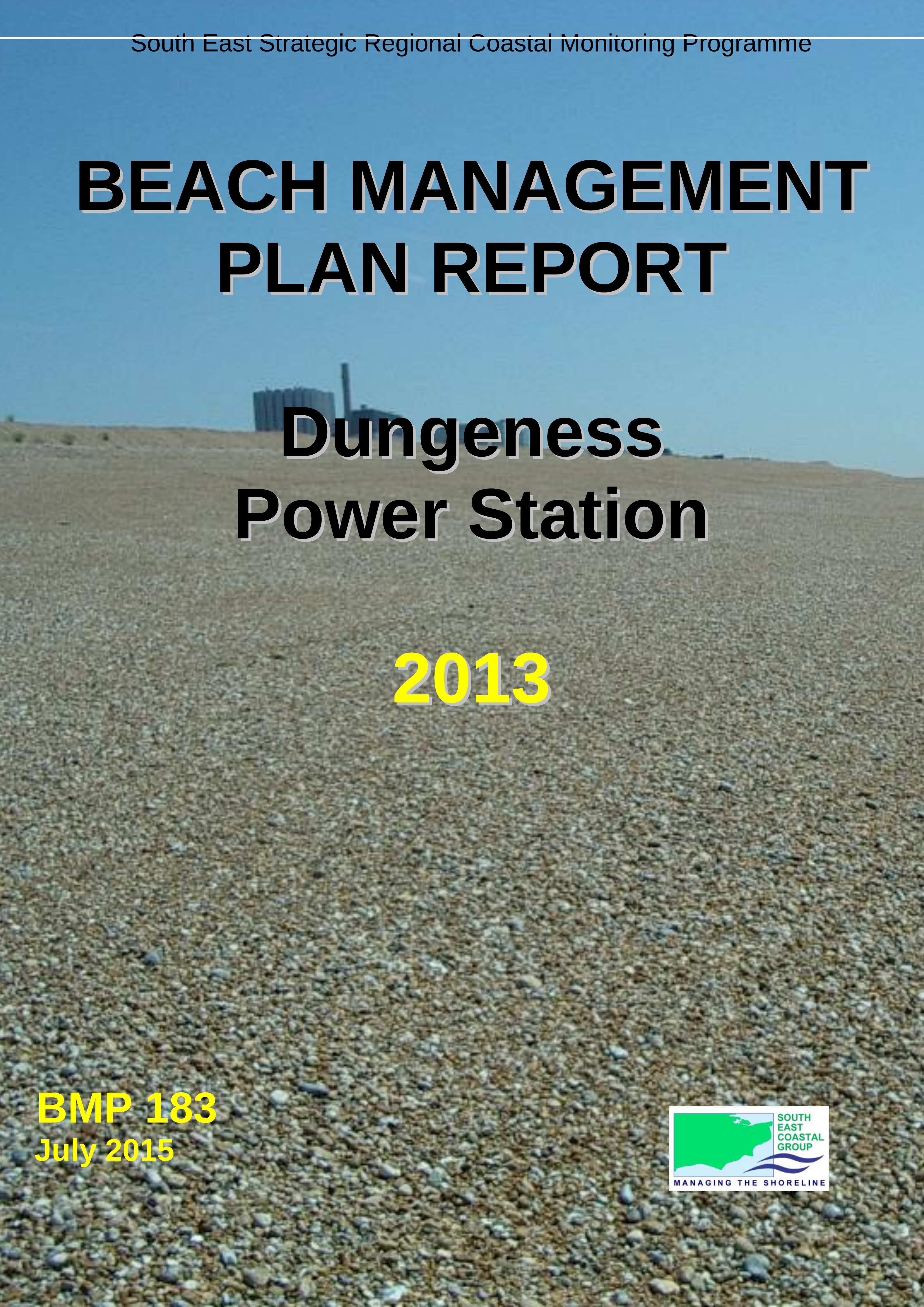

BEACH MANAGEMENT PLAN REPORT

Dungeness Power Station

2013

BMP 183

July 2015

SOUTH EAST COASTAL GROUP

MANAGING THE SHORELINE

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

Tel: 01227 862535
e-mail: Strategic.Monitoring@canterbury.gov.uk
Web Site: www.se-coastalgroup.org.uk
www.channelcoast.org

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Author:	M.Dorling
Checked By	C. Milburn
Approved By:	C. Milburn

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BMP 2005	No BMP Report	**BMP 19**	BMP 20
Annual Report 2006	Dover Harbour to Beachy Head – AR 19		
BMP 2006	No BMP Report	**BMP 38**	BMP 39
Annual Report 2007	Dover Harbour to Beachy Head – AR 31		
BMP 2007	No BMP Report	**BMP 55**	BMP 56
Annual Report 2008	Dover Harbour to Beachy Head – AR 41		
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BMP 2012	No BMP Report	**BMP 159**	BMP 160
Annual Report 2013	Dover Harbour to Beachy Head – AR 91		
BMP 2013	BMP182	**BMP 183**	BMP 184

Contents

List of Figures

List of Tables

Abstract

The shingle beaches provide a vital element of the flood and coastal erosion defences along the Survey Unit 4cSU13 Dungeness power station frontage. Without the protection of the shingle beach in front of the flood embankment the risk of it being overtopped or breached during a storm is significantly increased. The monitoring, analysis and feedback on the performance of the beach is therefore vital in ensuring the level of risk is maintained at an acceptably low level.

The condition and performance of different beach sections are currently monitored through the Strategic Regional Coastal Monitoring Programme. This report evaluates changes along the coastline over the 2012-2013 period.

The 2012-2013 reporting period witnessed the seventh consecutive year of erosion and the largest annual and net loss since records began. The losses that have occurred over the past year have primarily occurred at the base of the shingle embankment, with crestlines lowering and retreating. Erosion has occurred linearly across the frontage however the flood protection embankment has largely remained unscathed.

The data collected over the past year provides further evidence of an erosive tendency continuing which has been present since 2006. The volumetric analysis that has been carried out for the entire project timescale has shown an overall loss of material by approximately 119,000m^3 over the 2km frontage. It remains difficult to comment on the practical implications of this net change as no design beach profiles have been provided, however, with an ever diminishing volume of shingle available in the area the strain of maintaining the flood embankment will surely increase.

This report also highlights the fact that the beach continues to be very dynamic along this frontage and considering the rise in sea level and climate change effects, the magnitude of change experienced on this shoreline will increase. It is therefore recommended that to compliment the ongoing beach and coastal process monitoring that is carried out as part of the Regional Strategic Coastal Monitoring Programme, a range of design beach conditions are established. With this information it will then be possible to use this annual reporting mechanism to alert when 'warning' and 'critical' thresholds are approached.

It is important to recognise the potential inconsistency in short-term trends. As with many coastal areas a lot of annual variability is expected, thus drawing conclusions with increased confidence will become possible as more data is collected, with regard to annual losses, net sediment drift and erosion/accretion trends in section sub-units.

