Estuaries

Plans afoot to save Cape Town's largest estuary

What management interventions are most appropriate for Cape Town's largest estuary, degraded by 150 years of human impact?

Sue Matthews reports.

Photographs from the first aerial survey of the south-western Cape, conducted in March 1938, show the sandy course of the Diep River opening out into the vast, dried-out pans of Rietvlei, then reforming into a channel before entering the sea some 5 km north of Table Bay Harbour. Apart from a racecourse, a few roads and a handful of houses set amongst rows of empty plots – the nascent suburb of Milnerton – the land is undeveloped, but even then there is evidence of human impact on the estuary. The lower reaches are constrained between hardened banks, while a weir near the mouth dams the flow, designed to raise the water level for rowing and sailing regattas.

In fact, the estuary had already been dramatically altered by that stage. The earliest maps of the area show it joined by a backwater channel to the adjacent Salt River, resulting in an extensive wetland with two openings to the sea. The systems were separated during road and railway construction at the start of the 20th century, and at about the same time the lower lagoon was dredged for the first time.

Today, the estuary mouth, Milnerton Lagoon and Rietvlei are hemmed in by intensive urban and industrial development, while the rural reaches of the Diep River flow through a patchwork of wheatfields and vineyards. There was even talk about 50 years ago of converting Rietvlei into a fishing harbour or marina, when two large basins were excavated to provide sandfill for extensions to Table Bay Harbour. Instead, these new deep-water lakes, now called Flamingo Vlei, became the home base of the Milnerton Aquatic Club, and remain popular for power-boating, sailing and windsurfing, as well as angling.

The property was also donated by Transnet (or SA Transport Services as it was then called) for incorporation into a Nature Area, which included Rietvlei's seasonal pans and the Milnerton

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An excited group of learners collect and identify aquatic invertebrates during a visit to Rietvlei Wetland Reserve. Their visit in early September was arranged in honour of World Water Week by the Western Cape Wetlands Forum in conjunction with reserve staff, who run an active environmental education and outreach programme in the area .

Lagoon too. Five years after being promulgated in 1984, the Nature Area became a Protected Natural Environment, and then additional land was acquired for the formation in 1993 of the Rietvlei Wetland Reserve. Now these areas – together with a 'fynbos corridor' along the Diep River upstream, the Zoarvlei wetlands that once formed the Salt River link, the coastal strip adjacent to Rietvlei and conservation-worthy land within the old Milnerton Racecourse – make up the city's new Table Bay Nature Reserve.

