Southeast Strategic Regional Coastal Monitoring Programme

# BEACH MANAGEMENT PLAN REPORT

# Littlestone-on-Sea

# 2005 & 2006

**BMP 20&39**

**January 2007**

SOUTH EAST COASTAL GROUP

MANAGING THE SHORELINE

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# CONTENTS

## i. Executive Summary

Shingle beaches provide a vital element of the flood and coastal erosion defences along the Management Unit (MU) 17 frontage. The monitoring and management of this asset is therefore crucial to the successful and sustainable delivery of flood and coastal erosion protection.

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 2003-2006 period. The key findings are listed below:

- The MU17 frontage gained 36,140m³ in the first survey period (2003-2004), gained 118,798m³ in the second survey year (2004-2005) and 14,410m³ from 2005-2006. These figures are difficult to put into context given the lack of previous beach volume studies along this coastline. All figures are inclusive of an annual recycling scheme that extracts material from the ness peninsula for use on the erosion-dominant frontages at Dungeness (MU16) and Lydd Ranges (MU15).

- Accretion dominant beach processes in MU17 are highlighted by overall unit accretion despite the extraction of shingle out of the unit. It is believed that a smaller recycling operation in the 2004-2005 survey year is the cause of the comparatively large volume change here, though the strategic monitoring programme is awaiting more detailed recycling logs to verify this claim further.

- The physical processes causing this accretion are difficult to explain given the data sets available. The shoreline management plan suggests an easterly longshore drift rate of 680m³/yr through MU16, and a southerly longshore drift rate of 8,300m³/yr through MU17. This seems an underestimate given the annual beach accretion rates seen over the past 3 years. However, the mergence of these 2 drift directions seems a plausible cause of the accretion on the ness peninsula in particular.

- The general pattern of beach erosion and accretion in MU17 over the past 3 years is: i) slight localised erosion at the far northern end of MU17 at Littlestone-on-Sea at where some beach levels are at their lowest elevations since 2003 ii) a pattern of increasing accretion towards Dungeness as far as the recycling extraction zone, with the beach difference models showing accretion across the beach face, and profiles showing trends of increasing CSA at almost all profiles iii) a variable section of beach in the far south of the unit where recycling extraction occurs, with beach levels dependent on recent recycling activities.

- The frontage is extremely dynamic. A near-linear and open beach allows easy exchange of beach material along the frontage length. This is evident from the accretion of the beach face through much of the unit and the accretion rates seen year-on-year.

- The current recycling strategy to remove shingle from the Ness peninsula seems sustainable, though beach surveys have highlighted 1 area where beach levels are at their lowest levels since the monitoring programme began, and therefore shingle extraction could be temporarily reduced here to allow the beach to accrete naturally.

- Five storms passed the storm threshold at the Folkestone Wave Buoy from 2003-2006, though no post-storm profiles have been surveyed on this coastline.

It is important to recognise the inconsistency in short-term trends, particularly when natural processes and anthropogenic changes influence the beach simultaneously. 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.

# 1. Introduction

Management Unit 17 (MU17) is situated on the south Kent coast and extends from Dungeness power station to Littlestone-on-Sea. The 8.5km long beach consists predominantly of a shingle beach face, that becomes increasingly steep towards Dungeness, and a gently sloping sand and mud foreshore, that is most extensive at Lydd-on-Sea. Vegetated shingle and sand dunes form the backshore in the north of the unit, with shingle further south. The open beach acts as the only coastal defence along the frontage, though a few of the numerous groynes at Littlestone overlap into this management unit. Notably, sections of the beach fronting Lydd-on-Sea and Dungeness are designated as SSSI (Sites of Special Scientific Interest), SNCI (Sites of Nature Conservation Interest), National Nature Reserves, RAMSAR and SAC (Special Areas of Conservation), highlighting the importance of continual beach monitoring along this frontage.

The current accretional tendency of this frontage allows accumulated shingle to be utilised on surrounding coastlines. Although the preferred policy of the shoreline management plan for the frontage is 'do nothing', British Energy undertake annual recycling to balance the accretion-dominant eastern face of the Dungeness peninsula and the erosion-dominant south face in front of the power station. Recycled beach material from the east of the ness is also deposited throughout MU15 (Lydd Ranges) by the Environment Agency. No other major beach recycling/replenishment or engineering works are believed to have been carried out along the frontage since the Regional Coastal Monitoring Programme began in the spring of 2003.

The frontage faces east and experiences storms from the southeast. Net sediment drift direction along the frontage is predominantly from north to south (Shoreline Management Plan, 2000). Given the absence of groyne structures along the frontage, the coastline is particularly dynamic.

In strategic appraisal and management terms, the frontage has been divided into 7 sections (Figure 1.1) that reflect locations of major beach structures and previous sub-division used in past reports. The location of the frontage relative to wave and tide gauges is shown in Figure 1.2.

This report covers the changes in beach topography between the 2006 summer beach management survey and the 2003 baseline survey. It is a combination of a detailed report explaining beach changes in MU17 from 2003 to 2005 (AR 20) and a summary of changes over the last year (2005-2006, AR 39).

# 2. Tidal Conditions

Folkestone tidal statistics representative of Littlestone-on-Sea are presented in Table 2.1.

| Tide Level | Folkestone Tide Height (m above ODN) |
|---|---|
| MHWS | 3.45 |
| MHW | 2.70 |
| MHWN | 1.95 |
| MSL | 0.17 |
| MLWN | -1.65 |
| MLW | -2.35 |
| MLWS | -3.05 |

