

GUIDEBOOK

WATERSHED PLANS

Protecting and Restoring Water Quality



NEW YORK STATE

WATERSHED PLANS

Protecting and Restoring Water Quality



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CHAPTER ONE: INTRODUCTION



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Protecting and restoring water quality

Communities and individuals across New York State have a strong connection to the water. New York's landscape holds a diverse array of water resources, ranging from salt marshes, estuaries, and coastal beaches to freshwater lakes, streams, and wetlands. New Yorkers take pride in their water resources, for they help shape communities and provide us with drinking water, economic activity, wildlife habitat, recreational opportunities, and a place to just relax and enjoy the scenery.

With all these benefits, it is no wonder that communities throughout New York are searching for ways to protect and restore these resources while balancing the need for economic growth and development. Many communities are recognizing that a comprehensive watershed planning approach can help them to protect and restore their water resources.

Communities throughout the State are already implementing local watershed plans with great results. They have found that it takes a clear vision, broad public involvement, creative partnerships, patience, persistence, and a step-by-step strategy to create a successful watershed plan. Helping you achieve similar success is the goal of this guidebook.

What is watershed planning?

Imagine a drop of rain falling to the ground atop a high peak. Where does it go? Downstream. Once that drop falls to the surface of the land it will bond to other drops of rain, penetrate the soil or move as overland flow to the nearest body of water. The paths that this water will travel are varied. It will flow through a wide network of drainage pathways, either as surface or ground water, to the lowest point where it collects in a stream, pond or wetland. From there it may continue to flow on to another waterbody. A watershed is the land that drains, or *sheds*, this water to a single waterbody, such as a wetland, river, lake, coastal embayment or ocean.

Watersheds are geographic features; they do not reflect local political boundaries. More often than not a watershed will cover several counties and many towns and villages. Working together, these communities can plan for the future of the watershed.

Watershed planning focuses on the relationship between land use and land cover, the movement and storage of water, and water quality. It allows you to manage the land and how it is used in a way that will recognize the relationships between economic, social, and natural processes and keep drainage pathways functional and the water that flows through them clean.

Watershed planning allows communities to integrate water resource protection and restoration with growth management at the local level, balancing environmental and economic factors.

Watershed planning provides an opportunity for a community to reach out to its residents and businesses, building support for water quality improvements while planning for economic and community growth.

Watershed planning is an ongoing and flexible process that is successful when there is collaboration between all who live in the watershed. It cannot be done well without broad public participation.

A successful watershed plan will answer a series of questions as it guides the protection and restoration of a community's water resources. From the plan you should be able to identify why, where, what, when, who, and how much. That is - **why** the watershed plan is needed; **where** the existing problems, threats, and opportunities are located; **what** actions and projects are recommended to address the problems and threats and to take advantage of the opportunities; **when** the recommendations will be advanced; **who** will take the lead in making it happen; and **how much** it will cost to implement the plan.

A successful watershed plan will be informed by available data and driven by consensus. It will characterize the physical aspects of the watershed and assess municipal controls in place to ensure future water quality. Recommendations will cover corrective and preventive actions to restore and protect water quality.

As more and more people realize the importance of water in their communities, watershed planning will become the catalyst for improving water quality and overall watershed health. By developing and implementing watershed planning, these communities are protecting and restoring their watersheds:

- The Town of Southampton has been working to protect the coastal waters of Shinnecock Bay through a host of watershed planning

efforts geared towards re-opening shellfish beds and enhancing recreational use of the estuary.

- Management of the Cayuga Lake watershed is a successful model in which the 40+ members of the Watershed Intermunicipal Organization work together in partnership with a volunteer-based nonprofit and other local groups to implement the watershed plan.
- Protection and restoration of urban watersheds takes effective partnerships and creative water quality improvement projects. Westchester County, New York City, and the Bronx River Alliance are three groups working to protect the Bronx River by bringing people to the river and the broader watershed to evaluate watershed conditions.
- Watershed planning efforts in the Upper Susquehanna River have helped address both local and interstate management needs by implementing a successful wetland creation and restoration program that has improved water quality by storing flood waters and creating wildlife habitat.
- *Lake George - Planning for the Future* was developed for the Lake George watershed through a structured process using sub-committees to focus on specific tasks. Today, implementation of priority nonpoint source projects is resulting in improved water quality of the lake.

- The Wappinger Creek Watershed Intermunicipal Council and the Dutchess County Environmental Management Council, along with various local partners, have been successful in identifying and implementing local streambank restoration projects along Wappinger Creek to reduce sedimentation and improve habitat.

Learning from these successes will help you form your own ideas and strategies regarding watershed planning, water quality improvement, partnership building, and project implementation.

Who should read this guidebook

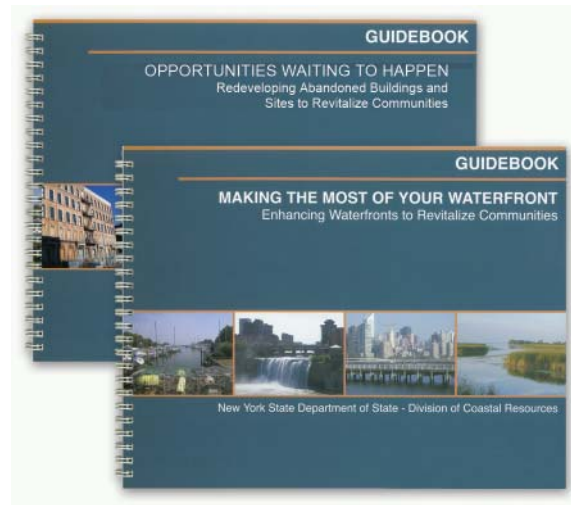
This guidebook provides a step-by-step watershed planning process for communities to create a plan that will improve water quality. Whether you are a municipal official, nonprofit or community organization, watershed protection group, or an individual interested in water quality, this guidebook will assist you in working with others to prepare your watershed plan.

About this guidebook

This guidebook is the print component of a multi-media package that provides information and resources on how to develop effective local watershed plans. Other components include a video and a website - www.nyswaterfronts.com. This package will provide readily accessible information on how to improve water quality

within your community. As you continue through this guidebook and website you will see examples of how people are striving to protect and improve their watersheds, be provided with additional sources of information, and hopefully be inspired to create a healthy watershed for your community.

This multi-media package is one in a series of guidance packages that address community issues. Other guidebooks include *Making the Most of Your Waterfront: Enhancing Waterfronts to Revitalize Communities* and *Opportunities Waiting to Happen: Redeveloping Abandoned Buildings and Sites to Revitalize Communities*.



How this book is organized

This guidebook lays out a step-by-step process for developing a comprehensive watershed management plan. These steps include:

- Laying the foundation - identifying the importance of community involvement showing how partnerships can strengthen the process of watershed planning and implementation
- Understanding your watershed - identifying and understanding your watershed and developing a vision and goals for its future
- Identifying opportunities for improvement - describing how to use field assessments to evaluate watershed conditions and identify specific recommendations to protect and improve water quality
- Crafting the watershed plan - showing how to pull it all together in a watershed plan
- Putting your plan into action - providing guidance on how to implement your plan, show early success through on-the-ground projects, sustain momentum, track progress, and make necessary updates to the plan



Great Sacandaga Lake, Mayfield



Southampton, Long Island

These steps are appropriate whether the watershed is large or small; whether there is one concern or a whole range of issues; or whether the watershed lies within one municipality or multiple jurisdictions. Within each watershed, local circumstances will dictate which elements of the planning process are emphasized. For example, in a highly urbanized watershed you may focus on restoration planning, while in a rural watershed you may focus your efforts on protection activities.

While these steps represent a broad outline of how many communities have developed their watershed plans, they are by no means rigid. The sequence of steps can vary to meet the needs of individual communities. Some communities might never have thought about a watershed approach, while some may already be well into the planning process. There is no reason that these steps cannot be carried out in a different order to suit the needs of the community. The critical message is that all of these steps are important in creating a successful watershed plan that has broad support from the community.

New York State Department of State - Division of Coastal Resources

The New York State Department of State (NYS DOS) Division of Coastal Resources works with communities throughout New York to help them make the most of what their waterfronts and watersheds have to offer. The Division works

in partnership with community groups, nonprofit organizations, and all levels of government to strengthen local economies, protect the environment, and improve the quality of life.

Since 1982, the Division has worked with local governments and communities to prepare Local Waterfront Revitalization Programs that define a local vision for the waterfront. The Division has provided technical and financial assistance to communities for plans and projects that have expanded public access, reinvigorated urban waterfronts, restored habitats, and strengthened local economies. In recent years, the Division has focused on helping communities protect and restore their natural resources through watershed planning.

If you are a coastal community, in other words, if your community is on Long Island Sound, the Atlantic Ocean, New York Harbor and the waters surrounding New York City, the Hudson River, one of New York's Great Lakes, the Niagara River or the St. Lawrence River, or if your community is located on an inland waterbody - a major lake, river or the State canal - that has been designated by the State Legislature under Article 42, you are eligible to participate with the Division of Coastal Resources. Whether you live in a rural town or a New York City neighborhood, the Division can assist you in your watershed planning efforts.

If you are interested in partnering with the Division of Coastal Resources, please call 518-474-6000 or visit www.nyswaterfronts.com.

New York State Department of Environmental Conservation

The mission of the New York State Department of Environmental Conservation (NYS DEC) is to: *“conserve, improve, and protect New York State’s natural resources and environment, and control water, land and air pollution, in order to enhance the health, safety and welfare of the people of the state and their overall economic and social well being.”* Many of the agency’s divisions play a role in watershed planning. Notably, the Division of Water has adopted a watershed approach toward assessment and management, integrating multiple programs to protect and improve water quality. The Division works with other governmental agencies, non-governmental organizations, and the public and private sectors to successfully manage and monitor water resources.

An example of these partnerships followed the passage of the 1996 Clean Water/Clean Air Bond Act. NYS DEC worked in partnership with the Division of Coastal Resources, the New York State Department of Agriculture and Markets, the New York State Environmental Facilities Corporation, and municipalities to restore, preserve, and protect New York’s valuable water and air resources. These agencies continue to partner in the selection of projects that help municipalities address water quality goals through the Water Quality Improvement Projects grants program. This

funding provides assistance to municipalities for wastewater treatment improvement, nonpoint source abatement, aquatic habitat restoration, and implementation of stormwater management programs required under the Phase II stormwater program.

Under the Phase II stormwater program, communities with municipal separate storm sewer systems (MS4s) must develop a stormwater management program to control stormwater runoff from both construction and post-construction activities. This joint state and federal stormwater management program requires municipalities to address six minimum control measures: public education and outreach; public involvement/participation; illicit discharge detection and elimination; construction site stormwater runoff control; post-construction stormwater management; and pollution prevention/good housekeeping. Communities can then integrate their stormwater management programs into broader watershed management plans. More information about the SPDES Phase II Program, including a copy of the General Permit, a description of the criteria used to designate “urbanized areas”, and a link to an “MS4 Toolbox” can be found on the NYS DEC website.

If you are interested in partnering with the Division of Water, please call 518-402-8179 or visit www.dec.ny.gov.



Watershed planning workshop



Chemung County

LOOKING AHEAD

You can protect and restore your water resources when...

- You understand your watershed and recognize the importance of water quality
- You recognize the relationship among economic, social and natural processes
- You create a clearly defined vision for the future of your watershed
- You establish creative partnerships and gain community support
- You set realistic goals and lay out a detailed strategy for implementation
- You base your plan on real on-the-ground priorities and make specific recommendations to improve water quality
- You take advantage of all your resources, assets, and opportunities
- You generate a sense of community ownership of the watershed
- You sustain improvements and continue momentum into the future
- You understand that watershed planning is a dynamic process, requiring careful monitoring and timely adjustments
- You have the patience and persistence to get through the many phases of watershed planning - one step at a time



Lake Ontario



Lake George



Orient



Fishkill Creek

CHAPTER TWO: LAYING THE FOUNDATION FOR PLANNING

Success in watershed planning comes about by involving people who have a strong interest in the future of your watershed. Developing strong partnerships and involving the community right at the start of your watershed planning process will lay the foundation for the successful implementation of your watershed plan. In this chapter, we will work through the following steps:

- Planning for community involvement
- Identifying the key stakeholders
- Organizing a watershed advisory committee
- Establishing partnerships
- Understanding the role of consultants
- Charting the course

Planning for community involvement

Watershed planning can only be successful when those that live and work in the watershed realize that they are a crucial part of their watershed. It happens when they recognize that their actions impact the health of the watershed. It happens when they are determined to protect and restore their watershed for the benefit of the entire community and future generations.

Right from the beginning, as you seek to protect and restore your watershed, you must involve the public. You will need the support of the community at every stage of the process. From gaining an understanding of the watershed to developing a vision and goals for your watershed's future, to planning for and implementing improvements, success will depend upon building and sustaining local support for your watershed plan.

Community participation can take many forms, but it is generally designed to:

- foster an appreciation of your watershed
- introduce local leaders and community residents to the watershed planning process
- generate a community consensus about the vision for the future of the watershed
- develop a strategy to address the most critical watershed issues

Meaningful public participation doesn't just happen. It has to be carefully thought out and planned to embrace the public in the planning process and to keep them informed about progress. Now is the time to begin to develop ideas about how the community can participate in the planning process. To start, it is important to understand who should be involved.

Identifying the key stakeholders

Stakeholders are critical. A stakeholder is a person or group who has something to gain or lose based upon the outcomes of your watershed plan. You will need to involve those individuals and groups - elected officials, business and civic leaders, neighborhood and environmental groups, and educational institutions - who have a direct stake in the future of the watershed. Make special note of the key leaders, and be sure to include those who may oppose your watershed planning efforts as well as those who are likely to support them.

From the beginning of your efforts to protect and restore your watershed, you will be seeking out stakeholders and trying to define their role in making your watershed vision a reality. In particular, you will want to seek out two groups with an interest in the watershed - the experts and the enthusiasts. Experts are people with useful knowledge. Enthusiasts are people who will bring energy to the effort from either a civic concern, or from a business interest. Both types of people can help you get the job done, and, as advocates, can help you achieve consensus in the community.

You will need to create a strategy to effectively involve these stakeholders. Identify how you will approach each contact and be clear what they can contribute. Is it to keep them informed and seek their support? Do you need their

funding help? Do you want them to participate on a committee? Be prepared in advance to address important issues and provide information about your watershed, including how their involvement may benefit them. Once you have their involvement, keep in touch and make sure your plans are on their front burner. By bringing people together you can create a vision that captures the ideas and interests of those concerned with the future of your watershed.

As you work to fulfill your vision, you may involve stakeholders and other community members in a variety of ways. These might include creating a watershed advisory committee; creating specific, issue-oriented subcommittees; establishing partnerships; encouraging participation in visioning and planning workshops; or “hands-on” participation in volunteer work parties. You will also need to keep the entire community informed about what is going on, including people who are not directly involved but may have a real interest in the watershed planning efforts. It is important to provide them with regular progress reports and keep them informed about how they can participate.

Organizing a watershed advisory committee

Early in the planning process most communities establish an advisory committee that will oversee all aspects of developing the watershed plan. In some communities this may be handled

by an existing group, such as a planning board or conservation advisory committee, but in most cases it is appropriate for a watershed advisory committee to be established. Having an advisory committee will help focus efforts, streamline the planning process, and see the plan through to implementation.

Responsibilities of this committee generally include:

- managing the watershed planning process or advising staff on managing the process
- providing input on watershed issues and conditions
- holding regular meetings related to watershed planning and project implementation
- informing the community about the watershed planning process and ways they can be involved
- organizing and participating in focus groups, visioning and project planning workshops, and public hearings
- reviewing reports, designs, and other documents
- keeping elected officials and municipal officials informed about the planning process

- working with municipal staff, consultants, state agency staff, and others to complete various tasks

It is important to find members who are likely to stay with the watershed planning process from initial planning through to implementation of improvements. Take a look at the stakeholders you have identified: who are the key players, and who among them would be best suited to sit on an advisory committee? It is important to recruit the “movers and shakers” to be on the committee - those who others listen to and recognize as having the ability to get things done. Local leaders can provide valuable experience, advice, guidance and resources, and will be able to persuade others to join and contribute to the watershed planning efforts.



Watershed planning workshop

Look for an effective chairperson - someone who will be able to create consensus and move the plan forward - as leadership will be extremely important. The size of an advisory group is also important to ensure productive group discussion. Ten to fifteen members are best, although there are circumstances when a smaller or larger group is warranted. While your advisory committee should be representative of a number of diverse interest groups, avoid forming a group that is so large it becomes unwieldy. You may want to get more people involved through their participation on sub-committees. Members of the advisory committee should include representation from the following groups:

- local governments, including elected officials, staff, and members of planning, zoning, and other boards of all municipalities within the watershed
- neighborhood and community organizations
- local and regional nonprofit organizations
- property owners
- representatives from the business community, particularly those whose livelihood depends on water resources
- water suppliers
- the academic community

Establishing partnerships

The establishment of a watershed advisory committee is just one element of a broader strategy to bring together all of the stakeholders in your watershed. Now is the time to assess the role of the various stakeholders and to establish partnerships with these stakeholders.

A partnership is an agreement between two or more entities to work together for a particular purpose. You will need to form a partnership if:

- you are pursuing goals that will affect other people and organizations
- you need more resources, whether financial, political, or human, to accomplish your goals
- you want a strong coalition that shows how interests are in agreement

As you begin to develop partnerships, you will need to identify the key issues that watershed planning may raise with the community, for example, improving water quality for shellfishing or controlling the siltation of a lake that impacts recreational use. Make sure that the partners you identify represent the divergent viewpoints on these issues and can relate to how the watershed plan and improving water quality will improve the community as a whole. Recognizing the varying degrees of watershed awareness, concern, and/or expertise and how stakeholders want to be involved in the process

will allow you to structure the planning process to provide multiple options and opportunities for involvement and to make the most of partnerships.

Success in watershed planning requires partnerships with the right blend of stakeholders. These will come from the private sector, all levels of government, and from the community to form a partnership with the common goal of achieving your shared vision. Important potential partners include:

- local and county government - elected officials, local boards, and staff
- adjacent municipalities
- regional planning or resource conservation organizations
- state and federal government partners
- academic institutions - colleges and universities, local schools
- representatives of businesses and industries in the surrounding area
- property owners in the surrounding area
- residents in the surrounding area
- community and neighborhood groups
- nonprofit organizations with a stake in the community and the watershed



Restored wetland



Orient, Long Island

The Appendix provides details of the many partners that could be involved in your efforts to protect and restore your watershed. Remember, partnerships can be formed at any time as needs arise and as common interests are identified.

Partnering with these stakeholders can provide technical assistance, bring in more resources, help with site acquisition, improve infrastructure, assist with funding and marketing, generate extra publicity, and create the framework for watershed protection and restoration. For instance, partnerships with:

- state and federal agencies can often provide technical, staffing, or financial support to watershed efforts
- Soil and Water Conservation Districts and local universities may bring in expertise in writing watershed plans or provide detailed information on watershed conditions that can help in the preparation of your plan
- County Water Quality Coordinating Committees can assist in developing strategies that guide water quality improvement efforts and prioritize water quality problems and concerns
- local or county public works or highway departments may have the necessary skills to implement specific recommended projects that result from your completed plan

- non-profit organizations or community members can provide volunteer labor, assistance setting goals, support for recommendations, and feedback on project priorities
- County Health Departments can provide technical assistance regarding the protection of water supply and health concerns related to water quality.

While you are likely aware of potential local partners available to help you through the watershed planning process, you should make the best use of regional, state, and federal assistance as well. Many New York State agencies provide technical and financial assistance that can support your watershed plan. The New York State Departments of State, Environmental Conservation, Health, Transportation, and Agriculture and Markets are just a few state agencies that can provide assistance with funding, data collection, and general watershed planning guidance. Figure 2.1 describes some federal and state regulatory and advisory programs advancing watershed planning in New York.

While establishing partnerships may seem challenging or time-consuming, watershed planning and management will be more successful as a result. Particular attention should be paid to maintaining a strong relationship with neighborhood leaders and community stakeholders. These individuals and

groups have a vested interest in the watershed. Together, you are partners in the watershed planning process. Having public support and community involvement can only strengthen your plan, and the investment of their energy and resources in the community has a powerful impact on your efforts.

The US Environmental Protection Agency (EPA) and the US Department of Agriculture - Natural Resource Conservation Service (NRCS) have created several documents that will help you strengthen public involvement in natural resource planning. EPA's *Getting in Step: A Guide to Conducting Watershed Outreach Campaigns and Community Culture and the Environment: A Guide to Understanding a Sense of Place* (www.epa.gov/owow/watershed/outreach/documents) may help you create public support by understanding community attitudes, values, and behaviors that affect environmental protection solutions. The NRCS documents *Conducting Rapid Resource Appraisals of Watershed* and *Strengthening Public Involvement* (www.ssi.nrcs.usda.gov/publications) provide information on how to "jump start" your planning process.

The format and formality of a partnership can vary widely. Whether it is simple or complex, everyone benefits if an agreement is reached beforehand about each entity's role and responsibilities. A Memorandum of Understanding (MOU) or a Memorandum of Agreement (MOA), which define each party's role, may be a good step

in order to gain consensus on responsibilities. The process of writing an MOU or MOA provides an opportunity for give and take to arrive at an agreement that all parties support. These documents, once signed by all involved parties, can also provide an opportunity to gain commitment on goals and objectives.

If you have a number of municipalities involved in your watershed plan, an Intermunicipal Agreement may be appropriate. This will formalize the municipalities' agreement to

support the watershed planning effort through funding, staff, or other resources. These intermunicipal arrangements are a good way to establish a long-term management structure to support the plan through implementation.

Successful examples of intermunicipal agreements include the Lake George Watershed Coalition, the Cayuga Lake Watershed Intermunicipal Organization, the Long Island Sound Watershed Intermunicipal Council, and the Wappinger Creek Watershed Intermunicipal Council.

Fishkill Creek Watershed Committee

The Fishkill Creek watershed drains approximately 190 square miles, or 123,000 acres, and includes 14 municipalities in the Hudson River Basin. The Fishkill Creek Watershed Committee is a grassroots organization dedicated to the protection of the Fishkill Creek. The Committee includes members of the general public and is dedicated to a policy of non advocacy, non partisan, science based work. Its stated mission is "to encourage individuals and entities, both public and private, to work for the protection of the natural environment within the Fishkill Creek Watershed." In meeting its mission, the Committee has been integral in developing and implementing a watershed plan, *Natural Resources Management Plan for the Fishkill Creek Watershed*. The Fishkill Creek Watershed Committee has benefitted from the technical and organizational support of Cornell Cooperative Extension and the Dutchess County Environmental Management Council, who assisted them in identifying and conducting specific assessment approaches and restoration projects, as well as hosting a website for the organization (www.fishkillcreekwatershed.org).



Figure 2.1 Federal and State Regulatory and Advisory Programs Advancing Watershed Planning in New York

- **NYS Coastal Management Program** (www.nyswaterfronts.com). The federal Coastal Zone Management Act and the New York State Waterfront Revitalization of Coastal Areas and Inland Waterways Act established direction for the appropriate use and protection of the nation's and the State's coasts and waterways. The State's coastal policies guide efforts to create and maintain clean, accessible, and prosperous coastal and inland waterways for present and future generations. These policies address development, fish and wildlife, flooding and erosion, general safeguards, public access, recreation, historic and scenic resources, agricultural lands, energy and ice management, air and water resources, and wetlands.
- **Local Waterfront Revitalization Program** (www.nyswaterfronts.com). The NYS DOS Division of Coastal Resources assists communities in preparing a comprehensive land and water use program for a community's natural, public, and working waterfront, and developed coastal area. It provides a comprehensive structure within which critical coastal issues can be addressed.
- **State Implementation of the Clean Water Act** (www.dec.ny.gov). Section 319 of the Clean Water Act requires states to prepare assessments and management programs for the identification and control of nonpoint pollution. This section of the Clean Water Act also makes grant money available to states for nonpoint source management. Sections 305(b) and 303(d) also require states to perform a unified assessment and restoration strategy for HUC-8 watersheds and prepare a list of impaired waterbodies. For impaired waterbodies, the state is required to develop and implement Total Maximum Daily Loads, which regulate the point and nonpoint sources of pollution in the watershed.
- **SPDES Stormwater Phase II** (www.dec.ny.gov). Under federal regulation, discharges of stormwater from municipal separate storm sewer systems, construction sites 1 acre and larger, and certain industrial sites require a permit. NYS DEC provides assistance in managing and treating point pollution, as well as holding workshops, training sessions, and conferences to help regulated communities meet permit requirements.
- **Nonpoint Source Management Program** (www.dec.ny.gov). The primary mission of the Nonpoint Source Management Program is to control, reduce or treat polluted runoff through the implementation of structural, operational or vegetative management practices; to administratively coordinate various state agencies and other interested partners having regulatory, outreach, incentive-based, or funding programs that foster installation of management practices for any of the identified sources of nonpoint pollution threatening or impairing the waters of New York; and to conduct local implementation and statewide coordination and evaluation on a watershed basis.
- **NY Surface Water and Groundwater Standards** (www.dec.ny.gov). This sets the ambient water quality standards for the various classifications of waterbodies and uses.
- **NYS DEC Antidegradation Policy** (www.dec.ny.gov). In accordance with the Clean Water Act, this policy sets forth the actions of the State to prevent degradation of water quality.
- **Wild, Scenic and Recreational Rivers System Act** (www.dec.ny.gov). This provides for the designation of certain qualifying segments of rivers and streams as wild, scenic or recreational. This designation affords these waters special protection through use guidelines and special consideration during project review when projects are proposed in their vicinity.

- **Hudson River Estuary Program** (www.dec.ny.gov). In order to protect, conserve, and enhance the Hudson River Estuary, and in response to the Hudson River Estuary Management Act, the NYS DEC established the Hudson River Estuary Program in 1987. Management of the estuary calls for a cooperative effort and supports watershed planning, community-based habitat conservation and stewardship, open space planning, and outreach and education.

- **Long Island South Shore Estuary Reserve** (www.estuary.cog.ny.us). Under the Long Island South Shore Estuary Reserve Act, a comprehensive management plan was created to improve water quality and living resources, provide public access, and preserve open space, the Reserve's maritime heritage, its economy, and foster education and outreach. Recommendations incorporate an ecosystem perspective into the management of the Reserve and recommend watershed planning.

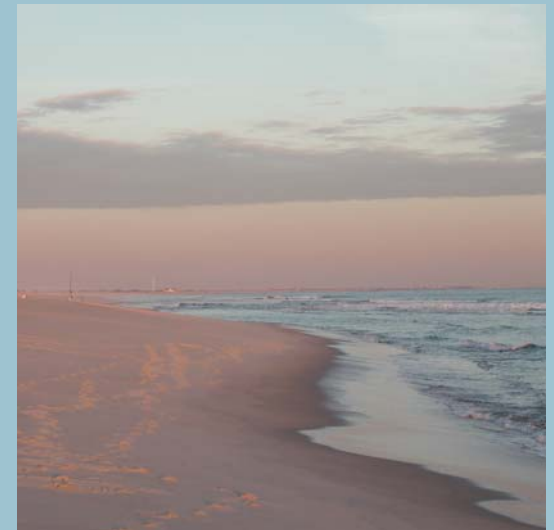
- **Great Lakes Programs** (www.dec.ny.gov). Using a watershed based approach, NYS DEC works to restore and protect water quality and quantity in the Great Lakes. Management includes addressing drinking water supplies, flood protection,

navigation, power generation, agriculture, and recreation, as well as elements of the ecosystem, including wetlands and other habitats. Through the Great Lakes Protection Fund, regional and statewide assistance is given for research and field assessment.

