BEACH MANAGEMENT PLAN REPORT

Graveney and Seasalter

2008

BMP 84 Annex

January 2010
Beach Management Plan Site Report 2008
4aMU4A – Graveney and Seasalter

Canterbury City Council
Strategic Monitoring
Military Road
Canterbury
Kent
CT1 1YW

Tel: 01227 862401
Fax: 01227 784013
e-mail: Strategic.Monitoring@canterbury.gov.uk
Web Site: www.se-coastalgroup.org.uk
www.channelcoast.org

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Author: A. Jeffery
Checked By: M. Mills
Approved By: M. Mills

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Beach Management Plan Site Report 2008
Unit 4A : Graveney and Seasalter

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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 Ground 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 modeling 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 an 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:

$$\text{Grid}_1 - \text{Grid}_2 \quad \text{Eqn (2)}$$

where Grid$_1$ = most recent baseline grid and 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

2008 Digital Ground Models
Annex C

Recycling Logs

2008
Annex D

Herne Bay Wave Recorder

July 2007 – June 2008
Herne Bay Wave Recorder - July 2004 to June 2005

Location
OS: 616870E 169390N
WGS84: Latitude: 51° 22' 55.5"N Longitude: 01° 06' 54.66"E

Water Depth
~0.5m CD

Instrument Type
Etrometa Step Gauge

Data Quality

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<th>C1(%)</th>
<th>Sample interval</th>
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Storm analysis

All times are GMT

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<th>Date/Time</th>
<th>Hs</th>
<th>Tp</th>
<th>Tz</th>
<th>Dir</th>
<th>Water level elevation(^1) (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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</thead>
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<td>14-Feb-2005</td>
<td>1.94</td>
<td>5.0</td>
<td>4.2</td>
<td>-</td>
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<td>HW</td>
<td>4.1</td>
<td>0.14</td>
<td>1.09</td>
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<tr>
<td>03-Mar-2005</td>
<td>1.73</td>
<td>5.0</td>
<td>4.0</td>
<td>-</td>
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<td>HW -1</td>
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<td>HW +1</td>
<td>4.7</td>
<td>0.58</td>
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Table A1  Storms during the reporting period, July 2004 to June 2005

A storm is defined using the Peaks-over-Threshold method (Figure A1). 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 since it covers the build-up and decay typical of a mid-latitudes depression.

The choice of the threshold value aims to identify 3 or 4 storms in an average year. The threshold used for Herne Bay is 1.6m.

Figure A2 shows the monthly time series of Hs, with the threshold shown in red. The occurrence of storm waves in the current reporting period is also compared with similar storm waves in previous years in Figure A3.

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\(^1\) Tidal information is obtained from the nearest recording tide gauge (the Step Gauge also measures tidal elevation). The tidal surge shown is the residual at the time of the highest Hs. The maximum tidal surge is the largest positive surge during the storm event.
Figure A1 Storm definition

Subsequent figures show a time series of the wave conditions for each of the storms listed in the table above, together with the tidal conditions at the nearest tide gauge. Each graph is centred around the highest $H_s$ of the individual storm.

In such shallow water, however, there is a tidal signature in $H_s$ and, therefore, the wave heights are expected to decrease as the water depth decreases; this effect is magnified during spring tides and is clearly visible in Figure A2. In some cases (e.g. Figure A4) there is an apparent storm sequencing effect, but it is more likely to be an artefact of shallow water wave processes, rather than a true indication of numerous individual storms. Accordingly, for this shallow water site, analysis will concentrate on the “storm event” as a whole, defined as the 16 hour period either side of a POT “storm” peak.

Summary

The reporting year was generally an “average” year. All of the events shown in Table A1 appeared to be at their peak within one hour of High Water, due to shallow water wave processes. High waves were not confined to the September-March period, but included also a storm in July.
Figure A2 Monthly time series of $H_s$ at Herne Bay. Storm threshold, shown in red, is 1.6m
Figure A3 Incidence of storms during: (a) reporting period and (b) since deployment.
Figure A4 Highest storm event of reporting period

This storm event saw an extended period of high waves and a lengthy surge, although the peak of the storm surge (which exceeded 1m) occurred during the Low Water preceding the storm peak. Both wave periods were very similar, suggesting a well developed sea state. The surge appears to have been driven by strong northerly winds and resulting in both a lengthy surge and High Water occurring earlier than predicted. The highest $H_{\text{max}}$ was over twice the $H_s$. The tidal signature in wave height is considered to be due to shallow water wave processes, rather than representing a change in meteorological conditions.
Figure A5  Second highest storm of reporting period

This storm resulted from the passage of a complex low pressure system and therefore the associated tidal surge was small and ephemeral.
Figure A6  Third highest storm of reporting period

This short-lived storm seems to have resulted from a rapidly-deepening, but fairly slow moving depression. Winds were generally easterly/noth-easterly and the tidal surge was negligible. The increase in $T_p$ to ~ 10s appears to herald a far-distant storm, but there is nothing on the North Atlantic weather chart to suggest where these swell waves were generated.
Figure A7  Fourth highest storm event of reporting period

This storm had the largest tidal surge (of the storm events given in Table A1), reaching 0.58m at the storm peak, but with a maximum surge of 1.31m around the following Low Water. The surge was driven primarily by a strong northerly (onshore) airstream which persisted for over 24 hours. The reduction in wave height around Low Water is considered to be an effect of the reduced water depth during the spring tide, rather than representing a change in meteorological forcing.
Return Periods

The Step Gauge has been deployed at Herne Bay since 1996 and therefore extreme statistics can be derived, with return periods of 200 years. Return periods are calculated in SANDS and the results shown in Table A2

<table>
<thead>
<tr>
<th>Herne Bay – Significant Wave Height, $H_s$, (m)</th>
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<tbody>
<tr>
<td>Return period (years)</td>
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<tr>
<td>----------------------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>5</td>
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Table A1.2 Extremes analysis for Herne Bay data (Sep 1996 – June 2005)

Conclusions

Tidal surges associated with storm events were driven chiefly by persistent, strong, northerly/north-easterly (onshore) winds, which were capable of generating lengthy periods of surge conditions lasting several tidal cycles. In none of the storms in this reporting period, did the maximum tidal surge coincide with High Water, or the storm peak.

Acknowledgements

Tidal predictions were produced using the TASK2000 software, kindly provided by Proudman Oceanographic Laboratory.