Department for Environment and Heritage

# Adelaide's Living Beaches
## A Strategy for 2005 – 2025

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of South Australia

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*Seacliff (Johnny Kamma)*

*All information in this report 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 report 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:** *Brighton*

Brighton jetty

West Beach (Johnny Kamma)

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Tennyson dunes


Brighton beach

# Foreword

## *Adelaide's coastline is a special asset and an inspiration to many local residents and visitors.*

The coastline is dynamic, always shifting in response to the wind and waves. However, human impacts have altered the dynamics of the coast to such an extent that natural processes can no longer sustain the beaches.

Most of the land behind the foreshore was developed from the early 1900s onwards. Roads, buildings, houses, recreational areas, and their sewerage and stormwater infrastructure were often built right over coastal dunes. Consequently, dune sand is unable to erode away during storms, and so substantial protection works have been put in place to retain the foreshore and beaches. Early on, this protection was in the form of seawalls. From the 1970s, however, protection was mainly achieved by replenishing beaches with sand.

Adelaide's coastline is now a highly managed one. The sand that forms the beaches is a scarce and moving asset. The future management of the beaches needs to be responsive to changing conditions to ensure that future generations are not disadvantaged by our decisions now.

It is tempting to think that a permanent structural solution to the moving sands is preferable to the ongoing recycling of sand from north to south. However, the scale and number of structures that would be needed to achieve this would be both costly and disfiguring.

Furthermore, the strategy of beach replenishment, using seawalls as the last line of defence, has been a successful and cost-effective method for maintaining sandy beaches, rebuilding sand dunes and preventing storm damage to property.

This document describes the strategy for managing Adelaide's beaches from 2005 to 2025, which has been developed by the Coast Protection Board for the State Government. A technical report, enclosed on CD, has been produced to accompany the strategy.

In concert with the Government's *Living Coast Strategy* (2004), the beach management strategy for 2005–2025 continues to manage erosion risks to metropolitan coastal assets by replenishing beaches and using structures in critical locations to slow the northerly drift of sand. In addition, the strategy contains three important initiatives. The first is to recycle sand more effectively using pipeline transfer systems. The second is to add sand from external sources to the beach system to counter the ongoing loss of dune volume and beach width caused by sea level rise and other factors. The third is to integrate sand bypassing at harbours with beach management. These initiatives will contribute to achieving actions listed in *South Australia's Strategic Plan* (2004), including maintaining the lifestyle quality of South Australians, seeking creative solutions to environmental issues and increasing investment in strategic areas of infrastructure.

In the long term, the strategy is expected to reduce the future cost of managing the Adelaide coastline by about 20%.

The community's views on beach management have been obtained during extensive consultation over many years, and these have been considered in the development of the strategy. Indeed, one of the major benefits of the strategy is that it will minimise the number of trucks carting sand along Adelaide's beaches and roads.

The Coast Protection Board will now guide the implementation of the beach management strategy for 2005–2025, which was endorsed by the Government in November 2005.

GRAHAM FOREMAN
**Chair, Coast Protection Board**

*Beach replenishment at Seacliff, 2004*

# Summary

*The Coast Protection Board has been managing Adelaide's beaches for over 30 years in response to sand eroding and moving north along the coast.*

The main management actions have been to replenish beaches with sand taken from other metropolitan beaches, offshore or elsewhere, and to build seawalls as the last line of defence against storms. Without these measures, several of Adelaide's southern metropolitan beaches would by now have very little sand left on them and numerous foreshore properties would have been damaged by storms.

Even so, the Coast Protection Board recognises the need to improve the management strategy, particularly in regard to reducing the number of trucks carting sand along Adelaide's beaches and roads. Moreover, following a major program of offshore dredging at Port Stanvac in the 1990s, historical sources of sand have now been exhausted. Alternative sources of sand have been investigated as a matter of urgency to supplement the existing finite amount of sand within the metropolitan beach system. However, the cost of importing sand from sources outside the beach system has escalated to the point that alternative management options have been initiated in critical locations. For example, a trial breakwater has been built at Semaphore South to slow sand movement. The trial is at an early stage, but the breakwater is already holding sand in the area and performing as expected.

Other recent developments have been the construction of the Holdfast Shores marina at Glenelg and the Adelaide Shores boat haven at West Beach. These harbours have interrupted much of the northerly movement of sand along the coastline. Ongoing bypassing and dredging of significant quantities of sand and seagrass around the harbours is now required.

In 2000, the Department for Environment and Heritage, on behalf of the Coast Protection Board, initiated a review of the management of Adelaide's metropolitan beaches. Based on examination of the benefits and costs of a range of strategies, along with the results of a series of modelling and feasibility studies and input from the community, the Department has developed this strategy for managing Adelaide's beaches from 2005 to 2025. The strategy will ensure the long-term viability of the city's coastal assets by maintaining beach quality for recreation, amenity and protection purposes, while reducing the impact of replenishment activities on beach users and coastal residents.

## The main components of the strategy for managing Adelaide's beaches from 2005 to 2025

1. ***Continue beach replenishment*** – Continue the existing program of beach replenishment, placing 160,000 cubic metres of sand each year at strategic locations on southern and central beaches to maintain the sandy foreshore, build up dune buffers, and protect coastal infrastructure.
2. ***Recycle sand more effectively using sand slurry pumping and pipelines*** – Existing sand supplies will be recycled more effectively using sand slurry pumping and pipelines, which will minimise the need for trucks to cart sand along beaches and suburban roads.
3. ***Add coarse sand from external sources*** – Coarser, more stable sand will be added to the system from external sources such as Mount Compass to tackle the ongoing loss of dune volume and beach width caused by sea level rise and other factors.
4. ***Build coastal structures in critical locations*** – Structures such as groynes and offshore breakwaters may be used in a few critical locations to slow the northerly drift of sand.
5. ***Integrate sand bypassing at harbours with beach management*** – Integrating sand bypassing requirements at harbours with the beach replenishment program will result in more effective recycling of sand and reduced harbour management costs.

Henley Beach, 1953 (State Library)

Semaphore Park, 1999

# Factors affecting the Adelaide coast

*The Adelaide coast is a dynamic environment controlled by numerous physical and biological processes.*

## Wind and waves

The dominant forces affecting Adelaide's beaches are the wind and waves, which together set up an overall northward drift of sand along the coast, although sand is also moved in other directions under different wind conditions. This movement of sand along the coast is known as *littoral drift.*

During coastal storms, large quantities of sand can be eroded causing considerable damage to nearshore, beach and dune areas. Adelaide's metropolitan beaches cannot be considered to be stable or in equilibrium, as many other beaches are. Before European settlement, the beach width was sustained by erosion of the coastal dunes, but subsequent development on top of these dunes has meant that this replenishment process has had to be carried out artificially.

## Coastal development

Large quantities of sand have either been 'locked up' or removed from the beach system as a result of coastal development. Many of Adelaide's coastal suburbs were built on an extensive system of coastal dunes or, alternatively, dunes were used to infill coastal backswamps to provide land for housing and Adelaide's airport. Land was also reclaimed along the Lefevre Peninsula to establish the suburb of North Haven.

## Stormwater and wastewater discharges

With coastal urbanisation comes the necessity for stormwater infrastructure and sewerage. Much of Adelaide's stormwater is discharged to the coast through the Patawalonga, Torrens and Port River systems, as well as via over 85 smaller outfalls that discharge stormwater within the dunes or directly onto the beach.

Four wastewater treatment plants located in and around Adelaide – Bolivar, Glenelg, Christies Beach and Port Adelaide – have discharged effluent into Gulf St Vincent. Effluent from the Port Adelaide plant is now diverted to the Bolivar plant for treatment rather than being discharged into the Port River. Up until 1993, sludge from the sewage treatment process was also discharged offshore from the Glenelg and Port Adelaide plants. These discharges increase nutrient and sediment levels in nearshore waters.

## Seagrass loss and seabed instability

A third of seagrass meadows along the Adelaide metropolitan coast have died since 1950. Poor water quality resulting from stormwater run-off and effluent disposal has most likely been the initial cause. Once there are gaps in the seagrass meadows, the sand below the meadow edge can be eroded by waves. This is thought to have increased the rate of seagrass loss and made it difficult for plants to recolonise the seafloor, even though water quality has been improved.