- **Source Water Assessment Program** (www.health.state.ny.us/nysdoh/water/swap.htm). In response to the 1996 Amendments to the Safe Drinking Water Act, the NYS Department of Health (DOH) developed a Source Water Assessment Program (SWAP) to complete assessments of sources of public drinking water and make the assessments available to the public. In order to complete these assessments, the DOH focuses on watershed-based assessments and protection strategies for drinking water supplies throughout the State.



Hudson River, Ossining



Jones Beach, Long Island



Marina, Finger Lakes



Satellite photo of New York City area

Understanding the role of consultants

Communities often hire consultants to supplement their own staff and volunteer resources or to gain use of special skills. This is particularly true for watershed planning where specific expertise may be needed. Consultants can help in conducting watershed assessments, collecting data, and designing and constructing projects. At various stages in the project you will likely need expertise in land use planning, biology, water quality, hydrology, Geographic Information Systems (GIS), and engineering available to help you. When considering whether to hire a consultant, it is helpful to answer some key questions, including:

- What do you want your consultant to do?
- What skills, expertise, and experience must the consultant have to develop and implement the watershed plan?
- When do you want it done?
- How will you relate to the consultant? Can you provide staff support, citizen participation, review, or other input into the plan?
- Is the consultant familiar with the local institutional framework, the watershed area, and common watershed issues (e.g., source water protection, special habitat protection, floodplain management), and have they worked on similar projects?

If you decide to hire a consultant, you will need to prepare a Request for Proposals (RFP). Your RFP must meet all applicable procurement rules and be designed so that responses from consultants will provide all the information that you will need to select and hire a consultant. Make sure you fully describe your needs and your watershed planning proposal and a schedule for implementation. Make sure to request details of the consultant's experience on similar efforts. To ensure a comprehensive response, the RFP itself should be advertised as extensively as possible and mailed to a wide range of consultants. The Division of Coastal Resources can provide sample RFPs as well as guidance on what to look for when you seek a consultant to help prepare and implement watershed plans.

After you receive the responses and review them carefully, set up interviews with potential consultants and talk with references. Prior to setting up interviews, prepare a set of questions to ask each consultant team. Find out more about them and their proposal, and try to determine how well they can achieve your vision. Find out why they are interested in your project and explore what they see as the main issues and challenges as they develop the plan. Fully explore the financial requirements of each consultant's proposal. Interviews are a great opportunity to develop an understanding of everyone's expectations and to set the stage for a strong partnership. Once you have selected your consultant and have executed a contract, it is time to begin planning for the future of your watershed.

Case Study: Cayuga Lake Watershed Intermunicipal Organization

The Cayuga Lake Watershed Intermunicipal Organization (IO) is an example of a successful watershed group in the Finger Lakes Region. The group has brought together representatives from 44 municipalities and 6 counties, State agencies, and non-governmental organizations, to address the preservation and restoration of the Cayuga Lake watershed.

Key to the success of the IO was the collaboration of municipalities and community-based organizations in the planning process. Community involvement in the form of the Cayuga Lake Watershed Network, a nonprofit citizen network interested in protecting and improving the lake's water quality, was a source of important information on the watershed and also an important source of volunteers for implementing the resulting watershed plan.

The *Cayuga Lake Watershed Restoration and Protection Plan* provides a framework for collaborating and implementing on-the-ground projects. The restoration of Six Mile Creek, a large tributary to Cayuga Lake, is one example of a successful effort involving the Cayuga Lake IO. Each member has played an integral role in one or more project components, including funding, coordination, site assessment, construction, vegetation planting, and outreach.

The Cayuga Lake IO has shown how intermunicipal organizations serve as a forum for local governments, state agencies, non-governmental organizations, and the public to address complex watershed issues in a coordinated manner and gain consensus on actions needed to protect and restore a watershed. With these partnerships, the IO has been able to restore and protect the water quality and natural resources of Cayuga Lake. (www.cayugawatershed.org)



Cayuga Lake within the Finger Lakes Drainage Basin



Six Mile Creek, streambank stabilization

Charting the course

Once you have laid the foundation for planning, it is essential to chart the course for the protection and restoration of your watershed by developing a step-by-step strategy to guide you through plan preparation and project implementation. Ask yourself what tasks need to be performed to develop and implement your plan, who will be responsible for completing these tasks, and how you will handle them. Take the time to discuss and plan your approach to watershed planning with your partners. This will strengthen consensus and support for your project.

Develop a concise, action-oriented agenda that describes the steps you will follow to complete and implement your watershed plan. View it as a scope of work for moving forward - one step at a time. To chart your course, you will specify the following:

- the tasks to be performed
- the techniques to be used
- the roles of the people involved and their areas of responsibility
- the time frame for action

This should be documented in writing, but there is no need to go overboard with detail. Keep it short and simple.



Carpenter Falls, Skaneateles Lake

CHAPTER THREE: UNDERSTANDING YOUR WATERSHED

Gaining an understanding of your watershed is key to preparing a successful watershed plan. Knowing your water resources, land use patterns, local regulations, and municipal programs will help you create goals for the future that also will be the framework around which you build your plan. In this chapter, we will work through the following steps:

- Delineating your watershed and subwatershed boundaries
- Gathering existing data
- Understanding water quality issues
- Assessing land use and land cover conditions
- Estimating pollutant loads and other analyses
- Assessing capacity of municipal programs
- Developing a vision and initial watershed goals
- Writing a watershed characterization report

Delineating your watershed and subwatershed boundaries

The first step in understanding your watershed is to determine the appropriate geographic scale for your watershed plan and to delineate the boundaries of your watershed. A watershed is the total area of land draining to a body of water such as a stream, river, wetland, estuary, or aquifer. Watersheds can range in size from a few acres that drain into a small creek to a large basin that drains an entire region into a major waterbody, such as Lake Ontario. By using the appropriate geographic scale, you can develop a watershed plan that best meets the needs of your community.

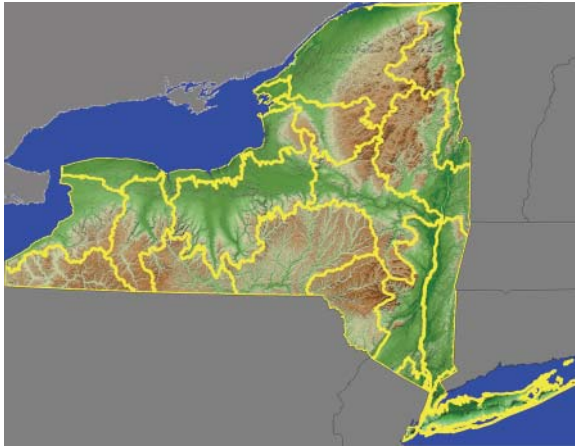
Basins are the largest watershed management unit. They cover areas ranging from several hundreds to thousands of square miles and contain a mosaic of diverse land uses, including forest, agriculture, suburban, and urban areas. There are 17 major drainage basins in New York State. Watershed management at the basin level often focuses on water supply, aquifer management, transportation issues, and regional planning.

Each basin contains a group of *watersheds*, which, in turn, contain *subwatersheds*. While watersheds have drainage areas that typically range from 20 to 100 square miles, subwatersheds, in general, drain areas of 5 to 10 square miles.

This guidebook focuses on the **watershed** as the primary planning unit and uses the **subwatershed** to conduct more detailed field assessments to pinpoint specific water quality problems and threats.

Once you know the geographic scale that you will base your plan on, you will need to identify the physical boundaries of your watershed. Having a well defined watershed boundary and clearly delineated subwatersheds will help you target goals, future field assessments, and specific recommendations.

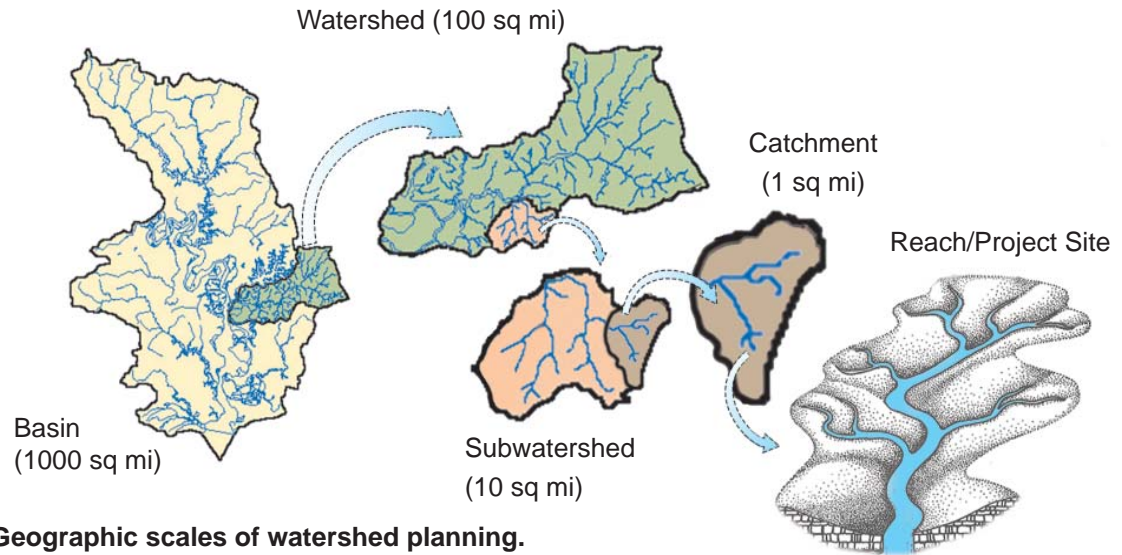
Many watersheds have already been delineated and are available on maps. You can typically find two scales of watershed boundaries: a sub-basin level, 8-Digit Hydrologic Unit Code (HUC) and a watershed level, 11-Digit HUC. These maps and other digital data can be obtained through the Cornell University Geospatial Information Repository (CUGIR) (<http://cugir.mannlib.cornell.edu>) and the NYS Geographic Information System Clearinghouse (www.nysgis.state.ny.us). You may be able to find more detailed maps of subwatersheds through other planning groups, such as your soil and water conservation district.



The 17 major drainage basins in New York State



Hudson Highlands, Hudson River



Geographic scales of watershed planning.

Basin: The Hudson River Basin is 13,000 sq mi, includes multiple states and is divided into 8 subbasins. This scale is appropriate for multi-state, regional management and planning.

Watershed: The Moodna Creek Watershed is 180 sq miles. Comprehensive watershed planning at this scale may be onerous, but doable, particularly if focused on a few target subwatersheds.

Subwatershed: The subwatershed is 10.7 sq miles in size. As a general rule of thumb, subwatersheds drain 10 square miles or less. This is the scale at which more detailed analyses are done as part of a watershed plan.

Catchment: Catchments are often less than 1 sq mile in size have relatively homogenous land use within a subwatershed. Stormwater is often evaluated at the catchment level since that size represents a typical drainage scale for individual stormwater practice.

Reach/ Project Site: The project site is the smallest scale for management, and is the location for project implementation. It may be necessary to implement many projects to achieve goals at the watershed level.

If maps do not exist for your watershed, you can delineate your own boundaries, either by hand or by using a Geographic Information System (GIS), using a United States Geological Survey topographic map as a base map. High points in the topography will typically define your watershed boundary, where a drop of rain landing inside the boundary will flow down into your target waterbody. An exception may include urban areas where stormwater drainage networks can alter natural drainage patterns, or in areas such as Long Island where there is significant subsurface flow.

To delineate watershed and subwatershed boundaries:

- Choose the outlet or final downstream point of the river, stream, or wetland in which you are focusing the plan. Make sure you consider the total drainage area of the receiving waterbody and take into account the impacts of highway and rail crossings, underground piping, subsurface flows, and direct drainage. These may play an important role in your watershed and affect boundaries.
- From your outlet, identify high points along the watercourse which will create your boundary ridge.
- Connect the high points, beginning and ending with the outlet to form a closed polygon. When connecting these high points, the contour lines should be crossed at right angles.

As you delineate your watershed you will want to identify other areas and boundaries that relate to your watershed such as sensitive areas, special groundwater recharge areas, public water supply boundaries, public sewer boundaries, and State Pollution Discharge Elimination System (SPDES) Phase II regulated communities. These areas may be sensitive to or contribute higher levels of pollutants to the watershed. These areas may also have management measures or recommendations in place that will help you through the planning process. The NYS Department of Health, under the Source Water Assessment Program, has delineated all surface water watersheds used for drinking water. These may be obtained on request.

Once you have delineated your watershed you need to check and refine its boundaries. You may be able to use an automated watershed delineation GIS tool that is based on digital elevation models/terrain models. While automated delineation tools may be a good starting point for determining watershed boundaries, the resolution may be too coarse to accurately delineate many subwatersheds. Whether you have delineated your watershed yourself or you have used an existing watershed map, it is important to verify boundaries through field inspections. This will help resolve any mistakes or discrepancies in the watershed boundaries and more accurately depict any questionable areas. Field inspections will also help you to begin to understand the issues in your watershed.

Gathering existing data

Now that you have delineated your watershed boundaries, it is time to get to know your watershed better. You should start by gathering existing data on such things as hydrology, topography, soil types, land cover, land use conditions, wetlands, habitats, and groundwater recharge areas. You may be surprised to see how much information already exists that characterizes your watershed.

You can start by talking with the partners that you have identified to help you with your watershed plan. Contact your municipal and county planning and natural resource agencies, public or private water providers, water quality coordinating committees, and soil and water conservation districts to see what information is available. You should also contact any regional organizations, like the Hudson River Estuary Program or the Regional Planning Councils. As organizations covering larger areas, they will often have access to important regional data. Key information about your watershed can also be requested from state and federal agencies. Reach out to community members as well. They will have first hand knowledge of the watershed and may be able to provide you with historic information on how the watershed has changed over time.

You should be gathering and reviewing information such as:



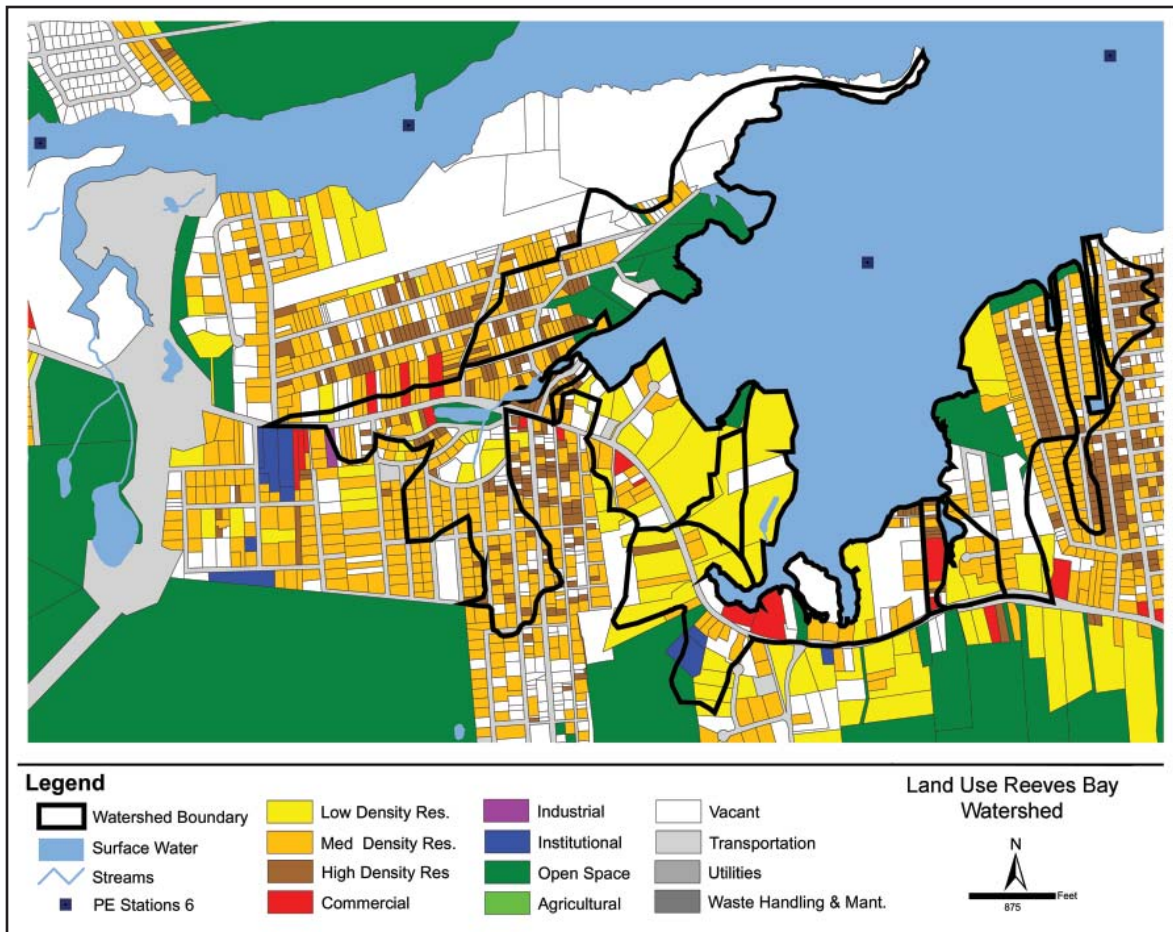
Aerial view of residential development



Aerial view of mixed use area

- topographic maps
- aerial photography
- previous watershed management plan(s)
- regional or basin-wide watershed reports
- local comprehensive plans, zoning and land use codes, water and sewer plans, or stormwater management plans, capital improvement plans
- land use assessments
- land cover assessments
- census data on watershed population and demographics
- NYS DEC Priority Waterbodies List
- Source Water Assessment Program reports (NYS Department of Health)
- local source water assessment plans
- New York Rural Water Association wellhead protection plans
- Agricultural Environmental Management County and Watershed Strategies
- County and Community Farmland Protection Plans
- Agricultural District Maps
- flood hazard reports
- soil surveys
- groundwater studies
- monitoring reports (i.e. water quality, stream habitat, biological communities)
- USGS gauging stations, and publications (reports, circulars)
- natural resource inventories (i.e., wetlands, Significant Coastal Fish and Wildlife Habitats, rare species, forests)
- SPDES Phase I and II permit applications
- wetland permit applications or mitigation bank documentation
- Total Maximum Daily Loading (TMDL) analyses
- agricultural reports

Organizing the data that you have collected is very important. While much of the information collected and the analyses and assessments described in the guidebook can be performed using basic approaches to analysis, most tasks discussed here assume a basic level of access to GIS.



GIS map showing sub-watershed boundaries and land use for Reeves Bay, Southampton.

Any watershed information or GIS data you gather should be consolidated in a central storage space (either digitally or physically) where it can be organized and viewed. It may be helpful to designate one person to oversee all the data to provide quality control; however, data should be readily available to all those involved in the planning process. It is important to critically review the quality of the data you use and document the source - keep in mind that data is often collected using different sampling methods and protocols, so be careful you know what data you are using and how you are using it.

GIS is one of the most effective ways to organize, store, and analyze watershed data. Using GIS can be as simple as generating a basic watershed map or it can be as sophisticated as developing a powerful database to store millions of pieces of data. No matter how it is used, GIS can be a great way to produce spatial representations of your watershed, making it easier to understand water quality impacts, locate water quality improvement projects, communicate with the public, and track progress over time. Table 3.1 lists some important GIS data that can be gathered at little to no cost.

When working with GIS data it is important to determine, in advance, what key data layers you currently have available, what layers need to be updated or refined, and what layers or data are missing. For example, you may want to refine maps with local inventories, convert

Table 3.1 Useful Mapping Data for Watershed Planning		
Data Type	Data	Common Sources ¹
Hydro-geomorphic Features	<ul style="list-style-type: none"> • Hydrology (streams, lakes, etc.) • Topography (10 ft contour or less) • Soils • Steep slopes • 100-year and 500-year floodplain 	NYS GIS Clearinghouse USGS CUGIR USDA FEMA Q3 Flood data Local Data
Boundaries	<ul style="list-style-type: none"> • Watersheds/subwatersheds • Municipal boundaries • Property/parcel boundaries • Urban growth boundaries or service areas 	USGS NYS DEC CUGIR NYS ORPS NYS GIS Clearinghouse Local Data
Land Use and Land Cover	<ul style="list-style-type: none"> • Aerial photos • Land use • Zoning • Land cover layers (impervious, forest, turf, etc.) • Major roads 	NYS GIS Clearinghouse USGS NY Water Science Center NYS DOT Local Data
Sensitive Areas	<ul style="list-style-type: none"> • Wetlands² • Contiguous forest • Rare, threatened, endangered species • Green infrastructure • Public drinking water supplies • Groundwater recharge areas/aquifers • Protected lands 	NYS DEC NYS GIS Clearinghouse CUGIR USDA Forest Service NY Natural Heritage Program NYS Health Dept. District Offices Local Data

Utilities	<ul style="list-style-type: none"> • Sanitary sewer network, Sewersheds • Stormwater infrastructure • Chronic SSO or CSO • Wells 	NYS GIS Clearinghouse CUGIR NYS DEC Local Data
Point Sources and Hotspots	<ul style="list-style-type: none"> • NPDES Phase I and II permittees • ESC construction permits • Septic and underground storage tanks • Landfills; superfund sites 	NYS DEC EPA Region 2 Local Data
Stream Condition	<ul style="list-style-type: none"> • Monitoring stations/sampling sites • Physical in-stream habitat • Wetland permits • Water quality <ul style="list-style-type: none"> - CWA Section 303(d) impaired waters - CWA Section 305(b) monitoring data 	NYS GIS Clearinghouse CUGIR EPA USGS NYS DEC Local Data
<p>Notes: 1: NYS GIS Clearinghouse www.nysgis.state.ny.us/gisdata; Cornell University Geospatial Information Repository (CUGIR) http://cugir.mannlib.cornell.edu; US Geological Survey (USGS) http://water.usgs.gov/data.html; US Environmental Protection Agency (EPA) www.epa.gov/region02/gis/data.htm; US Department of Agriculture (USDA) www.nrcs.usda.gov/Technical/land/maps.html; NYS Dept. of Transportation (DOT) www.nysdot.gov; NYS Dept. of Environmental Conservation (DEC); NYS Office of Real Property Service (ORPS) www.orps.state.ny.us 2: NYS DEC has developed a set of statewide maps of wetlands under the jurisdiction of the NY Freshwater Wetlands Act(see www.dec.ny.gov). In addition, NYS DEC has also developed a set of maps showing tidal wetland boundaries.</p>		



Water quality monitoring



Long Beach Bay, Orient

hard copy data to digital data layers, or create an impervious cover layer using aerial photo interpretation. It is also important to establish criteria for data projection, resolution, quality control, and metadata for any new layers developed. This will help make sure data is usable and reliable.

Understanding water quality issues

The focus of a watershed plan is on protecting and restoring water quality. Water provides each and every living organism the opportunity to grow, take up nutrients and, put simply, survive. Water also shapes our physical world. Most people recognize the importance of water, but so often its availability and quality are taken for granted. We continue to pollute our groundwater, wetlands, rivers, lakes, and oceans to a point where once reliable sources of drinking water can no longer be used without expensive treatment, our ability to use water for recreational purposes has been impaired, and habitats can no longer support wildlife. To combat pollution, we must understand the nature of the problem and select and implement practices that reduce our impacts on our water resources.

Pollutants that affect water quality can vary and can be generated from a wide range of sources. These include:

- Nutrients from sources such as livestock wastes, on-site septic systems, and lawn fertilizers increase growth of aquatic plants and algae. When these aquatic plants and algae are consumed by bacteria, oxygen is taken up, resulting in lower levels of dissolved oxygen in the water. The depletion of oxygen can cause fish kills and serious degradation of water quality.
- Pathogens, disease-causing organisms, are also associated with sewer overflows and on-site septic system failure. The potential presence of pathogens can result in the closure of beaches and shellfish beds, contaminate drinking water sources, and cause human health concerns.
- Sediment from eroding streambanks, construction sites, or road surfaces can cause water quality impairments as well. Sediment can affect boating and recreational activities by reducing channel depths and can impair habitat by altering the composition of substrate, increasing water temperature, and increasing turbidity.
- Hydrocarbons, such as those found in oils and grease, can be toxic to aquatic organisms. Oil and grease that leak from automobiles onto roadways and parking lots are transported via rainwater and attach to sediment. This sediment can accumulate on the bottom of waterbodies and can negatively impact aquatic organisms, often causing high levels of mortality.

- Floatables and trash from road runoff and illicit dumping can cause both water quality concerns as well as aesthetic impairments. Floatables and trash often contain oil, grease, heavy metals, and other toxic substances that can affect water quality. The presence of trash and floatables in rivers, streams, lakes, and other waterbodies can also cause physical safety and health concerns.

To improve water quality, we need to focus not only on the pollutants themselves but also on the sources of pollution:

- *Point sources of pollution* occur where harmful substances are introduced directly into a body of water, such as from sewage treatment plants or industrial facilities. Point sources are often thought of as “end-of-pipe” or concentrated sources of pollution. These sources are more easily detected since pollutants are discharged from one source at one point.
- *Nonpoint sources of pollution* occur where pollutants enter the water indirectly at multiple locations from many sources and are often associated with runoff or groundwater. Nonpoint sources are often thought of as “diffuse” sources of pollution. Nonpoint sources of pollution are often difficult to detect or regulate since pollutants can come from a variety of sources and are dispersed over large areas.

Nonpoint sources of pollution are separated, by EPA and NOAA, into six main categories:

- forestry
- agriculture
- hydromodifications
- marinas
- wetlands
- urban (including onsite waste disposal systems, buildings, roads, and bridges)

More information can be found in the US EPA's *Guidance Specifying Management Measures for Sources of Pollution to Coastal Waters* (www.epa.gov/owow/nps/MMGI).

Pollutants from these sources are generally transported as a result of precipitation events through overland runoff or groundwater flow. Rainwater flowing over land, for example, picks up a wide array of contaminants ranging from salt used for de-icing roads, to leaked motor oil and gasoline on driveways and parking lots, to agricultural and lawn chemicals, to large amounts of silt from open construction sites. It is important to keep in mind how pollutants are transported throughout the watershed and how land use alterations can ultimately affect storage and transport pathways.



Construction site erosion



Ditched salt marsh

NYS Department of State Division of Coastal Resources Open Space Analysis Tool

The Department of State's Division of Coastal Resources recently developed an open space analysis tool for the Long Island South Shore Estuary Reserve. This GIS tool uses aerial photographs, land use maps, land ownership information, and land protection status to perform a gap analysis that evaluates all of these data simultaneously to identify large, unprotected open spaces that currently exist in the Reserve. The tool prioritizes the selected open spaces for conservation and protection using a scoring system that accounts for a variety of criteria such as proximity to Natural Heritage habitat sites, historic sites, freshwater and tidal wetlands, tributaries and publicly-owned lands; land cover classification; and extent of tributary frontage. This tool is used in watershed planning to identify natural open spaces that can play a significant role in mitigating impacts from new and existing development, protecting water quality and quantity, and providing habitat for wildlife, thereby helping to explore the targeting of priorities for acquisition.

(www.nyswaterfronts.com)

In New York, the NYS DEC maintains information regarding water quality impacts and impaired waters in the state through its *Waterbody Inventory/Priority Waterbodies List (WI/PWL)* database (www.dec.ny.gov). The *Waterbody Inventory* refers to the listing of all waters, identified as specific individual waterbodies, within the state. The *Waterbody Inventory* includes both assessed and currently unassessed waters. An inventory for each large drainage basin in the state has been established as part of the WI/PWL update effort. The *Priority Waterbodies List* is the subset of waters in the *Waterbody Inventory* that have documented water quality impacts/impairments/threats. The WI/PWL assessments provide the foundation for both the compilation of the biennial Section 305(b) Water Quality Report on all waters of the state and for the development of the state Section 303(d) List, which is comprised of waters that do not meet water quality standards or otherwise do not support water uses.

