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Sauquoit Creek Basin Watershed Management Study

Volume 6
"THE WATERSHED MANAGEMENT STRATEGY"

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Chapter 1

Introduction

Impacts from nonpoint source pollution are a primary factor in contamination of 80 percent of surface water bodies that are classified as "Impaired" in New York State (See Priority Waterbody List, NYS DEC, 1996). Similarly, groundwater is also threatened by a wide range of nonpoint pollution sources. As this study has documented, solutions to preventing impacts to both surface water and groundwater lie in assisting land users and local officials in making informed decisions about the effects of land use changes on water resources.

There is an expressed need within the Sauquoit Creek basin to integrate diverse solutions and abatement programs of various county, state, local, and federal agencies into a coordinated, comprehensive, interagency, watershed based approach to management. A uniform, organized, well thought-out water resources strategy will provide for a more effective delivery of programs; will reduce duplication of efforts and agency "turf battles"; will identify program gaps; will clarify agency roles and responsibilities; will provide a means of identifying and obtaining future funding opportunities; and will result in the overall enhancement of water resources within the Sauquoit Creek basin.{1}

This document represents the culmination of the Sauquoit Creek Basin Watershed Management Study (Volume 1 through Volume 6) and specifically focuses on proposed solutions to each of the major issues identified in Volume 4 - Watershed Issues, Goals, and Objectives. This Volume provides recommendations and specific projects that can be undertaken as future funding is identified or becomes available.

This watershed management strategy, and its endorsement by the many involved agencies and jurisdictions within the basin, will permit those agencies and jurisdictions, each operating within their own statutory scope and areas of expertise, to select appropriate individual components for eventual follow-up and implementation. This process will ensure that each individual agency's or local government's future activities will be consistent with, and further, the overall basin goals and objectives. In practice, implementation of the basin goals and objectives will involve many different agencies and jurisdictions, each selecting and completing individual components, and each contributing their own individual resources and expertise towards the overall goal. Realistically, until an overall institutional structure is realized, the implementation of the overall basin goals and objectives is likely to occur gradually over many years as each agency "chips away" at identified components.

Each of the Multi-purpose Projects and Program Recommendations included at the end of Chapter 3 through Chapter 7 provides: a brief description of the general purpose of each project, an approximate schedule or priority of when the project should be implemented; a suggestion of what agency or individual may be best suited to undertake that activity; a cost estimate for that project; and the identification of a number of smaller, realistic, and implementable tasks for each project.

It should be recognized that in the identification and suggestion of which agency or individual may be best suited to undertake a particular activity, HOCCPP noted only the logical agency or individuals that first came to mind. The identification of these agencies or individuals should not preclude other agencies or individuals which are not identified from initiating any of the activities outlined in this study.

{1} From "Guidelines for Establishing County Water Quality Strategies," NYS Soil and Water Conservation Committee and NYS Department of Environmental Conservation, June 1990.

Chapter 2

Summary of Multi-Purpose Recommendations

For each of the twelve issues discussed in *Volume 4 - Watershed Issues, Goals, and Objectives*, a number of suggested recommendations and management practices evolved for each specific water resource issue. These recommendations were developed and considered individually with respect to each topic, and were devised according to the goals and objectives and the functional evaluation of each issue as discussed in *Volume 3 - Sauquoit Creek Basin Coordinating Committee* and *Volume 4 - Watershed Issues, Goals, and Objectives*. Following this exercise, an examination of all of the issues and their individual recommendations yielded five common suggestions that: 1) would solve the greatest number of problems (multi-purpose); 2) would satisfy the majority of goals and objectives identified; and 3) would complement each other - leading to the development of a comprehensive, integrated watershed management strategy.

These multi-purpose recommendations can be categorized into five major groupings focusing on:

1. Establishing a watershed-wide institutional structure and regulatory framework.

2. Developing a comprehensive, basin-wide stormwater management program. This program needs to be a hierarchical, comprehensive program that includes: (a) the planning and implementation of a basin-wide greenway along the Sauquoit Creek and selected tributaries; (b) the conservation, restoration, and creation of wetlands in areas best suited to provide the necessary ecological functions; and (c) a floodplain management strategy.

3. Implementing an integrated geographic information system (GIS) for the basin.

4. Creating a Sauquoit Creek restoration and enhancement program.

5. Establishing a community education and citizen involvement program.

The following chapters summarize each of these multi-purpose recommendations; discuss key implementation strategies and practices; identify areas of responsibility, possible obstacles, and remaining challenges; summarize the recommendations and immediate steps associated with each of the five groupings; identify steps for implementing the specific recommendations; and provides sample implementation projects.

The Multi-purpose Projects and Program Recommendations represent a sample of priority projects which, if undertaken, will work toward a comprehensive, basin-wide approach to water resources management within the watershed. It should be noted that these projects do not represent an all inclusive listing of potential projects but are provided to kick-off management activities within the basin and to initiate a similar thought process among involved individuals. Additional projects are encouraged to be formulated in the future and inserted into respective chapters. In developing additional projects, individuals and agencies should focus on documenting the relationship of the proposed project to meeting the goals and objectives of the five multi-purpose recommendations discussed below.

In addition to implementing identified Multi-Purpose Projects and Program Recommendations and identifying additional projects, perhaps the most needed "next step" involves the formulation of a basin steering committee to create a forum for continued discussion and dialogue. While the Sauquoit Creek Basin Coordinating Committee was created as part of this study, its scope was

somewhat limited to the identification and consensus of which issues were impacting the watershed. However, many of these same individuals should be represented on a steering committee which will further the achievements that have been gained so far.

Communities and agencies within the basin should focus on the investigation and identification of viable, specific alternatives to implement and accomplish many of the future activities and the more technical components which are outlined in *Volume 6 - Watershed Management Strategy*.

Specific activities for the initial start-up of such a committee might involve: identification and notification of appropriate individuals to serve on the committee; establishment of memorandums of understanding among basin communities concerning the steering committee functions; etc. Important goals for the committee should be to establish a continuing, long-term structure that is agreeable to basin municipalities and to identify potential sources of public and/or private financial resources for continued, long-term administrative support, as well as, project specific implementation efforts. These activities, as well as others, are outlined within the following chapters.

Chapter 3

Establishing a Watershed-Wide Institutional Structure and Regulatory Framework

A successful watershed management strategy depends heavily upon the institutional structure and regulatory framework that is developed. Communities will need to decide what administrative vehicle is most appropriate to address watershed issues and how technical understanding of the watershed will be used to solve specific problems such as flooding, water quality degradation, and loss of natural character. To accomplish this, municipalities and other government entities in the watershed must find a framework that enables them to work together to protect their common interest in the water resources of the basin.

There are several considerations necessary in the establishment of an effective institutional structure and regulatory framework for watershed management. These are discussed in more detail below and include the following. First, one consideration involves the appropriateness of a more formal administrative vehicle that provides the framework to encourage a basinwide approach to decision making (discussed below within Section 3.1). These mechanisms may range from: a simple memorandum of understanding among basin communities, to giving existing political institutions (such as county or municipal governments) new responsibilities for implementing regional strategies in the watershed, to the establishment of a totally new entity for the specific purpose of watershed management within the Sauquoit Creek basin. Second, specific and uniform regulations must be used to direct land uses that might affect the watershed and the vehicle identified that would provide for the uniform definition and enforcement of these regulations (discussed within Section 3.2). Third, watershed protection efforts must be funded on a continuing basis, so that the established framework can be maintained (discussed within Section 3.3). Finally, regulatory efforts by local decision makers must be guided by a technical understanding of the watershed to ensure that the controls established in the region will be effective at solving problems (discussed within Section 3.4).

SECTION 3.1

ESTABLISHING A WATERSHED ENTITY

There are several possible institutional arrangements that could be used to manage the watershed. These arrangements range from: a simple memorandum of understanding among basin communities, to giving existing political institutions (such as county or municipal governments) new responsibilities for implementing regional strategies in the watershed, to the establishment of a totally new entity for the specific purpose of watershed management within the Sauquoit Creek basin.

A) New Entity

Some watershed management efforts have been implemented through the establishment of a regional authority specifically designed to oversee activities that affect that watershed. In these cases, the jurisdiction of such an authority is defined by the physical characteristics of the watershed, rather than the political boundaries of existing institutions. Recently, there has been an increasingly regional focus on services that are required by communities within the Sauquoit Creek basin, such as water service, sewer service, and police protection.

The institutional structure and regulatory framework that is to be developed must allow decision makers to address a variety of interests that may conflict at times, and must establish procedures for resolving conflicts. Conflicting interests may include economic growth, equity for landowners, improving water quality, and flood prevention. Planning experts stress the importance of creating a stable, ongoing structure for addressing such conflict in the context of intermunicipal efforts (Godschalk, 1992). It may be useful to keep the members of the original Sauquoit Creek Basin Coordinating Committee involved with the watershed management effort in a formal advisory capacity, as their previous work in considering the broad range of issues in the watershed will help to form a basis for cooperation. Through such continued involvement, the committee can provide a structure for coordinating ongoing discussions between local stakeholders.

The organization of a new entity could be as a "single-entity" task force that has the responsibility of developing plans and managing actions. Another alternative that large watersheds have used is a hierarchical committee structure consisting of a number of layers that eventually would funnel input from technical, scientific, and citizen committees into a single decision making body.

In some cases, watershed associations can also be established as private, nonprofit corporations charged with preserving and enhancing water resources in a particular basin. This structure provides a formal framework for decision making, and makes the organization eligible for receiving foundation grants and private donations (DEC, 1986).

Some of the functions of an ongoing watershed management single-entity task force, authority, committee, or association might include:

- Setting more detailed and specific priorities within the basin.
- Developing expertise and experience on basin management issues, including knowledge about the natural and human systems of the watershed and the laws, regulations, and government processes.
- Developing credibility with local, county, state, and federal officials.
- Establishing a professional staff.
- Developing long-term projects, goals, and objectives.
- Working to preserve and protect the watershed as a whole.
- Serving as a focus for public participation and private involvement in watershed protection activities (i.e., developing a good relationship with the media, interaction with local citizen groups, officials, businessmen, and statewide environmental organizations).
- Becoming involved with public participation programs of federal and state agencies.
- Communicating with public and regulatory agencies through newsletters and other written material.

B) Existing Entity

An alternative to creating an entirely new watershed entity is to empower an existing entity with management functions within the watershed. The existing entity could perform functions similar to that of a new entity, as listed above, but would have the advantage of an already-established staff, and an existing relationship with local and state officials.

For example, reworking an existing entity that maintains county-based jurisdiction would offer the advantage of using an existing institution, staff, and operational guidelines thus eliminating the need to create a new institutional structure. However, given municipal Home Rule powers, Herkimer County and Oneida County would have limited control over land use decisions in the watershed. A county-based entity would most likely require new legislation giving certain powers and duties that were geared toward the specific needs of that watershed.

Currently, however, Article 5, Section 220-a of County Law authorizes the county legislature to create special water quality management agencies for the explicit purpose of water quality management program oversight. Such an agency may, at the discretion of the legislature, be an existing county official, county agency, a group of agencies or officials, or other county entity, or, may be a newly created agency. Such a water quality management agency shall be responsible for providing oversight of all water quality programs and related activities in the county. This includes a continuing assessment of the impact of both point and nonpoint sources of pollution on the waters of the county and the appropriateness of the monitoring and administrative activities related thereto. The water quality management agency shall have the responsibility to review and coordinate all activities of county officers, agencies, departments, or other entities of county government which have substantial impact on or interest in water quality management.{2}

There are also entities that currently exist and operate on a regional basis. For example, the Herkimer-Oneida Counties Comprehensive Planning Program (HOCCPP) has been the point agency in developing the Sauquoit Creek Basin Watershed Management Study, and has experience in mobilizing resources, securing funds, planning, and coordinating implementation efforts among entities. It may be appropriate for such organizations to implement stream corridor and watershed management tasks within the Sauquoit Creek basin. The designation of such a regionally-based entity would add continuity to the watershed management process, and continue a comprehensive integrative watershed effort. Typically, regional-based entities are also in an excellent position to secure further funds, coordinate many participants both from the private and public sector, and establish long-range water resource programs. As discussed in *Volume 4 - Watershed Issues, Goals, and Objectives (Section 2.11)*, however, continued funding is a key factor which is necessary to insure an effective institutional structure and management framework.

Staff of existing entities may require a reevaluation and reordering of work programs or may require new staff. At a minimum, for an example, new staff might include a watershed coordinator; half-time specialist (such as a GIS specialist to run the information effort); and a watershed engineer (which could be partly shared with existing town engineers to provide watershed protection services and supervise inspectors).

In dealing with both county-based or regionally-based entities, municipalities may wish to establish a mechanism to retain some control over the regulatory process and decisions in the watershed. For example, each

{2} From: Article 5 - County Law, Section 220-a, Water Quality Management Agency, effective June 1982.

community could appoint representatives to a board that provides policy direction to staff. These representatives would be able to ensure that watershed regulations and activities are acceptable to and in the interests of each of the municipalities.

SECTION 3.2

DEFINING AND ENFORCING MECHANISMS FOR LAND-USE CONTROL

An additional component which is necessary to establishing an effective institutional structure and regulatory framework involves the use of uniform and specific regulations to direct land use activities within the watershed. It is also important to insure a watershed entity is involved in defining and enforcing these controls.

There are several methods currently available that could be used (singly or in combination with others) to more effectively direct land use activities on a watershed basis. These include: intermunicipal agreements; comprehensive/master planning; land use zoning; subdivision review; and land acquisition/development rights. Each of these are described below in more detail.

A) Intermunicipal Agreements

Intermunicipal agreements could provide the avenue for obtaining more uniformity and cooperation in developing and enforcing regulatory controls within the basin. An intermunicipal agreement is simply a form of contract between two or more local governments, between a local government and state, county or federal entity, etc., to agree to the stated purpose within the contract.

For example, local governments can prepare written agreements for establishing voluntary stormwater management programs under Article 5-G of the General Municipal Law. Such agreements could include provisions for standardized zoning and subdivision regulations across municipalities, and for establishing drainage design standards for structural flood control measures. The municipalities could also develop a "drainage area master plan" providing designs for regional stormwater detention basins and watercourse management, as well as financing recommendations (Onondaga County EMC Report, 1993).

An advantage of intermunicipal agreements is that they are voluntary - which somewhat addresses the concern about strict enforcement by use of "policing" rather than by voluntary education and cooperation.

Current understanding and conditions among municipalities in the Sauquoit Creek region may be favorable to such arrangements. The Town of New Hartford is currently making some land use decisions based on potential impacts to the entire watershed, which is evidence that the town already recognizes the importance of considering the effects of development on other communities and the watershed. Additionally, the Town of New Hartford has bonded for $2.5 million to address stormwater problems under the auspices of regional basin planning. As a downstream community that directly feels the effects of stormwater management and flooding, the Town of Whitestown would benefit greatly from intermunicipal agreements and watershed-wide land-use controls. Additionally, development and growth are likely to extend increasingly to the Town of Paris. Intermunicipal agreements implemented among the three primary towns within the basin would have significant effects on the watershed and might create the incentive for other municipalities within the basin to join such an effort.

B) Comprehensive Planning

Land-use planning should be carried out with consideration of the entire watershed. A good watershed program also coordinates federal and state laws with local programs to create an overall watershed plan that improves water quality and addresses other significant issues, such as open space resources, the Sauquoit Creek's natural drainage character, and the floodplain. At the same time, the plan needs to support the economic, development, and transportation needs of the communities.

An overall, watershed-wide land use plan must also be incorporated into any other plan, such as those developed for roads, parks, utilities, and other public facilities. The plans must be acceptable to each of the local governments in the watershed and must adhere to state mandates and regional planning concepts.

A land-use plan for the Sauquoit watershed should address these issues by setting appropriate development goals. The plan should encourage resolution of conflicting goals so the environment is protected, development will be sustainable, and the Sauquoit Creek basin will be protected. While comprehensive planning provides general guidance in managing nonpoint source pollution, specific practices are most often put in place through zoning regulations.

C) Zoning

Two major mechanisms of land use planning that relate directly to a reduction in watershed pollutant loadings are: (1) controlling the type, size, and location of development in a given area; and (2) reducing pollution generated by specific levels of development. Zoning regulations can accomplish this goal by defining uses of land (e.g., types of buildings, lot sizes, design), and can be structured to control nonpoint source pollution. Several types of zoning, which are outlined below, would be useful in addressing the significant issues identified in the Sauquoit Creek basin.

- **Cluster Development.** This type of land use control generally permits a similar number of structures within a broad area but requires the structures be grouped or "clustered" into one smaller area - thus leaving the remaining areas undeveloped. This type of development can be used to preserve open space, encourage greenbelts, preserve existing topography, and leave substantial space for amenities such as playgrounds, parks, and natural character. Cluster development also helps preserve property values.

- **Planned Unit Developments (PUDs).** This type of development control involves up-front planning for large, mixed use developments, and often encourages clustered development with more open space areas, results in reduced impervious surfaces, and typically requires other "Best Management Practices" such as for stormwater management.

