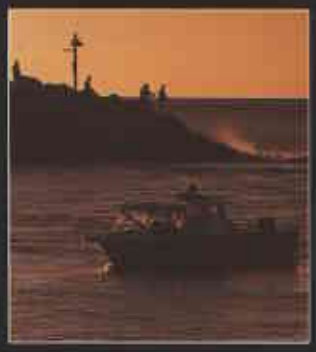
THE BAWESVILLE DILEMMA

to cut or not to cut



OVER the last 40 years, the Peel Inlet-Harvey Estuary ecosystem has come close to biological collapse. Phosphorus leached from farmlands has changed the estuary from a low nutrient ecosystem dominated by seagrasses to one that is nutrient-rich, contains excessive algae and is hostile to oxygen-breathing animals. The problem threatens to undermine two of the region's major industries: tourism and fishing.

Mandurah, the region's principal town, is a premier tourist resort. The town's economy relies heavily on attracting many of the 650 000 tourists who visit the South-West each year, spending more than $80 million. However, the algal problem obviously detracts from the area's attraction.

The Peel-Harvey estuary supports WA's largest commercial estuarine fishery. While commercial catches of weed-eating fish such as yelloweye mullet, cobbler and sea mullet have increased, crustaceans and other fish species have decreased due to mass mortality caused by algae deoxygenating the water. Also, in algae-affected areas less productive gill-netting must be used because of poor water clarity.

Fishermen first brought the declining health of the estuary to light in 1960, when they complained of a slimy, red algae clogging their nets. The first complaints of weed fouling the shore came in 1969. Weed accumulation and decomposition has been a public nuisance of varying degrees ever since.

Phosphorus (used in fertilisers) has leached from farmlands and caused the growth of excessive algae in the Peel Inlet- Harvey Estuary.▲

The Dawesville Cut, a man-made channel to the sea to improve flushing of excessive nutrients out to the ocean, is one of the options being considered by the State Government.
Photos- Alex Bond ▶

The problem began with a type of weed called goat weed (*Cladophora*), but then other species, such as rope weed (*Chaetomorpha*), increased in abundance.

But these merely set the scene for the major villain: *Nodularia*, a tiny blue-green algae. *Nodularia* bloomed on a large scale in Harvey Estuary in 1973 and 1974 and its appearance showed that the severely disturbed system had taken a dramatic turn for the worse.

Scientific investigation of the problem began in 1976, when the Environmental Protection Authority (EPA) asked its Estuarine and Marine Advisory Committee to determine the cause of excessive algae in Peel Inlet and propose methods for its control. The Committee found that the abundance of bottom-living, large green algae (macroalgae) was caused by excess nutrients, derived from fertilisers used in the farming areas in the catchment of the estuary. It recommended that nutrient input to the estuary should be reduced by catchment management and, if possible, increased flushing of nutrient-rich water to the sea.

Excessive algae in the estuary detracts from its attraction as a popular tourist destination.
Photo - Alex Bond ▶

Aerial view of the delta of the Harvey River which delivers phosphorus-enriched water into the inlet.
Photo - Robert Karri-Davies ◀

The Peel-Harvey Estuary is important for fishing, birdlife and recreation.
Photos - (from left) Alex Bond, Michael Morcombe, Alex Bond ◀

Nodularia bloomed again in the Harvey Estuary in 1978 and spread throughout the whole Peel-Harvey system in 1980, spurring an investigation into how to implement these recommendations.

A feasibility study was carried out by the University of Western Australia's Centre for Water Research to examine possible management options. Its proposals were adopted by the Peel-Harvey Study Group (with representatives from the Waterways Commission, the Peel Inlet Management Authority and the Departments of Agriculture, Marine and Harbours and Conservation and Environment), which published a report in August 1985.

The EPA assessed the Group's conclusions and published a report in December 1985, recommending a combined strategy of catchment management to control phosphorus inputs to the estuary and the construction of a new channel to the ocean at Dawesville, about 12 km south-west of Mandurah. Without the Dawesville Channel to flush excess phosphorus to the sea, it was felt that stringent catchment management would take so long to achieve a clean, healthy estuary that further environmental deterioration might make eventual recovery almost impossible.

