United States
Environmental Protection
Agency

Research and Development

Municipal Environmental Research
Laboratory
Cincinnati OH 45268

EPA-600/S2-83-043 Aug. 1983

EPA

# Project Summary

# Evaluation of Catchbasin Performance for Urban Stormwater Pollution Control

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**Data were collected in the field to evaluate the performance and utility of catchbasins in controlling pollution. The project had three phases. The first two were field data collection efforts and the third involved data reduction and analysis.**

**In the first phase of field work, three catchbasins in the West Roxbury section of Boston, Massachusetts, were selected from more than 40 sites throughout the city. The catchbasins chosen illustrated a diversity of land use, traffic situations, and design types. First, each basin was cleaned using traditional methods; then four runoff events were monitored at each catchbasin to evaluate performance. Influent, effluent, sump liquid, and sump sediment were monitored.**

**Catchbasin suspended solids removals varied widely, from a minus 10 percent (discharging before sump accumulations) to a positive 90 percent. On the whole, catchbasins were quite effective for reducing solids (on the order of 60 to 97 percent). Catchbasin removals of associated pollutants such as chemical oxygen demand (COD) and biochemical oxygen demand (BOD) were also significant (on the order of 10 to 56 percent and 54 to 88 percent, respectively).**

**The second phase of work involved the addition of an inlet strainer to each of the catchbasins according to European practice. The inlet strainers consisted of a number 8 mesh (0.0937 in./2.36 mm) brass screen permanently mounted on an aluminum backing plate. Runoff for an additional three events was monitored at each site during this phase of work. Inlet strainers provided a marginal increase in catchbasin pollutant removal (up to 10 percent).**

***This Project Summary was developed by EPA's Municipal Environmental Research Laboratory, Cincinnati, OH, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).***

## Introduction

### *Purpose of Study*

Control of stormwater runoff is a significant problem in the field of water quality management. Over the past 70 years, catchbasins have been used extensively to remove coarse materials from stormwater runoff. Yet their effectiveness (in removing pollutants) has not been evaluated in depth.

In a recent report by J.A. Lager *et al.*, entitled "Catchbasin Technology Overview and Assessment" (USEPA report number EPA-600/2-77-051 (NTIS order number PB 270 092)), it was recommended that monitoring programs be undertaken to: (1) determine the impact of best management practices in reducing solids and other pollutant loads in surface runoff that must be collected from urban areas and introduced to the sewer through catchbasins, (2) evaluate the effectiveness of closely monitored catchbasin cleaning programs with respect to the impacts of cleaning frequency and techniques on solids carryover as well as general pollution abatement, and (3) determine the extent to which solids deposition can be mitigated by properly designed and functioning catchbasins.

These recommendations were based on an analysis of catchbasin pollutant removal that used secondary data from a variety of sources. Direct and concurrent measurement of influent and effluent pollutant characteristics had not been previously performed. Prior measurements included either street surface pollutant characteristics or spot grab sampling of catchbasin sump liquor.

The basic purpose of this study was the careful, simultaneous monitoring of influent and effluent characteristics for several catchbasins in the Boston, Massachusetts, metropolitan area. The primary emphasis was to characterize the pollution load attenuation characteristics of a catchbasin. A secondary goal was to examine the pollutant reduction effectiveness of strainers inserted into several catchbasins within the study area. These devices are used in Europe and have been shown to be effective for removing gross floatables and settleable solids such as cigarette butts, leaves, lawn clippings, and paper.

## *Background*

A catchbasin is a chamber or well, usually built at the curbline of a street, for the admission of surface water to a sewer or subdrain; at its base is a sediment sump designed to retain coarse solids and detritus below the point of overflow. Because some communities call any device that receives stormwater a catchbasin, a distinction is made between those devices that intentionally trap sediment and those that do not. In this report, the device that traps sediment is referred to as a catchbasin.

Stormwater runoff in urban areas normally flows for a short period of time in the gutter and is diverted by an inlet structure leading to an underground conduit or open channel for transportation to a receiving body of water. The underground conduit, either a storm or combined sewer, may be protected from clogging by catchbasins built in conjunction with inlets.

Catchbasins serve two main purposes: to prevent sewer gases from escaping through the inlet gratings, and to prevent heavy or large solid matter and floatables from the street from entering the sewers. The trapping of sewer gases is accomplished by a water seal. The retention of solids is achieved by providing a sump or settling basin in which the heavy solids settle to the bottom and the light solids float on top. Water drains to the sewers through the outlet of the catchbasin, which is generally a few inches below the water surface to retain floatables and provide a water seal. These basins are normally built under the inlet grating or openings, either under the gutter or just behind the curb. Occasionally, one catchbasin serves two or more standard inlets.

