SVR DESIGN COMPANY/SEATTLE PUBLIC UTILITIES

Moving toward HIGH-PERFORMANCE INFRASTRUCTURE

MARY VOGEL

GREAT URBANISM CAN BE ACHIEVED WHILE PROTECTING—EVEN IMPROVING—STREAMS AND RIVERS.

In places where communities struggle with ever-expanding areas of impervious pavement and degraded water quality—and where flooding and drought are becoming a larger part of the picture—earth-based landscape approaches can have a measurable benefit. Alexandria, Virginia, for example, says it uses earth-based technologies to treat at least 20 percent of its stormwater—possibly more than any other jurisdiction in the nation.

Like New Orleans has its French Quarter, Alexandria has Old Town. Both are places with historic architecture, a great mix of uses, and a vibrant street life, and both experience flooding on a not-infrequent basis. Only a fraction of Alexandria's earth-based technologies are visible in the landscape—the rest are underground—and some are in dense urban environments, city staffer Diana Handy says.

The city's six-year-old, 60,200-square-foot (5,590-sq-m) central library has at least a half dozen rain gardens that filter stormwater from its roof and large parking lot. Although townhouses are located across the road and apartment buildings are within a quarter mile, its setting on a busy six-lane street mostly lacking sidewalks makes it unlikely that anyone will arrive on foot. Hence, there is a need for a great amount of parking—albeit parking whose runoff is filtered by rain gardens. While the building demonstrates some design features that could be used in a more compact space, Alexandria would not need to filter so much stormwater if it took a lesson from its own Old Town and focused on great urban, rather than suburban, design in its new development.

Seattle is one of the cities leading the way in redefining its streets to be a critical part of the public realm rather than just thoroughfares for cars, and in using the land to help manage stormwater runoff. In South Lake Union, a neighborhood at the northern edge of downtown Seattle, rain gardens will capture runoff from sidewalks and roof overhangs, and swales will collect street runoff.

At Kensington Courts, a three-story townhouse development off another busy Alexandria street, a gravel walkway through the vegetated swale at the site's lowest point leads to a boardwalk that terminates at what seems to be a rarely used pavilion. Everything about this development, too, is suburban. Two garage doors dominate the front of every home, and the plethora of driveways makes the narrow, street-edged sidewalk almost irrelevant. None of the streets connects with adjacent developments, and there are no shops or cafés, ensuring that anyone who lives here drives everywhere they go.

Portland's Southwest 12th Avenue green street (right) demonstrates how stormwater can be handled by the landscape in the existing sidewalks and right-of-way of a busy downtown street.

Alexandria, Virginia's central library uses French drains (below) to take roof water to rain gardens.

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Could not a new urbanist development located here achieve the same density—and the same level of stormwater treatment—but in a way that encouraged people to walk and get to know their neighbors? It is more important to address the causes of polluted waterways by getting people out of their cars through great urban design than to focus on the environmental aspects of individual buildings.

Why not carry the greening concept over to the streets as well? Why not have landscaping that works to treat stormwater and recharge groundwater, and that adds habitat for native pollinators, biodiversity to the landscape, and beauty? Why not provide these elements in the densest parts of new and old urban areas? Could not multifunctional landscaping work as well in a place with a streetscape as charming as that in Old Town Alexandria or the French Quarter?

Portland, Oregon, and Seattle are leading the way in redefining their streets to be a critical part of the public realm rather than just thoroughfares for cars, and in using the land to help manage stormwater runoff.

Portland has instituted a Green Streets program for retrofitting existing neighborhoods that involves installation of curb extensions designed to capture stormwater and landscaped with plants to help filter pollutants. In streets where curb extensions are not feasible, Portland pursues several alternatives, including lowered planter strips, landscaped swales, porous paver blocks, and pervious asphalt or concrete—alternatives more likely to meet the density challenge.

