Department for Environment and Heritage

Recreational Beach Widths along the Adelaide Coastline

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Glenelg jetty (Johnny Kamma)

Coastline is the serial publication of the South Australian Coast Protection Board. Previous editions of Coastline, which cover a range of coastal management issues, are available at <www.environment.sa.gov.au/coasts/pub.html>.

All information in this publication was correct at the time of printing.

Except where otherwise indicated, all figures and photographs have been provided by the Department for Environment and Heritage.

All volumes of sand quoted in this publication are compacted volumes, i.e. volumes in situ on the beach. When sand is loaded into trucks, the volume increases by approximately 30%.

Cover photo: *West Beach (Johnny Kamma)*

Brighton during a storm in April 1971 compared to the same area in April 2006, demonstrating the impact of the beach replenishment program

Introduction

The Adelaide metropolitan beach system, which extends for 28 km from Kingston Park to Outer Harbor, is continually changing in response to natural processes and human impacts.

Sea waves reaching the metropolitan beaches are mostly generated by west-south-west winds. When combined with swell entering Gulf St Vincent through Investigator Strait and wave refraction, the net wind-wave direction causes sand to move in a northerly direction along the coast.

Unfortunately, only a limited amount of sand enters the beach system from the south at Kingston Park. Over time, this has resulted in a considerable loss of sand from southern and central metropolitan beaches. Several beaches have become very narrow, and the foreshore in these areas has been damaged regularly by storms.

Most of the sand lost from the southern and central beaches has ended up on the northern beaches. In less than a century, over 100 metres of sand dunes have formed around the Semaphore jetty. Sufficient sand has been deposited along the Largs Bay seabed and Lefevre Peninsula to establish the Gulf Point marina and the North Haven residential area.

Coastal development has had a major impact on beach widths along the metropolitan coast. Prior to European settlement, the width of the southern and central beaches was sustained by sand being redistributed from the coastal dunes. This is no longer possible, because roads, buildings, recreational areas, and sewerage and stormwater infrastructure have been built on top of the original dunes in all but a few locations, locking up most of the dune sand.

In recent years, major structures have been built out from the coast, including the Adelaide Shores boat haven at West Beach and the Holdfast Shores marina at Glenelg. These structures have obstructed the northerly movement of sand along the coast, and sand has accumulated on their southern side. This has resulted in the width of the beach to the south of the structures increasing, and the width to the north decreasing. Sand has also accumulated south of the Torrens Outlet, because the flow of water across the beach obstructs sand drift along the coast.

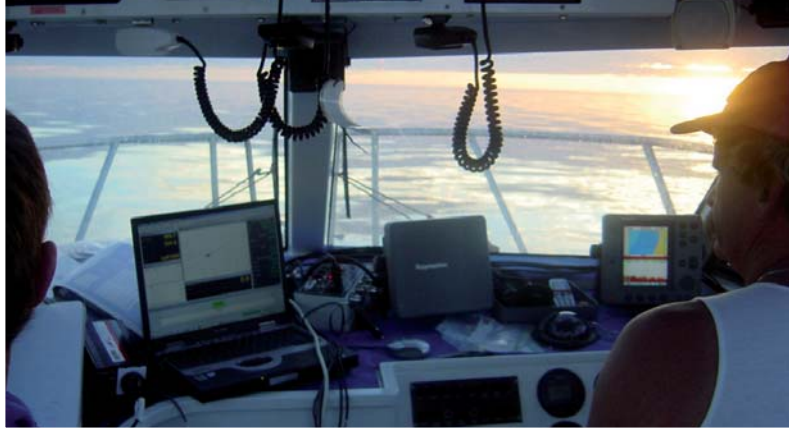
Since the 1970s, the Coast Protection Board has replenished Adelaide's southern and central metropolitan beaches on an ongoing basis to counter the loss of sand volume and beach width. In addition, sand has been bypassed from the southern side of coastal obstructions to the northern side to help maintain an equitable distribution of sand along the coast.

Beach monitoring, using techniques such as beach profiling, is an integral part of the beach replenishment program. Beach profiling measures dune, beach and offshore sand levels, which can be used to calculate recreational beach widths and sand volumes for each profile location. This information is vital when making decisions about where, when and by how much the beaches need to be replenished.