How we use and manage our land is another important factor in determining water quality. As we convert open space to more intensive land uses, development can have a negative effect on the watershed. Open space, such as forested and vegetated areas, can significantly reduce impacts on water quality from land use practices and development. Vegetated land cover protects water quality by reducing velocity and volume of runoff, filtering pollutants before reaching groundwater and streams, and providing habitat for plants and animals.

Open space, in the form of riparian buffers, also improves water quality by stabilizing streambanks and beds, providing shading to streams, and reducing excess sediment from reaching waterbodies.

It is important to protect open space within your watershed to protect water quality and aquatic habitat as well as to ensure public recreation opportunities. As you develop your watershed plan, keep in mind these important open space areas: lake shores, wetlands and their buffers, groundwater recharge areas, floodplains and their buffers, estuaries, and drinking water sources.

Without careful management of land use, we tend to:

- increase impervious cover, which reduces natural infiltration and increases flood potential
- expose soil to erosive wind and rain, increasing sedimentation rates in streams, rivers, lakes, and ponds which can have detrimental effects on fish, insects, and the overall quality of water
- lose highly productive farmland which affects local economies, and historical and cultural characteristics
- construct more sewer, water, and stormwater infrastructure which places barriers on drainage pathways and directs pollutants into waterways

- fragment natural areas, interrupting wildlife corridors and impairing wetland function
- encroach into floodplains and aquatic buffers, which reduces pollutant removal, flood protection, and habitat

These land use alterations reduce overall water quality and limit our use of water resources - health advisories become more common, fisheries close, and waterbodies can no longer be used for swimming or fishing. They also diminish groundwater recharge and worsen the impacts of seasonal droughts. Watershed planning, however, can help focus efforts on managing land use and the resultant nonpoint sources of pollution.

Watersheds are dynamic systems as surface water, groundwater, and waterbodies are exposed to point and nonpoint sources of pollution, physical alterations, and increased development. Watersheds are constantly changing - nonpoint pollution sources can change, streams continue to be physically altered, and impervious surfaces increase with changing land uses. Being aware of how watersheds change and how pollutants affect water quality over time will help you create a dynamic watershed plan that will be useful in the future.

As you gain a greater understanding of the water quality issues within your watershed and you begin to focus your planning effort on improving water quality, you should ask yourself:

- What are the current water quality conditions - are they improving or getting worse?
- Where are the water quality problem areas - are they located near sensitive habitats, residential communities, industrial sites?
- What are the impairments and the causes of these impairments - can we implement management strategies to address them?

Assessing land use and land cover conditions

As watersheds are converted from field and forest to more intensive land use, the quality of our waters and aquatic habitats begins to decline. Decades of research show that the percentage of impervious cover, forest cover, riparian buffers, and cropland within a watershed can be used to predict watershed health. These percentages can be easily generated by analyzing local land use and zoning maps. Average pollutant concentrations for common contaminants have been estimated for a variety of land use types and can be helpful when calculating urban stormwater loads. This data can be found in NYS DEC's *New York State Stormwater Management Design Manual* (www.dec.ny.gov/chemical/29072.htm).

Understanding land use and land cover can tell you a lot about the conditions of your watershed. Analyzing land use can tell you which subwatersheds may have the highest

quality waters, which subwatersheds may be contributing high levels of nutrients to your coastal bays, streams, or reservoirs, or where stormwater retrofits or residential stewardship efforts should be targeted. Analyzing the type, intensity and distribution of land uses, land cover, and census data will also give you a good idea where future development will occur and help you prioritize vulnerable areas for land conservation, decide where you want to spend money on protection or restoration, or where more stringent development criteria should be applied. You may also want to analyze current and projected use of surface and ground water in your watershed.



Agricultural land use, Cayuga Lake



Greenport, Long Island



Southampton, Long Island

There are four main types of land uses and activities that you should examine for their effects on water quality:

- *Development*, both existing and new, can be a major source of water quality problems. Examples include the expansion of impervious surfaces resulting in the erosion and sedimentation of streams and loss of base flow to wetlands and waterbodies, and contamination of ground and surface water from over-fertilization of lawns and septic systems. Build-out analyses can help you understand how much impervious surface could be added to your community over time under your current zoning and related regulations.
- *Roads* contain and collect contaminants and convey these contaminants into waterbodies. The NYS Department of Transportation follows the techniques and procedures in its Environmental Procedures Manual (www.nysdot.gov) in environmental matters relating to the planning, design, construction, and maintenance of transportation facilities. These approaches may help you manage local roads.
- *Agriculture* is an important land use in many watersheds throughout the State. It is also a source of water pollution from pesticides, fertilizers, sediment, and animal waste. To address these myriad sources of pollution, the Agricultural Environmental Management

(AEM) Program (www.agmkt.state.ny.us/SoilWater/AEM) provides a mechanism to assess farming operations, identify potential environmental problems, and identify options to reduce pollution.

- *Marinas* have many activities located directly at the water's edge, such as refueling and hull maintenance, that can directly pollute waterways. Similarly, direct discharges from boats can pollute waterways.

The US EPA provides more details on these and other pollution causes (www.epa.gov/owow/nps) and offers guidance for specifying management measures to address these causes (www.epa.gov/owow/nps/MMGI).

As mentioned previously, the percentage of impervious cover is a good indicator of watershed health. Impervious surfaces such as rooftops, roads, parking lots, and driveways can influence the quality of water. When rain hits a parking lot, it can no longer infiltrate the soil and flow through its natural pathways to a stream or river. Rainwater, however, will travel across the impervious surface picking up sediment, oil, grease, and other pollutants before it flows into a waterbody. These pollutants are then transported through the vast network of streams, rivers, and wetlands and can increase turbidity, increase biological growth (algae), raise water temperatures, and reduce water quality.

When assessing land use and land cover, there are a few key questions to ask yourself:

- What impacts will any changes in land and water uses have on water quality, and where will these occur?
- How will an expansion of impervious surfaces impact streams, habitats, and ground and surface water?
- How will increases in water consumption associated with existing and new development affect water quantity and quality?
- What practices or controls will maintain or improve water quality?

Estimating pollutant loads and other analyses

Depending on local watershed needs, there are supplemental tasks that can be performed in order to characterize your watershed.

Estimating pollutant loads

Many communities are faced with increased impervious cover or increased sources of nonpoint pollution and should, therefore, make an effort to estimate current and predict future watershed pollutant loads using simple spreadsheets or more complex models. Where

GIS resources are readily available, some communities are also conducting more detailed mapping analyses for sensitive areas in their watershed.

A variety of models have been developed to estimate pollutant loads. These models can help you:

- estimate target pollutant levels and how much is coming from an individual site
- predict additional loads from future development
- develop Total Maximum Daily Loads (TMDLs)
- identify hotspot areas contributing to overall water quality impairments
- determine priority subwatersheds for stormwater retrofits, pollution prevention, or discharge elimination efforts
- analyze the effectiveness of various treatment practices (stormwater facilities, street sweeping, etc.) at reducing pollutant loads at the subwatershed scale
- justify the cost of implementing watershed recommendations
- guide subsequent field assessments to identify pollution sources and key opportunities for restoration and mitigation

Table 3.2 summarizes a number of spreadsheet and simulation models that communities can use to gain a greater understanding of pollutant loading in their watershed.

When developing or using a pollutant model, keep in mind that few models can predict the impacts on biological indicators for water quality, such as fish and aquatic insects. Most models work better for calculating runoff volumes and predicting changes in hydrology and water quality based on chemical and physical characteristics.



Stormwater treatment installation, Lake George

Table 3.2: Models Used To Estimate Pollutant Loads and Simulate Watershed Hydrology

Watershed Treatment Model

- Simple spreadsheet model that provides rapid, inexpensive and reasonably accurate estimates of subwatershed treatment for sediment, nutrients or bacteria. The WTM is an ideal tool for most subwatersheds, although more complex models may be warranted in some situations.
www.stormwatercenter.net or www.cwp.org

SLAMM Source Loading and Assessment Management Model

- Continuous simulation of urban hydrology and water quality that takes a source area approach ideal for subwatersheds. Various stormwater treatment (SWT) scenarios can be directly evaluated.
www.winslamm.com

SWMM5 Storm Water Management Model

- Continuous simulation of stormwater hydrology and water quality, as well as sewers and CSOs. Can address most SWT scenarios.
www.epa.gov/ednrmrl/models/swmm/index.htm

HSPF Hydrologic Simulation Program-Fortran

- Continuous simulation of hydrology and water quality, with an emphasis on watershed land use. Analysis of SWT is cumbersome.
<http://www.epa.gov/ceampubl/swater/hspf/>

P8 Program for Predicting Polluting Particle Passage through Pits, Puddles and Ponds

- Continuous or single event simulation of hydrology and water quality that relies on NRCS curve number methods. Good capability to deal with structural SWT, but not designed to assess soluble pollutants.
<http://www.walker.net/p8/>

DR3M-QUAL Distributed Rainfall, Runoff and Routing Model

- Continuous or single event simulation of surface runoff and water quality designed for subwatersheds. Cannot simulate subsurface flow or sewers.
http://water.usgs.gov/cgi-bin/man_wrdapp?dr3m

HMS and HEC-RAS Hydrologic Modeling System and River Assessment System

- Storm event simulation of surface runoff and channel hydraulics for flood management assessment. Cannot assess water quality. SWT restricted to flood reduction options.
www.hec.usace.army.mil/

Pollutant models are currently being used throughout New York. On eastern Long Island, the Peconic Estuary Program developed a pathogen loading model to evaluate pathogen sources in various target areas within the watershed. This model assisted the Program in identifying important sources and mitigation areas for future restoration efforts. On Lake George, the Lake George Association, in conjunction with the Lake George Watershed Coalition, is using GIS to develop a nonpoint source pollutant loading model for the lake in order to identify restoration locations.

When estimating pollutant loadings or developing loading models, some key questions to ask yourself are:

- What are the pollutant loadings at the subwatershed level? This will help you pinpoint problem areas within your watershed.
- How are pollutants introduced into your watershed - through stormwater outfalls, illicit discharges, or other conveyances?
- Where would focused nonpoint source pollution management most likely maintain or improve existing water quality?

Sensitive Area Analyses

Another task involves refining existing information on sensitive areas in your watershed. Sensitive areas are those areas that have special significance, provide watershed benefits, or are particularly vulnerable to land development. They can include:

- streams and their buffers
- 100-year floodplains
- habitats for rare, threatened, and endangered species
- steep slopes
- coastal and freshwater wetlands
- contiguous forest
- hydric and erodible soils
- prime and important farmland soils
- public drinking water supplies
- wellheads
- historic and archeological sites



Sandy Island Beach State Park, Lake Ontario



East Hampton, Long Island

A comparison between predicted watershed development and existing natural areas will help you quickly assess threats to these sensitive areas. To study sensitive areas in your watershed there are a variety of analyses that can be performed:

- Local wetland inventories supplement state wetland maps with local wetland data, estimate wetland functions, and predict wetland impacts based on future land use scenarios. A wetland inventory provides a starting point for determining the functional services wetlands provide at the watershed scale, which in turn can impact future permitting and mitigation decisions.
- Forest cover analysis predicts changes in watershed forest canopy based on future land use and forest conservation scenarios.
- Riparian buffer mapping uses aerial photos to map the extent and locations of impacted riparian buffer areas. This analysis can help direct field crews to specific stream reaches and shorelines in need of buffer restoration.
- Steep slope analysis identifies which slopes are vulnerable to development, particularly those with highly erodible soils. For communities with few regulatory protections for steep slopes, this analysis can quickly gauge the impact of future development.

- Recharge and wellhead analysis uses soil and groundwater supply information to determine which natural recharge areas are vulnerable to development. This analysis is particularly useful for communities that rely on groundwater supplies for drinking water. It is also useful in maintaining stream and wetland hydrology. NYS Department of Health prepares Source Water Assessments that can help with this analysis.
- Farm susceptibility analysis measures land and productivity, along with other factors such as development pressure and public value, to assess which farm parcels are most susceptible to future development.
- Enhanced floodplain mapping reflects future hydrologic conditions.

Some key questions to think about when conducting sensitive area analyses are:

- What is the condition of the area? Is it relatively pristine, significantly impaired, or threatened by pollution, development, or overuse?
- Is the sensitive area rare or common?
- What value does the community place on the area?

- What are the significant human uses within the sensitive area - fishing, hunting, wildlife observation, plant harvesting, drinking water withdrawals? How have their uses changed over time?
- Is the area replaceable or irreplaceable?
- Is the area actively managed, by whom, and for what purpose?

These sensitive area analyses should be used to help build support for the watershed plan, identify resources vulnerable to future development, and screen potential sites to be further evaluated in the field (see Chapter 5).



Batavia Kill, Windham

Assessing capacity of municipal programs

Another important step in the watershed planning process is understanding how communities deal with the problems that exist in their watershed. Existing water quality problems can stem from a lack of adequate comprehensive planning or weak or non-existent local controls. Local controls can include zoning ordinances and subdivision regulations as well as local laws to regulate junk yards, erosion and sediment control laws, vegetation retention laws, docking and mooring laws, or wellhead protection laws. Water quality can also be affected by municipal practices and programs such as street sweeping, de-icing, catch basin maintenance, fertilizer applications, and mowing regimes. Collectively, these regulations and municipal programs can be considered local “tools” for watershed protection. To identify and address water quality problems in the watershed it is helpful to perform an evaluation of local controls and municipal programs that help protect water resources.

Conducting a guided self-assessment of the local controls, programs, and practices used in each of the municipalities in the watershed will identify available and missing tools that can help meet watershed goals.

When performing a self-assessment, you should ask yourself what local tools are available in your watershed pertaining to land use planning, erosion control, stormwater management, and watershed education and outreach. Other questions to keep in mind include:

- Does your community have a catch basin clean-out schedule?
- Are fertilizers and herbicides used in public/private lawn maintenance? Are there restrictions on amounts, types, and application schedules?
- Does your community have an erosion and sediment control law?
- Does your community conduct road and bridge maintenance (de-icing material use and storage, pot-hole repair, bridge washing, scraping and painting, etc.) according to best management practices?
- Does your community have a set-back ordinance?
- How does your community conduct right-of-way activities (mowing, brush removal, pesticide and fertilizer use, etc.)?
- Does your community have a septic system inspection requirement?
- Does your community have regulations to protect your water supply?



Fish stocking, Bronx River



Water quality data collection

Table 3.3 provides a description of some common local tools to consider when conducting a self-assessment.

To identify gaps in watershed protection, you should review local environmental laws and interview the program staff who implement those programs and regulations. Doing this will allow you to make regulatory and programmatic recommendations as part of the overall watershed plan - revisions to local development codes; a new stormwater local law; an illicit discharge hotline; updated maintenance practices. While assessing local environmental regulations is important, it is also useful to assess general land use regulations as well. There are a number of general land use controls, such as zoning laws and subdivision regulations, that can help improve water quality.

Here are several self-assessments to get you started:

- Genesee/Finger Lakes Regional Planning Council - *Protecting Water Resources through Local Controls and Practices: An Assessment Manual for New York Municipalities* (www.gflrpc.org)
- The Center for Watershed - *Codes and Ordinance Worksheet* (www.cwp.org)
- NYS DEC - *Stormwater Management Gap Analysis Workbook for Local Officials* (www.dec.ny.gov/chemical/8468.html)

Tool	Description
Land Use Planning/ Regulations	The application of regulatory measures and/or planning techniques designed to redirect development where appropriate, maintain or limit future impervious cover, and protect sensitive areas.
Land Conservation	Programs or efforts to inventory and conserve undeveloped sensitive areas, open space, or areas of particular historical or cultural value.
Aquatic Buffers	The protection, restoration, creation, or reforestation of stream, wetland, and urban lake buffers.
Better Site Design	Local ordinances and codes that incorporate techniques to reduce impervious cover and/or redirect runoff onto pervious surfaces in the design of new development and redevelopment projects.
Erosion and Sediment Control	The use of erosion control, sediment control, and de-watering practices at all new development and redevelopment sites.
Stormwater Management	The incorporation of structural practices into new development, redevelopment, or the existing landscape to help mitigate the impacts of stormwater runoff on receiving waters.
Non-Stormwater Discharges	Locating, quantifying, and controlling non-stormwater pollutant sources in the watershed. Operation and maintenance practices that prevent or reduce pollutants entering the municipal or natural drainage system.
Watershed Stewardship	Restoration activities and stormwater and watershed education or outreach programs targeted towards fostering human behavior that prevents or reduces pollution over a range of land uses and activities.

- American Farm Land Trust - *Guide to Local Planning for Agriculture in New York* (www.farmland.org)

Links to each of these assessments are posted on the Division of Coastal Resources website: www.nyswaterfronts.com.

Keep in mind that the watershed plan should identify where watershed tools should be applied to meet water resource objectives. As you work through a self-assessment of local controls and practices, try to answer some of these key questions:

- Where are the gaps in the existing point and nonpoint source controls and how can these be addressed?
- What changes to local land and water use controls, such as subdivision and site plan review, can be made to protect and improve water quality?
- What changes in routine roadway, drainage-way, and stream maintenance practices can be made to protect and improve water quality?

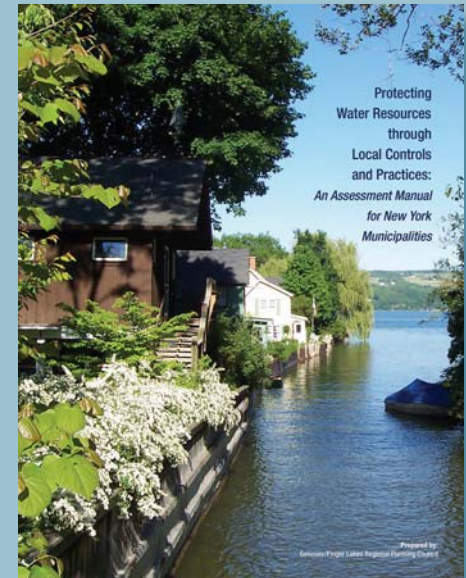
Assessing Local Capacity

The Genesee/Finger Lakes Regional Planning Council has worked with municipalities in the Cayuga, Canandaigua, and Conesus Lake watersheds to assess the current capacity of local ordinances and practices for water quality protection. The Council assessed existing local water quality controls in each of the 56 municipalities in these three watersheds. The assessments provided insight into the gaps between existing watershed plans and the current controls, e.g., laws, regulations, and practices that municipalities have to protect water quality.

Thirteen municipalities were then selected to incorporate elements of the watershed plans into their regulatory framework by developing new laws and revising existing laws. One result of this process was the development of the guidance manual *Protecting Water Resources Through Local Controls and Practices: A Manual for NY Communities*. The manual offers a methodology for identifying local controls and other practices to protect water quality and assess their effectiveness.

The manual walks the reader through the process of a municipal nonpoint assessment and gap analysis and provides, as samples, local laws that have been adopted in some NY communities, including an environmental protection overlay district, subdivision regulations, wetlands and watercourse protection, and onsite wastewater treatment system regulation.

More information on the Municipal Nonpoint Assessment is available through the Genesee/Finger Lakes Regional Planning Council (www.gflrpc.org).



Existing regulatory programs administered both by the state and a municipality may have developed standards and guidance documents that should be referred to for watershed protection. For example, with regard to stormwater management, NYS DEC has produced the *New York Stormwater Management Design Manual* (www.dec.ny.gov/chemical/29072.html) and the *New York Standards and Specifications for Erosion and Sediment Control* (www.dec.ny.gov/chemical/29066.html) to guide design, construction, and project review at the local level, and to assist communities in meeting SPDES Phase II requirements. Also available is the *Stormwater Management Guidance Manual for Local Officials* (www.dec.ny.gov/chemical/9007.html), produced by the New York State Departments of State and Environmental Conservation.

Developing a vision and initial watershed goals

Now that you know what is going on in your watershed and what potential problems may exist, you can begin to think about the future. A vision is your idea of what your watershed will become. A vision statement clearly describes what you hope to accomplish. Whether it is a sentence, a paragraph, or a list of bulleted points, it should be clear, focused, and based in reality. Your vision will set the tone of your watershed plan and will be used throughout

the planning process all the way through implementation. It should look to the future, motivate partners and the community, and bring together assets and resources.

Creating a vision involves taking a critical look at the watershed's unique characteristics and thinking about future goals. Your vision should be written in a way that can be easily translated into a set of goals and objectives. When developing a vision for your watershed you may want to touch upon a few concepts such as needing to maintain natural processes, encouraging sustainable activities, basing decisions on best available science, enhancing the understanding of watershed dynamics, and ensuring that watershed planning and implementation are collaborative.

Consider this example vision statement:

“Our watershed will be a healthy district in which our communities will have a strong relationship with the natural resources we share. Our waters will be clean and healthy and we will work to protect and improve water quality for future generations through the use of sound and environmentally friendly means. Our waters will support our drinking water, wildlife, recreation, and tourism needs. Watershed communities will work hand-in-hand to provide reasonable management decisions based on sound science and encourage the re-establishment of natural

processes where, in the past, they have been altered.”

You will need to develop something similar for your community.

Community participation in the visioning process is key and should be open to everyone. When bringing the interests and ideas of a broad audience together you can create a vision that is inclusive and dynamic. The vision statement is a starting point in the planning process. As you learn more about your watershed and the resources it contains, your vision can be modified to address these new facts. Setting some preliminary watershed goals can help refine your vision and provide direction for your planning process.

Once you have a strong vision statement, developing goals and objectives can often help you create a realistic framework for achieving that vision as well as help you focus limited resources on the most critical watershed issues or priorities. Goals are general statements of purpose or intent that express what the watershed plan will broadly accomplish (e.g., reduce sediment and nutrient inputs to the Hudson River). Distinguishing between goals and objectives can sometimes be confusing. Table 3.4 will help you differentiate between these two terms.

Table 3.4 Differences between watershed goals, objectives, and indicators		
Goals (broad)	Objective (specific)	Indicators (numeric)
<ul style="list-style-type: none"> • General statement of purpose or intent • Expresses what will be broadly accomplished • Understood by the public • Single phrase or slogan 	<ul style="list-style-type: none"> • Precise statement of what needs to be done • Outlines the specific actions that need to happen to achieve the goal • Instructions to managers • Series of bullets that outline what, how, who, when and where 	<ul style="list-style-type: none"> • Measurable parameter of aquatic health directly linked to goal • Tracks progress made over time in reaching goal • Interpreted by scientists • Chart or statistic showing indicator change over time
Examples		
<ul style="list-style-type: none"> • Maintain yellow perch populations • Reduce nitrogen loading 	<ul style="list-style-type: none"> • Prohibit the creation of fish barriers to upstream spawning areas • Reduce nitrogen loading from residential land by 40% through education program 	<ul style="list-style-type: none"> • Annual change in fish IBI counts measured at station x • Before and after responses to resident surveys on fertilizer use



Montezuma National Wildlife Refuge



Rondout Creek, Kingston



Atlantic Beach, Southampton

When forming goals and objectives it is important to reach out to the community. By listening to a diverse group, it is possible to gain agreement, or consensus, on the overall goals that will drive the implementation of the plan. Remember, initial goals can always be revised, updated, and expanded as you become more familiar with watershed conditions.

Writing a watershed characterization report

The watershed information, analysis and ideas that you have collected and developed should be organized and summarized in a watershed characterization report which will become part of your final watershed plan. This report will provide a context for the planning effort, and can be used to educate partners and the community on watershed conditions and generate local support. The watershed characterization report will provide you with a description of the watershed, a summary of baseline watershed conditions, and provide a sense of the key problems in the watershed. The characterization report should be in an understandable and readable format. Clearly written text, simple maps, and compelling photographs combined with concise captions will help readers visualize the watershed and any existing problems.

The minimum elements of a watershed characterization are:

- Geographic setting and special features - identifies the major basin in which the watershed is located, surrounding jurisdictions, special features and resources, and how the watershed fits into the broader context. This can also include census data such as population, school districts, average annual income, and industries.
- Watershed summary - describes the physical watershed, including watershed area, stream miles, number of subwatersheds, jurisdictions, wetland acres, designated habitats, and threatened and endangered species.
- Watershed maps - provides an easy to read base map that shows subwatershed boundaries, municipal jurisdictions, parcels, roads, land use, land cover, open space, zoning, and water features at a minimum. Additional maps can be used throughout the report as supportive material. Consider including individual subwatershed maps that can show additional details such as monitoring stations, remaining developable areas, and unique habitat areas.
- Review of existing data - summarizes data to provide an overview of water resource conditions in the watershed. Results should be presented using tables, charts, and maps. Supporting data can be provided in an appendix.

- Land use and land cover analysis - summarizes current and future land use conditions, pollutant loads, and sensitive area analyses. Includes a map portraying subwatersheds. Analyses also describe sensitive areas and particular threats due to future land use conversion.
- Regulatory status - identifies all Clean Water Act Section 303(d) listed waters and any TMDLs that exist for waterbodies in the watershed. This can also indicate all designated waterbody uses, and identifies any SPDES Phase II regulated urban areas. A summary of the existing regulatory and municipal programmatic tools should be provided, as well as potential gaps highlighted.
- Subwatershed summaries - includes subwatershed fact sheets that summarize the data at the subwatershed level. These can serve as the foundation for building subwatershed management strategies as part of the final watershed plan.
- Technical appendices - contains all the technical details to help keep your report manageable and readable for a diverse audience.

In order to get feedback, the characterization report should be distributed to state and local agencies, elected officials, and others to familiarize them with watershed conditions, planning efforts, and the roles they can play in the process. These agencies, organizations, or individuals can help fill in possible gaps or highlight where additional information may be needed.

The watershed characterization report also provides a key opportunity to ask for input from the community. Community members can provide important feedback such as identifying additional sources of watershed data, identifying watershed concerns or resources you had not previously considered, or generate additional support for the watershed plan.



Black River, Tug Hill



Canandaigua Lake



Congress Park, Lake George

Case Study: The Bronx River Watershed

The Bronx River, draining 56 square miles of suburban and urban land, begins at the Kensico Reservoir and flows 25 miles before entering the East River. Throughout its history, the Bronx River has been an important transportation corridor and has supported flour, paper, and tapestry mills, while its watershed served as home to thousands. By the early 1900s, the Bronx River was severely degraded and often described as an “open sewer.”

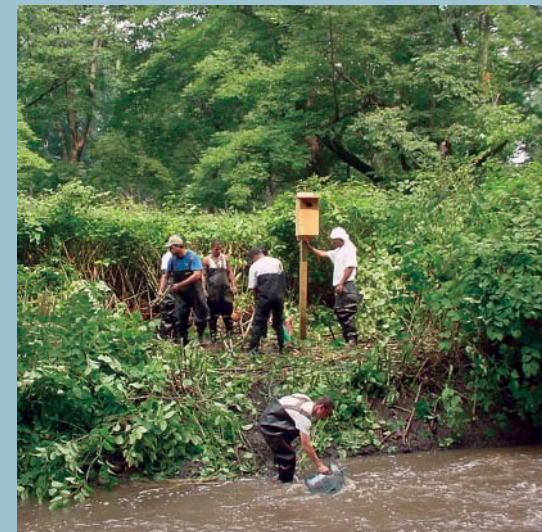
The Bronx River Watershed Coalition, established in 2005 and comprised of the City of New York and fourteen municipalities in Westchester County, has been working to characterize the physical conditions of the river and its watershed as one of the first steps in developing a comprehensive watershed management plan.