- **Incentive or Bonus Zoning.** This type of land use control can promote benefits to water resources within the Sauquoit Creek basin by providing developers with incentives to meet watershed goals. For example, a developer might be permitted a higher density development in return for maximizing open space, providing for public access, or maintaining a wider buffer adjacent to the creek.

- **Downzoning.** Downzoning is a process that changes an established zone to a lower density level or less intense use. This could be used along the Sauquoit Creek to provide buffers between industrial sites and the streambank, or on a whole area surrounding a water body.

- **Phase-In Zoning.** This strategy can be used when

present development is incompatible with watershed goals, but an abrupt change would be to disruptive to the economy of the community. For example, a "phase-in zoning" plan may set a process or strategy to close or decontaminate an industrial plant within a set time frame (ie: twenty-years).

- **Large Lot Zoning.** This approach could be used with large residential developments (5 to 20 acres) and could include designs that take advantage of water resource management techniques, such as common bioretention areas, stormwater detention basins, or aquifer recharge areas. Certain specific design standards, such as a limit on the percentage of impervious surface, can also be included.

- **Conditioned Zoning.** This type of zoning allows a particular development type (i.e., multi-unit apartments) if specific conditions are met (i.e., no septic systems).

- **Overlay Zoning.** Overlay zoning uses a mapped district that places additional restrictions or requirements on top of those that apply to the underlying zone. These zones can protect specific water resources, such as flood plains, wells, or wetlands lying within underlying residential, commercial, or industrial zones.

Overlay zoning that is designed specifically for watershed management establishes additional zones within the watershed that can operate within the existing planning framework - allowing for the continuation of elements that may already be in place. This may also eliminate a need to construct a new government entity or bureaucracy in order to implement a watershed management program.

- **Aesthetic Zoning.** Aesthetic zoning places design restriction on new or historic buildings, preventing development from degrading natural character and open space values identified by the study.

- **Performance Zoning.** This type of zoning limits development based on the resources of the specific property. It allows much variation (i.e., gross density) within overall zoning guidelines (i.e., overall intensity guidelines).

  Performance zoning is a mechanism for allowing cluster development, and can set a maximum use intensity (density factor) on the buildable portion of the site. For example, if an average overall intensity of use of one dwelling unit (du)/acre meets the zoning requirements, the gross density of use (1 du/acre) could vary depending on a property's characteristics. This approach avoids the creation of many small zoning districts with different levels of protection. The environment is protected from disturbance of unstable or rare resources, but flexibility is allowed in less sensitive areas.

With regard to land use planning techniques such as overlay zoning, the watershed itself can suggest strategies for prioritizing which areas of the watershed need to be protected the most. The map in Figure 3-1 shows a hypothetical example and a number of priority levels based on physical and biological features of a typical watershed.

As additional resources are inventoried, this map could be refined and developed into overlay districts to delineate management zones within the Sauquoit Creek basin. For example, potential overlay zones might include: 1) a Water Management Zone (Zone 1), Buffer Zone (Zone 2), Development Zone (Zone 3), and Visual Amenity Zone (Zone 4).

The water management zone could be designated as an area within 100 feet of the Sauquoit Creek or its tributaries, and could be expanded to include sensitive water resource areas, such as floodplains, riparian wetlands, and steep slopes. There are two primary areas within the water management zone: the conveyance zone and the collection zone. The conveyance zone contains the main channel of the Sauquoit Creek and adjacent areas, including the floodplain. The flows in this

zone are derived from runoff coming from the upland and upstream areas, as well as from groundwater inflow directly into the creek channel. Groundwater contributions provide the stream baseflow and constitute the vast majority of the stream discharge over the year. Stormwater, on the other hand, is derived mainly from the upper watershed areas, and though it contributes a small proportion of the total stream discharge, it contributes the bulk of the largest peak flows in developed or partially developed basins. The central conveyance zone (particularly near New York Mills) is also subject to flooding, but in this case, it is outflooding by the stream overtopping its banks. Because this zone is prone to comparatively large floods, especially as the upper basin becomes more developed, it is the zone least suited to development and most difficult to manage hydrologically. This zone can also be subject to severe erosion and even mass wasting (mudslides) during very large storms, and its banks have required heavy reinforcement with rip rap or concrete.

The collection zone includes areas within the middle and upper basin, and is subject to serious drainage problems. Seepage is common along the perimeter, and groundwater saturation can be expected in the lower central areas during much of the year. During periods of runoff, the collection zone is prone to inflooding (flooding caused by overland flow concentrating in a low area) caused by massive stormwater loading from upland surfaces. Inflooding is common in the Sauquoit Creek watershed and is probably the most common source of local flood damage.

The buffer zone (Zone 2) could be defined as areas within 1/4-mile from the Sauquoit Creek or 1/8-mile from any tributary, and within 100 feet of any state wetland. The buffer zone is intended to provide an area of protection between the water management zones (Zone 1) and the developed areas (Zone 3). A buffer zone may have special provisions for water resources that may be less restrictive than those in development zones. The upland areas are ideal for instituting buffer zones, as they are generally least susceptible to drainage problems. Buffer zones in these areas can capture or purify water so that it doesn't become a water quality or quantity problem downstream. Thus, the upland areas provide the greatest opportunity for site-scale stormwater management, because most sites have little upslope drainage to contend with and because surface flows are generally small and diffused.

The development zone (Zone 3) would include areas of existing development such as special agricultural districts, residential districts, and commercial and industrial districts.

The visual amenity zone (Zone 4) could be defined as areas between 1/4-mile and one mile from the Sauquoit Creek and could contain special visual guidelines such as the requirement for special review by a watershed entity to ensure that a desired landscape quality is maintained. For example, proposed new development may be required to meet guidelines to minimize visual change to the basic elements (ie: form, line, color, texture) inherent in the characteristic landscape.

The recognition of the constraints and opportunities associated with each of these overlay zones is an important step toward formulating development guidelines for the Sauquoit Creek basin. This recognition provides a rationale for defining the spatial patterns of land units, including the buildable land, open space, and special use (e.g., stormwater management) areas.

It is more difficult, however, to establish a rationale for specific density guidelines. Density is a measure of the intensity of development, which can be defined as percentage of impervious surface, total building floor space per acre, or population density. In regard to watershed planning, the percentage of impervious surface is commonly used to define density.

Controls of the percentage of impervious surface in the watershed should be established with an eye toward achieving certain goals and objectives. The watershed's ability to satisfy these goals

is referred to as its performance. For example, the statement "The Sauquoit floods too often and threatens the safety of Whitesboro residents," reveals an expected environmental performance.

The density guidelines for a watershed should be based on these performance goals, in addition to performance standards, performance controls, and the basin's carrying capacity. Once the performance goals have been formulated, performance standards can be defined, based on specific levels of expectation that must be met if goals are to be achieved. For example, a stormwater discharge might call for zero net increase in peak discharges in streams after a particular date (i.e., January 1998) or after a certain development density (i.e., 30 percent impervious cover) has been reached.

In planning new development, it will be necessary to consider all changes in land use in the watershed and to use this information to determine whether special performance standards are needed. If, for instance, cropland is being converted to woodland at the same time that woodland is being cleared for new residential development, the analysis may show that one change offsets the other, thereby maintaining the performance standard of zero net change in stormwater discharge.

Performance controls are the rules and regulations used to enforce the standards. These controls may take the form of specific ordinances or laws limiting the percentage of impervious surface, requirements for site plan review and approval, or incentives such as tax breaks for restoring open space. Controls are the "teeth" necessary to give watershed management the regulatory strength.

Formulation of performance standards and controls requires careful consideration of the carrying capacity of a particular drainage basin. Carrying capacity is a measure of the amount and type of development that the basin is able to sustain without suffering degradation of water features, water quality, biota, soils, and land use. Although this concept might seem straightforward, it is often very difficult to determine a basin's carrying capacity.

As a general rule, the advisable maximum for most basins should not exceed 30 percent development/ impervious surface, but this varies with the style of development and the character of the basin. In fact, there are indications that, in some cases, damage to habitat may occur at a far lower percentage of development/imperviousness. As the imperviousness of a watershed increases, a number of stream and water quality impacts may occur. It has been consistently demonstrated that a definitive threshold in habitat quality exists at approximately 10 to 15 percent imperviousness (Schueler, 1996). Where imperviousness exceeds this threshold, urban stream habitat quality is consistently classified as poor. Other evidence shows that post-development phosphorous loading in watersheds will rise above background loads once watershed imperviousness exceeds 20 to 25 percent (Schueler, 1996).

Relative to some other watersheds, the Sauquoit Creek basin tends to have a low development potential/ carrying capacity due to its hilly terrain, unbuildable slopes, thin soils, and rapid rate of stormwater transfer. Effective stormwater management, floodplain management, and sensitive development can increase the carrying capacity significantly.

D) Subdivision Regulations

Subdivision regulations are another common land use control adopted by many local governments. However, they are more limited in scope and purpose than zoning. Subdivision regulations empower the municipality to review and approve the plans for all subdivision of land within that community and they address the actual physical layout and development of the site. Subdivision regulations typically include: construction standards, specifications and procedures for proposed streets, drinking water supply, sewage treatment, and stormwater management systems.

In regard to watershed management, the subdivision review process allows government agencies and advisory boards to examine development plans to ensure that developers have met layout and physical aspect requirements that may be present in consideration of the watershed. These watershed requirements most commonly include a runoff analysis and drainage design plan.

Additional reference for runoff and drainage considerations can be obtained from requirements pertaining to State Pollution Discharge Elimination Systems (SPDES) General Permits, which apply to construction activities that will result in the disturbance of five or more acres of land.

E) Land Acquisition and Development Rights

Acquisition of land or development rights by a government agency or an authorized land protection organization can be an effective means of protecting land that is uniquely valuable to the community, such as properties bordering wells, wetlands, and floodplains, or areas identified for future stormwater management facilities. There are a variety of strategies for the acquisition of land and development rights, including: outright acquisition; conservation easements; the transfer of development rights; and restrictive covenants.

A municipality that is, for an example, trying to protect a wellhead area might attempt the outright purchase of the property within the recharge area. Land acquisition through this approach is typically expensive and does not insure complete protection if there are unwilling sellers. Additionally, land acquisition that benefits the watershed as a whole is relatively difficult to obtain when one community's efforts depend upon another community's success in outright purchase. This difficulty may be lessened somewhat if a basinwide entity was responsible for such acquisition.

With regard to conservation easements, these are typically legal arrangements which enable a qualified organization to own an interest in a piece of property thereby limiting or prohibiting certain types of development on that property, or setting aside a portion of the property for a specific use such as a drainage easement.

The transfer of development rights concept is a means of compensating owners for being unable to utilize the development potential of a piece of property. This approach has worked effectively in the Pinelands Development Credit Program of the Pinelands Commission in New Jersey. Under this concept, a landowner may sell the right to develop on his or her land to another landowner who wishes to develop on a parcel on which development is restricted. By doing this, the first landowner removes the right to develop from one parcel of land and transfers the development rights to a parcel more appropriate for development.

Restrictive covenants are legal agreements which attach limits to a piece of property that "run with the land" and apply to future owners. For example, a restrictive covenant might prohibit the owner from paving more than 10 percent of a parcel of land.

Funding that may be necessary for land acquisition is also discussed within Section 3.3.

SECTION 3.3

FINANCING AN INSTITUTIONAL STRUCTURE AND REGULATORY FRAMEWORK

Watershed protection efforts must be funded on a continuing basis and there are several alternative methods by which local governments can fund water management and watershed management programs. For example, these programs can be financed on an ongoing basis, by the use of bonds, special grants, or by a combination of these techniques. Additional methods that are available for financing an institutional structure and regulatory framework within the watershed are discussed in more detail below. However, before discussing specific methodologies, there are a number of factors to consider in deciding upon which methods of financing should be used.

The scope and type of specific program to be funded must be fully understood. For example, funding requirements will increase with a need for greater numbers of staff or need for computer systems, etc.. The funding mechanisms which are ultimately selected should be targeted toward the particular size and type of a specific project. For example, funds through the Federal Emergency Management Hazard Mitigation grant program are slated for emergency relief specific to natural disasters and are oriented to large-scale efforts. Other funds, such as the Soil Conservation Service Small Watershed Program, are focused on small-scale, long-range comprehensive planning efforts.

Another factor to consider in deciding upon a proper method of financing involves the need to insure that a watershed entity has the legal authority, through state or local statutes, to pursue a particular funding method. Funding mechanisms need to be within specific legal authorities (such as General Municipal Law). Therefore, consideration should be given to ensure that the particular funding mechanism is within the proper legal context. It is also important to consider whether there is an existing funding program or practice already in place locally. If there is an existing funding program already in place (e.g., subdivision fees for new development), it is often easier to modify this mechanism and expand it to apply to other issues within the watershed rather than to implement an entirely new funding mechanism.

The ease at which financing can be obtained depends upon the general financial health of the local government and constituents. Financially affluent communities can more easily accommodate a broad range of financing opportunities, while economically impoverished communities may need to rely more on limited assistance from outside of their community.

An important, but often overlooked, factor to consider in deciding upon a proper method of financing involves the local political atmosphere in which elected officials must make funding decisions. For example, political leaders may be reluctant to suggest a commitment to long term financing that may appear to increase the tax burden of the community.

Lastly, financing requirements for a specific purpose may be easier to acquire than funds for a more general need. For example, the Natural Resource Conservation Service has a funding program for emergency projects, such as the repair of a heavily eroded stream bank that may have resulted from an excessive storm event. Routine maintenance and operational activities may rely more on financing as part of municipal capital programs.

Based on the primary issues within the Sauquoit Creek watershed (as discussed within *Volume 4 - Watershed Issues, Goals, and Objectives*), the following paragraphs discuss several specific methods by which local governments can finance a watershed entity, land use regulation activities associated with land acquisition and development rights, and stormwater management facilities.

A) Financing a Watershed Entity

As discussed in Section 3.1 above, regardless of whether a new governmental entity or existing entity is used for management of the Sauquoit Creek basin, a continuous source of financing is necessary. Such financing can be obtained through a number of techniques, or combination of techniques. For example, additional funds that may be gained through slight increases in user fees could be applied to operational costs of a watershed entity. However, this method may be limited by competing demands for these extra revenues, and by political difficulties associated with increasing such fees. Similarly, an increase in local property or property transfer taxes presents comparable opportunities and constraints.

Depending upon the form a watershed entity might take (ie: whether an authority, district, existing agency, new governmental agency, etc.), municipal bonds may be an avenue which could provide revenues specifically targeted toward supporting the operational needs of that watershed entity.

B) Financing Activities Associated with Land Acquisition and Development Rights

The acquisition of land and development rights was identified in Section 3.2 above, as one mechanism available for controlling land use and related impacts within a watershed. There are a number of ways to finance the acquisition of land and development rights.

Donations and "bargain sales" take advantage of tax laws and motivate private support of land protection by allowing charity or tax deductions for the donation of, and loss on, property which is transferred (by sale or donation) to local governments or eligible nonprofit organizations. However, this method relies on the willingness of the landowner to make such a donation, quite likely foregoing a larger profit that could be obtained on the transfer of land ownership in the normal market. An additional concern is that the donation or sale of property to a government agency generally removes the land from the tax rolls.

Certain conservation oriented groups may be willing to purchase land and preserve its natural values by keeping it undeveloped. However, this methodology is also constrained by the willingness of that group to purchase the property and is further limited by available revenue of that nonprofit group.

Many nonprofit conservation groups are eligible to receive gifts of conservation easements. A conservation easement is a legal agreement between the landowner and the organization that allows the group to hold certain rights that will protect the natural values of the parcel, often by restricting development on the parcel. This method relies on the landowner's willingness to sacrifice the developable market value of the property for the sake of preserving the land, or on his or her eligibility for tax breaks that could serve as an incentive to donate an easement.

C) Financing Stormwater Management Facilities

Stormwater management facilities require expenditures for planning, design, construction, and operation and maintenance. Several techniques are commonly used to finance stormwater management, including mitigation fees, drainage district formation, fees in lieu of construction, formation of utilities, and special improvements districts.

Creative techniques for stormwater management financing initiatives have been pioneered in other areas of the country. The method utilized to equitably manage the apportionment of costs to the public benefactor is extremely important. In this regard, the use of a geographical information system (GIS) transcends the standard land-use management techniques and provides a realistic mechanism for financial development and control.

An excellent example of the use of GIS technology currently exists in the State of Washington's Spokane County Stormwater Utility. Using PC ARC/INFO{3} tied to digital land use patterns, the actual billing and collection of service charges is assigned to these land use patterns. Specific fees are then assigned according to land use based on the relative amount of impervious surface and potential to contribute runoff.

The Spokane County Stormwater Utility developed a methodology for collecting service charges to municipalities and developers for the purpose of funding the utility's work. Utilizing a customized ARC/INFO system combined with digital orthophotographs, the utility classified the entire watershed according to percent impervious surface. Within the Sauquoit Creek watershed, this could be easily accomplished through the use of the Land Use and Land Cover Map included in *Volume 5 - Existing Development, Regulatory Controls and Development Potential.* Based on percent of impervious surface, the utility developed a formula for billing municipalities and developers.

