Volume 4, Issue 3

Fall 2009

Watershed Management Group

Watershed Moment

Dear Readers,

This issue has a special focus on greening our cities. Read on to learn how WMG is working with communities to develop "green infrastructure," vegetated infrastructure that uses natural processes to provide services like stormwater infiltration, cleaning air and water, and reducing the urban heat island effect.

Included is an interview with Dave Elkin, one of the leaders in developing Portland Oregon's cutting-edge work in green street practices.

Also included in this issue are updates on WMG's latest work, information about our Water Harvesting Certification Program, and an article about a community in Burkina Faso, Africa that is seeking technical assistance from WMG.

WMG's Green Streets - Green Neighborhoods Program

By James MacAdam, WMG Project Manager

Imagine walking down a shaded neighborhood sidewalk with trees arching overhead. The ground next to the sidewalk is moist with street runoff from a recent rain; native shrubs and wildflowers buzz with insects, and bird calls fill the air. On the street, cyclists share the road with cars, both moving at respectful speeds through the neighborhood. Neighbors walk by, many of whom you know through various community gatherings. They're on their way to the office, a coffee shop, or a nature trail that follows the nearby riparian area.

Urban utopia? No, just a green street! Presently, many urban and suburban neighborhoods across the U.S. are dissected by streets that are too wide, move cars too fast, and are dangerous to walk or bike along. As we've covered the soil with roads and other impervious surfaces like rooftops and concrete, we've increased stormwater runoff creating a problem flooding streets and sending

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A pathway along a green street in Tucson's Dunbar/ Spring Neighborhood.

Inside this issue:

WMG Wins American Planning Association Award

On October 15, the Arizona Chapter of the American Planning Association (APA AZ) presented WMG and the Rincon Heights Neighborhood Association (RHNA) with the first annual "Making Arizona Competitive in the 21st Century" (MAC21) award. WMG and RHNA were chosen for the award based on their collaborative effort to conduct education and install green infrastructure practices throughout the historic neighborhood. Green infrastructure practices include curb cuts, landscaped basins, and gravel-filled infiltration trenches that collect stormwater. The practices improve water quality, reduce flooding, and use stormwater to passively irrigate native trees and shrubs that shade and beautify neighborhood streets.

Curb Cut and basin collecting stormwater

The MAC21 Award recognizes a program that "goes beyond the typical community plan and focuses on creating infrastructure components that contribute to livability and long term sustainability," as well as "help[ing] the community be economically competitive in the 21st Century."

Hundreds of volunteers from all over Tucson have participated in hands-on workshops to install green infrastructure practices on ten blocks in the neighborhood. WMG and neighborhood leaders worked with the University of Arizona (UA) to install similar features at six of the UA's parking lots and facilities in the neighborhood. Additional projects in the neighborhood include: traffic mitigation structures incorporating rainwater harvesting features along two main streets, workshops to train community leaders from 13 other Tucson neighborhoods in green infrastructure implementation, installation of a natural pocket park within the neighborhood, and an educational program on non-point source pollution.

What Is the Urban Heat Island Effect?

Here in the southwest, you often hear tales of someone who fell down on a hot city sidewalk and suffered serious burns. This dramatic example illustrates what we all intuitively know: cities are hot! All the asphalt, concrete and rooftops (collectively called "hardscape") we install in urban areas retain and radiate heat. The natural vegetation we pave over once shaded the ground and pumped cooling moisture through its leaves. The result? Urban Heat Island Effect—the phenomenon of cities being warmer than surrounding rural areas. Hotter urban temperatures cause us to turn up the AC, which increases energy demand and burning of fossil fuels. This—plus heat-induced formation of ground-level ozone—causes air pollution locally, and warming of the climate globally.

Some reduction of heat islands can be achieved by making/coating hardscape with light-colored surfaces that reflect rather than retain heat. The most effective solution, however, will be greening our cities. Green infrastructure practices reduce the amount of hardscape and provide trees and shrubs that shade streets, sidewalks and roofs.

Source: USEPA Heat Island web site, http://www.epa.gov/hiri/index.htm

This water harvesting traffic circle reduces heat-trapping hardscape; and its vegetation provides shade, stormwater treatment, beauty and wildlife habitat.

