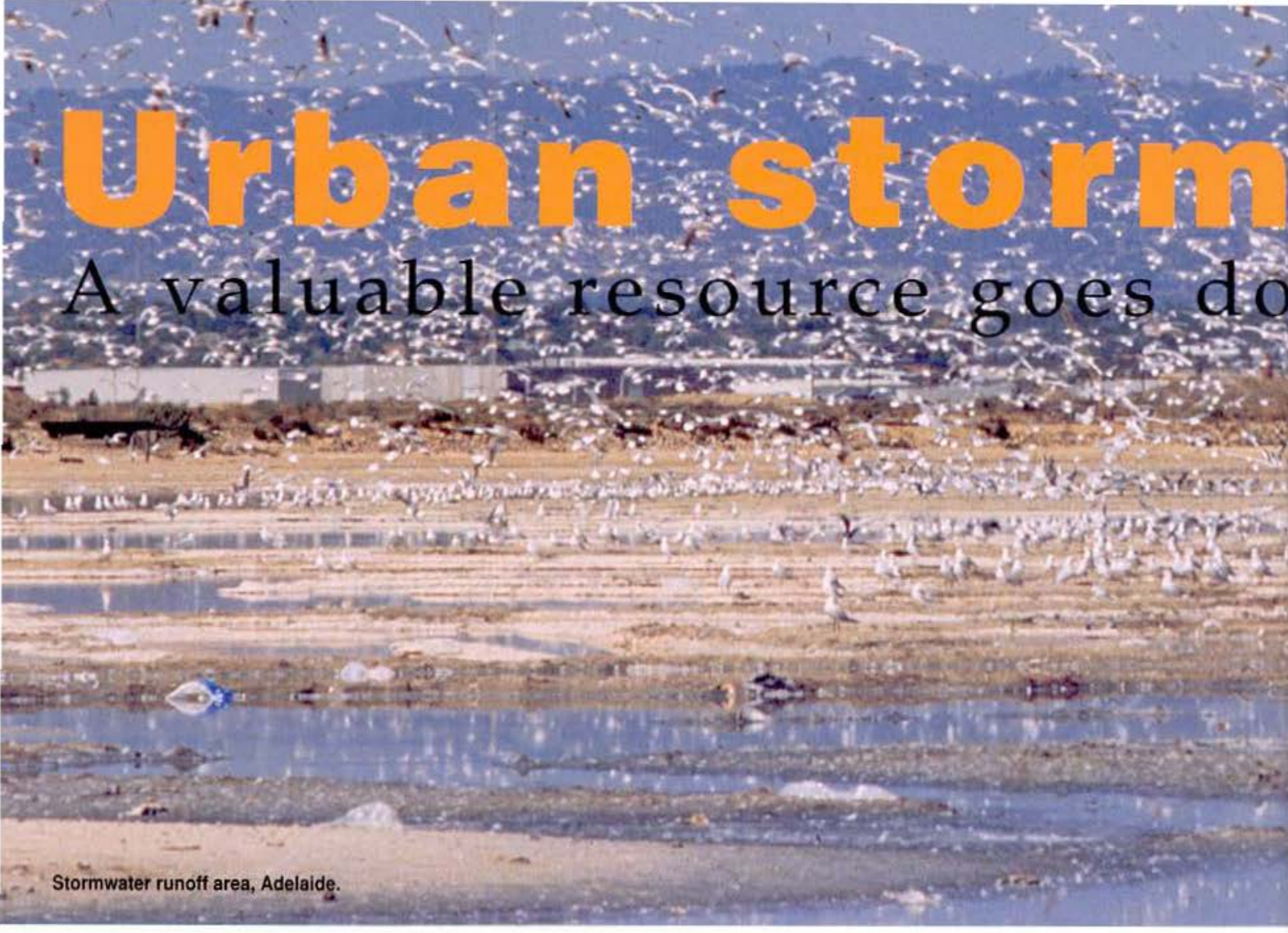
Urban storm

A valuable resource goes do



Stormwater runoff area, Adelaide.

Community involvement is needed to help improve the mangement of stormwater in Australia's towns and cities. Methods of preventing flood damage, reducing pollution and recycling stormwater for non-drinking uses are essential to ecologically sustainable development.

These issues are being considered by the Commonwealth Environmental Protection Agency (whose report, *Urban stormwater: a resource too valuable to waste*, forms the basis of this article), the Cooperative Research Centre for Catchment Hydrology, and the CSIRO Division of Water Resources, as well as other federal and state authorities.

The scale of the problem is such that interested bodies have been able to do little more than sketch ways of changing current practices from disposal to management. This has involved a complete reappraisal of drainage engineering systems so that they can be modified to save and redirect stormwater, rather than simply flush it out of sight.