This initial approach was highly successful in Spokane County and is now being enhanced by meshing additional information which was gathered in the watershed to the same database. The result is a cost-effective, accurate, user-friendly system that allows a broad, basinwide look at the county's stormwater problems and potential solutions.

This type of GIS use can easily grow from its more common applications for land use and watershed management, while allowing additional relational database linkages. An added benefit is that all data placed in such a system can be readily updated into a commonly accessible database. This is both cost-effective in the long-term and imperative to maintaining a valid, current system. The potential use of geographic information systems are discussed further in Chapter 5 of this Volume and in *Volume 4 - Watershed Issues, Goals, and Objectives.*

With regard to drainage user fees, New York State does not generally allow counties to impose user fees for financing stormwater and drainage operations. However, there can be voluntary agreements between municipalities for user fees via Article 5-G of New York State's General Municipal Law (Onondaga County EMC Report, 1993). These fees are determined by the amount of impervious area each property adds to the total drainage district and are a measure of anticipated stormwater runoff from that use. For example, a driveway associated with a single-family residence would generate runoff as it adds impervious surface, and therefore, the homeowner would be subject to a user fee. An office building and parking lot would contribute a much larger amount of impervious area, and that facility would thus be subject to a greater fee. Charges can also be based on whether the property is within the

{3} PC ARC/INFO and ARC/INFO are geographical information systems software packages produced and marketed under the registered trademark of Environmental Systems Research Institute, Inc., Redlands, CA.

floodplain or other sensitive area. In most cases, user fees would not apply to undeveloped properties, public streets and highways, railroad rights-of-way, or parks (Benson, 1992).

In addition to user fees, there are a number of specific capital funding mechanisms that can be used to finance stormwater management facilities. Some of these mechanisms may also be used for funding the broader components of watershed management efforts such as operational needs of a watershed entity or land use control (see Figure 3-2). Some of these mechanisms include:

- **State Program Funding.** New York has created a number of incentives to promote resource, energy, and economic development. Various state authorities exist to provide loans, loan guarantees, technical assistance, lease collateral and purchase leaseback agreements, tax exempt bonds, and tax credits.

  The specific corporations and authorities that may provide water resource funding include, but are not limited to: Federal Emergency Management Agency Hazard Mitigation grant; SCS (NRCS) Small Watershed Program (comprehensive); Agricultural Stabilization and Conservation Service Emergency Conservation; U.S. Geological Survey Federal State Cooperative Program; Water Bank and Wetlands Reserve Programs; Soil Conservation Service Great Plains Conservation, Emergency Watershed, Plant Materials for Conservation, and River Basin Planning programs; Farmers Home Administration Watershed Protection and Flood Protection Loans; National Park Service Land and Water Conservation Fund; Bureau of Reclamation Small Reclamation Projects; U.S. Fish and Wildlife Service Fish & Wildlife Management Assistance; U.S. Army Corps Small Flood Control Projects, Civil Works Projects, Flood Plain Management Services, Planning Assistance to States, Snagging and Clearing for Flood Control; Community Development Block Grants; State Consolidated Water Facilities Construction Program; Conservation Commission Grants; Department of Agriculture Urban Forestry Grants; local tax authorities; Ducks Unlimited; The Nature Conservancy; Migratory Bird Program; corporate and foundation grants, etc.

  These and other funding and financing programs that address many of the watershed issues that have been identified within the Sauquoit Creek basin are discussed in more detail and are included within Appendix A of this Volume.

- **Bonds.** This is the most common long-term borrowing mechanism used by municipalities. Debt limitations are generally established as some percentage of the borrowing base. Various types of bonds exist, including electoral debt bonds, nonelectoral general obligation bonds, straight revenue bonds, and guaranteed revenue bonds. The advantage of bond financing is that it makes a large sum of money available up front as a revolving fund, making it possible for a watershed entity to use funds in a most cost-effective manner.

  When considering financing and the assessment of user fees, it is important to recognize that revenue bonds, commonly used to finance sanitary and water supply projects, may not be directly applicable to stormwater or flood control projects having little or no revenue production.

- **Mitigation Fees-In-Lieu-Of.** This form of capital improvement financing is particularly applicable for efforts to regionalize stormwater management facilities. For example, individual, site-by-site small scale facilities are often not required in a regionally managed stormwater program, and therefore, mitigation fees could be used to construct such regional facilities and infrastructure.

  Fees-in-lieu-of can also work within an existing drainage or special improvement district. In practice, the district may apportion costs based on

FIGURE 3-2

A FUNCTIONAL APPROACH TO STORMWATER FINANCING

BMP	OPTION
• Watershed planning	- general revenues (property, income taxes; stormwater user charges)
• Source controls	
- Enforce ordinances	- general revenues
- Development regulations	- plan review and inspection fees
• Maintenance (e.g., street sweeping)	- general revenues
• Capital projects	
- new development	- developer exactions, fee-in-lieu
- retrofit existing areas	- bonds, sinking funds (general revenues)

• *Choices among methods are important because burden for payment differs.*

the percentage of impervious surface for existing and projected development, while a similar but larger percentage of imperviousness would be established for projects requiring mitigation fees. Applicability of mitigation fees to larger projects is a function of the relative impact, benefits accrued, and the predetermined location of appropriate sub-basins where fees are appropriate.

Several legal precedents have been established to govern the application of such mitigation fees. An engineering report on the Beaver Swamp Brook watershed in Westchester County, New York, advises that "the revenues generated must be earmarked for a particular use; they cannot be absorbed into general municipal revenues. Second, the fee must be a reasonable representation of the actual costs of the service. If the charges greatly exceed the actual costs, they are likely to be interpreted as a tax and invalidated if the proper taxing authorization does not exist. Third, there should be identifiable benefits that accrue to the development that paid the fee-in-lieu-of."{4}

- **Pay-As-You-Go Sinking Fund.** This financing technique is created by municipalities as a set-aside reserve fund, which is established to accumulate funds for future facility construction. Communities can be creative in developing funding sources such as through various municipal fees and/or a portion of available property tax revenues.

  Financing for operations and maintenance can be accomplished through the use of special tax revenue and general funds, formation of special tax or assessment districts, or the development of user service charges. Costs to individuals are generally levied as a function of the user impact such as the percent impervious surface, amount of runoff generated (which is related to hydrologic soil type and relative land slope), and/or type of property use. The cost should be equitable and directly related to the property owner's runoff impact relative to the regional facilities.

In addition to user fees and specific capital funding mechanisms, stormwater utilities can be formed and used to finance stormwater management facilities. A stormwater utility consists of a local government enterprise that provides stormwater services and is financially separate from other government functions. Stormwater utilities were first formed during the 1970s in Bellevue, Washington and Boulder, Colorado. By the mid-1980s over fifty stormwater utilities were established and by the 1990s, over 100 were in existence (primarily in Florida which contains 30 to 40). The primary reasons that most stormwater utilities were formed involve: providing a stable source of revenue for operations and maintenance; funding flood control programs; and funding water quality activities. A typical stormwater utility operates according to a master plan and provides functions such as; operations and maintenance, design, engineering, capital improvements, planning, regulation, enforcement, and general water quality management. Figure 3-3 provides an example of a typical fee schedule and total revenue collected through a stormwater utility approach based on impervious area of land uses. Similarly, Figure 3-4 illustrates revenue collected through a stormwater property tax district (based on average assessed value). Figure 3-5 provides a comparison of the differences in payment for land uses within a stormwater utility versus a property tax district.{5}

There are also a number of financing potentials that may be available should any basin plan consider the reconstruction of existing dams as in-line flood control alternatives. Several

{4} Walter B. Satterthwaite Associates, Inc., Westchester, NY, Comprehensive Stormwater Management Plan, Beaver Swamp Brook Watershed, Westchester County, New York. January 1986. A comprehensive and detailed discussion of capital improvement and operation/maintenance financing for stormwater projects.

{5} Greg Lindsey, Indiana University-Purdue University at Indianapolis, Indianapolis, IN, Financing Stormwater Management Practices - A Presentation. June 30, 1993.

Sauquoit Creek impoundments that are in poor repair might be evaluated in this regard. A general list of potential funding sources for this type of activity includes, but is not limited to: the Farmers' Home Administration, U.S. Forest Service, U.S. Department of Agriculture, U.S. Environmental Protection Agency, U.S. Department of Commerce, U.S. Department of Housing and Urban Development, the Small Business Administration, U.S. Department of Interior, U.S. Department of Health and Human Services, and the U.S. Department of Labor.

These and other funding and financing programs that address many of the watershed issues that have been identified within the Sauquoit Creek basin are discussed in more detail and are included within Appendix A of this Volume.

FIGURE 3-3

AN EXAMPLE: ANYTOWN STORMWATER UTILITY

LAND USE CATEGORY	PARCELS	AVERAGE ACRES/ PARCEL	RUNOFF COEFF.	ERUs/SFEs AVERAGE PARCEL	SFEs PER CATEGORY	AVERAGE PARCEL CHARGE	TOTAL CATEGORY CHARGE	PERCENT
INDUSTRIAL	100	10.0	0.7	7.0/70	7,000	$833	$83,000	17%
COMMERCIAL	1,000	2.0	0.8	1.6/16	16,000	$190	$190,000	38%
RESIDENTAL								
< 1 ACRE	8,000	0.25	0.4	0.1/1	8,000	$12	$96,000	19%
> 1 ACRE	2,000	1.5	0.2	0.3/3	6,000	$36	$72,000	14%
AGRICULTURE	100	25.0	?	--	--	--	--	--
UNDEVELOPED	1,000	5.0	0.1	0.5/5	5,000	$60	$60,000	12%
TOTALS	**12,000**				**42,000**		**$500,000**	**100%**

FIGURE 3-4

AN EXAMPLE: ANYTOWN STORMWATER PROPERTY TAX DISTRICT

LAND USE CATEGORY	PARCELS	AVERAGE PARCEL VALUE ($)	AVERAGE ASSESSED VALUE ($)	CATEGORY ASSESSED VALUE	AVERAGE PARCEL CHARGE	TOTAL CATEGORY CHARGE	PERCENT
INDUSTRIAL	100	1,000,000	450,000	45,000,000	406	$40,650	8%
COMMERCIAL	1,000	200,000	90,000	90,000,000	81	$81,300	16%
RESIDENTAL							
< 1 ACRE	8,000	75,000	33,800	270,000,000	30	$243,900	49%
> 1 ACRE	2,000	150,000	67,000	135,000,000	61	$121,950	24%
AGRICULTURE	100	100,000	45,000	4,500,000	41	$4,070	1%
UNDEVELOPED	1,000	20,000	9,000	9,000,000	8	$8,130	2%
TOTALS	**12,000**			**553,500,000**		**$500,000**	**100%**

TAX RATE: {500,000 = X(553,500,000/100} = .0903 PER $100 ASSESSED VALUATION

FIGURE 3-5

DIFFERENCES IN PAYMENT WITH CHARGES AND TAXES

	STORMWATER UTILITY			STORMWATER PROPERTY TAX DISTRICT		
LAND USE CATEGORY	AVERAGE PARCEL CHARGE	TOTAL CATEGORY CHARGE	PERCENT	AVERAGE PARCEL CHARGE	TOTAL CATEGORY CHARGE	PERCENT
INDUSTRIAL	$833	$83,000	17%	406	$40,650	8%
COMMERCIAL	$190	$190,000	38%	81	$81,300	16%
RESIDENTAL						
< 1 ACRE	$12	$96,000	19%	30	$243,900	49%
> 1 ACRE	$36	$72,000	14%	61	$121,950	24%
AGRICULTURE	--	--	--	41	$4,070	1%
UNDEVELOPED	$60	$60,000	12%	8	$8,130	2%
TOTALS		**$500,000**	**100%**		**$500,000**	**100%**

SECTION 3.4

PROVIDING TECHNICAL GUIDANCE FOR DECISION MAKERS

An important component necessary to establish an effective institutional structure and regulatory framework for watershed management emphasizes that regulatory efforts by local decision makers must be guided by a technical understanding of the watershed to ensure that the controls established in the region will be effective at solving problems.

It is important for decisions about appropriate land-use control mechanisms to be guided by reliable technical information about the impacts of these land uses on the water resources within the Sauquoit Creek basin. For example, models designed to estimate impacts from loadings of various pollutants can be applied to reflect different scenarios of development. Modeling can also provide a sound technical basis for implementing watershed management actions, and could strengthen regulatory actions by clearly demonstrating resulting water quality and quantity benefits. Many of these potential water resource impacts are discussed broadly within *Volume 4 - Watershed Issues, Goals, and Objectives.*

Additionally, *Volume 5 - Existing Development, Regulatory Controls and Development Potential* provides a model regulation which suggests the uniform control of stormwater throughout the basin. Adopting uniform land use controls is important to establishing an institutional structure within the basin but it must also be done with a full understanding of the intent of the regulation, its purpose, content and relationship to comprehensive plans and/or enabling legislation. If a legal challenge is mounted against a municipality to have a model regulation thrown out, the municipality may be unable to defend itself without a full understanding of the regulation. If a new regulation is to be adopted as part of an existing zoning ordinance or law, the municipality should be able to clearly demonstrate the regulation's relationship to a community comprehensive plan. If the new regulation is to be adopted as a separate local law or ordinance, the municipality should be able to demonstrate what public purpose is being served and how it relates to the public's health, safety and welfare.

Reliable technical information, and understanding it, can also provide a basis for financing decisions, and ensuring that the costs associated with potential development fees are distributed fairly. For example, the drainage fee structure could be established on GIS-based determinations of the amount of impervious surface contributed by each development in the watershed. This type of arrangement would allow the financial aspects of watershed management to be directly linked to the regulatory aspects.

SECTION 3.5

SUMMARY OF RECOMMENDATIONS FOR GETTING STARTED

As discussed above, there are many components, options, and methodologies available and necessary to establishing an effective institutional structure and regulatory framework within the watershed. In summary, the following major recommendations and short/long term recommendations were selected (based on the discussion above and the discussions within Chapter 4 - Watershed Issues, Goals, and Objectives) as a way to "get started" in regard to this element of watershed management within the Sauquoit Creek basin.

1. **Major Recommendation.** Establish the legal, financial, regulatory, and administrative framework for a watershed management program.

2. **Recommendations for Getting Started (Short-Term).**

   a. Establish a temporary watershed based entity or committee.

      1) Designate a point agency and key staff for a one-year trial.

      2) Enhance and refine the Sauquoit Creek Basin Coordinating Committee and its activities.

      3) Designate one person from each representative community to serve on the watershed entity/committee.

   b. Incorporate watershed-wide concerns into present building and zoning regulations.

   c. Develop new watershed-wide guidelines.

   d. Refine (as necessary) and implement the model stormwater, sediment and erosion control regulations.

   e. Establish a source for immediate, short-term financing for a watershed entity/committee.

3. **Recommendations for Longer-Term Solutions**

   a. Develop a structure for a permanent institutional framework within one year.

   b. Identify and obtain a source of continued financing for a watershed entity.

SPECIFIC PROJECTS AND PROGRAM RECOMMENDATIONS

This section outlines specific projects and program recommendations that are "ready made," fundable projects that would further the major recommendations and short/long term recommendations outlined above.

For each recommendation and specific project developed, the following steps need to be followed:

- obtain commitment of involvement from key decision makers
- set priorities for potential solutions
- develop a list of projects to be implemented for each solution
- set goals for accomplishing each project
- locate funding and technical expertise for projects that need it
- be practical
- evaluate progress.

Each of the following specific projects have been subjectively evaluated based on a priority rating system, range of cost, and potential point agency. Factors which were evaluated include, but are not limited to: the overall benefit of the project to the watershed; the cost of the project and potential availability of funding; whether there is a logical point agency or individual; and, the ease of implementation.

Projects receiving a "high" priority include those that should receive immediate attention, obtain a commitment of involvement, and identify the appropriate point agency. Additionally, funding is likely to be attainable and activities to obtain such funding should begin immediately.

Projects with a "medium" priority rating include those activities which are slightly less urgent but action relating to agency commitment and a funding mechanism should begin within the next year.

Projects with a "low" priority should be targeted for a longer term implementation schedule such as a 10-year cycle. These projects may require or involve additional thought and planning, and could be postponed unless a particular funding source becomes available or a point agency is willing to champion its cause earlier.

In addition to the priority rating, projects are also identified as being short-term or long term projects. As such, there may be high priority, short-term projects, as well as, high priority long-term projects. Short-term projects are those which can be accomplished within a relatively short span of time (ie: within one to two years).

Long-term projects include those activities that: may require or involve additional thought, research, planning, or collection of base data; may continue to be implemented over a number of years; may require continuous activity; or may take a number of years to conclude.

In estimating project costs, this evaluation criteria includes subjective and approximate estimations for planning purposes only. The estimates of costs are, however, based on professional knowledge of similar projects implemented in other watersheds. Once a project has been identified and a commitment to proceed established, a new, more accurate estimate should be made during the project application process. The ranges of costs and cost categories used for the evaluation of the following specific projects include: projects with a relatively "low" cost ranging from $0 to $100,000; projects with a "medium" cost ranging from $100,000 to $500,000; projects with a relatively "high" cost of over $500,000.