*Table 2.1 – Admiralty tidal levels at Folkestone*

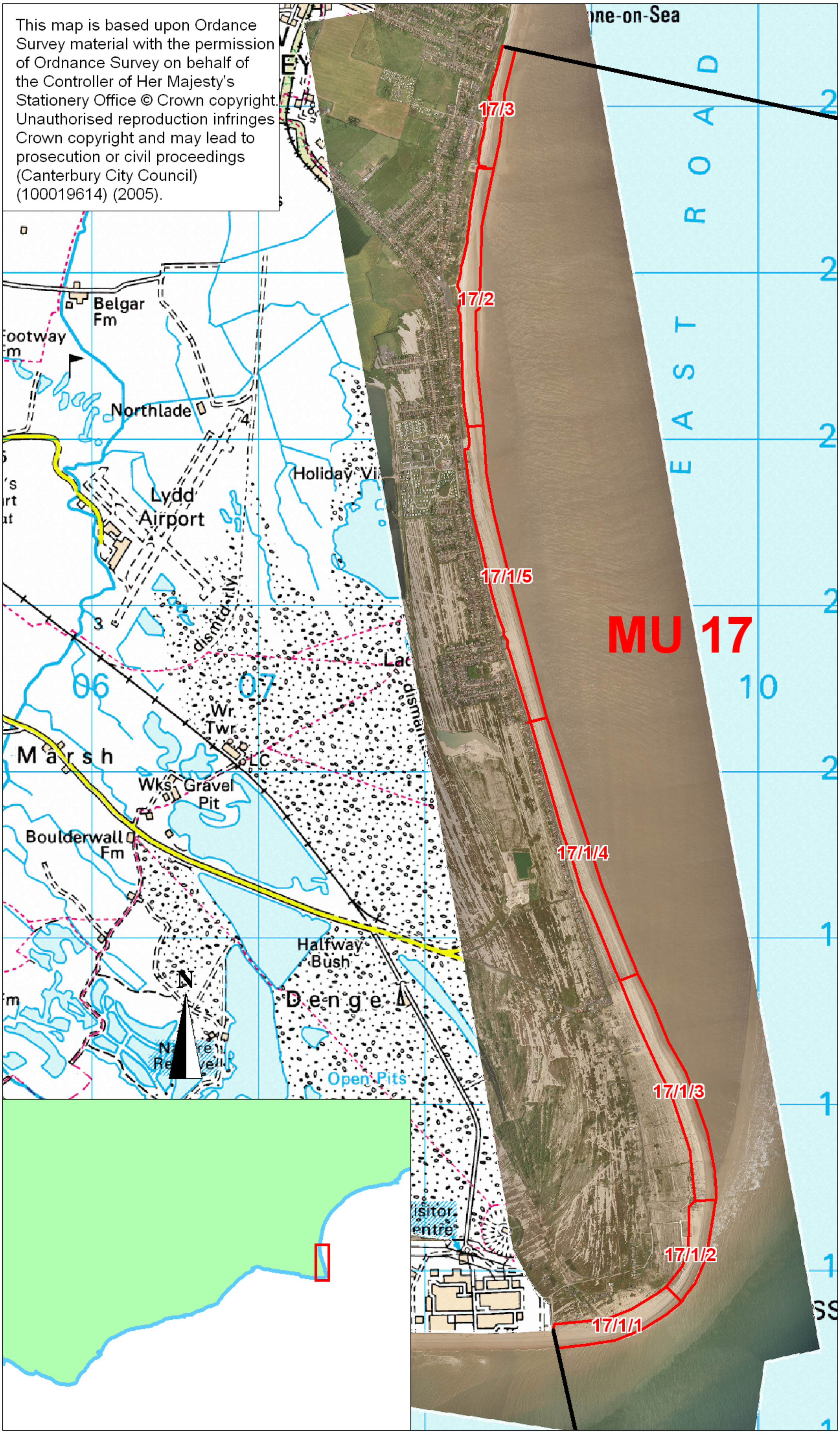
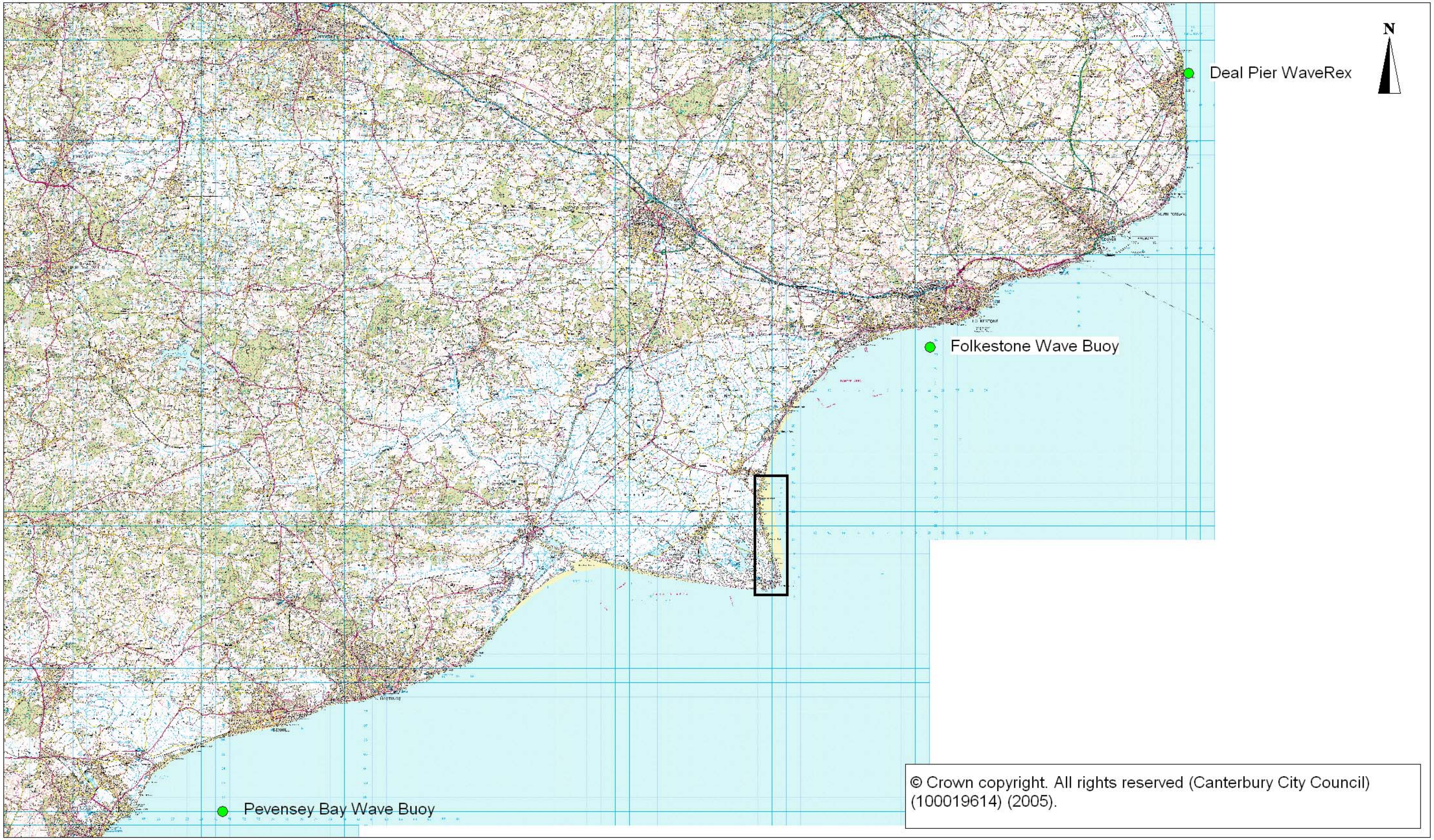



Fig. 1.1

SECG - MU17

Beach Management Plan Site - Frontage Overview






Beach Management Plan Site - Frontage and Hydrodynamic Data Locations SECG - MU17 Fig. 1.2

## 3. 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, as summarised in the Explanatory Notes (Annex A). The schedule of completed surveys since the commencement of the programme is shown in Table 3.1.

| Survey Period | Beach Profile | Beach Plan | Post-storm | Bathymetric |
|---|---|---|---|---|
| Summer 2003 | 28/07/2003 | | | |
| Autumn 2003 | 25/10/2003 | | | 11/11/2003 |
| Spring 2004 | 26/02/2004 | | | |
| Summer 2004 | 01/07/2004 | | | |
| Autumn 2004 | 26/10/2004 | | | |
| Spring 2005 | 10/03/2005 | | | |
| Summer 2005 | 02/09/2005 | | | |
| Autumn 2005 | 21/10/2005 | | | |
| Spring 2006 | 08/03/2006 | | | |
| Summer 2006 | 19/07/2006 | | | |

*Table 3.1 – Completed survey dates within MU17*

Digital Terrain Models (DTMs) of the 2003 Baseline topographic survey are shown in Annex B Figure 3.1, with Figures 3.2, 3.3 and 3.5 showing the 2004, 2005 and 2006 Beach Management Plan (BMP) surveys respectively, superimposed upon the ortho-rectified aerial photographs of 2005. The methodology for deriving DTMs is given in the Explanatory Notes.