Scheduled future monitoring includes profile surveys in Autumn 2013 and Spring 2014, and in addition post-storm surveys may be carried out if any event is deemed to have significantly affected the frontage. An interim report will be issued on completion of the spring profile survey, with the next BMP report scheduled to be issued after completion of the Summer 2014 beach plan survey. All historic monitoring data is accessible online (www.channelcoast.org), and future surveys will be available after satisfying quality assurance procedures.

1.0 Introduction

Survey Unit 13 (SU13) is situated on the South Kent coast and covers a 1.7km shingle beach fronting the Dungeness nuclear power stations. A natural beach fronts a managed 2-5m high shingle embankment that provides extra protection to the notable infrastructure here. The power station is approaching a full decommissioning programme that requires continued coastal protection of this area for the foreseeable future. The open beach acts as the only coastal defence along the frontage, and consequently the shoreline management plan's 'hold the line' policy is currently maintained by periodic renourishment of shingle and re-profiling. The far west of the SU13 beach and the immediate surrounding area of the power station development is designated as a SSSI (Sites of Special Scientific Interest), National Nature Reserve, and SAC (Special Area of Conservation), further highlighting the importance of continual beach monitoring along this frontage.

1.1 Coastal Processes

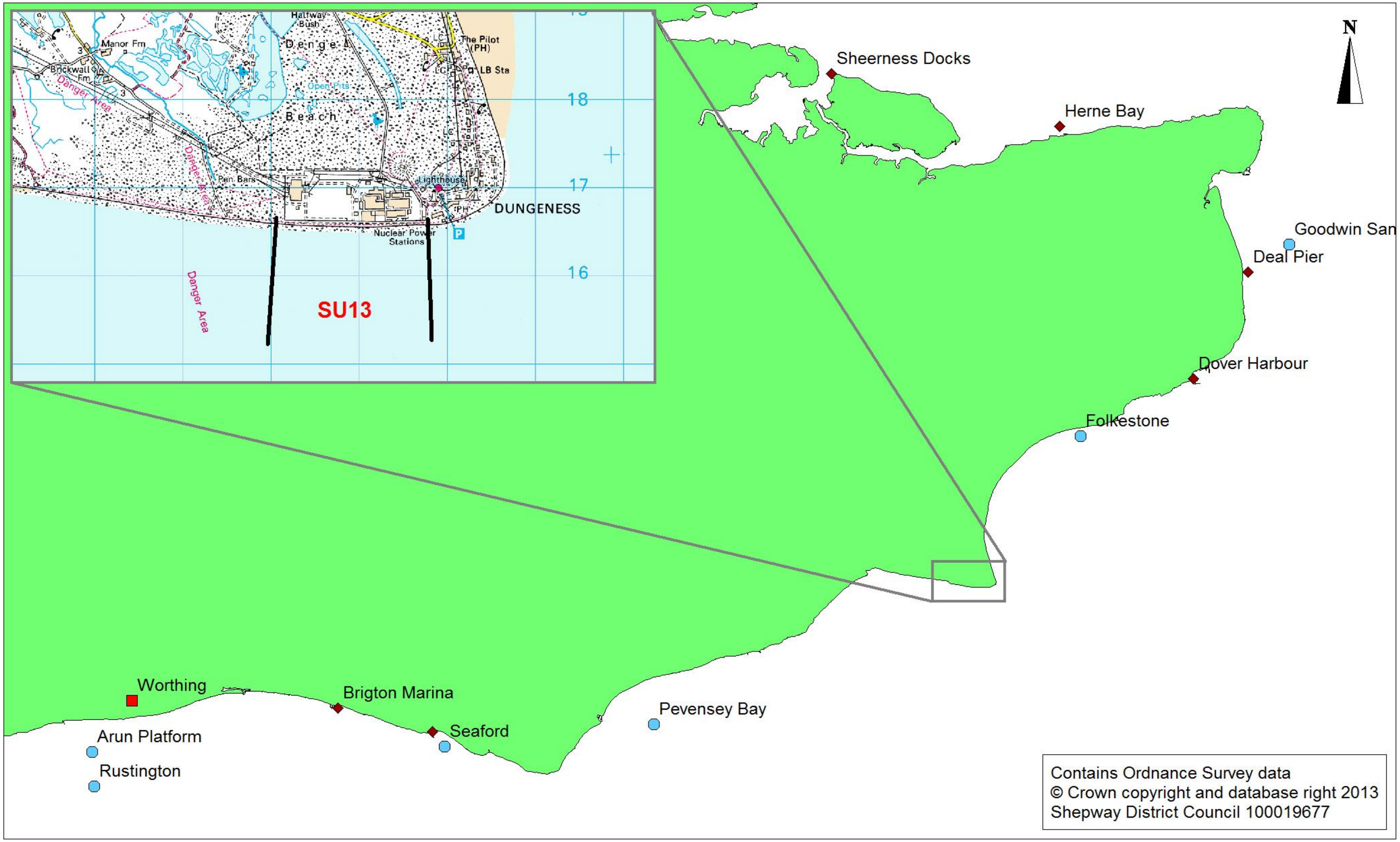
The frontage faces south and experiences storms approaching from a south-westerly and south-easterly direction. Net sediment drift direction along the frontage is predominantly from west to east (Shoreline Management Plan, 2000). Given the absence of groyne structures or hard sea defences along the frontage, the coastline is particularly dynamic and rates of change can vary year-on-year.

This report covers the changes in beach topography between the summer 2012 survey and the most recent 2013 beach management plan survey. In addition, this contains a lot of background information including site-specific information.

Unlike the majority of other coastal monitoring reports, this relatively short frontage is only divided into two individual sections for analysis. The boundary between SU13W and SU13E is derived from recycling data submitted by Halcrow (the boundary is located at profile 4c00787).

The location of the frontage is shown in Figure 1 and also includes the nearest wave buoys and tide gauges.

South East Strategic Regional Coastal Monitoring Programme | BMP Site Report



Beach Management Plan Site - Frontage and Hydrodynamic Data Locations | SECG - 4cSU13

Figure 1: Site Location and Wave/Tide Gauge

2.0 Design Conditions

The BMP for Survey unit 13 has not been updated since 2007 and as such no information is available on the standard of protection provided by the beach, nor the design profiles required to achieve it. Currently planning permission is being sort to renew a license to extract material for the accretion dominant eastern section and use this material to renoursihed the beach and shingle embankment. It is hoped that once the license has been agreed the BMP will be updated with detailed data on design profiles and recycling volumes. Therefore any analysis contained within this report will be based on changes that have occurred over the past year, with no reference to the standard of protection now provided by the beach.

3.0 Surveys

All topographic and bathymetric surveys are referenced to a Global Positioning System (GPS) control grid, established for the Regional Monitoring Programme and conducted according to the current Environment Agency's National Specification, summarised in the Explanatory Notes (Annex A).

3.1 Topographic Surveys

The schedule of completed surveys since the start of the Regional Monitoring Programme is given in Table 1.

Digital Ground Models of the 2013 Beach Management Plan topographic survey are shown in plate 2 (1 - 2) (Annex B) superimposed upon the ortho-rectified aerial photographs of 2008. The method used for deriving Digital Ground Models is given in the Explanatory Notes (Annex A).