Recreational beach width is a useful indicator of the general condition of each area along the metropolitan coast. In addition, values can be compared over time to reveal long- and short-term trends in beach erosion or accretion. However, it is important to be aware that recreational beach width is not a reliable indicator of the protection an area has from erosion and storm damage. A more reliable indicator is sand volume, because it is the quantity of the sand in an area that determines the ability of the beach and dunes to absorb wave energy. In some locations, particularly the northern metropolitan beaches, sand volumes have increased significantly during periods in which there has been a concurrent loss in recreational beach width.

This edition of the *Coastline* series contains a summary of the main results obtained from a 2005 survey of recreational beach widths along the metropolitan coast, plus a discussion of what these results mean.

Further details on recreational beach width over time for each profile site along the metropolitan coast are contained in an accompanying technical report (Department for Environment and Heritage 2005a).



Members of the monitoring team obtaining beach and offshore profile data

Beach profiling

On behalf of the Coast Protection Board, the Coastal Protection Branch of the Department for Environment and Heritage has monitored dune, beach and offshore sand levels along the metropolitan coast since 1975.

Beach profiling is one of the methods used to measure dune, beach and offshore sand levels. Measurements are taken from a number of permanent sites that have been established along the coast.

These sites have cross-section profile lines that traverse the active beach offshore. They have fixed control points defining their position, which are recorded in the State Survey Grid and have geographical references. The Australian Height Datum (AHD) is the reference used for elevation measurements.

On the metropolitan coast, profile sites are usually spaced about 600 metres apart. The profile lines are usually set at right angles to the line of the beach and extend to a distance of up to 5 kilometres offshore. Current metropolitan beach profile lines are illustrated in Figure 1.

Surveying of these profile lines is carried out using electronic distance measurers and a global positioning system (GPS), with offshore data obtained using a vessel and echosounder.

Data obtained on land is considered to be accurate to within 3 cm, while data obtained using a vessel and echosounder is considered to be accurate to within 20 cm.

A software program called BEACHPRO is used to calculate recreational beach widths and sand volumes for each profile location.

