

22 November 2007

Peter Fagan  
Project Manager  
Aspen Living  
Level 5  
33 York Street  
SYDNEY NSW 2000

email: [peterf@aspengroup.com.au](mailto:peterf@aspengroup.com.au)

Dear Peter

**Re: Fern Bay Seaside Village**

As requested we have reviewed Coastal Zone Management aspects of the proposed additional stages to Fern Bay Seaside Village in regard to location of the 100 Year Hind Dune Hazard Line on the landward of the Stockton Bight mobile sand dune system and the 100 Year Coastal Hazard Line.

In 1992 Australian Water and Coastal Studies (AWACS) was commissioned to undertake a series of studies to determine the Hind Dune Hazard Line and the Coastal Hazard Line. These studies were based on information that was available at the time regarding recession rates of the foredune and transgression rates on the hind dune. The studies included a determination of coastal hazards for 30 year and 100 year planning periods.

**1. 100 Year Coastal Hazard Line**

The results of the AWACS (1992) studies in regard to delineation of the Coastal Hazard Zone are summarised in **Table 1** and shown on Figure 4.2 (see **Attachment 1**) which has been extracted from the AWACS (1992) report.

**Table 1 – Coastal Hazard Zone Widths**

Hazard Zone Component	Coastal Hazard Zone Widths (m)	
	30 Year Return Period	100 Year Return Period
Beach Recession	36	120
Storm Cut	20	20
Greenhouse Effect	14	60
<b>Total</b>	<b>70</b>	<b>200</b>

The above assessment was based on an average beach recession rate of approximately 1.2 metres per year and sea level rise of 0.6 metres over the 100 year planning period.

**Beach Recession**

In 1995 the then Department of Land and Water Conservation (DLWC) undertook detailed photogrammetry of a 4.9 kilometre long section of the Stockton Bight mobile dune system. The area analysed extended approximately 2 kilometres south and 2.9 kilometres north of the eastern corner of Fern Bay Seaside Village land. The analysis included the development of shore normal

cross-sections at 50 metre intervals along the 4.9 kilometre section of Stockton Bight. The cross-sections extend from the low water mark on the coastal edge of the mobile dune system landward past the vegetated section to the west of the mobile dune system. Photogrammetry included analysis of aerial photos for the periods 1954, 1965, 1972, 1975, 1977, 1983, 1990 and 1994. The analysis generated 98 cross-sections in total with the Fern Bay Seaside Village land being located adjacent to approximately Cross-sections 25 to 50.

Analysis of DLWC's 1995 photogrammetric data was undertaken as part of the "Extension of Rutile and Zircon Mining 'Fullerton Project' EIS" prepared by Umwelt in 2000. The location and extent of the cross-sections are provided on Figure 5.11 of the EIS (Umwelt 2000) (see **Attachment 2**). Typical changes in dune cross-section for the period 1954 to 1994 are shown on Figure 5.12 of the EIS (Umwelt 2000) (see **Attachment 2**).

Using the 98 cross-section derived by DLWC (1995) the location of the 1.5 m AHD contour along seaward edge of the mobile dune system was derived for each of the eight periods analysed. The location of the 1.5 m AHD seaward contour which is approximately the High Water Mark in 1954 and 1994 is shown on Figures 5.13 and 5.14 of the EIS (Umwelt 2000) respectively (see **Attachment 2**).

As can be seen from Figures 5.13 and 5.14 (see **Attachment 2**), DLWC's detailed photogrammetric analysis indicates the High Water Mark (1.5 m AHD contour) in the location of Cross-section 25 to cross-section 50 has moved approximately 50 metres to 60 metres seaward of its 1954 location. This analysis indicates that rather than receding at an average rate of 1.2 metres per year as was assumed by AWACS (1992) (see **Table 1**), the beach was prograding at an average rate of approximately 1.25 to 1.5 metres per year. This analysis indicates that the beach recession component of the 100 year planning period Coastal Hazard Zone width listed in **Table 1** would be significantly less than the 120 metres used by AWACS (1992).