As with the other priority rating criteria, the suggestions for a point agency or individual are subjective recommendations of who may be the logical entity that might initiate that particular project. Obtaining the

commitment of this agency would be the first step in initiating these projects. The agency's available resources and interest in the projects would ultimately determine if they would become the sole point agency, the point agency with other co-sponsors, or if they would not be involved at all. Of course other entities not listed can initiate the activity if there is an interest or funding source available.

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Institutional Structure and Regulatory Framework

Project Title: Sauquoit Creek Watershed Committee

Project Description: Establish a temporary committee for implementing a watershed-wide management strategy.

Priority: High (short-term)

Potential Activities:

Formalize, enhance, and refine the Sauquoit Creek Basin Coordinating Committee or create a new steering committee to promote the long-term protection of the basin by providing a mechanism for communication and coordination among the many entities with an interest in the creek and/or basin. Specific activities of such a committee could include: identification and notification of appropriate individuals to serve on the committee; establishment of memorandums of understanding among basin communities concerning the steering committee functions; addressing watershed-related issues as outlined in the study; refining the identification of point agencies to implement certain Multi-Purpose Recommendations; monitoring activities that might affect water quality; review and updates to the Sauquoit Creek Basin Management Strategy; preparation of periodic status reports of basin; creation of committee by-laws; and efforts to stimulate public involvement and education.

In the short-term, such a committee should play an advisory role only. Until such time as a more permanent institutional framework is established within the basin, this committee should have no regulatory or land acquisition authority.

Point Agency or Individual:

The point agency could include any one of the participating municipalities but appears to be more appropriate for a county, regional, or state level agency to provide the initial support. The point agency should have the capability to designate and support adequate administrative staffing to the committee for a short-term, trial period (ie: one year).

At a minimum, municipal representation on the committee should include:

- Towns: New Hartford, Paris, Whitestown
- Villages: Whitesboro, New Hartford, Clayville, New York Mills, and Yorkville

(continued on back)

Participating agencies should include:

- New York State Department of Environmental Conservation
- New York State Department of Transportation
- Herkimer-Oneida Counties Comprehensive Planning Program
- State and/or County Department of Health
- Cornell Cooperative Extension of Oneida County
- Oneida County Department of Planning
- Oneida County Department of Public Works
- Oneida County Dept. of Water Quality and Water Pollution Control
- Oneida County Soil and Water Conservation District
- USDA Natural Resource Conservation Service
- Other state, federal, regional, county, or local agencies
- Special interest groups

Cost Estimate: Medium ($100,000 to $499,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Institutional Structure and Regulatory Framework

Project Title: Financing for a Watershed Committee

Project Description: Establish a source for immediate, short-term financing of a temporary committee.

Priority: High (Short-term)

Potential Activities:

Investigate and apply for funding which would support the functioning, activities, and key staff of a committee.

Point Agency or Individual:

Any one of the participating municipalities or agencies but is more logical to include the organization that anticipates being the point-agency for establishing the Sauquoit Creek Watershed Committee.

Cost Estimate: Medium ($100,000 to $ 499,000)

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Institutional Structure and Regulatory Framework

Project Title: Watershed Management Zones

Project Description: Develop a series of management zones within the Sauquoit Creek watershed to help incorporate watershed concerns into present land use controls and to encourage a watershed perspective within routine zoning and planning decisions.

Priority: Medium (Short-term)

Potential Activities:

Develop a series of management zones, such as those discussed within Section 3.2 of this volume. At a minimum, these should include:

- Riparian Zone: The immediate riparian zones along the river are the highest priority for protection. A minimum buffer area of 100 feet from the ordinary high water mark should be maintained.

- Uplands: Beyond the 100-foot buffer, existing regulations, incentive programs, and topography provide significant protection for the creek from adverse activities on upland areas.

Point Agency or Individual:

- New York State Department of Environmental Conservation
- Herkimer-Oneida Counties Comprehensive Planning Program
- Oneida County Department of Planning
- private sector consultant(s)

The Oneida County Department of Planning, HOCCPP, NYS DEC, or a consultant could define the management zones. However, each municipality is ultimately responsible for adoption of these zones until such time as a more permanent institutional framework is established.

Cost Estimate: Low (<$100,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Institutional Structure and Regulatory Framework

Project Title: Revision of Municipal Land-Use Regulations

Project Description: Revise existing municipal land-use controls and plans to incorporate watershed-wide concerns.

Priority: Medium (Short-term)

Potential Activities: Review and revise municipal land use regulations such as:

- Zoning
- Comprehensive Plans
- Subdivision Regulations
- Stormwater Management Ordinances
- Aquifer protection, etc.

The guidance memorandums which were sent to each municipality within the basin as part of the Sauquoit Creek Basin Watershed Management Study may be used as a reference and outline strengths, weaknesses, and effectiveness of these regulatory controls in addressing watershed issues. Copies of these memorandums are included within Volume 5 - Existing Development, Regulatory Controls and Development Potential or may be obtained directly from the municipality.

Point Agency or Individual:

- municipal staff or board

Municipalities with the assistance of respective state, county, regional and local agencies such as the county and local planning departments, state and county health departments, NYS DEC, etc.

Cost Estimate: Low (< $100,000)

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Institutional Structure and Regulatory Framework

Project Title: Development of New Watershed-Wide Guidelines

Project Description: In coordination with any revisions to existing municipal land-use controls and plans, develop appropriate guidelines for various watershed-wide concerns to insure uniform treatment of these issues within the entire basin.

Priority: Medium (Short-term)

Potential Activities:

Develop consistent watershed-wide guidelines for issues such as, but not limited to: stormwater management, stream buffering and setbacks, agricultural practices, highway construction and maintenance procedures, wellhead protection, etc.

Point Agency or Individual:

- municipal staff or board

Municipalities with the assistance of respective state, county, regional and local agencies such as the county and local planning departments, state and county health departments, NYS DEC, etc.

Cost Estimate: Low (< $100,000/topic)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Institutional Structure and Regulatory Framework

Project Title: Model Stormwater Management, Sediment and Erosion Control Regulations

Project Description: Refine and implement the model stormwater management, sediment and erosion control regulations provided in Volume 5, Appendix E.

Priority: High (short-term)

Potential Activities:

The following is designed to guide municipal officials in the thought process that leads to the development, refinement, implementation and adoption of a stormwater management, sediment and erosion control law or ordinance. Municipal officials are encouraged to consider the following questions and to maintain a record of their deliberations demonstrating a thorough understanding of the issue should the regulations be legally challenged.

- What is the nature of the stormwater problem in the community and will the adoption of these regulations help address the problem? If so, how? What are the purposes and objectives of the regulation?

- Under what authority can our community adopt the regulation? (ie: Article 9 or 16 of Town Law; Section 10 of the Municipal Home Rule Law; Article 7 or 20 of the Village Law; or Section 20 of General City Law, etc.).

- Who will (or will not) have to abide by the stormwater management regulations? Who will review and approve plans (ie: the planning board, codes officer, engineer, etc.)? Should a public hearing be required as part of the stormwater management review process? What types of information should be required in a stormwater management plan? Will an inspection process be established? Who will perform inspections and when?

- Are the proposed performance standards adequate to ensure that the quantity and quality of runoff after development is not substantially altered from pre-development conditions?

- Should the proposed regulations contain provisions for off-site control of stormwater? If so, what provisions will be incorporated?

- What arrangements will be made to ensure that stormwater management facilities are properly maintained?

- What provisions will ensure that the approved stormwater plan is properly implemented (ie: performance bonds, escrow account certification, irrevocable letter of credit, etc.)? Who will be authorized to release the developer from credit requirements, and when?

(continued on back)

Point Agency or Individual:

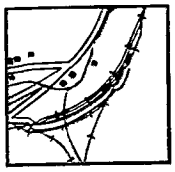
- municipal staff or board

Municipalities with the assistance of respective state, county, regional and local agencies such as the county and local planning departments, state and county health departments, NYS DEC, etc.

Cost Estimate: Low (< $100,000)

Chapter 4

Developing a Comprehensive Basinwide Stormwater Management Program



The second multi-purpose recommendation that has evolved as part of the Sauquoit Creek Basin Watershed Management Strategy involves the development and implementation of a comprehensive, basinwide stormwater management program. This program should be focused on the management of both stormwater quantity and quality, and should integrate knowledge about: sources of pollutants; the movement and processing of pollutants within the hydrologic cycle; the effects of these pollutants on receiving waters and receptor communities; and how to alleviate impacts through a variety of mechanisms. Much of this information is summarized in *Volume 4 - Watershed Issues, Goals, and Objectives*. That volume also identifies many of the cause-and-effect relationships that must be understood in order to develop a reasonable, technically effective stormwater management program.

In summary, the stormwater issues affecting the Sauquoit Creek basin include both water quality and quantity concerns. Flooding has typically been a concern among downstream communities in the Sauquoit Creek basin, particularly in New Hartford and Whitesboro. The primary causes of flooding are identified as heavy volume rainfall, rapidly melting snow, flowing ice, and subsequent stormwater runoff. Since the amounts of rainfall and snowmelt cannot be controlled, the design and operation of both transport and storage systems for stormwater must be implemented to minimize impacts from flooding. An effective stormwater management program should use both structural and nonstructural measures to effectively treat both quantity and quality issues. While this chapter focuses primarily on structural measures, other chapters of this volume discuss non-structural methodologies such as voluntary programs for flood insurance, analysis of data through the use of geographic information systems, community education programs, policy and regulatory controls, etc.

Within this long-term watershed framework, a stormwater management program should merge the watershed perspective with the site-specific (habitat) perspective. In addition, this approach should seek to define linkages among watershed characteristics, associated habitat features, and biotic communities in preparation for specifying required habitat maintenance. The general approach suggested for developing a comprehensive stormwater management program is outlined below, and specific projects to reach this goal are explained in Section 4.5.

SECTION 4.1

MERGING THE WATERSHED PERSPECTIVE WITH THE SITE-SPECIFIC PERSPECTIVE

A combination of known best management practices (BMPs) can be implemented through a four-tiered classification system to accomplish an effective stormwater management program in the Sauquoit Creek basin. This four-tiered system ranges from addressing activities on a site-specific basis to implementing activities at a basin-wide and regional scale. These varying tiers (or orders of control) are illustrated in Figure 4-1 and are described below in more detail.

However, as with all BMPs, biological solutions to stormwater management may have secondary impacts that need to be recognized and mitigated when possible. For example, efforts to infiltrate more surface water into the soil could potentially lead to contamination of groundwater. Proper design of the bioretention areas can ensure this does not occur. As another example, incorporation of wet ponds and constructed wetlands within a stream corridor could potentially raise the temperature of the receiving water. Proper shading and design must be incorporated if temperature fluctuation has been identified as a critical factor.

In summary, a watershed approach to stormwater management allows the application of appropriate best management practices. A functional, four-tiered approach offers an effective way of matching the best management practice to the correct situation and geographic location within the watershed.

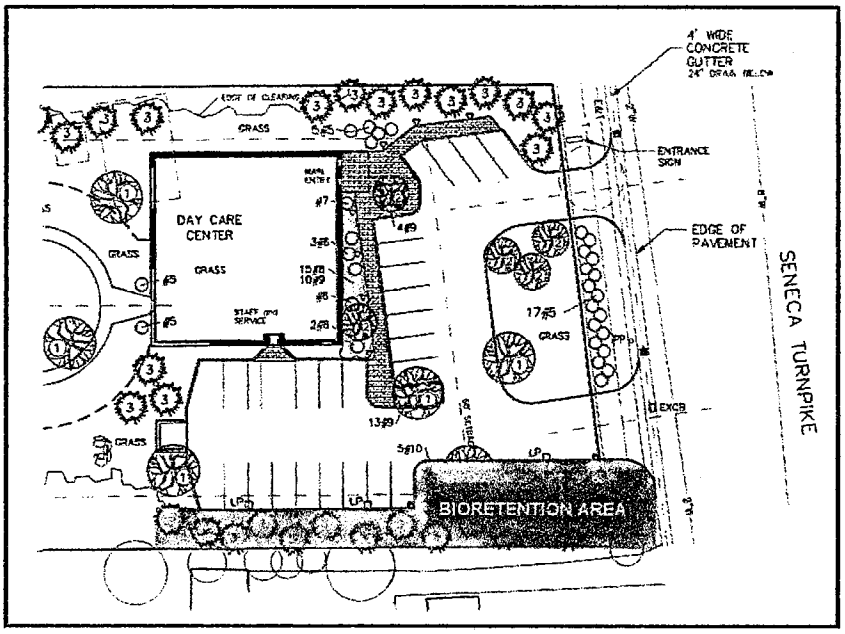
A) On-Site First-Order Controls

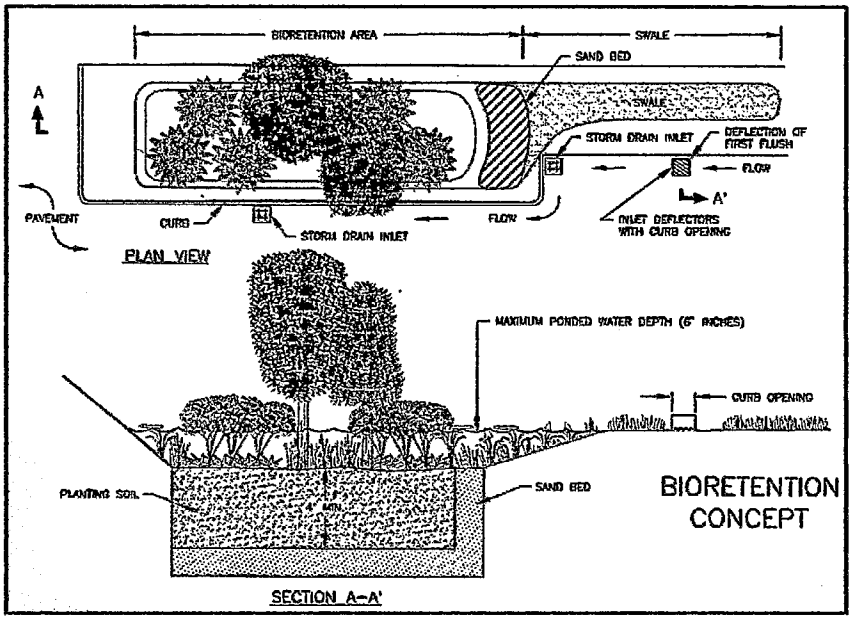
These controls include best management practices (BMPs) that are implemented on a site-specific basis, such as within a residential development or on a farm. These controls typically include bioretention and water quality catch basins in developments, or nutrient management, grassed swales, and/or land application on farms. On-site first-order controls (which are usually located in the upstream areas of a watershed) can be referred to as "source" controls. Because of the general location of first-order controls in a watershed, they are often easier to implement than downstream controls. First-order controls offer flexibility in choosing sites for facilities. Additionally, storage unit designs (such as detention basins) can be standardized and associated guidance documents can be more easily developed and applied. However, since these controls are typically numerous, and distributed over larger areas, inspection and monitoring are difficult and maintenance and operation costs are high.

Bioretention and grassed swales are common examples of first-order controls (Hammer, 1993).

Bioretention is a method of managing stormwater runoff with a combination of small topographic depressions, conditioned soil, and native plants. Bioretention is designed to capture sheet flow from impervious surfaces, and is typically limited to small drainage areas of up to one acre (Bitter and Bowers, 1994). Figure 4-2 provides details relating to a typical project which might implement the bioretention concept.

Within a typical bioretention facility, the surface of the planting soil is depressed to allow for ponding of runoff. The runoff is infiltrated into the planting soil through a surface layer of organic material such as mulch and/or ground cover. The runoff is, therefore, stored in the planting soil, where it is discharged over a period of days to the in situ material underlying the bioretention area. Once the infiltration capacity of the facility is





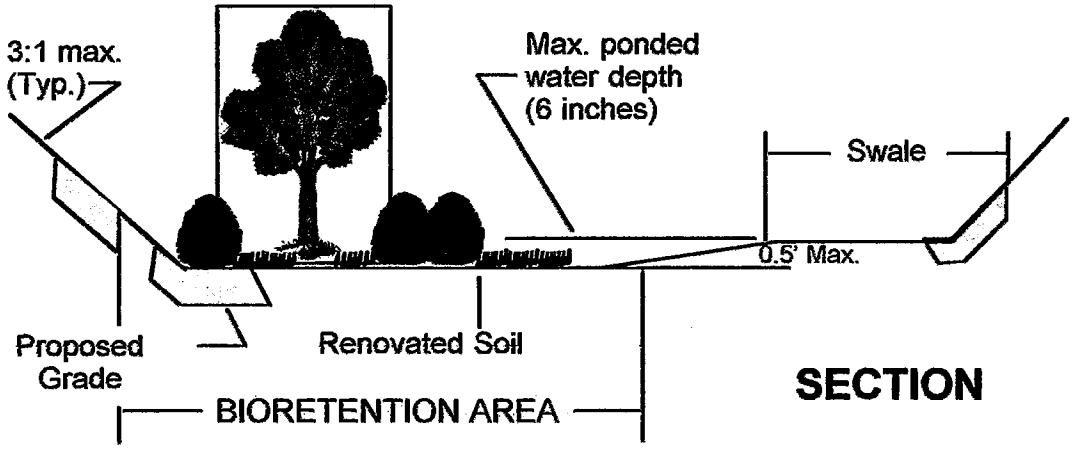


FIGURE 4-2
Bioretention Concept

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exceeded, stormwater is discharged at the surface of the planting soil. Organic material and planting soil will capture the "first flush" of stormwater, which contains the majority of pollutants, sediments, and thermal impacts.

