Justification of Project

- In the mid 1800's Lady Bay was a booming port and there was a need for development for better shipping access.
- Evidence of shoreline change however, difficult to quantify.
- Remote sensing provides cost effective method to quantify shoreline change using historical imagery.(Kuleli et al. 2011).
- Providing the opportunity to assess the impacts of man made structure in a coastal environment, following the construction of the breakwater.

Aims/Objectives

- To quantify shoreline change in Lady Bay between 1853 and 2007 across a 154yr period.
- Observe any trends occurring in shoreline change between 1853-1870, 1870-1909, 1909-1948, 1948-1994, 1994-2007.
- Determine siltation fluxes surrounding major historical engineering events.

Hypothesis & Expected Outcomes

- It is expected that sediment deposition processes in Lady Bay have increased due to the construction of the breakwater and the closing of the viaduct; and by analyzing historical time series it will enable quantification in the varying rates of shoreline change.

Study Site

- Lady Bay, Warrnambool, Victoria, Australia (38°38' S 142°48'E).
- Area 16km^2
- Coastal engineering (changes) on the south western area of the harbor.

Timeline of Major events

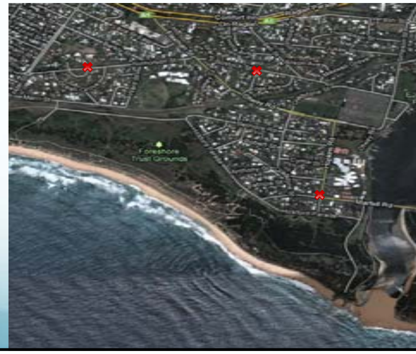
1840	• First settlers arrive in Warrnambool
1853	• First survey of Lady Bay by Captain John Barrow
1870	• Detailed survey of Lady Bay by Stanley
1874	• Construction of Breakwater by Sir John Coode approved by government.
1879	• Halt in construction of breakwater and revised plan to build timber viaduct instead.
1890	• Completion of Breakwater
1915	• Extension of Breakwater
1930	• Closing of Viaduct

Methodology

- Collecting of maps and Aerial images
- Georeferencing and collection of RMS
- Drawing of shorelines
- Casting of transects on
- Shoreline analysis

Step 1: Georeferencing and collecting RMS

- (before georeferencing occurred all maps and aerial images were projected to GDA 94 zone 54)



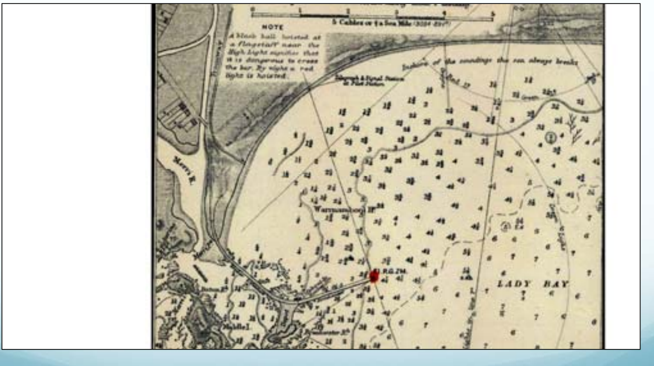
Barrow 1853

1853 RMS = 6.63

Stanley 1870

1870 RMS = 9.34

Stanley 1909



1909 RMS = 18.75

Aerial 1948

1948 RMS = 6.63

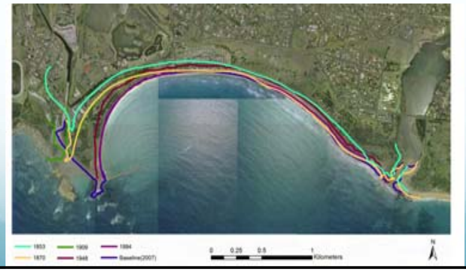
Aerial 1994

1994 RMS = 8.56

Aerial 2007

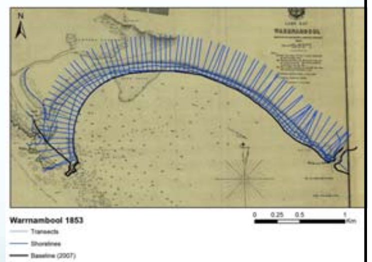
Step 2: Drawing of shorelines

- DSAS downloaded and installed onto ArcGIS
- A personal geodatabase was created in ArcCatalogue.
- 6 polylines were created to represent each shoreline
- Using the polyline tool in ArcMap the high tide mark of each shoreline was outlined.