Bathymetric surveys are shown in Annex C at Figure 3.4, with contours at 0.5m intervals. The survey extends a kilometre offshore and is scheduled to be repeated in 2006.

## 4. Difference Models

Now that sufficient data sets have been collected, it has been possible to overlay the results of the baseline survey with successive year's data. This enables comparative volumetric analysis to determine change over a given period. The combination of these 3-dimensional ground models and ortho-rectified aerial photographs allows visual representations of beach volume change within polygons incorporating the beach berm, face and toe. This is shown in Annex C Figures 4.1-4.4, with areas of accretion and erosion marked in blue and red respectively (note that 0.25m difference in elevation is considered as 'no change'). Figure 4.1 is the difference model of the 2004 survey minus the baseline survey (2003), Figure 4.2 is the difference model of the 2005 survey minus the 2004 survey, Figure 4.3 shows the 2005 survey minus the baseline survey, and Figure 4.4 is the most recent survey minus the 2005 survey.

Whilst these figures show an overall change in beach volume within each discrete section, it should be recognised that these data are based on the beach plan surveys, which are undertaken once a year (Table 3.1). The figures are only a snapshot in time of the region, and therefore the particular dynamics of each frontage need to be additionally considered. This will ensure that the information shown in the difference models represents the net change rather than capturing a particular extreme variation caused by a large event.

The remainder of this report section contains a narrative summarising the changes that have taken place over the last 3 years, and hypotheses of the processes driving these changes.

Also, to ensure that the results from the difference models are representative of the years change rather than a particular event that may have been captured by the survey, the difference models have been cross referenced with the other beach profile surveys (chapter 5) that have been carried out 3 times a year, thus providing an indication of seasonal beach variability.

A summary of the accretion/erosion rates seen throughout each individual section of MU17 are illustrated and detailed in Figure 4.0 and Table 4.0.

| | 2004-3 | 2005-4 | 2006-5 | 2006-3 | Error estimate |
|---|---|---|---|---|---|
| **17.1.1** | -6,593 | 65,320 | -9,150 | **49,577** | ± 3,216 |
| **17.1.2** | -17,918 | -21,554 | -9,163 | **-48,635** | ± 2,290 |
| **17.1.3** | 40,159 | 29,340 | 24,441 | **93,939** | ± 5,541 |
| **17.1.4** | 11,019 | 18,937 | 12,789 | **42,745** | ± 5,739 |
| **17.1.5** | 6,296 | 16,377 | 1,913 | **24,586** | ± 6,222 |
| **17.2** | -106 | 7,731 | -1,864 | **5,760** | ± 4,530 |
| **17.3** | 3,283 | 2,647 | -4,556 | **1,374** | ± 2,029 |
| | | | | | |
| ***Total*** | **36,140** | **118,798** | **14,410** | **169,348** | - |

*Table 4.0 – Annual and total beach volume changes (m³) from 2003 to 2006 in the 7 sections of MU17 shown in Figure 1.1. The expected error of volume calculations are based on a 30mm vertical survey error across the area of each section, although the error of combined surveys can be up to double this figure.*

## 4.1 Section MU17.1.1

Section MU17.1.1, located immediately east of Dungeness nuclear power station, covers part of a large recycling zone that stretches around the ness peninsula as far as The Pilot public house at the northern end of section MU17.1.3. Further details of recycling activities are explained in chapter 9.

Marked beach loss occurred in this section from 2003-2004 and 2005-2006, due to shingle extraction as part of a recycling programme. In the first survey year, the eastern half of MU17.1.1 'eroded', though the western half eroded in 2005-2006. Both these changes are thought to be as a consequence of recycling activities removing shingle from the beach face (Figure 4.1). Contrastingly, in 2004-2005, the difference models suggested MU17.1.1 accreted by the greatest volume of any section in MU17 since 2003. The cause of this accretion is uncertain (see chapter 9 for further discussion) though beach levels were raised by as much as 3.5m in front of the lighthouse in a single year. Though the beach face was exceedingly dynamic between surveys, the backshore remained very stable with no topographic change detectable from the difference models.