Table 1: Schedule of Topographic Surveys

SU 13								
Profile	**Beach Plan**	**Post-storm**	**Profile**	**Beach Plan**	**Post-storm**	**Profile**	**Beach Plan**	**Post-storm**
30/07/2003	30/07/2003		07/06/2007	07/06/2007				12/11/2010
24/10/2003			25/10/2007			10/03/2011		
25/02/2004					08/02/2008	19/07/2011	19/07/2011	
04/06/2004	04/06/2004		12/03/2008			27/10/2011		
28/10/2004			04/07/2008	04/07/2008				19/12/2011
09/03/2005			19/11/2008			13/03/2012		
29/06/2005	29/06/2005		01/03/2009			21/06/2012	21/06/2012	
21/10/2005			24/07/2009	24/07/2009		18/10/2012		
02/03/2006			22/10/2009			04/03/2013		
17/07/2006	17/07/2006				04/12/2009	16/07/2013	16/07/2013	
08/11/2006			21/03/2010					
		08/12/2006	12/08/2010	12/08/2010				
21/02/2007			28/10/2010					

3.2 Bathymetric Surveys

The schedule of bathymetric surveys since the start of the Regional Monitoring Programme is given in Table 2.

Table 2: Schedule of Bathymetric Surveys

SU13		
Date	**Line Spacing**	**Distance Offshore**
04/10/2003	50m	1000m
25/09/2006	50m	1000m

4.0 Beach Management Operations

According to records received from the operating authority, no beach management operations have taken place over the reporting period. Therefore all changes indicated by the difference models reflect natural processes and offer an improved view of the longer-term natural evolution for this section.

5.0 Beach Profile Analysis

5.1 Difference Models

Now that the 2013 BMP data set has been compiled, it is possible to overlay the results of the survey with BMP data from 2012. This enables comparative volumetric analysis to be undertaken to determine change over a given period. Through the use of three-dimensional ground models and ortho-rectified aerial photography, it is possible to create a visual interpretation of the volumetric change that has occurred during each analysis period. This is shown in Plate 1 (1-2), which indicates areas of net erosion or accretion (N.B. a 0.25m difference in elevation is considered as “no change”) and the location of any extraction/deposition sites.

Negative values represent erosion that has occurred between 2012 & 2013, and positive values indicate accretion. Whilst these figures show an overall change in beach volume within each discrete section, it should be recognised that the data is based on the BMP survey, which is undertaken once each year. It is therefore only a snapshot of one moment in time, and the particular dynamics of each frontage need to be taken into account. This ensures that the information shown in the difference models represents the net change rather than capturing a particular extreme variation caused by a large event.

5.2 Profile Evolution

While beach plan surveys provide a more accurate view of morphological change and beach volume levels, profiles clearly illustrate the changes in beach cross section. In addition, the 2013 BMP survey beach profiles have been cross-referenced with the other profile surveys carried out over the past year in order to ensure that the results from the difference models are representative of net profile change. This then gives an indication of the beach variability over three time steps in each individual year.

The Cross-Sectional Area (CSA) has been calculated for all beach profiles. This is calculated as the area of profile above a Master Profile (MP). In general, the lower boundary of the MP is the transition between the beach face and the foreshore (i.e. the beach toe). The landward boundary is either the seawall or, where a hard structure is not present, the landward extent of the stable part of the beach. The Master Profile is held constant for a given profile line and therefore the changes in CSA through time can be derived.