"The main challenge for retrofitting Southwest 12th Avenue was finding enough space for pedestrians, on-street parking, street trees, landscaping, street lighting, signage, and stormwater planters within an eight-foot-

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Portland's New Seasons Market, a locally owned neighborhood grocery store, was designed to infiltrate 1 million gallons (3.8 million liters) of stormwater annually from the market's rooftop, outdoor plaza, and parking lot drains to interconnected stormwater swales. Three stormwater planters in a planting strip between the sidewalk and street curb slow and filter runoff from the street.

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[2.4-m-] wide space," explains landscape architect Kevin Robert Perry, who designed the Southwest 12th Avenue green street. Perry's stormwater planters capture nearly all this part of the street's annual runoff, estimated at 180,000 gallons (681,000 liters). In fact, a simulated flow test has shown that stormwater planters on that section of the street can reduce by at least 70 percent the runoff intensity of even storms that can be expected to occur once every 25 years.

Perry says he quickly realized that for the stormwater planters to work in tandem with on-street parking, the design would have to focus on strong pedestrian circulation and connection from the sidewalk to the parking zone. His solutions included a three-foot- (0.9-m-) wide parking zone for people to open vehicle doors without competing with the stormwater planters, perpendicular pathways between each stormwater planter so that pedestrians would not have to walk far to reach their cars or the sidewalk, and a four-inch (10-cm) curb exposure at each planter to help indicate a drop in grade to pedestrians. To allow pedestrian flow along the parking egress zone, an ornamental grate meeting Americans with Disabilities Act standards covers each curb.

While the plant species chosen—grooved rush and tupelo for the planters, and nandina and liriope for outside the planter box—are adequate for the job, the planting plan could be improved by adding a greater diversity of plants. The stormwater planters are well integrated into the urban streetscape and bring natural hydrologic functions back into the city, but they could also bring back other functions of natural areas by celebrating Portland's natural heritage and improving the native pollinator habitat through the use of a variety of native plants.

Two of the biggest challenges in gaining acceptance of a new technology are education and maintenance. Portland placed a small interpretative sign at the project site to explain how the stormwater facilities function, as well as how to find more information on sustainable stormwater management practices. The city and Portland State University—whose campus the project runs through—have agreed to share maintenance responsibilities. A number of students and professors in the urban planning and environmental studies departments at Portland State are using the project in their research.

Like many older cities, Portland has some areas where stormwater goes into combined sewers with sewage. The owners of New Seasons Market, a locally

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owned neighborhood grocery store, cooperated with the city to address that issue when they redeveloped an old laundry site on Division Street that will remove about 1 million gallons (3.8 million liters) of stormwater from the combined sewer system annually.

In a system designed by Portland-based Lango Hansen, Inc., stormwater runoff from the market's rooftop, outdoor plaza, and parking lot now drains to interconnected stormwater swales built throughout the parking lot and on three sides of the market. In addition, three stormwater planters in a six-foot (1.8-m) planting strip between the sidewalk and street curb slow and filter runoff from Division Street. Before entering one of the swales, stormwater from a roof downspout at the building's northeast corner showers a sculpture set in motion by the rain. The market is in a walkable location and includes more than 60 bicycle parking spaces, including indoor bike parking for employees, reducing the amount of pavement needed for cars.

The design takes advantage of landscape space by managing runoff as a resource rather than as waste. Instead of flowing into a sewer pipe, rainwater flows into the landscape. By increasing landscape space for stormwater management, trees, and other vegetation, this design will also reduce Portland's stormwater management charges to the property owner because those charges are based on impervious surface area. The project reduces impacts on Portland's sewer system, enhances the neighborhood aesthetically by providing a pedestrian and bicycling destination, provides improvements to the property owners, and improves air and water quality.

