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guest feature

Stormwater Runoff Issues

By Jim Lindell, Marketing Manager

All Photos Courtesy GreenGrid

Residents in the United States have long believed they have some of the safest drinking water in the world. Thanks to effective water-treatment systems and policies enacted decades ago, people living in America are rarely concerned that the tap water they use for drinking, cooking, or bathing will lead to illness.

However, despite this lack of concern, the reality is that waterborne illnesses are prevalent in the United States and may actually increase in the near future because of climate change, population growth, and shifting land use[1]. As cities and suburban areas grow, land that once absorbed storm water runoff is now covered by impervious surfaces, such as building roofs, streets, and parking lots. As snowmelts and storm water travel over these surfaces, the runoff collects pathogens, metals, sediment, and a variety of chemical pollutants, which can be deposited directly into nearby streams and waterways. This is becoming a major threat to water quality throughout the United States.

The impurities in storm water runoff have been linked to chronic and acute illnesses as a result of direct exposure through drinking the water, or more indirect exposure from such actions as eating seafood that has been infected by the contaminated water. Additionally, the impervious surfaces in our cities often become stagnant pools of storm water, which breeds areas for mosquitoes and disease vectors for West Nile virus, hemorrhagic fever, and other infectious illnesses.

As cities and municipalities recognize the dangers of increased storm water runoff—especially as their local populations grow—they look for new ways to manage storm water and treat drinking water, keeping it free of impurities to protect public health. For example, the city of Portland, Oregon, is often cited as a leader in developing innovative—and less expensive—methods to treat and manage storm water runoff through a variety of low impact development techniques including the integration of landscape architecture and site design.

However, storm water–treatment systems are becoming increasingly costly and usually require significant infrastructure investments costing millions of dollars and often involving overcoming difficult technological obstacles. For this reason, some localities are considering entirely new strategies and technologies—such as the installation of green roofing systems on more facilities—as a way to help reduce storm water runoff and costs for local taxpayers.

Waterborne Disease

Although it has not been widely reported, it is interesting to note that since 1948 studies have revealed the most serious outbreaks of waterborne disease have followed extreme rainfall events. For example, it was heavy spring rains and snowmelt that preceded the Milwaukee *cryptosporidium* outbreak of 1993, which became the largest single waterborne-disease outbreak ever recorded in American history.

Cryptosporidium is a protozoan pathogen that causes a variety of intestinal illnesses. In a span of just two weeks, more than 400,000 people of an estimated 1.6 million Milwaukee-area residents became ill from drinking contaminated water, and more than 100 died[2]. It was later discovered that one of the city's two water-treatment centers had become contaminated, likely because it was overstressed from attempting to treat storm water runoff, which allowed for sewage and polluted water to pass untreated through the filtration system.

Other studies have found that the runoff from building roofs onto urban and suburban streets, parking lots, and lawns after major rainfall events generates large loads of bacteria in storm water. This runoff is responsible for an estimated 47 percent of the pathogen contamination in New York's Long Island Sound[3]. The problems are compounded because there, as in other parts of the United States, drainage pipelines have accumulated large volumes of sediment and contaminants.

Because there is no sunlight in these pipes, the natural die-off of bacteria can be inhibited, which creates bacterial reservoirs within the pipes. The contaminated runoff, combined with the bacteria-laden pipes, is often discharged into waterways because local treatment centers are overwhelmed and simply unable to treat the runoff.

The results of these discharges and untreated water are waterborne illnesses. Approximately 99 million people in the United States suffer from acute gastrointestinal illness each year, at a cost of billions of dollars. It is estimated that as many as 40 percent of these illnesses are caused by contaminated drinking water. And exposure to *cryptosporidium*, which caused the outbreak in Milwaukee mentioned earlier, is much more common in the United States than most people realize. In fact, it is estimated that 17 percent to more than one-third of all people tested in the United States have evidence of *cryptosporidium* infection by the time they are young adults.

Water-Treatment Issues

Even in an unusual situation where cost would not be an issue and all storm water runoff could be treated adequately, contaminated water would not necessarily be eliminated and could still be consumed by the public. In fact, this "ideal" situation could actually result in new problems.

Cleaning community drinking water usually involves filtering the water to remove sediment and then using chlorine to disinfect it. However, we know now that several microorganisms found in storm water runoff are resistant to both filtration and chlorine. A 1995 study found that 13 percent of sample drinking water that had been filtered and treated with chlorine at a water-treatment facility still contained cryptosporidium][4].

Some water-treatment facilities are now using ozone to disinfect water, instead of or in combination with chlorine. However, although high doses of ozone can inactivate cryptosporidium and other contaminants that chlorine cannot, neutralizing the ozone after treatment presents several technological difficulties. Plus, adding ozone to water that contains bromide can form bromate, a potential human carcinogen.