Engineering studies for the Dawesville Channel are now underway, along with dredging of the existing Mandurah Channel, catchment monitoring and management and studies of land use change on the coastal plain.

Essentially, the problem has two components: macroalgae and *Nodularia*. Macroalgae, referred to as "weed", grow on the bottom and float to the surface *en masse*. *Nodularia* grows as microscopic filaments throughout the water, but floats to the surface in calm weather to form a scum. Apart from being ugly, the decomposing weed gives off high concentrations of hydrogen sulphide gas which has been blamed for serious illness in local residents and has an unpleasant smell.

Since 1974, the local authorities have used tractors equipped with rakes to clear weed from beaches. In 1983 a floating harvester, which collected weed in water deeper than half a metre was introduced. However, weed harvesting addresses the

Local authorities have resorted to using tractors to harvest the accumulating weed, but this addresses the symptoms, not the cause.
Photo- Alex Bond ◄

Red and green kangaroo paws are among the vegetation that grows in the Dawesville Cut area.
Photo- Alex Bond ►

Banded stilts sometimes visit the Peel Inlet, where they feed on worms and small crustaceans in the shallow water around the edge of the estuary.
Photo- Michael Morcombe ▼

symptoms, not the cause. It has cost more than $1 million over the last 13 years and is ineffective against *Nodularia*. Destruction of marginal vegetation by the tractors has caused considerable erosion of the shoreline.

The Peel-Harvey system is a shallow, coastal lagoon of about 133 square kilometres. The bottom is well lit and the water is inadequately flushed because its one opening to the sea, the Mandurah Channel, is narrow and prone to silting and its river inflow takes place over only a few months of the year. These conditions are ideal for excessive algal growth.

Although only about 18 per cent of the whole catchment area is on the coastal plain, it contributes 90 per cent of the phosphorus which enters the Peel-Harvey estuary each year. Intensive agriculture

such as piggeries, market gardens and sheep holding yards have contributed most of the remaining 10 per cent. Only 60 tonnes of the estimated 143 tonnes of phosphorus that enters the Peel-Harvey estuary each year is flushed out through the Mandurah Channel. The remaining 83 tonnes stays in the system.

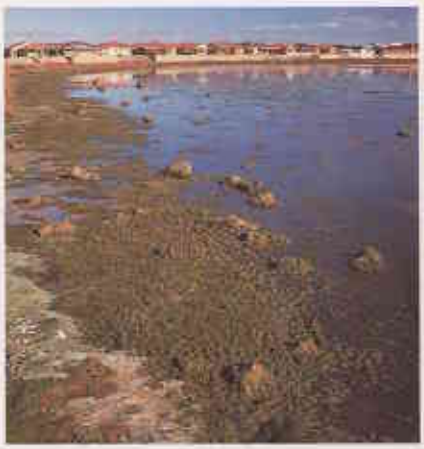
The amount of phosphorus entering the system is linked to the amount of rainfall in the catchment area. The last 10 years has been a period of below-average rainfall, so a return to normal or above-average rainfall (such as winter 1988) will worsen the problem.

Because the sediments have become a rich repository of phosphorus, a cycle of sediment-plant interchange has evolved. In winter, tiny plants called diatoms bloom, trapping inflowing phosphorus. When they die and decay, oxygen is taken out of the surface sediments, releasing some of the phosphorus held in the sediments. This promotes *Nodularia* blooms in spring and early summer. When salinity increases in late summer, *Nodularia* dies out and macroalgae grow. When macroalgae decay over the sediment surface, there is a decrease in oxygen and subsequent phosphorus release from the sediments.

Over the past 12 years, several management options have been considered: weed harvesting, fertiliser management, conversion of land use from agriculture to forestry, a moratorium on further clearing and drainage, enlarging the Mandurah Channel, algicides, use of nitrate to control release of phosphorus from the sediments and construction of the Dawesville Channel.

