PROMOTING INNOVATIVE STORMWATER SOLUTIONS FOR COASTAL PLAIN COMMUNITIES

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In 2008, the Center for Watershed Protection (CWP) surveyed seventy-three coastal plain communities to determine their current practices and need for watershed planning and low impact development (LID). The survey found that communities had varying watershed planning effectiveness and need better stormwater management, land use planning, and watershed management communication. While technical capacity is improving, stormwater programs are under staffed and innovative site designs may be prohibited under current regulations. In addition, the unique site constraints (e.g., sandy soils, low relief, tidal influence, vulnerability to coastal hazards, etc.) and lack of local examples are common LID obstacles along the coast (Vandiver and Hernandez, 2009).

LID stormwater practices are an innovative approach to stormwater management that provide an alternative to structural stormwater practices, reduce runoff, and maintain or restores hydrology. The term LID is typically used to refer to the systematic application of small, distributed practices that replicate pre-development hydrologic functions. Examples of LID practices include: downspout disconnection, rain gardens, bioretention areas, dry wells, and vegetated filter strips. In coastal communities, LID practices have not yet become widely accepted or applied.

The geographic focus for the project is the Atlantic and Gulf coastal plain province which includes nearly 250,000 square miles in portions of fifteen states from New Jersey to Texas (Figure 1). This project builds on CWP's "Coastal Plain Watershed Network: Adapting, Testing, and Transferring Effective Tools to Protect Coastal Plain Watersheds" that developed a coastal land cover model, conducted a coastal plain community needs survey (results are online here: http://www.cwp.org/#survey), created a coastal watershed Network, and adapted the 8 Tools for Watershed Protection Framework for coastal areas.

Figure 1. The US Atlantic Coastal Plain Province (based on Fenneman and Johnson's 1946 "Physical Divisions of the US").

In the previous project, CWP identified four major obstacles to implementing LID in the coastal plain study area. First, the coastal plain has a unique set of site constraints that can limit stormwater management practice selection, such as flat terrain, shallow groundwater, highly altered drainage, poorly-drained or excessively drained soils, and tidal interaction. Second, the existing regulations that govern site development at the local level do not generally promote LID practices. Consequently, designers, developers, and landscape architects tend to rely on practices that provide quantity control, such as stormwater ponds. Third, a lack of local examples are available to convince elected officials, local staff, citizens, and developers that LID practices function effectively, are cost effective, and are aesthetically pleasing. Finally, data summarizing the effectiveness of LID practices in this region is lacking.

In this project, CWP is addressing each of these four obstacles directly, using the following four-pronged approach: 1) Get the designs right by producing a book featuring local case studies that highlight "lessons learned," design specifications, economics, and photos; 2) Make sure LID is permitted in local codes by updating the Codes and Ordinance Worksheet (COW) for coastal communities; 3) Estimate the effectiveness of integrating LID practices using an updated coastal version of the Watershed Treatment Model (WTM) to predict nutrient load reductions; and

4) Educate local officials about LID benefits through interactive and adaptable products (e.g., webinars, slideshows, and presentations).

Get the Designs Right

While many designers and regulators realize that a one-size-fits-all methodology is not appropriate for stormwater management, an approach that is adapted to the unique local conditions along the coast is needed. Traditional stormwater treatment practices were originally designed primarily for use in the Piedmont and do not adequately address the water quality concerns of coastal areas, such as the growing demand for groundwater resources and the more stringent federal permits that focus on water quality. In two recent examples, Virginia's new stormwater regulations focus around using runoff reduction strategies that include LID and new USEPA permits were issued that require water quality monitoring at stormwater outfalls (Pritts, pers. comm., 2009). While wet ponds may still be needed for flood control, they typically cannot meet these goals as a stand-alone practice. Additionally, research shows that wet ponds can accumulate harmful pollutants (algae blooms, nutrients, bacteria, and toxic chemicals) in the surface waters and sediments (Mallin, 2000; Lewitus et al., 2008; and Weinstein, et al., 2008).

Therefore, a few communities are beginning to adapt their stormwater criteria and designs for coastal conditions. For example, the State of Georgia developed a Coastal Stormwater Supplement to their existing manual to address coastal stormwater (CWP, 20009). In addition, NOAA is developing stormwater management guidance for tropical island watersheds to address their unique characteristics. Further, some coastal communities are implementing innovative stormwater demonstration practices to help meet their NPDES stormwater program requirements. These practices are typically implemented as part of watershed redevelopment and retrofitting, and as community education and outreach efforts.

