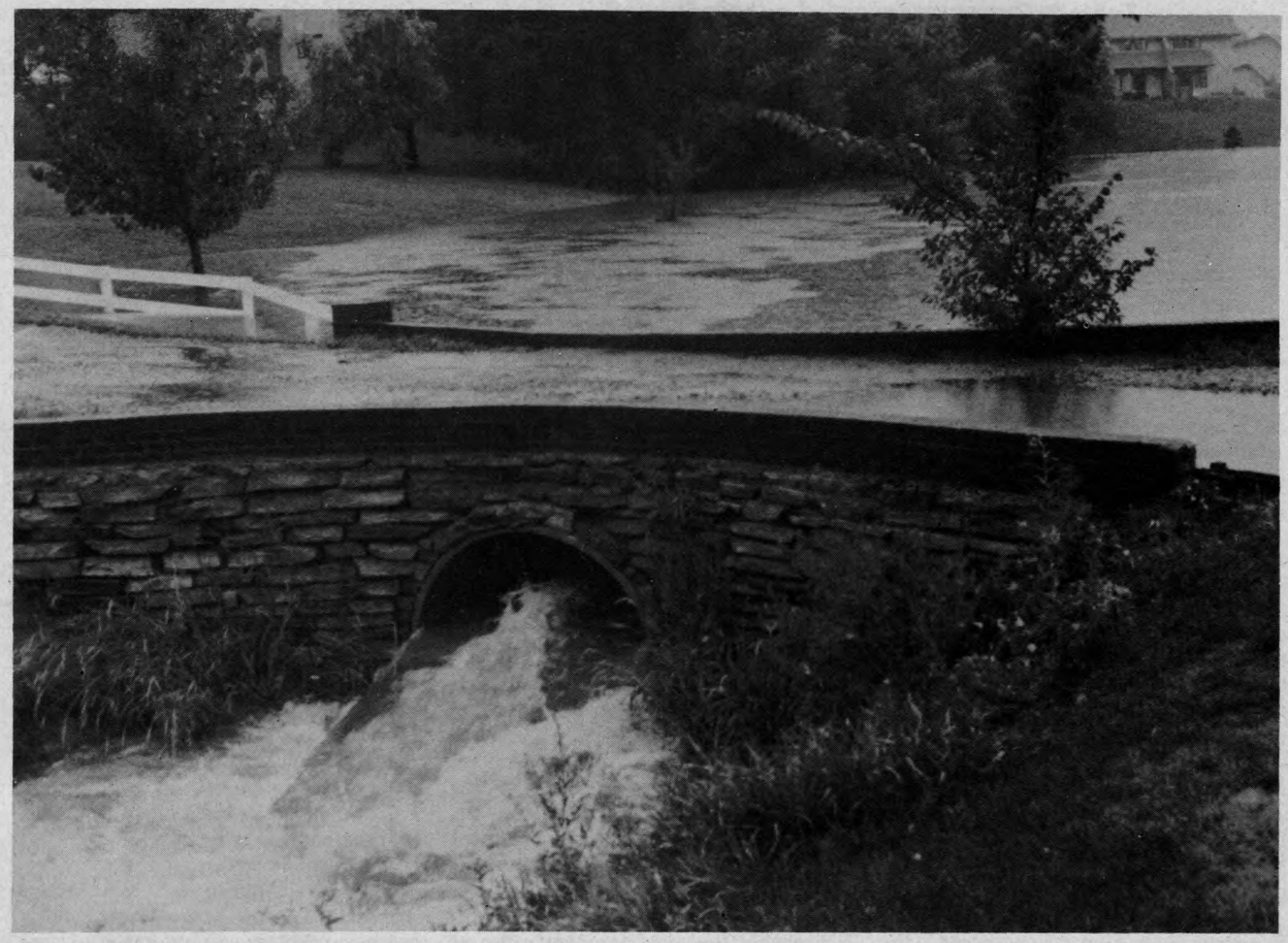

*Photo shows Spring Creek in Ft. Collins, Colorado, after a moderate storm. This watercourse carries runoff from agricultural drainage and storm runoff—no storm interceptors are provided in this catchment area. A consultant to the city, G. Fred Lee of Colorado State University, compared water quality implications of providing storm interceptors vs. using the natural channel. The latter is far cheaper, of course. The question is, is the adverse affect of pollutants from city streets acceptable? Lee says his studies suggest the answer is, "Yes." The reasons for this include: (1) pollutants are in particulate form, thus largely unavailable to pollute, and (2) storms are very short lived, compared with non-storm periods, so pollutants flush right through town, affecting fish and water plants relatively little as a result. Resident trout population is not significantly adversely affected in population, species types, health, or use as human food, Lee concludes.*

# Will EPA's Nationwide Urban Runoff Study achieve useful results?

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AT THIS TIME there is a substantial national effort to evaluate the water quality significance of stormwater drainage from urban areas. Approximately 30 different studies are underway in cities across the U.S. as part of the Nationwide Urban Runoff Program (NURP). This program is being conducted under the guidance and control of the U.S. EPA 208 program offices in Washington, D.C.

One of the primary factors that motivated the initiation of this study was the rediscovery during the initial 208 planning activities several years ago, that the concentrations and/or loads of a number of contaminants in urban stormwater drainage are equal to and sometimes greater than those in treated domestic wastewaters. Will large amounts of money be spent in domestic and industrial wastewater treatment with little or no improvement in receiving water quality because of the high contaminant loads-concentrations from urban stormwater drainage?

The authors strongly support the need for an NURP to define the importance of urban stormwater drainage as a cause of water quality deterioration in U.S. waters. They are, however, concerned that the current NURP will fall far short of obtaining useful results which would enable the communities in which the studies are being conducted, as well as others, to evaluate the water quality significance of contaminants associated with urban stormwater drainage. Further, there is a strong possibility that the current NURP will yield unreliable information which when used as a basis for contaminant control programs could readily result in the expenditure of large amounts of money in the name of water pollution control without there being a significant improvement in receiving waterbody water quality.