In May 1988, the Peel-Harvey Study Group issued its Stage 2 Environmental Review and Management Program, which suggested a three-pronged attack: continuing weed harvesting, catchment management and construction of the Dawesville Channel.

In 1985, a survey of individual residents and community groups indicated majority support for a high-cost, immediate solution such as the Dawesville Channel. However, professional fishermen opposed the idea. They considered that proper dredging of the Mandurah Channel would provide adequate flushing. Concern was expressed that a new channel would complicate fishing operations and affect commercial catches. In 1988, submissions to the EPA on the Peel-Harvey Study Group's Stage 2 report, indicated a turnabout in public opinion. The majority of the 84 submissions were from the public and most opposed the Dawesville Channel. Concerns related to conservation, recreation, public health and the economic effects of the Channel. The general feeling seemed to be that it had been foisted on the public without enough exploration of other options. The Dawesville Channel would be 1.5-2 km long, 150-200 m wide and 4.5-6.5 m deep. The cost, an estimated $35.6 million,



excludes land purchase. For a few years after construction, a further $2.4 million would need to be spent each year on operation, maintenance and estuary monitoring, reducing to $1.6-1.8 million annually after about five years. Construction would take three years.

Although it is the most expensive option, the Peel-Harvey Study Group believes that the Dawesville Channel is necessary to save the estuary from environmental disaster.

According to Waterways Commission scientist Rob Atkins, agriculture in the catchment area would have to be drastically reduced, if not eliminated, to achieve the same result as the Dawesville Channel: "This would be socially and economically unacceptable. The Channel is also insurance against future population growth."

The EPA has endorsed this view, as computer modelling has predicted that the Dawesville Channel will have more beneficial than detrimental effects on estuarine ecology.

The Channel will turn the estuary into a more marine ecosystem, as it was until 3 000 to 4 000 years ago when exchange with the ocean became obstructed, forcing a shift to a more estuarine ecosystem.

Proponents of the Channel claim that it would eliminate the worst aspect of the algal problem, *Nodularia*, through increased salinity, reduced phosphorus, clearer water and improved light levels.

Macroalgae would flourish with improved light levels, but only until sediment nutrient reserves were depleted. But macroalgae are more of a problem in human terms than ecologically since they are, indirectly, a rich food resource for crabs, prawns and fish and they provide cover from predators.

Other plant life in the estuary is likely to benefit from the Channel. Phytoplankton and benthic (bottom-living) diatoms are expected to adapt to a marine species composition and benefit from improved light and a larger intertidal area. Seagrasses would probably extend their range, while wetland vegetation would receive a more regular pattern of inundation and exposure.

The disappearance of *Nodularia* would mean better grazing for zooplankton and no more mass mortality of invertebrates such as worms, shrimps and molluscs; the main food of many birds and fish.

For fish and crustaceans, the Dawesville Channel would be another

The sulphurous gas given off by the algae has been blamed for illness in local residents.◀

The decomposing algae that accumulates on the Peel Inlets' shores is an eyesore.▲

Only 60 tonnes of the estimated 143 tonnes of phosphorus that enters the Peel-Harvey estuary each year is flushed out through the Mandurah Channel.
Photos- Alex Bond ▶