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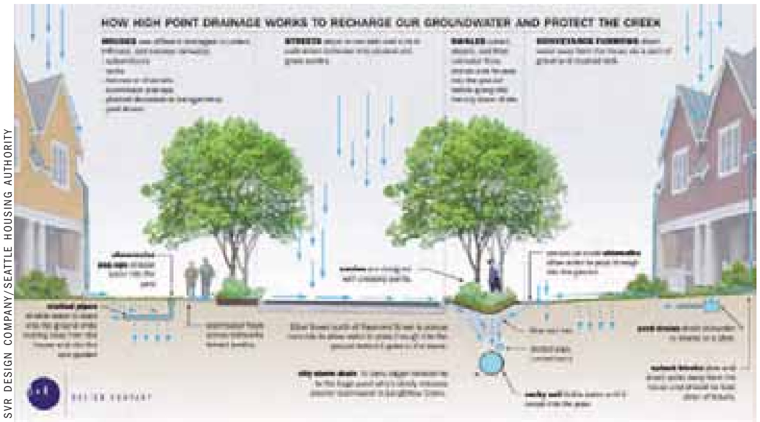
To capture stormwater runoff from the street, rooftops, and walkways, more than 100 deciduous and evergreen trees and 1,100 shrubs were added as part of the original 660-foot- (183-m-) long SEA (Street Edge Alternative) Streets project in Seattle.

While Portland offers some well-designed, if not bold, examples for treating stormwater in existing dense urban areas, Seattle has come up with the most innovative solution, with its Street Edge Alternatives Project, or SEA Streets, bringing a ribbon of nature back into the public realm. To capture stormwater runoff from the street, rooftops, and walkways, more than 100 deciduous and evergreen trees and 1,100 shrubs were added as part of the original 660-foot- (183-m-) long SEA Streets Project.

Measurements by scientists at the University of Washington indicated that the two-block pilot project captured 98 percent of the stormwater runoff in its first two years. The pilot project was so successful, in fact, that Seattle has expanded the concept to more than 30 blocks in two neighborhoods—the Broadview and Pinehurst Green Grid projects—through its natural drainage system program. The system will be used wherever stormwater drains directly into streams.

In areas with no curbs or gutters, the city has found that natural drainage systems are 25 percent less expensive to build and maintain than conventional drainage systems. The approach is popular with residents, who are largely responsible for maintenance, because it makes their neighborhood more livable and aesthetically appealing; some even say it has increased property values. Redesign of old streets has added sidewalks to areas where there were none. In addition, the curvilinear streets are slowing traffic, which helps create a pedestrian-friendly environment. Both increased pedestrian activity encouraged by the streetscape and the outdoor time residents put into maintaining the piece of swale in front of their property encourages more neighborliness. Plants and trees, the tools of natural drainage systems, maintain themselves and increase their benefit with time as they grow and provide more surface area to slow runoff and more root area to absorb it below ground.

Although Seattle has used natural drainage systems primarily in single-family-home neighborhoods with no existing curbs or gutters, similar designs could become part of a far denser, more compact, more urban development. The city has at least three redevelopment projects in various stages of progress that will lead the way—High Point HOPE VI, South Lake Union Urban Center, and Taylor 28.