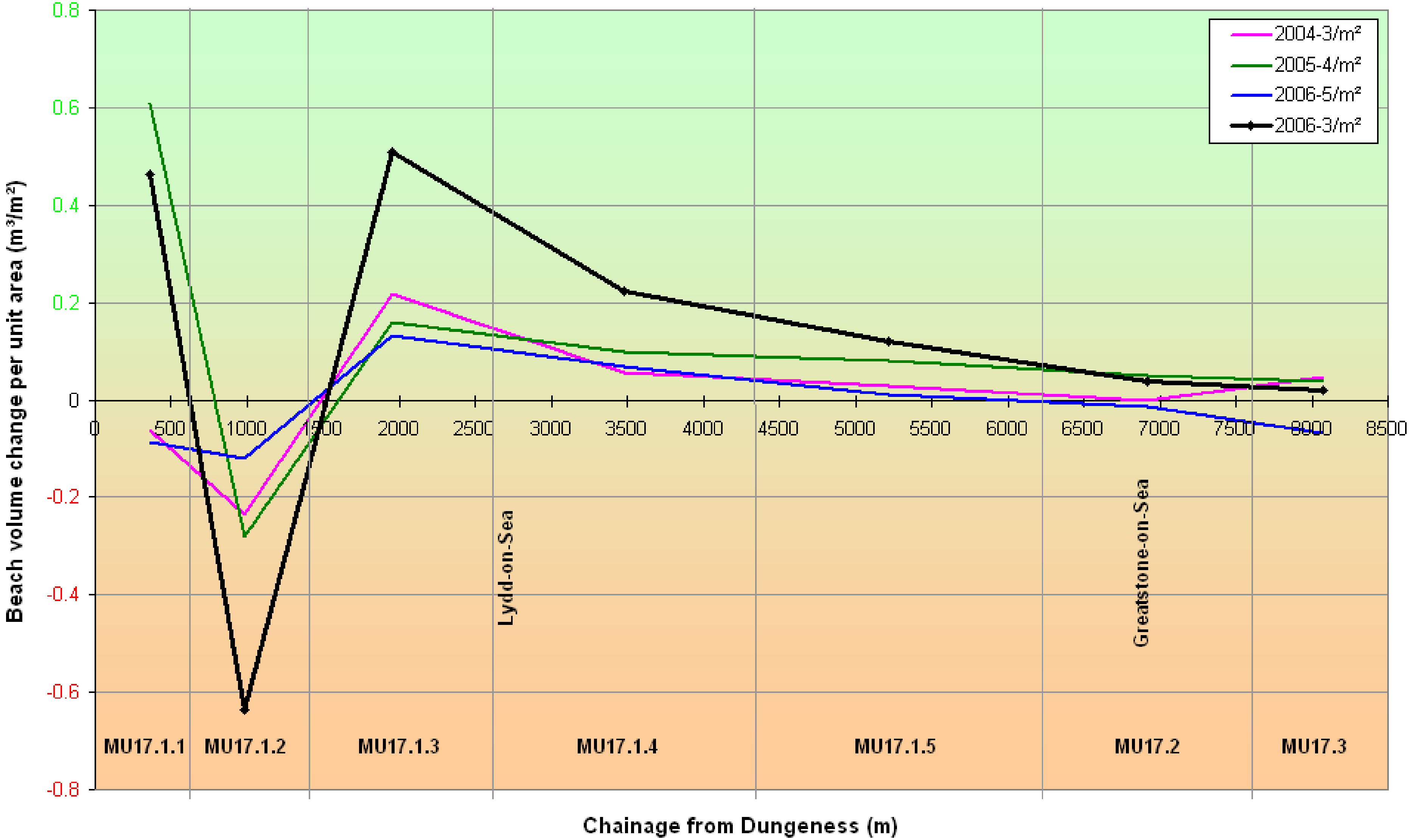



*Figure 4.0 – Beach volume change per metre square from Dungeness (chainage 0m) to Littlestone-on-Sea (chainage 8500m). Solid grey vertical lines represent section subdivision. Note that the approximate error expected through the use of RTK GPS is 0.03m. Therefore any annual change of more than 0.03m³/m² magnitude, roughly represented by the length of the tick marks on the x-axis, can be considered significant.*

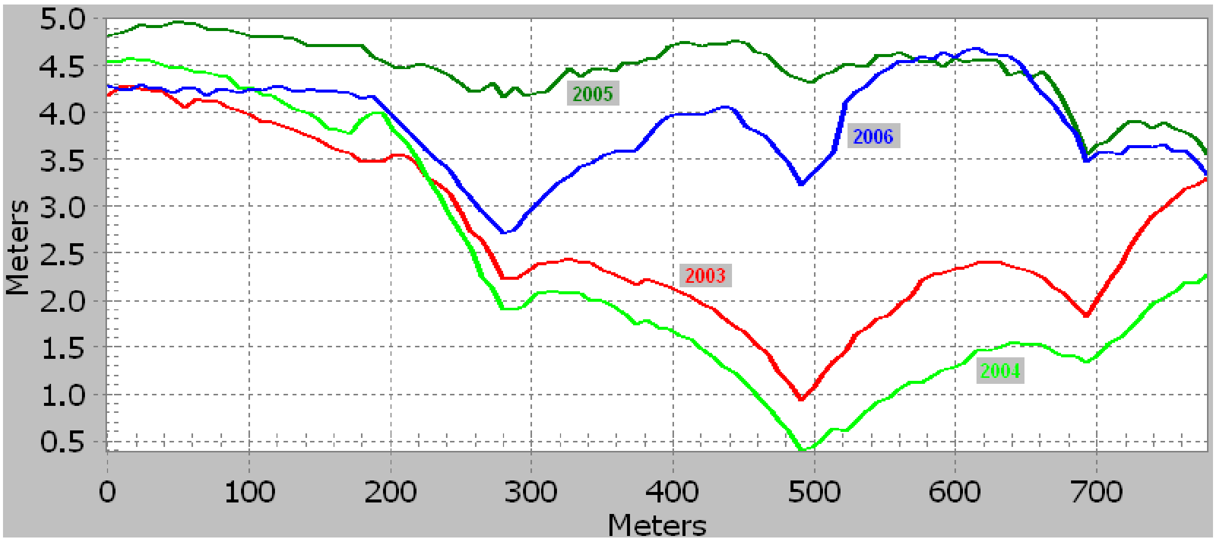



*Figure 4.1 – Beach levels in section MU17.1.1 extracted from beach plan models using a GIS. Each line represents the beach level along the same imaginary shore-parallel line running arbitrarily along the beach face (x-axis 0 metres is the western end of MU17.1.1, 780 metres is the eastern limit). Note the erosion in the east of the section in 2003-2004, the accretion the following year, and the erosion in the west from 2005-2006.*

## 4.2 Section MU17.1.2

The most 'erosive' section of the MU17 frontage was MU17.1.2. The difference models show that erosion has totally dominated this section, due to recycling programmes extracting shingle every winter since 2003. A comparatively large loss of beach volume occurred from 2003-2004 and 2004-2005 (17,918 and 21,554m³ loss respectively), though a loss of 9,163m³ from 2005-2006 still represents an average beach spot height change of 12cm over the entire area of the MU17.1.2 volume analysis polygon, emphasising the magnitude of the recycling schemes here. Beach loss from 2003-2005 occurred across almost the entirety of the beach face, though from 2005-2006 the loss of beach was slightly patchier with erosion focused in the west and eastern third of the section. Notably, no large area of beach accreted throughout the 3 years.

## 4.3 Section MU17.1.3

Section MU17.1.3 accreted by the greatest volume of any section over the 2003-2006 period (93,939m²). The northern boundary of the recycling programmes that influenced sections MU17.1.1 and 17.1.2 so greatly are unknown at the time of writing. The difference models suggest that mechanical extraction of shingle has not occurred in this section as large areas of beach loss, typical of sections MU17.1.1 and MU17.1.2, are not present here in any of the 3 survey years reported. However, an otherwise uniform shore-parallel band of beach accretion, present in all 3 year-on-year difference models, was interrupted by 2 small areas of erosion/unchanged beach topography, suggesting some anthropogenic influences to the beach (Figure 4.3). The 2003-2004 difference models locate these 2 small erosional zones in front of the lifeboat ramp and in front of an access road used by boats near the Anchorage beach cottages (profile 4c00737). Strangely, both these areas of erosion have moved north by 200m in 3 years, indicating beach movement by users of the lifeboat house and access road may not be the only cause of this erosion. Unfortunately, no anthropogenic beach movement logs exist to support this theory at present. It is also possible that the operation of the lifeboat and other craft is simply increasing the erosion potential of the beach here.

*Figure 4.3 – The 2004-2003 beach difference model is shown superimposed on the aerial photos of 2005. Located in yellow is the lifeboat house at the southern end of Lydd-on-Sea. Note how an otherwise constant band of accretion (blue) is interrupted by a small area of erosion in front of the lifeboat ramp (red), suggesting possible anthropogenic changes to beach levels.*

### 4.4 Section MU17.1.4

Accretion dominated beach plan difference models occurred over all survey years from 2003-2006 in this section at Lydd-on-Sea. The elevations over which accretion took place varied from year to year, but the total elevation range of the final 2003-2006 shore-parallel accretion bands (2-6m ODN) was consistent with the level of the beach face. Accretion rates were no greater than 0.5m/year at any elevation, and the maximum 2003-2006 rise was 1.0-1.5m at any location. In contrast, little beach volume change was apparent across the vegetated backshore or the beach toe.