When possible, any bioretention facility should be designed as an off-line treatment area. Meaning, the facility is somewhat removed and separated from the creek or discharge channel. However, by design necessity, it is difficult, if not impossible, to treat the first .5 to 1 inch of runoff with off-line treatment. For example, by the time the diversion weir begins to function and directs water off-line, the first flush has typically passed - untreated. It is important to accommodate the first flush through other methodologies.

Areas within a bioretention facility can be planted with trees that are tolerant to both wet and dry conditions and can serve to provide habitat, shade, and recreational values.

Grassed swales are another common example of first-order controls. Designed to regulate stormwater during transport (through modification of overland flow), this broad category of first-order controls can include grassed swales, grassed swales with check dams, and meander swales.

Many of these types of grassed swales use biofiltration and limited infiltration as a primary mechanism to remove pollutants. Additionally, to be effective, these first-order controls must be designed to maintain a certain design flow below the height of any existing vegetation. They must also be designed to maintain an even flow while keeping velocities below a threshold that might otherwise cause erosion [such as less than 5 cfs (cubic feet per second)].

Pollution removal rates in grassed swales are variable (Schueler, 1992) but seem to be most effective in the removal of metals and suspended solids. There is less long-term effectiveness for removal of nutrients (Debo and Reese, 1995).

B) Second-Order Controls

Second-order controls include BMPs that are more remotely situated (ie: at the downstream edge of a site or sites) and provide for the management of stormwater before the runoff enters a tributary or the Sauquoit Creek itself.

An example of a second-order control might include a strategically located constructed wetland-pond system, or a linear buffer strip or greenway located along the creek and its tributaries.

Constructed wetlands provide beneficial controls to both water quantity and water quality. Natural wetlands and constructed wetlands effectively reduce runoff peaks and increase baseflow. This characteristic is discussed in detail within *Volume 4 - Watershed Issues, Goals, and Objectives* and is illustrated on Figure 4-3.

Additionally, the locational position of the wetland in the watershed will determine the magnitude of the hydrologic benefit to stormwater management and the ease of construction. Table 4-4 highlights a few considerations in planning, and selecting sites, for constructed wetlands. In order to reduce flooding within the watershed, it is important to understand that the effect of wetlands on flood levels changes with the location of the wetland in the watershed and the size of storm. Since most wetlands discharge groundwater, the main function of wetlands in headwaters is to contribute baseflow to the stream. In a downstream landscape position, wetlands provide a major flood storage function and serve to decrease the flood levels. It is important to note, however, constructed wetlands can be used as a source control (first-order control) or as a downstream control.

At the same time, constructed wetlands can also be a low-cost and effective alternative in reducing impacts associated with contaminated runoff. Even

small wetlands can remove significant amounts of pollutants and bacteria if they are designed correctly. Constructed wetland-pond systems can provide 50 to 95 percent removal of total suspended solids and 20 to 90 percent removal of total phosphorous (Schueler, 1992). Additionally, constructed wetlands are flexible in terms of their sizing and location, and can handle various types of pollutants under many different circumstances.

Constructed wetlands can serve as both quantity and quality controls by utilizing natural biological processes that occur in wetland systems including sedimentation, nutrient removal, flood storage, and chemical transformation and removal. Typically, nutrients are trapped in wetlands and converted into plant tissues at relatively high rates.

Figure 4-5 shows a constructed wetland design that might be used for nonpoint source pollution control associated with agricultural runoff.

Greenways are another common example of second-order controls. Linear buffer strips or greenways are typically integrated open space corridors developed for a variety of purposes, including water quantity and quality protection, recreation, and aesthetic purposes. Ideally, a greenway or buffer strip can be an integral part of a stormwater management program, and can aid in first-, second-, third-, and fourth-order controls. In general, the complexity and size of the greenway or buffer will likely increase depending upon the placement as a first-, second-, third-, or fourth-order control (with a fourth-order greenway being the most complex). A more detailed discussion of greenways and buffers is included within *Volume 4 - Watershed Issues, Goals, and Objectives* and is also included below as part of the discussion for third- and fourth-order controls.

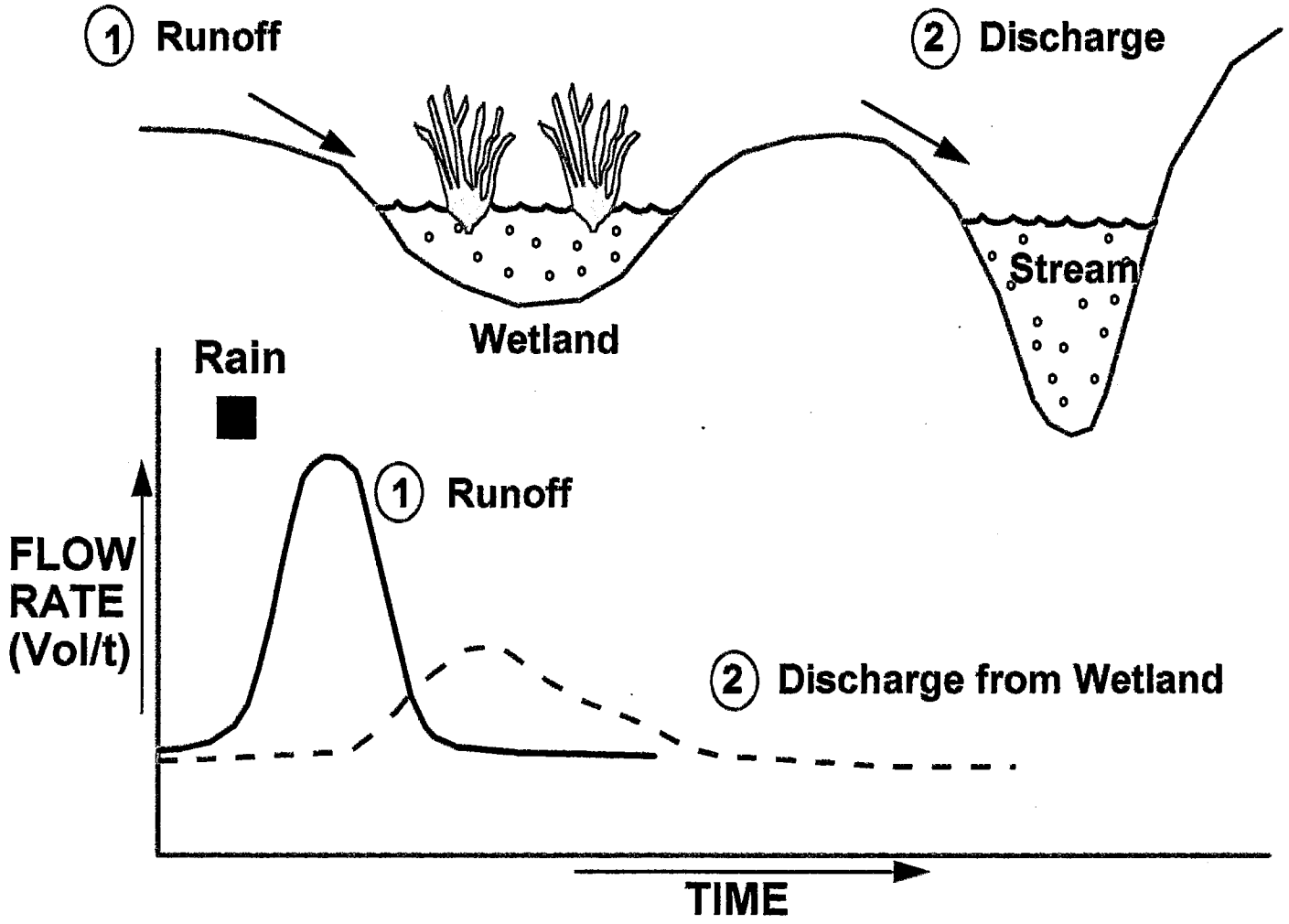
However, as a second-order control, buffers (which can be integrated into a watershed-wide greenway) can be an important component of the runoff treatment system at a development site. Since buffers only treat less than 10 percent of the runoff that the watershed contributes to the stream, they must be used in conjunction with other BMP's designed for treating the remaining 90 percent of the watershed runoff. For example, the most desirable location for the structural BMP (such as a constructed wetland or pond) is within or adjacent to the stream buffer.

C) Third-Order Controls

Third-order controls include BMPs that are strategically located basin-wide and are typically located along permanent streams and tributaries. Within the Sauquoit Creek basin, third-order controls would provide the best functional use in a particular landscape position that is located along the tributaries to the Sauquoit Creek itself. Such controls might include "restored" wetlands along the creek and/or a linear buffer strip or greenway located along the creek and its tributaries.

Restored wetlands include altered, artificial, and managed wetlands that have been changed and or managed by man. Their characteristics and function are, at least in part, dependent upon the activities of humans rather than natural processes. The hydrology of a restored wetland has been changed or manipulated in either gross ways (e.g., surface levels) or more subtle ways (hydroperiod, flood peaks) that affect their overall function and value. Severely altered or degraded wetlands that have lost much of their natural function and value offer an exceptional opportunity for restoration activities. Such wetland areas could be restored to function either in a natural (pre-disturbance) manner, or can be restored as a wetland that is managed for a particular function.

The water levels in restored wetlands can be intentionally manipulated to provide for a variety of purposes and functions such as: flood control, water supply, or other reservoirs; stormwater detention areas; tertiary treatment pond (created wetlands); waterfowl



SOURCE: Harris, L.D., and J.G. Gosselink. 1990.

FIGURE 4-3
The Role of Riparian Wetlands in Dampening "Flashiness" of Storm Flow

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TABLE 4-4

CONSIDERATIONS IN SELECTING CONSTRUCTED WETLAND SITES

CATEGORY	CONSIDERATIONS
Land Use and General	• Land availability • Existing site use and value • Site problems (e.g., previous dumping, utility lines) • Adjacent land use and value • Connection to wildlife corridors and potential for adjacent areas to be biological donors. • Public opinion • Accessibility for construction and maintenance • Ability to control public access according to project objectives
Environmental and Regulatory	• Federal, state, and local laws and regulations • Avoidance of archaeological and cultural resources • Avoidance of critical wildlife habitat areas
Hydrology and Water Quality	• Water supply reliability • Low potential for disruptive flooding • Water supply of adequate quality to sustain biota • Low potential for adverse effects on downstream waterbodies and adjacent properties and their water supplies • Need for lining to retain water or avoid groundwater contamination
Geology	• Flat or gently sloped topography • Adequate soil development • Sufficient depth to bedrock • Soil characteristics consistent with pollution control objectives • Suitability of site materials for constructed wetlands

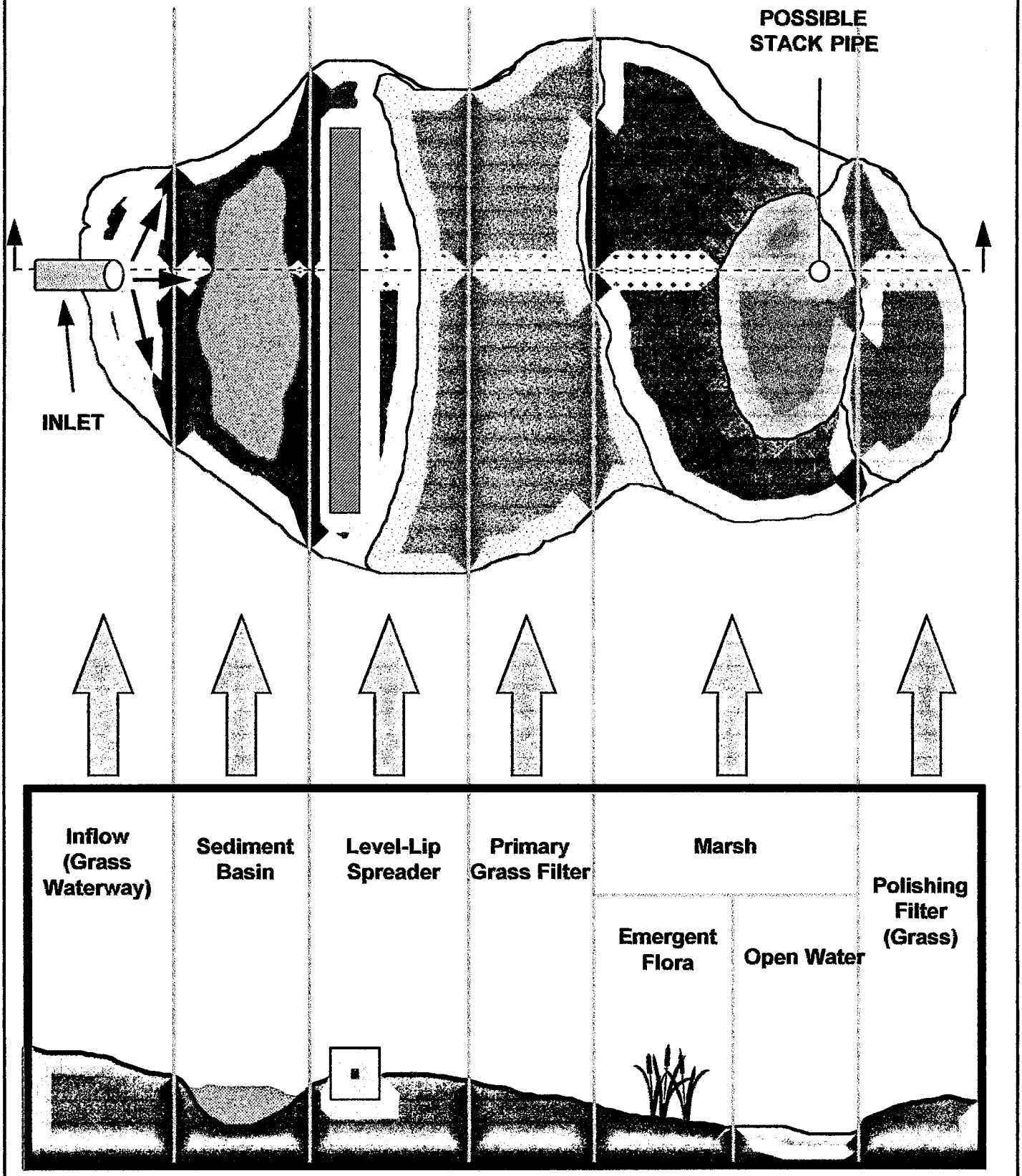

FIGURE 4-5
Wetland configuration designed for nonpoint source pollution control in agricultural landscapes

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impoundments; cranberry marshes; catfish, crawfish, or other fish habitat; and diked wetlands where water control structure are present in the dikes (Kusler, 1991).

Restored wetlands that might be located along the Sauquoit Creek offer a unique opportunity for a cost-effective means of improving both flooding and water quality problems while adding additional recreational, educational, wildlife, and aesthetic functions as well. Figure 4-6 shows a hypothetical example of a restored wetland being used for both flood control and as a regional stormwater detention area along the Sauquoit Creek.

Degraded or altered wetlands should not be treated in the same way as natural wetlands and present a variety of complicated planning and regulatory issues associated with restoration activities. Any attempt to manage an altered wetland needs to be carried out after pre-existing functions, existing functions, and/or values of that wetland have been adequately assessed. It should be clearly demonstrated that a managed wetland would greatly improve many, if not all, of the desired functions and values. In addition, any such plan should be carried out in close association with all the pertinent regulatory agencies (such as NYSDEC and COE) and with local planning officials.

As third-order controls, linear buffer strips or greenway corridors along streams provide benefits to both natural and human resources. These benefits include the protection of water quality, conservation of soil, expansion of recreational areas, provision of wildlife habitat, and preservation of biological diversity.

Greenways, if they are positioned between sources of nonpoint source pollution and receiving water bodies, serve as very effective means to remove pollutants. Greenways can be vegetated as grass, shrubs, forest, or any combination and the pollutant removal efficiency varies with the type and density of vegetation. Other characteristics of a greenway or buffer that influence pollutant removal efficiency includes: flatness of the surface, permeability of the soil, and symmetry of the stormwater flow.

The larger the greenway width (between source and receiving water), the greater will be the overall removal efficiency. On the average, a 100-foot forested greenway, designed as a filter strip, will remove 80 to 100 percent total suspended solids, 40 to 60 percent of total phosphorous (TP), 40 to 60 percent of total nitrogen (TN), and 80 to 100 percent of the metals. Figure 4-7 shows a three-stage greenway/stream buffer that combines a variety of vegetative types, density of vegetation, buffer widths, and suggested allowable uses.