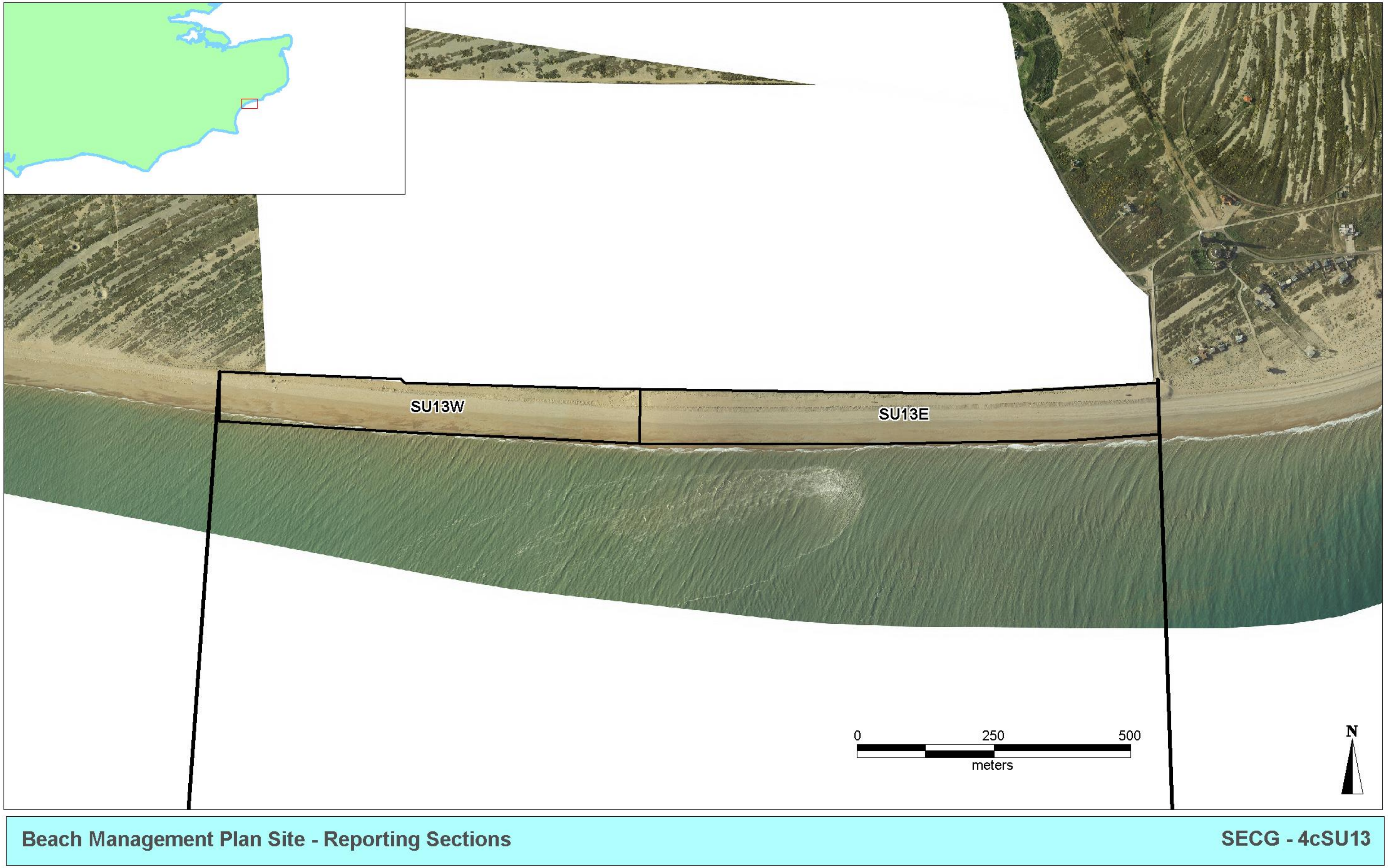
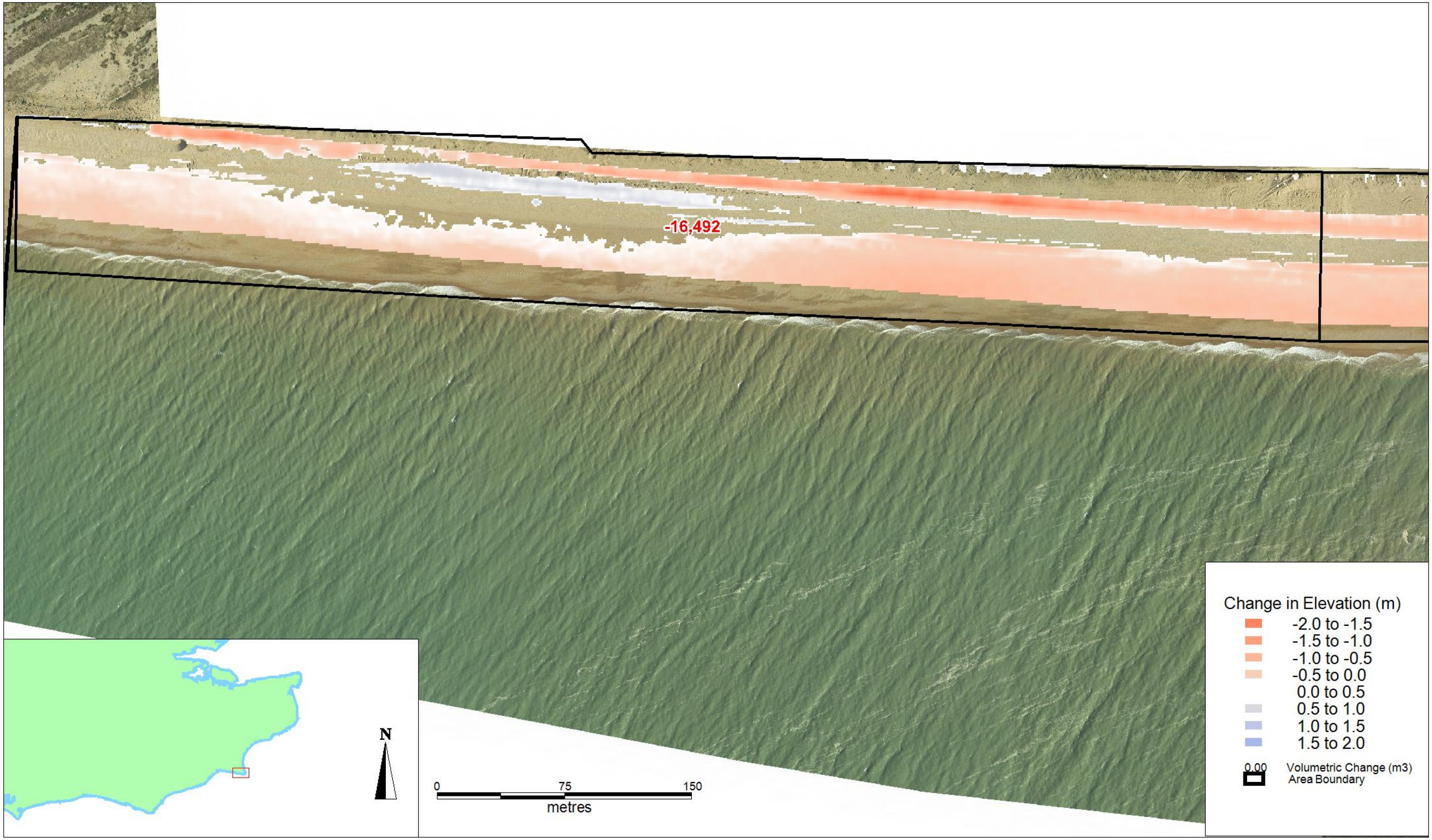
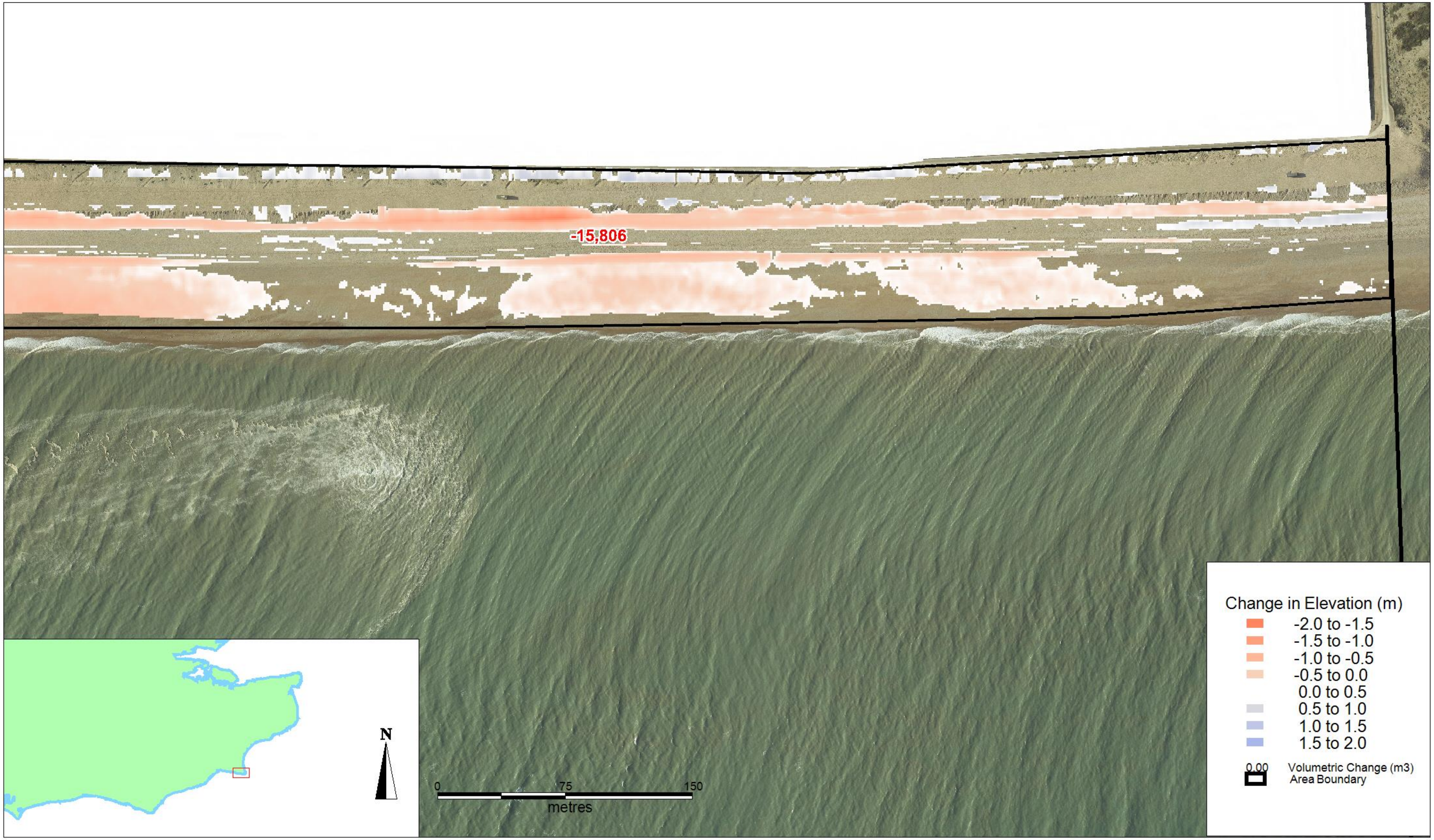