Based on the experience of the authors in conducting water quality impact studies, they feel that the most significant deficiency in the current NURP is the failure of those responsible for developing these studies to properly consider how chemical contaminants cause impairment


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of beneficial uses of water, i.e. impair water quality. Some of the facators that must be considered in properly formulating such study programs are discussed below.

Many chemical contaminants exist in aquatic systems in forms which are not and/or would not likely become available to affect water quality. Therefore, in general, the total concentration of a chemical in a water cannot be used as a basis for developing cost-effective, technically valid, environmentally protective programs for its control. This is especially true for waters receiving urban stormwater drainage which typically contains considerable amounts of suspended material. Recently-completed studies by Jones and Lee of the release of chemical contaminants from sediments suspended in the water column, have shown that at this time it is impossible to relate the concentrations of contaminants in particulates to the impact they will have on water quality (including aquatic organisms).

The amounts of available forms of chemical contaminants in a water cannot in general be determined by direct chemical analytical techniques or by extraction of "soluble" or other "leachable" forms. Bioassays *must* be used to determine the availability of contaminants present in aqueous systems, especially those receiving urban stormwater drainage, because as discussed above, it usually contains forms of contaminants which are not readily available. Cowen and Lee and Cowen *et al.* have shown that only a small part of the phosphorus in urban stormwater drainage is available to affect water quality in receiving waters.

***In general, total concentration of a chemical in water does not correlate well with its environmental impact. This is especially true for waters receiving urban stormwater drainage which typically contains considerable amounts of suspended material, because much of the chemical would be in forms not available for harming biota.***

The fact that bioassays are not required in NURP studies and are in fact prohibited by the director of the NURP studies, is a serious shortcoming. Unless appropriate bioassays become a key component of NURP analyses, the authors predict that the studies will have to be redone in order to obtain the data needed to properly evaluate the potential impact of urban stormwater drainage on water quality.