### 4.5 Section MU17.1.5

The largest of all the MU17 sections stretches from the southern end of Greatstone-on-Sea to Lade. This area did not accrete as much as MU17.1.3 and MU17.1.4 to the south, yet the difference models showed that no area of beach has eroded significantly between summer surveys since the monitoring programme began. Instead, shore parallel bands of beach accretion were visible each year at 2.5-5m elevations, suggesting the beach face is the area of most beach volume change, significantly contributing to the 24,586m³ of accretion estimated from 2003-2006. The beach face between profiles 4c00668 and 4c00674 has accreted by as much as 1.5m in places since 2003, though the rest of the section experienced closer to 0.5m vertical beach face accretion. Beach plan surveys did not always cover the entirety of the vast beach backshore to Coast Drive, but it appears this area of the beach is very stable. Little measurable beach volume change was evident close to the beach toe or on the foreshore.

### 4.6 Section MU17.2

Section MU17.2 fronts Greatstone-on-Sea, and has accreted by 5,850m³ since 2003, a significant change despite the large area of this section (Table 4.0). Each yearly difference model showed marked beach movement in the northern half of the section, though the beach south of the seafront car park was very stable. Figure 4.0 highlights slight erosion in the

2003-2004 reporting year, which occurred in 2 bands at the elevation of lower beach face and beach toe in the most northerly third of the frontage. From 2004-2005, the volume of change of 2 erosive areas in the north (non-coincident with the year before) were offset by 2 shore-parallel zones of accretion further south. The following year, the north/south split of erosion and accretion was reversed; a large area of erosion across much of the lower beach face was the chief cause of erosion. Overall, from 2003-2006, a 0.5-0.75m drop in beach level at 3-5m ODN elevation along a 200m stretch in the far north of the unit was the largest concern here. However, a similar sized area of accretion at similar elevation appears to have compensated for this loss further south.

### 4.7 Section MU17.3

The most northerly section of MU17 has been the most stable since the monitoring programme began. The total beach volume change from 2003 to 2006 was only 1,374m³, well below the 2,029m³ that would be caused purely by a 30mm surveying error across the entire area of MU17.3. Notably, this was the only section along the reporting frontage that did not accrete/erode by more than a volume that could be caused purely by survey error, highlighting the lack of beach movement into/out of this section. Some beach transport within the section is evident, particularly in 2004/2005 when the northern third of the unit experienced erosion across the lower beach face, and the southern third accreted over similar elevations. The 2003/2004 and 2005/2006 periods were more stable, though the overall change from 2003-2006 shows erosion in the north and accretion in the south. This is probably caused by a gradual southerly drift of shingle that is impeded by the lifeboat station boat ramp and the outfall at Romney Sands (Figure 4.7). The Environment Agency clear the mouth of the outfall when required, though the timings of this are unknown. The erosion in the north of MU17.3 between Victoria Road and Littlestone Road occurred from 2 and 4.5m ODN, where beach levels have dropped by 20-50cm since 2004 (Figure 4.8). Additionally, beach levels here are at their lowest levels since 2003, according to the beach plan data.


*Figure 4.7 – Survey photos looking north from profile 4c00631 highlighting accretion in the south of MU17.3 from 2004 to 2006, probably caused by the outfall shown and the lifeboat station ramp situated to the south of these photos.*


*Figure 4.8 – Survey photos at profile 4c00620 looking north. The red arrows indicate the same groyne pile from different survey days with notably different levels of shingle submergence.*

## 5. Profile Change Analysis

A cross-sectional area (CSA) has been calculated for all beach profiles that are scheduled for survey 3 times a year. CSA is calculated as the area of a profile above a ‘Master Profile’. The lower boundary of the Master Profile is approximately equal to the level of the interface of the foreshore and the beach (this varies between –3.0 and 0.5m ODN along the MU17 frontage). 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. Graphs of the individual profiles plus the Master Profile are included in Annex F and on the CD attached to this report, as are the time series of change in CSA for individual profiles.

Figure 5.1 (Annex E) shows the locations of the profile lines, which are colour-coded to represent the change since the previous year (the method of calculation of change in CSA can be found in the Explanatory Notes, Annex A). Whilst much of the beach behaviour has been inferred from the beach difference models (section 4), the beach profiles also perform an important part in describing the way in which the beaches along the MU17 frontage have changed. Figure 5.1 (Annex E) gives an indication of the annual change in terms of actual and percentage change in CSA at that location.

These changes in CSA are comparable with the overall erosion and accretion trends that are depicted in the beach change models (section 4). However, because the profile surveys are carried out more frequently than the beach management surveys (Table 3.1), it is possible to gain a better understanding of the beach's behaviour throughout each year. The profiles give a more accurate representation of the cross-shore change in the beach and the following comments have been made based on inspection of the profiles.

### 5.1 Section MU17.1.1 (profiles 4c00757 – 4c00770)

Despite 2 recycling programmes that extracted shingle from MU17.1.1 in the winters of 2003 and 2005, all profiles within this section exhibit accretion-dominant CSA trends over time. The general pattern of CSA change is accretional except for these periods when shingle is mechanically removed from the beach. The difference models illustrated most beach movement occurs across the beach face and the backshore remains largely unchanged; this is reinforced by profile data as well.

### 5.2 Section MU17.1.2 (profiles 4c00746 – 4c00756)

Section MU17.1.2 has been used as an extraction site for a recycling programme over all of the 3 winters since the monitoring programme began. The 4 profiles in this section that are surveyed 3 times a year are all decreasing in CSA over time. However, annual reductions in CSA, coincidental with the timing of the winter recycling programme by the Environment Agency, are the chief cause of this downward CSA trend. Profiles actually often show notable accretional recovery post-winter until the next extraction of shingle reduces profile CSA once again. Recycling-induced beach loss has resulted in some recent profile CSA values lying at their lowest levels since 2003 (Figure 5.2).