### **Greenhouse Effect**

Recent estimates of the Intergovernmental Panel on Climate Change (IPCC) (2007) for sea level rise over the 110 year period (1980 to 1990 relative to 2090 to 2099) range from 0.18 metres to 0.59 metres. The upper bound of this range is consistent with 0.6 metre used by AWACS (1992) in determining the sea level rise component of the Coastal Hazard Zone width set out in **Table 1**. As a result it is concluded that the sea level rise component of the Coastal Hazard Zone width would be equivalent to or less than that assumed by AWACS (1992).

### **Conclusion**

Based on the above analysis it is considered that the 30 year and 100 year return period Coastal Hazard Lines would be seaward of the respective lines shown on Figure 4.2 of AWACS 1992 (see **Attachment 1**).

## **2. 100 Year Hind Dune Hazard Line**

The results of the AWACS (1992) studies in regard to Hind Dune Hazard Zone Width are summarised in **Table 2** and shown Figure 4.2 (see **Attachment 1**) which has been extracted from the AWACS (1992) report.

**Table 2 – Hind Dune Hazard Zone Widths**

<b>Hazard Zone Component</b>	<b>Hind Dune Hazard Zone Widths (m)</b>		
	<b>0 year</b>	<b>30 Year Development Period</b>	<b>100 Year Planning Period</b>
Historic Transgression	0	95	320
Long Term Wind Climate	0	15	50
Nuisance Inundation/Safety Zone	50	50	50
<b>Total</b>	<b>50</b>	<b>160</b>	<b>420</b>

The historic transgression component of the Hind Dune Hazard Zone width determined by AWACS (1992) was based on an average dune transgression rate adjacent to the Fern Bay Seaside Village land between 1951 and 1983 of 3.2 m/year.

Analysis of DLWC detailed photogrammetry of the dune transgression between 1954 and 1995 indicates that the average rate of landward progression of the mobile dune system adjacent to Fern Bay Seaside Village land (i.e. between Cross-section 25 and Cross-section 50 of the DLWC analysis) for the period 1954 to 1994 was approximately 3 metres per year with the average rate of landward progression between 1983 and 1994 reducing to approximately 2.3 metres per year.

Detailed photogrammatic analysis by DLWC (1995) indicates that the landward toe of the mobile dune system in 1994 was at the eastern corner of the Pt Lot 5 DP 270466 (i.e. Fern Bay Seaside Village land). On 16 November 2007 the landward toe of the mobile dune system was re-surveyed by Fagan Mather Duggan Surveyors (see **Attachment 3**). This survey shows that the toe of the dune system is now approximately 20 metres to east of the corner of Pt Lot 5 DP 270466 indicating that the edge of the mobile dune system is now approximately 20 metres seaward of its 1994 position. This indicates that the landward progression of the mobile dune system at this location has stopped.

Combining the detailed DLWC 1995 photogrammetry and the November 2007 Fagan Mather Duggan Surveyors survey (see **Attachment 3**), the average landward rate of dune transgression between 1954 and 2007 is approximately 2 metres per year. On this basis the Historic Transgression component of the Hind Dune Hazard Zone width set out in **Table 2** would reduce by 120 metres from 320 metres to approximately 200 metres. As a result the total 100 year Planning Period Hind Dune Hazard Zone width would reduce from 420 metres as determined by AWACS in 1992 to 300 metres.

As shown on **Attachment 3** the eastern edge of Stages 7 and 8 of Fern Bay Seaside Village is approximately 325 metres north-west (i.e. shore normal) of the eastern corner of the land parcel and approximately 340 metres from the current landward edge of the mobile dune system making it outside the revised 100 year Planning Period Hind Dune Hazard Zone.

