Jordan Cove

Urban Monitoring Project

Background

Stormwater runoff from urban and urbanizing areas is widely recognized as a major cause of water pollution in the United States. Connecticut communities, like those in many urbanized states, are confronted with meeting nonpoint source management needs that often conflict with traditional subdivision regulations and construction standards. The challenge of meeting public safety and maintenance requirements in an environmentally sensitive manner is not currently being met, as evidenced by continued water quality impairments associated with new development. Can impervious surfaces be reduced, and curbing and storm drains be eliminated in a way that will not raise objections from municipal boards and commissions? Will homeowners accept cluster housing, natural landscaping, and "greener" home and yard maintenance practices? Most important, will those modifications make a difference in the quality and quantity of nonpoint source runoff under widespread application?

Project Purpose

The primary purpose of the Jordan Cove project is to measure differences in runoff quantity and quality emanating from traditional and "environmentally sensitive" development sites. The 18-acre "Glen Brook Green" subdivision, located in the southeastern Connecticut town of Waterford (Figure 1), is being constructed and monitored to make this comparison. The subdivision is split into two distinct "neighborhoods": one with building lots arranged in a traditional R-20 (half-acre) zoning pattern (Figure 2); the other, cluster housing with a variety of best management practices (BMPs) incorporated into the design (Figure 3).

Stormwater runoff from the traditional section is collected by curbs and catch basins, then piped through a stormwater treatment system before entering Nevins Brook, a tributary of Jordan Brook and, ultimately, Jordan Cove and Long Island Sound. Homeowners will not be subjected to any enhanced environmental education, or restrictions on how they manage their properties. The BMP neighborhood has grass swales(Figure 4); roof leader "rain gardens" (Figure 6); shared, permeable driveways; small building "footprints;" deed restrictions on increasing impervious surfaces; "low-mow," "no-mow," and

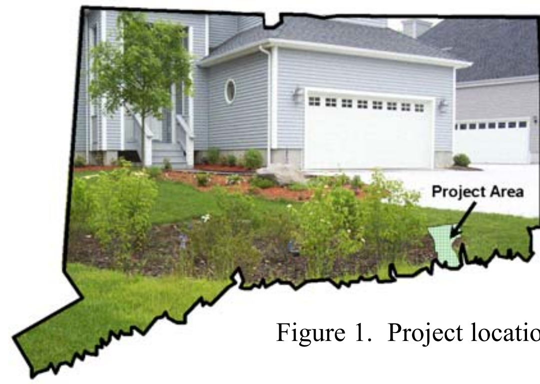

Figure 1. Project location

conservation zones; a narrower, permeable road surface (interlocking concrete pavement); and a vegetated infiltration basin, or bioretention area, located inside a "tear-drop" cul de sac. Several different driveway surfaces will be utilized, including interlocking concrete pavement, gravel, and asphalt, and monitored for their relative runoff rates. Homeowners and town road maintenance crews will be encouraged to adopt pollution prevention techniques, including controlled fertilizer and pesticide application, pet waste management, street sweeping/vacuuming, and reduced use of deicing agents.

The BMP neighborhood is expected to generate less stormwater runoff and pollution. Monitoring conducted before, during and after construction will document actual results. The Jordan Cove project team comprises a true public/private partnership, with researchers and educators from the University of Connecticut; federal, state, and local government officials; private consulting firms; and the developer.

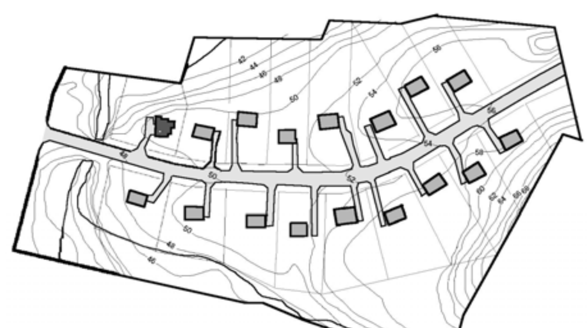

Figure 2. Traditional design

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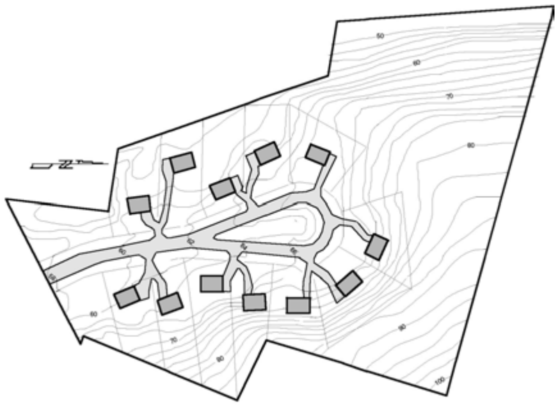

Figure 3. BMP design

The Jordan Cove Urban Watershed National Monitoring Project is funded, in part, through the Connecticut Department of Environmental Protection (CT DEP) by the U.S. Environmental Protection agency's (EPA) Section 319 National Monitoring Program (NMP).

It is one of 23 such projects nationwide. The Jordan Cove project is the only NMP project studying the effects of residential subdivision development on runoff quality and quantity, and of BMPs designed to mitigate those impacts.

Monitoring Design

This study is utilizing the "paired-watershed" monitoring design, which requires a minimum of two watersheds (control and treatment) and two periods of study (calibration and treatment). This approach assumes that there is a quantifiable relationship between paired water quality data for the two watersheds, and that this relationship is valid until a major change is made in one of the watersheds (e.g., construction, BMPs). It does not require that the quality and quantity of runoff be statistically the same for the two watersheds, but that the relationship between the paired observations of water quality and quantity remains the same over time — except for the influence of the land use changes in the treatment watershed.

