

# RAN: Working With Neighborhoods to Manage Stormwater

An innovative project works with suburban homeowners to design stormwater controls.

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Imagine this scenario: The real estate agent shows the excited young family all the latest features in the new split-level—solar-powered appliances, the latest in high-security systems, and wireless access. Young Johnny spies some folks working in the backyard. Mom asks, "Is that Chem-green?" "No," the agent replies, "that's the city crew maintaining your rain garden."

Far-fetched? Not really. The urgent need facing many smaller communities to manage stormwater is bringing control practices down to the local level. Water pollution control, whether practiced at major point-source dischargers like sewage treatment plants or by municipalities using detention basins to trap nonpoint-source runoff, has typically been out-of-sight, out-of-mind, far removed from the average suburbanite. Phase II regulations of the National Pollutant Discharge Elimination System (NPDES) are changing all that. Suburban homeowners are, in some cases, learn-

ing a lot more about stormwater than they might like to.

A team of researchers at the University of Vermont and city officials from South Burlington, VT, are assisting suburban neighborhoods as they struggle to comply with today's stormwater regulations. Dubbed "Redesigning the American Neighborhood" (RAN), this USEPA-funded program helps homeowners evaluate environmental, economic, and social factors while designing the best approach for managing stormwater in their neighborhoods.

While involving homeowners in discussions about stormwater management may not be a typical approach, it makes sense, because many of the water pollution and excess water problems plaguing suburban developments result when rain-fall picks up pollutants as it travels over homeowners' lawns, roofs, and driveways, and because many of the opportunities to treat and manage stormwater occur on homeowner properties in existing neighborhoods.

## Rationale

The RAN project is not reinventing the wheel. We are building on an excellent base of recent work on low-impact approaches to managing stormwater. Researchers with the Jordan Cove (CT) National Urban Watershed Monitoring Project (Phillips et al. 2003) have been comparing the quality of stormwater leaving a traditional housing development to runoff from an experimental housing complex with stormwater control techniques such as permeable pavement and rain gardens. Initial results suggest that such low-impact approaches can substantially improve stormwater quality. The innovative SEA Streets project in Seattle (Taus 2002) used vegetated swales to reduce the amount of impervious surface along urban streets, and reduced by 90% the volume of a two-year storm event.

An article in the September/October 2004 issue of *Stormwater* gave an excellent overview of similar efforts under way in Anchorage, AK; Denver, CO; and elsewhere to include innovative stormwater management approaches in new housing developments (Baxter 2004). The article highlights landscape architect Bill Wenk and his team's approach in their project in Denver's Goldsmith Gulch. Wenk's team worked with the local neighborhood to develop design concepts and participated in site walks to help neighbors visualize property improvements related to stormwater management.

But what about stormwater management efforts in existing neighborhoods? Shouldn't these homeowners also be part of the stormwater brain trust? By including homeowners, developers, and other stakeholders in stormwater management efforts, we can create both economic and non-economic incentives to move in the right direction. This process of shared learning has been shown to be a critical element in the success of past watershed-level management efforts (Voinov and Costanza 1999, Van den Belt 2004).

The purpose of the RAN project is to develop and test the tools that will allow homeowners, developers, and city/state officials to optimize the mix of stormwater interventions at various spatial scales that will best balance environmental, social, and economic goals. Using a diverse palette of ideas, technologies, engineering approaches, and ecologies specifically tailored to a particular neighborhood should help achieve the dual goals of effective stormwater management and public acceptance.

The RAN project consists of four elements: assessment, evaluation, participation, and implementation.

## Assessment

The Butler Farms and Oak Creek Village (BF/OCV) subdivisions in South Burlington, VT (Figure 1), provide an excellent opportunity to test our approach to stormwater management. These adjacent subdivisions of over 200 homes occupy about 65 hectares and are representative of so-called cookie-cutter neighborhoods that typify suburban sprawl. Tributary 7 of Potash Brook, a small impaired stream on Vermont's 303(d) list, arises in agricultural lands above BF/OCV, flows through the middle of the development, and then emerges onto conservation lands managed by the City of South Burlington (Figure 2).

The condition of the stream within BF/OCV is highly degraded, and the channel is deeply incised. In addition, some residents complain about excess water, including flooded basements, during wet weather. Improved stormwater management within BF/OCV must address both water-quality and -quantity issues.

The goal of the assessment phase of the project, now well under way, is to collect background information that will help identify opportunities for stormwater intervention in BF/OCV at different spatial scales and levels of community involve-



Figure 1. Butler Farm and Oak Creek Village in South Burlington, VT

ment. Interventions being considered include both centralized approaches, such as detention ponds or created/enhanced wetlands, and distributed interventions, such as swales and rain gardens, which would modify the neighborhood's hydrology at a micro-scale level.

