

Proposed Policy for Urban Area and Highway Stormwater Runoff Water Quality Management

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The policy governing the management of the water quality impacts of urban area and highway stormwater runoff should be the control of water pollution-use impairment in the receiving waters for the stormwater runoff to the maximum extent practicable using appropriate best management practices. This policy is in accord with current US EPA (1990) regulatory requirements. Pollution is understood to mean the impairment of the designated beneficial uses of the receiving waters for the urban area and highway stormwater runoff. This policy is designed to provide guidance on addressing the significant over-regulation of urban area and highway stormwater runoff that is beginning to occur today associated with implementing the US EPA's national stormwater runoff regulations.

This policy is also needed to address the litigation that environmental groups have initiated against public stormwater runoff management entities for the purpose of gaining financial support for the group's activities. By defining a national, regional, and local stormwater management policy that focuses on using public and private funds wisely for managing real water quality use impairments associated with highway and urban area stormwater runoff, it should be possible to eliminate the ability of those who wish to use the national stormwater management program as a basis for supporting their group's environmental activities.

The Problem

Urban area and highway stormwater runoff has been found to contain elevated concentrations of a variety of chemical constituents and pathogenic organism indicators that have the potential to cause water quality use impairments in the receiving waters for the stormwater runoff (Lee and Jones-Lee 1995a). Of particular concern are heavy metals and some organic chemicals as well as coliform organisms. It has been found, however, for the heavy metals and many of the regulated organics, that while the total concentrations of these constituents exceeds concentrations that are potentially toxic to aquatic life, the concentrations of toxic/available forms in urban area and highway stormwater runoff are below those which are adverse to aquatic life and other designated beneficial uses of waterbodies. Many of the heavy metals and organics in stormwater runoff from urban areas and highways are in particulate, non-toxic, non-available forms.

Further, the duration of exposure concentration of toxic form relationships in urban area and highway stormwater runoff receiving waters is such that it is rare that critical concentration duration of exposure relationships exist in the receiving waters to be

adverse to the numbers, types and characteristics of desirable forms of aquatic life in these waters. These situations cause the mechanical application of US EPA water quality criteria and state standards based on these criteria to lead to an over-estimate of the real water quality impacts-use impairments that occur in the receiving waters for stormwater runoff from urban areas and highways (Lee and Jones-Lee 1995b).

Over-regulation of Urban Area and Highway Stormwater Runoff

The current regulatory approach that is used for wastewater point source discharges, such as municipal and industrial wastewaters, in which the discharge cannot exceed the water quality standard at the edge of a mixing zone (if allowed) more than once in three years can, if applied to urban area and highway stormwater runoff, result in massive public expenditures on the order of \$1 to \$2 per person per day in perpetuity for urban area and highway stormwater runoff constituent control with little or no benefit in improved receiving water quality-beneficial uses. Because of the limited resources available for managing water quality, it is essential that the funds devoted to pollution control from urban area and highway stormwater runoff are focused first on solving the most important/significant water quality use impairments in the receiving waters for the runoff. Further, funds should be made available to determine whether there are other real water quality use impairments in the receiving waters that are caused by urban area and highway runoff derived constituents. Particular attention should be given in the receiving water impact evaluation to determining if there are real-subtle, non-discriminable impacts associated with stormwater runoff as well as whether new chemicals or combinations of chemicals result in adverse impacts that are not now present.

Appropriate Use of US EPA Water Quality Criteria

The US EPA (1996b) has determined that while NPDES permitted stormwater discharges from urban areas and highways must meet water quality standards in order to comply with the Clean Water Act requirements for NPDES discharges, failure to meet standards in the receiving waters for the runoff associated with runoff events does not constitute a violation of the NPDES permit. This approach reflects the fact that the US EPA's current water quality criteria and the state standards based on these criteria which were developed for domestic and industrial waste water discharges have limited applicability to assessing urban area and highway stormwater runoff water quality impacts (Lee and Jones-Lee 1995a,b).

