Article 7

Technical Note #15 from Watershed Protection Techniques. 1(1): 30-31

Sources of Urban Stormwater Pollutants Defined in Wisconsin

For the past two decades, most urban runoff monitoring activity has been focused at the end of a pipe or storm drain. Consequently, our knowledge about the concentration of pollutants in urban runoff has been confined to broad land use categories, such as residential, commercial, industrial, or combinations thereof.

With recent advances in runoff micro-monitoring pioneered by Roger Bannerman and his colleagues, we are starting to get a better resolution of the various source areas in the urban landscape that collectively contribute to the pollutant levels measured at the end of the pipe. Urban source areas include lawns, driveways, rooftops, parking lots, and streets.

Using specialized sampling devices, Bannerman *et al.* (1993) collected over 300 runoff samples from 46 micro-sites in two watersheds (Figure 1). The samplers collected runoff from lawns, driveways, rooftops (both residential and industrial), commercial and industrial parking lots, and a series of street surfaces (feeder, collector and arterial).

Up to nine samples were collected at each of the micro-sites over a two month period, characterized by small and moderate sized rainfall events. Geometric means of pollutant concentrations were calculated for each of the micro-sites (see Table 1). Runoff volumes were obtained by hydrologic simulation models that were calibrated for each subwatershed.

The monitoring revealed that streets were the single most important source area for urban pollutants in residential, commercial, and industrial areas. Not only did streets produce some of the highest concentrations of phosphorus, suspended solids, bacteria, and several metals, but they also generated a disproportionate