In addition to the reduced rate of dune progression that has been recorded since 1983, the mobile dune system adjacent of the site was reshaped as part of the Mineral Deposits P/L "Fullerton" heavy mineral sand mining operation that was undertaken between May 1997 and March 2001. As part of Mineral Deposits "Fullerton" mining operation, sand within the mobile dune system adjacent to Fern Bay Seaside Village land was moved up to 80 metres seaward of its pre-mining location to reduce the rate of landward transgression of the mobile dune system. This seaward relocation of the mobile sand mass will assist in further reducing the long term rate of mobile dune progression. As a result the 100 year Hind Dune Hazard Zone width could be even less than the revised 300 metre width discussed above.

If you require any further information in regard to this matter, please don't hesitate to contact Peter Jamieson on (02)4950 5322.

Yours faithfully

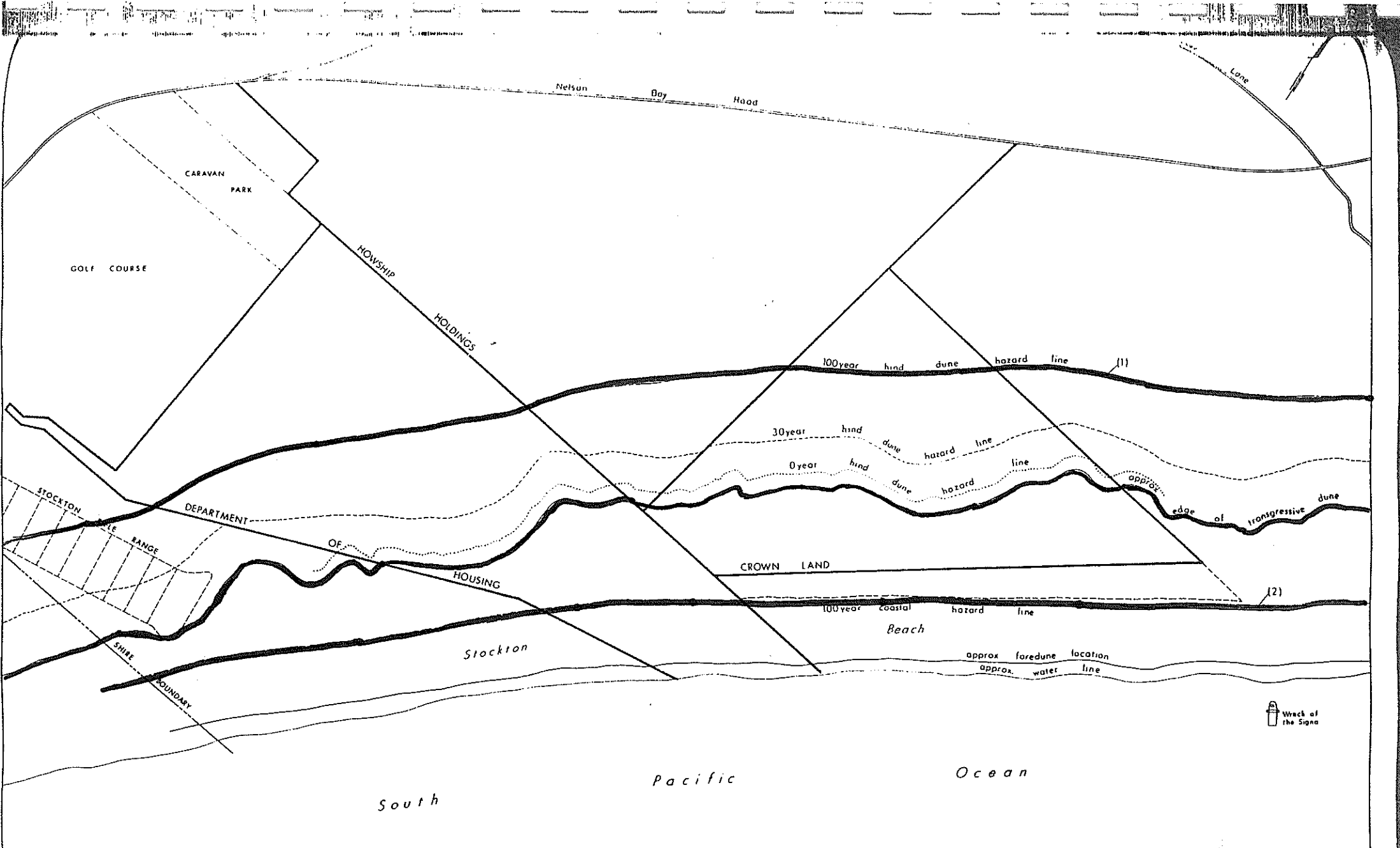


Peter Jamieson (BE Civil) CPeng  
Director

enc

## **Attachment 1**

**Figure 4.2 – Extracted from  
AWACS 1992**



- NOTES
- (1) Likely extent of transgressive dune migration in the absence of dune stabilisation measures
  - (2) Likely extent of foredune recession in the absence of any beach protection measures