There is need for the US EPA and state regulatory agencies to develop appropriate water quality standards for regulating stormwater runoff that will serve as a valid basis for detection and control of real water quality use impairments in the receiving waters for the runoff and serve as a basis for assessing regulatory compliance with NPDES permit conditions. The US EPA and state regulatory agencies recognize the current problems of the water quality criteria and state standards based on these criteria in leading to significant over-regulation of stormwater runoff for regulated chemicals such as heavy metals. The US EPA (1996a), as part of its Announced Proposed Rule Making (ANPRM) for Water Quality Standards, is considering various modifications of its water quality

standards implementation approach to provide for more technically valid standards/approaches for regulating urban area and highway stormwater runoff than the use of its current criteria and standards which were developed for regulating point source discharges.

Hopefully the current US EPA efforts in its ANPRM will ultimately lead to the Agency developing appropriate water quality criteria/standards and/or implementation approaches that can serve as guidance for stormwater runoff water quality management program development and implementation and goals for BMP development, implementation and compliance with stormwater NPDES permit conditions. However, since the ANPRM is a long-term effort that will require a number of years to possibly be implemented, it is essential that a national, regional, and local policy for stormwater runoff water quality management be developed and implemented that recognizes the current deficiencies in applying the US EPA's traditional NPDES permit regulatory approach developed for wastewater discharges to urban area and highway stormwater runoff.

Assessment of Aquatic Life Toxicity and Excessive Bioaccumulation

It is not possible to rely on the exceedance of a water quality standard in stormwater runoff as an indication that there will be water quality-use impairment of the receiving waters for the runoff. Site-specific investigations need to be conducted to evaluate whether the exceedances of standards in stormwater runoff for regulated constituents are causing pollution-impairment of the uses of the receiving waters for the runoff. Further, since urban area and highway stormwater runoff contains unregulated chemical constituents, such as in some areas the organophosphorus pesticides and other organics for which there are no water quality criteria and standards, it is important to develop and implement regulatory approaches that evaluate whether the unregulated chemicals in urban area and highway stormwater runoff are causing pollution of the receiving waters for the runoff. Of particular concern is toxicity that impairs the numbers, types and characteristics of desirable forms of aquatic life in these waters.

A key component of a stormwater runoff management program should be the measurement of aquatic life toxicity in the runoff waters and in the receiving waters for the runoff to assess whether the regulated as well as unregulated chemical constituents in the runoff cause significant aquatic life toxicity that impairs the designated beneficial uses of these waters. Where potentially significant toxicity is found in runoff waters, site-specific investigations in the receiving waters during and following a stormwater runoff event should be conducted to determine whether the persistence and areal extent of the toxicity in the runoff waters is potentially adverse to the beneficial uses of the receiving waters for the runoff.

Further, it should not be assumed that because urban area and highway stormwater runoff waters contain concentrations of heavy metals and other constituents that tend to bioaccumulate in excess of US EPA water quality criteria and state standards for chemicals that tend to bioaccumulate in aquatic life leading to the tissue concentration being hazardous for use as food, such exceedances represent actual excessive

bioaccumulation in the receiving waters. Site-specific investigations should be conducted to determine whether the receiving water aquatic life contains excessive concentrations of bioaccumulatable chemicals and, where found, determine the role of highway and urban area runoff-derived constituents in causing the excessive bioaccumulation.

Assessment of Real Water Quality Impacts

It is essential that an urban area and highway stormwater runoff management program include as the first step the determination of whether the runoff is adverse to the designated beneficial uses of the waterbody receiving the runoff. A site specific assessment should be made as to whether a current stormwater runoff situation of concern is causing real, significant water quality use impairments in the receiving waters for the runoff. For new developments, an assessment needs to be made as to whether the development's stormwater runoff is projected to contain constituents in toxic/available forms in sufficient concentrations and for sufficient exposures to be adverse to the designated beneficial uses of the waterbodies receiving the runoff.

Development of BMPs

Those developing an urban area and highway stormwater runoff water quality management program should not assume that the traditional BMPs, such as detention basins, filters, etc. that have been and continue to be used for urban area stormwater runoff are, in fact, effective BMPs for controlling real water quality impacts associated with stormwater runoff. Typically, toxic/available forms of chemical constituents are in dissolved forms and are not removable by the traditional stormwater runoff BMPs such as settling/detention basins and/or filters. Site-specific use impairment investigations should be conducted to assess the potential benefits of installing a particular BMP or combination of BMPs to ensure that the approach and funds allocated for their development, implementation and maintenance are being used to control real, significant water quality use impairments. Further, it should not be assumed there is a direct, understood coupling between the concentrations of a constituent removed in a structural BMP, such as a detention basin, and an improvement in the real water quality-use impairment of the receiving waters for the runoff. The evaluation of the efficacy of BMPs for existing stormwater runoff situations should be based on the evaluation of the changes in the degree of use impairment that occurs in the receiving waters for the stormwater runoff.