WMG Updates

Arizona State Forestry Division Awards WMG Funds to Develop Green Street Standards

WMG was awarded a grant from the Arizona State Forestry Division to develop and promote streetside water harvesting infrastructure to grow native trees. Through this grant, WMG will: 1) develop green infrastructure standards for streetside stormwater practices adapted for semi-arid environments in collaboration with the City of Tucson Department of Transportation; 2) conduct hands-on training to neighborhood leaders and residents through implementing stormwater harvesting retrofits; and 3) provide educational resources including presentations, tours, and on-line resources to neighborhood groups and the larger community. "We believe many more neighborhoods will be able to implement green infrastructure projects if they have a set of designs readily available to serve as a baseline for working with city departments and engineering firms," explains WMG's Project Manager, Catlow Shipek. These designs will also serve as a resource to city departments and engineering firms, who may not have expertise in this particular field.

WMG Co-op Becoming Community Model

As fall sets in, WMG's Co-op has packed schedule of residential workshops. The Co-op is enabling Tucson households to affordably install a variety of backyard sustainability projects. Along with a wide variety of water harvesting systems, one of the most recent projects included building a composting system and worm bin.

The success of WMG's Co-op has gained the attention of other communities and organizations. Tucson's Community Food Bank just recently started their own Co-op to help low-income families install vegetable gardens. They based their program closely off of WMG's model; however, they are focusing on volunteers working in their own neighborhoods. Another Tucson non-profit, Empowering Local Communities, consulted with WMG to start a Co-op that would focus on assisting homeowners install efficiency improvements on older homes. To find out more about the Green Retrofit Co-op, see the article on page eight of this newsletter.

Interest is growing in the Phoenix area to start up a Co-op program as well. Arizona Home Grown Solutions, a Phoenix non-profit, is partnering with WMG to run a Water Harvesting Certification program this spring to train workshop leaders for a Phoenix Co-op.

New WMG Board Chair and Officers

At our annual board meeting in October, board members elected a new set of officers for the year. We would like to welcome Jill Nunes as the new Board Chair, who has experience working with several non-profits and event fundraising activities. She is replacing Catlow Shipek, who has served as Board Chair for the last two years. In addition, Joe Silins was elected to serve as Vice Chair, Ross Bryant as Treasurer, and Andrea Martin as Secretary. Thank you to our outgoing officers for all their hard work: Catlow Shipek (Chair), Torey Ligon (Vice Chair), Pierre Bondoumbou (Treasurer), and Emmy Creigh (Secretary).

WMG's Co-op model is taking off.

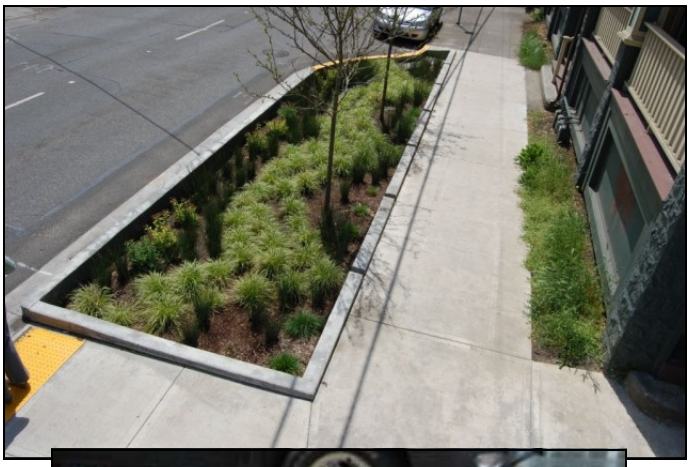
School Yard Program Boosted by U.S. Fish and Wildlife Funds

This fall, WMG is working with two schools on a comprehensive water conservation and wildlife habitat program. The U.S. Fish and Wildlife Service offers funds to schools to create wildlife habitat on school grounds. This year, U.S. Fish and Wildlife partnered with WMG to help schools create wildlife habitat through creating rain gardens that passively harvest rainwater. Both schools we are working with will also be installing cisterns to water their gardens. WMG staff member Blue Baldwin is working with teachers at Manzo Elementary and Youth Works High School to run water conservation activities and create the wildlife habitat at each school.