Using CWP's national reach, project partners, prior experience in coastal plain watersheds, land use planning and watershed expertise, and the coastal Network a coastal LID case study database was built. From this database about fifteen case studies were selected to develop further and were selected based on the following priority areas: geographical location, economic data, maintenance information, obstacles, education and outreach, research collected, collaborations and partnerships, and LID practice. In the next year CWP will develop project summary sheets, perform site visits, and compile a "coffee table" style book that highlights these real world examples of LID implementation projects in coastal areas.

Make Sure LID is Permitted in Local Codes

In 1998, CWP convened a group of national experts to develop twenty-two model development principles that encourage environmentally friendly development (CWP, 1998). The principles work together to reduce the creation of impervious cover, protect natural resources, and encourage the use of innovative stormwater management. The COW is a tool communities can use to evaluate their development codes compared to the model development principles and identify ways to improve environmentally friendly development. Over the past decade, CWP has successfully worked with communities nationwide to encourage environmentally sensitive development codes.

As part of this project, CWP is updating the COW to include recent research on the model development principles, provide updated codes and ordinance examples, and create a coastal addendum. The updated COW is organized by four areas: 1) street design; 2) parking design; 3) stormwater management; and 4) development layout and natural resources. These changes will improve the usefulness of the COW and its applicability to coastal areas.

Estimate the Effectiveness of Integrating LID Practices

The Watershed Treatment Model (WTM) is a user friendly spreadsheet model that estimates pollutant loads and determines the cumulative effect of structural and non-structural management practices in a watershed under current and proposed conditions (Caraco, 2002). The current publicly available version of the WTM (Version 3.1) uses event mean concentrations (EMCs) for nutrients, sediment, and bacteria removal based on national averages and there is a need to update the information and include coastal specific attributes. The WTM does not include the latest LID practices because the pollutant removal data from the two most comprehensive databases (the National Pollutant Removal Performance Database and the International Stormwater BMP Database) are for structural practices (Winer, 2000).

Currently, the WTM is being updated to more accurately reflect these newer practices. In particular, it is being modified to reflect runoff reduction as well as pollutant filtering by stormwater management practices. Second, the adaptations have better land use change information by accounting for management of pervious surfaces such as turf. As a part of this update, the WTM will incorporate agricultural management practices, and better account for septic systems, bacteria loading, and the fate of pollutants discharged to groundwater.

Educate Local Officials about LID Benefits

While LID practices are being implemented across the country, there is no central database of successful examples complete with photos, designs, and cost and effectiveness data to reference for coastal regions. The University of New Hampshire and Nonpoint Education for Municipal Officials (NEMO) has a LID database called the Innovative Stormwater Management Inventory. CWP will work with NEMO to integrate this project's products into the LID database and NEMO teaching materials.

CWP will develop a two-part education campaign for this project. The first is a presentation directed to local officials about the benefits of LID in coastal areas. A collection of photos and case study examples will provide educators with a stock presentation that can be tailored for the community and local officials. The second educational piece is to package the coastal stormwater design book, coastal COW, and coastal WTM into a toolkit that is promoted to the intended users: local government planners, engineers, and watershed managers.

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References

Caraco, D. 2002. The Watershed Treatment Model: Version 3.1. U.S. Environmental Protection Agency, Region V. Center for Watershed Protection. Ellicott City, MD.

Center for Watershed Protection (CWP). 1998. Better Site Design: A Handbook for Changing Development Rules in Your Community. Center for Watershed Protection. Ellicott City, MD.

Center for Watershed Protection (CWP). 2009. Coastal Stormwater Supplement to the Georgia Stormwater Management Manual. Center for Watershed Protection. Ellicott City, MD.

Lewitus, A.J., Larissa M. Brock, Marianne K. Burke, Krista A. DeMattio, and Susan B. Wilde. 2008. Lagoonal stormwater detention ponds as promoters of harmful algal blooms and eutrophication along the South Carolina coast. Harmful Algae 8 (1): 60-65.

Mallin, M. 2000. Effect of Human Development on Bacteriological Water Quality in Coastal Watersheds. Ecological Applications 10 (4): 1047-1056.

Pritts, Jesse W. 2009. USEPA Office of Water. Washington, DC. December 15, 2009.

Vandiver, Lisa and Debra Hernandez. 2009. Assessment of stormwater management in coastal South Carolina: A focus on stormwater ponds and low impact development (LID) practices.

Weinstein, John E., Kevin D. Crawford, and Thomas R. Garner. 2008. Chemical and biological contamination of stormwater detention pond sediments in coastal South Carolina. Charleston, SC.

Winer, R. 2000. National Pollutant Removal Database for Stormwater Treatment Practices. Second edition. Center for Watershed Protection. Ellicott City, MD.

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