For the Jordan Cove project, the treatment period will occur in two phases: (1) during construction of the traditional and BMP neighborhoods; and (2) after construction when the BMPs are in effect. The paired-watershed approach is being used to measure the differences in water quality and quantity between the treatment areas (traditional and BMP neighborhoods) and the control area (Figure 5), a nearby 10 year-old subdivision, caused by construction in the two treatment areas and the application of BMPs in the BMP neighborhood. Stormwater quality and quantity are measured at the outlets of each of the two treatment neighborhoods, and the control watershed. Water quality is measured by analyzing weekly flow-weighted composite samples for total suspended solids (TSS), total phosphorus (TP), total Kjeldahl nitrogen (TKN), ammonia nitrogen (NH_3-N), and nitrate+nitrite nitrogen (NO_3-N). Grab samples are analyzed for fecal coliform and BOD_5. Monthly analyses are conducted for copper (Cu), lead (Pb), and zinc (Zn).

Figure 4. Swale

Figure 5. Control Watershed

Figure 6. Rain Garden

The calibration period began in January 1996 to establish a baseline for future comparisons. Since the treatment period began in May 1998, runoff monitoring has focused on the effects of construction, and on the relative effectiveness of standard erosion and sediment control practices in the traditional neighborhood and enhanced controls in the BMP neighborhood. Post-construction monitoring began in July 2002 and will continue for three years.

Supplemental monitoring will be conducted on selected BMPs, including different driveway surfaces and enhanced turf management in the BMP neighborhood, and a "state-of-the-art" stormwater treatment device in the traditional neighborhood. This information will be used to evaluate the effectiveness of these specific practices.

Monitoring Results

Sampling during construction of the traditional neighborhood showed a significant increase in peak flow and flow volume. Total suspended solids concentrations did not change significantly during construction, indicating that erosion and sediment control was adequate. However, because the flow increased, mass export of total suspended solids, total phosphorus, nitrate, ammonia, total Kjeldahl nitrogen, copper, lead, and zinc also increased by over 90%.

During construction of the BMP neighborhood, a significant decrease in peak flow and flow volume was observed. However, total suspended solids concentrations increased 98%, and total phosphorus increased 99%. The mass export of solids and phosphorus also increased significantly.

These increases appear to be attributable to increased stormwater runoff volumes. The preliminary results from this study suggest that increased runoff, rather than erosion, is the cause of increased pollutant export from this construction site. Traditionally, erosion and sediment controls and stormwater management plans focus on the prevention of sediment and, occasionally, peak flow impacts on downstream areas. The preservation of pre-development hydrologic conditions within the watershed where construction is occurring is typically ignored.

Excess runoff, which is the driving force behind nonpoint source pollution, will transport pollutants into waterways and contribute to their degradation. Preliminary monitoring results demonstrate that erosion and sediment controls can reduce sediment and sediment-associated pollutants in construction site runoff. However, current erosion and sediment control practices do not address the increase in runoff from development sites. Consequently, these practices fail at reducing pollutant loads.

National Monitoring Program Section 319(l) of the federal Clean Water Act

(Nonpoint Source Management Programs Collection of Information) states that EPA shall collect and make available:

(1) Information concerning the costs and relative efficiencies of BMPs for reducing nonpoint source pollution.

(2) Data concerning the relationship between water quality and implementation of various management practices to control nonpoint sources of pollution.

The objectives of the Section 319 NMP are twofold:

(1) To scientifically evaluate the effectiveness of watershed technologies designed to control nonpoint source pollution.

(2) To improve our understanding of nonpoint source pollution.

To achieve these objectives, the NMP has selected watersheds across the country to be monitored over a 6- to 10-year period to evaluate how improved land management and the application of BMPs reduce water pollution. The results from these projects will be used to assist land use and natural resource managers by providing information on the relative effectiveness of BMPs to control nonpoint source pollution.

Next Steps

Construction of the BMP neighborhood was completed in June 2002, and the remaining three undeveloped lots in the traditional neighborhood will be completed in 2003. Monitoring of stormwater quality and quantity will be conducted for three years after build-out to determine the overall efficiency of the design. It should demonstrate that careful planning, landscaping, and use of vegetative BMPs can help protect and enhance the environment, while addressing other concerns that local planning and zoning commissions face. Lessons learned from this project have already been, and will continue to be, passed along to other communities through ongoing technical assistance and training programs administered by the CT DEP, the University of Connecticut Cooperative Extension System, and other agencies and organizations.

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http://www.canr.uconn.edu/jordancove/index.htm
http://www.epa.gov/owow/nps/education.html

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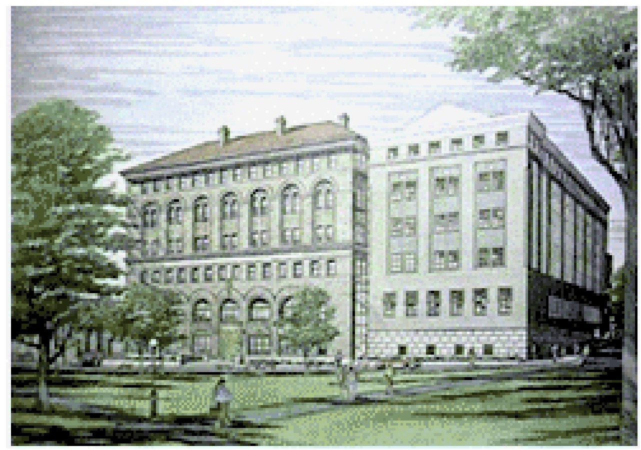

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Section 319 of the Federal Clean Water act authorizes EPA to award grants to states and tribes to support their NPS management programs. The CT DEP passes through a portion of these funds to other state, regional and local government agencies and non-government organizations to implement programs and projects.

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