Sustainable Stormwater and Green Streets in Portland, Oregon

By James MacAdam

This October, I spoke with Dave Elkin, Landscape Architect for the City of Portland, Oregon's Bureau of Environmental Services' Sustainable Stormwater Program. Portland has been a leader in the movement to develop infrastructure that helps clean and infiltrate stormwater as close to the source as possible using soil and vegetation (often called "green infrastructure"). Elkin has been part of a team implementing green streets facilities that have become a model for other communities across the country.



Portland Green Street facilities collect stormwater from the street and sidewalk into the vegetated area. Photos courtesy Dave Elkin, Portland Bureau of Environmental Services.

Humble Beginnings

Elkin said the seeds for Portland's Sustainable Stormwater program were planted in 1992, when he and others began to "understand there was a new way to manage stormwater," beyond the use of large facilities like pipes, concrete channels and large detention basins (now known as "grey infrastructure"). Their first installation was a bioswale, a gently sloping depression planted with tough native shrubs designed to catch and treat stormwater from a museum parking lot. In 2000, the group partnered with a private developer to install a green (vegetated) roof on a local apartment building. In 2002, Portland began installing green street facilities, using curb cuts and curb extensions to draw street runoff into landscaped areas for natural treatment (see photos).

Sustainable Stormwater Saves Money

Elkin explained the program got a big boost when his department began quantifying the stormwater benefits of the green practices. The group's most recent monitoring report shows that green street facilities reduce peak flow rates (the fastest rate that water flows down the street during a storm) by a minimum of 80%, and reduce overall runoff into the storm sewer by a range of 56%-95%.[1] This substantial reduction translates into reduced risk of sewer backups into local basements (like many cities, Portland has a combined sewer system for sewage and stormwater runoff), decreased flooding in local waterways, and less stormwater runoff—and thus, less water pollution—into the sewer system and ultimately the Willamette River.

Elkin said "green street facilities went from being an anomaly to something that could be calculated and then modeled in our giant citywide pipe models that we have for our stormwater system." And when the calculations were made, they found that green street facilities often provided a much cheaper solution than pipes for managing stormwater. In one dramatic example, city leaders had previously tabled a plan to replace and upgrade aging sewer infrastructure across a 2.5-square-mile swath of the city when cost estimates ran to $144 million. After Elkin's group's data was published, engineers reran the models, and found that green street facilities obviated the need for many of the planned sewer pipe size increases, reducing the total cost of the project to $92 million—including the cost of the 500 green street facilities.

Portland's Green Streets program is funded through the city's operational budget, federal grants and an innovative funding mechanism called "1% for Green," in which 1% of construction costs from certain city projects that affect stormwater go to green street projects. The facilities are maintained by the city as an integral part of their stormwater infrastructure.

Elkin pointed out that green streets synergize with other community goals like pedestrian safety—"they shorten the crossing distance and prevent vehicles from being parked directly adjacent to a pedestrian ramp (which improves visibility for pedestrians and drivers)." For this reason, initiatives like Safe Routes to Schools have also received funding for green streets projects.

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Graduates of WMG's first Water Harvesting Certification Program a Resource for Communities across the Southwest

A diverse group of professionals in landscape architecture, urban planning, hydrology, education, water harvesting and construction trades recently completed the first WMG Water Harvesting Certification. The Certification program provides comprehensive skills in water harvesting system design and implementation and tests participants to ensure the skills and concepts taught are sufficiently mastered.

Courses taught in the Certification include: passive water harvesting earthworks, cistern construction, gravity-fed greywater systems, small-scale erosion control, stormwater harvesting, and integrated design.

WMG Certification students learn how to install a kitchen resource drain with an underground infiltration chamber.