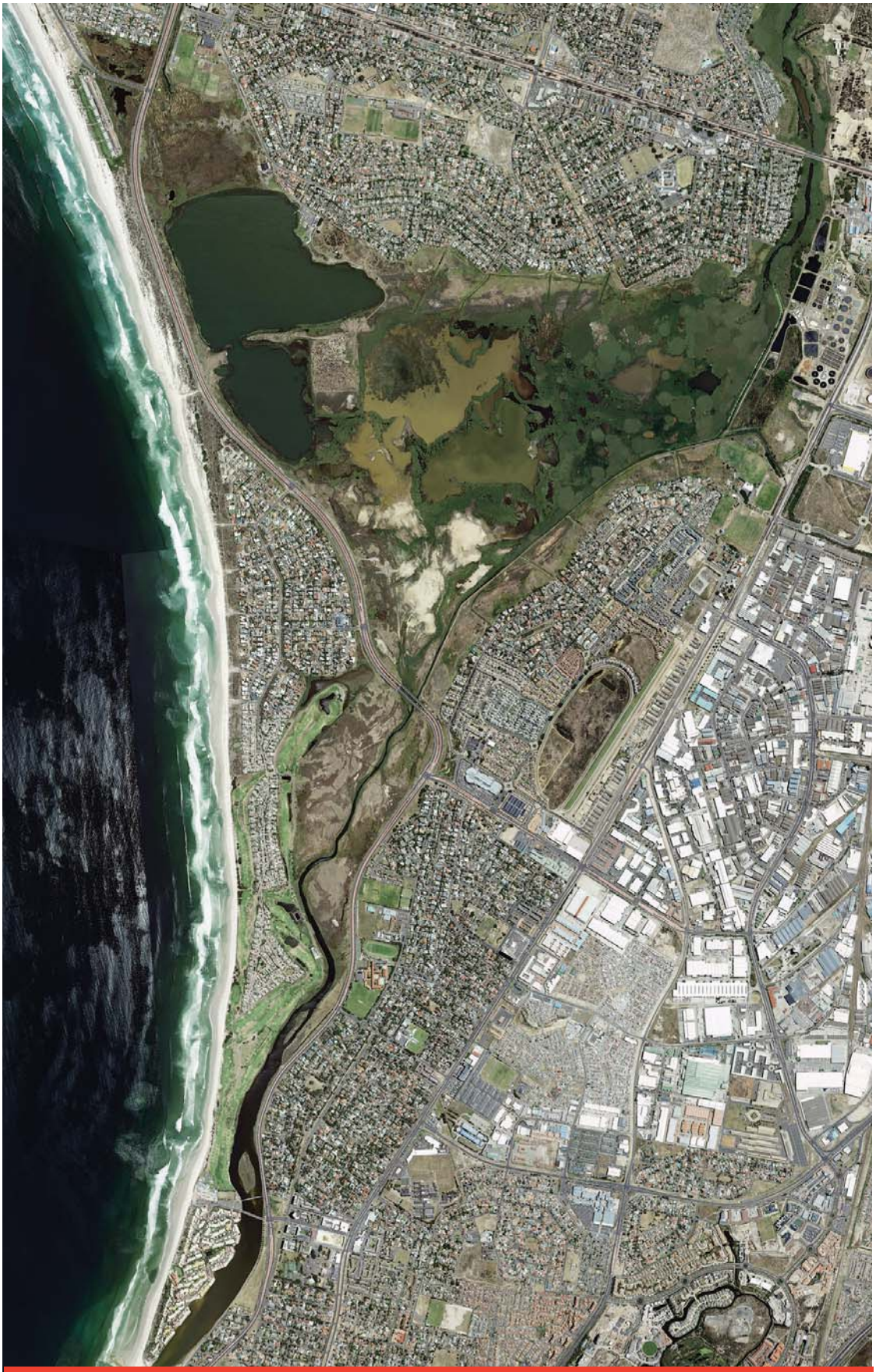
Nevertheless, the reserve can hardly be considered anything near a pristine natural environment, and the estuary itself was given an E for health in the most recent National Biodiversity Assessment (2011). Although the weir at the mouth was washed away by floods in the early 1940s, the lagoon was again dredged in the 1970s and '80s, while a bridge embankment for the West Coast freeway has effectively separated the lagoon from Rietvlei, confining flow to a narrow channel.

The most significant impact, though, is due to the construction in 1991/92 of a 3 km-long channel along the eastern edge of Rietvlei to convey final effluent from the Potsdam wastewater treatment works to the headwaters of the Milnerton Lagoon. This year-round discharge has converted the estuary from a salt-water system that sometimes closed during late summer in dry years – when evaporation rendered the upper reaches hypersaline – to one that has become increasingly freshwater dominated as the volume of treated effluent has increased over the years.

When the Diep River all but ceases flowing in summer, and stormwater runoff is limited to small pulses after rains, the Potsdam effluent contributes almost 100% of the freshwater entering the estuary. Although the volume is somewhat reduced at that time of year because more of the Potsdam effluent is used for irrigation purposes, the flow is still sufficient to prevent the mouth closing. Yet despite the estuary remaining permanently open to the sea, sedimentation at the mouth, around bridge supports and in the upper channels means that seawater penetration is limited to the lower reaches of the lagoon. The poor tidal flushing, combined with the large input of nutrient-rich effluent and polluted stormwater from low-cost housing estates and industrial developments, has resulted in a serious deterioration in water quality.

These changes are reflected in the fish and invertebrate communities, as described in a recent paper in the African Journal of Marine Science by Viskich et al., comparing survey data from 2014 with that of earlier studies. Only five fish species were recorded in 2014, two of which were newly detected freshwater invaders, compared to 12 in the 1950s. Likewise, the invertebrate species tally had been reduced from 47 to 23, and several of those were freshwater forms that had not previously been reported here. Sandprawn abundance was estimated from transect counts of burrow entrances at just over 12 million – down from 40 million in 1998.