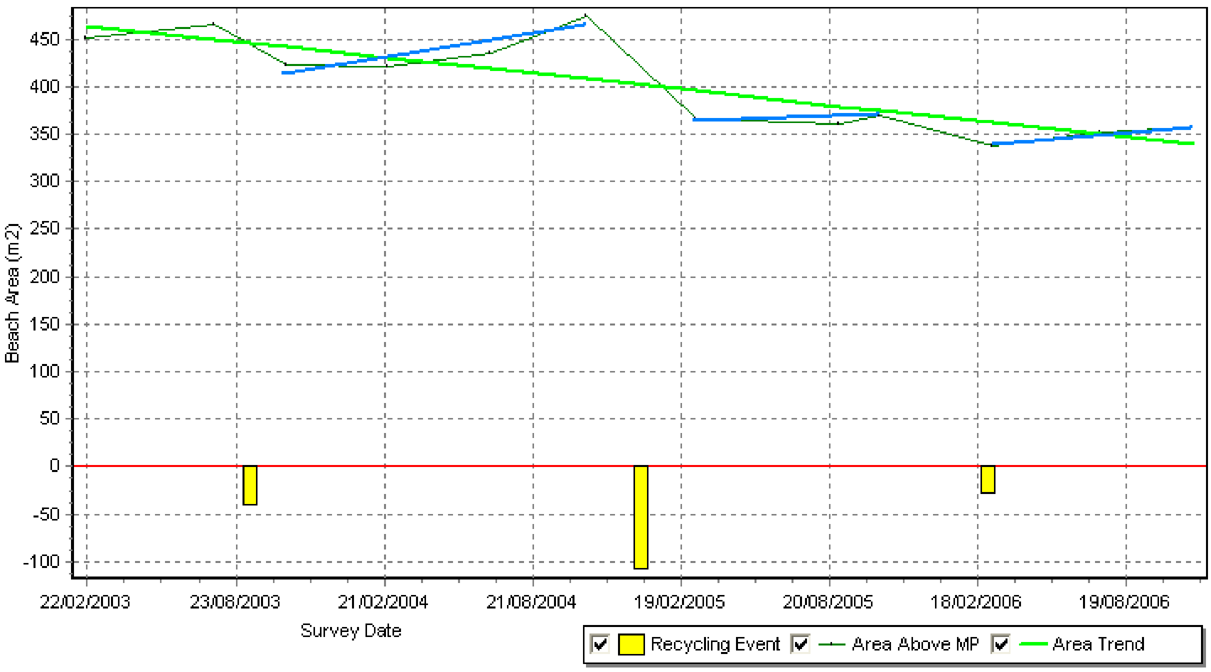



*Figure 5.2 – CSA trend of profile 4c00752 since the start of the monitoring programme. The influence of recycling events is clear from significant losses of CSA during the winters of 2003, 2004 and 2005. Note how the profile CSA actually increases between recycling events (blue lines) yet the effect of recycling has caused recent CSA levels to be amongst the lowest here since 2003.*

### 5.3 Section MU17.1.3 (profiles 4c00721 – 4c00745)

All profile CSA trends are generally accretional in section MU17.1.3. Over areas of the beach where the difference models showed accretion year-on-year, profiles here are accreting rapidly (e.g. 4c00722, 4c00731, 4c00740-743 are accreting at 20-50m²/yr CSA). The difference models also highlighted 2 areas of the beach topography remaining largely unchanged or even eroding, in front of the lifeboat house and an access road near profile

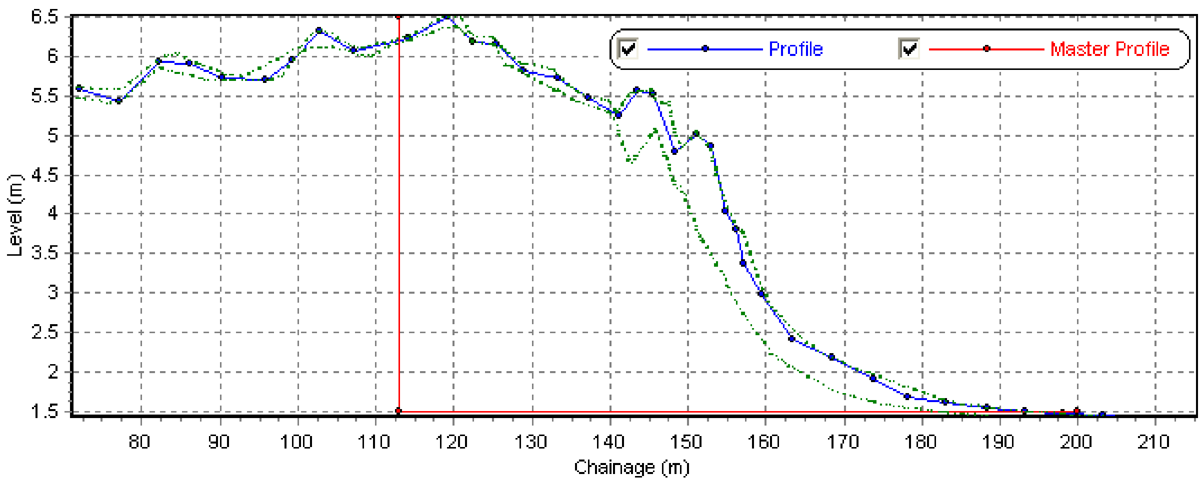
4c00737. In these areas, the rate of CSA increase is fairly variable and remarkably consistent with the patterns shown by the difference models. For example, profile 4c00737 eroded significantly from early 2003-early 2005 yet has accreted back to 2003 levels more recently. This is explained by an area of erosion migrating northwards away from this profile over the last 3 years, as shown by the difference models. Overall, this section remains significantly accretional, yet at these 2 aforementioned sites the profile CSA trend is fairly variable.

## 5.4 Section MU17.1.4 (profiles 4c00692 – 4c00720)

Accretion-dominated profiles throughout all of section MU17.1.4 confirm accretion shown by the beach difference models. Rates of CSA change are increasing between 2 and 15m²/yr, and at almost all profile locations the most recent survey in 2006 is at, or close to, it's highest level since such surveys began in 2003, especially across the beach face at elevations of 2-6m ODN. Most CSA data is fairly linear, suggesting similar rates of accretion continuing provided no major changes to the local sediment budget.

## 5.5 Section MU17.1.5 (profiles 4c00660 – 4c00691)

Most profiles within MU17.1.5 show a remarkably similar trend since the monitoring programme began. The difference models highlighted accretion across the beach face between 2.5m and 5m ODN, which is reflected in recent profile surveys appearing high in the profile envelope (see Annex F and Figure 5.5), particularly at these elevations. Such accretion has resulted in high rates of CSA increase over time in the northern half of the unit (5-15m²/yr), and more gradual yet consistent increases in the south (1-5m²/yr). The relative stability of the backshore and beach toe is also exemplified by profile surveys.



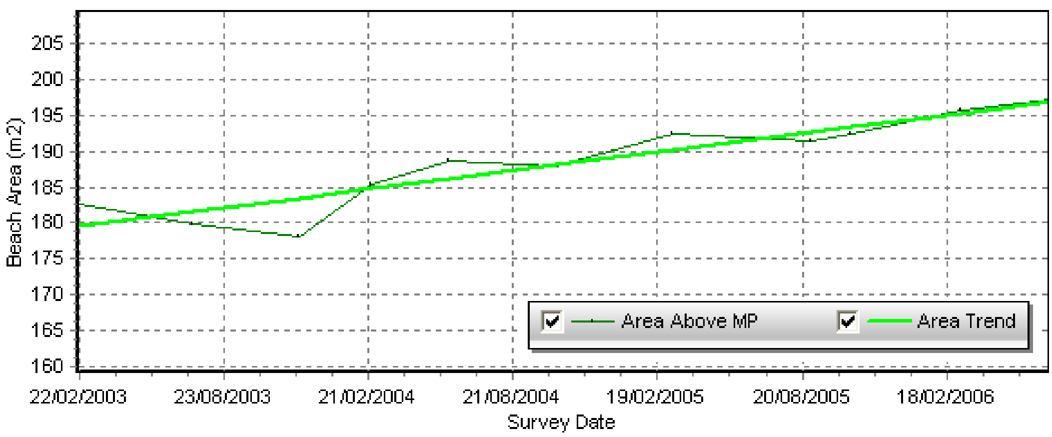



Figure 5.5 – Summer 2006 profile survey at profile 4c00674 (top). Note how this survey appears high in the profile envelope (dotted green line) illustrating the high elevation of the beach face compared to previous surveys. The stability of the backshore at this profile, and the increasing value of CSA of time (bottom), is also typical of profile trends in MU17.1.5.