Westchester County performed desktop analyses and field investigations to collect watershed data. The County and its consultants went on to complete baseline watershed assessments, hot spot investigations, neighborhood source assessments, and stream assessments. New York City is also conducting similar assessments in their portion of the watershed. Through the Ecological Restoration and Management Program, the Bronx River Alliance, a coalition of nonprofit community

groups, has joined with local governments in the effort and has partnered with agencies and organizations to assess and characterize the Bronx River.

The Alliance is involved in a variety of studies and planning projects which have helped form the basis for educational stewardship programs that allow the public to become engaged with the river. Working with the NYC Department of Parks and Recreation, the Alliance developed the Bronx River Action Plan, which identifies public access and park areas in need of restoration and opportunities to improve water quality and habitat. One resulting project - the Greenway Trail - brings people to the water by linking open spaces along the river. School groups have participated in the project by replanting and restoring riverbanks, completing watershed assessments, and performing other stewardship activities.

Characterizing the watershed has helped to build an understanding of the landscape and how individual activities can impact water quality. This understanding will enable the Bronx River Watershed Coalition to achieve the shared goals of improving water quality, restoring fish and wildlife habitat, and creating new opportunities for public use and enjoyment of the river. Having an intermunicipal watershed management plan that reflects watershed conditions and includes a list of prioritized projects will set the course for effective restoration and protection of the Bronx River ecosystem.



Invasive species management

CHAPTER FOUR: IDENTIFYING OPPORTUNITIES FOR IMPROVEMENT

While much can be learned about a watershed through developing a characterization report, there is no substitute for getting out in the field to evaluate on-the-ground conditions. Field assessments along water resource corridors and upland areas can help you gain a greater understanding of what is going on in the watershed as well as identify opportunities for improvement. In this chapter, we will work through the following steps:

- Prioritizing subwatersheds
- Evaluating watershed conditions

Prioritizing subwatersheds

Depending on watershed size, assessment needs, and staffing capacities, you may or may not have the resources available to conduct an entire watershed-wide assessment at one time. By prioritizing your subwatersheds you can target your field assessment to one or two priority areas early on in the process. Priority subwatersheds will generally be those that are impaired, are the most vulnerable to future development, contain important resources, or present the best opportunity for improvement. To help prioritize subwatersheds, consider selecting a manageable number of factors that can be used to compare subwatersheds. These factors, such as percentages of impervious cover, forests, and agricultural land, can be used to score and weigh subwatersheds. Examples

of factors that can be used are summarized in Table 4.1. Many factors can be identified by revisiting the characterization report.

A written summary can be prepared that supports the selection of priority subwatersheds, explains the factors used in the ranking process, and identifies subwatersheds on a simple watershed map.

Evaluating watershed conditions

Up to this point you have generated a general characterization of your watershed. You know your watershed boundaries; you know how many streams, rivers, lakes, and ponds are found within your watershed; you know what local controls are focused toward natural resource protection; and you have a general idea of pollutant loads generated throughout the watershed.

To evaluate and refine your characterization and to develop specific management recommendations and site specific projects, it is important to understand and examine several key characteristics of aquatic and upland systems:

- *Chemical* - the chemical composition of water and sediment affects the living resources and human uses that can be supported within the waterbody. Specific parameters that can be monitored include dissolved oxygen, pH,

temperature, salinity, conductivity, nutrients, pathogens, and toxic contaminants.

- *Biological* - the composition of living organisms, including fish, macroinvertebrates, and aquatic vegetation, can reveal information about the conditions of habitats. Biological communities are often used as indicators of ecosystem health and can be used to track or predict significant changes. For example, sensitive macroinvertebrate species, such as mayfly larvae, are indicators of high quality freshwater stream habitat.
- *Physical* - the physical environment provides the foundation for all chemical and biological characteristics. Physical conditions, including sediment composition, hydrology, and bank/shoreline erosion, can provide important information regarding overall health.
- *Human Influenced* - in addition to assessing ecological characteristics, it is also important to inventory how waterways and waterbodies have been impacted by humans. Outfalls and illicit discharges, barriers to flow, water use, and other notable impacts can be identified through field assessments.

Table 4.1 Example Factors Used to Classify and Rank Subwatersheds

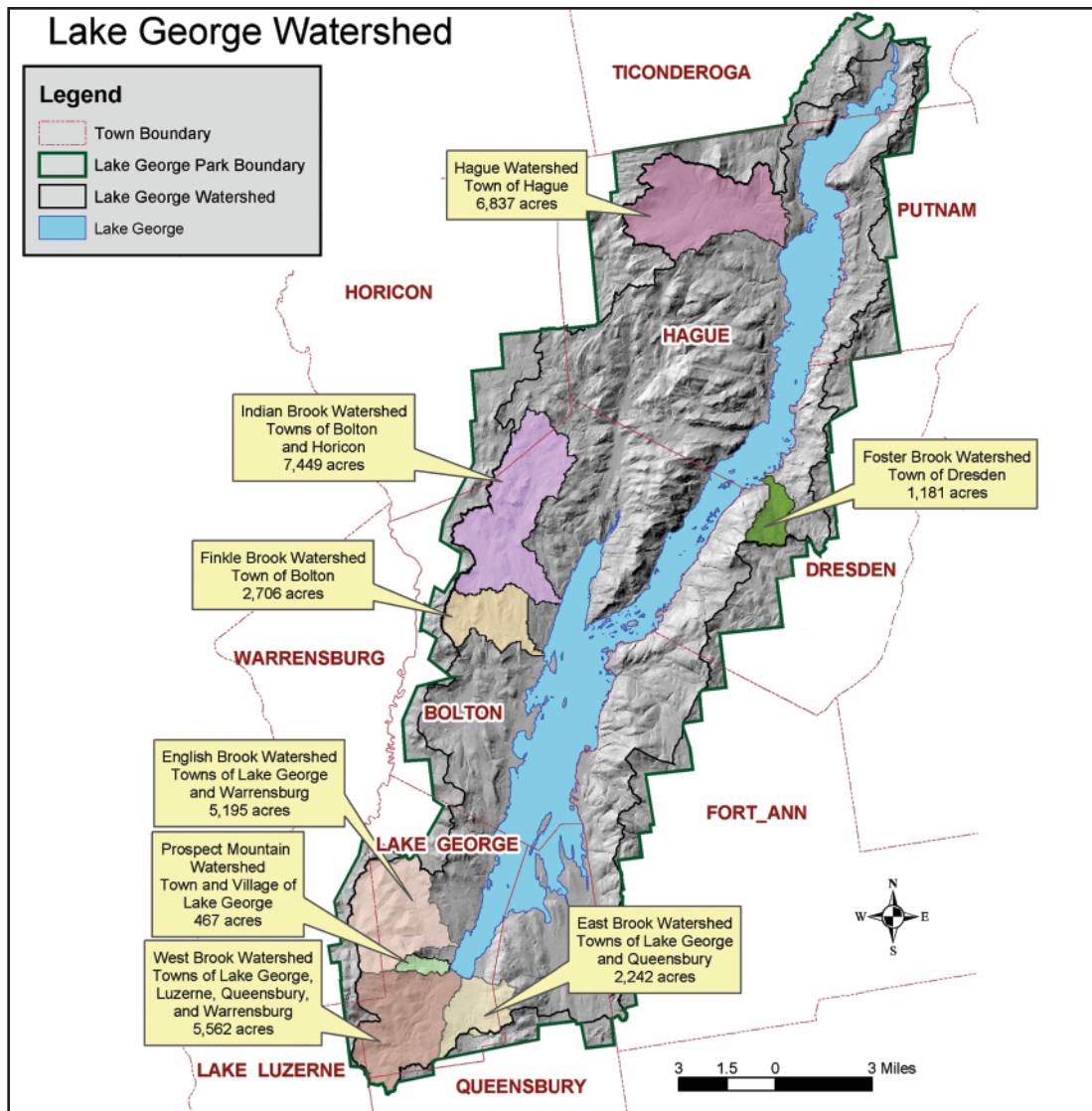
<p><i>Impairment</i></p> <ul style="list-style-type: none"> • % streams with CWA Section 303(d) listing, # violations of water quality standards • % impervious cover (current) • % cropland • Livestock density • % forested stream buffer <p><i>Sensitivity</i></p> <ul style="list-style-type: none"> • % forest cover or % forest interior • % critical habitat for rare, threatened and endangered species • % wetlands • Benthic macroinvertebrate diversity • Fish diversity • Physical in-stream habitat <p><i>Future Vulnerability</i></p> <ul style="list-style-type: none"> • % future impervious cover • Net change in future impervious cover • % developable land • % future forest loss 	<p><i>Restoration Potential</i></p> <ul style="list-style-type: none"> • Length of eroded stream bank • Condition of sewer system • Density of point sources or hotspots • Density of septic systems • Density of stormwater outfalls • Density of stormwater treatment practices • # road crossings per stream mile • % detached residential land • Age of development <p><i>Other useful metrics</i></p> <ul style="list-style-type: none"> • Density of streams • % public land • Presence of community or watershed organization • Presence of public drinking water supply • Presence of combined sewer systems
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Conducting field assessments in your watershed is a good way to study these characteristics and collect important information that will help you understand your watershed in more detail.

The data you collect during your assessments will help you distinguish between high quality habitats and waterbodies and those that have experienced some level of degradation.

Assessments will also allow you to target opportunities for water quality improvement, habitat restoration, or open space protection. You should build on previous assessment work - don't reinvent the wheel. When considering the types of assessment to use, you should choose those that:

- can be conducted by existing staff, local consultants, or trained volunteers - keep it simple and allow those involved in the planning process to get some field time and develop a sense of what is going on in the watershed
- are designed to monitor and track conditions over time - make sure you are able to do the assessment from year to year to see what improvements have been made



Lake George subwatershed map

Before you begin your assessments you may want to research additional sources of existing data for your watershed. Types of available data include biological, physical, and water quality data. Table 4.2 identifies some of these important sources of data.

Watershed assessments should be conducted in both the aquatic and upland systems in order to get a comprehensive understanding of existing conditions throughout the entire watershed.

Aquatic Assessments

Aquatic assessments consist of collecting data associated with a particular waterbody and its riparian buffer. These assessments allow you to gain a greater understanding of in-stream conditions, locate stormwater outfalls and illicit discharges, identify areas of concern, and generate potential management recommendations.

- *Stream Assessments*

Stream assessments are done along identified stream reaches throughout the watershed. Data is often used to evaluate physical in-stream conditions where water quality and biological communities are also sampled. Physical conditions, including sediment composition, hydrology, and bank/shoreline erosion, can provide important information regarding overall stream health. This is a useful assessment to quickly identify impacted and sensitive subwatersheds.

Table 4.2 Important Sources of Monitoring Data in NY

Type of Data	Source	Description
Hydrologic, Water Quality	USGS National Water Information System	Surface water data, groundwater data, and water quality data for more than 1.5 million sites nationwide.
Biological	NYS DEC Statewide Stream Biological Monitoring Program	Biological sampling of streams and rivers throughout the state, as part of the Rotating Intensive Basins Studies (RIBS) Project.
	NY Regulatory Freshwater Wetlands maps, available at CUGIR website	Maps of regulatory wetlands across the state.
	USGS GAP Program at Cornell University	Part of a nation-wide geographic analysis of distribution of native aquatic and terrestrial species to identify species gaps for conservation, data includes public and conservation lands, species distribution.
	Hudson River Watch	Annual Bioassessment Surveys of Hudson River Watershed, data available directly online, along with guidance on macroinvertebrate identification and assessment protocols.
Water Quality	National Water Quality Assessment Program (NAWQA), available at CUGIR website	Ambient fixed station water quality monitoring.
	NYS DEC Bureau of Water Assessment and Management	Chemical sampling of streams and rivers throughout the state, as part of the Rotating Intensive Basins Studies (RIBS) Project.
	US EPA BEACON Program	Database of beach monitoring data and advisories, through a volunteer partnership with beach managers.
	NYS DEC Bureau of Marine Resources	Bacteriological monitoring of shellfish beds to determine the status of shellfisheries for public consumption.
Physical	County Soil and Water Conservation Districts often have some of this information	Streamwalk designed to identify environmental problems such as eroding stream banks, inadequate stream buffers, and to collect habitat data.

Popular stream assessment protocols include the EPA recommended *Rapid Bioassessment Protocol* (Barbour et al., 1999) which uses the presence of aquatic invertebrates to determine stream health, and the *Stream Visual Assessment Protocol* (USDA, 1998) which focuses on stream bank stability. The NYS DEC Stream Biomonitoring Unit Quality Assurance Work Plan also highlights procedures for biological stream monitoring and has a detailed quality assurance/quality control component. Training is provided periodically by the Greene County Soil and Water Conservation District and by Hudson Basin Water Watch, with support from NYS DEC. The Upper Susquehanna Coalition has developed the ArcView Stream Evaluation and Assessment Monitoring System (AVStrEAMS) that helps communities develop assessment reports focused on a particular stream segment. The program helps organize, store, and utilize GIS data.

- *Corridor Assessments*

Corridor assessments include collecting data for an entire stream or shoreline network rather than a specific stream reach. By walking the entire stream or shoreline, extensive information can be collected on outfall location and condition, stream bank/shoreline erosion, trash accumulation, and riparian buffer quality. Specific restoration and protection projects can be identified

and a more comprehensive picture of the subwatershed stream corridor can be understood. The *Unified Stream Assessment* (Kitchell and Schueler, 2004) is a guide that can be used to conduct corridor assessments.

- *Geomorphic Assessments*

These assessments are often used to evaluate bank stability. The Greene County Soil and Water Conservation District, under contract with the NYS DEC, has been developing and implementing a Geomorphology Based Stream Stability Assessment methodology. This method focuses on the use of stream morphology or form as the basis for stream classification, stability assessment, and restoration design strategies, and is a more thorough assessment than the Stream Visual Assessment Protocol outlined above.

- *Wetland Assessments*

Wetland assessments can range from a rapid survey of observable impacts to more detailed assessments of functional capacity, reference conditions, or restoration potential. Depending on your needs, the rapid approach may prove ideal for short-term watershed and wetland planning, followed by more detailed assessments where appropriate. Many different wetland



Stream restoration workshop, Auburn



Wetland at Sucker Brook, Canandaigua



Stream barrier inspection



Wappinger Creek, Wappingers Falls

assessment methodologies exist. As these are often specific to a region or wetland type, care should be taken to decide which method is right for your watershed. In the *Wetland Journal* (Vol.12, No. 4) Bartoldus offers a selection matrix to assist wetland managers in distinguishing between wetland assessments and for choosing an appropriate protocol for use. The NYS DEC has also published the *New York State Freshwater Wetlands Delineation Manual* (1995). This manual provides methods, field indicators, and technical criteria for freshwater wetland delineation.

- *Vernal Pond Assessments*

Vernal pond assessments can help identify high quality ponds that are critical for wildlife. Vernal ponds, while not containing fish, are vital habitats for salamanders, frogs, fairy shrimp, and other species. A methodology for assessing vernal ponds and identifying conservation strategies can be found in *Conserving Pool-Breeding Amphibians in Residential and Commercial Developments in the Northeastern United States* by Aram J. K. Calhoun and Michael W. Klemens (2002).

- *Outfall Inventories and Illicit Discharge Investigations*

Outfall investigations can be done in conjunction with other stream and shoreline

assessments. Problem outfalls can be found using dry weather monitoring of indicators such as bacteria that signify the presence of a possible wastewater discharge, or by evaluating all outfalls during stream walks to discover suspicious flows or evidence of discharge events. More guidance on outfall inventories and methods for finding and eliminating illicit discharges can be found at (www.dec.ny.gov).

Upland Assessments

Along with assessing aquatic environments, investigating upland conditions is also critical to comprehensive watershed planning. Upland assessments involve field work directed away from specific waterbodies and focused more on 'dryland' evaluation. These assessments consist of investigating residential areas for possible pollutant contribution, open space investigation to identify possible areas for conservation, and hot-spot inventories to identify illicit discharges and possible point sources of pollution.

- *Impervious Cover Assessments*

The Impervious Cover Model (ICM), developed by the Center for Watershed Protection, can help you predict current and future water resource conditions and craft improvement recommendations. Doing this desk-based assessment first will help you target field assessment needs.

The model assumes that watershed and water quality health begin to decline when impervious cover exceeds 10%, with severe degradation expected beyond 25%. Using the ICM, subwatersheds can be grouped into one of four categories and can be used to develop subwatershed goals (Figure 4.1). Subwatershed goals will help you focus recommendations for improvement, restoration, and protection.

Four subwatershed categories that can be used are:

- *Sensitive* (<10% impervious cover) - good to excellent water quality, typically high, stable channels, excellent habitat structure, and diverse fish and aquatic insect communities. When working in sensitive watersheds it will be important to maintain stream biodiversity and channel stability in order to maintain water quality. Goals may include creating a land protection program, buffer ordinances, or more stringent development controls.
- *Impacted* (10-25% impervious cover) - clear signs of degradation due to changing land use such as increased urban development. Greater stormwater flows begin to alter stream geometry and coastal waters and show measurable nitrogen and bacterial loading. Stream biodiversity declines to fair levels, after the most sensitive fish and aquatic insects disappear from the stream.

Since water quality is starting to decline, subwatershed goals should focus on limiting degradation of habitat quality and maintaining a good biological community.

- *Non-supporting* (26-60% impervious cover) - channels highly unstable, exhibit severe widening, down-cutting, and streambank erosion. Many streams have been hardened. The water and biological quality of non-supporting watersheds is generally considered poor and is dominated by pollution tolerant insects and fish. When working in a non-supporting watershed it will be important to reduce downstream pollutants and alleviate downstream flooding. Goals should also focus on streambank stabilization and stormwater management.

- *Urban drainage* (>60% impervious cover) - stream often piped underground, or consists of concrete channels that do not support any aquatic life and serve only to convey flows. Goals for urban drainage subwatersheds should be similar to non-supporting subwatersheds and focus on reducing nonpoint source pollution.

The ICM allows predictions to be made based on build-out of current zoning to better understand which subwatershed may become degraded over time. Using the ICM, you can gain a clearer understanding of the potential impacts and problems affecting specific subwatersheds and determine where further studies need to be conducted, where potential protection measures should be focused, and where more intensive nonpoint source pollution management is needed.

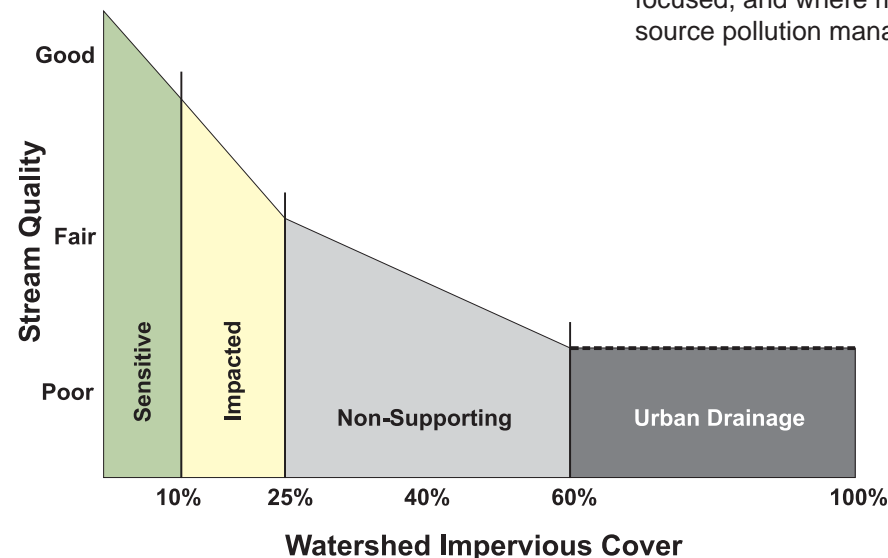


Figure 4.1 Stream and watershed quality as a result of impervious cover.

Eelgrass and salt marsh restoration in Shinnecock Bay

Cornell Cooperative Extension (CCE) is conducting an assessment of eelgrass in Shinnecock Bay. The goal of this project is to restore coastal ecosystems by restoring eelgrass and scallops, which naturally coexist in this area. The project consists of analyzing aerial photography to identify eelgrass meadows, and then ground truthing those aerial photographs. Going out into the bay, CCE assesses the populations of scallops and eelgrass by looking at stem density, macro algae, bottom types, depth and nutrients. This assessment will help prioritize restoration projects within the bay.

The Cornell Cooperative Extension previously participated in a salt marsh assessment project during the 1990s along the Southampton coastline. Working with a local consultant, degraded town owned salt marshes were identified and prioritized for potential restoration projects. One successful project restored a former dredge spoil site to a productive salt marsh. The site now offers public access, provides fish and wildlife habitat, and includes a trail and gazebo heavily used by bird watchers.

More information about eelgrass restoration is available through Cornell Cooperative Extension's Eelgrass Program. (http://counties.cce.cornell.edu/suffolk/habitat_restoration/seagrassli/index.html)

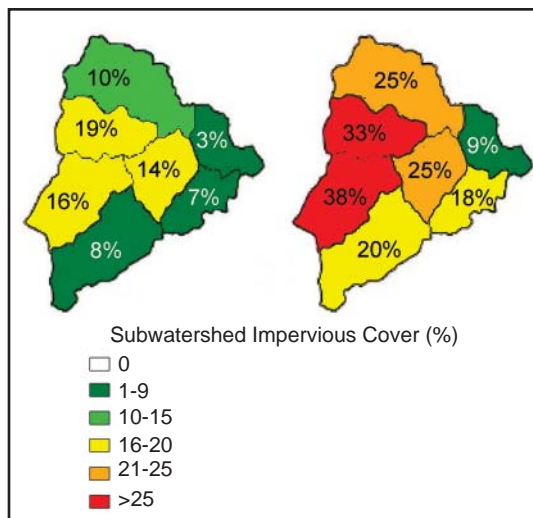


Figure 4.2 Shifting Impervious Cover

With changing land uses, subwatersheds can often shift from one category to another. Subwatersheds that are expected to shift from sensitive to a more impacted category in the future are of particular interest to watershed planners because they are likely to experience significant degradation unless development is restricted through zoning regulations (e.g., cluster development), development criteria and/or land conservation techniques to protect natural hydrology and pollution abatement functions. Impacted subwatersheds not expected to shift to non-supporting may become priority subwatersheds for restoration due to a higher chance of long-term success.

Subwatersheds that are highly impacted, such as those considered urban drainage, can also benefit significantly from restoration, and may become a priority in your watershed based on the opportunity to improve the quality of life in the surrounding community. Figure 4.2 illustrates subwatersheds shifting from sensitive to impacted conditions under future growth scenarios.

It is important to keep in mind that the ICM is only a guide to the approximate relationship between impervious cover and water quality. Water resources are variable. Factors such as gradient, watershed size, flushing rates, local geology, age of subwatershed development, and past management practices can and will make some water resources depart from these predictions.

- *Urban Pervious Area Assessments*

These assessments are useful in identifying areas such as vacant lots, parks, and large turf areas that may have compacted soil, invasive plants, and fragmented habitat. Assessments of these areas should be designed to identify sites where the soil and vegetative cover can be restored to better meet canopy cover, infiltration, and community health goals. The *Unified Subwatershed and Site Reconnaissance* (Wright et al, 2004) and the *Urban Watershed Forestry Manual* (Capiella et al, 2005) describe protocols for assessing natural area remnants and open space.

- *Upland Conservation Area Assessments*

Conservation area assessments are useful to investigate the quality of and threat to remaining natural areas in your watershed and to determine which sites should be priorities for land acquisition or other conservation efforts. Potential areas for conservation often include upland contiguous forest tracts; rare, threatened, or endangered species habitat; recharge areas; agricultural or historic preservation sites; steep slopes; etc. Field assessments can be targeted to specific areas through mapping tools such as those provided by the New York Open Space Conservation Plan and the New York Natural Heritage Program (NHP). NHP manages a database of information about the location of habitat for rare, threatened and endangered species, and provides information on field techniques. The New York Flora Association also maintains a New York Flora Atlas, which provides information on the distribution of plants, habitat specifics, and taxonomy.

- *Neighborhood Source Assessments*

Neighborhood Source Assessments are used to evaluate residential areas to determine which areas convey substantial amounts of stormwater pollutants directly into receiving waters or to stormwater conveyance systems. Businesses, residents, and landowners in these areas can then be targeted for

education and outreach programs (e.g., pet waste, lawn care practices, buffer management, and storm drain stenciling) and onsite retrofits (e.g., downspout disconnection, rain gardens). These assessments can also be used to include local homeowner associations as partners in the watershed planning process, as well as to check on the maintenance status of residential stormwater practices. *The Unified Subwatershed and Site Reconnaissance* (Wright et al., 2004) outlines a protocol for assessing neighborhoods. *The Home-A-Syst Assessment* by Cornell Cooperative Extension provides tools for evaluating homes and property for pollution and health risks.

- *Hotspot Source Investigations*

These investigations are useful for confirming which commercial, industrial, and municipal facilities are significant sources of stormwater contaminants in the subwatershed. This involves assessing the outdoor storage, waste management, vehicle maintenance, and other pollutant generating behaviors at typical hotspot locations. This investigation can help tailor pollution prevention plans and help target areas for pollution source control education. *The Unified Subwatershed and Site Reconnaissance* (Wright et al, 2004) outlines a protocol for assessing hotspots.

- *Farm Assessments for Water Resource Protection*

Farm assessments can be used to locate potential water quality degradation areas and help create an action plan to remediate problems. Through the 5-tiered approach of Agricultural Environmental Management (AEM), the New York State Department of Agriculture and Markets and local soil and water conservation districts provide assistance to farmers by surveying current farm activities and identifying potential environmental concerns. Farmers are then able to prioritize concerns and work with resource professionals to develop possible strategies and solutions and implement best management practices. Cornell University Cooperative Extension also provides assistance in farm assessments.

- *Stormwater Retrofit Inventory*

Stormwater retrofits help communities meet pollutant load reduction goals, improve flood attenuation, or increase infiltration. Retrofit inventories identify opportunities to provide stormwater treatment in developed areas where practices previously did not exist or are ineffective. Typical sites that may be investigated for possible retrofit projects include culverts, storm drain outfalls, highway rights-of-way, open spaces, parking lots, and existing detention ponds. Sites can often be identified through stream, neighborhood,



Stormwater retrofit inventory



Stormwater treatment installation

and hotspot assessments, or sometimes through the use of aerial photography. This investigation is also useful in creating an inventory of existing structures that can be used to update mapping information.

- *Septic System Assessments*

Septic system assessments can identify problem areas where there may be septic system failure. The New York Onsite Wastewater Treatment Training Network (OTN) has developed the *Uniform Inspection Documentation Form* and provides training in conducting septic system inspections. Cornell Cooperative Extension provides assessment tools for determining pollution risks in association with small water systems.

- *Source Water Assessments*

Source water assessments are used to evaluate basic information about drinking water supplies. These assessments will help the community identify where their drinking water comes from and what contaminants could threaten their water supply. NYS Department of Health has an ongoing Source Water Assessment Program that focuses assessments on all public water supplies. Local assessments can be conducted to produce a comprehensive source water protection plan.