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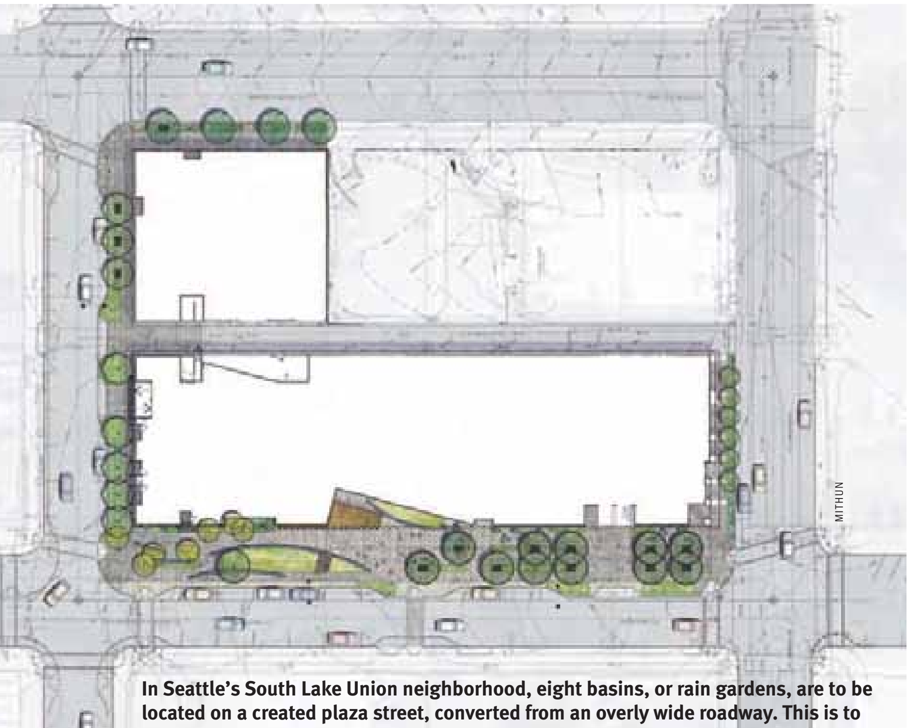
Natural drainage system methods have been applied to a 34-block, 1,600-unit, mixed-income, HOPE VI housing redevelopment, called High Point, in Seattle. There are vegetated and grassy swales, porous concrete sidewalks, and frontyard rain gardens with conventional curbs and gutters.



In Seattle's South Lake Union neighborhood, eight basins, or rain gardens, are to be located on a created plaza street, converted from an overly wide roadway. This is to provide a pedestrian zone near Taylor 28, a residential, mixed-use development in what is now a commercial and warehouse-dominated neighborhood.

At the intersections and a midblock crossing, **curb extensions** will further calm automobile traffic for increased pedestrian safety.

At High Point, located on a site that formerly held public housing, the city is engaged in its most ambitious initiative to date, working with the Seattle Housing Authority to apply natural drainage system methods to a 34-block, 1,600-unit, mixed-income HOPE VI housing redevelopment. The project, which began in 2003 and is scheduled for completion in 2008, will cover 129 acres (52 ha), representing 10 percent of the Longfellow Creek watershed. The system, one of the first natural drainage systems to be implemented for an urban housing development of this density and scale, is integrated into the landscape of the individual homes, as well as into the new street grid layout, creating a network of vegetated and grass-lined swales. The result is improved water quality, and green space that also links the community to the watershed.

The redeveloped High Point neighborhood also includes a new public library and health clinic, community gardens, a neighborhood center, 21 acres (8.5 ha) of recreational parks and greens, and a network of paths and trails. Land has been set aside just south of the library and health clinic for a retail center. Planners have been reasonably successful in connecting the neighborhood with the surrounding street pattern to the north, west, and south, although Longfellow Creek Ravine prevents such connections to the east. A grid network of narrow streets and sidewalks has made the streets safer for pedestrians and made it easier for residents to reach destinations without a car.

Designers used multiple strategies for natural drainage in High Point. On the homes, gutters feed water into tiny concrete troughs that lead to rain gardens—concave landscaped areas designed to absorb water. Other gutters lead to buried, perforated pipes that gradually leak the water into the ground. Some pipes convey water away from the home, then pop back up to release it into the yard.

Streets are tilted to one side instead of sloping from the center toward each shoulder, directing rainwater through cuts in the curbs, where it flows to landscaped and grassy swales. Designed with porous soil and a bed of gravel underneath, these swales clean, cool, and filter stormwater before it reaches Longfellow Creek, which has the highest count among all Seattle creeks for coho salmon—listed as a "species of concern" by the National Oceanic and Atmospheric Administration. The natural drainage system is expected to cut the runoff into Longfellow Creek during storms of one inch of rain or less by roughly 80 percent compared with a conventional system, according to a report from SvR Design, a local civil engineering firm designing the street stormwater network. Private developers are responsible for designing the natural drainage features in private yards using an SvR handbook. The city will work with the University of Washington to monitor the performance of the system once the project is completed. Plant species in the swales include a diversity of natives, such as grasses, rushes, sedges, lupines, asters, roses, ferns, willows, alders, and cedar.