Finer-grained sand that was once trapped by seagrass meadows has been released and washed ashore. Because the sand is fine, it accumulates in the sandbars and washes north to Largs Bay. Although in the short term this sand has added to protection of the coast, it is unsuitable for replenishing Adelaide's beaches in the longer term. This is because it tends to remain in the underwater part of the beach and is moved too quickly by waves.

As a result of the loss of sand from the seabed, the level of the seabed has steadily become up to one metre deeper and the wave energy reaching our beaches has increased. This causes a larger quantity of sand to drift north along the coast.

A laboratory and field study on seagrass rehabilitation techniques undertaken in conjunction with the South Australian Research and Development Institute (SARDI) is in its second year and is producing encouraging results. However, even if the study is successful, rehabilitation of seagrass meadows will not be able to replace the lost sand nor restore the seabed to its former level.

*Trash rack over Barcoo Outlet*

*Stormwater outlet, Taperoo*

## Sea level rise

One of the consequences of climate change and increasing global temperatures is that mean sea levels around the world are rising. Parts of the Adelaide coast are also subsiding. A relative sea level rise of one to two millimetres per year has been recorded for Adelaide. The effects of this sea level rise along the coast are gradual though highly significant over the long term.

Increases in sea level will cause greater erosion of the dunes and loss of beach width (Figure 1). Sea level rise and possible changes in prevailing wind direction will also be likely to alter the angle at which waves strike the shore, leading to changes in rates of littoral drift and, consequently, changes in the locations at which beaches build up or erode. Extra sand needs to be added to the beaches to counter the effective loss of sand as a result of sea level rise.

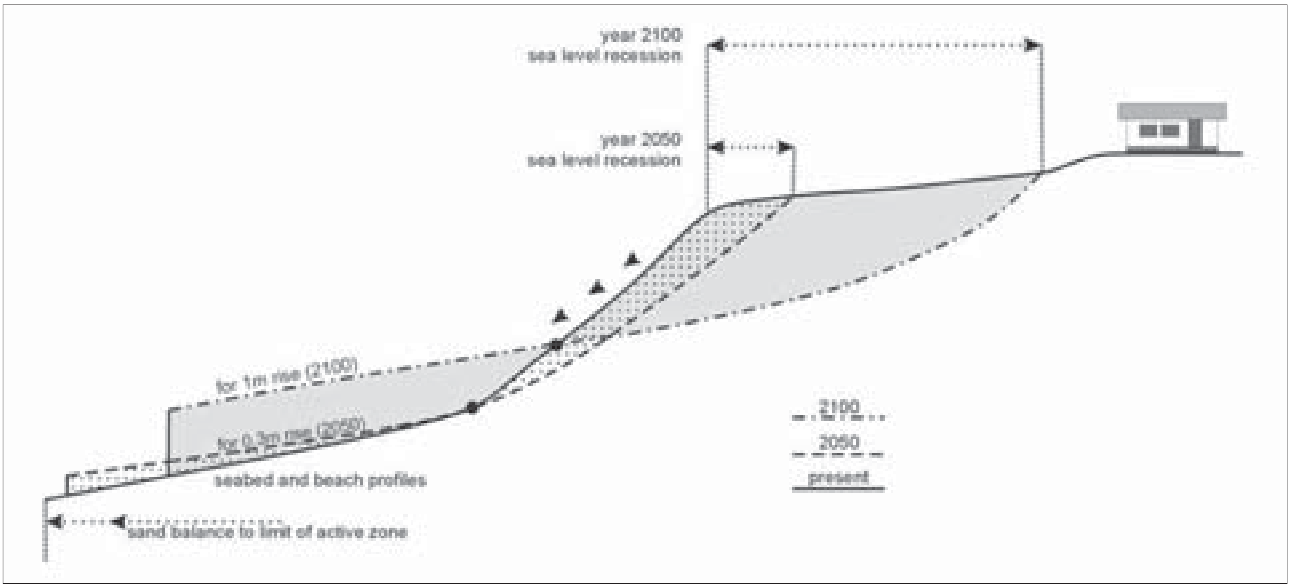


*Figure 1: Coastal recession due to sea level rise if beach replenishment rates are not increased*

Beach replenishment at Brighton, 1982

Sand from Port Stanvac being pumped ashore at Brighton, 1997

# Coast protection methods used to date

## Summary of coast protection methods used to date

***Beach replenishment*** – A high level of manual sand movement is undertaken, which is necessary if a moderately even spread of sand along the coast is to be maintained. This includes:

- *recycling or backpassing* – removal of sand, generally from more northerly sand accumulation areas to more southerly erosion areas
- *external replenishment* – addition of sand onto the coast from offshore or land-based resources.

***Sand trapping*** – Mobile sand is trapped through the construction of groynes and breakwaters. A trial breakwater has been constructed recently at Semaphore South, which will slow and trap some littoral drift sand. Sand can then be carted back to Semaphore Park to counter erosion of the foreshore.

***Sand bypassing*** – Sand is manually bypassed around built obstacles along the sandy coast, i.e. the Holdfast Shores marina at Glenelg, the Adelaide Shores boat haven at West Beach, the Torrens Outlet and, to a much lesser degree, the North Haven marina.

***Seawall protection*** – Seawalls have been constructed as the 'last line of defence' in locations where infrastructure and property are at a very high risk of erosion.

***Dune management*** – Drift fences, dune revegetation and access controls are used to reduce the amount of sand that blows away from the foreshore.

## Beach replenishment

The Coast Protection Board first implemented beach replenishment in 1973 as its main strategy for protecting Adelaide's beaches. Over the last 30 years, sand has been needed to replenish the beaches at Brighton and Glenelg North in particular, and this has been taken mostly from Glenelg, the Torrens Outlet, Grange and Semaphore. Sand has also been dredged offshore from North Haven. In all, the average quantity of sand moved along the Adelaide coast has been over 100,000 cubic metres each year.

While recycling has been an effective method in maintaining sandy beaches, it does have its pitfalls. Highest among them is the necessity for trucks and other earthmoving equipment to remove, cart, dump and level sand on the beaches when replenishment programs are in progress. Trucks also increase greenhouse gas emissions and traffic congestion in affected coastal areas. The community has rightly voiced concerns about safety issues, noise pollution and beach use interference.

Sand has also been imported from sources outside the metropolitan beach system to counter sand lost offshore, impounded onshore (locked up by development, seawalls and sand dunes), effectively lost from the beaches as a result of sea level rise, or simply blown inland by the wind.

Ideally, sand from elsewhere should be similar to that originally deposited on the beach. The sand considered most suitable for beach replenishment should be of a similar grain size or coarser than sand from Brighton beach. The sand should consist of silica, and at least 50% of it should be coarser than 0.2 millimetres, with less than 5% silt and clay content. Preferably, sand grains should also be rounded and off-white or pale in colour.

Investigations undertaken by the Coast Protection Board have located several sand sources of these or similar specifications in previous years. In 1989, nearly 190,000 cubic metres of sand was removed from the Torrens Island dunes and taken to Glenelg North. A particularly large deposit was also located offshore from the Port Stanvac oil refinery. This has so far been the major external replenishment source for Adelaide's beaches. Over one million cubic metres of sand was dredged and pumped onshore at Brighton during the 1990s. Much of this, over 600,000 cubic metres, was dredged to Brighton between October 1997 and February 1998.

*Semaphore South trial breakwater during construction, 2004*

*Sand bypassing at the Torrens Outlet (City of Charles Sturt)*

## Sand trapping

Sand trapping can occur either directly due to purpose-built breakwaters and groynes, which slow sand movement along selected areas of the coast, or indirectly as a result of coastal developments such as marinas and stormwater outlets obstructing sand movement.

For many years, the Semaphore Park and Tennyson foreshores have undergone considerable erosion associated with seagrass loss. A trial breakwater was constructed in 2003–04 at Semaphore South as Stage 1 of the three-stage Semaphore Park Foreshore Protection Strategy. The breakwater is designed to trap a proportion of the sand drifting north along the coast. Modelling has predicted that up to 40,000 cubic metres of trapped sand can be removed from the area near the breakwater each year and taken south to replenish the foreshore at Semaphore Park. This will minimise the need for sand to be carted from Semaphore beach to Semaphore Park.