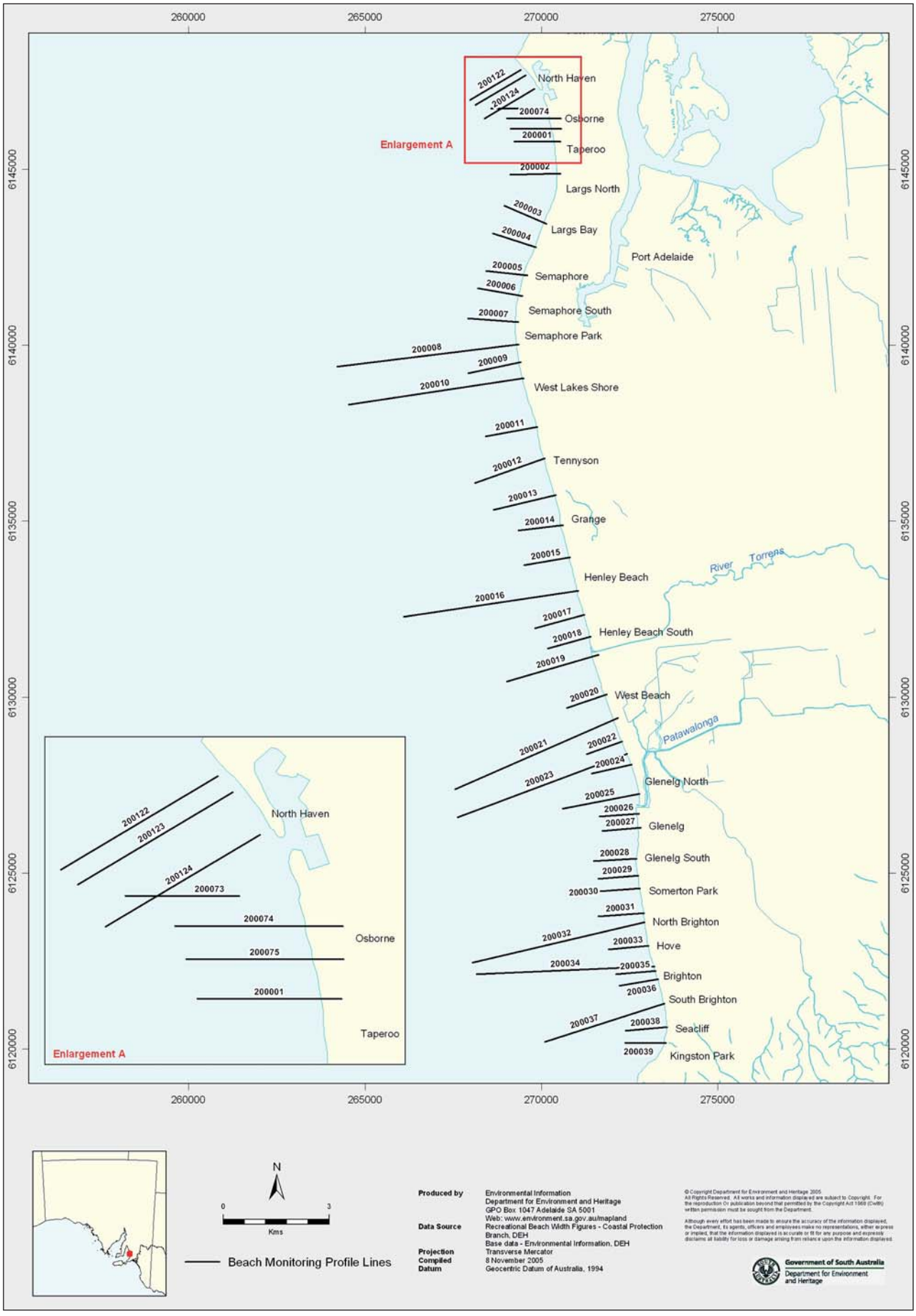


Figure 1: Current metropolitan beach profile lines

Semaphore in 1981 compared with the same area in 2005, showing extensive dune build-up resulting from northerly sand drift along the coast

Calculating recreational beach widths

Each year, the number of public visits to the metropolitan beaches far exceeds that of any other recreational activity in South Australia. It is important that the beaches are kept wide enough for the public to enjoy.

A recent survey by McGregor Tan Research estimated that people visit the metropolitan beaches about 9 million times a year (McGregor Tan Research 2003). People travelling from outside Adelaide's coastal suburbs make around half of these visits. In comparison, each year there are around 1 million visits to the Adelaide Botanic Gardens and around 3 million visits to South Australia's national parks.

Adelaide's beaches are clearly an important asset. They are used for a number of activities including walking, swimming, playing on the sand, and simply sitting and relaxing. The use of Adelaide's beaches for such activities was one of the major factors considered during the 1997 beach management review. The reference group for the review concluded that the protection of beach quality for recreation and amenity is at least as important as protecting the coast from storms (Department of Environment and Natural Resources 1997).

Most recreation and leisure activities are not possible in areas where the beach is too narrow. It is important to ensure that there is sufficient sand, even at high tide, for people to use the beach.

Calculating recreational beach widths is one way of assessing whether there is enough sand in a particular area for people to use. Recreational beach width is defined as the distance between high water mark and the toe of the dune or seawall (see Figure 2).