Step 3: Casting of transects on DSAS

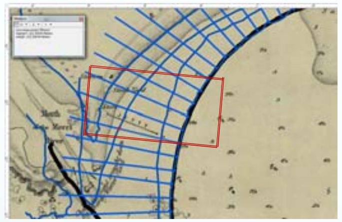
- Upon completion of individual lines, these were all appended to one single file
- Input of metadata.
- Transects were cast.
- Shorelines were clipped and ready for statistical analysis.



Step 4: Shoreline analysis

- 5 cast transects, 50m apart in the western zone were used to quantify shoreline change.
- Total distance between 1853 – 2007 (154 years) along the transect line to calculate the overall shift in shoreline.
- Average rate of change between each time series: 1853-1870, 1870-1909, 1909-1948, 1948-1994, 1994-2007.
- Linear regression rate for overall shoreline change over time.

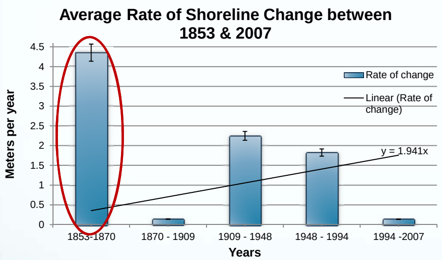
Results



Date	Years	Meters	Average rateof shoreline shift/yr
1853 - 1870	17	74.0	4.3
1870 - 1909	39	5.4	0.1
1909 - 1948	39	87.6	2.2
1948 - 1994	46	83.9	1.8
1994 - 2007	13	1.8	0.1

- Total shift in shoreline of 299m along the first transect.
- The table below is a summary of the data that is projected in the graph.
- It indicates the number of years between each time series, the number of meters and their corresponding sediment accumulation rates.

Results



Greatest rate of change between 1853-1870, average shoreline shift was 4.354m/yr.

Spike in shoreline change between 1909 & 1948; 2.247m/yr, due to the closing of the viaduct.

Discussion

- Drastic seaward movement of shoreline ~299m between 1853 and 2007 along cast transect line.
- Greatest rate of change occurred between 1853 & 1870, but some questionability of the map.
- Closing of the viaduct had a significant impact as wave system is reversed and sediment is no being transported in and out of the bay (Gill 1984).
- van Rijn (2004) construction of structures perpendicular or oblique to the shoreline will lead to sedimentation on the updrift side of the structure due to the blocking of sediment transport.

Conclusions

- Closing of the viaduct increased siltation to the lee of the breakwater.
- Therefore for future coastal engineering projects, coastal management; we must take into consideration the geographical morphology of the bay and have an understanding of sediment transport processes within the given area. Thus minimising side effects such as sand trapping/deposition, sand starvation and downdrift erosion.
- Future research – use of historical imagery across this same 154yr time period combined with bathymetry in this location may give greater insight into 1853.

Acknowledgements

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References

- Gill, ED 1984, '*Coastal Processes and the Sanding of Warrnambool Harbour',* Warrnambool Institute Press, Warrnambool.
- Kuleli, T, Guneroglu, A, Karsli, F & Dihkan, M 2011 'Automatic detection of shoreline change on coastal Ramsar wetlands of Turkey', *Ocean Engineering*, vol. 38, pp. 1141–1149.
- Van Rijn, LC, 2004, 'Estuarine and coastal sedimentation problems. Proceedings of the ninth international symposium on river sedimentation', Yichang, China, pp. 105-120
- Warrnambool City Council 2011, *Port of Warrnambool-Safer Boating and Harbour Facility Study*, Quality Systems, Victoria