Graduates of the Level 1 program include:

- Emily Brott, Sonoran Institute
- Marti Craft, Just Sustainable Solutions
- Hans Huth, Arizona Department of Environmental Quality
- Nicholas Irvine, Monsoon Rainwater
- Gabriela Kinkead, urban planner
- Mead Mier, Pima Association of Governments
- Robin Myers, general contractor
- Luis Perales, Totlecalli High School & Chicanos Por La Causa
- Renee Schaefer, Outside Views
- Barbara Wishingrad, permaculture designer

Graduates of the Level 2 program include:

- Blue Baldwin, WMG School Yard Coordinator
- Marti Craft, Just Sustainable Solutions
- Allen Denomy, Blue Agave Design
- Hans Huth, Arizona Department of Environmental Quality
- Gabriela Kinkead, urban planner
- James MacAdam, WMG Project Manager
- Robin Myers, general contractor
- Lincoln Perino, WMG Co-op Instructor and Technicians for Sustainability
- Renee Schaefer, Outside Views
- Paul Whitby, biologist

Upcoming Certification Programs

WMG will be offering the next Level 1 Water Harvesting Certification course starting this winter in late January running through mid March. The course will take place over 8 weeks, including evening lectures on weekday evenings and hands-on workshops on weekends. WMG will be running two courses simultaneously, with a capacity to train about 20 people.

WMG's certification is the only one of its kind in the United States and aims to set the bar high for training professionals from across the country. WMG believes Tucson is an ideal place to host the Water Harvesting Certification due to the leadership, innovation, and demonstrable models in water harvesting that have developed here. Those who complete the Certification are qualified to assess, plan, and implement a variety of water harvesting systems and are resources for the community at large for water harvesting projects.

By mid November, we will have the exact dates and cost of the winter program along with applications to apply. Please check the following webpage for more details on the course: www.watershedmg.net/programs/wh-certification.

In addition to the two winter courses, we will be offering a Level 1 course in Phoenix in the spring and our intensive Level 1 and Level 2 courses over the summer. The summer courses are designed to accommodate out-of-town participants, since the course will take place over 9 consecutive days.

Rural Village in Burkina Faso, Africa Seeking WMG's Help

By Sowmya Somnath, WMG Engineer/Sanitation Specialist, and Jared Buono, WMG Senior Hydrology Scientist

Deou is a small village in northern Burkina Faso. In many ways it is not unlike rural parts of the Southwest; people make a living by raising livestock and farming in the desert. They also face shrinking aquifers and are dealing with the effects of drought and climate variability.

But there are some major differences. Infrastructure is limited as there are few roads, no electricity, and no municipal water supply. Water is pumped, mostly by hand, from great depth via a few wells. Many of these wells have gone dry, forcing women and children to spend much of their day walking long distances, and waiting in long lines to fill their buckets from a trickle and then carry them on their heads for the long trek home. This process can take up to 24 hours during the dry season, so family members must take turns. When wells are on private land the water must be purchased at high fees.

The pressures of intense land use have led to a denuded landscape where storm water rushes downstream and rampant erosion reduces food production. Revegetation is required, but it is difficult to establish plants under the intense grazing; livestock is not only a source of income but it is also the banking system that allows families to save and pass on wealth. This is often their only asset. These issues are compounded by drought, making water scarce for people, livestock and farming. This has resulted in widespread malnutrition, loss of livelihoods and migration.

But there are solutions for Deou. The people have banded together to make a better future. They are developing a watershed plan to restore the landscape. They hope to capture runoff, spur vegetation, and infiltrate rains to increase

A casualty of drought.

Women and children travel up to 24 hours to get water.

ground water. They want to control grazing around sensitive areas and water sources. And they plan on constructing a series of boulis (a local word for an artificial pond) which are designed to harvest runoff from intense summer storms. These large ponds are lined with counter season crops that can provide income, limit evaporation, and store water for long periods ensuring water supply and promoting ground water recharge.

This is where WMG comes in. The villagers need our help to plan and implement their watershed activities, specifically with ensuring that erosion is limited and the boulis do not fill up with silt. We will also assist with techniques to increase ground water recharge around wells so that people and animals have access to water year round.

A local NGO, AMURT, who has been in the community for over 20 years, has worked with a WMG member in the past in neighboring Ghana. They would like WMG to come to Deou early in 2010. We are hoping to raise just $5000 to send two WMG members to the community for a month. We understand that fund raising during a global recession is a difficult thing, but the need in Deou is immeasurable – and we can have a direct impact. For those of us that live through Southwest summers, it is difficult to imagine not having enough water to drink.

If you're interested in learning more about the Burkina Faso project or would like make a financial contribution or assist with fundraising, please contact Lisa Shipek at lisa@watershedmg.org.