The results from monitoring during the four- to five-year trial period will inform the decision on proceeding to Stage 2 of the Semaphore Park Foreshore Protection Strategy. Stage 2 would involve converting the trial breakwater to a permanent structure. In the future, it is possible that carting sand from the breakwater to Semaphore Park could become unsustainable because of increased sand requirements, increased costs or other impediments. Stage 3 of the Semaphore Park Foreshore Protection Strategy allows for construction of a further four breakwaters to directly protect the Semaphore Park foreshore.

## Sand bypassing

Sand bypassing is the manual movement of sand to overcome an obstacle that has caused it to become trapped, with the intent that sand continues to move as if unhindered by the obstacle. Along the Adelaide coast, sand bypassing presently occurs from south to north at the Holdfast Shores marina at Glenelg, the Adelaide Shores boat haven at West Beach, and the Torrens Outlet.

One of the most marked changes to the Adelaide coast in recent years has been the construction of the Holdfast Shores and Adelaide Shores harbours. Dredging and sand bypassing are undertaken at each facility to maintain channel depths and enable sand to continue to drift northward. Sand from the channel areas is dredged and pumped offshore, while sand from the salients (the build-up of sand between the harbour breakwaters and the beach) is carted by truck and dumped either immediately north or, in the case of Holdfast Shores, periodically to Brighton and Seacliff. Sand from the salient at Holdfast Shores is also dredged and pumped to Glenelg North. At the Adelaide Shores boat haven, seagrass wrack is also carted by truck and used as a buffer to reinforce the base of the West Beach dunes.

Much of the sand that accumulates at the Torrens Outlet is bypassed by the City of Charles Sturt to the north at Henley Beach South, although several large amounts have been used on an ‘as needs’ basis to replenish Glenelg North, Somerton Park and Seacliff. In 2004, sand was taken to protect the dunes at West Beach, and in 2005, sand was used to replenish the West Beach dunes, Glenelg North, Brighton and Seacliff.

*Rip-rap seawall at Seacliff, 2003*

*Drift fencing at Tennyson, 2002*

## Seawall protection

Seawalls currently protect a length of 14 kilometres – about half of the metropolitan coastline. Most of the seawalls are found south of Grange, in particular at Henley Beach, West Beach and from Glenelg North to Seacliff (apart from the Minda and West Beach dune areas). Seawalls act as the last line of defence in protecting coastal infrastructure and property during storm events.

While early seawall designs were often solid concrete structures, most seawalls since the 1960s have been constructed and repaired using large boulders and rocks. This has enabled seawalls to better absorb wave energy. Nevertheless, many of the seawalls are inadequate and the forces of the sea are such that, in the future, most seawalls will need repairs. Had beach replenishment not been implemented in the 1970s, thereby creating dune buffers, many of Adelaide's seawalls would by now have been undermined at their base. Continued beach replenishment has therefore reduced the risk of seawall damage and reconstruction costs.

## Dune management

The Coast Protection Board undertook widespread dune stabilisation work in the 1970s when large areas of dune were affected by wind-blown sand drift. More recently, dune management has been implemented by coastal councils. This has included drift fencing, dune revegetation and access controls, together with the installation of educational signs and viewing areas at some locations. Drift fencing and dune revegetation are primarily carried out to prevent the loss of wind-blown sand inland and to maintain dune stability.

The dunes are further maintained by ensuring the public uses formal pathways to access the beach and providing suitably located car parking and public amenities.

A number of volunteer dune care groups as well as contractors undertake revegetation and dune weeding programs. Since 2003, the Urban Forest Million Trees Program has been working with coastal councils on a series of vegetation management plans to guide councils and volunteer groups in the implementation of revegetation works in coastal reserves.

*Dune weeding program, Semaphore*

Geotextile groyne at Somerton Park, 2003

Sand carting at Glenelg, 2004

# Alternative management strategies

*In 2000, the Department for Environment and Heritage, on behalf of the Coast Protection Board, initiated a review of the management of Adelaide's metropolitan beaches.*

During the review, the Department considered a range of alternative coast protection strategies. Most of these alternatives had been examined in previous studies in 1970, 1984, 1992 and 1997. However, all alternatives were reassessed in light of the recent changes to the coast and the results of updated coastal process modelling data commissioned by the Board during the review.

## Alternative management strategies considered during the review

### Match sand movement

1. ***Maintain current strategy:*** Maintain the current sand management activities, i.e. beach replenishment and harbour bypassing (including carting and dredging of sand), to not only match the rate of littoral drift but also slowly build up dune buffers in critical areas.
2. ***Reduced level of beach replenishment:*** Maintain sand management activities, but reduce the level of beach replenishment to 'just match' the rate of littoral drift.
3. ***Major replenishment:*** Undertake a large replenishment program that will make further replenishment unnecessary for 20 years.
4. ***Recycle sand:*** Install pipelines and pumping systems to pump sand that accumulates on northern beaches back to southern beaches.

### Retreat or no replenishment

5. ***Retreat**:* Relocate, 'buy back' or rezone foreshore development allowing the shoreline to recede as a result of erosion, i.e. no replenishment, no new seawalls, and gradual removal of existing seawalls as they are undermined by erosion.

### Slow sand movement

6. ***Groynes with replenishment:*** Construct a groyne field along the coast to minimise net littoral drift, and replenish the beaches between groynes as required.
7. ***Offshore breakwaters with replenishment:*** Construct a field of offshore breakwaters along the coast to minimise net littoral drift, and replenish the beaches in the lee of the breakwaters as required.
8. ***Hybrid field of structures:*** Construct a field of groynes and offshore breakwaters, tailored to local coastal values and uses, and replenish the beaches along the field as required.
9. ***Use coarser sand:*** Replenish the beach with coarser sand, which drifts less under Adelaide's wave conditions.

### Fusion approaches

10. ***Sand recycling and/or replenishment combined with structures:*** A combination of approaches, managing sections of the coast with sand recycling and/or minor replenishment and sections of the coast with structures.
11. ***Sand recycling combined with structures and replenishment with coarse sand:*** A combination of approaches, managing sections of the coast with sand recycling and sections of the coast with structures, but also adding coarse sand from external sources.

### Other approaches

12. ***Seawalls:*** Protect foreshore development from erosion when and as needed by constructing seawalls.
13. ***Do nothing:*** No further sand management or coast protection works. Remove seawalls, roads, pipelines, other infrastructure and houses when damaged by erosion.

*Groynes and seawall in Sheringham, UK (Bedford High School)*

*Groynes and seawall in Florida, USA (US Geological Survey)*

## Evaluation of alternative strategies

During the review, the Department for Environment and Heritage evaluated the alternative strategies as follows:

### 1. Maintain current strategy

This alternative is practical, maintains sand on the beaches, builds up dune buffers and provides additional sand to compensate for sand loss as a result of relative sea level rise. However, the cost of coastal management under the existing strategy is continually increasing.

### 2. Reduced level of beach replenishment

This alternative would not build up dune buffers nor provide additional sand to compensate for sand loss as a result of relative sea level rise. Consequently, there would gradually be less and less sand on beaches affected by erosion. Maintaining sand on the beaches is important to the community for both social and economic reasons, so this alternative is unacceptable.

### 3. Major replenishment

The environmental and social impacts of this alternative are unacceptable. Nearshore seagrass would be buried under replenishment sand, stormwater outfalls would become clogged with sand, and beaches would initially be very wide and subject to high levels of sand drift. Furthermore, the replenishment rates necessary to undertake such a major replenishment could only be achieved by dredge, and no suitable offshore sand sources have been identified that are economically viable at present.

### 4. Recycle sand

This alternative is not feasible on its own, because sand accumulating on the beaches north of Semaphore is mostly fine and calcareous and therefore unsuitable for replenishment of the southern beaches. Nevertheless, the concept of a pipeline to recycle sand is valid and is considered under alternative 11.

### 5. Retreat

This alternative would unlock impounded sand within the dunes and maintain beach amenity. However, the cost for purchasing properties alone would be prohibitive, let alone the cost of replacing and modifying public infrastructure such as roads, water mains and pipes, and sewerage systems. Assessment of the cost of properties and equating this to the volume of sand released indicates a cost in the order of $400 per cubic metre, which is more than 10 times the current cost of sourcing all sand from Mount Compass. In some areas, sub-surface clay could be exposed, thus reducing beach amenity. In addition, it would be very difficult for retreat to be achieved in a manner that was fair to coastal residents. This alternative is therefore not feasible.