Figure 2: SU13 beach analysis sections


-16,492
Change in Elevation (m)
-2.0 to -1.5
-1.5 to -1.0
-1.0 to -0.5
-0.5 to 0.0
0.0 to 0.5
0.5 to 1.0
1.0 to 1.5
1.5 to 2.0
0.00 Volumetric Change (m3)
Area Boundary
N
0 75 150
metres


-15,806
N
0
75
150
metres
Change in Elevation (m)
-2.0 to -1.5
-1.5 to -1.0
-1.0 to -0.5
-0.5 to 0.0
0.0 to 0.5
0.5 to 1.0
1.0 to 1.5
1.5 to 2.0
0.00 Volumetric Change (m3)
Area Boundary

Survey Unit 13 Analysis

The remainder of this chapter contains a narrative summarising the changes that have taken place over the last year, and hypotheses of the processes driving these changes.

5.3 Section 1 – SU13W

During the 2012-2013 reporting period this section has seen a seventh consecutive year of net erosion with the loss of approximately 16,500m^3. The rate of erosion is in keeping with previous years and supports a relatively consistent rate of material loss. The loss of material has primarily occurred throughout the beach slope although the embankment has also incurred some losses as shown in figure 3 below.

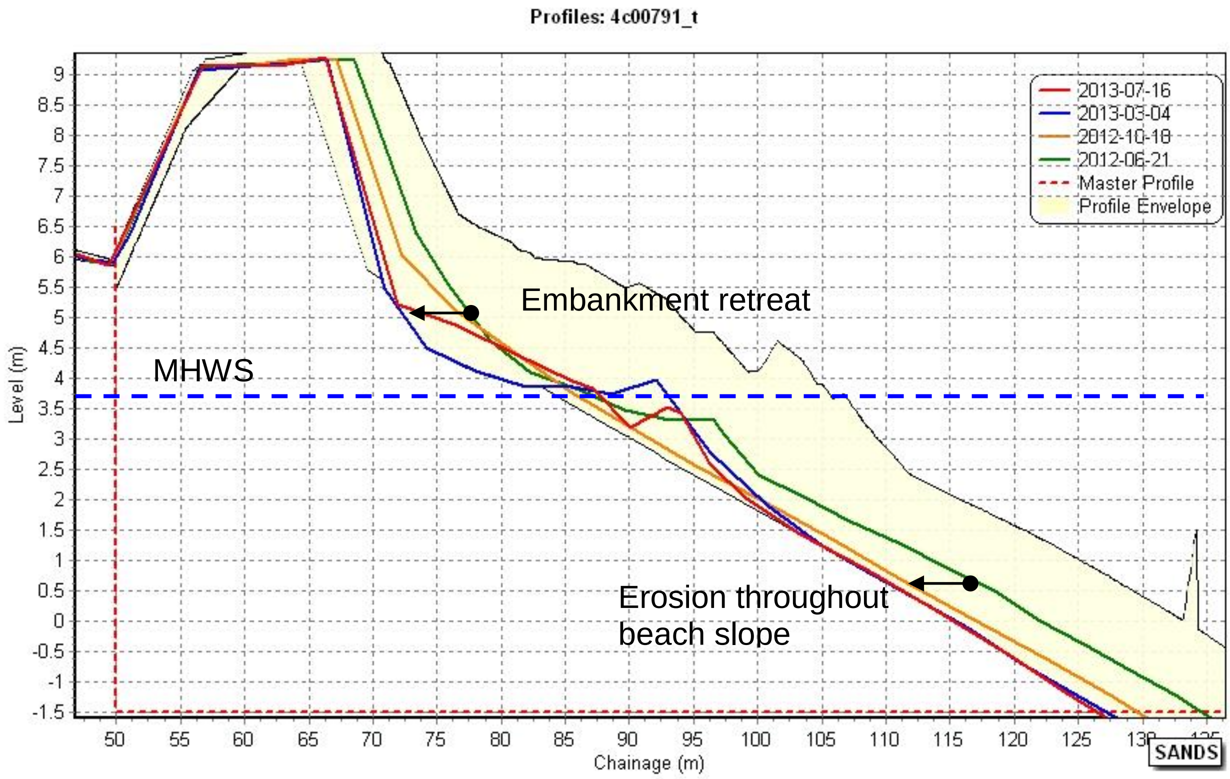


Figure 3: Cross sectional changes at profile 4c00794

From Profile 4c00791 it can be seen that between June 2012 and July 2013 the slope of the embankment had retreated by approximately 5m. This loss is consistent throughout the entire height of the embankment indicating the natural angle of repose for the embankment.

The apex of the embankment has largely remained constant over the past few years with the profile envelope indicating the maximum and minimum elevation since monitoring begun. This again reiterates the stabilising effect the annual beach works have in maintaining the embankment height with a maximum deviation of 0.4m across 9 years for data for this profile.

The main area for concern, and main contributor to the net losses indicated in the difference models is the continued loss of material at the crest of the beach in front of the embankment. The profile clearly indicates a further reduction in crest width by approximately 5m. By considering the profile envelope it is also possible to identify that the current position of the beach profile demarks the most landward limit of all profiles since 2003. This therefore indicates that the mobile beach in front of the embankment has the lowest cross sectional area since records began and reflects the degree of erosion that has occurred over the past seven years.

5.4 Section 2 – SU13E

During the current reporting period section 2 has again shown a continuation of erosive processes at a similar rate to neighbouring section 1. Between 2012 and 2013 this section has lost approximately 16,000m^3 of material. From the difference models it can be seen that the majority of these losses have occurred linearly across the beach slope in a shore parallel bands, although there has also been some localised losses along the top of the embankment. Figure 4 below illustrates how these loses have affected the beach cross section for profile 4c00785 which is located in the centre of this section.