Support Watershed Management Group Today!

WMG is starting our year-end fundraising drive, to raise funds to support our regular programs into the next year. Please consider making a year-end donation to ensure that WMG's essential programs can continue and to enable us to outreach to new communities in need. Donations can be made by check or credit card on our website.

Become a regular WMG supporter by becoming a monthly donor! Monthly donations allow donors to have a larger impact, through smaller, recurring contributions. At the same time, monthly donations provide WMG with a dependable source of income to support our work. Please contact the Executive Director, Lisa Shipek, if you would like to become a monthly donor by email at lisa@watershedmg.org or by phone at 520-396-3266.

WMG's Co-op members create a wildlife rain garden in an alley in southern Tucson

Watershed Management Group is a 501(c)3 not-for profit organization. All donations are tax deductible.

Suggested Individual Contribution Levels:

- ◊ Dewdrop: $25
- ◊ Silver Raindrop: $50
- ◊ Flowing River: $100
- ◊ River Basin: $500
- ◊ International Watershed: $1,000

Suggested Business Contribution Levels

- ◊ Sabino Creek: $100
- ◊ Rillito River: $250
- ◊ Santa Cruz River: $500
- ◊ Gila River: $1,000

See WMG's Sponsor Package

WMG Wish List

- ◊ Laptop Computer
- ◊ Garden tools (shovels, pick axes, hand trowels, etc.)
- ◊ Locking file cabinet
- ◊ Office desk

You may also make your tax deductible donation online at www.watershedmg.org on our Contributions page.

Watershed Moment is a quarterly newsletter written by WMG staff and guest contributors, with final editing by Lisa Shipek. If you are interested in submitting a story to The Watershed Moment, please contact Lisa at lisa@watershedmg.org or at 520-396-3266.

The mission of Watershed Management Group is to improve rural and urban livelihoods by integrating community development and conservation. We provide local residents and community groups with the knowledge and skills necessary to sustainably manage their natural resources.

"Building Community While Rebuilding Our Homes:" Green Retrofit Co-op Inspired by WMG Model

Guest article by Tres English, Director of Empowering Local Communities

The Green Retrofit Co-op is a work and buying cooperative that helps members fix each other's homes and make them more sustainable. In many ways, it is patterned after the Watershed Management Group co-op approach, with a few tweaks.

The Green Retrofit Co-op is an affiliate of Empowering Local Communities (ELC), a non-profit corporation established to develop and disseminate techniques to make Tucson more sustainable. ELC provides technical and administrative support for the Co-op. The Green Retrofit Co-op is also a Working Group of Sustainable Tucson, so in addition to individual projects we hope to work with neighborhoods on larger scale projects, such as a neighborhood-wide lead abatement program.

ELC has been working for nearly four years as the Teaching & Helping program using grants from Pima County. On December 12, we will be doing our first project as the Green Retrofit Co-op, using a Pima County grant to support low-income families. If you would like to join us, this is your chance to learn practical skills—like how to insulate your house, replace windows, install a solar water heater, and even widen doorways for wheelchairs. It is also a great change to work with a lot of really good people.

Like Watershed Management Group, Green Retrofit Co-op members volunteer for projects on the homes of other co-op members (or grant funded projects) to earn the right to host projects at their own home. Host families must have already contributed sufficient hours prior to hosting a project and to receive help from other co-op members.

A host family pays for the materials used for their project, as well as for the cost of a mentor to lead the volunteer team and for administrative support. The mentors are members of the Teaching & Helping Mentor team, which ELC has been developing for the last three years.

If you would like to get involved, or find out more, contact Tres English, tres@sustainabletucson.com

Our Sincere Thanks

A Special Thanks To:

- KXCI for donation of a Public Service Announcement about our Co-op grants
- Peace Supplies for donation of services towards our Co-op t-shirts
- Janis and Robert Hall for donation of a Flip video camera
- Joanie Sawyer, with Pro Neighborhoods, for assisting with a Board Member Mission & Vision brainstorming session
- Trees for Tucson and the Tucson Plant Materials Center for partnering with WMG to provide native plants for green street projects in Rincon Heights Neighborhood
- Keri Dixon, Membership Director of the Center for Biological Diversity, for leading a donor development training for WMG board and staff members.
- Andrea Martin for weekly volunteer assistance with administrative tasks