### 6. Groynes with replenishment

This alternative would require an extra two million cubic metres of sand from external sources than a beach without structures, and is therefore very expensive. Once constructed, a groyne field could not be readily adjusted to cater for ongoing sea level changes or managed for seasonal variations in wave conditions, other than by adding or removing sand.
A groyne field would also interfere with the coastal landscape and limit pedestrian access along sections of the beach. This alternative was costed during the review but has been dismissed because of the social impacts and high ongoing capital and operating costs involved.

Seawall reconstruction at the Broadway, Glenelg, 2004

Storm damage at Glenelg, 1960

### 7. Offshore breakwaters with replenishment

This alternative is similar to alternative 6, but with higher construction costs offsetting a relative advantage in terms of continued pedestrian access along the coast. This alternative has been dismissed for similar reasons as alternative 6.

### 8. Hybrid field of structures

This alternative has been dismissed for similar reasons as alternative 6.

### 9. Use coarser sand

This alternative could not by itself prevent erosion of Adelaide's beaches. The large-scale replacement of the vast quantity of sand on the beaches is not feasible, even were a sand source of this size available. Furthermore, littoral drift would continue to occur at substantial levels, requiring ongoing recycling and replenishment. The use of coarse sand is therefore best combined with other methods, as considered under alternative 11.

### 10. Sand recycling and/or replenishment combined with structures

This alternative is a combination of the best aspects of alternatives 4 and 8. While this alternative is feasible, it is less effective than alternative 11, and of a similar or slightly greater cost.

### 11. Sand recycling combined with structures and replenishment with coarse sand

This alternative draws on the best aspects of alternatives 4, 8 and 9. It is more effective than alternative 10 because it incorporates the use of external sand sources to counter the ongoing loss of dune volume and beach width caused by sea level rise and other factors. *This alternative forms the basis of the beach management strategy for 2005–2025.*

### 12. Seawalls

This alternative would quickly result in the loss of sand from beaches if not combined with beach replenishment. Maintaining sand on Adelaide's beaches is important to the community for both social and economic reasons, so this alternative is unacceptable on its own. However, seawalls are important as the last line of defence against storms, so their continued maintenance has been included in the strategy for 2005–2025.

### 13. Do nothing

This alternative would quickly result in the loss of sand from beaches and progressive damage to foreshore infrastructure and buildings. The cost due to loss of beach value alone would be very high, with further costs incurred for the management of subsequent debris and pollution. This alternative is therefore not feasible.

*Brighton (Johnny Kamma)*

*Semaphore in 1923*

# The management strategy for 2005–2025

*The management strategy for 2005–2025 is based on sand recycling combined with coastal structures and replenishment with coarse sand.*

The strategy is cost-effective, can be adapted to meet changing climatic conditions, and will reduce the impact of beach replenishment activities on beach users and coastal residents.

The main components of the strategy are summarised on page 3 and illustrated in Figure 2.

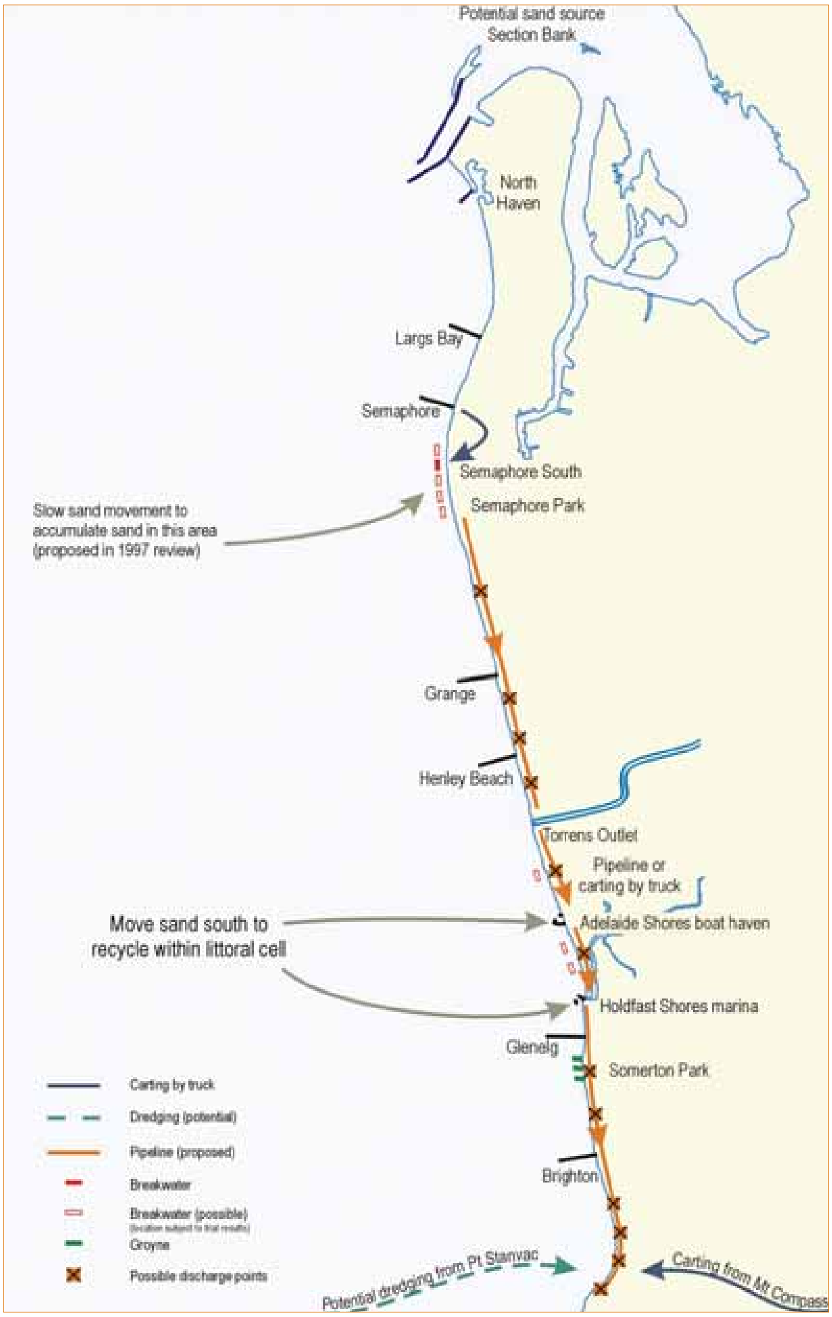


*Figure 2: The main components of the management strategy for 2005–2025*

*Build-up of sand north of Semaphore jetty, 2003*

*Build-up of sand near the Torrens Outlet*

## Continue beach replenishment

The strategy for 2005–2025 involves continuing the existing program of beach replenishment, placing 160,000 cubic metres of sand each year at strategic locations on southern and central beaches to maintain the sandy foreshore, build up dune buffers, and protect coastal infrastructure. Sand will be recycled at higher rates from areas of net gain within the metropolitan littoral cell including Semaphore, the Torrens Outlet and Glenelg.

The wave climate and thus the longshore drift rate decline progressively in Largs Bay (the water body between Point Malcolm and Outer Harbor) from south to north. This has the effect of sorting the sand that drifts in from the south, with the coarser sand dropping out of suspension in the water at the southern parts of the bay, and the finer material continuing north until the waves are too small to carry it further. The end result is that the coarser fraction of the sand, which is suitable for replenishment purposes, collects on the beach at Semaphore, whereas the remaining sand, which is too fine and carbonate-rich for beach replenishment purposes, drifts north to Largs Bay, Largs North, Taperoo and North Haven.

In the past 30 years, over 700,000 cubic metres of sand has been removed from Semaphore beach, both immediately south and north of the Semaphore jetty. This sand has been trucked along local and major roads to beaches such as Brighton and Seacliff. In recent years, the sand has been carted along the beach to replenish the eroding foreshore at nearby Semaphore Park. In 2004, 120,000 cubic metres of sand was carted from Semaphore beach to pre-fill the salient at the trial breakwater site at Semaphore South. This was expected to cause a dune recession at Semaphore of between 30 and 50 metres, or approximately the volume of sand that has built up in the area over the last 10 years. However, after construction of the salient was completed, a dune recession of between three and five metres was measured, possibly due to the relatively mild winter, with sand being moved inshore rather than from the dune to readjust the beach shape. By necessity, while sand continues to build up and impound in the dune system at Semaphore, this area will be considered a source for beach replenishment sand. If Stage 3 of the Semaphore Park Foreshore Protection Strategy goes ahead, sand may be pumped from Semaphore beach through a temporary pipeline to fill the salients of the breakwater field at Semaphore Park.