Urban stormwater flows are basically stormwater floods. Up to 90% of rainfall runs off built-up, urban areas and this occurs at a fast rate. Peak flows are therefore reached more quickly than in areas where natural vegetation remains.

This isn't just an engineering problem: aquatic ecosystems that evolved to handle small-scale flows are literally swamped by storm flows. The flows may carry huge loads of silt, litter, nutrients and pollutants into natural drainage systems. They also consist largely of water low in oxygen, which can kill aquatic plants and animals.

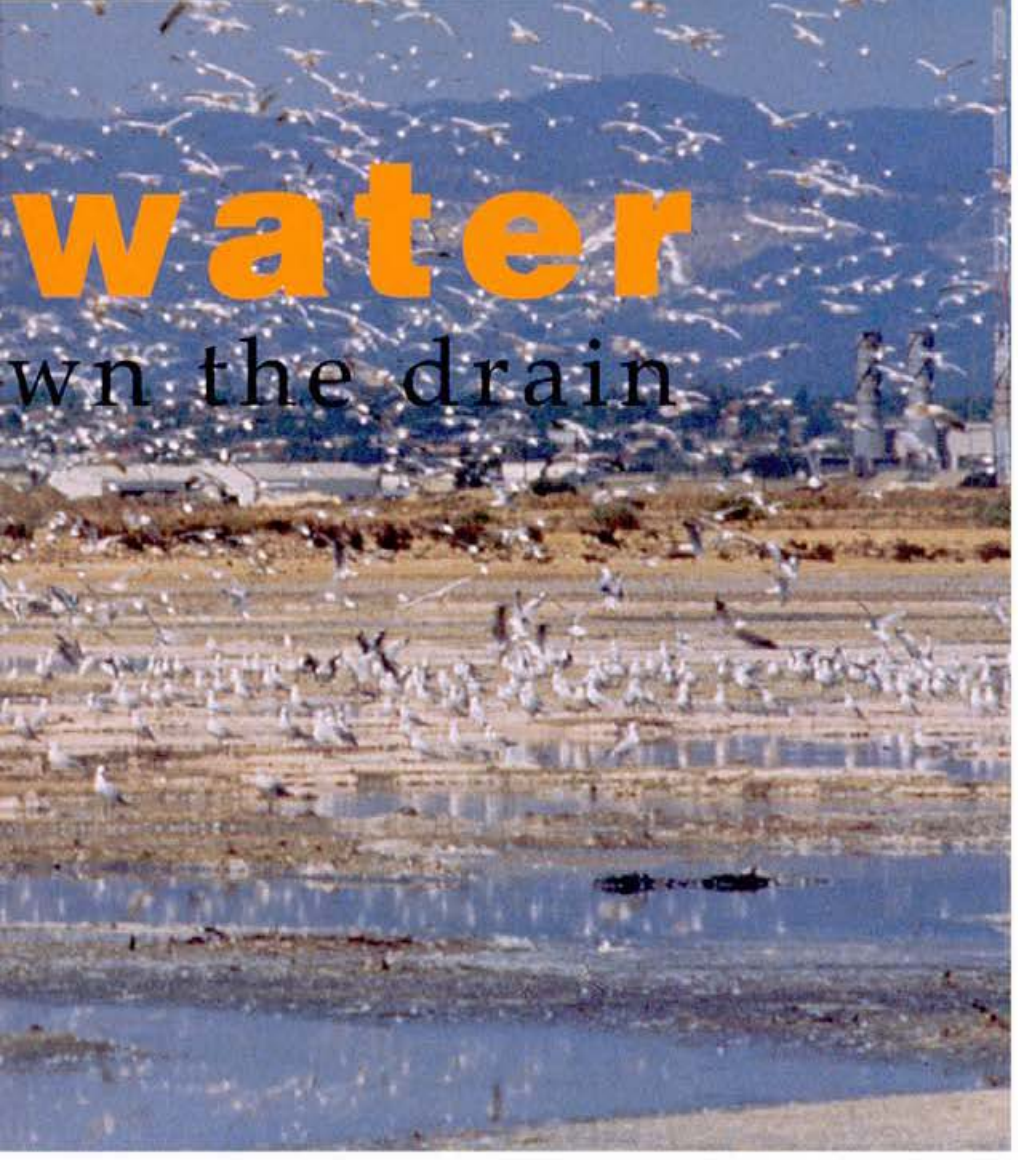
CSIRO's Division of Water Resources is involved with research into the effects of stormwater discharges and into monitoring the benefits of new discharge strategies. Three case studies illustrate the seriousness of current practices, and the positive consequences of new approaches.