The first step in the assessment process was to collect specific data on the landscape of the neighborhood. These included historical GIS base soils data, a map of watershed boundaries, and site hydrology. When assembled and mapped, this information suggested stormwater management approaches most appropriate for BF/OCV. Surveys of BF/OCV homeowners informed us about their level of understanding about stormwater in general and how their daily lives might contribute to local water-quality and -quantity problems.

To help stakeholders visualize and evaluate their options for managing stormwater, we developed a framework that allows users to consider the costs and benefits of the range of possible interventions. This framework, posted on the project's Web site ([www.uvm.edu/~ran](http://www.uvm.edu/~ran)), includes an introductory virtual tour of the BF/OCV neighborhood and the impaired stream; background information on stormwater and its envi-



Figure 2. Tributary 7 of Potash Brook flows through the development.

ronmental impacts; photos and case studies of many of the best management practices (BMPs) available; and a listing of local, state, and national stormwater resources. The framework can be used by homeowners and local officials anywhere to help manage stormwater at the local level.

## Evaluation

In the evaluation phase, we will develop and use a variety of analysis tools to compare various BMP implementation scenarios. Our evaluation focuses on potential stormwater interventions identified during the assessment phase. This evaluation allows community members and local regulators to learn about potential approaches and compare the relative costs and benefits of each intervention using ecological, social, and economic criteria.

For example, an evaluation of options by residents of BF/OCV may find that construction of a large detention basin in the neighborhood is the cheapest option. However, more individualized approaches like onsite rain gardens are likely to enhance property values and may be worth the additional cost. Another possible option, the use of two vacant city-owned lots to develop ecotechnologies like a stormwater ecopark (Todd,

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Brown, and Wells 2003) may be more expensive than a traditional detention basin but may provide additional economic and ecological services like biofuel production or habitat enhancement that increase benefits.

Several tools are helping facilitate the evaluation. A stormwater BMP evaluation tool (RAN-55) based on an existing rainfall-runoff simulation model will bridge the gap in understanding the hydrology of stormwater between scientists and engineers and residents in affected neighborhoods.

Environmental life cycle assessment (LCA) will provide further insights into the various management options. Combined with life cycle cost analysis, LCA will enable us to evaluate the long-term direct, indirect, and cumulative costs and benefits of several candidate BMPs for BF/OCV.

Finally, we are developing a modeling framework to help stakeholders visualize and evaluate the costs and benefits associated with different stormwater management options. This integrated assessment tool will explicitly include both monetary and non-monetary costs that we pay for polluting the environment. The model will help stakeholders understand how the costs and benefits of stormwater management are distributed.

Defining specific outcomes (e.g., reduced nutrient loading to Potash Brook or dampened storm-flow peak volume) that can be achieved for different costs will help stakeholders better see what they are getting for their money. The RAN team, the stakeholders, and the regulators are working together to determine the costs and acceptability of potential management options. This collaborative effort will ensure that the proposed interventions will be politically feasible. Our goal, then, in the evaluation phase is to use a variety of analysis tools that can broadly compare various BMP implementation scenarios.

## Participation

Involvement of the community stakeholders throughout the various phases of the RAN program is critical to our success. We are using various means to encourage participation. Several residents of BF/OCV act as informal liaisons to the broader community. Representatives from the City of South Burlington, relevant state and federal agencies, and local non-governmental organizations sit on our advisory committee. To promote outreach, we have created a Web site so that the community can learn more about the project and view up-to-date monitoring data and other project activities. Links to the cost-benefit analysis framework described above are also prominently displayed on our Web site.

Direct interaction with community members is the most important activity in this phase. At the outset, we met with a small group of interested BF/OCV residents who were concerned primarily with flooded basements during storm events. This was followed in the fall of 2004 with a Saturday field day in the neighborhood. Attended by more than 50 residents, this event introduced the RAN project team to the community. The RAN team discussed project goals and responded to questions and concerns of residents and demonstrated low-impact stormwater interventions, such as rain barrels.

In the spring of 2005, the City of South Burlington formed a utility to help manage stormwater communitywide. As a result, neighborhoods like BF/OCV became more aware of their

roles in citywide efforts to better manage stormwater. The RAN project has taken advantage of this upswing in interest to organize several community meetings. A recent such meeting, reportedly the largest public meeting ever held in South Burlington, was devoted to discussing the implications of Phase II stormwater regulations for BF/OCV and the role RAN might play in working with residents to explore effective stormwater management.

As an outcome of the meeting, a neighborhood Stormwater Study Group has formed. RAN team members will work with the community through this group to evaluate the stormwater management alternatives available to BF/OCV residents. In the coming year, the Stormwater Study Group will use the information generated during the assessment and evaluation phases of our project to give BF/OCV residents an opportunity to develop their own comprehensive stormwater management plan.