The Torrens Outlet and much of its lower drainage system was constructed in the 1930s. The flow of stormwater from the outlet across the beach creates a ‘hydraulic groyne’ effect, causing sand to be deposited south of the outlet and erosion to occur to the north. A large dune system has built up south of the outlet, resulting in much of the sand being impounded and reducing the amount of sand available for the rest of the metropolitan coast. To limit further sand impoundment and maintain beach levels at Henley Beach South, the City of Charles Sturt currently undertakes manual bypassing averaging approximately 20,000 cubic metres of sand every year. In addition, large volumes of sand have been removed from the area in the past on an ‘as needs’ basis to replenish Glenelg North, Somerton Park, Seacliff and West Beach. Overall, including the bypassing, 500,000 cubic metres of sand has been recycled from the Torrens Outlet. A plan to draw down the dune reserves at the Torrens Outlet by 50,000 cubic metres each year for five years was initiated in 2004–05. In autumn 2005, 50,000 cubic metres of sand was removed from south of the Torrens Outlet and carted to Brighton/Seacliff, Glenelg North and the West Beach dunes. From 2005–06 to 2008–09, each year 25,000 cubic metres of sand will be backpassed to southern locations and 25,000 cubic metres will be bypassed to Henley Beach South.

A sufficient dune volume and width will be maintained at both Semaphore and the Torrens Outlet to provide protection against two 1-in-100-year average return interval storms, with an allowance over time for one metre of sea level rise.

For a discussion of future sand recycling from Glenelg, see page 17.

*Slurrytrak system in operation at the Dawesville and Mandurah Inlets, Western Australia (CGC Dredging)*

*Pipeline booster station operating at Noosa, Queensland (SlurrySystems)*

## Recycle sand more effectively using sand slurry pumping and pipelines

Pipeline transfer systems are an effective way to move granular material, such as beach sand, long distances with minimal operational costs. Pipelines are already being used at a number of locations around Australia to recycle beach sand and bypass harbours. The most notable of these locations are the Tweed River (New South Wales), the Nerang River (Queensland), the Dawesville and Mandurah Inlets (Western Australia), Lakes Entrance (Victoria) and the Port of Portland (Victoria).

The strategy for 2005–2025 involves dividing the Adelaide metropolitan coastline into a series of management cells and using pipeline transfer systems to recycle or backpass sand from north to south within some of these cells. The following pipelines could be constructed:

- a 6.5 km pipeline from south of the Glenelg harbour to Kingston Park
- a 1.5 km pipeline from south of the West Beach harbour to Glenelg North
- a 1.5 km pipeline from south of the Torrens Outlet to the West Beach dunes
- a 9.5 km pipeline from West Lakes Shore to Henley Beach South.

The pipeline transfer systems require a sand acquisition system to remove sand from the beach, mix it with seawater to form a slurry mixture, and pump this slurry into the pipelines. Two options for the sand acquisition system have proven track records in Australia: the Sand Shifter and the Slurrytrak. The main difference between the systems is that the Sand Shifter has the advantage of better noise control whereas the Slurrytrak has the advantage of better manoeuvrability. Both systems have advantages over conventional dredging techniques: the sand slurry that is pumped can be controlled to a more consistent density, sand volume can be measured more reliably, and seagrass and other material can be separated through a screening process.

The pipelines will usually be constructed from medium- or high-density polyethylene pipe approximately 300 millimetres in diameter. A booster station is required to pump the sand slurry along approximately each 2 km length of pipeline. Booster stations are usually housed in shipping containers that are insulated to reduce noise emissions. The placement of the pipelines and booster stations will be designed to fit with the level of development along each part of the coast. In areas where there is an existing dune system, the pipelines and booster stations will be installed along the rear of the dunes. In areas where there is an existing seawall but no dunes, the pipelines and booster stations will be installed in the seawall.

A number of outlets will be present along the length of each pipeline. Sand will be discharged from these outlets directly onto the beach in strategic areas.

Trials of sand slurry pumping equipment including the Sand Shifter and Slurrytrak are scheduled to take place in the early years of implementing the future strategy (see page 19).

During trials of the sand slurry pumping equipment, temporary pipelines will be used. The potential for long-term pumping of sand will be evaluated following the trials. Permanent facilities would be installed under an open tender arrangement to ensure best practice, innovation, cost effectiveness, transparency and accountability.

*Unimin Sand Plant at Glenshera, Mount Compass*

## Add coarse sand from external sources

The strategy for 2005–2025 makes allowance for the need to provide additional sand on the metropolitan beaches, preferably coarser in grain size, to counteract land subsidence, sand loss and sea level rise. The main benefit of coarser sand is that it is much more resistant to across-shore transport, and so provides a more stable buffer against storm erosion. It also adds to the total amount of sand on the coast.

The Coast Protection Board has recently carried out a range of offshore and land-based sand source investigations at locations including North Haven, the Section Bank, Port Stanvac, Nalpa, Mount Compass and northern Yorke Peninsula.

Around 360,000 cubic metres of sand is potentially available offshore from North Haven, but analyses indicate that the sand is too fine and carbonate-rich to be used for replenishing southern beaches.

The Section Bank contains well over 2.5 million cubic metres of sand. Of concern, however, are the seagrass and mangrove habitats in the surrounding environs that have been degraded as a result of discharges from the Bolivar wastewater treatment plant and the Port River estuary. It is possible that dredging sand from the area could further affect the condition of local seagrasses and mangroves. The Board does not intend to use the Section Bank as a sand source unless any environmental impacts of dredging the area can be adequately addressed.

Additional dredging of the Port Stanvac dredge site may be viable following the closure of Port Stanvac in 2004, which has allowed an extension of dredging into a previously restricted area. Even so, the dredge site remains constrained at its boundaries. Important seagrass habitats to the south would be at risk from nearby dredging. Additionally, the northern and western borders have poor-quality sediments and/or shallow rock or clay, and on the eastern border the Department for Environment and Heritage assessed that dredging should not occur in less than 10 metres of water to avoid affecting inshore coastal processes.

Onshore deposits of silica sand suitable for beach replenishment exist at Nalpa near Wellington and Glenshera near Mount Compass. When washed, the Nalpa and Glenshera sands are coarser than the existing beach sand at Brighton and Seacliff. Sand from Price on the Yorke Peninsula is also suitable as it falls within the optimal grain-size range, although it requires further haulage than the sand from sources near Mount Compass.

To date, small quantities of suitable sand have been purchased from commercial operations at Mount Compass, including the Unimin plant at Glenshera, to supplement Brighton and Seacliff. However, the Department for Environment and Heritage estimates that 25,000 cubic metres of sand will be required each year from external supplies as part of the strategy for 2005–2025. The Department is therefore investigating a potential long-term supply of sand from non-commercial operations in the Mount Compass area.

*One of the new groynes installed at Somerton Park in 2005*

*The trial breakwater at Semaphore South, January 2005*

## Build coastal structures in critical locations

It will also be necessary, particularly for the cost-effectiveness of the strategy for 2005–2025, to devise appropriate ways to slow sand movement along the coast. However, it is important to note that coastal structures will only be used in a few critical locations because of the impact they have on coastal amenity.

The Semaphore South breakwater trial is an important step in determining whether shore-parallel, 'least intrusive' structures can be effective in slowing sand movement. Similar physical conditions along the length of Adelaide's coast mean that the results from the trial can be applied to the design of breakwaters at other locations south of Semaphore Park. For example, the construction of two breakwaters between Glenelg North and the West Beach harbour is being considered as an alternative to backpassing sand within this management cell. The construction of a breakwater north of the West Beach Surf Life Saving Club is also a possibility. The trial is at an early stage, but the breakwater at Semaphore South is already trapping and holding sand in the area and performing as expected.

