

## **Summary Report on Woolli Coast-Cams for 2013-14**

### **Executive Summary**

#### **Introduction**

This is a summary of the second annual report from Dr. Shaw Mead of eCoast on results produced by the automated camera system monitoring changes in the southern part of Woolli Village beach. CCPA set up the system as an initial step in addressing a lack of detailed data about Woolli beach and the processes that shape it. The system will provide information that can contribute to an evidence-based long term beach management and protection strategy for Woolli.

#### **Objectives**

The primary objectives in this second year were to:

- To measure changes in the average width of the beach compared to last year and
- To confirm the accuracy of the coast-cam system and the quarterly beach surveys by comparing their findings taken on the same dates. The quarterly beach surveys provide a record of the changes to the beach's height and volume of sand.

Other valuable objectives for which the system can be used (subject to available funding) are listed in the Full Report.

#### **Results**

The camera system's headline results for this second year of the systems operation are:

- That the overall beach width grew (or accreted) over the 16 month period from March 2013 to July 2014. This overall trend of beach accretion also happened over the 28 month period from March 2012 to July 2014. That is, the rate of beach growth over the recent 16 months more than offset the erosion over the prior 12 months
- There is good agreement in beach growth between the data from the camera system and that from the beach surveys.
- The camera system was operational for approximately 95% of the time compared to 85% in the first year.

# 1 Introduction

This report describes the findings of the analysis of 16 months of coast-cam image data collection between March 2013 and July 2014, and follows on from the previous analysis (March 2012 to March 2013 (Mead and Atkin, 2013)). The coast-cam system is comprised of 3 high-resolution cameras atop the Wooli water tower and is detailed in Mead (2012). The primary purpose of this data capture and analysis is the development of a long-term continuous dataset monitoring the width of Wooli beach. Prior to the initiation of the coast-cams, only very sparse data on the beach were available in the form of historical aerial photographs that represented only snapshots of the beach and provided little if any information with respect to the patterns of beach change and how the beach responds to particular events. Wooli Beach is over 7 km long. This dataset provides hourly images each day along a stretch of Wooli Village Beach some 420 m long from the school to the most-southern houses.

Our analysis of this data is focused on measuring fluctuations of the high tide position on a daily and monthly basis. This is because the high tide mark is a useful proxy for the width of the beach at any one time. Although there are a number of variables that effect the location of the high tide mark (neap versus spring tidal phase, barometric pressure, wave set-up, wind set-up, wave height and period, etc.), these variations are seen as 'noise' in the data and do not significantly change the overall trends. In addition, the quarterly beach survey data for the area has been compared to the camera data captured on the same dates to compare trends and consistency between the 2 datasets.

## 2. Detailed Results

Each day the three cameras (north, central and south) each took a photo every hour during daylight. From these photos twelve measurements were taken spaced along the 420 m of beach being monitored. These measurements included the average-width of the beach plus the minimum and maximum widths.

The results from analysing these measurements are:

- On average the beach was wider this year (2013-14) than last year. It was also more volatile with a narrower-minimum-width and a broader-maximum-width than the previous year (refer to the full report for detailed measurements)
- The northern camera captures the large erosion/accretion events through into the winter of 2013, as well as events of similar magnitude in spring and early summer of 2013/2014. However, the usual seasonal variation, with the beach most eroded in the late winter months and most accreted in late summer is not as evident as the previous year. By August 2013 the beach recovered to higher volumes than the summer of 2013 and continues to fluctuate around an overall accretionary trend. Following a relatively active period of erosion and accretion through March and April 2014, the beach was relatively stable, but for an erosion event that recovered relatively quickly in early July.
- Similar trends can be seen in the central and southern data. However, the magnitude of the erosion/accretion events is less in the centre and less again in the south; i.e. there is a similar trend of erosion/accretion along the whole monitored area, rather the variation between the 3 parts observed in the previous year (Mead and Atkin, 2013).
- When the whole dataset back to March 2012 is considered (i.e. 28 months), there has been an overall trend of accretion, which has been greatest in the northern area (16- 22 m), lowest in the southern area (2-6

m), and in between in the central area (11-18 m); i.e. the monitored area has a trend for increasing accretion rates moving from south to north. The general accretion trend is summarised in Table 3.2. In comparison, the daily data for the previous year (i.e. March 2012 to March 2013) indicated that the beach had undergone erosion over the period.