Allowable uses must be defined and considered in conjunction with types and densities of vegetation. Within a series of management zones in a buffer (as illustrated on Figure 4-7), the most natural vegetation associations and the most restrictions for uses are located within the "inner core" of the buffer (ie: area closest to the receiving water body).

D) Fourth-Order Controls

These controls (such as basin-wide wetlands and/or detention facilities) provide final water quality polishing in addition to maximum flood reduction. These are typically located down gradient of first-order, second-order, and third-order controls and are usually less costly to construct, maintain, and operate than the equivalent benefits provided by several smaller facilities that are scattered over a larger area. However, fourth-order controls generally require more land, and site selection may be complicated by public opposition.

The site selection process may be further complicated by various priorities placed on certain site selection criteria that meet the needs of only a few municipalities in the basin. For example, basin-wide facilities can provide benefit to reduce the impact of erosion and sedimentation on highway

ditches and culverts. However, the location in which such facilities are placed will have a direct impact on which highway facilities receive such benefit. The same is true when addressing water quality benefits, recreational potential, etc.

The combined issues of floodplain management, sedimentation, erosion control, wetlands protection, water quality improvement, wildlife habitat, open space preservation, etc. are all contributing reasons why constructed or restored wetlands are ideally suited for basin-wide stormwater management. The integration of constructed wetlands-pond systems within a greenway system (as explained above) combines the benefits of both systems. For example, the most valuable wildlife habitat is typically found adjacent to streams and the most mature vegetative stands and scenic areas are also located along waterways. As discussed above, the greatest benefit to water quality improvements are obtained when buffer strips adjoin streams and tributaries. In addition, surveys have found that 80 percent of recreationalists prefer to recreate near water features. These examples illustrate the combined benefits obtained when multipurpose greenways are combined with wetland areas to provide fourth-order controls.

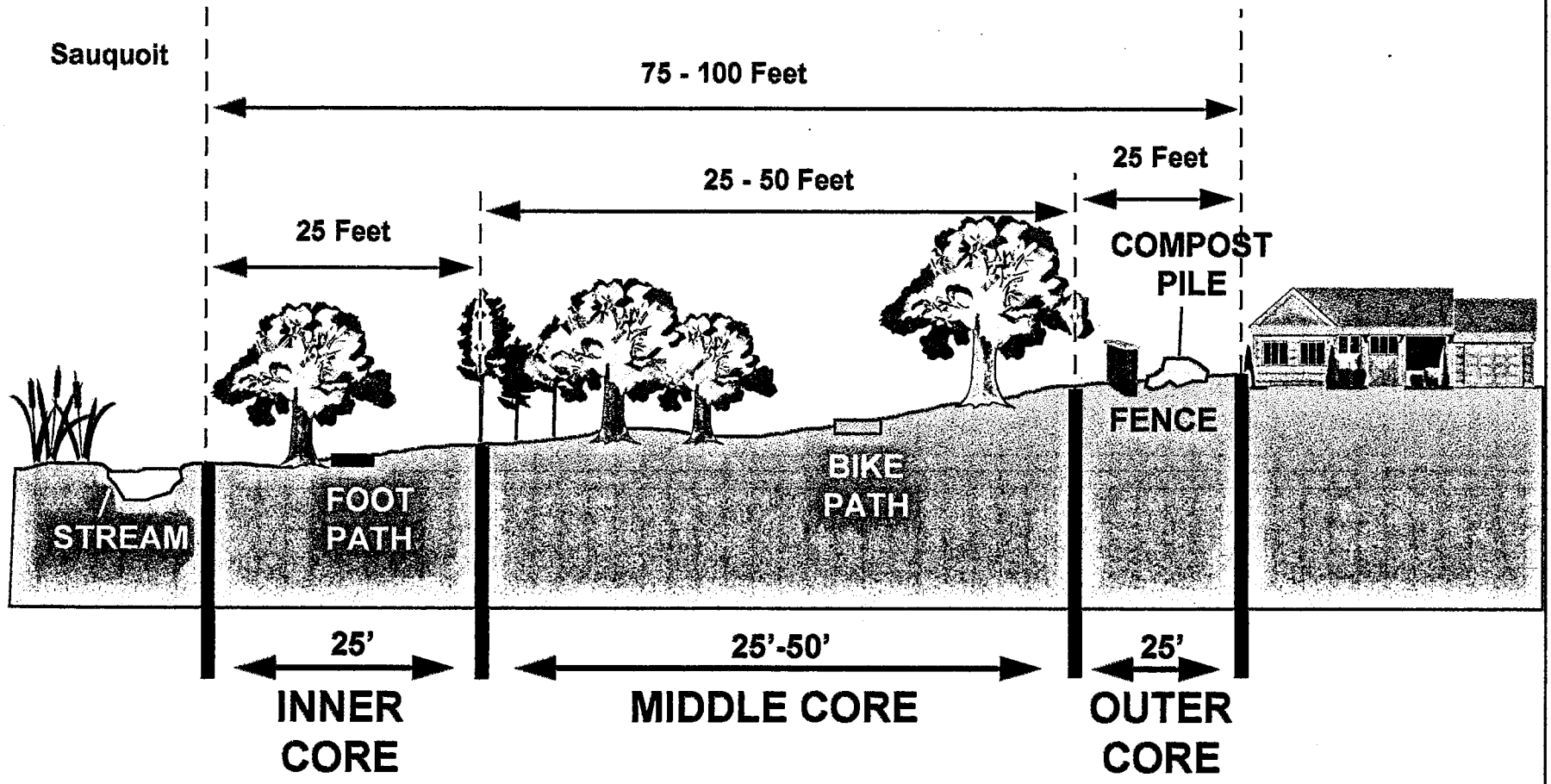
Within the Sauquoit Creek watershed, basin-wide storm management controls, such as the placement of a wet detention pond in a location that takes advantage of the high water table in the lower, down gradient portions of the Sauquoit sub basins, can be very effective in serving as a multipurpose amenity. As a hypothetical example, such a pond can be specifically designed for a particular species of bird. An island, constructed in the center of the pond, can easily provide a safe haven for birds while protecting them from domestic pets or other predators. A trail system could be integrated around the perimeter of the pond to provide access for hiking and nature observation, as well as for maintenance activities. The pond can be stocked with fish to help control mosquito populations, and the natural character of the pond can provide visual relief from the surrounding built-up, commercial, and industrial environment that is common within the lower, downstream portions of the Sauquoit Creek basin. Additional details concerning the establishment of a greenway pilot project within the Sauquoit Creek basin are discussed within Section 4.3, below.

Not only do fourth-order controls include basin-wide wetlands and/or detention facilities that provide final water quality polishing, flood reduction, and multipurpose benefit, but fourth-order controls can involve planning, design, and management alternatives for the collection and transport of urban wastewater. Such alternatives include sanitary and storm sewer separation, the control of inflow/infiltration (I/I), design and construction considerations, and maintenance/operations.

With regard to the collection and transport of urban wastewater as a fourth-order control, there are no active combined sewers in the Sauquoit Creek basin. All sanitary sewer lines are separate from storm sewer systems. While the Oneida County Wastewater Treatment Plant is located outside the Sauquoit Creek basin, the sanitary sewer system that connects to this plant has serious problems associated with flooding, inflow, and infiltration. This is also true at the Sauquoit Creek Pump Station that, while located within the basin, discharges overflow into the Mohawk River.

Corrections of inflow conditions may be primarily dependent on regulatory action on the part of municipal officials, rather than on structural/construction measures. If elimination of existing inflows is deemed necessary because of adverse effects of these flows on sewer systems, pumping stations, treatment plants, or combined sewer regulator-overflow installation, new or more restrictive sewer use regulations may have to be invoked.

Sewer inflows can be reduced by a variety of methods. As identified within *Volume 4 - Watershed Issues, Goals, and Objectives*, a major source of inflow is runoff from rooftops and inundated manhole covers. Solutions to these types of issues may be



CHARACTERISTICS	INNER CORE	MIDDLE CORE	OUTER CORE
Width	25 feet, plus wetlands and critical habitats	25 to 50 feet, depending on stream order, slope, and 100year floodplain	25 foot minimum setback to structure
Vegetative Target	Undisturbed forest. Reforest if grass	Managed forest, some clearing allowable	Forest of turf
Allowable Uses	**VERY RESTRICTED** e.g., flood control, utility right of ways, footpaths, etc.	**RESTRICTED** e.g., some recreational uses, some stormwater BMPs, bike paths, tree removal by permit	**UNRESTRICTED** e.g., residential uses including lawn, gardens, compost, stormwater BMP's

Source: Watershed Protection Techniques- Vol. 1, No 1,1994

FIGURE 4-7
Three Stage Stream Buffer

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as simple as raising the elevation of depressed manhole covers or replacing vented covers with unvented covers.

Excessive infiltration is also a serious problem in the design, construction, operation, and maintenance of sewer systems within the basin. Neither combined sewers nor separate sewers are designed to accept large quantities of such infiltration flows. The reduction of infiltration involves two basic areas of concern: (1) prevention of infiltration in new sewers through the utilization of adequate design, construction, inspection, and testing practices; and (2) the elimination or cure of existing infiltration in old sewers by proper survey, investigation, and corrective measures.

The control of infiltration in new sewer systems involves engineering decisions and specification such as the methods and materials of sewer construction, pipe, joints, procedures and techniques. Correction of existing sewer infiltration can be accomplished by three basic approaches: (1) replacing the defective component; (2) sealing the defective component; and (3) rebuilding or repairing within the existing component.

SECTION 4.2

INTEGRATION OF A STORMWATER MANAGEMENT PROGRAM

A number of factors must be considered and questions answered when developing an integrated, comprehensive stormwater management program - especially one that addresses basinwide concerns. For example, where should facilities be located? Should they be in-line facilities or off-line facilities? Who will operate and maintain the facilities? What financing is available for construction, operation and maintenance? How will construction and financing be phased-in?

In regard to determining the location of facilities, a number of criteria must be considered in combination with a variety of factors. For example, local topography will somewhat dictate the usefulness of a site for stormwater management. The availability of land and/or willing sellers is also a consideration, as is timing and routing of flows, a cost-benefit analysis, and consideration of damages caused by stormwater flows.

Local regulatory controls will also play a role in an effective stormwater management program. How will local regulatory controls be made compatible and/or uniform to facilitate a basinwide approach and facilities? How will best management practices be incorporated into local controls or otherwise implemented? Which management practices are most important to implement (ie: highway maintenance, agriculture, etc.)? What sub-basins require what management practices?

As will be discussed in Chapter 5 of this volume, a geographic information system that provides stormwater modeling capabilities is also important to the development and integration of a stormwater management program. However, this raises additional questions concerning which models are needed and where. There is also a benefit to developing a digital terrain model (DTM) and folding-in existing water quantity and quality modeling.

Additionally, an effective stormwater management program can minimize the impacts of development and reduce significant impacts from stormwater, erosion and water quality pollution by requiring preconstruction considerations early in the planning process for specific development - particularly at the site plan review stage. For example, a developer might be required to submit a detailed plan for managing runoff and for returning the site to a predetermined hydrological condition after construction is completed.

The following includes a listing of guidelines that may be required during the preconstruction planning stages of a project to reduce the impacts associated with stormwater runoff (Terrene, 1994): respect contours and natural features of the landscape (for example, avoid stream valleys and steep slopes); limit development by soil types and based on its proximity to a waterbody; restrict or prohibit development in sensitive areas as may be identified in a comprehensive plan; preserve the natural 100-year floodplain; allow no modification of the natural floodplain; and ensure that development is consistent with a community's comprehensive plan.

SECTION 4.3

ESTABLISHING A GREENWAY PILOT PROJECT

The development of plans and implementation of a greenway buffer would serve as an excellent pilot project within the Sauquoit Creek watershed - demonstrating a variety of benefits. Such a pilot project would immediately benefit a broad cross-section of the community, including walkers, bicyclists, and equestrians. The project would demonstrate what a greenway is and what it has to offer (The Conservation Fund, 1993). The project could build a greenway constituency, show the public that the project is real, and might help to overcome the hurdle of a laborious planning and analysis process.

The following are suggestions for setting up a successful greenway pilot project within the Sauquoit Creek basin:

- Investigate adequate ownership of the land or have a secured right-of-way or easement.

- Be sure the project makes sense. The greenway providing recreation needs to be accessible and trails need to lead to somewhere of significance. Ideally, a trail should be multi-functional. For example, it should be located in an area that not only allows access and connection, but provides value as a riparian buffer and perhaps as habitat.

- Begin a segment of the project in an area that is likely to bring broad-based public support. Such a project should help to secure community and government backing for a larger greenway or for the entire watershed-wide effort. The effort can also be used to develop funding sources for the future - perhaps leading to the completion of more remote segments of the greenway.

- Be sure that the pilot project is substantial enough to make an impression. It should showcase as many greenway benefits as possible and should be in a visible, accessible location.

- Plan ahead for likely future segments of the greenway. These should build on the pilot project and should be planned and scheduled at regular intervals.

SECTION 4.4

SUMMARY OF RECOMMENDATIONS FOR GETTING STARTED

As discussed above, there are many components, options, and methodologies available and necessary to establishing an effective basin-wide stormwater management program. In summary, the following major recommendations and short/long term recommendations, were selected (based on the discussion above and the discussions within Chapter 4 - Watershed Issues, Goals, and Objectives) as a way to "get started" in regard to this element of watershed management within the Sauquoit Creek basin.

1. **Major Recommendation.** Establish a comprehensive stormwater management program and integrate a basin-wide greenway system.

2. **Recommendations for Getting Started (Short-Term).**

   a. Identify the desired benefits for establishing a comprehensive, basin-wide stormwater management program and consider which basin resources require the most protection.

   b. Identify and verify potential sources of non-point pollution within the basin and identify existing BMPs that may help to manage those sources.

   c. Identify sensitive and critical management zones in which to target stormwater management efforts (see also: Section 3.2).

   d. Develop and implement a model stormwater management ordinance for the basin.

   e. Integrate watershed-wide stormwater management concerns into existing local land use controls.

   f. Identify public lands and right-of-ways which have potential for joint use as engineered wetlands to control stormwater and non-point pollution.

   g. Initiate a greenway pilot project to demonstrate multipurpose watershed benefits.

3. **Recommendations for Longer-Term Solutions**

   a. Identify existing BMPs that may help to manage issues within the basin.

   b. Develop a complete, multipurpose, basin-wide greenway system within the Sauquoit Creek watershed.

   c. Based on the desired benefits and pollution sources identified in those activities noted above, identify probable locations for first-, second-, third-, and fourth-order controls.

   d. Implement and construct specific first-, second-, third-, and fourth-order controls.

   e. Encourage the voluntary implementation of existing floodplain management practices, including those related to stormwater management, in an effort to obtain reductions in flood insurance premiums.

   f. Establish a monitoring program to analyze the effectiveness of implemented BMPs or to obtain more detailed information on potential sources of pollution.

   g. Implement a variety of flood mitigation strategies to reduce stormwater impacts.

SECTION 4.5

SPECIFIC PROJECTS AND PROGRAM RECOMMENDATIONS

This section outlines specific projects and program recommendations that are "ready made," fundable projects that would further the major recommendations and short/long term recommendations outlined above.

For each recommendation and specific project developed, the following steps need to be followed:

- obtain commitment of involvement from key decision makers
- set priorities for potential solutions
- develop a list of projects to be implemented for each solution
- set goals for accomplishing each project
- locate funding and technical expertise for projects that need it
- be practical
- evaluate progress.

Each of the following specific projects have been subjectively evaluated based on a priority rating system, range of cost, and potential point agency. Factors which were evaluated include, but are not limited to: the overall benefit of the project to the watershed; the cost of the project and potential availability of funding; whether there is a logical point agency or individual; and, the ease of implementation.

Projects receiving a "high" priority include those that should receive immediate attention, obtain a commitment of involvement, and identify the appropriate point agency. Additionally, funding is likely to be attainable and activities to obtain such funding should begin immediately.

Projects with a "medium" priority rating include those activities which are slightly less urgent but action relating to agency commitment and a funding mechanism should begin within the next year.

Projects with a "low" priority should be targeted for a longer term implementation schedule such as a 10-year cycle. These projects may require or involve additional thought and planning, and could be postponed unless a particular funding source becomes available or a point agency is willing to champion its cause earlier.

In addition to the priority rating, projects are also identified as being short-term or long term projects. As such, there may be high priority, short-term projects, as well as, high priority long-term projects. Short-term projects are those which can be accomplished within a relatively short span of time (ie: within one to two years). Long-term projects include those activities that: may require or involve additional thought, research, planning, or collection of base data; may continue to be implemented over a number of years; may require continuous activity; or may take a number of years to conclude.

In estimating project costs, this evaluation criteria includes subjective and approximate estimations for planning purposes only. The estimates of costs are, however, based on professional knowledge of similar projects implemented in other watersheds. Once a project has been identified and a commitment to proceed established, a new, more accurate estimate should be made during the project application process. The ranges of costs and cost categories used for the evaluation of the following specific projects include: projects with a relatively "low" cost ranging from $0 to $100,000; projects with a "medium" cost ranging from $100,000 to $500,000; projects with a relatively "high" cost of over $500,000.