The beach management strategy for 2005–2025 assumes the continuation of the Semaphore Park Foreshore Protection Strategy. Depending on the results of the breakwater trial, which is due to be completed in 2006–07, a further four breakwaters may be constructed by 2009–10 to directly protect the Semaphore Park foreshore.

Shore-parallel structures (offshore breakwaters) are generally preferred over perpendicular structures (groynes) because the latter would interrupt the mostly continuous beaches we are so fortunate to have today. Nevertheless, small groynes can be useful for raising beach levels on a minor scale. An example of this is the small geotextile groyne constructed at Somerton Park in 2001, which is approximately 1.5 metres high and 25 metres long. This groyne has collected enough sand to raise the beach level to the south of it above the normal high-tide level on a beach that was previously submerged at high tide. There is no observable adverse effect on the beach to the north of the groyne. Similar groynes have been installed at Somerton Park in 2005 to raise upper beach levels and provide beach access over longer periods of the day.

*Close-up of a groyne at Somerton Park showing geotextile bag construction*

*Sand bypassing at Adelaide Shores, West Beach*

*Dredging of sand and seagrass at Holdfast Shores, Glenelg*

## Integrate sand bypassing at harbours with beach management

The harbours at Glenelg and West Beach require ongoing sand and seagrass bypassing and channel maintenance at a cost of $1.9 million per year (in 2004–05), which is about the same as the current cost of metropolitan beach replenishment. In 2004–05 and previous years, the bypassing work was undertaken by Transport SA. At Glenelg, sand was dredged from the Patawalonga channel and from the leeward side of the breakwater and pumped offshore at Glenelg North. At West Beach, sand was dredged from the harbour channel and pumped offshore immediately to the north, while sand south of the breakwater was removed by excavator and truck and carted north to the West Beach dunes.

The responsibility for sand management at the Glenelg and West Beach harbours was transferred to the Department for Environment and Heritage at the start of 2005–06. As part of the beach management strategy for 2005–2025, sand bypassing at the harbours will be integrated with the management of the rest of the metropolitan beach system over the coming years. Sand building up at the harbours will be backpassed to replenish beaches to the south, which will result in more effective recycling of sand as well as reduced harbour management costs. Similarly, erosion north of the harbours will be prevented by backpassing sand from areas further north along the coast.

In other words, sand building up at the Glenelg harbour will be backpassed to replenish Brighton and Seacliff, sand building up at the West Beach harbour will be backpassed to replenish Glenelg North, and sand building up at the Torrens Outlet will be used to replenish the West Beach dunes.

*The Adelaide coastline, 1992*
*(South Australian Tourism Commission)*

*Glenelg (South Australian Tourism Commission)*

*The West Beach dunes, June 2005*

## Implementation plan

Seven coastal management cells are proposed in the strategy for 2005–2025 (Figure 3).

Implementation of the strategy will take place in a phased manner over a five-year period from 2005–06 to 2009–10. This is necessary in order to trial sand acquisition and pipeline transfer systems, ensure that designs are prepared in a manner that takes into account existing development and land use, allow time for public consultation in conjunction with development applications, and allow time for the necessary infrastructure to be put in place.

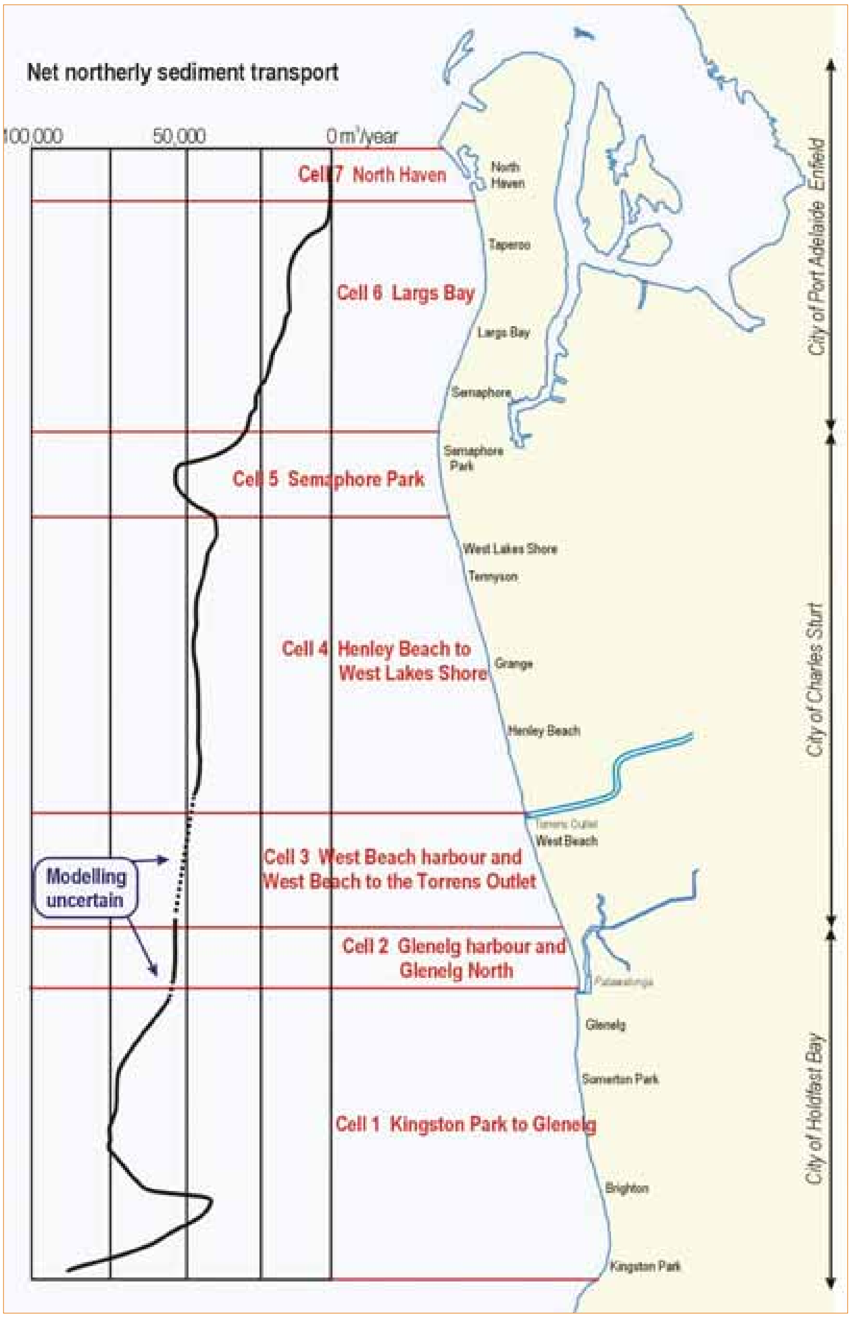


*Figure 3: Coastal management cells in the strategy for 2005–2025, showing net northerly sediment transport along the metropolitan coast*

