Environmental Design+Construction

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Web Exclusive: Working With Water

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Innovative Design Approaches for Stormwater Management

In Oregon we have a complex relationship with water. On one hand we love the lush landscapes, stunning mountains and pristine waters, created by our varying amounts of rainfall. On the other, we are continually challenged to find ways to live with either too much or not enough water throughout the seasons. This challenge significantly affects the way we build and live – and can be seen either as a problem that needs dealing with, or an opportunity to create innovative sustainable solutions.

The rainwater plaza at North Main Village in Milwaukie, Oregon provides open space while acting as 'green infrastructure' to treat stormwater

In Oregon, annual precipitation can vary from around 7 inches per year in the southeast portions of the state to over 40 inches in the Portland metro area, accumulating even higher (up to 80 inches) along the coast. These extremes are further magnified by Oregon's typically dry summers and wet winters, providing too much water when we don't need it, and to little when we need it most.

Typically these issues are treated as problems solved by mechanical means, with large pipes carrying stormwater off-site, often creating combined-sewer overflow issues, or with regulations such as water-use restrictions to handle summer droughts. Throughout Oregon, designers are looking for better ways to deal with the extremes of climate and rainfall by making it an integral part of the landscape we inhabit. This involves new, innovative ways to conserve, convey, retain, purify, and perhaps most important – to celebrate water.

Strategies and Solutions

Through our design practice at Macdonald Environmental Planning, we are continually challenged to compile the most up-to-date research and innovative solutions to create more sustainable landscapes. An innovative municipal approach we often use is the Stormwater Management Manual, created by the City of Portland Bureau of Environmental Services. This document offers a variety of options to deal with stormwater in the rainy Portland climate, and has been adapted for use throughout the state. This manual offers solutions ranging from filter strips, swales, flow-through planters, detention ponds, rooftop gardens, and green roofs – all working as a system to treat, store, and distribute water.

Another strategy gaining momentum is the idea rainwater harvesting, or capturing rain and storing it for later use. This idea is an ancient one, evolving from arid regions throughout the world as a means to capture rainfall for use throughout the dry season. Over the rainy season, even a small roof has the potential to capture enormous amounts of water that otherwise flows down the drain. For example, a typical residence in Portland (36 inches of rain/year) with a 2,000 square foot (s.f.) roof collection area will result in around 35,000 gallons of water captured per year, and average of almost 100 gallons per day.

The goal of rainwater harvesting is to maximize the amount of collection and storage, resulting in less water use and lower water bills. This is not always easy with the extremes of our climate, as pointed out by Larry Giardina, who works for the City of Ashland Conservation Division. Giardina points out that the “challenge of implementing an effective rainwater management system is to utilize the water when and where it is needed and protect property and the environment from damage from water when there is more than can be used."

To meet this challenge, prior to any planning or building, all potential stormwater management and water conservation options should be considered by weighing their benefits and costs. They may range from simple applications that can be incorporated into homes or businesses to complex systems that attempt to retain and treat all stormwater on-site. The goal is to maximize the overall potential of the system, and realize that with any application, no matter how large or small, benefits quickly add up.

A number of these management and conservation strategies may add to initial construction budgets, especially new techniques that have yet to become common in the industry. But these added costs may be reduced when you explore the availability of grants and other incentives. Money may be saved in the long-term when life-cycle costs (reduced energy costs, water fees, building life, etc.) are factored in. As new research emerges, there are signs that green building can actually have upfront construction cost benefits. A recent study we conducted with Metro Regional Government outlined significant potential construction cost savings by implementation of ‘green infrastructure’ instead of traditional pipe and mechanical solutions.

Green Roofs: Integrated Systems

When looking at your options for stormwater management and conservation, strategies that have multiple benefits tend to offer the most compelling opportunities. One such opportunity comes with the installation of a layer of soil and plants on top of a structure, called a green roof (also referred to as an ecoroof). This technique has a long history in other countries, such as Germany, and has been gaining momentum in this region. Green roofs ability to retain stormwater can be an important component of a stormwater management system. A green roof can retain up to 50% of a 1-inch rainstorm, and up to 70% of the total annual rainfall by holding water and reducing peak runoff.

The 15,000 s.f. Multnomah County Building Green Roof provides stunning city views, as well as an interpretive plaza that is accessible to the public

While similar to roof gardens, green roofs differ in that they use a thin, lightweight soil profile, different plant materials, and generally do not allow for public access. There are two types of green roofs: extensive and intensive. Extensive systems have a shallow, light-weight soil profile (2-6”) and are planted with hardy plantings such as sedums that can handle harsh, dry conditions. Intensive green roofs have deeper soils (6-12”), allowing for more diversity of vegetation and water retention. Choosing which system is most appropriate is a matter of building suitability, project goals, maintenance requirements, and budget.

One reason for the increasing popularity of green roofs is the benefits they offer beyond stormwater controls. There are community benefits - from the reduction of urban heat island effects, increased biodiversity, filtering of airborne pollutants, and increased open space and wildlife habitat. There are building benefits, such as increased the longevity of the roof, increased roof insulation to help in heating and cooling efficiency, and improved worker productivity. Finally, the aesthetic benefits are immeasurable. A green roof can transform a previously blank or unattractive rooftop into a lush, vibrant, and diverse plant community that blends the building with the environment.

Green roof technology is applicable to a wide range of building types, including both flat and sloped roofs. The major limitation in selecting a location for a green roof is the structure’s ability to accommodate the added weight, especially when soils are fully saturated with water. Green roofs can be as light as 8 pounds per square foot (p.s.f.) up to 100 p.s.f. or greater depending on the depth and composition of soils. The biggest contribution to a green roof’s success is the quality of the roof waterproofing, and the use of proper soil and plants. The proper selection of these components requires professional knowledge and expertise – to ensure successful projects that endure season after season.

Our experience designing green roofs has provided us the necessary knowledge to expand the variety of applications of green roofs throughout the region. We have projects of all sizes, ranging from 170 s.f. sunroom roof at People’s Food Cooperative to the award-winning 15,000 s.f. Multnomah Building Green Roof. Our residential projects offer home owners examples of smaller-scale green roof applications, such as the Orpinela Residence (700 s.f.) and the Hawthorne Condominiums (1500 s.f.). As our knowledge and number of projects grows, we hope that our projects will inspire more people to install green roofs around the state.

Oregon’s extreme climate provides for a rapidly expanding list of approaches to dealing with stormwater management and water conservation. These innovative solutions can be integrated into sites at a variety of scales to maximize the environmental benefits and even save money. Rainwater harvesting is suited to climates both wet and dry to use water that would normally be lost into city systems. Green roofs and other stormwater management methods are proven to provide a wide range of benefits in any region. The goal in choosing the proper combination of stormwater management components is to create a system that uses water most efficiently within the constraints of a site. This way, with greater success and acceptance, we will see an overall greening of the way we conserve our natural rainfall, and incorporate it into our surroundings. We can turn our complex relationship with rain throughout Oregon from a problem into one of celebration and innovation.

Macdonald Environmental Planning, p.c. (MEP) is a Portland-based landscape architecture firm specializing in sustainable design, healing environments, and creating communities throughout the Pacific Northwest. Jason King is a landscape architect and LEED accredited professional with a focus on ecological design solutions. For more information, visit their website at www.mep-pc.com.