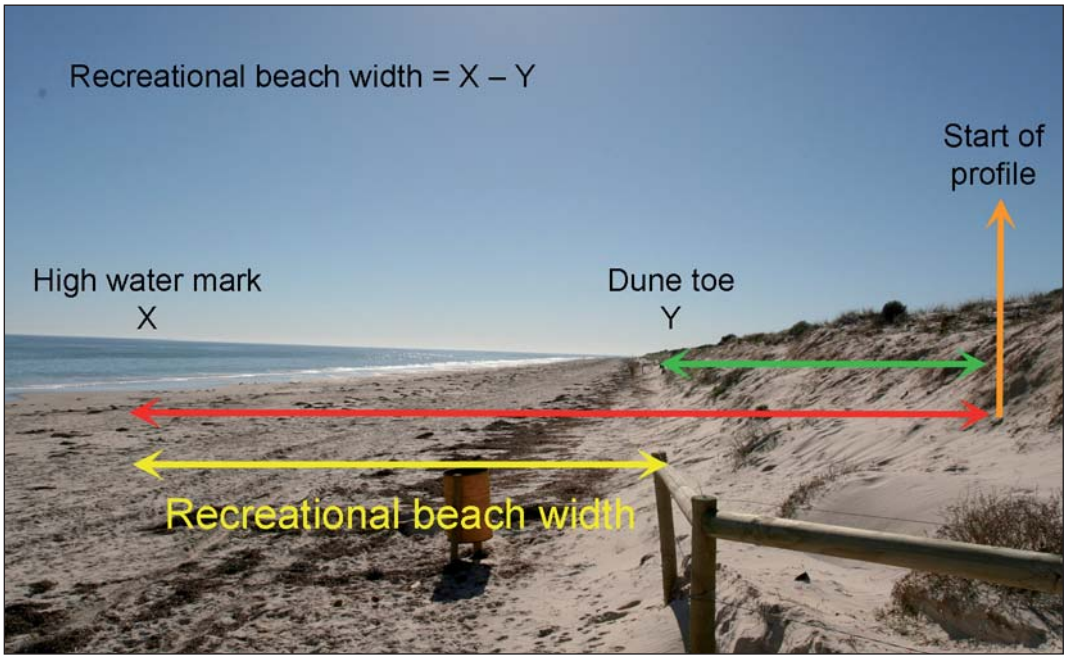


Figure 2: A diagram showing the method used to calculate recreational beach width

Glenelg North in 2005 and the West Beach dunes in 2006 – the narrow recreational beach widths at these locations is the result of sand being trapped south of the harbours at Glenelg and West Beach

Recreational beach width results

In 2005, average summer recreational beach widths were calculated for each profile location along the metropolitan coast. Results were compared with data obtained in previous years to reveal long- and short-term trends.

Average summer recreational beach widths in 2005, 2004, 2003 and 1980 were graphed and transposed onto a map of the metropolitan coast to assist in interpretation (see Figure 3).

Results from 2005 and 1980 were then colour-coded to highlight areas that have undergone significant changes in beach width over the last 25 years (see Figure 4).

In 1980, extremely narrow recreational beach widths were found at several locations on the southern part of the metropolitan coast – Henley Beach South (profile 200018), in front of the Glenelg Sewage Treatment Works at West Beach through to Glenelg North (profiles 200022 to 200024), Glenelg South (profile 200028), Somerton Park (profile 200030), Hove (profile 200033) and Brighton (profiles 200034 to 200036).

In the same year, moderately or extremely wide beach widths were found along most of the northern part of the metropolitan coastline, particularly at Osborne and Taperoo (profiles 200074, 200075 and 200001) and at Semaphore and Semaphore Park (profiles 200005 to 200008). Extremely wide beach widths were also measured south of the Torrens Outlet (profile 200019), south of the Holdfast Shores marina at Glenelg (profile 200026), and at Kingston Park (profile 200039).

In 2005, extremely narrow recreational beach widths were present only at Glenelg North (profiles 200024 to 200025), Glenelg South (profile 200028) and Somerton Park (profile 200030).

In the same year, extremely wide beach widths were present only at North Haven, Osborne and Taperoo (profiles 200122, 200075, 200001 and 200002), south of the Holdfast Shores marina at Glenelg (profile 200026), and at Kingston Park (profile 200039).

In other words, although narrow recreational beach widths still predominate on the southern beaches, and wide beach widths still predominate on the northern beaches, there is now much less variation in beach width between different parts of the coast than there was in 1980. This is the result of the beach replenishment program carried out by the Coast Protection Board, which has redistributed sand from areas of excessive build-up, such as Semaphore, Glenelg and south of the Torrens Outlet, to areas with insufficient sand, such as Brighton, Hove and Henley Beach South.

Despite sand being removed regularly from Glenelg to replenish other parts of the coast, sand has continued to build up in this location over recent years. This has been due to the extension of the harbour training walls and construction of the offshore breakwater between 1996 and 1997. Sand has also built up south of the Adelaide Shores boat haven at West Beach (profile 200022), which was constructed in 1998.