### 5.6 Section MU17.2 (profiles 4c00633 – 4c00659)

Beach profile surveys show that the far northern end of MU17.2 has been slightly erosional since 2003. Recent profiles taken at 4c00635 and 4c00638 are at low elevations compared with previous surveys. Further south, the remainder of the section shows slight accretion trends with CSAs that do not fluctuate greatly from survey to survey. These beach change patterns are almost in agreement with the beach models that indeed show erosion in the far north, yet the profile analysis shows slight accretion that was not evident through beach model analysis, possibly because the overall accretion is so small.

### 5.7 Section MU17.3 (profiles 4c00616 – 4c00631)

The difference models showed this section was fairly stable compared to the rest of the MU17 frontage, with a narrow band of erosion in the north and accretion in the south. Profile CSA trends correspond well with this pattern, with parts of the beach face currently at their lowest levels since 2003 in the north (e.g. 4c0618), and the 2 most southerly profiles both accreting over time. The remainder of this section showed little CSA change from 2003-2006.

## 6. Wave Climate

Wave records are recorded by the Datawell Directional WaveRider located 1.5km offshore of Sandgate, Folkestone. Though the buoy has recorded wave information since July 2003, an onboard fault has meant data collected prior to March 2004 is erroneous. Furthermore, in late June 2004, the buoy was cut from it's moorings and not re-deployed until early October, resulting in a 3 month offline period.

A detailed report summarising recent wave results is attached in Annex G, with historical reports on the Regional Monitoring Programme website (www.channelcoast.org). In summary, the significant wave height ($H_s$) storm threshold of 2.5m was exceeded by 3 storms in the 2003/2004 survey year, 2 storms in the 2005/2006 survey year, though no storms exceeded this figure in 2004/2005. The largest storms originated from the south, south-east and easterly approach direction (Figure 6.1).

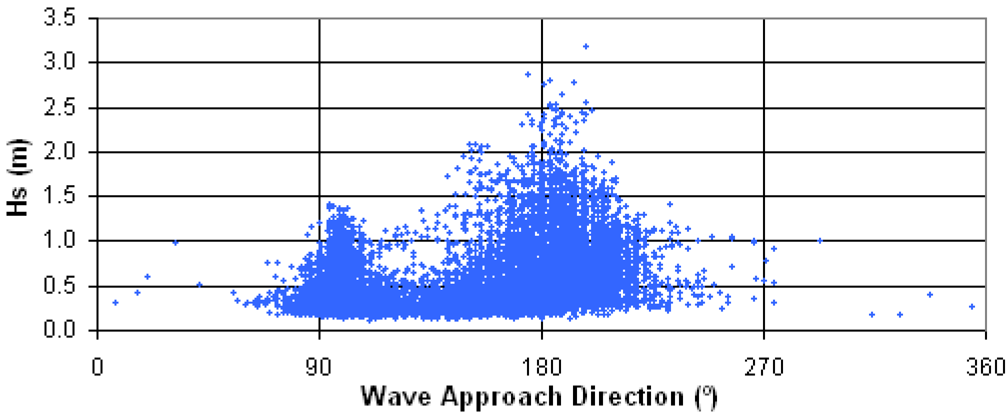



*Figure 6.1 – Relationship between wave approach direction and significant wave height ($H_s$) at Folkestone, based on data from March 2004-August 2005.*

## 7. Storm Event Performance

There were a number of storm events during the reporting period that exceeded the storm threshold, but no additional post-storm profiles have being taken. Procedures have now been put in place to allow early notification of storm threshold ascendance, thus allowing early mobilisation of survey contractors to collect post storm profile data.

Whilst the wave buoy at Folkestone can alert the existence of a storm, it is difficult to assess which areas of the coastline will have been affected. Local frontage managers can assist in this process by notifying the lead authority of any possible 'damage' to beaches so that survey contractors can be mobilised and the most beneficial data collected.

## 8. Performance Overview

### 8.1 Critical Beach Conditions

The strategic coastal monitoring project has no details of beach design conditions in any section of MU17. Although this report illustrates the accretion-dominant beach changes seen over the past few years, these increases in sea defence level cannot be compared to any particular standard.

### 8.2 Sediment Budget

It is difficult to reach any conclusions regarding the overall sediment budget of MUU17 with a high degree of confidence given the relatively short-term trends produced over a 3-year monitoring period. Additionally, no literature details expected rates of shingle loss/gain throughout this frontage. The shoreline management plan suggests a southerly sediment transport rate of 8,300m$^3$/yr which, given adjacent MU16's easterly drift estimate of 680m$^2$/yr easterly, seems a considerable underestimate as MU17 accreted by 168,480m$^3$ from 2003-2006, and by at least 16,000m$^3$ in any 1 year since 2003 (Table 4.0). These figures also include the removal of shingle used on the MU15-16 frontages, therefore the 'natural' accretion rate is probably much higher than 16,000m$^3$/yr currently.

Table 4.0 highlighted the magnitude of accretion overall in MU17 in 2004-2005 (118,798m$^3$) compared to a years previous (36,140m$^3$) or the year after (14,410m$^3$). It is uncertain if this is due to a smaller recycling operation to remove shingle from sections MU17.1.1 and MU17.1.2 being undertaken in this year, and/or if the Littlestone to St. Mary's Bay beach replenishment scheme, that was completed in 2003 immediately to the north of MU17.3 in MU18, has increased the sediment budget of MU17. A previous report by the regional monitoring programme (BMP0021) showed that MU18 accreted overall in both 2003-2004 and 2004-2005, and that losses of beach material in the south of the replenished area of MU18 were offset by accretion in the north. This suggests material is not necessarily drifting southwards from MU18 in great volumes. A lack of detailed recycling logs for MU17 (see chapter 9) also makes more sounds conclusions about the influence of shingle extraction on this unit difficult at the present time. The monitoring programme is currently attempting to obtain all recorded recycling logs relating to the Dungeness peninsula.

