Chapter 1: Introduction and Background

Rein in the Runoff is a collaborative, community-based Integrated Assessment project that examines the causes, consequences, and corrective alternatives available to the communities within and downstream of the Spring Lake Watershed (MI). The project goal is to minimize the negative impacts of polluted stormwater runoff to local water bodies. Led by researchers at Grand Valley State University's Annis Water Resources Institute (AWRI), an interdisciplinary team with expertise in aquatic ecology, environmental law and policy, environmental engineering and consulting, GIS and data analysis, economics, communications, and outreach and education, has been working with stakeholders to help address management and stewardship issues regarding stormwater discharges.

This 190-page report describes the environmental, social, and economic conditions in the Spring Lake Watershed that led to the development of the Rein in the Runoff Integrated Assessment (IA). It summarizes the technical and stakeholder components of the IA process, including the underlying data and modeling approaches relied upon by the project team to assess the causes and consequences of stormwater pollution within the watershed, and the extent of the stakeholder education and participation. A suite of common stormwater best management practices – or BMPs – are provided with spatial guidance for the most appropriate locations for implementation of structural BMPs throughout the Spring Lake Watershed, as well as an economic assessment of each structural and nonstructural stormwater BMP. The analysis also includes projections for future stormwater pollution in light of different rates of population growth and continued urbanization of the watershed. The Rein in the Runoff project report concludes with the Integrated Assessment results, project products, and potential next steps for watershed stakeholders. Appendices provide supplemental technical information regarding different aspects of the IA process and Rein in the Runoff products and results.

MANAGING STORMWATER RUNOFF

The management of stormwater and stormwater runoff is an important issue for municipalities, whose citizenry demand clean drinking water, the prevention of flooding, water drainage, and sanitation (Chocat et al. 2001). As new development throughout the United States continues to outpace population growth (Theobald 2005), there is a greater loss of rural and natural lands to increasing amounts of impervious cover (Dougherty et al. 2006). Impervious surfaces are roadways, rooftops, driveways, parking lots and other impermeable land covers within an urban landscape (Schueler 1994). As rainwater falls onto these hardened surfaces, it cannot soak into the ground, and instead runs off into local surface waterways.

Stormwater runoff creates a variety of problems for land use managers, homeowners, fish and wildlife, and ecological systems. As more water flows into streams and rivers, it can result in unstable and eroding channels, loss of instream habitat, and more severe and more frequent flooding problems (Schueler 1994). It also collects pollutants (such as street dust, eroded sediments, heavy metals, road salt, oil and grease, organic matter, nutrients, and pesticides) from impervious surfaces, farm fields, residential lawns, and commercial and industrial properties, and deposits them in receiving waterbodies (Obropta and Kardos 2007; Tsihrintzis and Hamid 1997; Domalgaski 1996; McFarland and Hauck 1999). This, in turn, can degrade water quality, lead to fish kills and loss of species diversity, stimulate algae blooms, and create public health risks (Schueler 1994; Trim and Marcus 1990; Steinman and Ogdahl 2008; Obropta and Kardos 2007). Generally, the more impervious surface cover within a watershed, the greater the problems associated with stormwater runoff tend to be (Alberti et al. 2007). Watersheds with impervious surface cover greater than 10% are considered to be impaired, but water quality impacts are measurable in watersheds with even lower levels of hardened surface areas (Schueler 1994).

Further, these effects are only expected to increase as global warming progresses (Madsen and Figdor 2007). Scientists are predicting that global climate change will cause warming temperatures and an increase in the frequency of extremes in the hydrologic cycle – i.e., severe storms, increased flooding, and more periods of drought (Patz et al. 2008).[1] Heavy runoff associated with these severe storm events can increase the risk of sewage overflows, contaminate local recreational waters, decrease the productivity of agricultural lands, and increase the risk of human illnesses (Patz et al. 2008; Madsen and Figdor 2007; McLellan et al. 2007). These problems can be further compounded by urbanized waterfront communities, which provide for decreased flow path lengths for stormwater runoff into local waterways (Beighley et al. 2008).

Although numerous studies have been conducted addressing the water quality impacts of stormwater and stormwater runoff, considerable obstacles continue to impede progress in developing and applying effective watershed-based approaches to managing stormwater. In many cases, local officials simply do not fully understand the impacts of, or the need to control, stormwater runoff. While they may be concerned about the quality of a natural resource, there may be no consensus about the goals for management of that resource. Alternatively, the value of the resource is not considered high enough to spend money fixing the associated problems, and other budgetary items take priority. Decision-makers simply may be unaware of the impacts of stormwater discharges to their local water resources. Although flood control is an obvious problem that needs attention, the reduction in groundwater baseflow resulting from impervious area that limits or prevents water from soaking into the ground, for example, might not be noticed. In addition, uncertainties in the performance and cost of stormwater control measures, limited funding and other resources, and ongoing maintenance and

---

[1] Grand Rapids (MI) is one of 55 cities nationwide to see a significant increase in the frequency of major storms with heavy precipitation in the last 50 years (Madsen and Figdor 2007).

opportunity costs can impede implementation of stormwater BMPs (Roy et al. 2008). Finally, future problems resulting from stormwater runoff have not been fully identified in urbanizing watersheds.

