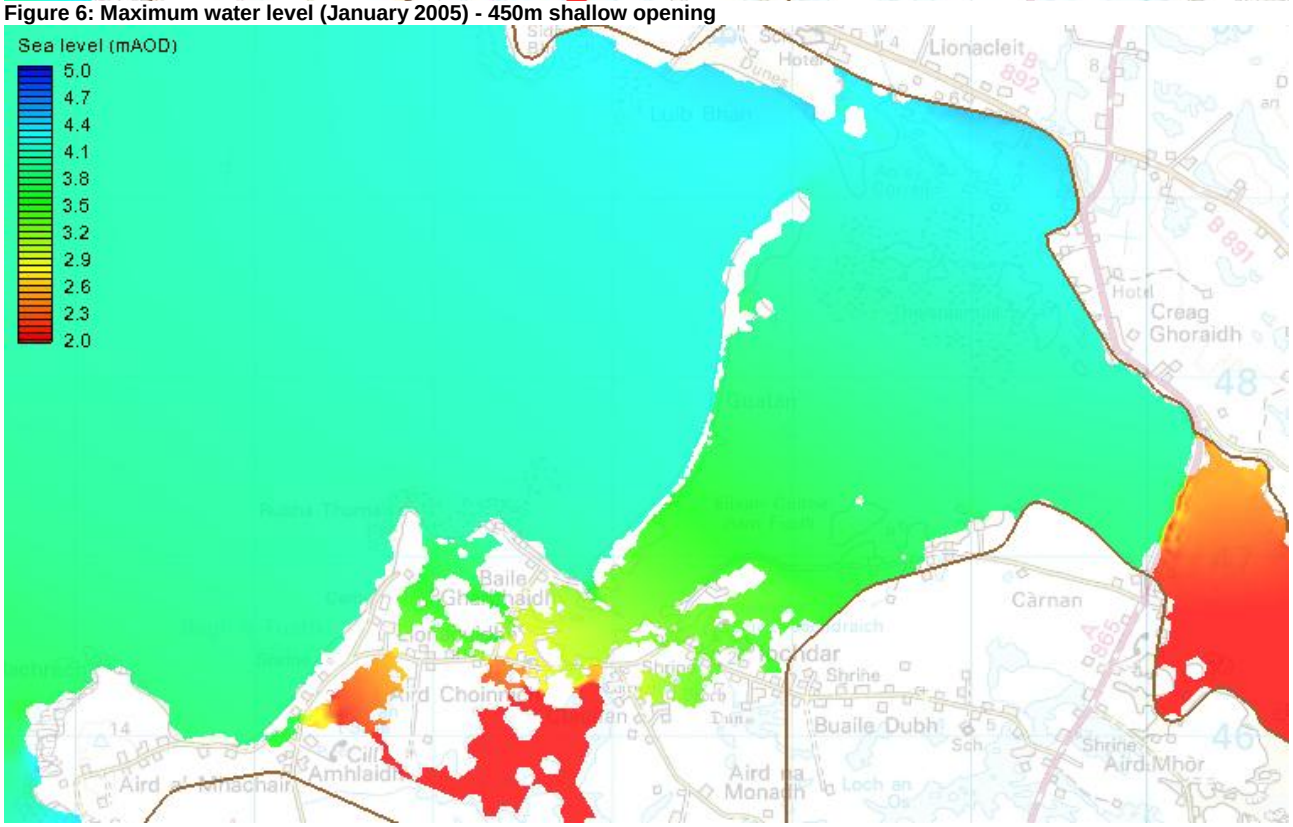

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Figure 7: Maximum water level (January 2005) - 450m deep opening