For more information on the above watershed assessments, go to: www.nyswaterfronts.com

When conducting assessments it is beneficial to keep in mind some key questions:

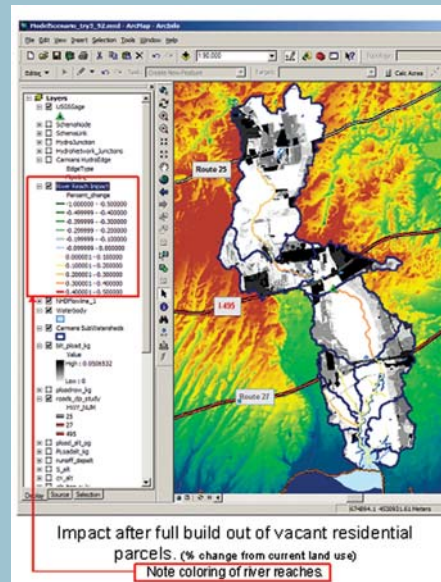
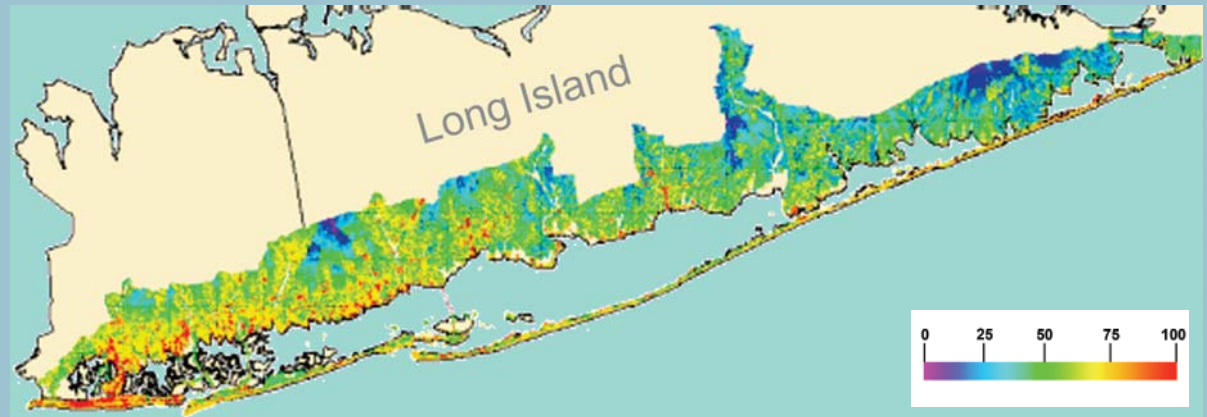
- What changes in pervious or impervious cover will affect water quality?
- Where would you expect impairments to be located?
- What types of improvement projects will help maintain or improve water quality? How can impacts be reduced?
- How can you maintain or increase the number (or acreage) of conservation areas that provide water quality benefits?
- What are the main human uses for these resources? How have they changed over time?
- What level of protection does this resource have? Is it publicly owned or owned by a conservation group? Is it protected by government regulation?
- Who in the community is knowledgeable about the natural areas in your watershed?

Nonpoint Pollution Runoff Potential Model

As part of the development of the Long Island South Shore Estuary Reserve comprehensive management plan, the Department of State Division of Coastal Resources developed a nonpoint source pollution runoff potential model. This GIS-based model factors in land cover, elevation, soils, and distance to surface waters and graphically depicts the relative risk of pollution to nearby surface waters.

The model has been useful in prioritizing stormwater retrofit projects in the Reserve and has been incorporated into stormwater discharge identification and mitigation plans for the towns of Islip, Oyster Bay, and Babylon. The model has also been applied in the Lake George watershed.

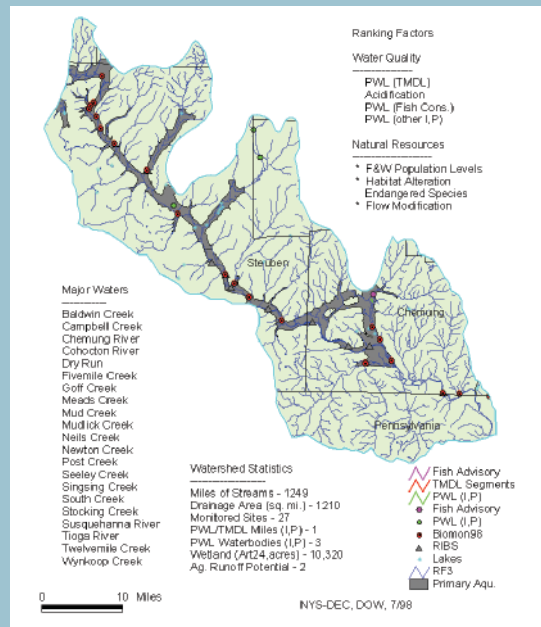
Through a partnership with SUNY College of Environmental Science and Forestry (ESF), the Division further developed a pilot dynamic nonpoint pollution interactive model for the Carmans River watershed on the south shore of Long Island. ESF delineated the watershed, developed a database of hydrologic data, and wrote additional code to implement the model. The model can help decision makers evaluate storm intensity, pollutant loading, development in a watershed, and the potential effects of mitigation. (www.nyswaterfronts.com)



Coastal development in Long Island

Case Study: Susquehanna River Watershed

Jim Curatolo, Watershed Coordinator for the Upper Susquehanna Coalition, identifies two key components in developing management opportunities within a watershed. One is to have a point person that develops and provides the link between and among a network of interested and involved citizens throughout the watershed and a network of interested governmental agencies. The second is having access to a Geographic Information System (GIS).



Jim, who coordinated the efforts of the Upper Susquehanna Coalition with a broad network of local citizens and local government agencies, sees GIS as a valuable tool for mobilizing activities, pushing projects forward, advocating for funds, and implementing projects throughout the watershed's 15 counties. Working with area farmers, best management practices were implemented on local farms, reducing nutrient and sediment loads to the Susquehanna River and its tributaries.

To address chronic flooding within the watershed and the associated problems of erosion, habitat loss, and water quality degradation, the Coalition used GIS to gather information about the watershed, track changes over time, and locate potential wetland creation and restoration opportunities. By storing flood waters, wetlands provide for groundwater recharge and slow runoff during storm events.

The resulting wetlands program focuses on creating and restoring wetlands in key locations throughout the watershed. The wetlands provide flood attenuation and improve habitat, water quality, and recreational opportunities. The wetlands program has been successful in completing many projects, including a 40-acre wetland complex in the Seeley Creek watershed among the over 400 acres already constructed. These wetland creation projects also enhance in-stream habitat in the Susquehanna River's tributaries by helping to dampen high velocity stream flows that tend to erode streambanks.

The Upper Susquehanna Coalition has also been instrumental in developing several watershed management plans. As headwaters of the Susquehanna River and the Chesapeake Bay, watershed management in the Catonk and Seeley Creeks benefit downstream water quality beyond their own watersheds. Both plans represent a strategic process to managing flooding, habitat degradation, and streambank erosion. With prioritized projects and opportunities for restoration and protection, these plans not only address water quality within the Catonk and Seeley Creek watersheds, but address issues that are important for the entire Chesapeake Bay.



- What value does the community place on these resources? Is there a community stewardship program?
- What types of education programs can be initiated to address nonpoint sources of pollution in residential neighborhoods and agricultural communities?

Here are a few things to consider when conducting field assessments:

- You may want to consider the time of year you conduct your assessments. Summer leaf out may make walking difficult, but plant identification is often easier. Snow cover often makes residential and natural area assessments difficult, as it becomes difficult to assess lawn care conditions or to determine soil suitability. Snow melt, however, may show polluted runoff - particularly from salt and other de-icing chemical applications. Identifying which outfalls may be discharging pollution may be easier to detect during dry weather conditions.
- While some field assessments should be left to professionals, there are many that can be conducted by trained staff and volunteers. Make sure that those conducting field assessments have been trained to do so. A training field day may be helpful for volunteers to practice conducting

assessments and filling out data sheets. Training field days are also a good time for staff members or trainers to answer any questions that volunteers may have prior to conducting assessments.

- When heading out to the field it is important to be as well prepared as possible. Prior to conducting assessments, make sure you prepare field maps including recent aerial photography, topography, hydrology, and road maps. Prepare an itinerary. Identify where you will conduct your assessment, how you will get there, and what supplies you will need. Make sure to notify property owners that you will be conducting assessments in the area. They can often direct you to problem areas and provide a historical context to local watershed conditions.
- While data sheets can be very detailed and highlight all the information you will need to gather, there is no substitute for photographs. Consider taking a digital camera with you to document present conditions. Log all the photos you take. Include the date, time, and location and identify which data sheet the photo complements. A GPS (Global Positioning System) unit is also very helpful in identifying locations, photographs, and datasheets. The coordinates derived from the GPS unit will allow you to visit the exact same location from year to year.

- Watershed assessments present a unique opportunity to conduct outreach and meet residents of the watershed. Informally interview residents, business owners, and farmers to introduce them to the watershed planning process and to hear their concerns or ideas. Assessments are also useful in identifying watershed partners (i.e., schools, community associations, interested farmers) that should be included in the planning process and that can be key to implementation.

- Remember to always work in teams - there is always safety in numbers. Establish safety protocols and keep a cell phone handy - preferably in a waterproof container. Always be aware of private property boundaries. Limit disturbance to vegetation and habitat. If you have more than one team in the field working at different locations, be sure to meet up at the end of each day to 'debrief.' This provides quality control as well as an opportunity to share findings among team members.

Once assessments have been completed, you should have a good idea of the problems and threats that your watershed is facing and where there are opportunities for specific improvements. (Table 4.3) You will develop these issues and opportunities further as you pull together your watershed plan.

Table 4.3 Opportunities for Water Quality Improvement

<p>Aquatic Assessments</p>	<ul style="list-style-type: none"> • Stream repair - bank stabilization, day-lighting, natural channel design, de-channelization • Outfall, sewer, or culvert maintenance and repairs • Potential stormwater retrofit • Discharge prevention; illicit discharge detection • Buffer restoration - reforestation, invasive management • Stream cleanups; dumping prevention • Fish barrier removal • Exclusionary fencing/alternative water source • Enforcement actions • Wetland protection and land acquisition projects • Wetland restoration candidates • Source water protection • Good housekeeping BMPs
<p>Upland Assessments</p>	<ul style="list-style-type: none"> • Inspection and maintenance tracking database • On-site septic upgrades • Downspout disconnection - rain barrels and rain gardens • Lawn care education • Pet waste signage and storm drain stenciling • Neighborhood stormwater practice maintenance • Buffer management • Stormwater retrofits and management • Pollution Prevention Plan - secondary containment, covered outdoor storage; improved vehicle operations • Nutrient management plans • Farm BMP application • Soil reclamation • Urban reforestation • Tree planting

CHAPTER FIVE: CRAFTING THE WATERSHED PLAN

Now that you have a thorough understanding of your watershed, it is time to pull all the information together into a cohesive watershed plan. In this chapter, we will work through the following steps:

- Refining watershed goals
- Crafting the watershed plan
- Identifying watershed management recommendations
- Developing your recommendations and preparing an implementation strategy
- Requesting review and comments

Refining watershed goals

By now you have developed a vision and a set of watershed goals to protect and restore water quality, build community support for watershed planning, and established partnerships to develop a watershed plan. You have also characterized your watershed, conducted field assessments to understand existing conditions, completed assessments of local programs and practices in order to identify the changes needed to better control activities causing pollution, and heard from the community about their concerns for the watershed.

Until now your vision has been based upon your initial understanding of your watershed. Now that you have taken a closer look around, you can re-evaluate your vision, give it a “reality check”, and make any appropriate changes. When refining your vision and initial watershed goals, ask yourself a few questions:

- What have you learned about how you can fulfill your vision and achieve your goals?
- What are the obstacles to your vision and goals?
- Have you discovered more opportunities than you originally thought?
- Are your ideas still sound?

Crafting the watershed plan

Now it is time to focus on putting your watershed plan together. In your watershed plan you explain the purpose of your planning efforts, present your understanding of the watershed, lay out your vision for its future, and outline how, over time, your community will achieve its vision.

A watershed plan should be:

- **Realistic** - it should indicate what is possible given available or potential resources

- **Comprehensive** - it should address fully the range of conditions that affect the quality of water and the quality of life within the watershed
- **Specific** - it should target and address the distinct needs of different parts of your watershed
- **Coordinated** - it should be integrated with other planning tools, including comprehensive plans and Phase II requirements
- **Partnership-based** - it should bring public and private interests together in a combined effort to address issues and opportunities
- **Citizen-focused** - it should enjoy broad community support
- **Understandable** - it should be easy to read and understand
- **Solution-specific** - it should identify community issues and directly propose solutions which will remedy or address these issues
- **Timely** - it should be updated when necessary to reflect changing conditions and changing community perceptions



Lake George



Democrat Point, Long Island

Your watershed plan should be well organized and easy to navigate. It should include prioritized recommendations such as capital improvements to correct existing impairments and the revision of local controls to prevent future impacts to water quality. Recommendations should be keyed to a watershed map showing specific project locations. Photographs can often improve the visual presentation of a watershed plan by providing the reader with specific examples of problem areas and threats and potential areas for protection and restoration. Watershed plans generally include six main sections:

- *Executive Summary*

The executive summary presents the key points of the watershed plan. Here, you provide a brief overview of the purpose of the watershed plan and who was involved in the planning process. The executive summary is also where you highlight your vision, the main findings, the list of watershed goals, and your recommendations. The executive summary is important as it provides a quick, concise, and clear reference for the entire document.

- *Introduction*

The introduction should describe the watershed plan and allow the reader to get a basic understanding of the planning

process. An overview of the watershed - where it is located, general facts about the watershed and the communities that lie within its boundaries, and general demographics of the watershed - will give the reader an understanding of the watershed and why watershed planning is important. It will also be useful to explain the methodologies used to prepare the plan. You will identify the partners involved in the planning process and how they contributed. Finally, you will want to discuss the watershed vision - what it means to the community and how it will shape the future of the watershed.

- *Characterization*

This section will build on your watershed characterization developed in Chapter 3 of the Guidebook. It will provide an inventory and analysis that describes the current state of the watershed. This section delineates the watershed and subwatershed boundaries and describes its waterbodies. It will describe the physical and biological characteristics of the watershed, including how the watershed functions, explain existing land use and land cover patterns, and identify trends within the watershed. The characterization should also include an identification of sensitive resource areas, water quality issues, pollutants, and corresponding activities impacting water

resources. Another important aspect of the characterization is the assessment of the programs and practices in place for controlling pollution. It will be helpful to describe the assessment process used and discuss the gaps found during the assessment. The characterization is the basis for the development of watershed management recommendations.

- *Watershed Management Recommendations*

This section will explain how water quality will be protected and restored within your watershed through a series of projects and actions developed to correct existing impairments and prevent future impacts to water quality. You should explain how you arrived at these specific recommendations and include a discussion of the assessments conducted which support the recommendations. While recommendations should be supported by data, consider moving extensive technical information into an appendix or supplemental report.

- *Implementation Strategy*

This section will set the stage for implementation by identifying the actions needed to address the problems and opportunities in your watershed. It will set out an implementation schedule, lay out

priorities, establish realistic expectations for partner involvement, and outline budget needs.

- *Monitoring and Tracking*

This section will outline a proposed long-term monitoring plan, describe indicators and performance criteria for monitoring restoration projects, establish milestones and tracking mechanisms to evaluate progress over time, and propose mechanisms for reporting progress and updating the watershed plan. Creating a plan for observing changes in water quality will help you understand how well certain practices work and how to adapt your plan to continue to provide water quality improvement. Monitoring and tracking will be discussed in more detail in Chapter 6.

Using this structure will create the framework for a successful watershed plan.

Identifying watershed management recommendations

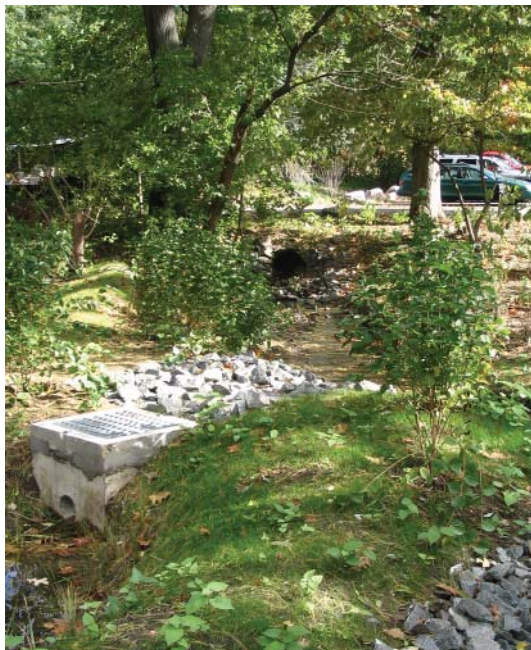
You have already characterized your watershed and undertaken assessments that have identified problems, impairments and threats that your watershed is facing and where there are opportunities for specific improvements. As you craft your watershed plan you will need to develop watershed management



Esopus Meadows, Hudson River



East River, New York City



Stormwater treatment, Westchester



Six Mile Creek restoration, Caroline

recommendations to achieve your goals.

Watershed recommendations are generally broken down into two categories:

- Regulatory and programmatic actions - includes recommended changes to local laws and programs identified during the municipal and field assessments. Examples include adopting a stream buffer or stormwater ordinance, updating development standards to promote better site design, hiring a watershed coordinator, or enhancing a municipal street sweeping program.
- Restoration and protection projects - includes land acquisition, structural activities such as stream restoration or stormwater retrofits, and educational programs such as storm drain stencils that are implemented on-the-ground and are identified during field assessments.

As you begin to develop recommendations, use existing data and the information collected while preparing your watershed characterization and assessments to help you frame your recommendations. These assessments will help you develop specific management recommendations based on existing problems. Aquatic corridor assessments might lead you to identifying areas needing streambank stabilization, flood control management, or barrier mitigation. Similarly, upland assessments might lead you to identifying areas in need of buffer restoration, agricultural best management

practice education, or stormwater retrofits.

Think about what the problems are, where they are located, and what on-the ground project or regulatory action can help reduce adverse impacts to the watershed. It is often helpful to organize recommendations into watershed-wide and subwatershed recommendations.

Watershed-wide recommendations will include broad-reaching recommendations for the entire watershed. These recommendations may include building capacity of the watershed organization; adopting local laws for environmental protection; or creating a monitoring and project tracking system.

Subwatershed recommendations are site specific. Subwatershed recommendations can include implementing streambank stabilization on a specific creek; installing stormwater retrofits on a specific road; or performing further stream assessments at specific locations. The subwatershed scale offers a variety of water quality and management opportunities. Take a close look at your subwatersheds to help focus and prioritize your recommendations. By doing this, you can tailor recommendations to specific problem areas.

You may want to develop management recommendations that focus on a particular pollutant, such as nitrogen. In this case, all activities generating that particular pollutant may need to be better controlled. Alternatively,

recommendations may focus on a single activity known to be the most significant source of a pollutant. For example, road runoff might be a significant source of pathogens to a lake, or failing septic systems might be the most significant source to that lake.

When developing your recommendations, keep in mind that it may take more than one approach, project, or action to fully address a particular problem. Remember to cover all your bases and look at the problem from all angles. Each recommendation does not have to meet all your watershed goals, but collectively they should. Involve the public when deciding which alternative is best for your community. This will help build support for your project.

When generating a list of potential recommendations, consider:

- the water quality, quantity, and related infrastructure such as outfalls and other conveyances
- the sources and extent of pollution and the various types of pollutants
- uses and activities impaired by pollution
- local nonpoint source pollution management programs and practices

- existing institutional arrangements of local, state and federal agencies, and roles of regional planning boards and non-governmental groups in protecting water quality
- existing land and water use laws, including zoning, site plan review, harbor management, erosion and sediment control, and wetlands and watercourse laws to see if they deal with water quality issues
- key resources warranting special protection or restoration

Your recommendations should be well justified and include a summary of supporting data compiled for the watershed characterization. Data should include information on water quality, land use or natural resources, as well as a discussion of current problems and future threats. Recommendations should also include maps and photographs showing project locations and conditions.

Developing recommendations and preparing an implementation strategy

Having a list of recommended on-the-ground projects and regulatory and programmatic actions is a good start to implementation. Now you need to take these further. Preparing an



Watershed-Based Stormwater Management on Eastern Long Island

The Suffolk County Department of Health Services is implementing stormwater management plans in four pilot watersheds on eastern Long Island to address runoff from farms, villages, and commercial properties. The project involves identifying potential stormwater retrofits in each watershed and developing a ranking system to identify the top sites for priority construction. Factors considered in the ranking system include the potential reductions in nitrogen and bacterial loading, construction cost, land ownership, permitting constraints, construction and maintenance access, maintenance burden, habitat potential, and supplemental public benefit (e.g., educational opportunity). Project sites were scored and ranked to develop a “short list” of projects for immediate implementation. This ranking will be used to focus funding for stormwater retrofits over the next several years. (www.co.suffolk.ny.us/)



Black River, Tug Hill



Lake Ontario beach and dunes

implementation strategy will help you develop your ideas and allow you to set out a systematic plan for putting your recommendations into action.

Most communities will not be able to implement all the recommended actions or projects simultaneously due to staffing, funding, and time constraints. When it comes to an implementation strategy, prioritizing your recommendations will help you decide which projects to tackle first.

When prioritizing recommendations you may want to use some ranking factors to compare your projects and actions. It may also be helpful to prioritize your on-the-ground projects and your regulatory actions separately.

Some potential ranking factors include:

- Watershed goals - Will the project address watershed goals, and how many?
- Subwatershed priority - Does the project lie within a priority subwatershed?
- Vulnerability - Is the project area likely to be developed or impacted in the near future?
- Pollutant reduction - How much pollutant reduction will be achieved?
- Habitat value - Will the project improve, conserve, create, or enhance wildlife habitat?

- Cost - What is the overall cost, including planning, design, and implementation?
- Permitting - What permits or approvals are needed? What is the time period for permit issuance?
- Maintenance - What are the maintenance requirements? Is special equipment needed?
- Land owner cooperation - Are landowners in support of the project? Are they willing to provide necessary easements?
- Project integration - How well can this project be integrated with other initiatives and projects to gain maximum benefits?
- Access - How difficult is access to the project site? Will steep slopes, soils, or other barriers limit access?
- Innovation - Does the project involve a practice that has not yet been implemented in the community? Can the project be used as a demonstration site?
- Partner involvement - How many partners will need to be involved in project implementation?
- Public visibility - Will the project be in the public eye? Will the community be able to learn more about water quality and watershed planning from the project?

Case Study: Lake George Watershed

The Lake George Watershed Coalition - comprised of municipalities, non-governmental organizations, county and state agencies, and citizens interested in preserving the beauty and health of Lake George - developed a plan to manage the Lake George watershed titled *Lake George - Planning for the Future*. With the number of diverse groups involved, it was essential to gain consensus on the issues affecting Lake George.

During the watershed planning process, the Lake George Watershed Coalition acknowledged the need to address four key actions in order to develop and implement a successful watershed plan. These included:

- *Providing staff* for the development and implementation of the plan;
- *Reviewing previous studies* relating to water quality issues and land use;
- *Establishing a report card* of successes and status of implementation within the watershed; and
- *Developing public participation* during plan development and implementation.

Addressing these key actions early on in the planning process resulted in a document that reflects consensus and includes comprehensive recommendations to address nonpoint source pollution, a major concern in the watershed and a priority recommendation in *Planning for the Future*. Since the completion of the plan in 2001, twenty-five stormwater management projects have been completed which together eliminate and/or treat over 250,000 gallons of runoff per day.

The Lake George Watershed Coalition also recognizes the importance of water quality monitoring. Biweekly samples are collected and analyzed to track the rapid changes that occur in water quality during the spring. Monitoring is conducted at 12 sites throughout Lake George, which allows planners, scientists, and citizens to track the health of the lake and determine the effectiveness of water quality improvement projects.

Public outreach and education is another priority identified in *Planning for the Future*. The Coalition supports a number of public outreach programs including an interactive web site and cable television programs that highlight water quality issues and invasive species such as zebra mussels and Eurasian watermilfoil.



Volunteer sampling

The Dutchess County Better Site Design Roundtable

By reviewing the development codes of the Towns of Wappinger and Clinton, the Dutchess County Environmental Management Council determined the extent to which Better Site Design principles could be applied in each community. Better Site Design principles aim to reduce impacts from traditional types of development and use innovative design techniques to maintain natural resources on a site. During the review process, the Dutchess County Environmental Management Council hosted a Better Site Design workshop and roundtable in April 2005 to discuss options that could be employed in the Hudson River Watershed. The results of the development codes review and the workshop have been used to kickoff a county wide roundtable process to revise existing codes and ordinances that will promote environmentally friendly development.



Wappingers Falls

Once you have generated a list of priority recommendations, you now have to think about how you will begin to implement them. You will need to ask yourself:

- Who will be involved in implementation?
- What permits will be needed if it is a construction project?
- What funding sources are available to help support the project?
- How much time will it take? Will you need to phase the project? How long will the review process take?

Presenting your recommendations clearly in your watershed plan will help you answer some of these questions and allow potential partners and funding agencies to determine whether the time and assistance they provide will be well spent. Placing brief descriptions of projects and other actions in a table will clearly show the priority of projects and how you expect to implement them.

The implementation strategy does not have to be very detailed. As more information on individual projects is gained, budgets evolve and your experience grows, the implementation strategy can be updated. The elements of an implementation strategy include:

- *Watershed goal(s) targeted* - reference specific watershed goal(s) and objective(s) to be addressed
- *Target area* - identify whether each set of recommendations targets the whole watershed, a specific subwatershed, a specific pollution generating activity, a municipal jurisdiction, or other defined area, such as a stream corridor
- *Project leader/Other involved organizations* - identify which partners will take the lead on implementation and which ones will assist on the project
- *Potential funding sources* - determine agencies/organizations that could provide grant funding for specific projects and other actions
- *Cost* - provide cost estimates for both capital improvement projects and regulatory or programmatic changes. Also include costs for project monitoring
- *Implementation timing/Schedule* - consider the need for phasing by pollution-generating activity or by subwatersheds and estimate when the implementation of specific projects and other actions should take place

Table 5.1 shows an example of an implementation strategy.

Table 5.1 Sample Watershed Implementation Strategy								
Management Recommendation	Goal	Target Sub-watershed	Project Leader* & other involved organizations	Potential Funding Sources	Potential Cost†	Implementation Timing		
						1 year	2-5 years	5+ years
Build capacity of watershed organization and coordinator	1, 2, 4, 5	All	Watershed Task Force* SWCD, County Planning Dept., Town A, Town B	NYS DOS, NYS DEC, EPA	\$15,000	X		
Adopt local laws for environmental protection	10, 13, 14	All	Town A*, Town B*, NYS DOS, Regional Planning Council	NYS DOS	\$20,000- \$60,000	X		
Implement priority stream restoration	7, 10	A, C, E	Watershed Task Force*, NYS DEC, SWCD, Town B,	NYS DEC; Hudson River Estuary Program	\$260,000		X	
Install priority stormwater retrofit	11, 12	B, D, E	SWCD*, Watershed Task Force, Town A, NYS DOS, NYS DEC	NYS DEC; NYS DOS; NYS DOT	\$350,000		X	
Illicit discharge detection and elimination	11	C, E, F	Watershed Task Force*, Town B, County DOH	NYS DEC, NYS DOH, EPA	\$7,200	X		
Monitoring and project tracking	2, 3	All	Watershed Task Force*, NYS DEC, USGS			X	X	X

† Potential costs are for illustrative purposes only * Denotes project leader



Agriculture, Susquehanna River Watershed



Clarks Gully, Italy

It will also be helpful to think about which recommendations can be implemented in the short, mid, and long-terms. This will help you prioritize your projects and plan for implementation. Examples of short to long-term recommendations include:

Short-term (years 1 and 2)

- Identify/hire a watershed coordinator
- Establish conservation easements to protect remaining sensitive habitats
- Implement easy demonstration projects (stream buffer plantings, rain gardens, stream cleanups) and begin permitting and design process for top priority projects
- Initiate enforcement and critical maintenance activities (i.e., illicit discharges and culvert cleanouts to alleviate flooding)

Mid-term (years 2 - 4)

- Update local land use laws or ordinances to protect stream buffers, encourage conservation design, improve stormwater treatment, and provide erosion control
- Build on or create an education program to target specific pollutants and behaviors of concern

- Implement top three stream restoration and stormwater retrofit projects
- Prepare and submit grant applications for special studies (i.e., greenway planning, septic system surveys, hydrologic modeling)

Long-term (years 5 and beyond)

- Identify sources of funding for long-term implementation
- Establish monitoring and tracking program
- Conduct special studies
- Report progress and update the watershed plan

Keep in mind that the first project that you implement may not be ranked as the highest priority. It will usually be one that can be achieved quickly, with positive and visible results.