As with the other priority rating criteria, the suggestions for a point agency or individual are subjective recommendations of who may be the logical entity that might initiate that particular project. Obtaining the

commitment of this agency would be the first step in initiating these projects. The agency's available resources and interest in the projects would ultimately determine if they would become the sole point agency, the point agency with other co-sponsors, or if they would not be involved at all. Of course other entities not listed can initiate the activity if there is an interest or funding source available.

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide Stormwater Management Program

Project Title: Defining the Purpose of a Basin-wide Stormwater Management Program

Project Description: Identify the desired benefits for establishing a comprehensive, basin-wide stormwater management program and consider which basin resources require the most protection.

Priority: High (Short-term)

Potential Activities:

Assign priorities to certain basin resources based on the desired level of protection to those resources. Consideration should be given to the protection of resources such as: roads and associated structures like bridges, culverts and ditches; other infrastructure such as public water and sewer service; individual property values; natural stream habitats; water quality; etc.

Point Agency or Individual:

- A combination of municipalities within the basin
- A newly established Sauquoit Creek watershed entity (see; Volume 6, Chapter 3)
- Private sector consultant(s)

Municipalities with the assistance of respective state, county, regional and local agencies such as the NYS DEC, county, regional and local planning departments, private sector consultants, the County Water Quality Coordinating Committee, etc.

Cost Estimate: Low (< $100,000)

Primary Category/Issue: Basin-Wide Stormwater Management Program

Project Title: Pollutant Source Inventory

Project Description: Identify and verify sources of pollution that pose a risk to the Sauquoit Creek basin, and identify existing BMPs that may help to manage those threats.

Priority: Medium (Short-term)

Potential Activities:

Through the analysis and interpretation of existing information and through the use of biological indicators, become familiar with the range of pollutants within the basin. Implement a modeling program to evaluate pollutant loadings within the basin. Water quality sampling could be used to calibrate such models, but may not be necessary. Identify specific pollutants which threaten both surface and ground waters. Develop a priority list of pollutants of concern.

Incorporate the use of a geographic information system for inventory, monitoring, and assessment of pollutants. Fully digitize the existing land-use and land cover map of watershed. Develop a nutrient loading estimate (model) for each subwatershed within the Sauquoit watershed (see Volume 4, Section 2.2, Table 2-4). Major categories of general pollutants (natural sources, agricultural, suburban/residential, and urban/commercial) should be determined, and specific types and degrees of pollutants should be identified within the Sauquoit watershed. At a minimum, estimates of nitrogen, phosphorous, BOD, COD, suspended solids, and metals (zinc, lead, and copper) for each category should be determined.

Point Agency or Individual:

Municipalities with the assistance of respective state, county, regional and local agencies such as the NYS DEC, county, regional and local planning departments, private sector consultants, the County Water Quality Coordinating Committee, etc., or

- New York State Department of Environmental Conservation
- State and/or County Department of Health
- Oneida County Soil and Water Conservation District
- A newly established Sauquoit Creek watershed entity (see; Volume 6, Chapter 3)
- Private sector consultant(s)

Cost Estimate: Low (< $100,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide Stormwater Management Program

Project Title: Identification of Appropriate BMPs

Project Description: In response to pollutants identified within the basin, inventory existing BMPs that may help to manage those sources so improvements can be made, either retrofitting or adding new BMPs.

Priority: Medium (Long-term)

Potential Activities:

Identify existing BMPs and their effectiveness for protecting each subwatershed within the Sauquoit Creek basin. Evaluate the reduction in nonpoint source pollution loading on a subwatershed basis, and establish what percentage of the runoff is currently being treated.

Point Agency or Individual:

Municipalities with the assistance of respective state, county, regional and local agencies such as the NYS DEC, county, regional and local planning departments, private sector consultants, the County Water Quality Coordinating Committee, etc.

Numerous agencies, individuals and/or organizations exist that can implement components of this project that relate to their respective areas of expertise.

Cost Estimate: Low (<$100,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide Stormwater Management Program

Project Title: Water Management Zones

Project Description: Identify hydrologically sensitive areas and critical management zones in order to establish target areas for protection within the Sauquoit Creek watershed.

Priority: Medium (short-term)

Potential Activities:

Critical management zones should be established by identifying sensitive areas that receive excessive pollutant loadings. Based on the inventory of pollutants, determine categories of general pollutants (natural sources, agricultural, suburban/residential, and urban/commercial) and specific types and degrees of pollutants will be identified within the Sauquoit watershed. The methodology can be similar to that defined by Cornell University in the 1994 draft publication of the Evolving Whole Farm Planning Guide. Hydrologically sensitive areas can be defined as those that contribute surface water runoff to sensitive Sauquoit Creek basin tributaries or contribute subsurface flow to recharge areas for springs and wells.

Point Agency or Individual:

Municipalities with the assistance of respective state, county, regional and local agencies such as the NYS DEC, county, regional and local planning departments, private sector consultants, the County Water Quality Coordinating Committee, etc.

Cost Estimate: Low (<$100,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide Stormwater Management Program

Project Title: Development and Implementation of Model Stormwater Regulations

Project Description: In coordination with revisions to existing municipal land-use controls and plans, develop and implement appropriate regulations for stormwater management to insure uniform treatment of this issue within the entire basin.

Priority: Medium (short-term)

Potential Activities:

Review and adopt the model stormwater management ordinance provided as part of the Sauquoit Creek Basin Watershed Management Study (Appendix E,*Volume 5 - Existing Development, Regulatory Controls, and Development Potential*).

Point Agency or Individual:

Municipalities with the assistance of respective state, county, regional and local agencies such as the NYS DEC, county, regional and local planning departments, the County Water Quality Coordinating Committee, etc.

Cost Estimate: Low (< $100,000/topic)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide Stormwater Management Program

Project Title: Revision of Municipal Land-Use Regulations

Project Description: Revise existing municipal land-use controls and plans to incorporate stormwater management concerns.

Priority: Medium (Short-term)

Potential Activities: Review and revise municipal land use regulations such as:

- Zoning
- Comprehensive Plans
- Subdivision Regulations
- Aquifer protection, etc.

The guidance memorandums which were sent to each municipality within the basin as part of the Sauquoit Creek Basin Watershed Management Study may be used as a reference and outline strengths, weaknesses, and effectiveness of these regulatory controls in addressing stormwater management issues. Copies of these memorandums are included within *Volume 5 - Existing Development, Regulatory Controls and Development Potential* or may be obtained directly from the municipality.

Point Agency or Individual:

- municipal staff or board

Municipalities with the assistance of respective state, county, regional and local agencies such as the NYS DEC, county, regional and local planning departments, the County Water Quality Coordinating Committee, etc.

Cost Estimate: Low (< $100,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide Stormwater Management Program

Project Title: Creation/Preservation of Wetlands for Stormwater Management

Project Description: Develop a proposal to incorporate public lands through the joint use of highway, utility, and other right-of-ways with engineered wet lands for the control of stormwater.

Priority: High (short-term)

Potential Activities:

- Identify public lands which have potential for joint use as engineered wetlands to control stormwater and non-point pollution.

- Provide a preliminary analysis of sites associated with highway projects which could help facilitate regional design for water quantity and quality facilities.

- Enlist the aid of state, county and community highway departments to reach targeted goals of non-point source pollution reduction through special project design.

Point Agency or Individual:

- New York State Department of Environmental Conservation
- Herkimer-Oneida Counties Transportation Study
- New York State Department of Transportation
- Oneida County Department of Public Works
- Utility Companies
- A newly established Sauquoit Creek watershed entity (see; Volume 6, Chapter 3)
- Other state, federal, regional, county, or local agencies, or

Municipalities with the assistance of respective state, county, regional and local agencies such as the NYS DEC, county, regional and local agencies, the County Water Quality Coordinating Committee, etc.

Cost Estimate: High (> $500,000)

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide Stormwater Management Program

Project Title: Greenway Pilot Project

Project Description: Develop and implement a greenway pilot project within the Sauquoit Creek basin to demonstrate multi-purpose watershed benefits and to analyze the effectiveness of a variety of technologies for establishing a greenway.

Priority: Medium (Short-term)

Potential Activities:

Investigate and insure adequate ownership of the land or have a secured right-of-way or easement. Consider beginning a segment of the project in an area that is likely to bring broad-based public support. Select a project that should help to secure community and government backing for a larger greenway or for the entire watershed-wide effort. Develop funding sources for the future - perhaps leading to the completion of more remote segments of the greenway.

Identify an area suitable for a greenway pilot project that offers a variety of landscape and watershed characteristics in an effort to demonstrate and analyze a number of greenway technologies.

Point Agency or Individual:

- New York State Department of Environmental Conservation
- Herkimer-Oneida Counties Comprehensive Planning Program
- Cornell Cooperative Extension of Oneida County
- Oneida County Department of Planning
- Oneida County Soil and Water Conservation District
- USDA Natural Resource Conservation Service
- A newly established Sauquoit Creek watershed entity (see; Volume 6, Chapter 3)
- Other state, federal, regional, county, or local agencies, or

Municipalities with the assistance of respective state, county, regional and local agencies such as the NYS DEC, county, regional and local planning departments, the County Water Quality Coordinating Committee, etc.

Cost Estimate: Low (< $100,000)

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide Stormwater Management Program

Project Title: Basin-Wide Greenway System

Project Description: Develop a complete, multi-purpose, basin-wide greenway system within the Sauquoit Creek watershed.

Priority: Medium (long-term)

Potential Activities:

Based on the findings of a Greenway Pilot Project implement appropriate greenway technologies basin-wide. Identify desired benefits, locational considerations, ownership or easement issues, funding opportunities, and a management approach for maintenance and operations.

Point Agency or Individual:

- New York State Department of Environmental Conservation
- Herkimer-Oneida Counties Comprehensive Planning Program
- Oneida County Department of Planning
- Oneida County Soil and Water Conservation District
- USDA Natural Resource Conservation Service
- A newly established Sauquoit Creek watershed entity with the assistance of private sector consultants (see; Volume 6, Chapter 3)
- Other state, federal, regional, county, or local agencies

Cost Estimate: Medium ($100,000 to $500,000)

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide Stormwater Management Program

Project Title: Four-Tiered Stormwater Management System

Project Description: Implement, design and construct first-order, second-order, third-order, and fourth-order controls to address key watershed issues within the Sauquoit Creek basin such as: reduction of flooding, enhancement of water quality, and provision of habitat value.

Priority: Medium (long-term)

Potential Activities:

Based on the desired benefits, characteristics of pollution sources, and critical watershed areas, identify appropriate locations for BMPs associated with each of the tiers, as appropriate. Utilize the existing ACOE's HEC-1 hydrologic model to determine appropriate flood hydrographs at various points within the watershed. Educate developers, individual property owners, and the agricultural community regarding key elements and considerations for establishing first-order controls. (see: Volume 6, Chapter 4, Section 4.1).

Develop general criteria and considerations for locating and identifying appropriate BMPs. Based on these considerations locate proposed areas for: second-order and fourth-order controls such as linear buffer strips or constructed/restored wetlands; and fourth-order controls such as basin-wide detention facilities.

Based on technologies found to be appropriate within the Sauquoit Creek basin, implement appropriate BMPs. Identify and mitigate secondary impacts of proposed BMPs.

Point Agency or Individual:

- A newly established Sauquoit Creek watershed entity (see; Volume 6, Chapter 3), or

A joint project with municipalities and the assistance of respective state, county, regional and local agencies.

Cost Estimate: High (>$500,000)

An example of potential capital costs for the implementation of a fourth-order control such as a basin-wide stormwater detention facility is illustrated below.

Construction Cost:	$130,000 (30-acre feet storage)
Land Cost:	$30,000 to $80,000
Planning Design Supervision:	$40,000
Operation and Maintenance Cost:	$6,500/year
Total Cost:	**$200,000 to $300,000**

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide Stormwater Management Program

Project Title: Voluntary Implementation of FEMA's Community Rating System

Project Description: Encourage the voluntary application by communities to the Federal Emergency Management Agency's (FEMA's) Community Rating System which provides reductions in flood insurance premiums to communities that implement floodplain management activities.

Priority: Medium (long-term)

Potential Activities:

Encourage and provide incentives for the implementation of various floodplain management activities such as: stormwater management, open space preservation, education and outreach, etc. Educate communities and provide assistance in making application which guarantees a minimum 5% reduction in flood insurance premiums in that community. Emphasize that depending upon the number of management activities implemented, a community could realize a reduction in flood insurance premiums of up to 45%. Package all related activities - each of which may serve as a credit-bearing activity supporting the Community Rating System program.

Point Agency or Individual:

- Municipal staff or board

Individual municipalities with the assistance of respective state, county, regional and local agencies such as the NYS DEC, county, regional and local planning departments, the County Water Quality Coordinating Committee, etc.

- New York State Department of Environmental Conservation
- FEMA

Cost Estimate: Low (<$100,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide Stormwater Management Program

Project Title: Nonpoint Source Pollution Modeling

Project Description: Establish a monitoring program to analyze the effectiveness of implemented BMPs and/or to obtain more detailed information on potential sources of pollution.

Priority: Medium (long-term)

Potential Activities:

Model nonpoint source pollution throughout the watershed. Model the nutrient loading, reduction in loading (based on BMPs), and impact on hydrologically sensitive areas. Using an established GIS system, model nutrient loading in order to determine needed improvements within the Sauquoit Creek watershed. Modify the stormwater management program using an understanding of the existing conditions, and develop a knowledge of the impact of nonpoint source pollution on hydrologically sensitive areas. Develop recommendations for each subwatershed based on the above analysis. For example, as appropriate, develop a nutrient reduction strategy for point sources and nonpoint sources.

Point Agency or Individual:

Numerous agencies, individuals and/or organizations exist that can implement components of this project that relate to their respective areas of expertise.

Cost Estimate: Low (<$100,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide Stormwater Management Program

Project Title: Miscellaneous Flood Mitigation Strategies

Project Description: Implement a variety of independent, but interrelated, mitigation strategies to reduce stormwater impacts associated with future flooding.

Priority: High (long-term)

Potential Activities:

Initiate four basic flood hazard mitigation strategies including: prevention, property protection, emergency services and flood control. Prevention should include activities such as planning, acquiring, or regulating the development or use of land to keep flooding problems from becoming worse. Preventative measures are typically administered by building, zoning, planning, or codes enforcement boards or staff. The protection of individual buildings or property from flood damage is usually the responsibility of the property owner, although governmental agencies can provide information and technical or financial assistance. Emergency services methodologies include activities that are taken during a flood to minimize impacts. Flood control measures involve activities to keep floodwaters away from a particular area and are usually designed by engineers and managed by public works staff.

It may also be beneficial to redelineate the floodplain of the Sauquoit Creek and its tributaries.

Responsible Agency:

- A newly established Sauquoit Creek watershed entity (see; Volume 6, Chapter 3)
- Other state, federal, regional, county, or local agencies such as: DEC, SEMO, FEMA, ACOE cost share, etc.

Cost: High (>$500,000).

An example of potential costs for the redelineation of the 100-year floodplain and the purchase of property or acquisition of land within the 100-year floodplain, is illustrated below.

Potential costs for redelineation include: $4,000 per mile for hydraulic analysis (i.e., plan and profile sheet preparation and field surveying) for stream with current flow data for existing and future conditions. Approximately 44 additional miles of stream have been identified for possible floodplain delineation at a cost of $176,000. These areas should be field investigated to determine if floodplain delineation is necessary. These costs can typically be borne by the Federal Emergency Management Administration (FEMA).

Based on recent land acquisition costs of $4,000 to $10,000 per acre, purchase of land will likely include a price range. For the purchase of 50 acres of land for open space use, total costs may range from $200,000 to $500,000.

Additionally the estimated price range for acquisition of housing units and lots ranges from $40,000 to $90,000. Therefore, for the purchase of six homes and lots, total costs may likely range from $250,000 to $600,000.

Chapter 5

Developing a Basinwide Geographic Information System

Planning for the Sauquoit Creek basin's long-term management requires broad-based decision-making that is derived from a combination of geographic, technical, and institutional factors that relate to the entire watershed. A geographic information system (GIS) can accomplish multi-purpose, basin-wide management by linking a variety of information sources such as: regulatory and decision making standards (e.g., permit criteria, etc.), spatial data sources (e.g., aerial photos, land-use maps, etc.), methods of analysis (e.g., quantity modeling, etc.), and financing (e.g., equating square feet of impervious cover to user fees, etc.).

SECTION 5.1

COMPONENTS OF A GIS

Figure 5-1 illustrates the basic components of a geographic information system - the GIS database; the management of that database; the use of the GIS in implementation activities; and the ability to easily modify and supplement implementation programs. These components are discussed further in the paragraphs below. Generally, however, a GIS can serve to integrate a number of common concerns and problems that require computerized handling of data. Such a system combines computer hardware, software, spatially distributed databases, and tabular information, in an effort to extract, analyze, and classify geographic data, and subsequently to store, modify, manipulate, investigate, and perform spatial analysis on this data. A GIS holds two essential types of data: spatial data (mapped information), and descriptive/tabular data (consisting of supplementary information about the spatial data that is necessary to analyze this data).

