BEACH MANAGEMENT PLAN REPORT

Dungeness
Power Station

2012

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Approved By: C. Milburn

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Beach Management Plan Site Report 2012
4cSU13 – Dungeness Power Station

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Annex A: Explanatory Notes
1. **Summary of method of conducting topographic and hydrographic surveys (based on the Environment Agency’s National Specification Sections XII and XIII)**

   Topographic cross-shore (profile) measurements are made at the intercept of the beach and a hard structure, at all changes of beach slope, at changes in surface sediment and at maximum defined intervals (every 5 metres). Each measurement is feature-coded with the type of surface material. Profiles are 100-500m apart, depending on management status. The seaward limit to be achieved is Mean Low Water Springs or 50 metres from the beach toe.

   Topographic spot height (baseline) surveys are carried out annually at Beach Management Plan sites. Profiles are measured at 50m intervals, with the addition of spot heights at the toe of hard structures, the beach surface surrounding structures, all beach ridge crests, all other changes in slope and sediment changes, plus contour lines at a maximum spacing of 5m. All measurements are feature-coded with sediment type. Sufficient data points must be measured to generate a reliable Digital Terrain Model.

   Hydrographic surveys are conducted with a single beam echo-sounder, with the position fixing requirement relaxed to DGPS. Soundings are taken along cross-shore profile lines 50m apart and extend 1km offshore. A minimum of 4 shore parallel tie lines are required (including one near the landward and seaward boundaries). The landward limit varies slightly across the region, due to the variation in tidal range, but in general is landward of Mean Sea Level, thus providing overlap with the topographic surveys. Tidal control may be by RTK GPS or by correction from tide gauges which are tied to the survey control network.

2. **Change in Cross-sectional Area (CSA)**

   The annual change in cross-sectional area is calculated as the difference in CSA between two surveys, expressed as a percentage change compared to the earlier CSA.

   \[
   \frac{CSA_1 - CSA_2}{CSA_2} \times 100
   \]

   Eqn (1)

   where \(CSA_1\) = most recent springtime survey and \(CSA_2\) = spring survey previous year. Therefore an annual change of –14% represents erosion during the last year of 14% of the area of last year’s survey.

3. **Method of derivation of Digital Ground and difference models**

   The Digital Terrain Model is created by interpolating the points of a topographic baseline survey collected by using RTK GPS system. The interpolation method used to create the SECG DGMs is specified as
Triangulation with smoothing and is applied in MapInfo Vertical Mapper to create a 1 metre resolution grid.

Triangulation is a process of grid generation that is usually applied to data that requires no regional averaging, such as elevation readings. The surface created by triangulation passes through all of the original data points while generating some degree of "overshoot" above local high values and "undershoot" below local low values. Elevation is an example of point values that are best "surfaced" with a technique that predicts some degree of over- and under- estimation. In modelling a topographic surface from scattered elevation readings, it is not reasonable to assume that data points were collected at the absolute top or bottom of each local rise or depression in the land surface.

Triangulation involves a process whereby all the original data points are connected in space by a network of triangular faces, drawn as equilaterally as possible. This network of triangular faces is referred to as a Triangular Irregular Network (TIN). Points are connected based on the nearest neighbour relationship (the Delaunay criterion) which states that a circumcircle drawn around any triangle will not enclose the vertices of any other triangle.

To visualise the resulting grid, the same colour scheme is applied, thus enabling comparison between grids of different geographic origin. The colour bands cover a elevation range between -4 to +12 metres OD with elevations lying between -2 and + 5 metres OD are shown in 0.5 metres intervals, the remaining elevation bands shown in 1 metre intervals.

All difference models are created by using a grid calculator within the GIS system. For example the difference model of two baseline surveys is created by subtracting the earlier baseline grid from the most recent baseline grid:

\[ \text{Grid}_1 - \text{Grid}_2 \]  

Eqn (2)

where \( \text{Grid}_1 \) = most recent baseline grid and \( \text{Grid}_2 \) = previous baseline grid. Therefore an annual change of \(-14m^2\) represents erosion during the last year of \(14m^2\), whilst positive values represent accretion over the period.
Annex B: Digital Ground Models
Annex C: Rye Bay WaveRider Buoy

September 2011 – August 2012
Rye Bay Waverider Buoy - September 2011 to August 2012

Location
OS: 596521E 109474N
WGS84: Latitude: 50° 51.083’ N  Longitude: 00° 47.433’ E