Requesting review and comment

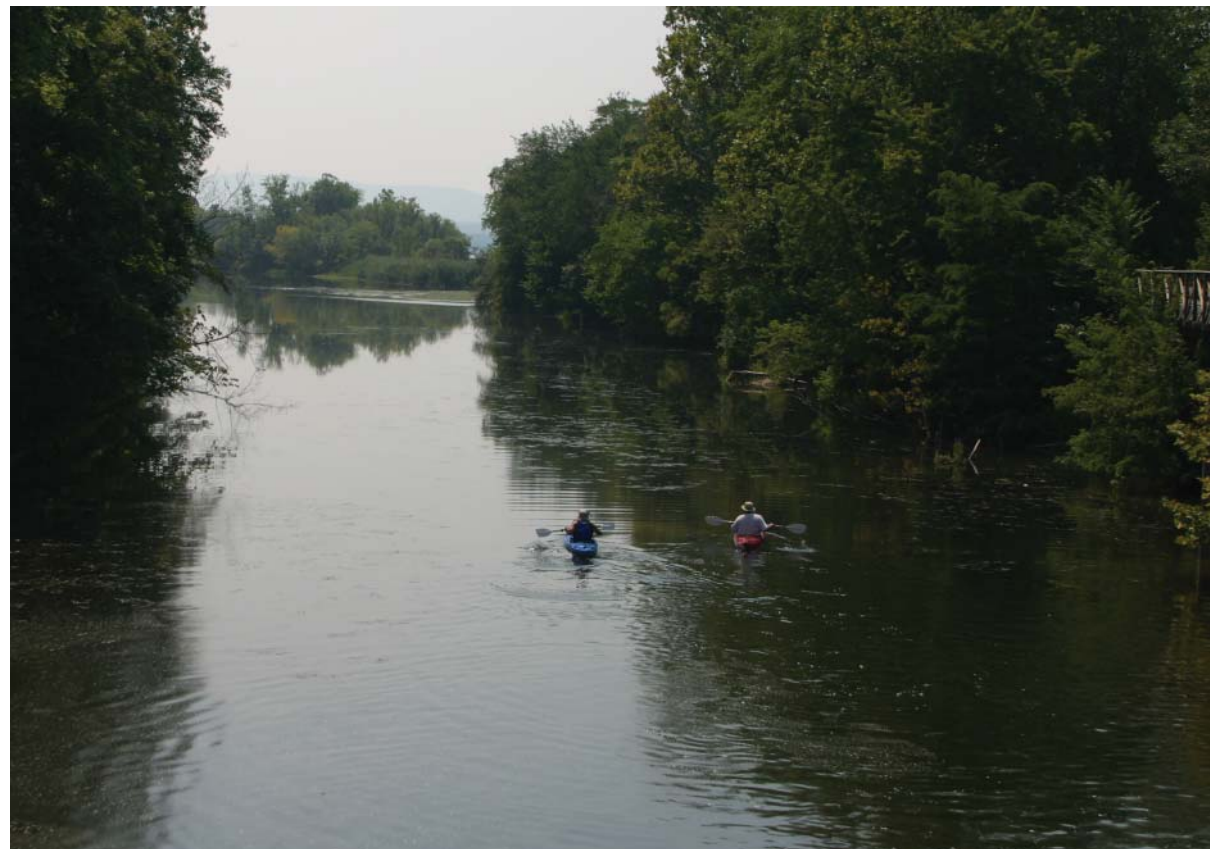
Once you have prepared a draft watershed plan, it is important to send the draft to your partners for review and comment. You should also provide the public a chance to review the plan and provide comments. One way to do this is to conduct a public meeting where you can provide partners and the community with an overview

of the document and explain what types of comments you may be looking for. You may want to consider making the draft available to people electronically. Having the plan available on a website or on CDs may allow you to reach a broader audience and may save you money by reducing the number of paper copies needed. Make sure to give people enough time to fully review the document; typically, a month is an adequate amount of time.

Below is a list of agencies and organizations that may provide a critical review of your plan:

- NYS DOS Division of Coastal Resources
- NYS DEC Division of Water
- NYS Department of Health
- NYS Department of Agriculture and Markets
- County Soil and Water Conservation District
- County Health Department or Environmental Agency
- County Water Quality Coordinating Committee
- County Planning Department
- Regional Planning Agency
- Municipal Water Supplier or Water Authority (District)

Remember, the goal of the public review is to gain input from the community and from those that can help with implementation. Public review will also help attain overall support for the plan and identify or resolve any issues that may arise. Once comments are addressed, you can finalize your watershed plan.



Fishkill Creek, Beacon



Bronx River volunteers and staff assess restoration potential

CHAPTER SIX: PUTTING YOUR PLAN INTO ACTION

Now that you have formalized a plan and strategy to protect and restore your watershed, it is time to implement your vision. Your success will depend on how you organize your community and manage the implementation of the various projects that will fulfill your vision. In this chapter, we will work through the following steps:

- Ensuring success - organizing for implementation
- Moving forward with capital improvement projects
- Strengthening municipal controls on development
- Strengthening local watershed practices
- Continuing public outreach and education
- Measuring success - tracking implementation and monitoring performance
- Making revisions and updates

Ensuring success - organizing for implementation

Completing a plan for your watershed often generates a feeling of closure for the community and on the part of those involved in the planning work. But if your plan is going to protect and

restore your watershed it must be used. One way to help ensure success is to establish the right organization to implement the plan.

Early in the development of a watershed plan most communities establish some sort of coordinating and oversight committee, often known as the watershed advisory committee. If you established a committee to guide you through the planning process, you should think about using this committee to oversee implementation of the plan. The committee structure is already in place, partnerships will have already been developed, and everyone is aware of what needs to be done to make the watershed vision a reality. If you don't have a committee, then now is the time to ask if one would be helpful. Advice on how to establish an oversight committee can be found in Chapter 2.

If you have a committee in place, this is a good time to re-evaluate who is on the committee. Do you still have the key stakeholders involved? Are there other individuals or groups that should be involved now that you are focused on implementation? You may want to broaden the membership and consider creating sub-committees focused on particular topics or projects. Remember, it is important to recruit the "movers and shakers" for the committee - the people who others listen to, and who have the experience, personal connections, and resources to make things happen.

The committee will be responsible for overall management and coordination of the watershed plan and implementation of its policies and projects. The committee's tasks will likely include:

- advising the local government on implementation, priorities, work assignments, timetables, and budgetary requirements of the watershed plan
- seeking funding from State, federal, or other sources to finance projects to implement the watershed plan
- coordinating with other committees, such as the Planning Board, Zoning Board and Conservation Advisory Commission, and other nonprofit organizations and community groups to implement the watershed plan
- ongoing monitoring of the watershed plan and its procedures by developing measurable performance indicators to review the plan's overall success

In some communities the development of the plan may have been handled by an existing board, such as the Planning Board or a Conservation Advisory Commission, or by assigning the responsibility for coordinating the implementation of the plan to existing staff, such as in the Planning Department, Community Development or Natural Resources Department. Now is the time to see if this arrangement still



Carmans River, Brookhaven



Saltmarsh, Orient

works. Do you have the staff and expertise to implement your projects? If you need more help, consider identifying or hiring a watershed coordinator or a consultant to advance your projects.

A watershed coordinator can help a community by providing direction and organization for the implementation of watershed projects. This full or part-time position focuses on achieving the watershed vision. This person will be responsible for managing, directing, and coordinating all aspects of the implementation of a plan and its projects, making sure that all aspects of a project - from planning, grant writing and administration, design, permits, environmental review and construction - are completed in an appropriate and timely fashion. A watershed coordinator can oversee all contractors and consultants, and also makes sure that all stakeholders and partners are kept up to date and involved in the project.

The watershed coordinator should be able to:

- coordinate with agencies, partners and volunteers
- convene and provide support for meetings of the intermunicipal organization, including the preparation of agendas and provision of supporting material to members
- help establish and provide support for sub-committees

- manage and track implementation of plan recommendations
- assist in securing resources (e.g., technical resources, supplies and equipment) and funding (e.g., identify cost-sharing opportunities) for implementation
- administer stewardship and ongoing public education efforts
- monitor trends in the watershed
- oversee revisions and updates to the watershed plan

Moving forward with capital improvement projects

Project planning

Each project identified in your plan will likely require additional planning, feasibility analysis, engineering, design and consultation before it can be implemented or constructed. Because you have already done some initial planning as to how and when your projects should be implemented, you might be tempted to rush into action. However, before you act, you need to formulate a carefully considered game plan for each project. Take the time to discuss and plan your approach with your partners. This will not only avoid costly mistakes, but it will strengthen consensus and support for your project.

When you are planning and designing your project:

- Consider the tasks to be performed, the people involved, and their responsibilities.
- Determine whether permits are needed for your project. Permits may be needed for projects that involve wetland restoration or creation, forest conservation, stream crossings, streambank stabilization, etc. When working in or near waterbodies and wetlands, arrange a pre-application field meeting with appropriate regulatory staff (e.g., NYS DEC Regional Office, USACOE) to get input on permitting requirements and other issues that may need to be incorporated into the final design.
- Make sure your final construction documents are complete - the final designs should include everything needed to initiate the project, including plans certified by a licensed professional engineer, specifications, and cost estimates.
- Find out whether easements are needed for access and maintenance - all necessary easements and maintenance agreements should be secured prior to breaking ground.
- Consider vegetation plans - most projects use some form of vegetation to stabilize the site and provide important restoration functions. Carefully specify how the site will

be prepared, establish limits of disturbance, decide what species and planting methods will be used, and outline how vegetation will be maintained and managed during the first few critical years after establishment.

- Keep in mind the time frame for the project - expect surprises during design and construction. The design, permitting, and review process can often take longer than expected, equipment can fail, or the weather may not cooperate. Always plan extra time and plan for these contingencies in your project schedule and budget.

Each type of project has its own unique considerations relating to design, permitting and construction. Table 6.1 summarizes common design and construction considerations associated with various types of restoration practices.

Depending on who is involved in your project, a series of facilitated workshops may be the best approach to starting a project. Bring together key stakeholders, diverse interest groups, resource experts, and others who are involved in your project. See if there are others you want to include - it is important to continue to look for ways to expand your partnerships. Remember, it might take several sessions to reach consensus on how to implement a project, and you will continually need to reevaluate it as the project advances.

When preparing to implement a project, it is a good idea to develop a brief project summary explaining how the proposed project will be implemented and how it relates to the established vision. By doing this repeatedly as projects are planned, you can anchor the vision statement in the minds of various stakeholders and help the community at large understand how each individual project is part of accomplishing the overall long-term vision for your watershed.

Project financing

One of the challenges of implementing and updating watershed plans is funding. Your implementation strategy and planning for project implementation will have outlined how to fund project implementation. Communities use many different creative funding strategies to finance projects and it is important to look to a variety of funding sources to implement your plan. Funding sources may include grants from state, federal and local agencies, foundations, legislative appropriations, fee-for-service



Hydroseeding road bank

Table 6.1 Common Design and Construction Considerations for Different Restoration Practices

Design and Construction Consideration	Restoration Practice						
	Stormwater Retrofits	Stream Repair	Riparian Reforestation	Discharge Prevention	Watershed Forestry	Source Control	Municipal Operations
Geotechnical analysis	●	◎		◎			
Structural analysis	●	◎					
404 Wetland permit application	◎	●	◎				
401 Water quality certification	◎	●					
Waterway construction permit	◎	●	◎		◎		
Construction drawings	●	●	◎		◎		
Sequence of construction	●	●	◎		◎		
Standard specifications	●	●	◎	◎	◎		
Onsite construction supervision	●	●	◎		◎		
Cut/fill estimates	●	◎					
Construction/installation windows	●	●	●		●		
Erosion and sediment control plan	●	●	◎	◎	◎		
Maintenance schedule and agreement	●	◎	◎		◎		◎
Access/maintenance easements	●	●	◎	◎	◎		
Planting plans	●	●	●		●		
Floodplain modeling	◎	◎	◎				
Sediment transport modeling		◎					
Hydrologic modeling	●	◎	◎				
Hydraulic modeling	●	◎	◎				
Dam safety analysis	◎						
Project tracking form	●	●	●	●	●	◎	◎
Cost estimates	●	●	●	●	●	●	●
Bid documents	●	●	●	◎	●	◎	◎

Source: Schueler, Kitchell, 2004 ● survey normally required for the practice ◎ survey may be required in some project situations

contracts, special events, and corporate giving. Depending on the size and scope of the project, some projects will have one designated funding source, while others will have multiple sources of support. Some projects may be fully funded at the outset, while others will be phased with only initial funding available and will require ongoing fundraising and grant writing to ensure completion. Increasingly, many communities will be called upon to develop partnerships which leverage and combine an array of public and private sector sources of funding.

Communities often rely heavily on grant assistance to complete watershed plans and projects. There are many grant programs available from federal and state government, nonprofit groups and charitable foundations that are targeted for watershed improvements. By using their own capital funds, staff costs, in-kind services and the value of community volunteers as a match for public and private grants, communities are able to leverage funding to achieve their vision for the watershed. Keep in mind that showing early success through demonstration projects will work in your favor, as it can show your ability to complete projects in a timely manner and use funding in an appropriate manner.

Grant awards are highly competitive. Your success in receiving funding will depend on your ability to convince reviewers that your project has merit, represents a well thought-out approach to protecting or restoring water quality,

and shows that you are capable of seeing the project through to completion on time and within budget.

Once you have found a grant program that might help you, identify the requirements for the grant and ensure that you are eligible or can partner with someone who is. The key to successful completion of a grant application is to be as organized as possible, and to think the project through in advance to the greatest extent possible.

When applying for grants:

- Make sure you can meet any match requirement. In most cases, the grant match will be a cash contribution, perhaps derived from municipal revenues or a private donation. Sometimes it is in the form of donated land, buildings, goods, services, or facilities rental.
- Be as organized as possible and use the guidance provided in the application to fill out the relevant forms.
- Make sure you answer all the questions, provide all the supporting information that is required, and that your budget information and schedules are realistic.



Greenport, Long Island



Tuscarora Bay, Wilson

A Watershed Organization that Passes Down the Funding

The Finger Lakes/Lake Ontario Watershed Protection Alliance (FOLLOWPA) implements a program called the Special Projects Fund, which provides small grants for projects that advance the goals of watershed management. Projects must be sponsored by a member county and collaborative projects are encouraged. FOLLOWPA funds have supported stream bank stabilization, habitat protection, invasive species management, water quality monitoring, and education and outreach projects throughout the watersheds of New York's Lake Ontario basin. For example the FOLLOWPA Special Projects program awarded \$10,000 for research focused on controlling Eurasian waterchestnut populations in the Seneca Oswego Oneida River System. (www.followpa.org)



Aquatic plant harvesting

- Graphic materials such as engineering/technical drawings, plans, maps, and photographs can help the grant reviewer understand your project, and letters of support from community groups, government agencies, and nonprofits show widespread support for your project. Double check the application instructions to make sure these materials are required and how they should be submitted.
- As you pull your application together, make sure you have all the required forms, certifications, and signatures, and make sure you follow the submission requirements.

Remember, being successful in obtaining grant assistance requires that you target the grant programs that are right for your project. No matter what the grant program, you should always make sure you are clear as to why your project is worth doing, what is involved in successfully implementing it, and what end result and benefit can be expected.

Finding out about grants and funding assistance

Opportunities for grant assistance from public and nonprofit agencies are generally distributed by direct mail or announced in press releases, newsletters, or websites. Make sure you are on these mailing lists and collect information on grant programs. Keep a calendar with grant schedules on it so that you are aware of your opportunities and deadlines. You should also talk to others who have received grants and

discuss your ideas with those who award the grants. They will probably know of additional sources of funding.

Federal grants are usually announced in the Federal Register, and state grants in the State Register and the Contract Reporter. You may want to look at the online Catalog of Federal Domestic Assistance (www.cfda.gov) gives you access to a database of all federal programs available to state and local governments; domestic public, quasi-public, and private profit and nonprofit organizations and institutions; specialized groups; and individuals. You can search this database to find grant and funding opportunities that match the requirements of your project. Another excellent source of information on all aspects of grants is the Foundation Center (www.foundationcenter.org). Its mission is to promote public understanding of philanthropy and to help grant-makers and grant-seekers succeed. The Center is a valuable resource for a wide range of information on grantsmanship and provides training on the grant-seeking process. Additional funding opportunities are provided through a number of private foundations that can be found by accessing the Environmental Grantmakers Association website (www.ega.org).

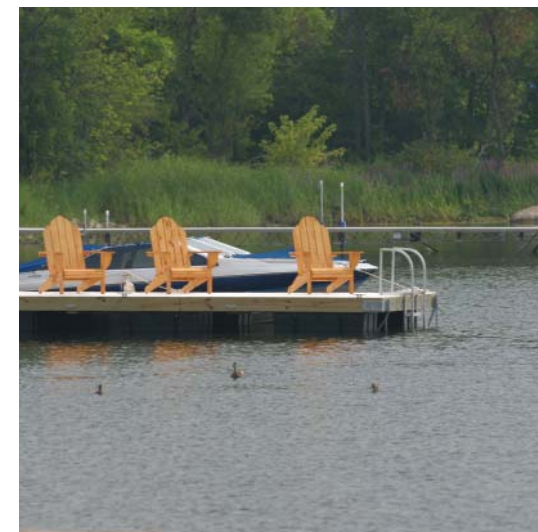
New York State offers a number of funding opportunities for local watershed organizations and municipalities. One of the first grant sources you should examine is the New York State Environmental Protection Fund. This is the State's first permanent fund dedicated to addressing a broad range of environmental needs.

The Division of Coastal Resources provides grants to municipalities through the Environmental Protection Fund's Local Waterfront Revitalization Program (www.nyswaterfronts.com/grantopps.asp). The Division can fund planning, design, feasibility studies, and construction projects that advance preparation or implementation of Local Waterfront Revitalization Programs. Any municipality located on the State's coastal waters or on a designated inland waterway is eligible, although some restrictions apply. Program details and priorities are reviewed annually. Eligible activities include preparation or implementation of watershed management plans.

The Department of Environmental Conservation administers a number of funding programs, including the Environmental Restoration Program, the Hudson River Estuary Grants Program, the Invasive Species Eradication Grant Program, the Great Lakes Protection Fund, and the Habitat/Access Funding Program. More information about environmental grants can be found on the NYS DEC website: www.dec.ny.gov

The Department of Agriculture and Markets also administers a number of funding programs that assist communities with agricultural nonpoint source abatement and control. The Agricultural Nonpoint Source Abatement and Control Program supports the Agricultural Environmental Management (AEM) Program by providing funding to conduct planning activities or implement agricultural best management practices (BMPs). Funds may be used for preventive or remedial initiatives, or both. More information about the Agricultural Nonpoint Source Abatement and Control Program can be found at: www.agmkt.state.ny.us

Federal funding is available through the EPA Watershed Initiative Program and other EPA grants programs, described on the EPA Region 2 website: www.epa.gov/Region2/grants. The USDA Natural Resources Conservation Service administers several funding programs, including the Environmental Quality Incentives Program (EQIP), to help farmers implement conservation measures; the Conservation Reserve Enhancement Program (CREP) to install conservation buffers; the Wetlands Reserve Program (WRP) to preserve, protect, and restore valuable wetlands; and the New York Farmland Protection Program, which helps purchase land rights in order to keep land in farm production. To find more information about USDA NRCS programs visit: www.nrcs.usda.gov/programs/. The NOAA Sea Grant Program, hosted by the State University of New York and Cornell University, provides grants



Lake Champlain



Braddocks Bay wetland, Lake Ontario



Invasive species



Southold vineyard

for environmental research projects as well as symposiums, meetings, and workshops. Additional information can be found at: www.seagrant.sunysb.edu.

Demonstrating early success with highly visible projects

While long-term solutions are important, it is also beneficial to implement short-term projects to “get the ball rolling.” Low cost and highly visible projects that require minor design and permitting work up front can often be used as demonstration projects. Examples include stream buffer plantings, trash cleanups, rain gardens, or installing small stormwater retrofits. Implementing these projects can:

- Build confidence for watershed planning
- Generate public support for the watershed plan and future restoration efforts
- Provide an opportunity for local volunteer participation
- Give local engineers, contractors, and others practice in project implementation
- Show early success to funders, elected officials, and others to generate future support
- Serve as pilot projects to test construction and maintenance procedures
- Improve conditions at the project site

Constructing improvements

While the way you approach each project will vary with project types - different regulations will apply and simple projects might not need to go through every step - it helps to be organized and take the implementation of a project one step at a time. Below is a typical approach you might follow on many construction projects - be they simple drainage improvements, streambank stabilization projects, or wetland restoration. Implementation of the project might be completed by municipal staff, but more often a community will hire a consulting engineer to design and manage the improvements.

Conducting a site reconnaissance

It is crucial that project participants have at least a preliminary analysis of the conditions of the site as early as possible in the project. You will likely have gathered some of this information as part of your watershed planning, but now you should make sure you update this information and complete any additional investigations needed to advance your project. The initial analysis will generally take the form of a written and illustrated report that includes the following components:

- site survey showing extent of project boundary
- identification of ownership/grant/lease status of any lands to be incorporated into the design

- soils and, as appropriate, core samplings to determine site stability
- topography and hydrology
- natural resources, including location of mature trees
- condition of manmade structures or facilities on or adjacent to the site
- above and below ground infrastructure
- environmental conditions
- access to local transportation network
- view corridors
- historic and archeological resources
- indication of any critical conditions requiring immediate stabilization or repair and including a cost estimate for the recommended work

It is especially important to understand the potential impact of the current ownership and zoning and other regulations on the proposed project. You should try to identify potential obstacles that might occur down the road.

- Who owns the project site? If it is not already in public ownership, will the current owner help facilitate or hinder the proposed project? Is it for sale or lease? If so, what are the

asking price and terms? Would the owner consider being a partner in the project? What are the current property taxes? Are back taxes owed on the property? Are there any encumbrances (mortgages, liens, easements)?

- Is the existing zoning of the site conducive for the proposed project? If not, what is involved in securing zoning and site plan approval? Will the community support the proposed project and help facilitate any regulatory approvals? Is the site a known or potential brownfield? If so, what investigations have been completed and what is known of the potential contaminants? What permits will be needed?

At this stage, the scope of work specifically does not include the preparation of plans and specifications or construction documents.

Land assembly techniques - acquiring key parcels

No matter whether a project is being implemented by the public or private sector, a common challenge to the implementation of a watershed plan is the fact that areas targeted for protection, improvements, or restoration often consist of separate parcels of privately owned property. It is often a challenge to accommodate the individual schedules and interests of the various owners and organizations to assemble the key parcels of land. In overcoming this challenge, communities have tried a number of successful approaches including:



Wetland restoration, St. Lawrence County



Streambank cleanup volunteers, LaGrange



Employing and Promoting Good Practices in Westchester County

Westchester County has implemented a number of watershed friendly programs over the last several years in an effort to meet water quality requirements and improve public awareness of water quality issues. A 2002 policy halted the use of pesticides on county lands in Westchester, and a public education campaign called the Grassroots Healthy Lawn Program encourages reducing pesticide use on private lands. In addition, storm drain stencils and markers were installed throughout the county to identify catch basins and notify people that they drain to important water resources, including drinking water supplies. An additional public education campaign called the Go Native Program promotes the use of native plants in private landscaping rather than non-native plants that require more water and nutrients. (www.westchestergov.com/SectionIndex/envdetail.asp)

- community visioning sessions which build shared agreement about how and where protection, improvements or restoration should occur - convincing property owners to sell, transfer or donate property
- acquisition of land through simple contractual negotiations for land purchase by the municipality or a nonprofit entity
- development of conservation and/or maintenance easements through federal, state, or local programs, or a nonprofit entity
- purchasing available parcels or working with local and state government agencies to negotiate a land swap, or similar deal, trading one parcel for another to accommodate needs and goals of buyer and seller
- tax and mortgage foreclosures
- eminent domain where municipal entities and certain development authorities may condemn property for a compelling public purpose or to address a health and safety threat

Conceptual or schematic design

After you have fully understood what you have to work with it is time to discuss design alternatives. Schematic designs establish the concepts and design characteristics of a project and are prepared based on the pre-design consultations and an analysis of project requirements. Preliminary cost estimates

should be prepared which can help determine the scope, cost and schedule needed for each project. Zoning and planning requirements and related permitting processes should be checked. Options may be presented and alternatives evaluated. Coordination with permitting and funding agencies is essential at this stage to ensure that your project is acceptable. It is important to document the federal, state and local permit and environmental review requirements for your project and how the requirements will be satisfied by the design. Early in the project development process, prepare a timeline incorporating as many permit approval schedules as possible. Revise it periodically as the timeline progresses. Remember that construction of a project cannot commence until the SEQRA process is complete and all required permits have been issued.

Detailed design

Design development follows as conceptual plans and schematic drawings are worked up in more detail to evaluate alternative approaches and reflect programmatic needs, technical aspects, site requirements, and materials. Site plans, elevations, landscaping plans, and plans for related infrastructure improvements are developed. Key dimensions and materials will be established. Best management practices should be identified to avoid or reduce water quality impairments from upland runoff or in-water activities. It is essential that coordination with permitting and funding agencies continues throughout this stage of design development.

Working/Contract documents

This is the most work-intensive phase of project design and involves preparation of detailed working drawings and specifications to describe the project for contractors who may bid on the construction of the project. These drawings will also be used to obtain permits, which will be needed before the project can progress to the next step.

The drawings typically include all types of construction details, such as:

- site and drainage plans
- elevations and cross-sections
- structural details
- stormwater/water infrastructure details
- landscaping

A written specification is also prepared which may include conditions of contract. Documentation is sometimes split into two stages, with minimum drawings for consent purposes followed by supplementary drawings providing the added detail required for pricing and construction.

Bidding phase

Next you will secure competitive bids to hire a contractor to build your project. If you hired one, your consultant team will assist in selecting

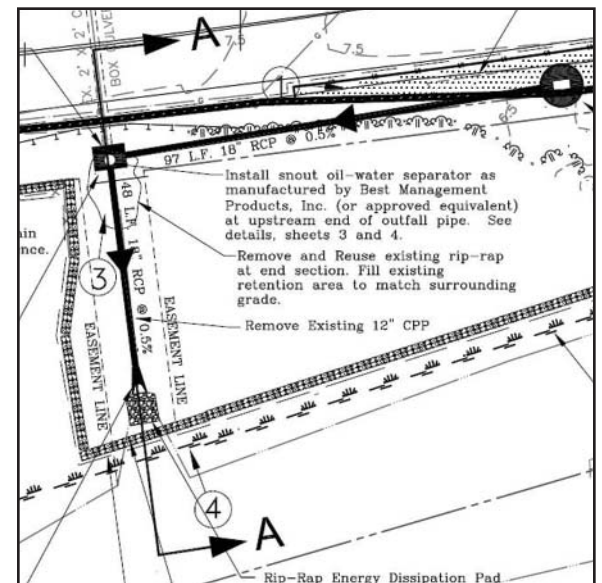
building contractors, obtaining competitive pricing, and formalizing a contract. This process is typically specified by local procurement and contracting requirements and, if grant funding has been made available, by requirements established by the funding agency.