## Implementation

A key component of the project's implementation phase is water-quality and -quantity monitoring. We have already collected more than a year's worth of baseline and stormwater-quality data on Tributary 7 of Potash Brook. Isco samplers have been installed above and below BF/OCV to collect flow-weighted proportional composite samples during storm events. Key parameters being measured include pH, total suspended solids, total phosphorus, nitrate, nitrite, total Kjeldahl nitrogen, and total metals.

The goal of the stream monitoring effort is to measure the total load of pollutants entering the stream during individual storm events. Monitoring results will allow us to evaluate the effectiveness of the BMPs employed in BF/OCV. In order to provide a snapshot in time of existing conditions, geomorphic and biological surveys have also been completed. Rainfall and discharge are also being continuously monitored.

The culmination of the project will be the approval and implementation of the stormwater management plan developed by BF/OCV residents. Key throughout the project has been the involvement of City of South Burlington officials. Juli Beth Hinds, the director of planning and zoning for South Burlington, has been an invaluable ally. In addition to acting as a liaison to the community and interpreting relevant city regulations, she has secured federal funding to help defray the costs of putting structural components of the plan into place. Once BF/OCV has implemented its stormwater management system, the city will assume responsibility for maintaining stormwater interventions on city land.

The "town gown" relationship has proved to be invaluable. As Hinds notes, "The university's strong involvement as the 'honest broker' of sound scientific information, coupled with the faculty expertise in environmental consensus building, created an atmosphere of trust and cooperation that would not have been possible otherwise."

The project team hopes that the approach being tested might be used elsewhere to help suburban landowners make wise decisions about stormwater management. As Project Manager Eric Perkins of EPA's Region 1 notes, "The kinds of decision-making tools being developed through this project should have significant applicability in the other New England states and beyond. I think there will be a lot of interest, especially in

the RAN-55 and cost analysis components—these are relatively simple but innovative tools that should help empower homeowners, businesses, and watershed associations to become much more proactive on stormwater issues.”

## Lessons Learned

While the project is in its second year, we have learned several important lessons so far:

1. Despite a number of challenges, applied research can help address local environmental issues. With a community facing a real need to manage stormwater and a supportive city government, we have been able to make substantial progress in developing and testing an innovative approach to making decisions about the best way to manage stormwater in communities.

There are and will remain obstacles. Federal funding runs in annual cycles. There is no guarantee that funding will continue until all project goals are met. In the RAN project, there is a considerable time lag between the initial discussion of BMP approaches and final implementation of the community-developed stormwater management plan. The challenge for us is to complete both the stormwater management effort and the post-implementation monitoring to evaluate effectiveness. The slow and sometimes arduous process of ensuring community involvement and leadership doesn't lend itself well to a conventional funding schedule.

It is crucial to maintain momentum. The research process needs to be continuous and gradually build up to project goals. With the many stops and starts typical of stormwater management, this can be a daunting challenge.

2. Meshing the goals of individual homeowners in BF/OCV with broader project goals is not always easy. For example, convincing a resident suffering from frequently flooded basements that he or she should be as concerned about reducing the movement of phosphorus into nearby Lake Champlain for the greater good is difficult. Our challenge is to meet local concerns while improving the broader environment.

Of course, for overall project success, it is vital that the research team be able to set some part of the agenda and not constantly need approval from external parties. In this manner, project goals are more likely to be accomplished, an important outcome for any grant.

3. The role of stakeholder cooperation is critical. While there are many divergent opinions among BF/OCV homeowners about stormwater approaches, no action is not an option. When faced with the reality of having to spend money to control stormwater, many residents appear willing to work with the RAN team to develop solutions.

Also key is the support of the city government. We have benefited from the help of city officials familiar with the neighborhood and its issues, and we hope the city will see an outcome based on both the best available science and the wishes of the community. If RAN is successful, we believe that the city could employ the approach in other affected neighborhoods as well.

It is crucial to tailor such activities as data gathering and model generation to stakeholder needs. Nothing will turn off the stakeholders more quickly than an academic presentation that is not germane to the issues at hand. The challenge for

the research team is to learn to package findings in a way that is appealing and responsive to stakeholder needs. The art is learning how to weave in the facts and findings that the research team thinks important with stakeholder needs.

4. There are reasons that stormwater management has remained such a difficult issue to resolve. The wide variety of pollutants moving off the landscape in massive volumes during rainstorms presents a host of technical challenges. It is crucial that scientists adequately explain these challenges to all stakeholders. At every step, it is important to be open with residents about what's achievable and what isn't with any approach or set of approaches.
5. Luck plays an important role. There is no way to predict whether a particular stakeholder group will operate effectively. Sometimes a single individual can drive, and possibly derail, the whole process. Unforeseen external factors can also be important. In our case, the implementation of a stormwater utility in the city proved to be a stimulus for BF/OCV residents to become more involved with RAN.

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