

The removal of urban litter from stormwater conduits and streams: Paper 3 - Selecting the most suitable trap

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Abstract

A large quantity of urban litter is finding its way into the drainage systems to become an eyesore and a potential health hazard. Many of the traps currently installed are, however, extremely ineffective at trapping and storing urban litter. An extensive review of some 50 designs indicated that only seven showed much promise for South African conditions, although one or two other designs may be suitable for specialised installations. This paper describes the seven most promising options and recommends a trap selection procedure. A preliminary assessment of the seven most promising trapping structures concludes that three designs - two utilising declined self-cleaning screens and the other utilising suspended screens in tandem with a hydraulically actuated sluice gate - are likely to be the optimal choice in the majority of urban drainage situations in South Africa.

Introduction

Urban litter, defined as visible solid waste emanating from the urban environment (Armitage et al., 1998), and henceforth called simply "litter, is extremely difficult to trap and remove once it has entered the drainage system.

Although the central areas of most South African towns and cities are provided with the normal civil engineering services, poverty and mismanagement have often led to the partial collapse of such basic services as litter collection and removal. Furthermore, many millions of people live in informal settlements on the urban fringe where services are rudimentary or non-existent. Run-off from rainfall soon carries the litter into the drainage system. To compound the problem, even in areas where formal stormwater drainage conduits exist, they are often used as a form of refuse removal. Grids cannot be placed over stormwater drainage entrances for fear of blockage and consequential flooding, and when they are provided, they are frequently stolen. For many, the struggle for survival takes precedence over care of the environment.

In view of the above, the Water Research Commission of South Africa funded a four-year study into the removal of urban litter from stormwater conduits and streams (Armitage et al., 1998) looking particularly at the design of litter traps. Some 50 different designs from around the world were evaluated in terms of a number of general criteria including:

- the size of catchment that could be serviced by the device (which is related to the runoff and the litter loads);
- the typical cleaning frequency;
- the hydraulic head requirement for operation;
- the efficiency (expressed as a percentage of litter removed from the flow);
- the capital and operating costs; and
- any other features that might make the structure attractive or unattractive to the potential user.

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The traps investigated included: in-line screens, self-cleaning screens, booms, baffles, detention/retention ponds, and vortex devices. In the end, seven patented devices were identified as showing the most promise for South African conditions - although one or two other designs may be suitable for specialised installations.

A rational selection procedure, presented in this paper, was then developed to assist designers with the choice of the optimal trap for a particular situation. Finally, the seven patented devices were evaluated for possible installation in a typical (hypothetical) catchment.

The most promising litter trap designs

Side-entry catchpit trap (SECT)

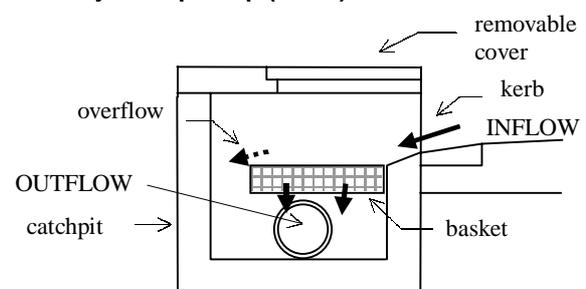


Figure 1
Cross-section through a typical SECT

A perforated tray is mounted on metal supports next to and underneath a catchpit opening (Fig. 1). Stormwater either flows through the perforations leaving the litter behind, or, if the perforations are blocked and/or the tray is full, the stormwater flows over the back wall of the tray. To remove the litter, the basket is either manually cleaned, or it is vacuum educted ("sucked" clean) and washed with water under high pressure (Melbourne Water, 1995).