Individual Donations:

Flowing River Level:
Bill and Robin Charles
Ilene and Gregory Grossman
Paul Maxon
Ed Thompson

Silver Raindrop Level:
Kim and Jim Afinowich
Christopher Brooks
Henry Jacobson
Jill Nunes
Francine Shacter
Lisa and Catlow Shipek

Dewdrop Level:
Margaret Barnes
Katy Brown
Evan Canfield
Betty Davis-Voelkel
Martha Retallick
Richard Roati
Wil and Mai Schaefer
Joe Silins
Dave Stewart

WMG's Green Streets—Green Neighborhoods Program (cont'd.)

(Continued from page 1)

water-borne pollutants into our waterways and groundwater.

Fortunately, more and more cities and neighborhoods are realizing that stormwater should be treated like a resource not a problem — and that streets should provide comfortable transportation for cars, buses, bikes, and pedestrians. Neighborhoods are also seeking to beautify and shade their streets while reducing flooding and pollution.

WMG works with Tucson neighborhoods to transform their streets into such spaces, and we have come to collectively call these efforts our "Green Streets - Green Neighborhoods" program.

What are green streets? Practically, green streets employ techniques like water harvesting, planting of street-side native vegetation, reducing impervious surfaces, traffic calming measures, improvements for bicyclists and pedestrians, preservation and restoration of natural areas and wildlife corridors, and even community events to make streets a more beneficial and sustainable part of community life. In a broader sense, green streets are roadways that take into account the needs of people, nature, and the needs of the community—not just cars.

Green streets can become a part of new or existing neighborhoods. WMG's work with central Tucson's Rincon Heights neighborhood has become a flagship demonstration of these practices in an existing neighborhood. Over the past three years, WMG has worked with the neighborhood and hundreds of volunteers from all over the city to install water harvesting basins, swales, and curb cuts along a dozen blocks. This green infrastructure captures stormwater runoff from streets, allowing it to percolate into the soil to feed native trees and shrubs.

These practices are a good example of how green streets projects work: instead of serving just one function (like a concrete channel that exists only to convey stormwater), green infrastructure provides benefits and services in myriad ways. The water harvesting basins reduce the amount of stormwater on neighborhood streets, while soil and vegetation in the water harvesting basins help to clean the stormwater of pollutants (for more information on this, see inset on page 11). The use of water harvesting allows neighborhoods to grow street-side trees and shrubs without the need for long-term irrigation, and the vegetation itself provides many services

A right-of-way in Rincon Heights neighborhood before (above) and 5 months after (below) installation of curb cut, basins and plants.

such as habitat for native birds and insects, shade for adjacent sidewalks and parking areas (see article on Urban Heat Island Effect on page 2), and natural beauty. The vegetation also helps to calm traffic on neighborhood streets[1] and has even been proven to increase local property values[2].

WMG has also worked with Tucson's Northwest Neighborhood to design innovative green street practices like bike-friendly chicanes (see photo on page 10), a street-width reduction project that replaces unused asphalt with pedestrian pathways and rain-fed vegetation, and the transformation of a weedy alley into a permeable pedestrian walkway connecting the neighborhood to a nearby park.

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WMG's Green Streets—Green Neighborhoods Program (cont'd)

The "Green Neighborhoods" aspect of WMG's Green Streets/Green Neighborhoods Program recognizes that working on roadways is just part of a holistic approach to greening the places we live. Much of the stormwater and pollution that ends up flooding neighborhood streets originates from higher in the urban watershed—that is, from individual commercial and residential properties. Therefore, it is essential to capture stormwater on private properties; this practice is sometimes called, "downspout disconnection," where water from rooftops is directed to landscape features instead of being directed to impervious surfaces like parking lots, driveways, and streets.

At the core of WMG's Green Streets/Green Neighborhoods program is WMG's mission to educate and empower residents to effectively manage their natural resources. Most neighborhoods that develop green streets practices provide the impetus for their installation and the labor for their maintenance, and WMG's workshops and programs give residents the skills and experience to do so. WMG is currently training its second group of "Neighborhood Watershed Leaders," residents from all over the Tucson area who seek to bring green street practices—and awareness—to their own neighborhoods.