## 9. Coastal Works

### 9.1 Recycling

At the time of writing, the following recycling data has been submitted to the strategic monitoring programme:

- A review map of the south Kent area estimates annual recycling volumes to be removed from MU17 as 39,000m³/yr.
- Recycling logs for the winter of 2003 quote an extraction of 130,000m³ based on lorry capacities and the number of lorry loads used to transport shingle to between Broomhill and Jury's Gap, though this figure is believed to be erroneous.
- Recycling data for the above extraction, detailing lorry frequency throughout the recycling scheme. A figure of 43,500m³ is quoted in this document.
- Recycling logs for the winter of 2005, quoting an extraction of 38,000m³ based on lorry numbers and capacities to MU15 again.

Notably, there are no recycling logs for any shingle extraction destined for the power station in MU16, although shingle deposition details to MU16 have been submitted for the winter of 2005 only. The Environment Agency are gathering recycling data for the winter of 2004, and their continued feedback into recycling operations is vital for the understanding of beach movement shown by the beach model and profile surveys.

The description of recycling activities from MU17.1.1 and MU17.1.2 within chapters 4 and 5 is believed to be correct given the recycling information provided and the interpretation of the data gathered to date. For the most part, the description of recycling activities in this report concurs with the recycling information provided thus far. For example, major losses of profile CSA within an otherwise accretionary CSA trend in most winter months are seen as evidence of beach recycling. In the winter of 2003, the timings of these drops relative to surveys even suggest that recycling operations moved in a northeasterly along the beaches. It is, therefore, possible to draw fairly robust conclusions from the survey data that correspond with recycling logs provided.

Despite the agreements between recycling logs and beach changes suggested from survey data, some areas of MU17's beaches have been assumed to have been recycled despite recycling logs suggesting the beach has remained 'untouched'. The main assumption made in this report is that the major beach level changes in MU17.1.1 are indeed caused by recycling, even though recycling logs don't classify this section as a shingle extraction site. This assumption was made because profiles in MU17.1.1 show big drops in CSA over winters yet the CSA trend is otherwise linearly increasing. Had the CSA trend been more variable at other times of the year (and not linear) this might indicate winter drops in CSA were caused by storms, though this doesn't seem to be the chief cause of erosion here. Also, a linear increase of CSA between the winters of 2003 and 2005 suggests that the 65,320m³ of shingle accretion in 2004-2005 was due to natural processes, and not recycling that would have been shown by a single 'jump' upwards in CSA.

A summary of the perceived recycling scheme boundaries on the ness peninsula from 2003-2006 is:

- In the winter of 2003, recycling stretched through the entirety of MU17.1.2 and most of MU17.1.1.
- In the winter of 2004, recycling stretched through all but the northern tip of MU17.1.2, but did not extend to MU17.1.1. This would explain the great accretion seen in this section compared with marked erosion a year previous and a year after (Table 4.0, and Figure 9.1).
- In the winter of 2005, recycling extended through almost all of MU17.1.1 and MU17.1.2.


*Figure 9.1 – Perceived recycling boundaries on the ness peninsula (MU17) from 2003-2006 (green, yellow and blue lines), superimposed on the aerial photos from 2005 and the difference model showing accretion in section MU17.1.1 and erosion in section MU17.1.2 from 2003-2006.*

### 9.2 Replenishment

No beach replenishment schemes have influenced the MU17 coastline directly. The Littlestone-on-Sea to St. Mary's Bay sea defence scheme completed by Jacobs Babtie in 2003 is located immediately to the north in MU18.

## 10. Conclusions

Since the start of the monitoring project in 2003, 2 of 7 sections of the MU17 frontage have undergone annual recycling, often without detailed recycling logs to compliment the impact of such works on the beaches. This makes the analysis of beach change somewhat complex as natural processes and anthropogenic influences have altered the beach simultaneously.

As a whole, the MU17 frontage has accreted by approximately 36,000m$^3$ from 2003-2004, 119,000m$^3$ from 2004-2005, and 14,000m$^3$ from 2005-2006. It is thought that the comparatively large accretion in the 2$^{nd}$ survey year is due to a smaller recycling programme that did not extract as much shingle to nearby management units as in the 1$^{st}$ and 3$^{rd}$ survey years. Nevertheless, the fact that the management unit still accreted by such magnitude even with shingle extraction taking place highlights the shingle accretion that occurs within this frontage. The origin of this material is uncertain, though the convergence of longshore shingle transport southerly in MU17 and easterly from MU16 is likely to aid shingle accretion. Nevertheless, large volumes of beach material are not being lost from MU18 (Littlestone–Dymchurch) according to a previous beach management report (BMP0021) or from MU17. This might suggest the easterly longshore drift direction through MU16 is the chief cause of shingle input to the ness peninsula, though the shoreline management plans quote the sediment transport rate as only 680m$^3$/yr here.

At this early stage of the regional coastal monitoring programme, the overall pattern of beach erosion and accretion is: i) slight erosion at the far northern end of MU17.3 where some beach levels are at their lowest elevations since 2003 ii) a pattern of increasing accretion towards Dungeness as far as the recycling extraction zone, with the beach difference models showing accretion across the beach face, and profiles showing trends of increasing CSA at almost all profiles iii) a variable section of beach in the far south of the unit where recycling takes place, with beach levels dependent on recent recycling activities. More detailed intra-section beach movement is described in chapters 4 and 5. Every section of MU17, other than MU17.3 in the far north, accreted or eroded by a magnitude greater than can be explained purely by surveying error. The patterns of overall beach movement depicted in this report, therefore, are not caused purely by the method of survey, and there was good agreement between beach movement portrayed by the difference models and the beach profile surveys.

Given the erosion-dominant beaches of MU15 and MU16, the current policy to recycle shingle from MU17 seems appropriate, provided that ecological impacts on the beach and surrounding area are not detrimental. Assuming the interpretation of currently available recycling data within this report is correct, this process is sustainable at its current rate. However, the beach within MU17.1.2 is at its lowest level since 2003 due to continued annual extraction of shingle, whereas neighbouring MU17.1.1 and MU17.1.3 are at their highest levels since 2003. There is potential, therefore, to shift recycling operations to other areas if the quality of sea defence provided by the beach is inadequate. Unfortunately, no beach design conditions are available to quantitatively show any areas of beach weakness.

Five storms exceeded the storm threshold at the Folkestone Wave Buoy within the reporting period. However, no post-storm surveys have been taken on this frontage since the monitoring programme began.

It is important to recognise the changeability of short-term trends. As with many coastal areas, much annual variability is expected, thus drawing conclusions with increased confidence will become possible as more data is collected. It is likely that the substantial overall accretion seen from 2003-2006 will continue if similarly sized recycling schemes as those seen in recent years prevail.

Scheduled future monitoring includes profile surveys in the spring of 2007. Storm surveys may be carried out if any event is deemed to have significantly affected the frontage. An interim report will be issued during the coming months, with the next BMP report scheduled for issue after completion of the Summer 2007 beach plan survey. All historic monitoring data is available at www.channelcoast.org, and future surveys will be obtainable after satisfying the projects quality assurance procedures.

## 11. References

Shoreline Management Plan (2000). *Beachy Head to South Foreland, Shoreline Management Plan Consultation Draft*.