Bypassing activities have to date been insufficient to adequately redistribute the sand building up south of the harbours. This is reflected by a significant increase in recreational beach width at these locations between 2003 and 2005. A corresponding reduction in beach width has occurred at the locations immediately north of the harbours, namely Glenelg North (profiles 200024 to 200025) and the West Beach dunes (profile 200021).

Although short-term changes in recreational beach width are often the result of sand being trapped by coastal structures, such changes may also be the result of sand being moved around during beach replenishment activities. For example, between 2003 and 2004 a dramatic increase in beach width occurred south of the Torrens Outlet (profile 200019). Although the direct cause of the sand accumulation was the fact that the outlet obstructs sand drift along the coast, a contributing factor was that sand bypassing activities had not taken place since 2001–02. Sand bypassing to Henley Beach South resumed in 2004–05, and during the same period approximately 50,000 cubic metres of sand was carted south to Brighton, Glenelg North and the West Beach dunes. In 2005, recreational beach width at the outlet consequently dropped back to below 2003 levels.

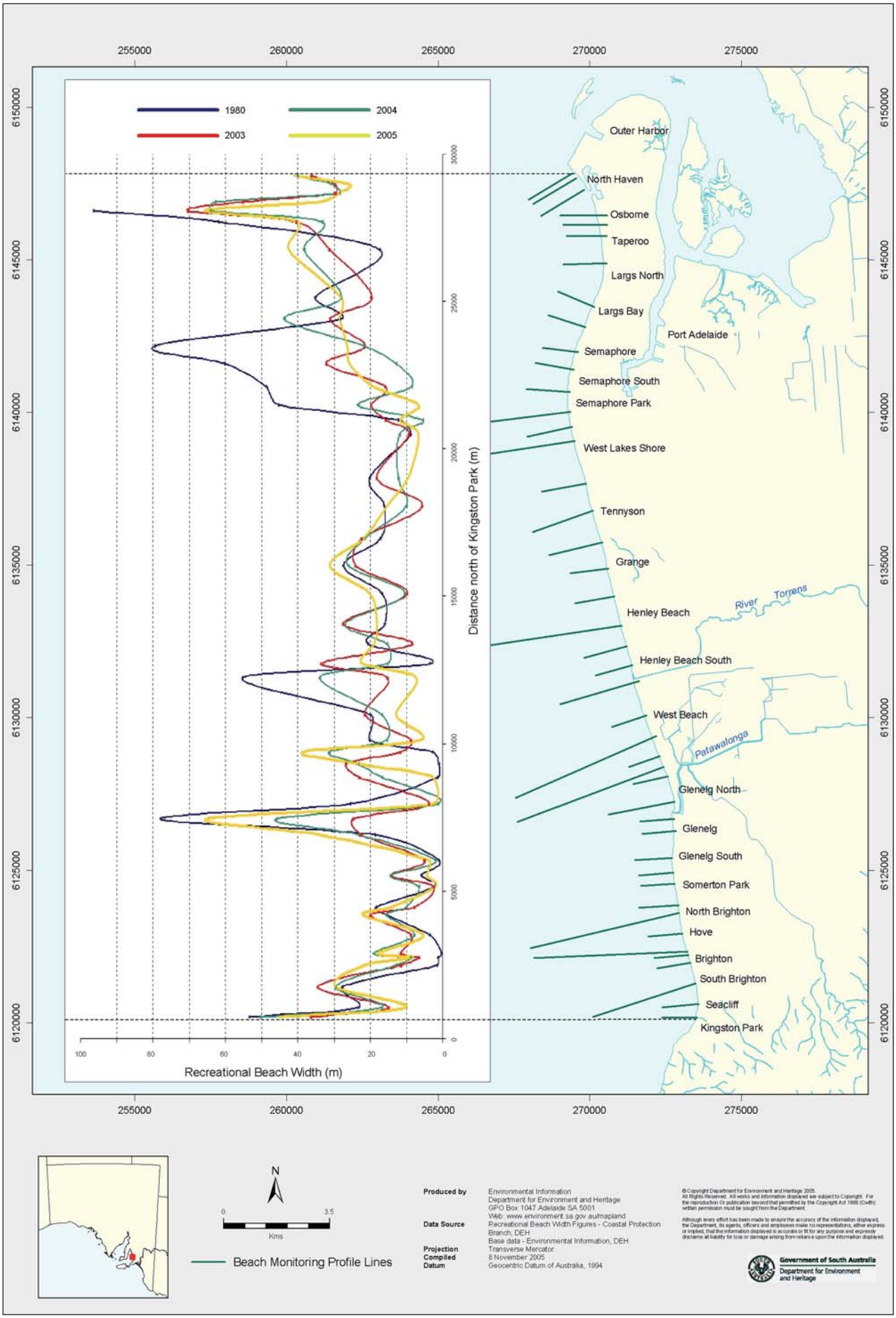


Figure 3: Recreational beach widths along the metropolitan coast in 1980, 2003, 2004 and 2005