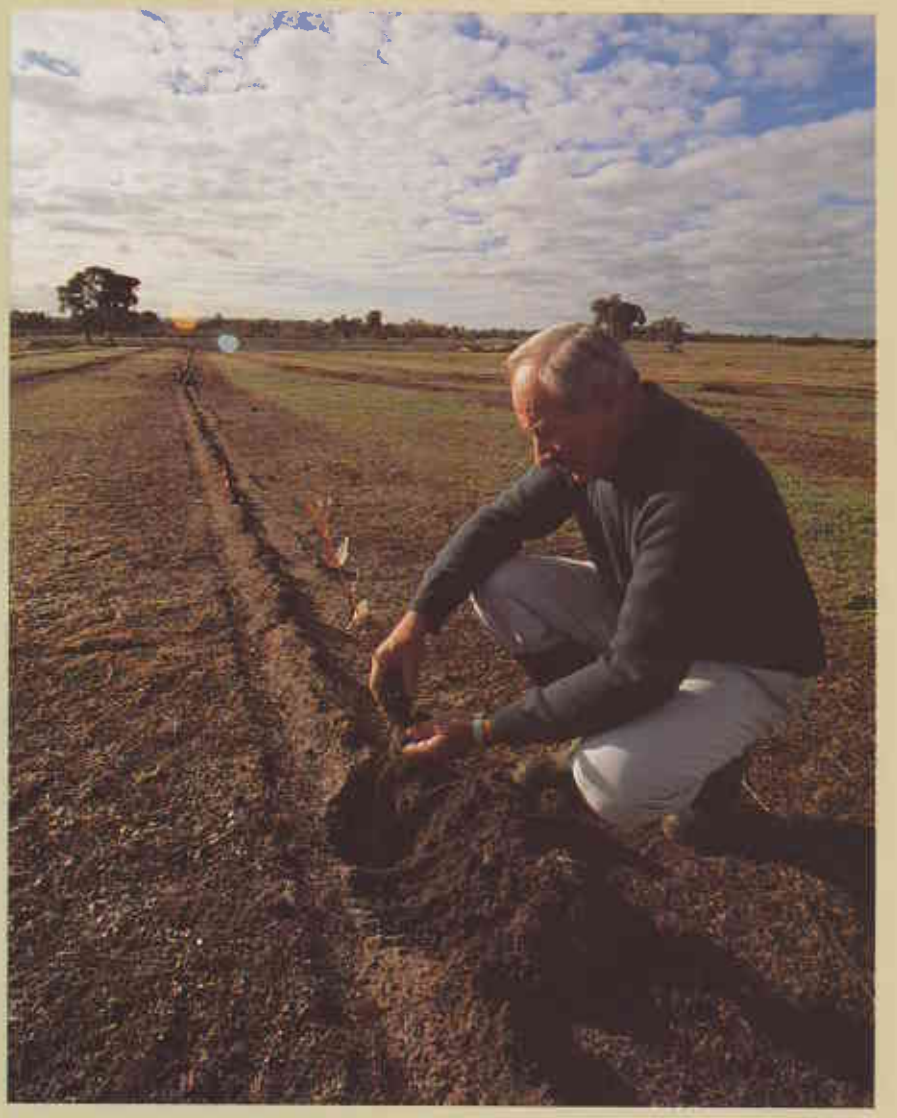
Little Pied Cormorants, which nest in the fringes of the estuary, are among the rich birdlife the area supports.
Photo- Michael Morcombe▼

Restoring Nature's Balance

Commercial tree farming is one option being considered by landholders to solve eutrophication of the Peel Inlet-Harvey Estuary.

So far about 1000 ha of cleared farmland in the Estuary's catchment has been planted with eucalypts by the Department of Conservation and Land Management (CALM) through its reforestation program.

The trees, whether grown by the hectare or as shelterbelts, use water that would otherwise carry phosphorus to the estuary and help solve waterlogging problems.



Sir Donald Eckersley examines bluegum trees which are part of a 127-hectare planting on his farm at Harvey. This year CALM has planted 2 200-hectares of Eucalyptus globulus *plantations in co-operation with farmers.*

Owners of larger properties in the area have been quick to convert some or all of their farm to growing trees, while owners of smaller farms have been more hesitant.

Agriculture Department Senior Research Officer Ross George says some farmers have reservations about the economics and feasibility of tree farming. But he says if the economics are right farmers will join the scheme.

In its sharefarming reforestation program, CALM funds the planting of eucalypt trees on a farmer's property and pays an annuity to the farmer each year while the trees mature.

Species planted are all Australian eucalypts, including Tasmanian bluegum, false mahogany, ribbon gum and Sydney bluegum.