Water Depth
~11 m CD

Instrument Type
Datawell Directional Waverider Mk III

Data Quality

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<th>Recovery rate (%)</th>
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Storm Analysis

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<th>$H_s$ (m)</th>
<th>$T_p$ (s)</th>
<th>$T_z$ (s)</th>
<th>Dir. (°)</th>
<th>Water level elevation* (OD)</th>
<th>Tidal stage (hours re. HW)</th>
<th>Tidal range (m)</th>
<th>Tidal surge* (m)</th>
<th>Max. surge* (m)</th>
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Table D1: Highest storms during the reporting period, September 2011 to August 2012

A storm is defined using the Peaks-over-Threshold method (Figure D1). Each storm is then examined in detail, and covers the period 16 hours either side of the storm peak, so as to include both the build-up and decay of the storm. This is the procedure recommended by the CIRIA Beach Management Manual (second edition) since it covers the build-up and decay typical of mid-latitude depressions.

At present, the threshold for Rye Bay is derived empirically, since the measurements span 4 years only and, therefore, errs on the low side. Once the record length exceeds 5 years, a more realistic value of the Threshold can be derived, so as to identify 3 or 4 storms in an average year. The

* Tidal information is obtained from the nearest recording tide gauge (the National Network gauge at Dover). The surge shown is the residual at the time of the highest $H_s$. The maximum tidal surge is the largest positive surge during the storm event.
threshold used for Rye Bay is 3 m. It is envisaged that this threshold will increase in forthcoming years.
Summary

The buoy had been cut adrift on 10 December 2011, just prior to a period of building seas conditions which culminated in a large storm which affected the eastern English Channel on 13 December, and was one of the highest storms recorded by Waveriders at Rustington and Seaford. Accordingly, it was impossible to re-deploy the buoy until 22 December. Storm wave direction was consistently from between SWbyS and SW.

Acknowledgements

Tidal data were supplied by the British Oceanographic Data Centre as part of the function of the National Tidal and Sea Level Facility, hosted by the Proudman Oceanographic Laboratory and funded by DEFRA and the Natural Environment Research Council.
Monthly time series of $H_s$

Figure D3: Monthly time series of $H_s$ at Rye Bay. Storm threshold, shown in red, is 3 m
Highest measured storm

Both the highest and second highest measured storms during this reporting period resulted from a very deep depression (966 hPa) which tracked quite slowly across northern Britain, then remained ~stationary near southern Norway with a complex series of fronts across southern England (see Figures D5 to D8). During the first event (Figure 4) significant wave height exceeded 3m for at least 12 hours; wave direction remained consistently from the SW. The peak of the storm spanned Low Water on a moderate tide and was accompanied by a small negative surge (at Dover).

Rye Bay - Storms during Sep 2011 to Aug 2012

Figure D4: Highest storm of the reporting period
Figure D5: Surface Pressure chart on 03 January 2012 at 00:00Z

Figure D6: Surface Pressure chart on 04 January 2012 at 00:00Z
Figure D7: Surface Pressure chart on 05 January 2012 at 00:00Z

Figure D8: Surface Pressure chart on 06 January 2012 at 00:00Z
Second highest measured storm

There was no clear peak to this event, rather an 8 hour period of sustained high waves from the SW followed by a significant storm surge (at Dover) of 1.2m at its maximum about 8-12 hours after the period of high waves.

Rye Bay - Storms during Sep 2011 to Aug 2012

Figure D9: Second highest storm of the reporting period
Third highest measured storm

This storm was the pre-cursor to the major storm which affected the eastern English Channel on 13 December 2011. At Rustington, for example, the highest waves since the deployment of the Waverider in 2003 were recorded. A significant negative tidal surge was observed at Dover.

Rye Bay - Storms during Sep 2011 to Aug 2012

Figure D10: Third highest storm of the reporting period
Fourth highest measured storm

This storm is included because, although not particularly high in terms of significant wave height, it occurred in June, in response to a quite deep (for June) depression over central-southern England (Figure D11), leading to some 12 hours of moderately high south-westerly waves. Tidal surge at Dover was negligible, but the higher waves spanned High Water on a spring tide.

Rye Bay - Storms during Sep 2011 to Aug 2012

Figure D10: Fourth highest storm of the reporting period
Figure D11: Surface Pressure chart on 08 June 2012 at 00:00Z