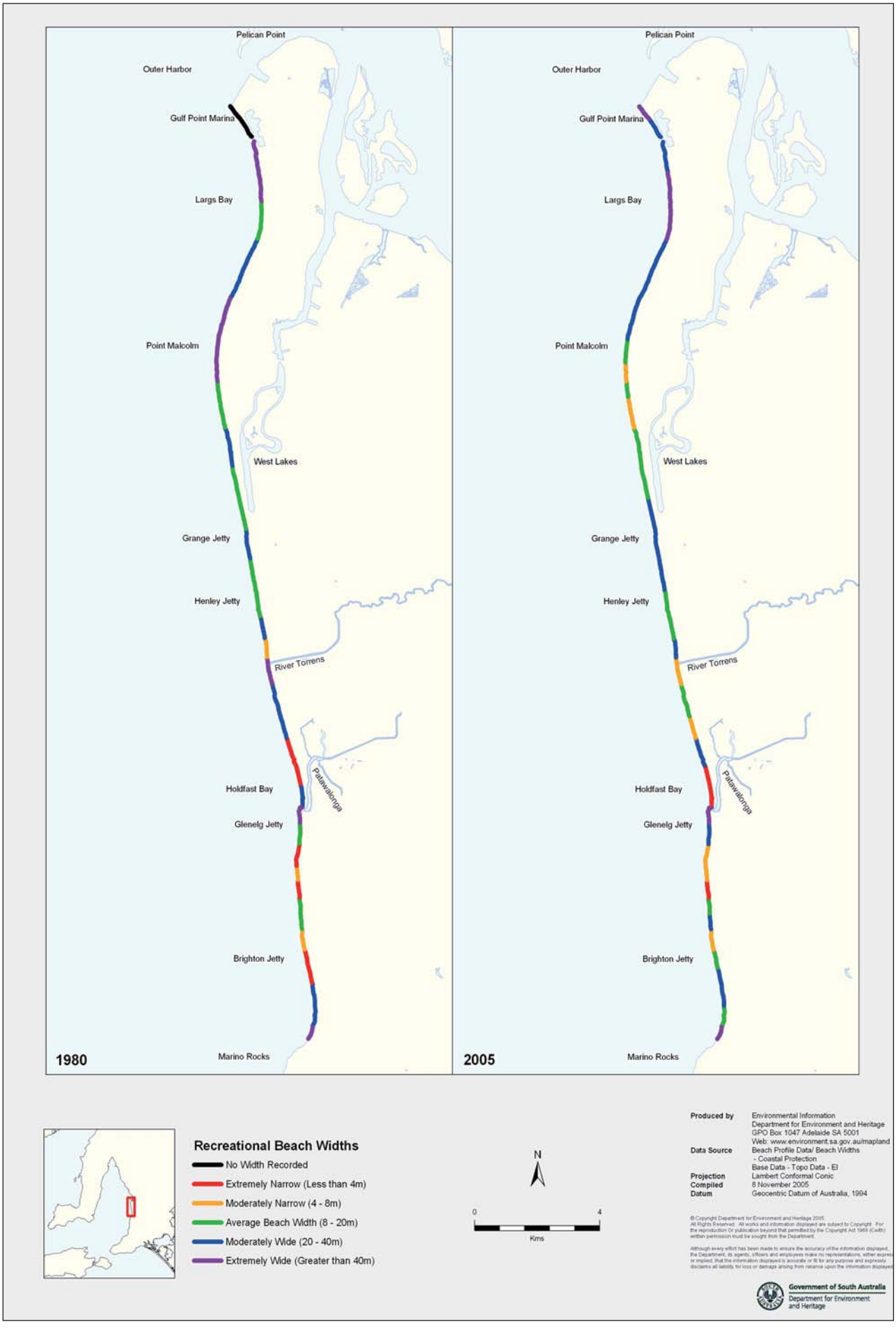


Figure 4: Summary of narrow and wide recreational beach widths along the metropolitan coast in 1980 and 2005

Henley Beach South in 1981 and 2006 – dune volume and beach width have increased due to bypassing of sand around the Torrens Outlet

Discussion

Although narrow recreational beach widths still predominate on the southern beaches, and wide recreational beach widths still predominate on the northern beaches, there is now much less variation in beach width between different parts of the coast than there was in 1980.

Variation in recreational beach width may be caused by a variety of morphological factors including the northerly drift of sand along the coast, weather patterns, sand grain size and beach slope. However, the results of this study suggest that the two major factors associated with changing beach widths are artificial beach replenishment and the presence of obstructions along the coast such as harbours and breakwaters.

The beach replenishment program carried out by the Coast Protection Board has clearly been responsible for an increase in recreational beach width along Adelaide's southern beaches, particularly Henley Beach South, Hove and Brighton.

Adelaide's southern and central metropolitan beaches will continue to be replenished under the new strategy for managing the coast, which is called *Adelaide's Living Beaches: A Strategy for 2005–2025* (Department for Environment and Heritage 2005b). However, a major difference is that sand will be recycled from north to south using a pipeline system, which will minimise the need for sand carting using trucks. Sand will also be added from external sources to tackle the ongoing loss of dune volume and beach width caused by sea level rise and other factors.

Other areas where recreational beach width has increased significantly since 1980 are south of the harbours at Glenelg and West Beach, but this has been due to the northerly drift of sand being obstructed at these locations. Bypassing activities have to date been insufficient to adequately redistribute these sand reserves. This has resulted in a reduction in recreational beach widths at Glenelg North and the West Beach dunes over recent years. Additional sand has therefore been added to these locations from other parts of the coast or, in the case of Glenelg North, imported from external sources to help replenish the beach.