Every time neighbors get together at a workshop or other green street-related event, they are building connections that help to strengthen and enliven their neighborhoods over the long term. More than any single practice, it is the enthusiasm, know-how and mutual support of neighbors that will make "green neighborhoods" a reality.

Volunteers help install water harvesting berms in the Grant Campbell neighborhood in Tucson as part of a larger effort to green their neighborhood.

This just-planted chicane in Rincon Heights neighborhood slows traffic by reducing street width, and helps treat stormwater by slowing and infiltrating some of it in vegetated areas.

WMG's work in Rincon Heights neighborhood is funded by a grant from the Arizona Department of Environmental Quality.

[1] "22 Benefits of Urban Street Trees," Dan Burden, Glatting Jackson and Walkable Communities Inc. 2006. www.ufei.org/files/pubs/22BenefitsofUrbanStreetTrees.pdf

[2] "Benefits of Trees (web site)" Arbor Day Foundation, http://www.arborday.org/trees/benefits.cfm

Portland Green Streets (continued)

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Portland Green Street facilities integrate improvements for bicyclists and pedestrians.

Political Will

Elkin repeatedly remarked on the importance of political will in the success of the Sustainable Stormwater and Green Streets programs. Portland's mayor recently announced the "Grey to Green" initiative, a 5-year plan to dramatically improve the urban watershed's condition through installation of 920 new green street facilities, 43 *acres* of green roofs, 83,000 trees, acquisition of upland habitat areas, and upgrading of culverts for fish passage. Elkin calls these goals "outrageous," but points out that the City freed $50 million for the project by using its favorable bond rating to refinance some of its bonds. He sounds enthusiastic when he says his bureau is rushing to meet the Mayor's mandate.

Community Involvement

Portland's citizens participate in the process of planning green street facilities and are encouraged to help maintain them by cleaning stormwater inlets. A student-initiated group called "Friends of Green Streets" has taken up the cause, working to spread the word and advocate for green streets throughout the city. In general, however, Portland's model is one in which the government has actually led the way. For an example of inspiring community-led green streets, Elkin points to the program of Vancouver, British Columbia, which has both city and neighborhood maintained green streets facilities.

Elkin's message on green streets is simple, and part of a larger vision of sustainability. He said, "we talk about managing water at the source, on the surface with vegetation. That is the crux of the issue. The sustainable option is not to put it into a pipe system and let it be somebody else's problem. In this world of global warming and all the environmental concerns that we have, people have to take responsibility for their waste as close to home as possible. This situation doesn't create a 100,000 gallon problem down the hill, it creates a 1,000 gallon collection area right at the source point."

For more information, visit:

City of Portland Sustainable Stormwater Program:

http://www.portlandonline.com/bes/index.cfm?c=34598

City of Vancouver Green Streets Program:

http://vancouver.ca/engsvcs/streets/greenstreets/index.htm

[1]*2008 Stormwater Management Facility Monitoring Report Summary.* City of Portland Bureau of Environmental Services. 2008. http://www.portlandonline.com/BES/index.cfm?c=36055&a=232643

How Do Green Street Facilities Improve Water Quality?

Surface-level, vegetated stormwater practices like the ones in Portland's Green Street facilities use natural processes in the plants and soil to break down pollutants. When stormwater flows into a facility, pollutants are broken down by the following processes:

- **Sedimentation:** Stormwater slows as it ponds in the facility and as it comes in contact with the rough surfaces of soil, mulch and vegetation. This causes heavier particles to drop out of the water.
- **Adsorption:** Pollutants like metals, phosphorus and hydrocarbons attach themselves to clay particles in the soil.
- **Filtration:** As water passes through vegetation, soil and plant roots, organic matter, phosphorus and suspended solids are strained out of the stormwater.
- **Uptake:** Plants and soil organisms use nutrients like nitrogen and phosphorus for their growth.
- **Microbial action:** Bacteria in the soil and plant roots break down pollutants like nitrogen and even petroleum.

Source: "Storm Water Technology Fact Sheet Bioretention." USEPA, 1999. www.epa.gov/owm/mtb/biortn.pdf