• Treated sewage, agricultural, urban and industrial runoff, stream discharges, groundwater and climate all affect the quality of the water in Melbourne's Port Phillip Bay by adding nutrients (mainly nitrogen and phosphorus) and a variety of toxic substances. In the past 20 years, an increased percentage of sewered properties in metropolitan Melbourne and diversion of treated sewage into Bass Strait has reduced nitrogen inputs into Port Phillip Bay by 700 tonnes a year. Bacterial levels have also decreased, as have direct industrial discharges, so pollution of the Bay's water and seafood is generally less than in the 1960s and 1970s.

• Sydney's coastal beaches provide a major recreational resource for the city's four million inhabitants. Most of Sydney's treated sewage effluent is discharged through deep-water ocean outfalls, but there are about 200 stormwater outlets discharging on to the city's ocean beaches and many thousands discharging into coastal waters. A recent study conducted by the Sydney Water Board examined the pollution impacts of this system, particularly on bathing water quality. It concluded that even dry weather runoff contributed to the pollution of some Sydney beaches, indicating possible health risks.

While the Sydney Water Board study was principally concerned with public safety, it also noted that little was known about the condition of the coastal marine environment, or the possible ecological impacts of urban stormwater.

• Canberra depends on the Murrumbidgee River and its tributaries



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for the city's water supply, for water-based recreation and for waste-water disposal. All stormwater from Canberra also drains into the Murrumbidgee, so protecting the river and local lakes from pollution is vital, requiring an integrated stormwater management strategy for both existing and planned urban development.

Waste-water, consisting primarily of secondary treated sewage, was the single most important source of water pollution in the Australian Capital Territory until an advanced waste-water treatment plant was commissioned in 1978. Since then, urban stormwater discharges have become the most significant pollution source for Canberra waterways, causing bacterial and algal pollution, accelerated sediment build-up and visual degradation.

Computer design

These problems are being addressed in a variety of ways, with a contribution from the CSIRO Division of Mathematics and Statistics in the form of NESSIE, a computer model that allows engineers to design artificial lakes for pollution control and stormwater management. NESSIE has already been employed in Canberra to design stormwater control lakes, and is seeing widespread use at a local government level throughout eastern Australia.

The community perception of urban stormwater management is changing from one of simple disposal to one that encompasses storage, but we are only beginning to address how this approach can be implemented.

The first priority is the design of integrated conveyance systems involving:

- establishment of urban lakes, primarily as sedimentation and biological treatment systems;
- construction of water pollution control ponds and wetlands to act as physical and biological treatment systems;
- construction of gross pollutant traps to intercept debris, litter and coarse sediments;
- construction of temporary sediment detention ponds as part of land development works, to intercept and treat stormwater from development sites before it reaches the stormwater discharge system; and
- retention of natural creeks, augmented by retardation basins rather than the construction of stormwater pipe systems and concrete-lined drains.

Next, authorities must agree on a common set of water-quality control practices, including measures to control pollution (whether of sediment, toxic chemicals, oils and detergents or sewage) at the origin instead of downstream.

Such control represents a major break from current practices, and must be approached on a case-by-case basis. This is no minor task when we consider that Sydney has between 6000 and 10 000 sewer overflow points, at which overflows can occur as many as 50 times a year.

The Sydney Water Board is compiling an inventory of these overflow points to minimise the frequency of overflows. The board recognises that minimising the impact of overflows is just part of an integrated strategy. For example, the construction of buffer storage in the form of in-line, oversized pipes, tanks and basins, in Sydney's Lane Cove catchment could reduce overflows from 30 to five a year, and further reduce overflow volumes by 85%.

The intensity of storm flow transport of pollutants must also be reduced, by building swale drains, gully pits and grassed waterways to intercept sediments, litter booms or grates across stormwater drains to trap debris and litter, and sedimentation basins. For control of water held in storage while sediments and pollutants settle out, authorities must allow for dry retention basins (which fill only during intense storms) and wet retention basins that provide flood protection, attractive landscape features, passive recreation areas and habitats for wildlife.

All these measures are bound to be expensive to install and to maintain, but they are needed. Stormwater runoff from Australian cities is roughly equal to the amount of high-quality drinking water those same cities use. More than 50% (costing up to $150 million each year) of that high-quality water is used for low-quality purposes, such as garden watering and toilet flushing. It therefore makes economic and environmental sense to expand collection, storage and re-use of this neglected resource.

More about the topic

Commonwealth Environment Protection Agency (1993). *Urban stormwater: a resource too valuable to waste.* Canberra.