SCCWRP #1443

Design of a Mobile, Field-Scale Rainfall Generator for Urban Runoff Water Quality Studies

Edward D. Tiernan[1], Jerod Gray[1], Li San Beck[2], Elizabeth Fassman-Beck[1]

[1]*Southern California Coastal Water Research Project, Costa Mesa, CA*
[2]*Engineering Consultant, Costa Mesa, CA*

ABSTRACT
Design principles and construction of a low-cost, portable rainfall generator (RFG) as a tool for field-scale urban runoff water quality studies are presented. The novel RFG (i.e., rainfall simulator) is an adaptation of a classic Norton-Ladder-type RFG that produces and uniformly applies near-natural rainfall to a movable, field-scale footprint. The simulated rainfall mimics the kinetic energy and peak intensity of a significant natural rainfall event in the Mediterranean climate of southern California. Kinetic energy is considered the most important characteristic for mobilizing pollutants. Air-induction nozzles are used to produce a relatively coarse droplet such that the calculated kinetic energy reasonably agrees with kinetic energy modeled by intensity-energy relationships. The 32mm=h intensity of the present RFG matches a 25 year, 60 min return period storm for the Los Angeles region. The design of the RFG system overcomes shortfalls of previous RFGs that underestimated the kinetic energy of low-intensity events, a symptom of small droplets having reduced terminal velocity. The overall system design generates a constant rainfall intensity through eight oscillating nozzles over a uniform area of 6.5 m^2. Pilot testing indicated that pollutant concentrations in runoff created by the RFG are representative of urban runoff. An initial application suggests that the apparatus is useful for measuring the impact of street sweeping on runoff water quality, among other potential comparative assessments.