Chemical contaminants affect water quality according to concentration of available forms—duration of exposure relationships. That is, the concentration of available forms of the contaminant must be sufficiently high for a sufficient period of time in order to have an adverse impact on beneficial uses of the receiving waters. The US EPA water quality criteria of July, 1976 (Red Book criteria) and water quality standards numerically equal to these criteria or developed using a similar worst case approach, have limited utility for judging the water quality significance of chemical contaminants in urban stormwater drainage since these criteria typically represent chronic-lifetime exposure, safe concentrations of available forms of contaminants. They would be directly applicable to urban stormwater drainage or its receiving waters only if all the forms of the contaminants present in the water were available and if the organisms that reside in these waters could receive a chronic-lifetime exposure to the contaminants. This situation rarely occurs with urban stormwater drainage since it tends to occur as short term—high intensity (pulse) events. In general, organisms can be exposed to concentrations of available forms higher than the chronic safe level without adverse impact as long as the duration of exposure is sufficiently short. For example, the dissolved oxygen concentration in a river receiving urban stormwater drainage (especially that containing combined sewer overflow) can in many instances fall considerably below the US EPA Red Book 5 mg/l dissolved oxygen criterion without significantly adversely affecting beneficial uses of the water because the input is in pulses of short duration. Similarly, waters receiving urban stormwater drainage, which typically contains substantial amounts of lead and zinc, can have concentrations of these contaminants several orders of magnitude above Red Book criteria without having an adverse impact because of the pulse nature of the input as well as the forms of these contaminants which make them largely unavailable to affect water quality.

As discussed by Lee *et al.*, and Lee and Jones, the water quality standards used for urban stormwater drainage must be directed toward the concentrations of *available* forms of contaminants rather than the *total* concentrations, and must allow consideration of the *length of time* that concentrations of available forms exceed the critical concentrations for any duration of exposure at each site of concern, as well as the impact of those couplings on beneficial uses of the waters in question. Lee *et al.*, have proposed an approach that can be readily used to develop case-by-case water quality standards which will be protective of the beneficial uses of waters receiving urban stormwater.

The focal point of urban stormwater drainage impact studies must be the assessment of its impact on beneficial uses of the water by man. As discussed by Lee *et al.*, "water quality" cannot be defined by a list of concentrations of chemical components. Frequently, marked changes can occur in the concentration of a chemical contaminant in a water without there being a perceptible change in water quality. The significance of the presence of a contaminant in a water at a particular concentration must be judged by the impact that it has on organisms or some other beneficial use of the water.

***U.S. water quality criteria and water quality standards do not correlate well with environmental impact of chemicals in stormwater. That is because these criteria typically represent chronic-lifetime exposure. But stormwater flows occur only a small percentage of the time.***

Urban stormwater contaminant management programs should focus on the control of those sources contributing loads-concentrations of contaminants most likely to directly affect the "swimmable-fishable" characteristics of the receiving waters. Subtle, difficult to detect and interpret "ecological" impacts on the ecosystem in the waters receiving urban stormwater drainage should be addressed *after* the readily discernible impacts have been corrected. It should be noted that at this time, and likely for many years to come, insufficient information is available to relate the more subtle changes in numbers and types of lower organisms (lower than fish) and other functions of the ecosystem to impacts on beneficial uses of the water, and hence cannot be appropriately used in public policy decisions for contaminant control. Such decisions must be based on a predictable contaminant load—water quality impairment relationship.

It is recommended that those responsible for conducting current and planned NURP studies carefully evaluate the approaches being taken in the studies and the usefulness—interpretability of the types of data being generated to be certain that the studies will yield results which can be used as a basis for developing technically valid, cost-effective control programs which provide the desired degree of environmental protection on a site specific basis for waters receiving urban stormwater drainage.

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