Under the new beach management strategy, the width of the beach at Glenelg North and the West Beach dunes will no longer depend on bypassing of sand around the harbours. Instead, sand will be recycled from south of the Torrens Outlet to replenish the West Beach dunes, and from south of the West Beach harbour to replenish Glenelg North. Sand building up south of the harbour at Glenelg will be recycled to Brighton and Seacliff. This will be a more effective way of managing our finite quantity of sand, resulting in a more equitable distribution of sand along the coast as well as reduced harbour management costs. Coarse sand from external sources will continue to be imported to Glenelg North and Brighton.

The sand reserves south of the Torrens Outlet will also be redistributed as part of the new beach management strategy. Up until 2008–09, 25,000 cubic metres of sand will be bypassed each year to the north to replenish Henley Beach South, while the same quantity will be recycled each year to the south to replenish Brighton. Once the pipeline system is established, most of the sand building up at the Torrens Outlet will be recycled south to replenish the West Beach dunes, while sand will be recycled from further north to replenish Henley Beach South.

Recreational beach widths at Largs North and Taperoo have continued to increase over recent years. Unfortunately, sand accumulating north of Semaphore is mostly too fine and carbonate-rich to use for replenishing the southern and central beaches. On the other hand, sand at Semaphore and Semaphore South is quite suitable for replenishing the southern and central beaches. The dramatic reduction in beach widths at these locations since 1980 is the result of large quantities of sand being removed from the area and carted to southern beaches including Brighton and Glenelg North. In more recent years, sand has also been carted from the area along the beach to replenish the eroding foreshore at Semaphore Park.