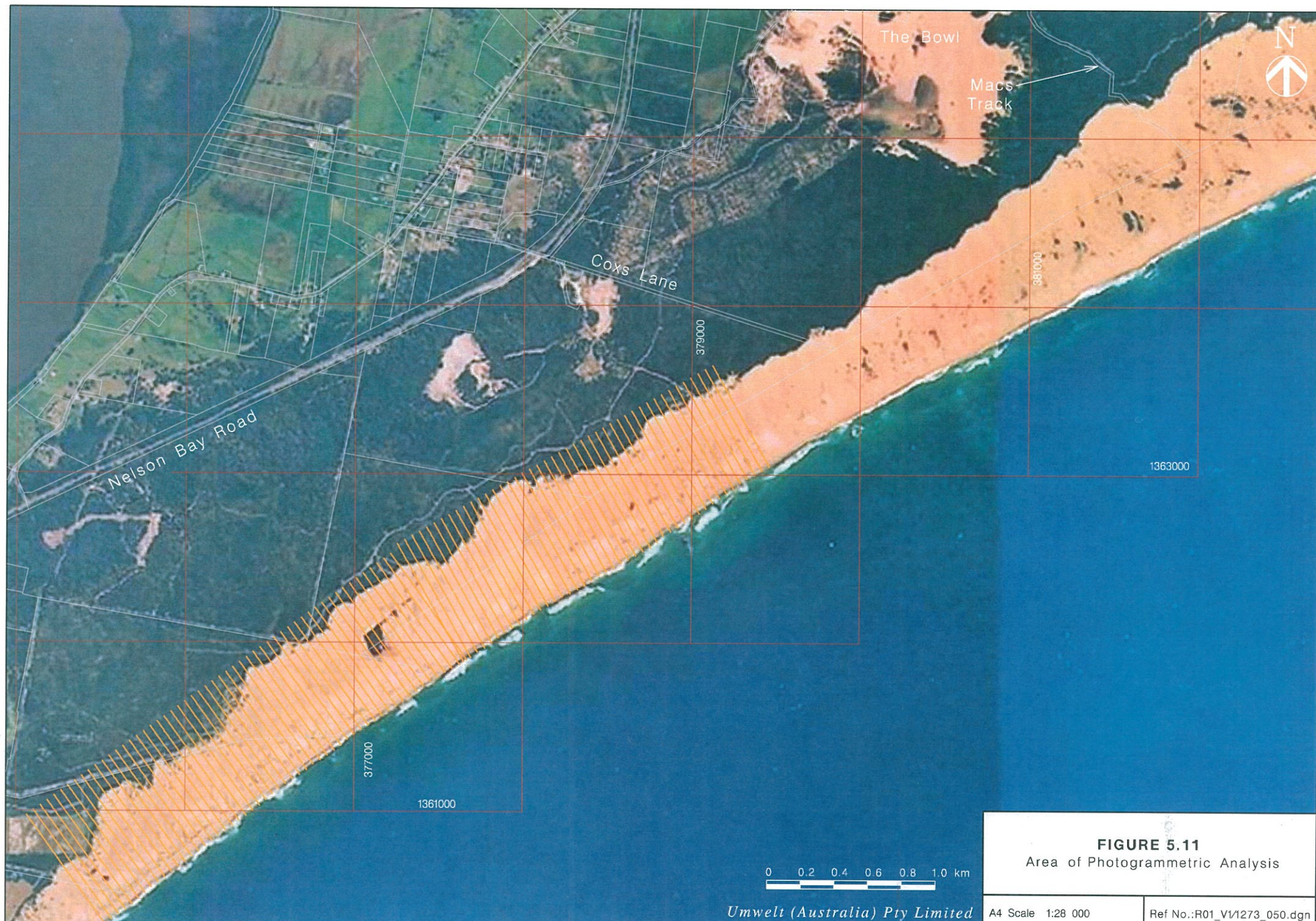
Figure  
4.2



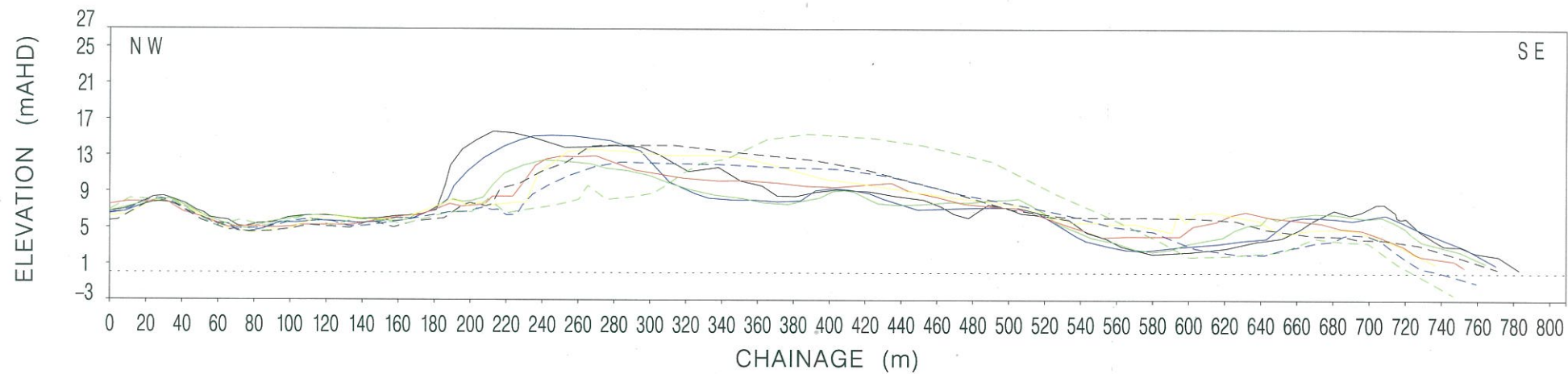