INTEGRATED ASSESSMENT

Because of the complex ecological, political, and social processes associated with stormwater management, the project team adopted an Integrated Assessment approach for the Spring Lake Watershed. Integrated assessment (IA) is the synthesis of existing natural and social scientific knowledge to solve a natural resource management problem or policy question (Parson 1995; Hillman et al. 2005). IA is an active and rapidly developing field, and a multitude of approaches exist to aid in solving environmental resource management questions and policy issues (Hisschemöller et al 2001). For the Rein in the Runoff IA, we selected the six-step approach outlined in Scavia and Bricker (2006):

1. Define the policy relevant question around which the IA is to be performed.

2. Document the status and trends of appropriate environmental, social, and economic conditions related to the issue.

3. Describe the environmental, social, and economic causes and consequences of those trends.

4. Provide forecasts of likely future conditions under a range of policy or management options.

5. Provide technical guidance for the most cost effective means of implementing each of those options.

6. Provide an assessment of the uncertainties associated with the information generated in Steps 1-5.

The initial policy question for this IA was developed by Michigan Sea Grant and public officials from Spring Lake Township and the Village of Spring Lake. The policy and management objectives that these communities had regarding water quality and the management of stormwater runoff included the identification of *the causes, consequences and correctives of stormwater discharges to the watersheds surrounding Spring Lake Township and the Village of Spring Lake, specifically Spring Lake, the Grand River and ultimately, Lake Michigan*. The primary objectives indentified for the Rein in the Runoff IA were to:

- Increase Spring Lake area residents' and decision-makers' general knowledge and understanding of the causes and consequences of stormwater runoff, and how they apply specifically to Spring Lake, the Grand River, and Lake Michigan;

- Increase stakeholder stewardship of the water resources surrounding Spring Lake Township and the Village of Spring Lake, and in particular, increase participation in stormwater control and management;

- Identify inconsistencies between state regulations and/or local ordinances that can improve local stormwater management and control;

- Provide a suite of alternative stormwater management Best Management Practices (BMPs) tailored to Spring Lake Township and the Village of Spring Lake.

However, once established, the project team – with input from these same community representatives – expanded the policy question to include the other communities within the Spring Lake Watershed, and the adjacent communities further downstream to the mouth of the Grand River at Lake Michigan to incorporate a broader group of stakeholders. The revised policy question for the Rein in the Runoff IA was:

> *What stormwater management alternatives are available to the communities in the Spring Lake Watershed that allow for future development and also mitigate the effects of stormwater discharges and improve the water quality in Spring Lake, the Grand River, and ultimately, Lake Michigan?*

To most effectively answer this policy question for local and regional stakeholders and accomplish the identified project goals, the project team adapted the Scavia and Bricker (2006) IA approach described above. This adapted approach included five underlying steps that guided the Rein in the Runoff Integrated Assessment (Figure 1-1). Each of these steps had several components, and each one was informed by a broad range of participants, including scientists (team members and project reviewers), decision-makers and stakeholders (project partners), and members of the general public (Rabalais et al 2002).

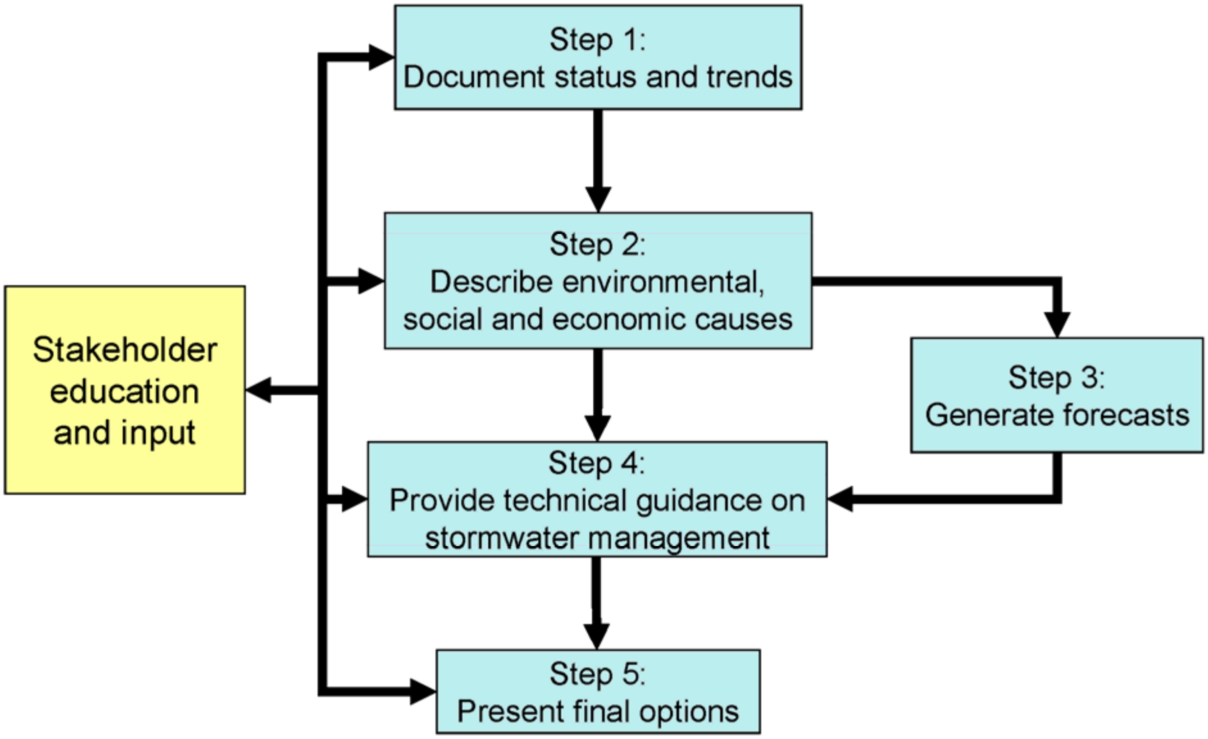

Figure 1-1. Rein in the Runoff Integrated Assessment approach for stormwater management alternatives in the Spring Lake Watershed.