Somerton Park during construction of a geotextile groyne in July 2005, compared with the same area in February 2006

In early 2004, 120,000 cubic metres of sand was removed from the beach south of the Semaphore jetty to pre-fill the salient at the trial breakwater site at Semaphore South. This resulted in a significant reduction in recreational beach width at Semaphore and Semaphore South between 2003 and 2004. However, by 2005 beach widths had returned to levels similar to those present in 2003. This demonstrates the capacity of the beach to adjust its shape in response to the removal of large quantities of sand, by sand moving inshore or from the dunes.

Unfortunately, recreational beach width at Semaphore Park remains reasonably narrow despite over 300,000 cubic metres of sand having been placed there to replenish the eroding foreshore since 1991.

It is difficult to retain sand at Semaphore Park because of the high rate of longshore sand drift in the area, which is thought to be due to extensive loss of offshore seagrass since the early 1970s.

Beach width at Semaphore Park is expected to improve due to the installation of the trial geotextile breakwater at Semaphore South. During the trial, sand trapped by the breakwater will be carted south to replenish Semaphore Park. Depending on the results of the trial, which is due to be completed in 2006–07, the geotextile structure may be armoured with rock. In addition, a further four offshore breakwaters may be constructed to protect Semaphore Park directly.

Other areas where it is difficult to retain sand because of the high rate of longshore sand drift include Somerton Park and Glenelg South. A series of geotextile groynes has recently been installed at Somerton Park to trap northward moving sand and raise the level of the beach. More of the beach now remains exposed at high tide, so people can walk along the beach over longer periods of the day. Additional groynes may be constructed in the near future to further increase the width of the beach. Groynes may also be constructed in future near the Broadway, Glenelg South, to increase the width of the beach at this location.

Conclusion

It is clear from the above discussion that recreational beach width is a useful reporting measure, particularly when beach widths are compared over time to reveal long- and short-term trends in beach erosion or accretion.

The major finding of this study is that the beach replenishment program has successfully increased the width of the beach in several critical areas along the metropolitan coastline.

On the other hand, the study has highlighted areas where the beach remains narrow despite being replenished with large quantities of sand, for example at Semaphore Park, Somerton Park and Glenelg South. Alternative methods must be used to protect these areas, such as the offshore breakwater currently being trialled at Semaphore South and the series of geotextile groynes recently installed at Somerton Park.

Finally, the study has demonstrated that sand bypassing to date at the Glenelg and West Beach harbours has been insufficient to maintain the width of the beach to the north of these structures. Under the new beach management strategy, sand building up at the harbours will be recycled to the south rather than bypassed to the north.

Despite being useful in this manner, recreational beach width is not a reliable indicator of the protection an area has from erosion and storm damage. A more reliable indicator is sand volume, because it is the quantity of sand in an area that determines the ability of the beach and dunes to absorb wave energy.

It is therefore necessary to ensure that data on beach and dune buffer volumes is also taken into account when planning and evaluating the beach replenishment program.

A future edition of the *Coastline* series will examine beach and dune buffer volumes along the metropolitan coast in more detail.

References:

Department for Environment and Heritage 2005a, *Recreational Beach Width for Adelaide's Metropolitan Beaches*, Technical Report 05/02, prepared by the Coastal Protection Branch for the Coast Protection Board, Adelaide. Available at <http://www.environment.sa.gov.au/coasts/adelaide_studies.html>.

Department for Environment and Heritage 2005b, *Adelaide's Living Beaches: A Strategy for 2005–2025*, prepared by the Coastal Protection Branch for the Coast Protection Board, Adelaide. Available at <http://www.environment.sa.gov.au/coasts/adelaides_living_beaches.html>.

Department of Environment and Natural Resources 1997, *Report of the Review of the Management of Adelaide's Metropolitan Beaches*, prepared by the reference group appointed by the Minister for Environment and Natural Resources, the Hon. David Wotton, MP, Department of Environment and Natural Resources, Adelaide.

McGregor Tan Research 2003, *Metropolitan Adelaide Beach Users Study Summary Report*, prepared for the Department for Environment and Heritage, Adelaide. Available at <http://www.environment.sa.gov.au/coasts/adelaide_studies.html>.

For further information please contact:

Department for Environment and Heritage Information Line
T: (08) 8204 1910
Email: dehinformation@saugov.sa.gov.au
Web Address: www.environment.sa.gov.au

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