## **Attachment 2**

**Figures 5.11 – 5.14 – Extracted  
from Umwelt 2000**



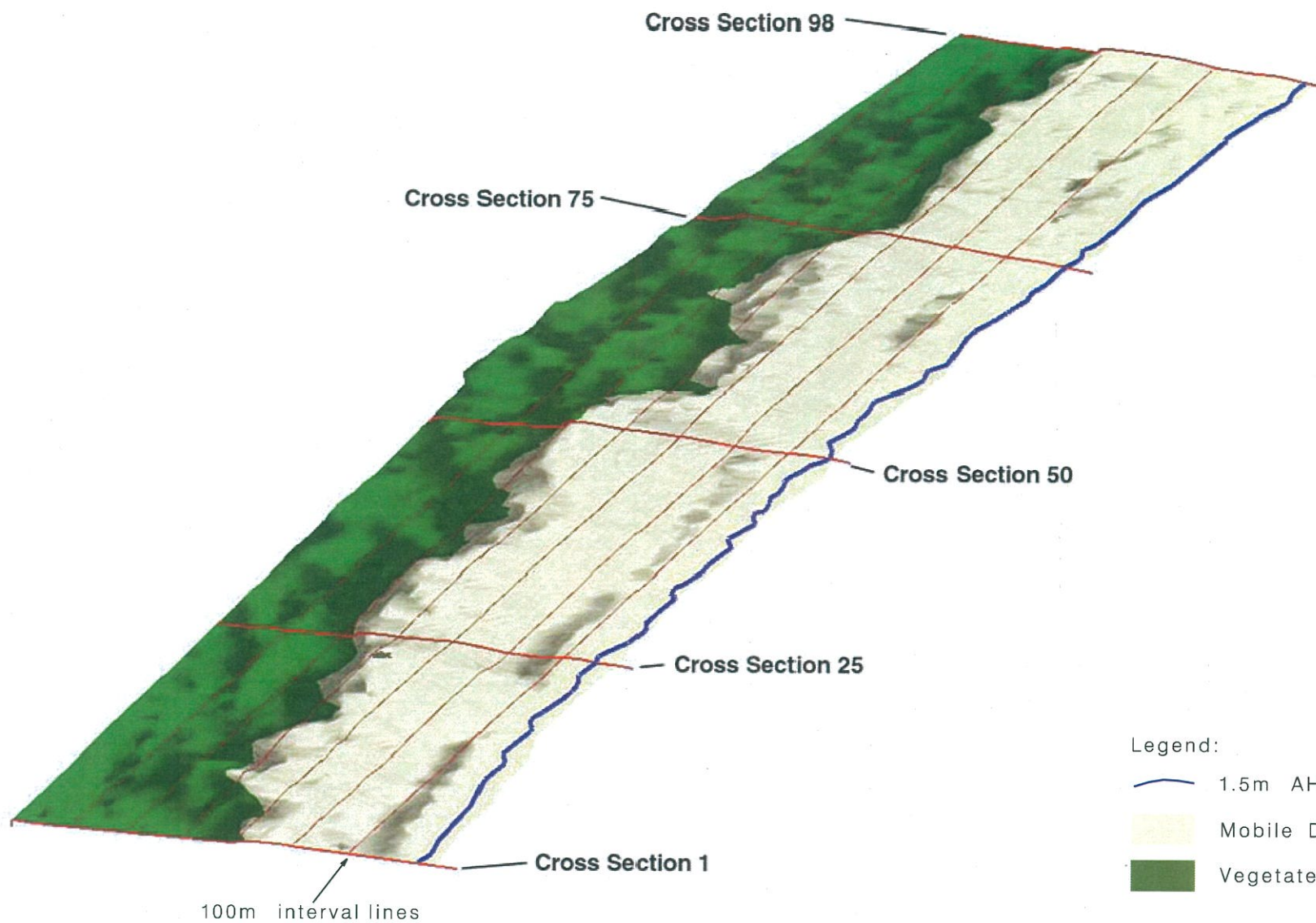









**FIGURE 5.12**  
Typical Changes in Cross-section  