Make sure that you advertise widely the availability of the bid package. The bid must clearly outline the scope of work; an explanation of the preferred format for bid submissions, including required forms; a process for proposing alternates; logistical information about the bidding process such as how, when, and where bids should be submitted; the type of contract that will ultimately be used; and insurance and permit requirements. Notification regarding the availability of bid packages is usually sent out to contractors the community has worked with before. Solicitation of bids is also advertised in local newspapers as well as publications such as the NYS Contract Reporter. Make sure that you follow your procurement policy as you select your contractor.

A helpful step in the bidding process may be to include a “site showing” or “site walk.” This allows potential contractors to visit the project site to get an understanding of site conditions. This is also a good time for them to ask questions about the project.



Stormwater treatment system



Stormwater conceptual design



Buffer restoration, Sheldrake River



Stormwater treatment

Construction phase

Before you begin construction it is essential that all related environmental reviews, permits, and other approvals are in place.

The consultant team can help oversee construction, administer the contract, and carry out various functions such as:

- project initiation
- scheduling
- regular site visits and meetings
- clarifying details with the builder
- monitoring construction progress and adherence to documents
- processing variations and change orders to the contract
- certifying progress claims
- final inspections and preparation of a punch list
- checking final accounts
- closing the project

For larger projects, a construction manager may be necessary. In this case, the general contractor will become involved earlier in the process, enabling them to be more involved in the design phase of the project. Using

knowledge from a capable construction manager in the design phase can reduce costs, save time later in construction, and reduce the potential for change orders.

It is important that everyone involved in the project understands their roles and responsibilities. Municipal staff also need to monitor the performance of consultants and contractors on an ongoing basis and maintain all records associated with the disbursement of municipal revenue and compliance with all grants and permits.

Ongoing management and maintenance

Completed projects need ongoing management and maintenance. For example, wetland restoration projects will need close attention to make sure the plantings survive. Implementation planning must address how a project will be managed and maintained. These responsibilities are best incorporated into a formal plan that assigns responsibilities, schedule and a budget - and this plan should be developed at an early stage in the design of your project.

Strengthening municipal controls on development

As part of developing an understanding of your watershed, outlined in Chapter 3, you will have conducted a municipal assessment of local controls that focus on addressing water quality impairments and threats. In doing this, you will have generated a list of regulatory and

programmatic recommendations to improve water quality, maintain conservation areas, and control development. Since the primary responsibility for regulating land use and development in New York State rests with local municipalities, they play a major role in addressing water quality and quantity. By strengthening local controls, municipalities can achieve water quality improvement and restoration, while promoting appropriate development in the watershed. This can be done through revisions to comprehensive plans, zoning, site plan review, subdivision regulations, and other local laws designed to protect sensitive resources.

There are a variety of tools and techniques that you can use to fill regulatory or programmatic gaps identified during municipal assessments. The following examples are specific tools communities can use to address watershed management issues to protect and enhance water quality and quantity.

Comprehensive Plans

A comprehensive plan is used by a community to establish a vision for its future growth and development and to develop policies, goals, and recommendations for implementing that vision. A successful comprehensive plan recognizes the importance of water resources and is used to highlight the need to protect water quality, quantity, and natural resources, including stream corridors and wetlands. The plan should include data and maps of the watershed and water resources to help identify areas where growth should be focused and where development should be limited. The comprehensive plan should also incorporate watershed plan recommendations and

implementation strategies. New York's enabling statutes for zoning require that zoning law be adopted in accordance with a comprehensive plan. Therefore, the comprehensive plan should be thought of as a blueprint on which zoning and other land use regulations are based.

Zoning

Zoning is an important tool used to regulate the use, density, siting, and form of development on individual parcels of land. Effective zoning is used to implement a municipality's comprehensive plan and will be used to direct growth and development to appropriate areas and away from sensitive areas, such as stream corridors and wetlands. Some specific zoning techniques include:

- Special use permits- allows a municipality to require special review and conditions for proposed uses that could have adverse impacts. For example, special use permit criteria can require development proposals to provide buffer areas and best management practices for control of nonpoint source pollution adjacent to stream corridors or wetlands. They can also require that a percentage of land be left as open or green space.
- Overlay Zoning- allows a community to apply additional review requirements and standards for the protection of designated resources that may cross several zoning districts. The standards for the overlay district can be structured to address riparian buffer protection, floodplain management,

Development of the Tompkins County Comprehensive Plan

The Tompkins County Comprehensive Plan was developed over a three year period from 2001 to 2004. During this time, County planners worked with municipalities and integrated goals and projects from many existing planning documents throughout the county. Many of the objectives listed in the natural resources section of the comprehensive plan mimic the watershed plan in promoting stream buffers, water quality monitoring, and inspections and maintenance of onsite wastewater treatment systems. Referencing the watershed plan within the comprehensive plan creates consistency between the two and provides formal County adoption and support for these action items. The Tompkins County Comprehensive Plan was formally adopted on December 21, 2004 by the Tompkins County Legislature. (www.cayugawatershed.org)



The Tompkins County Comprehensive Plan incorporates objectives outlined in the Cayuga Lake Watershed Restoration and Protection Plan.



Site plan review meeting



Site plan concept design

stormwater management, habitat protection, or the amount of impervious cover.

- Incentive Zoning- allows developers to exceed the dimensional, density, or other limitations of zoning regulations in return for providing certain benefits or amenities to the municipality. Incentive zoning can be an effective way to direct development away from sensitive areas.
- Performance Zoning- regulates development based on the permissible effects or impacts of a proposed use. Under performance standard zoning, proposed uses whose impacts would exceed specified standards are prohibited unless the impacts can be mitigated. Performance zoning is often used to prevent negative environmental impacts, such as stormwater runoff, scenic and visual quality impacts, and defined impacts on municipal character.
- Planned Unit Developments (PUDs)- allows for more flexible development practices than traditional zoning. A planned unit development can provide a mix of residential densities or a mix of residential and non-residential uses. Development within the PUD is typically clustered so open space and sensitive resources are preserved.

Subdivision Review

Subdivision regulations control the process by which land is divided into smaller tracts of land.

The review process can also be used to ensure practices are in place to protect water quality and quantity, such as individual wastewater treatment systems and stormwater management systems. Subdivision review is also important to ensure that future development adequately protects riparian areas and wetlands from physical disturbances, hydrological modifications, and pollutant loading.

Cluster subdivisions can be used to allow more flexibility in the design of residential subdivisions and concentrate development on the most appropriate portion of a site. Cluster subdivisions can also be used to preserve important resources, such as open space, scenic views, and agricultural lands, as well as to protect streams, riparian areas, wetlands, steep slopes, ground water, and wildlife habitats.

Site Plan Review

Site plan review is a land use technique used to regulate the arrangement, layout, and design of a proposed use on a parcel of land. Site plan review allows communities to address a wide range of issues by incorporating standards for stormwater management, traffic flow, parking, landscaping and buffering, and any other elements specified in the local site plan law or ordinance. This technique can be used to ensure that designs for new developments avoid sensitive areas and incorporate standards for water quality protections, including building location, road design, stormwater management, and wastewater treatment.

Official Maps

Under the statutes, the governing body of a municipality may establish an official map of its area, showing the streets, highways, parks, and drainage systems established by law. This official map may also be used by a municipality to develop logical, efficient, and economical street and drainage systems and protect the future rights-of-way needed to implement these systems. Future requirements for facilities and the land may be added to the official map to graphically show preserved land which may not be used for other purposes without the consent of the municipality.

State Environmental Quality Review Act

The State Environmental Quality Review Act (SEQR) provides a procedural framework for incorporating social, economic, and environmental factors into the community planning and decision-making processes. SEQR applies to all discretionary actions by a municipality, either through direct actions or through funding or approval of projects. The intent of SEQR is to evaluate the potential environmental impacts of a proposed project and to take those impacts into account when deciding to undertake, approve, or fund it. SEQR can be used to ensure that water quality and quantity considerations are addressed when reviewing development proposals.

Often, a community will want to address a specific issue or resource within the municipality or the watershed. Below are a few common watershed issues that can be addressed by incorporating standards within zoning, subdivision, and site

plan review controls. These issues may also be addressed using stand-alone regulations or ordinances.

Erosion and Sediment Control and Stormwater Management

Activities involving the clearing of land can create erosion, which leads to the sedimentation of waterways. Communities can manage construction sites and post-construction stormwater runoff to protect water quality and natural resources by adopting an erosion and sediment control/stormwater management law. These tools can be used to ensure that post construction runoff does not exceed pre-development conditions and water quality treatment is incorporated.

Incorporating Low Impact Development (LID) and Green Infrastructure are two other techniques to manage stormwater at its source. LID uses a variety of small cost-effective landscape features located onsite, including bioretention areas, rain gardens, permeable pavement, and vegetated swales to minimize stormwater runoff. Green infrastructure is an interconnected network of open spaces and natural areas, such as greenways, wetlands, and parks which serve to naturally manage stormwater, reduce flooding, and improve water quality while providing wildlife habitat and opportunities for recreation.

Onsite Wastewater Treatment Systems

Improperly functioning septic systems are a major source of nonpoint source pollution. Onsite



Land use map



Improper use of control measures



Hardened streambanks effect water quality



Public meeting, Clifton

wastewater treatment systems are regulated by State and county health laws, but municipalities can offer an additional level of regulation through local land use regulations and the issuance of building permits and certificates of occupancy. Local laws can include additional standards for design, inspection and maintenance. Education and outreach for homeowners and training for local officials such as planning boards, building inspectors, and code enforcement officers are critical for maintaining properly functioning onsite wastewater treatment systems. The New York On-site Wastewater Treatment Training Network (OTN) provides training and technical assistance on the siting, design, inspection and maintenance of on-site wastewater treatment systems.

Wetlands and Watercourse Protection

Wetlands provide a number of important values and functions, including water quality protection, flood control, open space, wildlife habitats, and opportunities for recreation, tourism and education. Naturally vegetated stream corridors also provide water quality benefits by stabilizing erodible soils, promoting infiltration, trapping sediment, and providing shade to protect habitats from thermal impacts.

Local regulation of wetlands and watercourses is an important tool for protecting the integrity and functioning of watershed ecosystems in a comprehensive and consistent manner that also supports local planning objectives. Local wetland and stream corridor regulations should define and map the resource to be protected, establish buffer requirements, and establish standards

for protection, including standards for regulating physical disturbance, discharge of stormwater, and changes in hydrology.

Aquifer Protection

Both the quantity and quality of groundwater can be affected by changes in land use. Increased impervious surface associated with development reduces the amount of water reaching aquifers. Groundwater quality can also be impacted by pollutants that can leach into aquifers from land use activities at the surface. These pollutants can include petroleum products from parking lots and service stations, road salt from highways, and fertilizers and pesticides from agricultural uses. Communities can protect groundwater resources through local zoning or through stand-alone local laws. One technique for protecting groundwater resources involves the use of an overlay district to implement specific regulations for activities in aquifer recharge areas. The overlay district can be used to prohibit uses that may contaminate groundwater, impose performance standards for pollutant generating activities such as wastewater treatment, or to require site plan review to ensure that site designs contain adequate measures to protect groundwater.

Floodplain Management

Floodplain regulations are land use controls that govern the amount, type, and location of development within defined floodprone areas. Floodplain management not only improves public safety, but can lead to less development on sensitive areas near waterbodies and can protect and improve

water quality. The National Flood Insurance Program enables property owners in participating communities to purchase flood insurance in exchange for State and community floodplain management regulations that reduce future flood damages. In order to participate in the National Flood Insurance Program municipalities are required to adopt and enforce ordinances restricting development in the 100-year floodplain. Local floodplain regulations can include a more accurate hazard area, the identification of a larger hazard area (such as a 500-year floodplain), and limitations of certain types of construction within flood hazard areas.

Open Space Protection

Open space can be publicly or privately owned and can include recreational sites, parks, greenways, trail networks, cemeteries, forests and woodlands, wetland and stream corridors, agricultural land, and historic properties. Open space can serve important water quality, quantity, and natural resource goals by limiting development on sensitive areas. A good way for a municipality to assess the importance of its open space resources is to develop an Open Space Plan or to include an assessment of open space resources as part of its comprehensive plan. This plan/assessment should categorize open space resources, examine their use and function within the community, set priorities for their protection, and consider the best options for the use and protection of open spaces.

Agriculture

Well-managed farmland can help protect water

quality and enhance community character while providing significant support to the local economy. Unfortunately, improperly planned or implemented agricultural activities can have significant impacts on water quality. Runoff from farms can contribute to increased levels of nutrients that can cause algae growth and oxygen depletion in nearby waterbodies. Sediment from eroding fields can also choke public drainage ditches and streams. Municipalities can encourage farms to participate in a number of voluntary programs through the Department of Agriculture and Markets. Two such programs include the Agriculture Environmental Management (AEM) Program, which helps farms manage environmental impacts through cost-effective and science-based comprehensive farm plans and the Conservation Reserve Enhancement Program, which focuses on maintaining natural vegetation along streambanks to control erosion and trap pesticides and fertilizers.

Forest Management

As with any land disturbance, timber harvesting can increase erosion and sedimentation. These impacts are typically associated with logging roads and wetland and stream crossings. Municipalities can regulate timber harvesting in a number of ways including local laws regulating erosion and sediment control, wetland or stream disturbances, or through a comprehensive timber harvesting law. Education and outreach to property owners and loggers and voluntary compliance with best management practices is also extremely important for avoiding impacts associated with timber harvesting. County Soil and Water Conservation



North Creek rail stop, North Creek



Farmland protection improves water quality

Table 6.2 Techniques for Filling Regulatory and Programmatic Gaps

Watershed Tool	Techniques
Land Use Planning	<ul style="list-style-type: none"> • Require site plan proposals to include watershed/subwatershed name. Encourage plan reviewers to consult watershed plans during plan review process • Incorporate watershed plan into comprehensive plan • Adopt overlay districts or watershed-based zoning to protect sensitive areas • Establish resource protection ordinances for resources including wetlands, forests, and other sensitive resources • Adapt model local laws from neighboring communities or those provided by county or state agencies to fit your community
Land Conservation	<ul style="list-style-type: none"> • Allocate tax funds for land conservation • Authorize local governments or local land trusts to hold conservation easements • Establish a transfer of development rights (TDR) program that transfers development potential from environmentally sensitive areas, called sending zones, to specific areas designated for growth, called receiving zones
Aquatic Buffers	<ul style="list-style-type: none"> • Adopt a local buffer law that includes a minimum 100 ft width, explicit vegetative standards, excluded uses, maintenance criteria, etc. • Require final property surveys/plats to include riparian buffer demarcation • Develop and implement an invasive species management plan in public open space • Encourage riparian buffers to be set aside as conservation areas in new developments
Better Site Design	<ul style="list-style-type: none"> • Complete a codes analysis to identify regulatory barriers to implementing open space design • Conduct a site planning roundtable to reach consensus among developers, residents, conservationists, and local staff on recommended code changes • Provide incentives for conservation design, such as stormwater credits or expedited review for sites utilizing conservation design

Erosion and Sediment Control	<ul style="list-style-type: none"> • Hire a part-time Erosion and Sediment Control (ESC) Stormwater Inspector • Provide training/certification program for inspectors and contractors on ESC practice installation and maintenance • Adapt more stringent design standards for ESC practices and provide incentives to minimize the amount of clearing at development sites • Establish a “hotline” for reporting failing ESC practices
Stormwater Management	<ul style="list-style-type: none"> • Enhance stormwater criteria • Allocate a portion of capital budget for implementation of priority stormwater retrofits • Educate homeowner associations and private businesses on proper practice maintenance • Establish a stormwater district to collect fees for infrastructure maintenance and program support
Non-stormwater Discharges	<ul style="list-style-type: none"> • Develop an illicit discharge detection and elimination program and citizen “hotline” for reporting problems • Require point of sale inspections of septic systems and sewer connections • Encourage cost-sharing partnerships between municipalities for maintaining sewer infrastructure • Require certification of septic system inspectors and mandatory inspections in sensitive watersheds • Provide incentives of funding for septic system upgrades and the use of alternative septic systems that provide greater pollutant reduction



Susquehanna River

Case Study: Shinnecock Bay, Long Island

Estuaries throughout Long Island have long supported a vibrant shellfishing industry, but significant changes in land use and development in recent decades have increased inputs of bacteria, nutrients, and sediments, decimating eelgrass beds and shellfish populations. As a result of the Town of Southampton's targeted watershed planning and implementation efforts, Shinnecock Bay, located on the south fork of Long Island, is experiencing improvements in coastal water quality and habitat and a related resurgence of bay scallops and other shellfish.

Recognizing the importance of wetlands in protecting water quality and habitat, the Town of Southampton adopted a Wetlands Protection Law in 1993. The primary goal of the law is to restore wetland and buffer areas as mitigation for proposed new development or expansion. The wetland ordinance requires a permit for projects that include filling, digging, dredging, or other activities associated with new construction, installation of fences, vegetation pruning, demolition, and environmental testing within wetlands and specified wetland buffer zones.

Southampton has made significant strides in mitigating stormwater runoff by identifying key problem areas and implementing best management practices to remove sediment and other pollutants from storm water. This includes an effort to "peel back" roadways that end at the shore by creating naturalized buffers of beach grass and shoreline vegetation at road ends. In an effort to improve the ecological functions of degraded wetlands, the Town has restored the natural hydrology of several marshes by removing dredged materials and replanting those areas with native wetland vegetation.

The Town has also been successful in acquiring lands to preserve sensitive coastal and wetland areas. The Town of Southampton enacted a Community Preservation Fund which places a two percent tax on all land transfers within the Town. Revenue generated from the tax is used to purchase sensitive lands that provide critical ecosystem functions.



Salt marsh pool restoration

Districts and Cornell Cooperative Extensions can play an important role in the education and outreach process.

Strengthening local watershed practices

It is important that the people responsible for the implementation of the recommendations in your watershed plan are aware of preferred watershed practices and understand how and why those practices protect or restore water quality. One way to advance the implementation of effective practices is through the preparation of written guidelines for capital improvement projects and maintenance and operation of existing municipal facilities and public roadways. Developing a schedule for inspection of catch basins and other stormwater infrastructure with an eye on identifying how often sediment needs to be removed from catch basins can go a long way toward preventing pollution of local waters. Holding regular meetings to discuss the progress on capital improvement projects and identifying opportunities to improve maintenance is a good way to keep these issues on the front burner.

Two examples of approaches to assessing local practices - *Protecting Water Resources through Local Controls and Practices: An Assessment Manual for New York Municipalities* (Genesee Finger Lakes Regional Planning Council, 2006)(www.gflrpc.org) and *Strengthening Local and State Development Controls and Practices*

to Protect Lake George Water Quality, (Albany Law School, 2006)(www.lakegeorge2000.org) - present a series of recommendations for improving practices to protect water quality. These include recommendations related to:

- sewer/water infrastructure
- on-site wastewater treatment systems
- flood plain management
- environmentally sensitive areas, including wetlands, riparian areas, and lakeshore areas
- erosion and sediment control
- stormwater management and drainage
- road and bridge maintenance
- junkyards
- waste storage
- mining and drilling
- agriculture
- forest management
- boating and marinas

Providing training to local staff and other interested parties on watershed protection practices through workshops, consultations,



Greenport Harbor, Long Island



Eighteenmile Creek, Niagara County



Watershed education workshop



Installing stormwater treatment

certifications, and guidebooks is a good way to promote the practices recommended in your plan. Training can be targeted to:

- *Highway department staff* - road de-icing practices, pollution prevention practices at municipal yards, street sweeping, catch basin cleaning, fleet operations, and public open space management
- *Engineers, landscape architects and developers* - site planning, stormwater design, on-site wastewater systems, construction and maintenance practices, installation and maintenance of erosion control practices, utilizing native plant species, buffer management, and low impact lawn care practices for protecting water quality
- *Contractors* - installation of erosion and sediment control practices, benefits of porous pavement, installation and maintenance of stormwater improvements
- *Municipal staff* - developing stormwater programs and conducting watershed assessments
- *Civic associations and watershed groups* - landscape practices for protecting water quality, building and maintaining rain gardens, stream and other aquatic assessments, and volunteer monitoring

- *Site inspectors and enforcement officers* - proper installation and maintenance of erosion and sediment controls, stormwater practices, certification for inspection and enforcement officers
- *Business associations* - pollution prevention measures unique to their business type (e.g., the use of best management practices at marinas)

In New York, there are a number of training opportunities available for local governments and staff:

- The Stormwater Management Program Series, provided by SUNY College of Environmental Science and Forestry and the NYS Department of Environmental Conservation (www.esf.edu/outreach/stormwater)
- Septic system management training through the On-Site Wastewater Treatment Training Network (OTN) supported by SUNY College at Delhi and the NYS Department of Environmental Conservation (www.delhi.edu/corporateservices/otn_wastewater_programs.asp)
- The Cornell LEAPE (Locally-led Education and Action for Protecting the Environment), an educational program for local governments based on the protection of water resources (www.css.cornell.edu/leape/index.html)

- NYS DOS Division of Local Government Services links to watershed related training including stormwater management, management of onsite wastewater treatment systems, highway official training for maintenance associated with local roads (www.dos.state.ny.us/lgss/addtraining.htm)
- The Land Use Law Center at Pace University's School of Law, training opportunities that focus on land development, local land use decisions, strategic planning, and stakeholder development (<http://law.pace.edu/landuse/index.html>)

Continuing public outreach and education

Throughout the planning process you should have been reaching out to the public for their input, concerns, and comments. The information that the public can contribute to the planning process is irreplaceable, as is the information that you can give back to them as to how to improve water quality. Continued public outreach can help keep the community informed of water quality project implementation and advances in any regulatory and programmatic recommendations.

Public education programs can be used to keep the community involved and educate community members about how their actions are related to and affect their water resources. Programs

can provide residents with specific messages depending on the activity or pollutant of concern. For example, if excess nutrients are a concern in your waterbody, you may want to devise an education program about the responsible use of lawn fertilizer, disposal of pet waste, and maintenance of on-site wastewater treatment systems. Keep in mind that education programs should focus on the specific impairments, problems or threats identified during your field assessments, and, wherever possible, tie them into an existing municipal education program. Before developing a watershed education program, you should consider some key questions:

- Who is the target audience?
- How familiar is your target audience with the water quality issues in the watershed?
- What educational messages do you want to promote?
- What outreach methods are most effective in getting the message out?

Outreach to the community can be conducted in a variety of ways. Messages sent through television, radio, and local newspapers are far more influential in reaching residents than any other technique, with up to 30% recall rates by the watershed population. These methods can sometimes be expensive. To potentially reduce costs, consider pooling resources together with

neighboring watersheds in order to develop a regional media campaign. This may allow you to hire outreach professionals to create and deliver an effective message. You may also be able to use a variety of media to reach out to a wider audience.

Another way to reach out to the community is to incorporate watershed management into the science curriculum of local schools. This helps to connect students to their water resources, provides an educational component for protection and restoration projects, and generates a source of potential volunteers for activities such as streambank clean-ups, tree planting, or monitoring.



Oswego, Lake Ontario

Case Study: Wappinger Creek

Wappinger Creek is one of five major tributaries to the lower Hudson River Estuary and drains a watershed of over 180 square miles. Past disturbances to the creek such as dredging, road and railroad crossings, and low density residential development, have caused a decline in water quality and habitat diversity. In addition, the invasive exotic waterchestnut has become especially problematic in slow-moving sections of the creek.

In response to these issues, the Wappinger Creek Watershed Intermunicipal Council was formed to improve and preserve the natural beauty and integrity of Wappinger Creek. The Council provides a forum for nonprofit organizations, concerned citizens, and municipal governments to discuss existing conditions, research and management needs, and to identify implementation opportunities within the watershed.

Steep slopes along the creek's natural buffer are threatened by erosion. In an effort to address these erosion issues, the intermunicipal council developed a framework for restoring the streambank and provided an avenue for a coordinated volunteer effort to put the restoration plan into action. With technical assistance from the Dutchess County Environmental Management Council (EMC), the two groups developed site-specific

restoration designs and settled on a two-phase program to rebuild, strengthen, and re-vegetate the streambank.

Phase I involved re-establishing the creek's natural elevation and stabilizing its streambank. Biodegradable mats were used to hold the bank in place, and grasses and willow fascines were planted to further stabilize the bank. A variety of partners made the restoration project a reality: Trout Unlimited; a local quarry that provided the rip rap used for stabilization; the Natural Resource Conservation Service, which provided conservation grass mixes; the Town of LaGrange Highway Department, an important source of equipment and manpower; Vassar College, which provided land for a willow nursery; local boy scouts, who were hands-on volunteers; and local landowners who provided easements that facilitated restoration. Phase II of the project will include additional vegetative planting along the streambank to provide long-term stability and provide shade and cover for wildlife.



Wappinger Creek lies within the Lower Hudson Watershed



Wappinger Creek

Measuring success - tracking implementation and monitoring performance

Measuring success and evaluating improvements is key to continued water quality improvement. To document success, you will need to show how water quality has improved as a result of your efforts. In particular, funding agencies, regulators, and other partners will have a keen interest in measuring whether restoration and water quality improvement projects were successful in order to make future funding decisions.

Success can be measured in many different ways including tracking the number of projects completed, such as the number of rain gardens installed, total acreage conserved, or measuring changes in water quality and habitats, such as the reduction of turbidity or improved aquatic insect communities. Trend monitoring is often the best way to determine if conditions are improving and watershed goals are being met.

Creating a monitoring plan will help organize your monitoring effort and help you track your progress. A monitoring plan includes:

- *Project monitoring* - Project monitoring best illustrates the benefits of individual restoration or water quality improvement efforts. Monitoring can include simple visual observation or it can involve complex

modeling. Physical inspections can also be performed at individual projects to assess how conditions have changed over time. For example, monitoring a reforestation project might focus on determining tree survival or the effects of invasive species, whereas stormwater retrofit monitoring might focus on determining if anticipated pollutant load reductions are being achieved. Monitoring also allows you to make adjustments to a project in order to increase your chances of success.

- *Fixed monitoring stations* - Fixed monitoring stations are effective in determining whether conditions are changing in a subwatershed or watershed and can be established to measure long-term trends. Look to see if fixed stations, such as US Geological Survey stream gauging stations or monitoring stations for the NYS DEC Rotating Intensive Basin Study (RIBS), exist in your area. If monitoring stations are not in place, consider partnering with local colleges or universities to establish one or more local stations. Keep in mind that data from fixed monitoring stations can often be influenced by local factors such as outfalls or other point source pollution discharges. Make sure that stations are strategically placed and are representative of the overall conditions of the watershed. To collect consistent data, sampling should be performed during the same time of day, during the same seasons, and, where applicable, under the same flow conditions.