**Table 3.2. High-tide beach positional changes (accretion) calculated from all transects for each area for the full 28-month dataset and the associated annual rate of accretion.**

	Range (m)	Average (m)	Annual rate (m/yr)
North Camera	16-22	18.67	8
Central Camera	11-18	13.2	5.7
Southern Camera	2-6	4.5	1.9

- The daily beach position data for the past 28 months has highlighted two particular issues that relate to the need for long-term daily beach monitoring in order to determine long-term trends. The first is that sporadic measurements of beach position (e.g. historical aerial photograph analysis) can easily misrepresent the actual erosion/accretion trends. For example, in the space of one day the beach can erode or accrete over 30 m (note, accretion does not always immediately follow erosion, and vice versa. In addition, there are seasonal trends and longer term climatic variations (e.g. ENSO and IPO) that can bias observations with sporadic and long (decadal) spacing. Secondly, that a short data set is not a good indicator of long-term erosion/accretion trends, as shown by considering the March 2012-2013 12 month dataset to the full 28 month data set.
- Monthly results follow those presented for the daily measurements. They also show that the beach fluctuations are not constant changes both on-offshore and alongshore, i.e., there is variability along the length of each area. Such variability is usually driven by the morphology of the near-shore bars and the consequent feedback that can lead to temporary stability and relatively large perturbation in comparison to the offshore features (e.g. Coco and Murray, 2007). Of note are the very large beach cusps (sand ridges and valleys along the beach) in May 2013 and April/May 2014.

### **3 Comparison to Quarterly Beach Survey Data.**

The quarterly beach survey (conducted by surveyor Brian Saye) included profiles S12-S18 which fall within the field of view and area of measurements of the water tower cameras (Figure 4.1). Although the beach profile data do not provide the kind of information on beach position changes on a daily basis and in response to particular combinations of wave, tide and wind events, they provide valuable information with respect to the volumetric distribution of sand on the beach (rather than only a 2-dimensional/horizontal beach position), and also long-term trends with continued monitoring and the development of a long-term dataset.

By comparing the date of the beach profile surveys with the high-tide beach location for the camera image of the same date, a general trend of accretion and seaward transgression of the beach berm is found in the camera image data. This trend is broadly replicated in the beach profile data, along with several additional features.

One of the most obvious features is the increasing height of the fore dune/back beach along this stretch of the beach monitored by the cameras. This is attributed to the continued accumulation of wind-blown sand due to the plantings, sand fences plus the flood debris bulldozed to the back of the beach.

Another feature of beach evolution present in the beach survey data is the large increase in the volume of sand above means sea level (MSL), which is similar to the Australian Height Datum (AHD). In the northern area of the video-monitored stretch of beach, the beach height has increased by up to 2.0 m over the 15 month period. The increase in beach height above MSL decreases moving southward along the monitored stretch. However, in the southern area, the beach height increase extends to the low tide mark, and so represents a similar to greater volume of beach accretion (i.e.  $\sim 30 \text{ m}^3/\text{linear metre of beach}$ ). In the northern area, the beach below MSL is steeper in June 2014 than it was in March 2013, the latter of which was a period of aggressive erosion due to a series of late summer storms.

## Looking to next year

It is recommended that next year's report should:

- Continue to monitor changes in beach width
- Continue to compare results between coast-cams and the beach surveys
- Look for opportunities to add extra value by analyzing the impact of major events (e.g. a shift to El Nino or the occurrence of a major storm) should they occur.