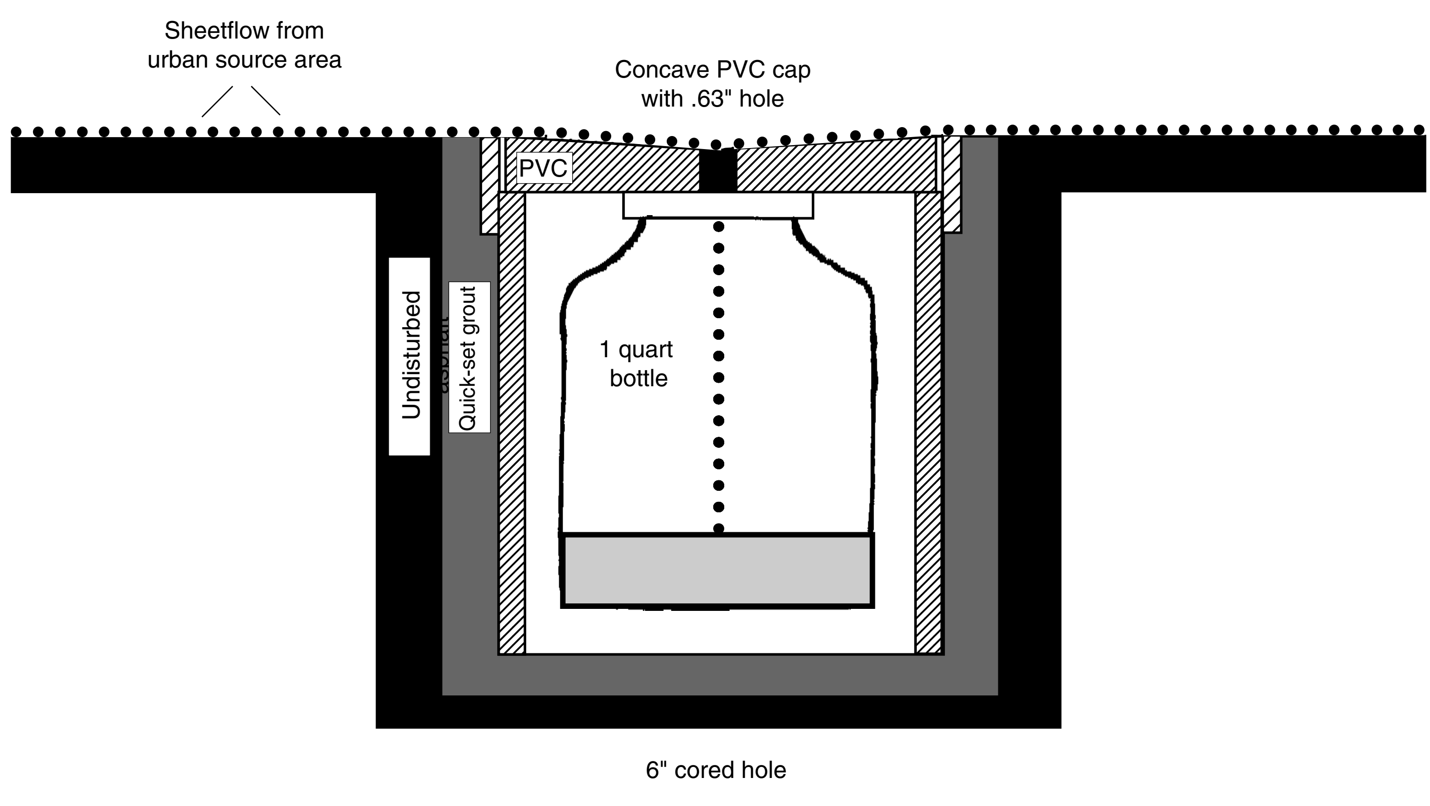

Figure 1: Diagram of a Street Sampler (Bannerman *et al.* 1993)

Table 1: Geometric Mean Concentrations of Pollutants in Stormwater Runoff From Selected Urban Source Areas (Bannerman *et al.*, 1993)

Source Area	Total P (mg/l)	Solids (mg/l)	E. coli (C/100ml)	Zinc (µg/l)	Cadmium (µg/l)	Copper (µg/l)
Residential Feeder Street	1.31	662	92,000	220	0.8	46
Residential Collector Street	1.07	326	56,000	339	1.4	56
Commercial Arterial Street	0.47	232	9,600	508	1.8	46
Industrial Collector Street	1.50	763	8,380	479	3.3	76
Industrial Arterial Street	0.94	690	4,600	575	2.5	74
Residential Roofs	0.15	27	290	149	ND	15
Commercial Roofs	0.20	15	1,117	330	ND	9
Industrial Roofs	0.11	41	144	1,155	ND	6
Residential Lawns	2.67	397	42,000	59	ND	13
Driveways	1.16	173	34,000	107	0.5	17
Commercial Parking	0.19	58	1,758	178	0.6	15
Industrial Parking	0.39	312	2,705	304	1.0	41

amount of the total runoff volume from the watershed. Consequently, streets typically contributed four to eight times the pollutant load that would have been expected if all source areas contributed equally.

The importance of street runoff for urban pollutant loading is due to a number of factors. First, as streets are directly connected to the drainage system, they possess a very high runoff coefficient. Second, the curb and gutter system along streets is very effective at trapping and retaining fine particles that blow into them. In addition, as most other source areas are "upstream" from streets and their gutters, pollutants delivered from sidewalks, driveways, rooftops, and lawns ultimately pass through street gutters on their way to the storm drain.

Lastly, streets are strongly influenced by local emissions and leaks from vehicular traffic. Metals that are strongly linked to cars, such as copper and cadmium, reached their highest levels on streets and parking lots. The same pollutants were rarely encountered in roof and lawn runoff.

Rooftop runoff tended to be relatively clean. Low concentrations of phosphorus, solids, coliforms, and metals were observed. A major exception was zinc, which was found at higher concentrations in runoff from rooftops than any other source areas. This was presumably due to leaching from galvanized roofing material, particularly on flat industrial roof sites.

Runoff from lawn areas yielded the highest overall phosphorus concentrations, which may be attributed to excessive lawn fertilization. Lawns typically were a very important source area for fecal coliforms, as were residential streets. Parking lot source areas had moderately high concentrations of all pollutants, but did not exhibit the "hotspot" levels that have been noted in other regions of the country.

As more runoff micro-monitoring data is gathered, it may soon be possible to select and size stormwater treatment practices to control the runoff and pollutants for specific source areas in the urban landscape. **See also article 15.**

—TRS

Reference

Bannerman, R., D. Owens, R. Dodds, and N. Hornewer. 1993. "Sources of Pollutants in Wisconsin Stormwater." *Water Science & Technology*. (28):3-5 pp. 241-259.