The Role of Infrastructure and Green Roofs

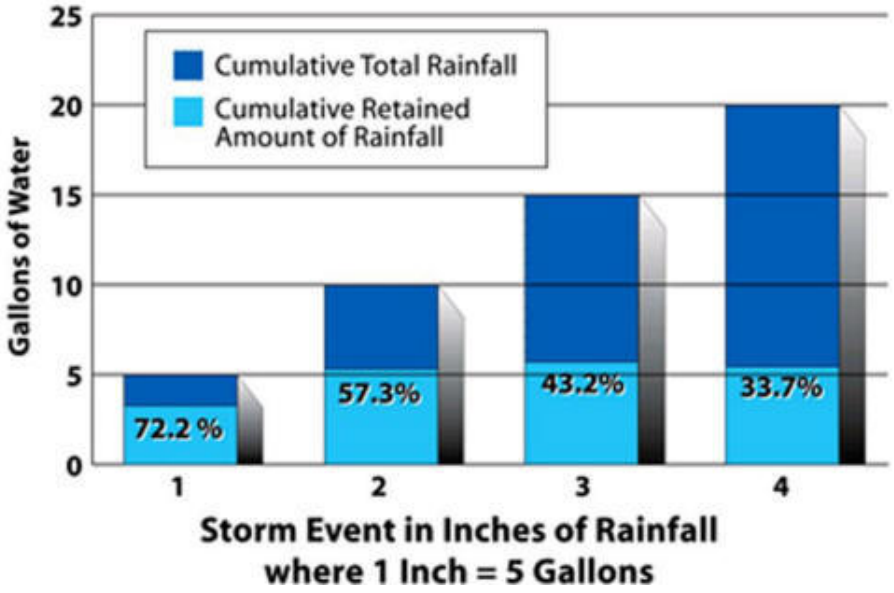
Conventional urban storm water management requires a huge investment in infrastructure. For example, since the Milwaukee cryptosporidium outbreak of 1993, the city has invested nearly a billion dollars to construct a tunnel and related systems for storing excess storm water during and after heavy rainfall events.

Another instance of significant infrastructure investment has occurred in New York City. In an attempt to minimize the amount of storm water runoff that can contaminate its water supply in the Catskill Mountains and in Delaware, the New York City Water Department has chosen to spend 1.4 billion dollars to purchase land around these areas to act as a buffer against development that can cause storm water runoff. The city believes purchasing this land will prevent them from spending more than 6 billion dollars to construct new water-treatment and filtration facilities.

The University of Wisconsin-Milwaukee Great Lakes Water Institute greenroof, 2003. See the profile in The Greenroof Projects Database.

A study conducted by the University of Wisconsin, which installed an extensive, modular green roof system in 2003 as shown above, found that the system helped reduce storm water runoff by as much as 75 percent. Studies conducted by Weston Solutions®, Inc., a leading environmental and redevelopment firm and owner of GreenGrid, a green roofing system, showed that cumulative water retention of a green roof during a simulated two-hour rainstorm produced the following results:

- One inch of rainfall: 72.2 percent of the water retained
- Two inches: 57.3 percent retained
- Three inches: 43.2 percent retained
- Four inches: 33.7 percent retained



Cumulative Rainfall Retention on a Greenroof Over a Simulated Two-Hour Rainstorm Event.

A 2005–2006 study conducted by Green Roofs for Healthy Cities indicates the green roof industry is growing dramatically. The study sites a growth rate of more than 25 percent above a similar study conducted in 2004–2005, representing more than three million square feet of green roofs installed in 2006. The green roof

industry, according to the study, is growing rapidly in response to the pressing need for cleaner air, improved energy efficiency, more usable green space in communities, and better storm water management. In fact, it concluded that the storm water–management benefits of green roofs make them ideal for ultra-urban areas; they don't consume additional land, and they reduce the need for costly drainage/filtering systems. One manufacturer of modular green roofing systems reports that they have installed as many green roofs in one month of 2007 as they did in all of 2006.

Simply put, green roofs are proving to be ideal for growing urban communities. Not only do they help to reduce storm water runoff, but green roofs play a significant role in protecting human health as well.

Jim Lindell is the GreenGrid Green Roofs National Marketing Manager. He has seven years of experience in the green roof and environmental consulting industries. GreenGrid is a business of Weston Solutions, Inc. Jim Lindell can be reached at Phone: 847.918-4011 or Email: j.lindell@westonsolutions.com.

Learn more about GreenGrid Green Roof Systems in The Greenroof Directory here or at: www.GreenGridRoofs.com.

References:

1. Stephen Gaffield, Robert L. Goo, Lynn Richards, and Richard Jackson, "Public Health Effects of Inadequately Managed Stormwater Runoff," American Journal of Pubic Health, Sept. 2003.

2. Corso PS, Kramer MH, Blair KA, Addiss DG, Davis JP, Haddix AC. Cost of illness in the 1993 Waterborne *Cryptosporidium* outbreak, Milwaukee, Wisconsin. Emerg Infect Dis [serial online] 2003 Apr [*September 12, 2007*]. Available from: URL: http://www.cdc.gov/ncidod/EID/vol9no4/02-0417.htm.

3. U.S. Environmental Protection Agency, Long Island Sound Study: Summary of the Comprehensive Conservation and Management Plan, 1994.

4. Ms. Annie Lechevallier "Giardia and Cryptosporidium in Raw and Finished Water," Journal of American Water Works Association, 1995.

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