| Coastal management cell | Proposed actions |
|---|---|
| **1: Kingston Park to Glenelg**<br>Average annual net northward drift of sand is 70,000 cubic metres | Add 25,000 cubic metres of sand each year to the dunes at Brighton/Seacliff to counter the ongoing loss of dune volume and beach width along the metropolitan coast caused by sea level rise and other factors. From 2005–06 to 2008–09 this sand will be backpassed from the Torrens Outlet, with coarse sand added from trials of onshore sources.<br>In 2006–07 backpass 40,000 cubic metres of sand from Glenelg to Brighton/Seacliff by truck and commence construction of the pipeline between Glenelg and Kingston Park. In 2007–08 start pumping 50,000 cubic metres of sand each year from Glenelg to Kingston Park. |
| **2: Glenelg harbour and Glenelg North**<br>Expected annual net northward drift of sand is 50,000 cubic metres at Glenelg North | Dredging of the Glenelg harbour is being managed by the Department for Environment and Heritage from 2005–06 onwards (it was previously managed by Transport SA). In 2005–06 bypass approximately 100,000 cubic metres of sand from channel and tombolo maintenance around the Glenelg harbour to Glenelg North. Thereafter, bypass only 20,000 to 30,000 cubic metres of sand each year. Continue using a dredge to bypass seagrass from the channel and tombolo to offshore Glenelg North.<br>In 2006–07 undertake a sand pumping trial to backpass 30,000 cubic metres of sand from the West Beach harbour to Glenelg North and commence construction of the pipeline between the West Beach harbour and Glenelg North. In 2007–08 start pumping 30,000 cubic metres of sand each year from the West Beach harbour to Glenelg North.<br>Consider construction of two breakwaters between Glenelg North and the West Beach harbour as an alternative to backpassing. |
| **3: West Beach harbour and West Beach to the Torrens Outlet**<br>Expected annual net northward drift of sand is 50,000 cubic metres from West Beach to Torrens Outlet | Dredging of the West Beach harbour is being managed by the Department for Environment and Heritage from 2005–06 onwards (it was previously managed by Transport SA). From 2005–06 bypass approximately 30,000 cubic metres of sand and seagrass around the West Beach harbour each year.<br>From 2005–06 to 2008–09 draw down the sand reserves at the Torrens Outlet by 50,000 cubic metres each year, with 25,000 cubic metres of sand backpassed to Brighton and 25,000 cubic metres bypassed to Henley Beach South.<br>In 2005–06 undertake a sand pumping trial to backpass 40,000 cubic metres of sand from south of the Torrens Outlet to the West Beach dunes. In 2006–07 backpass 40,000 cubic metres by truck/scraper and commence construction of the pipeline from the Torrens Outlet to the West Beach dunes. In 2007–08 start pumping 40,000 cubic metres of sand each year from the Torrens Outlet to the West Beach dunes. This assumes that, of the dredged bypass sand, at least 10,000 cubic metres each year can be fed onto West Beach and that, under current conditions, an average of around 16,000 cubic metres of sand accumulates each year at the Torrens Outlet despite annual mechanical bypassing of 25,000 cubic metres.<br>Construct a breakwater north of the West Beach Surf Life Saving Club if erosion there cannot be contained. Consider a breakwater south of the West Beach Surf Life Saving Club to further stabilise dunes if necessary. |
| **4: Henley Beach to West Lakes Shore**<br>Expected annual net northward drift of sand is 50,000 cubic metres | Until the Semaphore Park breakwater field is completed, this area will depend on mechanical bypassing of 25,000 cubic metres of sand each year from the Torrens Outlet plus natural northerly drift.<br>From 2009–10 onwards, backpassing of 50,000 cubic metres of sand by pipeline from south of the breakwater field will be necessary. |
| **5: Semaphore Park**<br>Expected annual net northward drift of sand to breakwater is 60,000 cubic metres | In 2005–06 backpass 40,000 cubic metres of sand from the trial breakwater at Semaphore South to Semaphore Park.<br>The trial breakwater is currently operating until 2006–07. In 2007–08, subject to successful completion of the trial, armour the trial breakwater and construct a new rock breakwater.<br>In 2008–09 construct two further breakwaters (subject to the results of the trial) and commence construction of the pipeline from south of the breakwater field to the Torrens Outlet. In 2009–10 construct a final breakwater (subject to the results of the trial) and start pumping 50,000 cubic metres of sand each year from south of the breakwater field to the Torrens Outlet. |
| **6: Largs Bay**<br>Expected annual net northward drift of sand is 30,000 cubic metres | During the breakwater trial, backpass up to 10,000 cubic metres of sand each year from Semaphore to the north of the trial breakwater using trucks or scrapers. This assumes around 33,000 cubic metres of sand drifts north past the breakwater each year.<br>Subject to successful completion of the breakwater trial, draw down the Semaphore dunes to fill the salients of the breakwater field, using a temporary pipeline to pump the sand to Semaphore South. |
| **7: North Haven**<br>No expected annual net northward drift of sand except for accumulation south of, and in the channel of, North Haven | Dredge the channel at North Haven (conducted by the Department for Transport, Energy and Infrastructure). Consider using the reserve of fine sand at North Haven, and further south towards Largs Bay, to backfill the Section Bank if dredging of beach replenishment sand from the Section Bank is found to be economically and environmentally sound in the future. |

Brighton jetty, 1979

Brighton jetty, 2002

# Economic, social and environmental considerations

*During the development of the beach management strategy for 2005–2025, due consideration has been given to economic, social and environmental aspects.*

## Economic assessment

As outlined in the section on evaluation of alternative strategies, the only feasible options determined by the review were either to continue the existing management activities (alternative 1) or to implement a strategy for the future based on alternative 11.

The capital and operating costs of the following four scenarios were examined during the review to determine the most cost-effective method:

1. Continue existing management activities
2. Implement the future strategy using predominantly excavators and trucks
3. Implement the future strategy using a Slurrytrak and pipelines
4. Implement the future strategy using Sand Shifters and pipelines

Completion of the Semaphore Park Foreshore Protection Strategy, involving the possible construction of a field of breakwaters at Semaphore Park, is assumed in each scenario. An increased supply of externally sourced sand is also assumed in each scenario, with the cost based on supply from Mount Compass.

It is not particularly useful to make a direct comparison of the costs of the four scenarios, because the costs accrue over different periods and the value of money changes over time.

A commonly used method for eliminating this variable is to convert all costs to an equivalent dollar value at a particular point in time. It is usual to convert the costs to today's dollars and call the result the net present value (NPV). To achieve this, a discount rate is applied to future costs. The discount rate is the rate, per year, at which future costs are diminished to make them more comparable to values in the present.

The Department of Treasury and Finance currently recommends that a discount rate of 7% be applied to public sector projects, but that sensitivity checks are made using rates of 4% and 10%.

In simple terms, the NPV of each scenario depends not only on the overall costs but also on how the costs are scheduled over the 20-year forecast period. The cost of the progressive construction of a groyne field (alternative 6) has been included in the table below to demonstrate its prohibitive cost as discussed in the section on evaluation of alternative strategies.

**Net present value of the costs of each scenario over a 20-year period**

| Scenario | NPV ($million) at different discount rates | | |
|---|---|---|---|
| | 4% | 7% | 10% |
| Progressive construction of a groyne field | –113 | –89 | –73 |
| Existing management activities | –89 | –70 | –57 |
| Future strategy using excavators and trucks | –76 | –60 | –49 |
| Future strategy using a Slurrytrak and pipelines | –75 | –61 | –51 |
| Future strategy using Sand Shifters and pipelines | –67 | –56 | –47 |

*Sand dumping platform at Edwards Street, Brighton*

*Carting sand from near the Semaphore jetty, 2004*

As shown in the table on page 20, the cost of the Sand Shifters and pipelines scenario in today's dollars using a discount rate of 7% is approximately $56 million over 20 years, whereas the cost of continuing the existing management activities in today's dollars is approximately $70 million over the same period. This equates to a saving of 20%. The Sand Shifters and pipelines scenario is the cheapest across all discount rates.

Trials of the Sand Shifter are scheduled to take place in the early years of implementing the future strategy (see page 19). The Slurrytrak or a similar device will also be trialled, because there may be locations where its use could be more suitable.

## Social impacts

Beach replenishment activities to date have usually required the presence of trucks and earthmoving equipment on the beach. Earthmoving equipment is loud, especially when reverse warning alarms are in use, and nearby beach users and residents must endure their repeated and unpleasant noise. Although these activities are mostly carried out during those months when there are fewer people on the beach, the work still poses a risk of injury, disturbs beachside residents and deters visitors from using the beaches.

Another concern about beach replenishment activities to date has been the amount of disturbance and traffic congestion created when trucks cart sand along suburban roads. Much of this disturbance has been experienced in Brighton and Seacliff. Rail crossings and roundabouts are common in these suburbs, and trucks need to slow or stop regularly, thus generating noise from braking and acceleration and air pollution from exhaust fumes.

A major benefit of the strategy for 2005–2025 is that the use of pipeline transfer systems will minimise the need for earthmoving machinery and trucks on beaches and suburban roads. Nevertheless, some negative impacts on the community will be associated with the strategy. For example, a significant but short-term matter will be the effect on beach amenity and public safety during construction of pipelines and booster stations. It is likely that some beach areas will need to be fenced off. In the event that this is necessary, all efforts will be made to maintain a safe route along the coast for pedestrians, as has been past practice for coastal works.

