Session K3: Innovative Techniques for Monitoring, Session 2

Room B117-119
3:30 – 5:00 pm

0248
K3-1

Quantifying Solids and Phosphorous Loads Captured by Catch Basins and Manholes

Melissa Baker

Capitol Region Watershed District, Saint Paul, Minn., USA

The Capitol Region Watershed District in Saint Paul, Minnesota, constructed eight underground infiltration trenches as part of a larger capital improvement project (Arlington Pascal Project) aimed at improving the water quality of Como Lake (an impaired water body). The infiltration trenches were constructed beneath residential streets and became operational in July 2007. Each trench is comprised of two, parallel 10-inch perforated pipes in an aggregate backfill. In addition, 16 sumped manholes and 30 sumped catch basins were incorporated to pre-treat stormwater runoff before discharging into the trenches, in order to maintain the performance and increase the longevity of the trenches.

In a performance analysis of the trenches, it was observed that significant pollutant loads were being captured by the catch basins and manholes. Supplemental monitoring was conducted to quantify the mass of gross solids (litter, organic debris, and coarse sediments) and total phosphorous (TP) loads being captured by the sumped units. A sample extraction methodology was developed and samples were collected from all 30 catch basins. The samples were analyzed for bulk density, TP content, and particle size.

Mean bulk density and TP content concentrations of samples collected from the 30 catch basins were 1.28 g/mL (80 lbs/cf) and 402 mg/kg, respectively. These values, in addition to calculated volumes of gross solids which accumulated in each unit annually, were used to determine total annual accumulations of pollutant loads captured by the catch basins and manholes from 2007 to 2010. Approximately 92,000 lbs of gross solids and 37 lbs of total phosphorous were captured by all units from 2007 to 2010; on average of 23,000 lbs of gross solids and 9 lbs of TP were removed each year.

0003
K3-2

Improving upon Decades of Poor Quality Solids Data in Urban Stormwater Through use of an Automated Depth-Integration Sample Collection System

Bill Selbig

US Geological Survey, Middleton, Wis., USA

Sediment in runoff has long been used as a surrogate for other water-borne urban contaminants and its removal has been the target for many management practices. Misrepresentation of sediment concentration and particle size in runoff may lead to improperly sized or overly costly engineering solutions. To address this concern, a new water sample collection system was developed to improve representation of solids entrained in urban stormwater by integrating water-quality samples from the entire water column. Compared to traditional fixed-point sample collection methods, the depth-integrated sample arm (DISA) was better able to characterize suspended-sediment concentration and particle size distribution in storm sewers at three independent study locations. Use of the DISA resulted in generally lower suspended-sediment concentrations and finer particle size distributions with lower variance. Decreasing variability improved statistical regression of particle size distribution to environmental parameters, such as precipitation depth and intensity, something that was unlikely using fixed-point sampling methods. In turn, environmental managers are better able to characterize concentrations, loads, and particle size distributions in urban runoff from contributing source areas. These results emphasize the need for a water sample collection system that integrates the entire water column, rather than a single, fixed point to properly characterize the concentration and distribution of particles entrained in stormwater pipe flow.

0363

K3-3

Quantifying Suspended Sediment Sources, Sinks, and Residence Times Using Radioisotopic Methods and Reservoir Theory

Katherine Skalak[1] and James Pizzuto[2]

[1]US Geological Survey, Reston, Va., USA, [2]Univ. of Delaware, Newark, Del., USA

Suspended sediment transport and storage in rivers remains a critical research area for a myriad of reasons. The fate and transport of contaminants and nutrients in streams is often determined by fine sediment dynamics. Consequently, many current restoration efforts are targeted at reducing suspended sediment loads. To effectively remediate persistently contaminated rivers, poorly understood transport processes must be evaluated over long timescales that typically exceed the temporal span of monitoring data. We reconstruct a mercury contamination history for a 40-km reach of the South River, Virginia, caused by an industrial release related to rayon acetate production from 1930-1950 using the age and mercury concentration of sediments deposited from suspension in the channel margins. We use radioistopic dating of in-channel sediments (Pb-210, Cs-137, and bomb radiocarbon) to determine sediment ages. By assuming steady state conditions through time, we can construct a distribution of ages that we assume applies to all sediments stored in the reach. We similarly construct distribution of Hg concentrations for the reach. We treat the deposits as a single reservoir exchanging contaminated sediments with the overlying water column, and develop a stochastic model defining the history of mercury contamination since 1930. Our innovative methods can be extended to other contaminants and watersheds.

0103

K3-4

Instream Turbidity Monitoring Used to Assess Landslide Hazards in the Western Cascades

Steven Sobieszczyk

US Geological Survey, Portland, Oreg., USA

Landslides are a common geologic feature across much of the western Cascades in Oregon and Washington. The combination of heavy seasonal rainfall, deeply weathered soils, and steep slopes in the region make hillsides highly susceptible to slope failure. Whether landslides materialize as shallow, rapidly moving debris flows, or slow- moving, deep-seated earthflows – landslide activity poses a risk to people and the environment, including increased sediment transport in streams, degradation of aquatic habitat, damage to infrastructure, or even loss of life. Because landslides often flow into mountain valleys, they can quickly supply a large amount of sediment to local streams and rivers. This increased sediment load proves especially problematic for water providers in rivers that serve as the primary source of drinking water for nearby communities because highly turbid water requires costly treatment prior to distribution and consumption. Using water-quality monitoring, it is possible to detect periods of increased turbidity and relate these measurements to landslide source locations. Once a connection is established between a known landslide and a water-quality monitor, instream turbidity then can be used to highlight periods of landslide reactivation and quantify potential erosion rates from the landslide. This methodology has been used in the North Santiam River Basin to monitor changes in sediment input from landslides and determine how land management and climate may alter landslide frequency and magnitude. For example, on November 6, 2006, a large debris flow mobilized from the western slopes of Mount Jefferson into the Milk Creek watershed. The debris flow deposited boulder-sized material over a 0.45 km<sup>2<sup> area and sent 15,000 metric tons of suspended sediment downstream. The suspended sediment increased downstream turbidity in the North Santiam River to an estimated peak value of 30,000 Formazin Nephelometric Units. This was the third such event from Mount Jefferson since 2001. Other landslides, such as the Evans Creek Landslide, routinely contribute over 1,000 metric tons of sediment each year to the North Santiam River. Because sediment flux from landslide source areas is not dependent on stream discharge, the turbidity–streamflow relation is much different for landslide sources than that for precipitation-driven surface erosion.