CALM Principal Research Scientist John Bartle believes tree farming is competitive with traditional agriculture. He says planting trees needn't change a farmer's lifestyle, as trees provide shelter for livestock.

John says some farmers have a negative attitude towards tree farming in the Peel-Harvey area, despite the scheme being oversubscribed by farmers in other regions.

CALM will undertake two to three years of further research and demonstration work with farmers to promote the "sustainable farming" option. This will see the planting of shelterbelts and other small areas for commercial use.

CALM is presently running trials in Baldivis with eucalypts to soak up effluent from piggeries.

route for migration and recruitment. The more marine conditions would favour a greater diversity of species. Most fish and crustaceans would adapt to changes in food species and tidal amplitude.

Birds are the most uncertain factor in the environmental equation. The Peel-Harvey estuary is the most important waterbird habitat in the South-West but not enough is known about the birds' diets and how they use the estuary. It is unlikely that the Channel would affect long-legged waders, waterfowl, rushdwellers and gulls at all. Migratory waders and fish-eaters would not be affected if additional roosting sites were constructed from dredge spoil. However, the estuary supports large numbers of resident waders which may be affected by the increased tidal variation limiting or interrupting their feeding.

Bob Kagi, Associate Professor at Curtin University of Technology and an environmental chemist, objects to the Dawesville Channel on three grounds. He claims it is too costly an option at a time when the State economy can ill afford it, aspects such as sand pumping mean that it is designed to fight nature and it is an incomplete solution.

He feels that the Dawesville Channel became the major thrust of management proposals for the Peel-Harvey system before other options were thoroughly evaluated. These include establishing a buffer zone of trees around the southern Harvey estuary or a drain to divert as much phosphorus runoff as possible to the south, for example, through the Myalup Drain to the sea.

Bob believes another option, the application of powdered limestone to the sediments, should be further explored. Research by the EPA indicates that phosphorus is bound in the sediments by iron compounds. Adding limestone amends the pH of the sediments to approximate that of seawater, and insoluble calcium compounds (apatites) form. When bound with calcium to form an apatite, phosphorus is rendered inert.

Bob sees this man-made option as running parallel to the natural system, as there is evidence that apatite is already forming in the estuary. He has obtained reports that indicate that phosphorus input to the Mississippi River is controlled naturally by the formation of apatites.

Earlier this year, the State Government put the Channel's construction "on hold", while the various options are reconsidered.

Time is running out for the Peel-Harvey ecosystem. The future will reveal whether the 'Dawesville Cut' is indeed the kindest cut of all. ⊡

ANDREW BELL

Experts are not sure how the proposed Dawesville Cut would affect birdlife in the estuary.
Photo- Michael Morcombe ▲

The application of powdered limestone to the sediments in the estuary may be a possible solution to the algae problems.
Photo- Alex Bond ▶

LANDSCOPE

VOLUME FIVE NO 1 SPRING EDITION 1989

Perth people were devastated when a fire tore through their favourite bushland retreat. But, with Spring, new life and colour is returning.

Rottnest isn't the only unspoilt island on Perth's doorstep- what about Penguin, Garden, Seal and Carnac Islands? They are steeped in history and provide a haven for some unique wildlife.

Algae has clogged the estuaries near Mandurah, killing fish and creating an eyesore. What is the solution?

Jarrah dieback- the word strikes fear into any forester's heart- but research is fuelling the fight against the killer fungus.

Explore the waterways of the South-West by canoe.

COVER

*What's new in Kings Park this spring? Artist, Susan Tingay, couldn't resist this magnificent collection of spring orchids. From left- cowslip orchid (*Caladenia flava*), jug orchid (*Pterostylis recurva*), King spider orchid (*Caladenia huegelii*), donkey orchid (*Diuris longifolia*), rabbit orchid (*Caladenia menziesii*), and pink fairy orchid (*Caladenia latifolia*).*
*Back Cover: Stimson's python (*Morelia stimsoni*)*
Photo-Jiri Lochman

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LIFT-OUT POSTER
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