Profiles 1954 to 1994

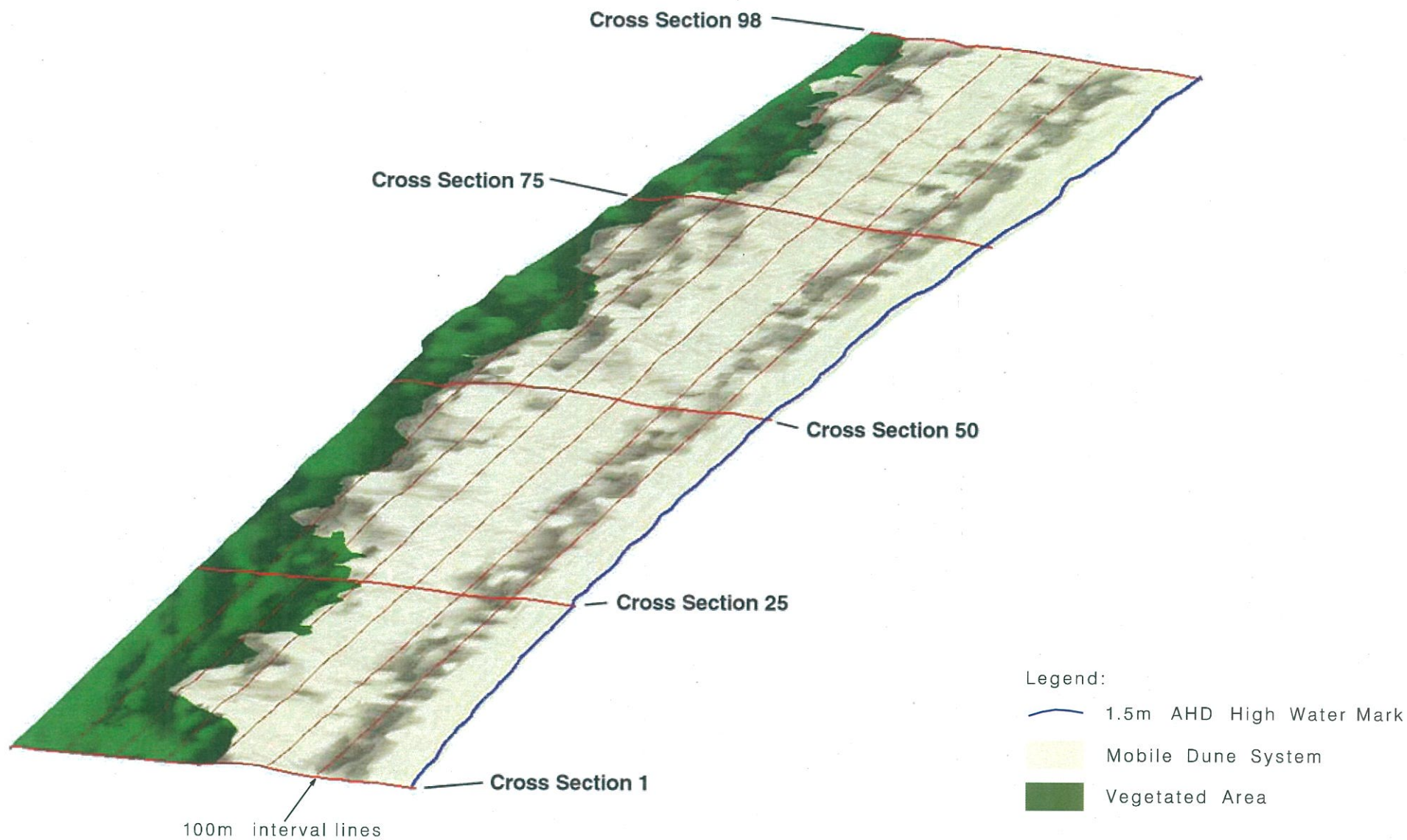




Legend:

-  1.5m AHD High Water Mark
-  Mobile Dune System
-  Vegetated Area

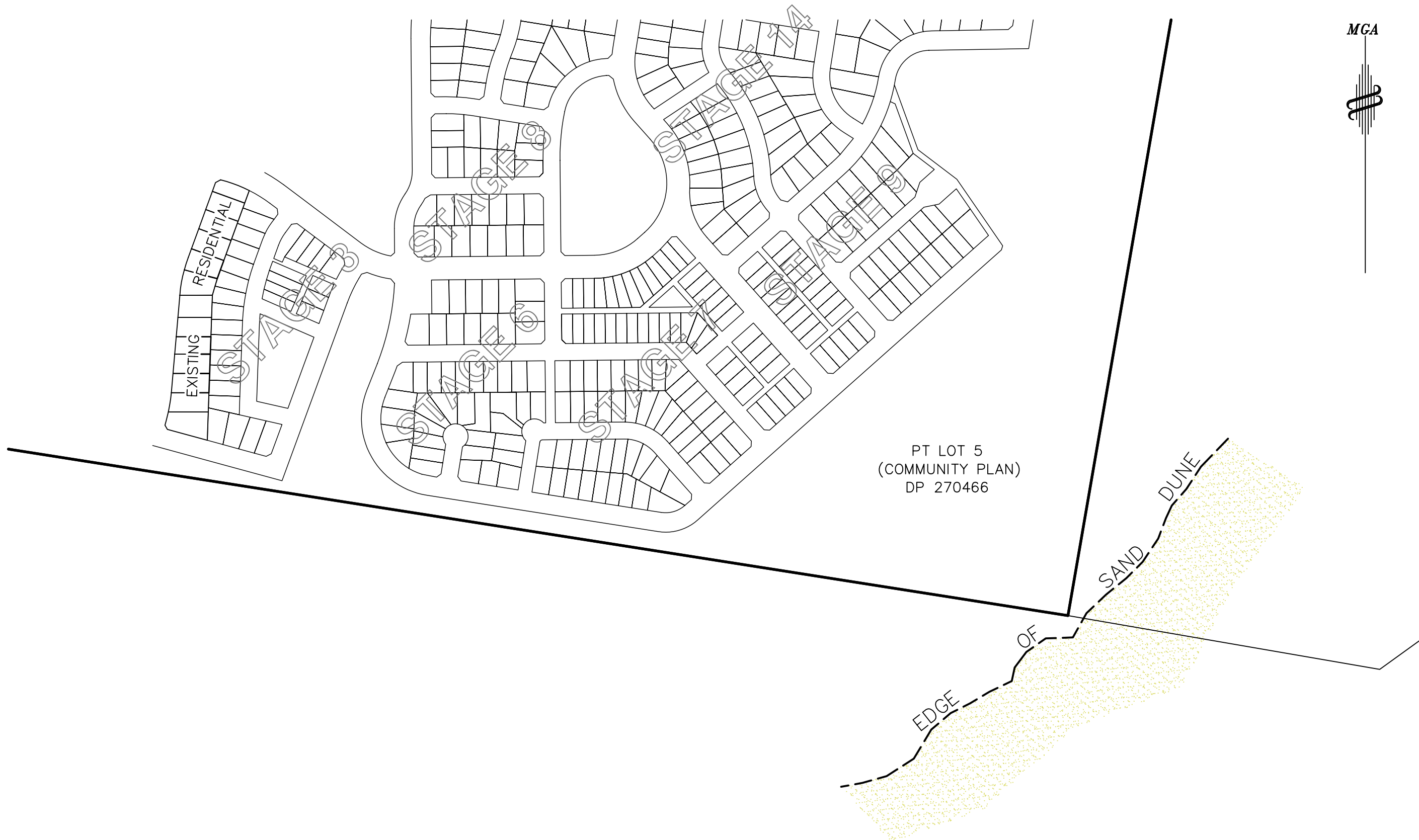
**FIGURE 5.13**  
Reconstructed 1954 Landscape



**FIGURE 5.14**  
Reconstructed 1994 Landscape

## **Attachment 3**

**Location of Extent of Existing  
Sand Dune – Fern Bay Seaside  
Village – Fagan Mather Duggan  
Surveyors**



© COPYRIGHT FAGAN MATHER DUGGAN PTY. LTD. THIS DOCUMENT MAY NOT BE REPRODUCED, COPIED, STORED, DISTRIBUTED OR TRANSMITTED IN ANY FORM, OR BY ANY MEANS WITHOUT THE WRITTEN PERMISSION OF THE PUBLISHER.

THIS SURVEY IS NOT AUTHORIZED TO BE USED BY ANY PERSON OTHER THAN ASPEN GROUP LIMITED. THIS SURVEY HAS BEEN CARRIED OUT FOR THE EXPRESS BENEFIT OF THE CLIENT. NO LIABILITY IN NEGLIGENCE WILL BE ACCEPTED TOWARDS THIRD PARTIES. SUCH THIRD PARTIES ARE WARNED TO RELY UPON THE RESULTS OF THEIR OWN INVESTIGATIONS. DIMENSIONS SHOULD NOT BE SCALED OR ELECTRONICALLY INTERPOLATED FROM THIS DRAWING.