The city also required conventional pipes and a pond for the infrequent but heavy storms that might overwhelm the new features. The dual stormwater systems will cost $3 million more than use of one system alone, but Seattle Public Utilities is paying the expense in order to test the new water control strategies on a large scale, as well as to improve the creek for the coho salmon.

In South Lake Union, a neighborhood at the northern edge of downtown that is being rapidly redeveloped by Vulcan Real Estate, Seattle has a natural drainage system in the preliminary design stage. Vulcan is creating an urban center where buildings will be ten to 12 stories high, built to the property line, and include a mix of retail, housing, and office space.

If approved, the pilot "Swale on Yale" will be 20 feet (6.1 m) wide, but only two to 2.5 feet (0.6 to 0.8 m) deep. It will run the entire six blocks between Mercer and Thomas streets, three blocks along Yale Avenue North, and another three blocks along Pontius Avenue North. Eight feet (2.4 m) of the width will come from eliminating a parking lane on the swale side of the street, another three feet (0.9 m) will come from the developer, and the rest from narrowing the roads, which will still handle the same volume of traffic. Sidewalks will be on both sides of the street—possible because of Seattle's emerging philosophy that streets are an important part of the public realm, not just thoroughfares for cars. It is hoped that designers will acquiesce to the neighborhood plan that bids them to "seek to increase tree coverage, reintroduce native plant species into the neighborhood, and provide for additional wildlife habitat appropriate to the urban environment."

With Taylor 28, the first residential, mixed-use development is planned in what is now a largely single-story, large-footprint commercial and warehouse-dominated neighborhood. Seeking to set a precedent for a new urban design standard, landscape architect T. Frick of Mithun Partners and her design team have worked with the city to negotiate the transfer of underused roadway width back to the pedestrian realm to provide what they are calling a plaza street along Taylor Avenue. The designers are transforming about 20 feet (6.1 m) of the Taylor roadway into the pedestrian zone along the eastern edge, creating a pedestrian space with a minimum 36-foot (11-m) width. At the intersections and a midblock crossing, curb extensions will further calm automobile traffic for increased pedestrian safety.

The plaza area incorporates permeable and specialty paving interspersed with both small and large rain gardens and movable and built-in seating to create a series of "outdoor rooms." The rain gardens and permeable pavement are projected to infiltrate all the rainwater reaching the plaza pavement during a severe storm that would occur once every 25 years, capturing and infiltrating 28,000 gallons (106,000 liters) of stormwater. Native plants such as tufted hair grass, dwarf redtwig dogwood, and a variety of sedges and rushes create the feel of wetlands amid the pavement. "The city was not ready for the introduction of the roadway water into these elements yet, although that had been our original intent," maintains Frick. The design incorporates a 15,500-gallon (58,700-liter) cistern beneath the building's parking structure to capture and reuse its roof rainwater for landscape irrigation. To reduce the heat-island effect and to offset production of carbon dioxide, Mithun's plan introduces an appropriately scaled tree canopy—limbed for vertical clearance to accommodate pedestrians while providing a clear view of the retail space in the new five-story structure. The owner, BRE Properties, Inc., will be funding and maintaining this right-of-way improvement for the Taylor 28 project.

Portland and Seattle have perhaps come closest to designing natural stormwater management for an urban density that would please urbanists of all stripes. Portland's 12th Avenue is a model for fitting nature-based stormwater management into the traditional street network in moderate- to high-density areas. In bringing even more of nature's functions into such areas, Seattle's "Swale on Yale" and Taylor 28 move further in the direction of what architect Hillary Brown, principal of New York City–based New Civic Works, calls high-performance infrastructure. As designers incorporate these ideas in their own designs, expect them to spread—like native fireweed after a forest fire. UL

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