Adelaide Coastal Waters

Information Sheet No. 4

Physical processes

Issued August 2009

EPA 770/09: This information sheet is part of a series of Fact Sheets on the Adelaide coastal waters and findings of the Adelaide Coastal Waters Study (ACWS).

Introduction

The coastal processes occurring in Gulf St Vincent and along the Adelaide coastline are quite complex. Gulf St Vincent is relatively shallow and joins the Southern Ocean through Investigator Strait and the deeper but narrow Backstairs Passage (Image 1). These restricted entrances constrict the large ocean swells entering the Gulf and modify the tidal conditions within the Gulf. The tidal patterns and wind patterns influence the coastal processes occurring along the Adelaide metropolitan coastline (Image 2). These processes have been in operation since sea level rose to its current level approximately 6,500 years ago.

Image 1 **Satellite image of Gulf St Vincent, Investigator Strait and Backstairs Passage**

Image 2 **Adelaide metropolitan coastline**

Sediment transport along the coast

The predominant winds along the Adelaide coastline are southerly, although there are occasional strong north-westerly winds. The direction of wind-driven waves and coastal processes vary from year to year, but the dominant southerly winds lead to a net drift of sand in a northerly direction along the metropolitan coast. The waves generated by these winds are low to medium energy waves. These waves strike the metropolitan coast at an oblique angle and induce a coastal process known as littoral transport. Littoral transport is the movement of sediments in the nearshore zone by waves and currents. When the waves strike the beach at an oblique angle, the sediment is worked along the beach by the wave energy. This littoral transport process causes the net northerly drift of beach sediment on Adelaide's metropolitan coast.

The process of littoral drift along Adelaide's metropolitan coastline is evident, as seen in Image 2, with the large accumulation of sand on the southern sides of obstructions in the harbours of West Beach (foreground) and Glenelg. It is estimated that the net average northerly annual rate of littoral drift of sand is between 30,000 and 80,000 m^3.

A major beach management issue for the Adelaide metropolitan coastline today is that there is no naturally continuing replenishment source of sand. The 30 km of sand dunes which once stretched from Seacliff to Outer Harbor have been developed. These dunes are now trapped under roads and houses or held back by walls. As there is no continuing replenishment source of sand combined with a net northerly littoral drift and an increasing mean sea level; the long-term effect is the need to artificially maintain Adelaide's beaches. The current beach replenishment strategy is to dredge sand from Adelaide's nearshore environment and pump it onto beaches. Unfortunately this strategy has presented its own implications for the nearshore water quality for Adelaide's coastal waters. As part of Adelaide's Living Beaches Strategy pipelines along the coast will be used to move sand from north to south to counter balance the impact of littoral drift.

Image 3 Littoral transport: sand accumulation at West Beach and Glenelg

Image 4 Sand carting at Glenelg Beach

Distribution of suspended matter in Adelaide's coastal waters

Due to the north-south tidal regime and littoral process in operation along the Adelaide coastline there is limited offshore movement of suspended solid loads from major land-based discharges from wastewater treatment plants (WWTPs), rivers and creeks. Water movement in the nearshore zone along the metropolitan coast is further restricted due to the combination of the low energy conditions in the surf zone. This results in water being moved along the shore rather than away from the coast. Movement of sediment and suspended material is generally from south to north in the summer and from north to south in the winter.

Image 5 Turbid water entering Gulf St Vincent from the Torrens River

The littoral processes of the Adelaide coastline initially confine the impact of discharges to the nearshore zone which has resulted in seagrass loss in this region. This loss is represented by the movement of the blue-line of seagrass further off-shore. Locally generated waves can then cause re-suspension of mobile sediment.

Catchment modelling of Adelaide's coast and sediment research has found levels of suspended solids have been greatest in the northern region of the Adelaide coastal waters and least in the southern region of Port Noarlunga, Port Willunga and Aldinga. The maximum levels of suspended solids occur in the winter months of July and August when wind and wave re-suspension during storms is greater and also while stormwater volumes are greater. At Pt Gawler there has been a decline in the level of suspended solids since January 2000. This is likely be associated with the measures in place since this time to reduce discharge loads from the Bolivar WWTP.