It should be stormwater runoff water quality management policy that source control BMPs should be evaluated and implemented where possible to control real water quality use impairments associated with urban area and highway stormwater runoff. Also, the development of BMPs, where real water quality use impairments are found, should be based on a watershed-based water quality evaluation and management program that considers all sources of constituents and their relative significance in causing real water quality use impairments in the receiving waters for the runoff.

Overall

The implementation of this policy will result in the development of technically valid, cost-effective programs for the control of urban area and highway stormwater runoff that will protect and, where degraded, enhance the nation's waters receiving stormwater runoff to the maximum extent practicable using BMPs that are designed to control real, significant water quality use impairments.

Evaluation Monitoring

As part of developing a more appropriate approach for assessing urban area and highway stormwater runoff water quality impacts and formulating technically valid, cost effective BMPs, Drs. Lee and Jones-Lee have developed an Evaluation Monitoring approach which focuses monitoring resources on a watershed based, stakeholder developed evaluation of the real water quality use impairments that are occurring in a waterbody that are potentially impacted by urban area and highway stormwater runoff. The Lee and Jones-Lee (1996b) Evaluation Monitoring approach shifts the monitoring funding from edge-of-the-pavement, end-of-the-pipe monitoring of stormwater runoff events to receiving water analysis. For example, rather than monitoring a suite of heavy metals and organics that are potentially toxic and try to extrapolate to the extent and duration of aquatic life toxicity that would occur in the receiving waters, the Evaluation Monitoring approach focuses on directly measuring aquatic life toxicity in the runoff and receiving waters. This approach measures toxicity due to the regulated chemicals as well as the unregulated chemicals present in urban area and highway stormwater runoff.

Also, rather than measuring chemicals that would tend to bioaccumulate in runoff waters and try to extrapolate to the degree of bioaccumulation in the receiving waters, the actual bioaccumulation in the receiving water organism tissue is measured. Where potentially significant toxicity or excessive bioaccumulation is found, the cause of the toxicity is evaluated and through forensic analysis using a combination of chemical and toxicity/bioaccumulation measurements, the source of the chemicals responsible is determined. The stakeholders for the watershed based water quality management program then work together to control the input of the chemical constituents and/or pathogenic organisms causing the real water quality use impairment in the receiving waters for the runoff at their source through source control to the maximum extent practicable.

References

Lee, G.F. and Jones-Lee, A., "Stormwater Runoff Management: Are Real Water Quality Problems Being Addressed by Current Structural Best Management Practices? Part, I," *Public Works*, 125:53-57, 70-72 (1994). Part II, 126:54-56 (1995a).

Lee, G.F. and Jones-Lee, A., "Appropriate Use of Numeric Chemical Water Quality Criteria," *Health and Ecological Risk Assessment*, 1:5-11 (1995b). Letter to the Editor, Supplemental Discussion, 2:233-234 (1996).

Lee, G.F. and Jones-Lee, A., "Stormwater Runoff Quality Monitoring: Chemical Constituent vs. Water Quality," *Public Works*, Part I 147:50-53 (1996a), Part I 147:42-45, 67 (1996a).

Lee, G.F. and Jones-Lee, A., "Assessing Water Quality Impacts of Stormwater Runoff," North American Water & Environmental Congress, Published on CD-ROM, Amer. Soc. Civil Engr. New York, 6pp (1996b).

US EPA, "National Pollutant Discharge Elimination System Permit Application Regulations for Stormwater Discharges; Final Rule." 40 CFR Parts 122, 123, 124, Federal Register 55(222):47990-48091, November 16, (1990).

US EPA, "Interim Draft of EPA's Advance Notice of Proposed Rulemaking on the Water Quality Standards Regulation at 40 CFR 131," Office of Water, Washington, DC, (1996a).

US EPA, "Stormwater Runoff Policy Statement," Washington, DC, (1996b)



Reference as: "Lee, G. F. and Jones-Lee, A., 'Proposed Policy for Urban Area and Highway Stormwater Runoff Water Quality Management,' Report G. Fred Lee & Associates, El Macero, CA (1997)"