

Pollutant release: A 'dirty secret' in stormwater treatment

Catch-and-release may be a sound concept in fishing, but catching pollutants in stormwater runoff and releasing them later during large storms is obviously a problem. Yet many stormwater treatment systems do just that; they capture pollutants over time, only to release them back into the environment when the system becomes overwhelmed during high-intensity storms.

Communities across Canada have made significant investments in improving water quality. Are we getting the best return on our investments? How effective are most manufactured stormwater treatment systems? And what can be done to ensure that the best systems are being installed?

During typical storms, water and sediment flow into the chamber of a stormwater treatment system. Oil rises and sediment settles typically under calm conditions. According to Stoke's Law, the smaller the particle size of the sediment, the more time is required for it to settle.

The primary focus to date in stormwater treatment has been on removing total suspended solids (TSS), which include smaller sediment particles (clay and silt-sized) as well as larger sediment particles (sand and gravel-sized). Many urban pollutants attach themselves to TSS, including hydrocarbon oil, heavy metals and nutrients. It is the smaller particles, with their dramatically larger surface area for a given mass, that absorb the majority of the pollutants.

Most stormwater treatment devices or oil and grit separators receive runoff from parking lots or roads. The fine particles that are captured contain brake pad dust, tire wear fragments and motor oil. It is crucial for this black, tar-like, pollutant-laden sediment to settle and remain contained inside the treatment units until it is physically removed during the units' next maintenance event.

How pollutants are released

Small storms make up most of the annual volume of runoff and, therefore, typically represent the majority of pollutants coming off an urban site. During these smaller storms, the runoff rates are lower and, in a properly-designed treatment system, sediment and free oil are removed, including the higher pollutant-laden clay and silt-sized particles.

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Larger, high-intensity storms represent a much smaller portion of annual runoff but present the challenge of much higher runoff rates. The main focus during an intense storm, from a treatment standpoint, is to protect the TSS and pollutants that were previously captured. Failure to do so results in the high-velocity runoff stirring up previously captured pol-



The pollutant-laden sediment captured by a stormwater treatment device is often tar-like and toxic.

lutants, re-suspending them in the runoff and consequently sending them downstream to our precious water bodies.

While much effort has been devoted to designing systems to minimize pollutant release, other inadequately designed devices are very much at risk of re-suspending and releasing previously captured sediment and pollutants when a high-intensity storm occurs.

Surprisingly, while most stormwater treatment devices are required to be rigorously tested by numerous agencies to verify pollutant capture rates, the attention given to re-suspension and release has been minimal. The few re-suspension tests that have been completed to date focused mainly on larger particle sizes. In reality, it is the smaller particles (clay and silt) that contain most of the pollutants and are more susceptible to re-suspension and release.

The vast majority of pollutant removal testing is conducted on "clean" units. While this makes it easier to measure what was removed initially from runoff water, in real life these units almost always contain previously captured solids and sediment that have built up during previous rain events.

One North American agency has recognized this gap in testing methodology and sees pollutant release as a real threat to water quality. The New Jersey Department of Environmental Protection (NJDEP), which has overseen the Technology Acceptance and Reciprocity Partnership Program for stormwater, has begun working on a new re-suspension testing protocol. This protocol needs to be stringent and include fine particles if the industry's "dirty" little secret is going to be dealt with properly.

The NJDEP has also recently implemented a policy requiring all in-field installations to ensure that urban runoff during large storm events will completely bypass the treatment chamber of the device.

A set of rigorous re-suspension studies was recently completed by the University of Florida's (UF) Department of Environmental Engineering Sciences. UF has been actively

studying the area of re-suspension and has tested two full-scale, manufactured stormwater treatment systems that were pre-loaded with a buildup of sediment in order to replicate the typical conditions in the field. The contrasting results of the two studies clearly highlight that pollutant re-suspension and release occurs without proper flow control technology and bypass functionality.

The “Big Three” guidelines

The design of a manufactured stormwater treatment system is key in preventing pollutant release. Following are three core guidelines for specifying a re-suspension proof system:

1. Choose a device designed to minimize re-suspension.

Several systems incorporate specific design features that reduce pollutant release. In a properly designed treatment device, the incoming runoff velocity and force is significantly weakened and reduced in order to avoid stirring up settled sediment and re-suspending the pollutants. Ensure the manufacturer can back up its claims with third-party studies.

2. Size the device properly. The sizing methodology of a system should be based on supportive testing, to determine the depth and diameter necessary to ensure the correct hydraulic loading rate for the site conditions. There are also advantages to systems that offer highly developed sizing software, with the option to input site parameters including particle size distribution.

3. Maintain the device properly. All stormwater devices require maintenance. Regular maintenance is critical to overall performance. Too often, this is neglected, compounding the pollutant release issue. This is perhaps the biggest “dirty”



The runoff exiting from an underground stormwater treatment device should not contain this level of pollutants.

little secret of all in the industry. Units are specified, installed and then forgotten, often for years. The problem is noticed only when water quality objectives are not met, or when dramatic environmental damage has occurred. We should all be pushing to highlight the importance of proper ongoing maintenance.

Like many of the environmental dilemmas facing Canada, combating stormwater pollution requires both ingenuity and commitment. The guidelines listed above, when combined with knowledge of individual site conditions and the regional environment, can help to ensure that the best system is implemented to protect the environment and meet water quality objectives.

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