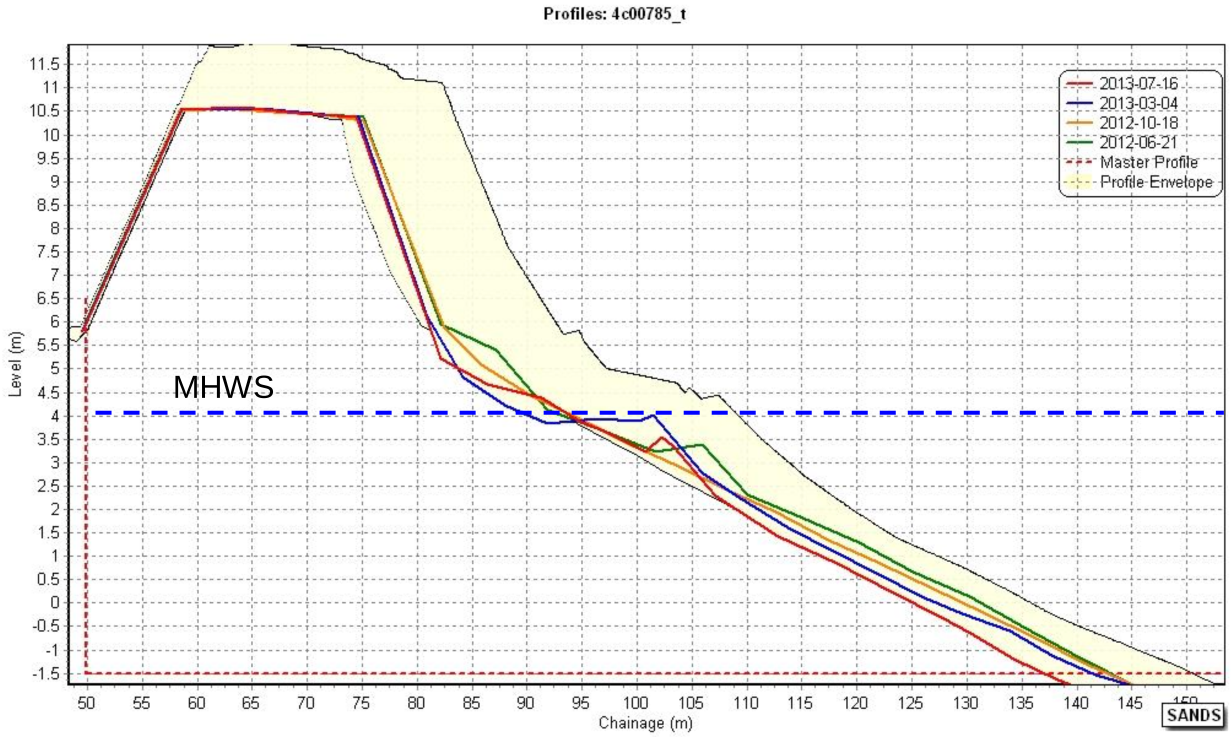


Figure 4: Cross sectional losses at profile 4c00785.

From Figure 4 it can be seen that the losses over the past year have been most notable at the base of the embankment and the lower beach slope. The toe of the embankment has reduced in height by 0.5m and maintains the lowest elevation surveyed since records began. The beach slope in front of the embankment has rolled back to a slightly steeper profile and represents one of the lowest cross sectional areas since records began.

Figure 5 below shows the beach cross section for Profile 4c00773 which is located near the eastern boundary of section 2. This profile presents a more stable view in contrast to the changes shown in Figure 4 and clearly shows a stable embankment height and width over the past year.

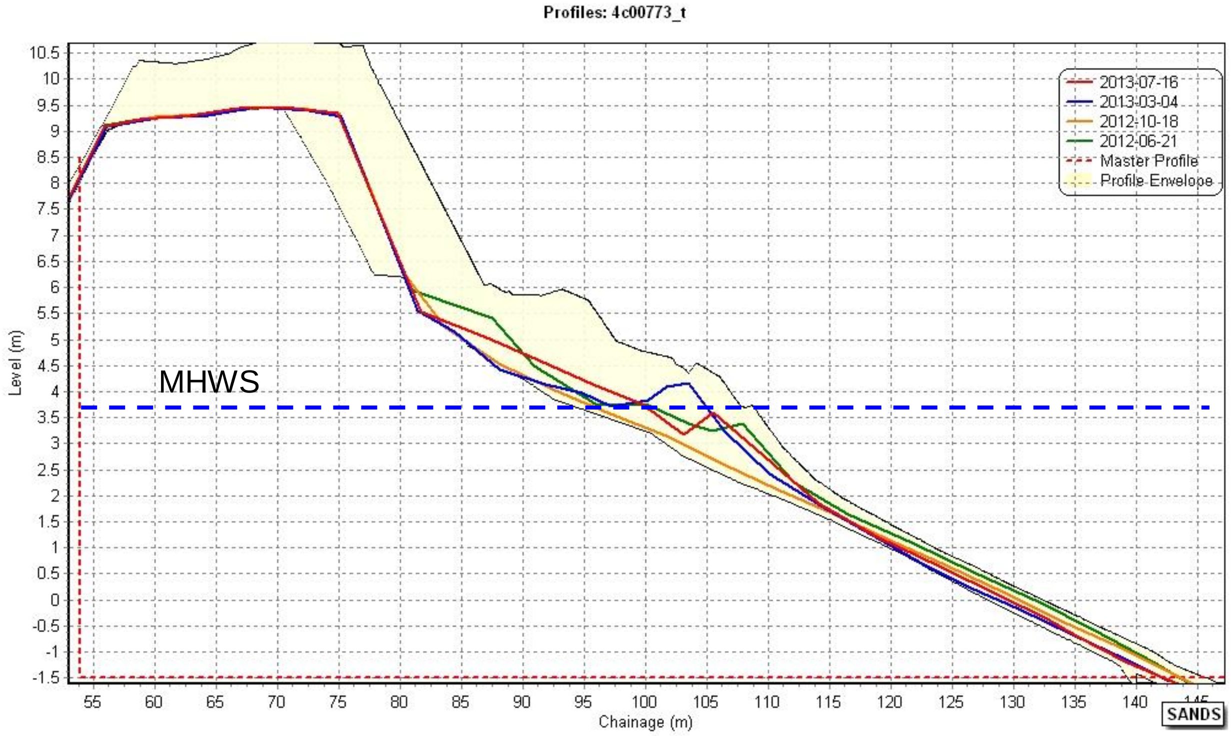


Figure 5: Profile 4c00773 showing a stable embankment formation

Summary Data

Table 3 provides a summary of volume change within each section during the period between the 2012 and 2013 summer surveys.