The impact of the Potsdam channel construction is not limited to the lagoon though. The Diep River used to flow into Rietvlei,



National Geo-spatial Information

The Diep River Estuary, comprising Rietvlei and the Milnerton Lagoon, is surrounded by intense urban and industrial development.

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depositing salts from the catchment's Malmesbury shales that formed a saline crust as the seasonal pans evaporated. These days, the much-reduced flow diverts into the channel and bypasses Rietvlei, unless the river is in flood, when it can overtop the channel banks. The seasonal pans are now filled by stormwater runoff from the surrounding suburbs, as well as groundwater rising to the surface in winter, but some suspect that the channel acts as a sub-surface drain, causing the pans to dry out faster than before. Apart from the fact that the pans provide important habitat for flamingoes and other wading birds when inundated, fine dust blown off the exposed surfaces by the area's notorious south-easterly winds is a nuisance to local residents.

Area Manager responsible for the reserve, Koos Retief, has the difficult task of addressing these issues and evaluating various possible management interventions. He is guided by the Diep River estuary management plan (EMP), developed between 2008 and 2011 by external consultants with stakeholder participation, which lists one of the long-term objectives to be the optimal functioning of Rietvlei as a wetland – with the pans undergoing seasonal cycles – and appropriate tidal flows and salinity levels in the lagoon.

"It was also stated in the EMP that in order to answer questions about what is happening ecologically and how to manage the system, we need to have a thorough understanding of how the system operates hydrologically and geohydrologically," says Retief.

The City of Cape Town therefore advertised a tender in August 2014 for a study involving the collection of data on surface water and groundwater, and the development of a hydrodynamics model for use by reserve staff. The contract was awarded to the Civil Engineering Department at the University of Stellenbosch, but the team includes a number of independent specialists. Consultant hydrogeologist, Ross Campbell, is responsible for data collection and equipment, as well as assisting with project management.

"There's a big monitoring component to the project, so we're collecting surface and groundwater levels, temperature and salinity data with automatic loggers, which take measurements every half hour, plus we've installed an automatic weather station," he explains. "We've now got an enormous amount of very interesting hydrological data for the estuary, which has never been monitored in such detail before."

Loggers for surface water monitoring have been installed at four sites – one in Flamingo Vlei and three at the various road bridges across the river, approximately 1 km, 4 km and 8 km upstream of the mouth – while eight groundwater monitoring wells housing piezometers were drilled with hand augers in various parts of the wetland. The latter have already revealed how groundwater salinity increases as the water table rises, bringing brackish water towards the surface or re-suspending salts locked up in the soil, while inundation of the pans by stormwater tends to dilute the salts.

"We're getting very high salinities of 70 to 80 ppt in some of the groundwater in the central areas of Rietvlei," says Campbell. "The salt crust that forms on the surface of the dried out pans in summer is partly held in place by halophytic plants, but without new salt coming in – whether from the catchment or the sea, as in historical times – the salinity profile in the soil is probably moving down. This means there may not be enough salt in the upper layers any more to form a strong crust or keep a cover of halophytes, which could be contributing to the dust problem."

The main focus of the modelling effort is on the surface water, and involves simulating water flows and salinity from the mouth to the road bridge 8 km upstream. Early next year, the team will be training the reserve staff and other key municipal officials to use it.

"We're hoping that such a model will assist us in future decision-making," says reserve manager, Retief. "When there are changes in hydrology, such as increased volumes from Potsdam or more reuse of the effluent, we need to be able to predict what the outcomes will be in the system downstream. Should we perhaps be filling in the bypass channel, and would this increase the flood risk to properties upstream that lie within the 1:100 year floodline? When do we need to remove sediments from the system, and where should we do it?"

"We're even considering establishing a population of hippopotamus at Rietvlei, because they would trample canals through the reedbeds and allow water to flow through to places where it currently doesn't reach."

He explains that the freshening of the system has facilitated the invasion of the seasonal pans by the couch grass Paspalum, which now grows as thick tussocks in areas that were once either exposed ground or covered with saltmarsh vegetation.

"It needs a heavy bulk-grazer to keep it under control, because that habitat is useless to migrating birds, and it's a fire hazard too," he says. "Hippo would also be a tourism drawcard, of course, but we would have to strengthen our fences to ensure they don't go walkabout in the surrounding suburbs!"