Concerns about Adelaide's coastal water quality

In summary, suspended sediments and nutrients do not readily move offshore. If there are discharges to the marine environment they stay in the nearshore zone moving backwards and forwards along the coast for some time before they are dispersed. If polluted stormwater enters the nearshore zone it is influenced by the coastal processes operating along the coastline. This causes coloured and turbid water to remain in the nearshore zone, consequently reducing light availability for seagrass. Nutrient rich waters from industrial discharges and WWTPs may also remain in the nearshore zone and promote epiphyte growth on seagrass which further reduces the light availability for seagrass growth. Refer to Adelaide Coastal Waters Information Sheet 2 *Seagrass Health* (2009) for more detailed information.

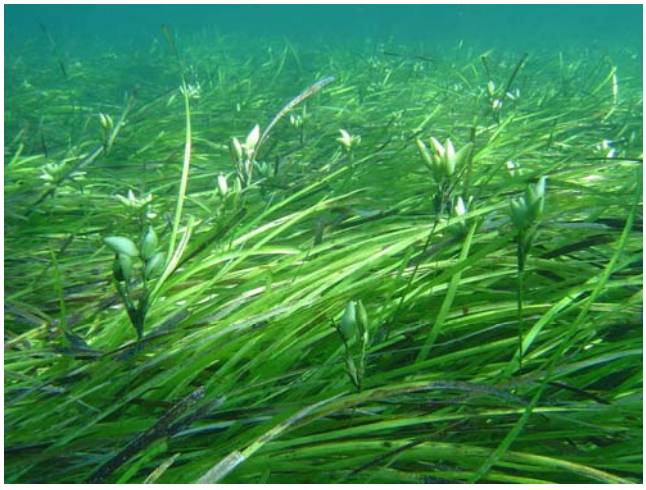

Image 6 *Posidonia sinuosa* seagrass with fruits

References

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EPA 1998, Changes in Seagrass Coverage and Links to Water Quality off the Adelaide Metropolitan Coastline, Environment Protection Authority, Adelaide.

-- 2008, 'Coasts and Seas' , State of the Environment Report 2008 for South Australia, EPA, Adelaide.

-- 2003, Ambient Water Quality Monitoring of the Gulf St Vincent Metropolitan Coastal Waters Report No.2: 1995–2002, EPA, Adelaide.

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Petrusevics, P. 2005, *Distribution of Suspended Matter in Adelaide Coastal Waters Using SeaWifs Data*, Final Technical Report. ACWS Technical Report No. 5 prepared for the Adelaide Coastal Waters Study Steering Committee. Oceanique Perspectives, Adelaide.

Acknowledgments

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Contributing authors

Linda-Marie McDowell, Darren Green and Damian Griffante.

Useful websites

Environment Protection Authority (SA) Water Quality pages <www.epa.sa.gov.au/water_quality.html>

Coast and Marine website <www.environment.sa.gov.au/coasts/index.html>

CSIRO Adelaide Coastal Waters Study pages <www.clw.csiro.au/acws/.html>

South Australian State of the Environment Report 2008 <www.epa.sa.gov.au/soe>

Adelaide's Living Beaches: A Strategy for 2005–2025
<www.environment.sa.gov.au/coasts/adelaides_living_beaches.html>

Images

1 Gulf St Vincent, Investigator Strait and Backstairs Passage. Satellite imagery courtesy of DEH.

2 Adelaide metropolitan coastline, EPA.

3 Littoral Drift sand accumulation West Beach and Glenelg courtesy of the Coastal Protection Branch, DEH.

4 Sand Carting at Glenelg Beach courtesy of Waterwatch Adelaide and Mount Lofty Ranges and EPA.

5 Turbid water entering Gulf St Vincent from the Torrens River courtesy Simon Bryars, DEH.

6 *Posidonia sinuosa* seagrass with fruits courtesy of Simon Bryars, DEH.

Disclaimer

Further information

Legislation

Legislation may be viewed at: <www.legislation.sa.gov.au>

Copies of legislation are available for purchase from:

Service SA Government Legislation Outlet	Telephone:	13 23 24
Adelaide Service SA Centre	Fax:	(08) 8204 1909
108 North Terrace	Internet:	<shop.service.sa.gov.au>
Adelaide SA 5000		

For general information please contact:

Environment Protection Authority	Telephone:	(08) 8204 2004
GPO Box 2607	Facsimile:	(08) 8124 4670
Adelaide SA 5001	Freecall (country):	1800 623 445
	Internet:	<www.epa.sa.gov.au>
	Email:	<epainfo@epa.sa.gov.au>