In American practice, a standard catchbasin appears to be nonexistent. Attempts at uniformity within individual cities show varying degrees of success. The effectiveness of the water seal gas trap is an important issue in American practice. In addition, organics that are allowed to accumulate in the catchbasin may decompose with time and contribute odors similar to sewer gases even if the water seal has not evaporated.

Catchbasin sizes vary in Europe, but they have been standardized in Germany. Two types of catchbasins are used: a simple depository type and one generally called a selective catchbasin, in which a bucket sieve or some means is used to select and separate various solid materials. The latter type varies greatly in different countries and cities. The buckets provide and easy and rapid method for cleaning by street crews.

During the second phase of this study, inlet strainers were fabricated and installed in three monitored catchbasins to assess their pollutant removal effectiveness, thus simulating the European practice.

## Procedures

During the period November 1979 through January 1980, seven runoff events were monitored at each of three catchbasin sites, yielding a total of 21 monitored runoff events. All of the catchbasins were located in the West Roxbury section of the city of Boston. Analyses were conducted for total suspended solids (TSS), volatile suspended solids (VSS), chemical oxygen demand (COD), biochemical oxygen demand (5-day) (BOD), total Kjeldahl nitrogen (TKN), total phosphorus (TP), sediment particle sizing, and percent volatiles. Special analyses were conducted to assess the sump liquid and solids conditions before and after the runoff events. Inlet strainers similar to those used in Europe were specially fabricated, installed in the catchbasins, and monitored over three runoff events to assess their impact on overall performances.

## Conclusions

1. Catchbasins were very effective in removing suspended solids-related stormwater pollutants from influent waste streams. Pollution mass reductions of 60 to 97 percent TSS, 48 to 97 percent VSS, 10 to 56 percent COD, and 54 to 88 percent BOD were observed for relatively low intensity storms during December and January. No data were obtained for summer type storms.

2. The limited data collected indicated that catchbasins do little with respect to nutrient removal.

3. Though the total mass of the influent to the catchbasins varied widely, the concentration profiles of both the influent and effluent with time were very consistent.

4. Sieve analyses of catchbasin sump sediment samplings (taken 21 times over the course of the evaluation program) yielded results consistent with those found in the literature.

5. Sump sediment was highly organic--on the order of 60 to 90 percent, depending on particle size range.

6. Inlet strainers were designed, fabricated, and installed on the three test catchbasins for three runoff events each. The strainers consistently retained significant dry weather accumulations ranging from 150 to 500 g of dry solids per day.

7. Accumulation of dry weather solids in the catchbasin inlet strainers seemed to be primarily a function of degree of vehicular traffic at each location.

8. Inlet strainers offered a slight gain in overall pollutant removal efficiency of catchbasins, but they would not be functional on a large scale. These devices are effective for the removal of coarse material that could cause visual upsets. Problems with clogging and potential for decomposition and ultimate discharge of pollutants negated their value unless weekly (or more frequent) maintenance was employed.

## Recommendations

1. If maintained, catchbasins are an efficient pollutant reduction/maintenance tool and should continue to be used.

2. Monitoring studies such as those conducted in Boston should be done in other geographic areas to substantiate the findings of this study. Regions recommended are the midwest, south, and west because of their difference in climate, hydrology, and system characteristics.

3. Since energy dissipation is of prime importance to the function of catchbasins, further research should be conducted into simple ways of reducing influent energy.

4. Field-scale demonstration of closely monitored, concurrent street sweeping, catchbasin cleaning, and sewer maintenance programs should be conducted in varying terrain for both separate and combined sewerage systems to investigate the optimal mix of best management practices for maintenance and pollution control. The main emphasis of the studies should be the careful monitoring of the separate and joint effectiveness of these techniques

and an assessment of the impacts of cleaning frequency, solids carryover mechanisms, general pollution abatement, and associated costs.

5. Additional monitoring studies should investigate the effectiveness of catchbasins for removing heavy metals as well as oil and grease.

The full report was submitted in fulfillment of Grant No. R-804578 by Northeastern University under the sponsorship of the U.S. Environmental Protection Agency.

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***Richard Field** is the EPA Project Officer (see below).*
*The complete report, entitled "Evaluation of Catchbasin Performance for Urban Stormwater Pollution Control," (Order No. PB 83-217 745; Cost: $11.50, subject to change) will be available only from:*
*National Technical Information Service*
*5285 Port Royal Road*
*Springfield, VA 22161*
*Telephone: 703-487-4650*
*The EPA Project Officer can be contacted at:*
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☆U S GOVERNMENT PRINTING OFFICE: 1983—659-017/7142

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