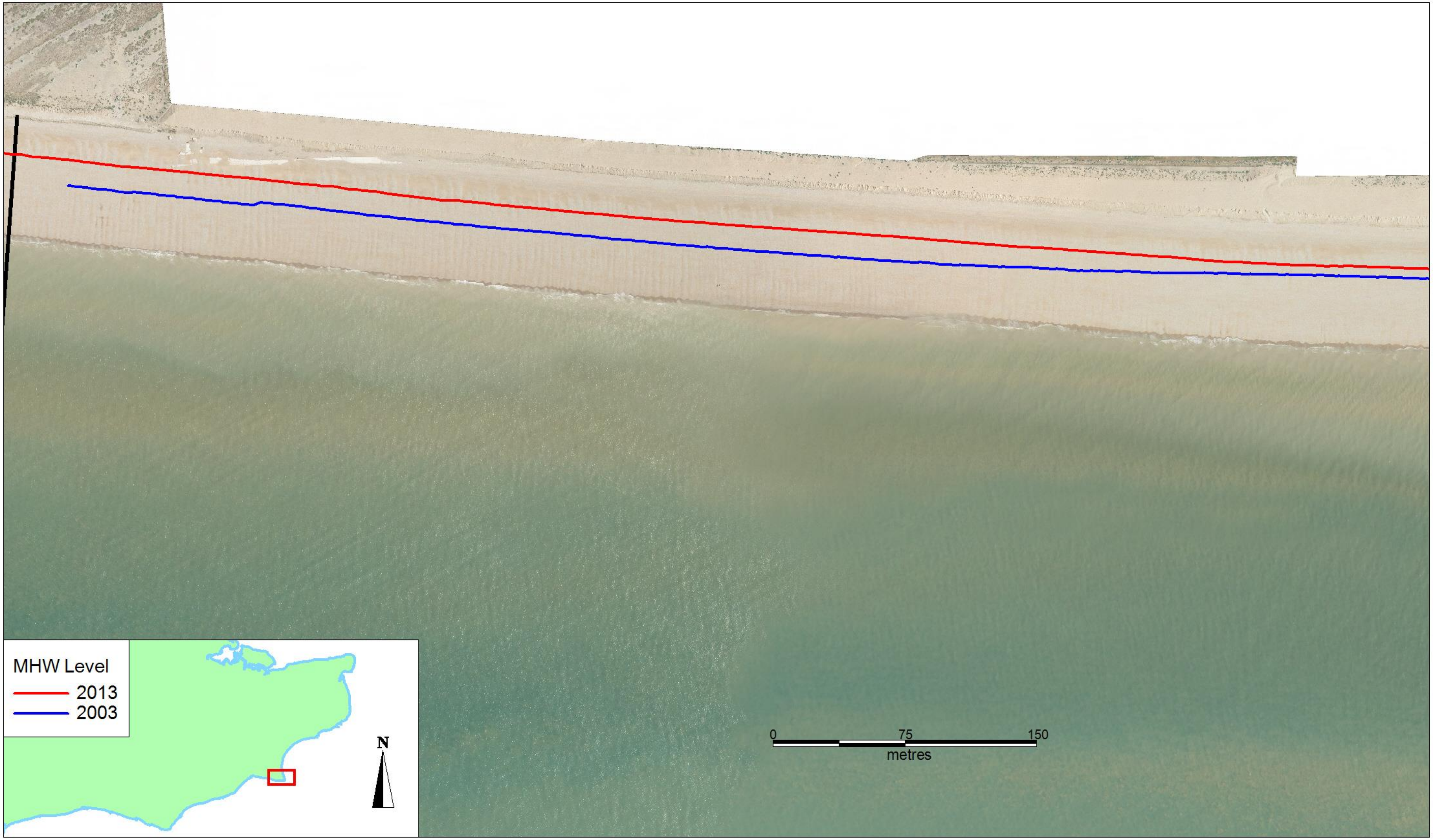
Table 3: Survey Unit 13 - Summary of Erosion/Accretion Totals

Area	Error Estimate*	Erosion/Accretion (2011 to 2012)	Erosion/Accretion (2012 to 2013)
1 - SU13W	$^+/_-$ 2,017m^3	-22,836m^3	$^-$16,492m^3
2 - SU13E	$^+/_-$ 2,830m^3	-7,470m^3	-15,806m^3
Total	**-**	**-30,306m^3**	**-32,298m^3**

** Error estimates are calculated as the survey area multiplied by a $^+/_-$ 30mm error margin, although unlikely the error of combined surveys can be up to double this figure*

5.5 Changes in Mean High Water Mark

The Mean High Water mark at Dungeness is +2.75m OD. The MHW contour has been cut out of the Digital Ground Models for 2003 (the first dataset) and 2013 (the current dataset) and compared in Plate 3; shown below. In general, the 2013 MHW mark has retreated in the west and maintained position in the east. This trend clearly reflects the management regime which has allowed the shingle embankment to roll back in areas where the flood risk is reduced.



Beach Management Plan Site - MHW Mark 2003 & 2013

SECG - 4cSU13

Plate 3 (1 of 2)

Beach Management Plan Site - MHW Mark 2003 & 2013

SECG - 4cSU13

Plate 3 (2 of 2)

Long Term Summary

When analysing the current reporting period it is evident that this frontage is influenced by erosive forces and has suffered its sixth consecutive year of net losses. The continuation of losses indicates that although the embankment is maintained periodically, the works undertaken fail to maintain a consistent sediment budget and material continually passes into the adjacent Survey unit.

Table 4 below indicates the long-term trends for this section and magnitude of change that has occurred since 2003.

Table 4: Beach Volume Change Summary (2003 - 2013)

Section	Volume Change (m^3)										
	2003 - 2004	2004 - 2005	2005 - 2006	2006 - 2007	2007 - 2008	2008 - 2009	2009 - 2010	2010-2011	2011-2012	2012-2013	NET
1 (W)	-2,013	16,185	1,306	-15,421	-20,487	-10,847	-5,360	-13,452	-22,836	-16,492	**-89,417**
2 (E)	6,562	14,135	2,806	-6,195	7,694	-12,382	-7,080	-11,858	-7,470	-15,806	**-29,594**
NET	**4,549**	**30,032**	**4,112**	**-21,616**	**-12,793**	**-23,229**	**-12,440**	**-25,310**	**-30,306**	**-32,298**	**-119,299**

When considering the net change since 2003 it is clear that there is a large disparity between the volume of change in section 1 and section 2. This likely reflects the changes in priority for providing adequate protection, with tighter control placed on the management of the eastern section where the consequence of breach is greater.