There will be ongoing but relatively minor impacts associated with the sand acquisition and pipeline transfer systems. It is anticipated that the Sand Shifter system would be fully automated and would operate at night under off-peak electrical power, which would reduce the likelihood of noise levels and machinery affecting local residents and beach users. The Slurrytrak system, on the other hand, would operate during the day and, being mobile, could not as easily be electrically powered. Therefore, it would cause some inconvenience due to noise levels and reduced amenity. However, the system is able to transfer sand at a much higher rate than the historical method of excavating and trucking, so the impact on any given area of the coast would be reduced.

*Sand carting equipment on the beach and nearby beach users*

It is expected that the Sand Shifter and Slurrytrak systems would pump sand only intermittently, thus minimising the time of discharge from pipeline outlets. Because seagrass and other material is separated through a screening process before entering the pipelines, discharged sand can be placed directly onto the beach, and the likelihood of nuisance odours and deleterious matter being present is reduced.

If sand is imported in an ongoing manner from Mount Compass or another external source, as suggested in the strategy, changes will be required to minimise the impacts on both regional and beachside residents. Designated routes or a variety of different routes will need to be established over times that are the least inconvenient to the community. A holding depot somewhere near Brighton Road with a pipe to transport sand to Seacliff and Brighton is being investigated as a way of minimising traffic through residential streets. Safety issues and secondary costs such as increased wear on roads will also have to be considered when comparing Mount Compass with other potential sand sources.

The use of structures to slow sand will be limited to a few critical locations because of their visually intrusive nature and potential interference to beach users and coastal residents. To be effective they have to be high enough to be exposed during most tidal conditions. Careful design can, however, minimise this impact by ensuring that the height is carefully chosen for the structure's purpose. Breakwaters are generally preferred over groynes because they do not have such a hard effect on the coast and maintain easy alongshore pedestrian access.

The integration of sand bypassing requirements at the Glenelg and West Beach harbours with beach management will also reduce the impact of coastal works on beach users and local residents. Changes in how dead seagrass is handled are likely to reduce the current odour impacts associated with accumulation of rotting seagrass.

## Environmental impacts

The environmental impacts caused by beach replenishment are many and varied although once identified they can be minimised through best-practice management. Environmental impacts directly affecting the community (e.g. noise) are discussed in the section on social impacts.

When sand is removed from beaches for recycling purposes, dunes may be eroded and dune flora and fauna disrupted. Damage to vegetation and habitats may be caused to a small area at the rear of dunes by burial of pipelines. In addition, there is the potential for weeds and marine pests to spread through sand carting and pipeline transfer systems. Continued vigilance in regard to weeds and marine pests is inherent in the strategy. Dune rehabilitation works will be undertaken in affected areas in line with coastal vegetation management plans developed by the Urban Forest Million Trees Program in conjunction with local councils. However, it is important to note that the primary role of recently created dunes (e.g. at the Torrens Outlet and Semaphore) is to provide reserves for sand recycling and to buffer coastal infrastructure from the sea.

Recent investigations regarding the use of the Section Bank as a sand source and the potential impacts of dredging have shown that the region is already highly stressed and that dredging the Section Bank may pose, or at least be seen to

*Erosion of the dunes near the Semaphore jetty, July 2004*

*Dredge operating in the West Beach harbour, June 2005*

pose, significantly high risks to the coastal ecosystem. Therefore, for the immediate future, until environmental impacts can be ruled out, alternative sand sources will be necessary to replenish Adelaide's beaches.

Land-based sources with sand suitable for beach replenishment include Mount Compass, Nalpa and the northern Yorke Peninsula. Potential impacts of sand mining include erosion, groundwater pollution and the loss of other land uses. Impacts are managed and minimised by operators of existing mines through government legislation and mining lease conditions. Importing sand from a land-based source will require the use of trucks, which will result in greenhouse gas emissions.

The use of sand acquisition and pipeline transfer systems in the future strategy is also likely to result in greenhouse gas emissions. An assessment of the relative greenhouse gas emissions for alternative means of transporting sand gives the following annual carbon dioxide emission rates.

| | | |
|---|---|---|
| Excavators and trucks | 640 | tonnes/year |
| Sand Shifters and pipelines | 1,030 | tonnes/year |
| Slurrytrak and pipelines | 1,170 | tonnes/year |

The substantial difference in emission rates between the excavators and trucks scenario and the pipeline transfer scenarios is due to the fact that not only sand but also water is being pumped through the pipelines, in the form of a slurry mixture. This requires a greater quantity of energy to be expended per volume of sediment transported. The possibility of offsetting this increase in emissions by using only green energy will be investigated during the trials of sand recycling methods and equipment. It is not anticipated to affect the overall cost of the strategy by more than 1%.

Possible environmental impacts from the construction of groynes or breakwaters in critical locations include construction on seagrass meadows, turbidity during construction causing light attenuation and/or sedimentation, impacts on benthic fauna, creation of conditions suitable for pest species, and environmental effects on sand source areas (to supply sand for salients).
It is important to note that structures to slow sand movement along the Adelaide coastline will not be built over existing seagrass. This is because the structures need to be built within 500 metres offshore, and seagrass loss has already progressed beyond this point. Moreover, the Coast Protection Board supports the preservation of the remaining seagrass meadows so would not act to harm them. Similarly, the sites where sand-slowing structures are feasible are distant enough from seagrass meadows that any turbidity created by the structure's construction is not likely to be a risk. Nevertheless, detailed assessments of this risk would be required as part of the design and environmental assessment process for each structure. Benthic infauna are generally capable of quick re-establishment if disturbed, and in many cases their communities can recover from a disturbance within a 12-month period.

The rationalisation of sand bypassing requirements at Holdfast Shores and Adelaide Shores will reduce the amount of sand and seagrass that will need to be dredged from the harbours. This is expected to reduce the amount of decomposed seagrass that is macerated by dredging, which would result in improved water quality and reduced odours.


*Public information session held in November 2004 at the Henley Sailing Club*

# Community education and consultation

*Adelaide's coastline is one of the defining characteristics of the city, widely recognised as an integral component of our cultural identity and quality of life.*

As well as being a focus for urban development, industry, employment and tourism, the coast caters for a range of recreational activities including walking, swimming, sailing, and simply relaxing and enjoying the scenery. In addition, the beaches provide a venue for social gatherings and functions, sporting clubs and events, and environmental care and education.

The community has the right to not only be informed about issues facing the beaches and their possible solutions, but also to be involved in decisions about how the beach is managed. Community members often bring valuable experience, knowledge and skills to coastal management activities.

A number of public meetings have taken place since the 1997 review to inform local residents and community groups about beach management activities. Participation in the Metropolitan Seaside Councils Committee and the City of Charles Sturt Community Coastal Reference Group has facilitated communication between the Department for Environment and Heritage, community groups and councils concerning coastal issues and potential management strategies.

In early 2003, a focus group was formed to update the Coast Protection Board's understanding of community views on beach management and provide assistance in identifying stakeholders. The focus group included representatives from Coastcare, the Conservation Council of SA, the Port Adelaide Residents Environment Protection Group, the Henley and Grange Residents Association, the Friends of Patawalonga Creek and the Marine Discovery Centre.

In 2003, the Department for Environment and Heritage commissioned a study to determine how the community uses the beach, the value of particular beach attributes, and attitudes towards different beach management strategies. A clean beach, a clean ocean and having sandy beaches were considered valuable by a large proportion of respondents. Beach replenishment received the most support in terms of different management strategies, because it was generally perceived to be the most effective and least intrusive method. Pipelines were suggested by some participants as an effective way of maintaining sand on the beaches while minimising social impacts.

The community clearly agrees that sand must be maintained on the Adelaide beaches, not only for protecting coastal properties and infrastructure but also for the social, recreational and economic benefits a sandy beach provides.

However, there is a need to reduce the impact of beach replenishment and sand slowing activities on beach users and coastal residents.

The views of the community have been considered carefully during the development of the beach management strategy for 2005–2025. For example, the strategy will use pipeline transfer systems to recycle sand more effectively and minimise the need for trucks and earthmoving equipment on beaches and suburban roads. Structures such as groynes and breakwaters will only be used in critical locations because of their visually intrusive nature and potential interference to beach users and coastal residents.

It is important to note that affected individuals and groups will be consulted on the strategy over the coming years as part of the development application process, which is required before the necessary infrastructure can be put in place.

*Children playing at Kingston Park (Johnny Kamma)*

**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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