Monitoring Progress by Monitoring Fish Habitat

Guidelines for Monitoring Fish Habitat in Wadeable Streams of the Catskill Mountain Region, NY, published by the US Geological Survey in 2003, grew out of the need to monitor the success of stream channel stabilization projects in Catskill Mountain streams. Stream channel erosion was causing sedimentation and degrading water quality in the downstream reservoirs that are the drinking water supply for New York City. By monitoring stream habitats, managers are able to evaluate how well stabilization projects reduce sedimentation and other impacts. The US Geological Survey, Greene County Soil and Water Conservation District, and the NYC Department of Environmental Protection worked together to develop, test, and publish an assessment methodology that monitors fish habitat suitability of a stream for one year prior to restoration and three years following restoration. The monitoring guidance document serves as a mechanism to evaluate the success of the restoration project and includes the methodology, a field equipment list, and monitoring forms. (<http://ny.water.usgs.gov/pubs/of/of02484>)



East Hampton, Long Island



North Tonawanda, Erie Canal

- *Illicit discharge monitoring* - Illicit discharge detection and elimination are critical elements of watershed restoration and planning. Illicit discharges such as connections between sanitary and storm sewers are often a significant source of pollution in a watershed. Monitoring individual outfalls and identifying connections can help you identify significant sources of pollution to your waterbody. Observations of illicit discharges need to be reported to the MS4 permittee and/or DEC.
- *Project tracking* - Managing the implementation of a large number of projects within a subwatershed can be complex and time consuming. It is a good idea to create a master project spreadsheet and where possible link it to a GIS system. This system can then track the status of individual projects through final design, permitting, construction, inspection, maintenance, and performance monitoring. For non-structural efforts, tracking systems might include recording the number of outfalls inventoried, the number of untreated discharges mitigated, the number of hotline calls, or the number of dedicated volunteers. By tracking projects, you can assess implementation progress over time which, in turn, helps explain future changes in water resource quality. Project tracking can also improve the delivery of future projects and can help you create reports that document implementation progress for key funders. Ideally, a designated person should manage implementation

tracking. This person will need to determine what information to track, update project information in spreadsheet/GIS format, and periodically report on the status of implementation. A tracking system should account for all practices undertaken in the watershed plan regardless of their type or size and should include enough information so that you can:

- determine actual project costs
- track individual project status
- access design and permit information
- establish inspection, maintenance, and monitoring schedules
- report progress on individual projects and, overall, on how well you are implementing your watershed plan
- provide information to show progress toward meeting federal/state stormwater implementation or water quality goals
- remind everyone how much has actually been accomplished

You should be using the monitoring and tracking information to report on your progress to partners and other interested agencies or individuals. Progress reports should:

- summarize the number, types, and descriptions of projects
- summarize information gathered during monitoring
- include budget updates
- describe grant awards
- highlight key partner involvement
- reference any additional studies or information on the watershed

Reporting on an annual basis will allow you to reassess progress and identify areas of the plan that may need corrections or adjustments based on monitoring data or lessons learned.

Progress reports can either be distributed at annual public watershed meetings or at internal municipal meetings that include local municipal officials. An annual meeting serves as a simple approach to update partners and the public on the status of the watershed plan and obtain feedback on what could be done better in the future. An annual meeting is also a great way to show project success to past and future funders.

Making revisions and updates

Changes are constantly occurring throughout the watershed - whether it is increased streambank erosion or changes in land use. As changes occur in your watershed, your plan should also change and adapt to address those issues. Updating your plan to reflect changes in the makeup of councils, community goals, or the regulatory environment will keep your plan relevant and fresh. It is also important to revise your plan to address changes in technologies and new opportunities for water quality improvement.

As you implement the recommendations in your watershed plan you should continue to conduct periodic aquatic and upland assessments to update inventories and to have an up-to-date assessment of existing conditions. It will also be important to evaluate how you are meeting your watershed goals. As goals are met, you should create a new set of goals to keep your plan relevant to current conditions.

Updating the Watershed Management Plan

The 2005-2009 Strategic Update of the Canandaigua Lake Watershed Plan includes a description of projects that have been implemented since completion of the original plan in 1999. Some of these successes include streambank restoration on Naples Creek, obtaining grant funding for a sewer extension project in Ontario County, a wetland creation project in the Town of Canandaigua, and obtaining funding for a major dredging project along Sucker Brook to clean up contaminated sediments. The updated plan looks ahead to future projects in research, education, restoration/protection and regulation. (www.canandaigualake.org)



CONCLUSION

This guidebook has shown you the techniques and resources available to you for developing a comprehensive watershed plan. We began by recognizing the importance of understanding and knowing your watershed and finished with specific recommendations for improving water quality. Each section provided guidance and lessons on how to protect and restore your watershed.

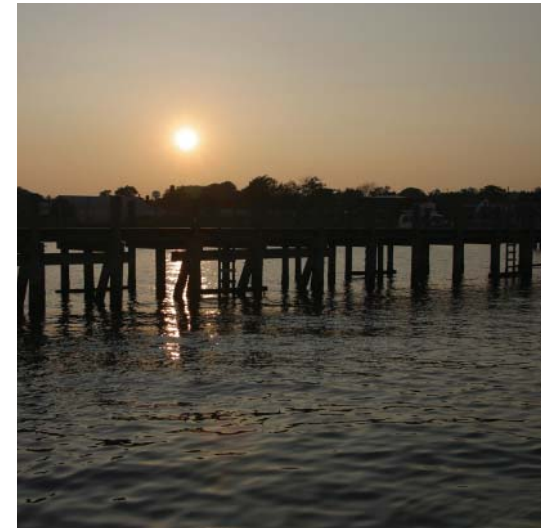
More and more people are realizing that protecting and improving their watersheds is important to the entire community. It starts by recognizing that the watershed belongs to the community. By developing and implementing watershed plans, communities are coming together to protect water resources and improve the overall quality of their wetlands, streams, rivers and lakes, helping you improve not only your water quality but the community as well. This translates into a healthy environment, a good quality of life, and strong local economies.

You can protect and enhance your water resources when.....

- ✓ You understand your watershed and recognize the importance of water quality
- ✓ You have recognized the relationship among economic, social and natural processes
- ✓ You have created a clearly defined vision for the future of your watershed
- ✓ You have established creative partnerships and gained community support
- ✓ You have set realistic goals and laid out a detailed strategy for implementation
- ✓ You based your plan on real on-the-ground priorities and made specific recommendations to improve water quality
- ✓ You have taken advantage of all your resources, assets and opportunities
- ✓ You have generated a sense of community ownership of the watershed
- ✓ You sustain improvements and continue momentum into the future
- ✓ You understand that watershed planning is a dynamic process, requiring careful monitoring and timely adjustments
- ✓ You have the patience and persistence to get through the many phases of watershed planning - one step at a time



Narrow River, Orient



Greenport

APPENDIX

Where to find potential partners and information for watershed planning and implementation

Local Resources

Local governments- whether county, city, town, or villages- may have planning, design, and engineering staff, as well as local committees who can be instrumental in helping you protect and restore your watershed. They can provide local plans and consultant studies such as feasibility studies, engineering reports, land use studies, and infrastructure analyses. They can also provide technical assistance at all stages of developing and implementing a watershed plan.

The **New York State Conference of Mayors and Municipal Officials** (www.nycom.org) can provide technical assistance to its members and holds a Main Street conference annually that addresses many issues related to the redevelopment of waterfronts and watersheds and how they can link to downtowns. The **Association of Towns of the State of New York** (www.nytowns.org) serves town governments by providing training programs, research and information services, technical assistance, legal services, computer software programs, insurance programs, and a variety of publications to member towns.

County governments are an important source of information for communities undertaking

watershed planning efforts. County agencies or organizations can provide census information, digital mapping data, water quality data, etc. You can find individual County websites through the **Direct Links to County Websites** (www.nysegov.com/citguide.cfm?context=citguide&content=munibycounty1); or the **New York State Association of Counties** (www.nysac.org/).

County Soil & Water Conservation Districts provide technical assistance on nutrient management, stormwater runoff and other resources issues. While different counties may have a specific focus based on regional issues, resources related to watershed planning may be obtained through their staff. The **NYS Association of Conservation Districts** (www.nyacd.org) can direct you to your local County Soil & Water Conservation District.

County Environmental Management Councils are voluntary advisory boards appointed by their county governments throughout New York. Their mission is to advise county governments and to provide a liaison between the community and the county. The **New York Association of Environmental Management Councils** (www.nysaemc.org) can direct you to your local County Environmental Management Council.

There are several other county organizations that can provide information and watershed related data for your watershed plan. Contact your **County Planning Departments, County Planning Boards, and County Water Quality**

Coordinating Committees for assistance in the creation of your watershed plan. **County Health Departments** (www.health.state.ny.us/nysdoh/lhu/map.htm) can also provide local water quality data and information on health related issues related to water quality.

Regional Resources

Due in part to the geographic diversity of New York State, there are many regional planning and environmental organizations that can help you throughout the development and implementation of your watershed plan.

New York State Association of Regional Councils (NYSARC) (www.nysarc.com) fosters coordination among neighboring communities and provides a regional approach to issues crossing municipal boundaries. A map showing NYSARC Water Resources Management Program coverage by New York State drainage basins can be viewed at (www.cnyrpdb.org/nysarcwater).

If your watershed lies within Appalachia, the **Appalachian Regional Commission** (www.arc.gov) may be able to assist you in your watershed planning effort. This commission is a state-federal partnership that looks for opportunities to create a better quality of life and enhance economic development. The Appalachian Regional Commission can provide guidance on funding sources, preparing grant proposals, strategic planning, and regional data.

The **Adirondack Park Agency** (www.apa.state.ny.us) can provide assistance related to land use management within the boundary of the Park. The Agency can provide local assistance with zoning, reviewing local regulations, and administering Agency approved programs. The Agency also has GIS data related to watershed planning.

Watersheds in the Tug Hill Region of New York can benefit from contacting the **Tug Hill Commission** (www.tughill.org). The Commission provides technical assistance to local governments and organizations related to natural resource management, land use planning, and economic development.

Great Lakes Commission (www.glc.org), a bi-national agency, fosters the conservation and protection of water and natural resources within the Great Lakes Region. Resources include data and monitoring information, management strategies, and land use and soil management information.

The **Hudson River Valley Greenway Communities Council** (www.hudsongreenway.state.ny.us/index.htm) provides community planning grants and technical assistance through the Greenway Communities Grant Program and the Greenway Compact Grant Program. These programs help eligible communities develop and achieve a vision for their future and assist in the development of the Greenway Compact, a regional planning strategy for the Hudson River Valley.

The **Hudson River Estuary Program** (www.dec.ny.gov/lands/4920.html) is a unique regional partnership designed to protect, conserve, restore, and enhance the estuary. The Hudson River Estuary Action Plan sets forth twenty commitments intended to protect and conserve the estuary's natural resources and ecosystem health, clean up pollution and other impairments, and promote public use and enjoyment of the river. Grants are available from the Environmental Protection Fund to enable communities to help implement the Action Plan and protect and enhance the Hudson River Estuary.

The **Hudson River National Estuarine Research Reserve** (www.dec.ny.gov/lands/4915.html) protects four tidal wetland sites on the estuary. Spaced along the river from the brackish Tappan Zee to tidal freshwater shallows north of the City of Hudson, these sites provide ideal settings for education and comparative research. The Reserve is managed in partnership by NYS DEC and the National Oceanic and Atmospheric Administration (<http://nerrs.noaa.gov/HudsonRiver>).

The **New York City Department of Environmental Protection** (www.nyc.gov/html/dep/home.html) can provide water supply information, maps of watersheds and drainage areas, water treatment systems, groundwater data, and reservoir data. The DEP also has a variety of outreach and education programs that address water and the environment. The **Long Island South Shore Estuary**

Reserve (www.estuary.cog.ny.us) can provide technical assistance in the preparation and implementation of local watershed plans. Reserve Office staff also assist in education, outreach, and stewardship programs to enhance public awareness and appreciation of the Reserve's many resources.

The **Long Island Sound Study** (www.longislandsoundstudy.net/index.htm) provides assistance in the implementation of the Comprehensive Conservation and Management Plan and can provide technical data including water quality monitoring data, restoration assistance, and education and outreach.

The **New York/New Jersey Harbor Estuary Program** (www.harborestuary.org), part of the US EPA National Estuary Program, implements the Comprehensive Conservation and Management Plan. The Harbor Estuary Program provides technical assistance, data, and encourages stewardship and outreach activities.

State Resources

Many New York State agencies provide an array of technical and financial assistance that can support your watershed planning process. The Department of State's **Division of Coastal Resources** (www.nyswaterfronts.com) can provide assistance on all aspects of watershed planning to help you make the most of your community's water resources. The Division

can provide technical and financial assistance to help communities integrate watershed planning with efforts to expand public access, reinvigorate urban waterfronts, restore habitats, protect scenic resources, preserve historic resources, manage water uses, improve water quality, protect against flooding and erosion, and strengthen local economies.

The Department of State's **Division of Local Government Services** (www.dos.state.ny.us/lgss/index.htm) can provide training assistance to municipalities related to zoning procedures and other practical legal and technical advice. Local Government Services can also provide technical assistance to watersheds within the New York City drinking water supply watershed.

The **Department of Environmental Conservation** (DEC) (www.dec.ny.gov) can provide assistance with conserving, improving, and protecting natural resources and the environment, and controlling water, land, and air pollution. Of interest to communities are the funds for protecting clean water. A variety of funds are available for municipal wastewater treatment improvement, pollution prevention, and agricultural and non-agricultural nonpoint source abatement and control. Significant support is available to acquire open space that protects water resources, and to acquire public parklands and protect farmland. The Stormwater Phase II Program (www.dec.ny.gov/permits/6045.html) requires permits for stormwater discharges from Municipal Separate

Storm Sewer Systems (MS4s) in urbanized areas and for construction activities disturbing one or more acres.

The **Environmental Facilities Corporation's** (EFC) (www.nysefc.org) mission is to promote environmental quality by providing low-cost capital and expert technical assistance to municipalities, businesses, and State agencies for environmental projects in New York State. Its purpose is to help public and private entities comply with federal and State environmental requirements. EFC's primary activities are the State Revolving Funds (SRF), the Industrial Finance Program (IFP), and Technical Advisory Services (TAS).

If your watershed contains public drinking water supplies, the **Department of Health** (www.health.state.ny.us/nysdoh/water/main.htm) provides information and technical assistance related to financing mechanisms, preventing drinking water contamination, and additional public health related water protection programs including publications outlining the regulatory framework. New York's Final Source Water Assessment Program Plan (November, 1999) and a list of contacts by county can be viewed at www.health.state.ny.us/nysdoh/water/swap.htm.

The **Department of Transportation** (www.nysdot.gov) funds and implements environmental benefit projects that improve water quality, restore wetlands, promote eco-tourism, protect fish and wildlife, and

enhance transportation corridors through its Environmental Initiative.

Agriculture is an important cultural and economic resource throughout New York State. There are several agencies that work to provide technical and financial assistance to New York farms.

The **Department of Agriculture and Markets** (www.agmkt.state.ny.us) administers several funding programs including the New York State Agricultural Nonpoint Source Abatement and Control Program (ANSCAP), the Agricultural and Farmland Protection Implementation Project Program, and the Farmland Viability Program. The **New York State Soil and Water Conservation Committee** (www.agmkt.state.ny.us/SoilWater) develops and implements "an effective soil and water conservation and agricultural nonpoint source water quality program." Technical assistance is provided through the Agricultural Environmental Management Program, including comprehensive nutrient management planning, streamside conservation, and community conservation. The **NYS Conservation Reserve Enhancement Program** (NYS CREP) (www.agmkt.state.ny.us/SoilWater/crep/index.html) aims to reduce pollution in streams by helping agricultural landowners to voluntarily plant trees, shrubs, and grasses on streambanks to trap sediment, pesticides, and fertilizers in runoff.

New York State Quality Communities

Clearinghouse (www.qualitycommunities.org) is an easy-to-use directory or 'portal' to 25 State agencies with brief descriptions of services and links to the appropriate agency website pages. Organized by "Quality Communities Principles," the web site provides guidance on state agency funding programs that can help you with planning, economic development, and outreach.

Federal Resources

The federal government offers a range of programs associated with the conservation and protection of water and natural resources. These programs offer a wealth of information on water quality, habitat inventories, soil information, and much more. Contact these federal agencies for both technical and financial assistance. The online **Catalog of Federal Domestic Assistance** (www.cfda.gov) gives you access to a database of *all* federal programs available to State and local governments, domestic public, quasi-public, private profit and nonprofit organizations and institutions, specialized groups, and individuals. You can search this database to find grant and funding opportunities meeting the requirements for your waterfront project. You can then contact the office that administers the program and find out how to apply. Also available on this site are several aids to guide you in the writing of a proposal to apply for assistance.

The **National Oceanic and Atmospheric Administration** (NOAA) (www.noaa.gov) is the source of a wealth of information relevant to water quality restoration and protection. The nation's coasts are managed by the coastal states and territories through the federal Coastal Zone Management Program (CZMP). The CZMP (<http://coastalmanagement.noaa.gov>) is a federal-state partnership dedicated to comprehensive management of the nation's coastal resources, ensuring their protection for future generations while balancing competing national economic, cultural, and environmental interests. To carry out NOAA's responsibilities under the Coastal Zone Management Act, the Office of Ocean and Coastal Resources Management (OCRM) works directly with coastal states and territories to support the development of Coastal Management Programs and National Estuarine Research Reserves, provide technical and financial assistance to coastal program and reserve operations, and promote coastal stewardship on a variety of critical coastal issues (see Regional Resources for more information of the Hudson River National Estuarine Research Reserve). Such issues include: coastal habitat protection and restoration; coastal hazards; public access to the shore for recreation; sustainable development of coastal communities, including urban waterfronts; and polluted runoff. In 1990, Congress established a new program requiring coastal states such as New York to prepare a Coastal Nonpoint Pollution Control Program to implement a series of management measures (www.epa.gov/owow/nps/MMGI)

The **United States Environmental Protection Agency** (USEPA) (www.epa.gov) protects environmental quality through a variety of air, water, pollution, and toxics and chemicals management programs, primarily through its Office of Wetlands, Oceans and Watersheds (www.epa.gov/owow). USEPA provides information on water quality programs and assistance with planning and managing watersheds, water quality, wetlands (www.epa.gov/water), and groundwater and surface water supplies and wastewater treatment (www.epa.gov/safewater). USEPA also administers the **National Estuary Program** (www.epa.gov/owow/estuaries), which includes three estuaries in New York: New York/New Jersey Harbor Estuary Program, Peconic Estuary Program, and the Long Island Sound Study, which are highlighted in Regional Resources.

The **United States Fish and Wildlife Service** (USFWS) (www.fws.gov) administers most of the nation's fish and wildlife management programs, including terrestrial and freshwater endangered species protection (<http://endangered.fws.gov>) and migratory bird management. USFWS manages public lands and outdoor recreation (www.recreation.gov) as part of the National Wildlife Refuge system (<http://refuges.fws.gov>). USFWS also offers several funding programs (www.fws.gov/grants), including Coastal Wetland Conservation Grants and North American Wetlands Conservation Act (NAWCA) grants. The Cortland New York, field office can provide you with state and regional information (www.fws.gov/northeast/nyfo).

The **U.S. Geological Survey (USGS)** (<http://water.usgs.gov>) can provide you with information on stream flow, water quality, water quantity, maps, and application software. The USGS has real time data, surface water data, and ground water information. USGS also provides historic topographic maps which can be helpful when delineating your watershed. The USGS New York office (<http://ny.water.usgs.gov>), in partnership with collaborating agencies, has conducted assessments of streams in several of New York's physiographic regions to develop regional stream curves, which illustrate the relationship between watershed size, stream form, and discharge. These relationships will be useful in guiding future stream restoration activities. You can also find publications, including site specific investigations and circulars, which are useful in building understanding of watershed processes.

The **U.S. Department of Agriculture** (www.usda.gov/wps/portal/usdahome) can provide assistance with rural development and help communities with natural resource concerns, such as erosion control, watershed protection, and forestry. The Forest Service (www.fs.fed.us) and the Natural Resources Conservation Service (www.nrcs.usda.gov) are two agencies under the Natural Resources and Environment section of the USDA.

Not-For-Profit Resources

There are several nonprofit organizations specializing in water and natural resources, outreach, and education. These organizations can provide information on protecting or restoring natural habitats and river or stream corridors, as well as localized demographic information and historical data.

New York Rivers United (www.newyorkriversunited.org) is a statewide river conservation organization that works with local communities and partners actively involved in watershed restoration.

New York State Wetlands Forum Inc. (www.wetlandsforum.org) is a non-advocacy organization comprised of individuals and groups with diverse backgrounds, interests and viewpoints regarding wetlands and their science, use and management. Its purpose is to: improve communication among people interested in wetlands; call attention to and objectively discuss local, statewide, regional, national, and global wetland issues as they relate to New York State; improve its members' knowledge and understanding of wetlands; and make information about wetlands available to its members and the general public.

The Institute of Ecosystem Studies (www.ecostudies.org/index.html) is dedicated to the creation, dissemination, and application of knowledge about ecological systems. This knowledge is created through scientific research,

disseminated through teaching, writing, and exhibits, and applied through participation in decision-making regarding the ecological management of natural resources and through promotion of a broader awareness about the importance of ecological relationships to human welfare.

Another source of assistance is local land trusts. Community-based land trusts are experts at helping interested landowners find ways to protect their land in the face of ever-growing development pressure. The **Land Trust Alliance** provides a full array of advice on land trusts and how they can help communities (www.lta.org). The **Open Space Institute** protects significant recreational, environmental, agricultural, and historic landscapes in New York State (www.openspaceinstitute.org).

In rural areas, communities can obtain assistance from the **Rural Community Assistance Partnership (RCAP)** (www.rcap.org). This partnership assists communities in meeting their water supply, wastewater management, and solid waste needs. They can also help you with community and regional planning, public health management, and education and outreach.

The **New York Farm Bureau** (www.nyfb.org) is a non-governmental, volunteer organization financed and controlled by families for the purpose of solving economic and public policy issues challenging the agriculture industry.

If your watershed lies within the Chesapeake Bay Watershed, the **Upper Susquehanna Coalition** (www.u-s-c.org) may be able to provide you with technical assistance. The Coalition is a network of county natural resource professionals who develop strategies, partnerships, programs, and projects to protect the headwaters of the Susquehanna River and Chesapeake Bay watersheds.

Lake George Watershed Coalition (www.lakegeorge2000.org) involves state, county, and local governments, along with non-governmental organizations, to conserve and protect Lake George. They provide education and outreach to local citizens and foster partnerships for conducting water quality monitoring and restoration projects.

Other not-for-profit organizations include: **American Farmland Trust** (www.farmland.org); **Association of State Floodplain Managers** (www.floods.org); **Association of State Wetland Managers** (www.aswm.org); **Center for Watershed Protection** (www.cwp.org); **Conservation Foundation** (www.theconservationfoundation.org); **National Audubon Society** (www.audubon.org); **New York Planning Federation** (www.nypf.org); **Sierra Club** (www.sierraclub.org); **Society of Wetland Scientists** (www.sws.org); **The Nature Conservancy** (www.nature.org); **Trust for Public Land** (www.tpl.org); **Wildlife Conservation Society** (www.wcs.org/sw-wcs_in_new_york).

Not-for-profit organizations can also have a regional interest. These organizations often have localized data, outreach programs, and other information that focus on local issues:

Long Island

Hempstead Harbor Protection Committee (www.hempsteadharbor.org); **Manhasset Bay Protection Committee** (www.manhassetbayprotectioncommittee.org); **NY/NJ Baykeeper** (www.nynjbaykeeper.org); **Save the Peconic Bays** (www.savethebay.org); **Save the Sound** (www.savethesound.org).

Great Lakes

Finger Lakes-Lake Ontario Watershed Protection Alliance (FL-LOWPA) (www.flowpa.org); **Great Lakes Research Consortium** (www.esf.edu/glrc); **Lake Ontario Coastal Initiative (LOCI)** (www.ceinfo.org/loci); **Lake Plains Resource Conservation and Development** (www.lakeplainsrcd.org); **Rochester Environment** (<http://rochesterenvironment.com>); **Save Our Sodus** (www.saveoursodus.org).

Hudson River Valley

Catskill Center for Conservation and Development (www.catskillcenter.org); **The Glynwood Center** (www.glynwood.org); **Hudsonia** (www.hudsonia.org); **Scenic Hudson** (www.scenichudson.org).

Educational

Colleges and universities also provide a wealth of knowledge in the areas of water and natural resources, planning, and local law assessment. Colleges and universities can often provide up-to-date research and data collection techniques.

The **State University of New York, College of Environmental Science and Forestry** (www.esf.edu), provides a number of research institutes and centers that focus on water quality, watershed studies, and hydrology. Assistance in watershed assessments and water quality studies may be available through these institutes (www.esf.edu/research/#Anchor-InstitutesCenters-3).

SUNY Delhi and **New York Onsite Wastewater Treatment Training Network (OTN)** along with **New York State Department of Environmental Conservation (NYS DEC)** has developed a series of hands-on training courses for onsite system professionals and water quality managers. Participants can learn the essentials of onsite wastewater treatment system design, system inspection, proper installation and maintenance, and alternative onsite treatment system technologies. Participants can earn in-service hours of educational credit and network with other industry professionals. Additional information can be found at: http://www.delhi.edu/corporateservices/otn_wastewater_programs.asp

The **New York Sea Grant Program** encourages the wise stewardship of marine resources through research, education, outreach and technology transfer, and can provide assistance with research, education, and outreach relevant to coastal issues ranging from fisheries, environmental quality, coastal processes, and development. A cooperative program of SUNY Stony Brook and Cornell University, New York Sea Grant (<http://nyseagrant.org>) has 10 offices throughout the State that work with partners “bringing science to the shore.”

The **Institute for the Application of Geospatial Technology** (www.iagt.org/gov.asp) at **Cayuga Community College** is a nonprofit organization dedicated to accelerating the application of geospatial information technology (GIT) across government, education, and commercial sectors.

Cornell University Cooperative Extension (www.cce.cornell.edu) and the **Community and Rural Development Institute** (www.cardi.cornell.edu) provide assistance to communities on development, the environment, and agricultural issues. **New York State Water Resources Institute** (<http://wri.eas.cornell.edu/>) is another research group at Cornell University where staff and project principals focus on water research and education projects in support of the public, water suppliers, businesses, and governments.

Pace University Land Use Law Center (www.law.pace.edu/landuse) provides assistance on the development of sustainable communities in New York State.

Cooperative Institute for Coastal and Estuarine and Environmental Technology (CICEET) (<http://ciceet.unh.edu>), a partnership of the University of New Hampshire (UNH) and the National Oceanic and Atmospheric Administration (NOAA), facilitates the development and application of environmental technology that monitors, manages, and prevents the contamination and degradation of coastal waters and habitats. CICEET administers research programs that invest in the development and application of innovative coastal technologies.

UNH Center for Stormwater Technology Evaluation and Verification (www.unh.edu/erg/cstev) has completed a first year report based on data from monitoring the effectiveness of stormwater treatment systems in addressing water quality and the volume of runoff. It also offers a series of stormwater treatment unit fact sheets.

Other universities and educational organizations that are involved with natural and water resources include **Colgate University** (www.colgate.edu); **Hobart and William Smith Colleges, Finger Lakes Institute** (<http://fli.hws.edu/resources.asp>); **Paul Smith’s College** (www.paulsmiths.edu); **SUNY Brockport**

Department of Environmental Sciences and Biology (www.brockport.edu/envsci); **SUNY College at Purchase**, Environmental Studies Program (www.purchase.edu/Departments/AcademicPrograms/las/sciences/EnvStudies); **SUNY Plattsburgh**, Environmental Science Program (www.plattsburgh.edu/academics/envsci); **SUNY University at Albany**, Department of Geography and Planning (www.albany.edu/gp/index.html).