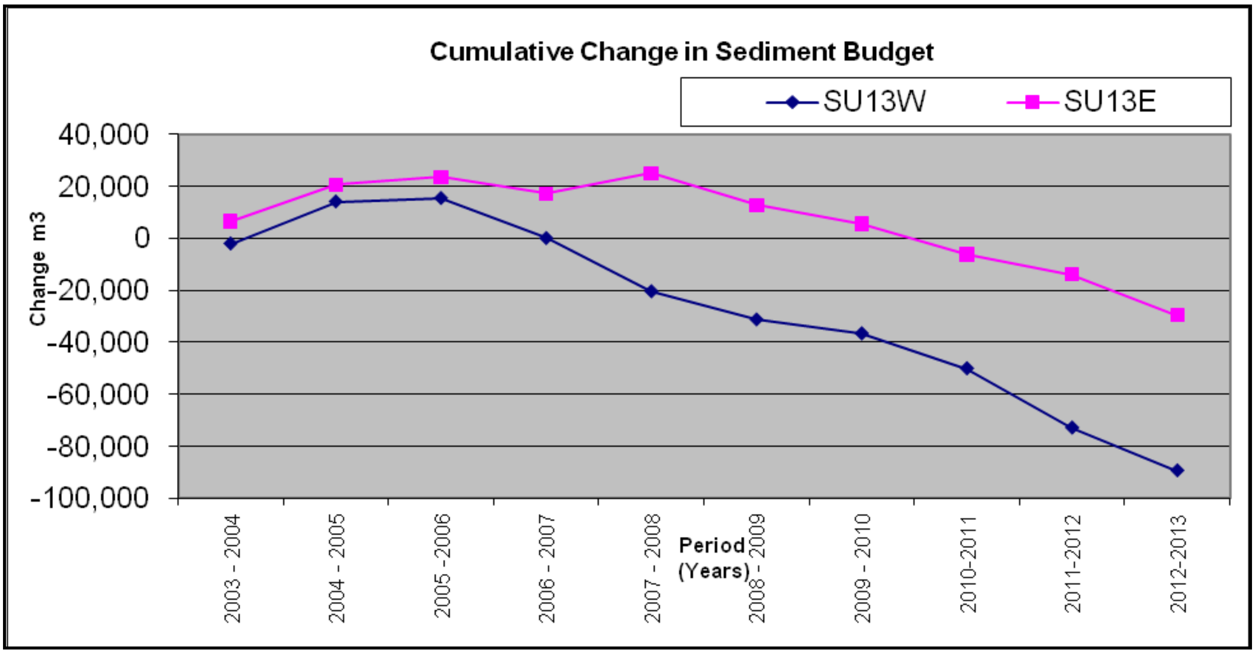


Figure 6: The cumulative change in sediment budget for Survey Unit 13.

Figure 6 above clearly shows the negative trend for this frontage and projects a continued rate of sediment loss. The graph also indicates the disparity between the western and eastern sections and the magnitude of losses that have occurred in the west.

These changes need to be considered in combination with the design volume for this frontage so that an assessment can be made as to when or if trigger levels have been reached. Until design levels have been provided it remains impossible to comment on the consequential effects of the changes highlighted above.

6.0 Wave Climate & Storm Events

Wave records are recorded by a Datawell directional wave rider buoy off Folkestone, first deployed July 2003. A detailed analysis of the wave climate for September 2012 to August 2013 is given in Annex C.

This reporting year was relatively quiet, with only two storms exceeded the threshold, in late autumn/early winter. Storm wave direction was either S or SbE. A number of moderate events occurred in late winter/early spring but nothing exceeding the threshold.

Table 5 below lists the two largest storm events recorded over the past year although a more detailed analysis can be found in annex C.

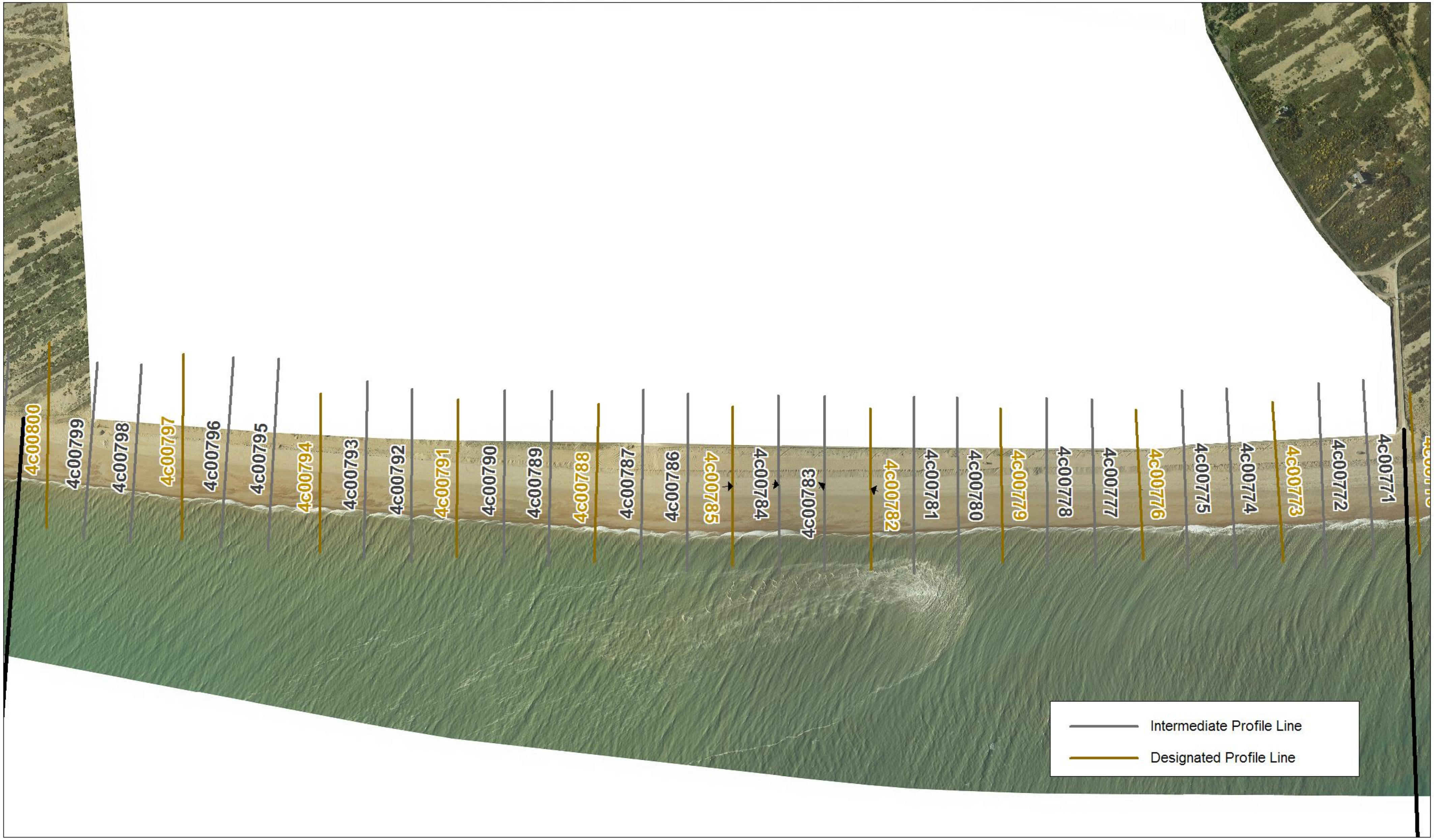
Table 5: Breakdown of storm events 2012-2013

Date/Time	H_s (m)	T_p (s)	T_z (s)	Dir. (°)	Water level elevation* (OD)	Tidal stage (hours re. HW)	Tidal range (m)	Tidal surge* (m)	Max. surge* (m)
14-Dec-2012 13:00	2.87	6.7	5.3	169	-	HW +2	6.1	-	-
25-Nov-2012 04:30	2.81	7.7	5.2	181	-	HW -4	4.3	-	-

Although two events exceeded the storm threshold, no post storm surveys were initiated and therefore no comment can be made as to the impact of these events.

* *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.*

Profile Location Diagrams



Profile Locations