A) The GIS Database

The ability of GIS to integrate spatial data from different sources, with different formats, structures, projection, or levels of resolution, is a powerful aid to effectively utilizing the extensive data that is available and to allowing the addition of new data that become available. A GIS serves as a means of integrating data from a number of collection sources and methodologies, such as surveying, remote sensing, cartography, global positioning systems (GPS), image processing, engineering and architectural plans, site photographs, document images, and tabular data.

It is important to establish an ongoing process for identifying what data is available to set up a comprehensive database for the watershed. Table 5-2 presents a potential list of sources for such information within the Sauquoit Creek basin, but is not all inclusive. One of the advantages of a GIS is that data layers and information can be added or modified as needed.

Spatial databases tend to be large, and are difficult and expensive to create. This is particularly true of digital imagery, where a single analysis may require gigabytes (109) of data and representation of geographic variation in three dimensions. Fortunately, the recent

scanner and editing technology has made a marked improvement to help solve this difficulty.

Another difficulty with GIS technology is that there has been very little standardization in the collection of data or the range of techniques used in spatial analysis. However, there has been some work done by a GIS coordinating group that has developed a State Forum of Information Resource Management (IRM). This IRM forum was created to increase the coordination of information resources and technologies through serving as a network, clearinghouse, and educational resource. The group has recently focused on GIS as a platform to discuss data-sharing and institutional issues, including demonstration projects. The group maintains a membership from state, academic, local, and non-profit organizations, and would be a key resource for similar GIS activities within the Sauquoit Creek basin.

B) Database Manager

Within the Sauquoit Creek basin, a basin coordinating committee, along with the GIS database manager, should establish a framework for policies, standards, guidelines, and procedures for the development, functioning, and maintenance of a geographic information system. An operational prototype GIS should be established first to test the preprocessing, analysis, and postprocessing of data such as that discussed above. The system should initially provide access to data that includes, at a minimum: topographic data, general administrative boundaries, cadastral data, baseline thematic mapping data, and a data dictionary and directory.

The database manager might also initially explore the potential for integrating the GIS into a data network. Within a data network, a variety of users are integrated in the entry, creation, use/analysis, update, and maintenance of data. A GIS tied to a network can provide integrated access to survey control, base maps, property maps, and ownership titles. It may also provide a means to insure all data is current while distributing costs associated with data management to a larger number of agencies and individuals - thereby decreasing such cost burden for a single agency.

C) Implementation/Use of a GIS

Specific uses of a GIS within the Sauquoit Creek basin might include a direct interface with the institutional framework established within the watershed. For example, the system could be a permanent working tool that is operated by a newly formed watershed entity, a county agency, a local planning or engineering department, or it could be run by a commercial (profit or nonprofit) venture.

A GIS is generally developed in order to handle geographic data derived from a number of sources in digital form, and allows this data to be used in a variety of ways, including: 1) preprocessing data from large volumes into a form suitable for analysis, including such operations as reformatting, change of projection, resampling, and generalization; 2) providing direct support for analysis and modeling, such that forms of analysis, calibration of models, forecasting, and prediction are all handled through instruction to the GIS; and 3) postprocessing of results, including such operations as reformatting, tabulation, report generation, and mapping.

Although a GIS is ideally suited for the integration of spatial data and mapping, some of the most practical uses of a geographic information system relate to implementation programming. Implementation programming is the application of GIS technology and environmental modeling to policy development and to the implementation of land-use management programs. The post-processing capability is critical here, and

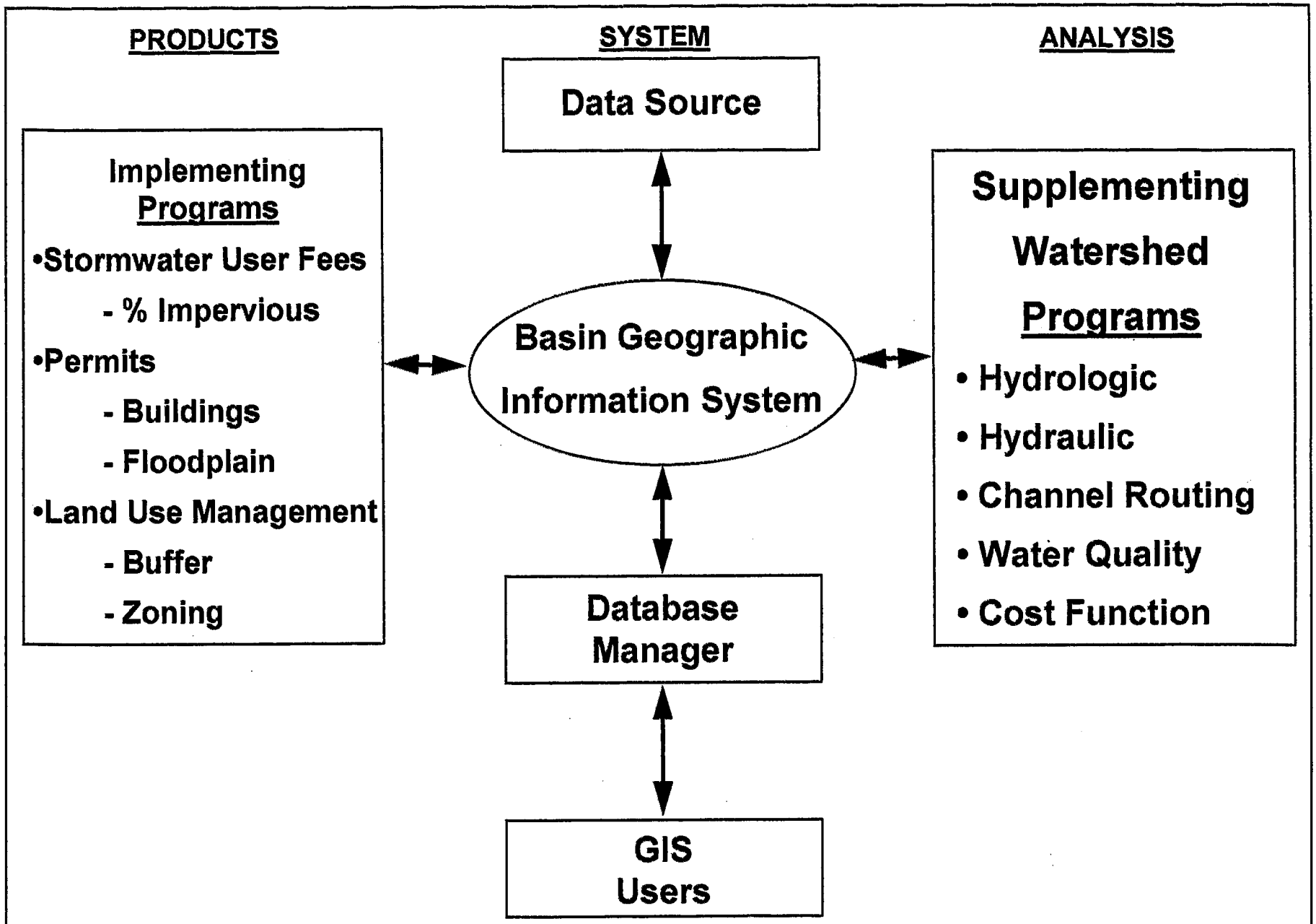


FIGURE 5-1
Integration of GIS System with Other Programs

Herkimer-Oneida
Sauquoit Creek Basin

Stearns&Wheler,LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

TABLE 5-2

POTENTIAL SOURCE LIST OF DIGITAL INFORMATION FOR THE SAUQUOIT CREEK BASIN

ISSUE	POTENTIAL SOURCE	GIS LAYER
Water Quantity	USGS, NYSDEC, HECI HOCCPP	Topography/elevation/slope/aspect/solar illumination
	Vendors	Digital Orthophoto Quarter Quads (DOQQs) at 1"=1,000' (1:12,000) scale are becoming widely available and are the most horizontally accurate and up-to-date base maps of overlay of diverse geographic information.
	NOAA	Precipitation
Water Quality	HOCCPP, SWCD, Cooperative Extension	Land use/vegetation/high potential sediment sources/nutrient loading
	NYSDEC	Stream sampling data monitoring and assessment RIBS survey data
Farm Practices	NRCS, SWCD	Soils/agricultural districts
Fish and Wildlife	NYSDEC	Stream classification/invertebrate data/wildlife priority habitats/threatened and endangered species
Recreation	NYSOPRHP, Local Communities	Public lands/access/trails
Natural Character	NYSOPRHP, Local Groups	Natural and unique resources
Wetlands	NYSDEC, Fish and Wildlife	State wetlands COE wetlands/local wetlands
Development/ Land Use	HOCCPP, Local Communities	Zoning/land-use data
	HOCCPP, US Census	Census data
Highway/ Transportation	NYSDOT, HOCTS, Oneida County DPW	State, county and local roads
Groundwater/ Drinking Water	NTSDEC, USGS	Aquifers/wells and surficial geology
Regulatory Controls	HOCCPP, Local Communities	Zoning/buffers
Community Education	Schools, Cooperative Extension	Educational/natural areas

includes the ability of the administrative unit to aggregate information, and to easily utilize data for comparisons or correlation. For example, utilizing the percent of impervious cover as a means of financing a project review process would likely require the identification of individual parcels of land, and perhaps, the categorization of information more broadly by land-use classes. For effective policy implementation, displays and mapping must be developed that allow the presentation of results of the analysis in a convincing and easily understood format.

Another aspect of GIS that could be useful to policy makers is the capability GIS provides directly to decision makers which allows them to experiment with multiple development scenarios or analyses. So, for example, a planner or town official could test three or four development scenarios in the Sauquoit Creek watershed and immediately see the result of each alternative on a number of issues such as flooding impacts, water quality impacts, or impacts to wildlife or fish habitat. Other potential users and beneficiaries of a GIS could be any of the present stakeholders, local residents, landowners, farmers, commercial and industrial representatives, and/or regulatory agencies within the Sauquoit Creek basin.

A GIS can also be networked and/or linked with various emergency management databases to effectuate a real-time response to flooding and other disaster circumstances. For example, the State Emergency Management Office's (SEMO's) "Emergency Management Systems" software package is one illustration of this capability of a GIS.

A GIS system can also be used as an educational and data collection tool. For example, a selection of maps could be transferred to a multimedia Compact Disk-Read Only Memory (CD-ROM). Using video cameras, 35-millimeter cameras, and sound equipment, high-resolution on-site images could be obtained and incorporated into the CD-ROMs. This information could be keyed to hard-copy watershed maps so that such information is more usable and understandable at a local level. The CDs could also be easily distributed to local schools, organizations, and agencies to educate local residents about conditions in the watershed and environmental management.

D) Supplementing a GIS System

There are numerous software programs available today that serve to integrate many of the required functions of a GIS. Most of the GIS applications available today, such as those for environmental modeling, are best handled, not by integrating all forms of desired analysis into one software package, but by providing appropriate linkages to allow many software components to operate in a coordinated GIS effort. As will be discussed further below, this coordinated linkage can be extremely useful in the implementation of watershed management modeling.

Although there are many GIS software programs available, ARC/INFO (by ESRI, Redland, California) is evolving as one of the most used for processing and analyzing watershed data. This GIS software can be set up on a UNIX-based operating system, or on a PC-based system (at a lower cost). Data can be digitized on various tables, such as CalComp (Anaheim, California), or scanned and digitized directly on the computer. If the system is set up on a UNIX-based, full ARC/INFO system, it can also be downloaded to a PC for viewing and analysis of maps using programs such as ArcView (by ESRI, Redland, California). In addition, hard copy maps can be easily printed on a standard plotter.

A GIS within the Sauquoit Creek basin could be used to integrate hydrologic, hydraulic, and stormwater management models. A comprehensive review of these models should be one of the early tasks in establishing a GIS within the basin. As needs arise, other models (e.g., for stormwater analysis) can be easily added to the GIS system in the future and are very impor-

tant for the evaluation of impacts of proposed land-uses and alternative control measures. For example, stormwater models are necessary to calculate flow, velocity, and water surface elevations; to represent hydraulic controls in the watershed; and to handle backwater and surcharged pipe flow conditions. In order to adequately assess proposed land-uses, the model must have land use categories as a direct input parameter. The model should be able to function by taking into account other physically based parameters as well - such as slope. The model should examine localized impacts as larger-scale, watershed-wide impacts.

There are many stormwater models in existence - both water quality and water quantity models - that can form a basis for addressing many watershed issues, and new models are constantly appearing on the market. A number of stormwater and watershed-related models are discussed below. Additionally, an October 1994 NYS DEC publication: "Predicting Pollutant Loading Through the Use of Models," provides an evaluation and comparison of the capabilities of a variety of models.

1. **Stormwater Management Model (SWMM).** The US Environmental Protection Agency (EPA) developed SWMM as the first watershed model to be designed exclusively for urban stormwater studies. With the development of SWMM/EXTRAN, the ability of SWMM to handle urban systems has been significantly improved. The SWMM model consists of three basic variations with slightly different emphases - SWMM/Runoff; SWMM/Transport; SWMM/EXTRAN. Unlike HEC-2 (discussed below), which can only provide steady-state simulation of water surface profile in open channel systems (i.e., based on peak flow only at each location), the SWMM model relies upon dynamic instream routing simulation (i.e., based on routing of complete streamflow hydrographs at each location). Since the SWMM model provides a dynamic simulation with complete hydrographs throughout the watershed, it can be used to simulate the downstream interactions and impacts of outflows from detention basins, stream crossings (e.g., culverts), and channel improvements.

The SWMM model considers the following as input and/or output characteristics:

a. **Catchment Hydrology.**
- multiple catchment inflows
- dry weather flows
- input on several hyetographs
- runoff from impervious areas
- runoff from pervious areas
- water balance between storms

b. **Sewer Hydraulics.**
- flow routing in sewers
- upstream and down stream flow control
- surcharging and pressure flow
- diversions
- pumping stations
- storage
- printouts of stage
- printouts of velocity

c. **Miscellaneous.**
- continuous simulations
- choice of time interval
- design computations
- real-time control
- computer program available

2. **Soil Conservation Service, Technical Release-20 (TR-20).** TR-20 is a water quantity model that is utilized on a watershed basis. The model was developed by the Natural Resource Conservation Service (NRCS) [formerly the Soil Conservation Service (SCS)] for the evaluation of flood protection measures in small agricultural watersheds (SCS, 1982). The model relies upon "SCS Curve Number" hydrology, which was originally derived for nonurban land uses only. With the release of SCS Technical Release Number 55, known as TR-55, SCS Curve Number hydrology was routinely applied to urban watersheds, even though the original hydrologic methods were not intended for urban stormwater studies. The TR-20 model is a simple step-by-step procedure that does not require extensive engineering

judgment or a detailed understanding of hydrologic/hydraulic principles. Additionally, the model does not directly simulate stormwater systems, and tends to underestimate volumes and peak flows in urban watersheds.

The TR-20 model considers the following as input and/or output characteristics:

a. **Catchment Hydrology.**
- multiple catchment inflows
- input on several hyetographs
- runoff from impervious areas
- runoff from pervious areas

b. **Sewer Hydraulics.**
- storage
- printouts of stage
- printouts of velocities

c. **Miscellaneous.**
- choice of time interval
- design computations
- computer program available

3. **US Army Corps of Engineers, Hydrologic Engineering Center (HEC-1).** HEC-1 is a water quantity model commonly utilized for ungaged watersheds. The model relies upon unit hydrograph techniques to simulate watershed hydrology. The model can route flow through open channels and reservoirs only. Several instream flow routing techniques are available in the model. Unlike the SWMM model, HEC-1 cannot simulate flow through storm sewers and backwater and surcharge effects. HEC-1 is often run in series with the steady-state HEC-2 model for backwater analysis and the development of water surface profiles.

The HEC-1 model considers the following as input and/or output characteristics:

a. **Catchment Hydrology.**
- multiple catchment inflows
- dry weather flows
- input on several hyetographs
- snowmelt
- runoff from impervious areas
- runoff from pervious areas
- water balance between storms

b. **Sewer Hydraulics.**
- upstream and downstream flow control
- diversions

c. **Miscellaneous.**
- continuous simulations
- choice of time interval
- computer program available

4. **US Army Corps of Engineers, Hydrologic Engineering Center (HEC 2).** HEC-2 is a stand-alone hydraulic model that is used to simulate water surface profiles for stream channels of any cross-section for either subcritical or supercritical flow conditions (COE, 1973). It is customary to operate HEC-2 with peak flow output generated by hydrologic models like HEC-1. The effects of various hydraulic structures such as bridges, culverts, weirs, embankments, dams, and channel improvements may be considered in the HEC-2 computation. The principal use of the program is for determining profiles for various frequency flood elevations under both natural and modified channel conditions.

The HEC-2 model considers the following as input and/or output characteristics:

a. **Catchment Hydrology.**
- NA

b. **Sewer Hydraulics.**
- upstream and downstream flow control
- prints stage
- prints velocities

c. **Miscellaneous.**
- computer program available
- unsteady-state ice jam algorithm available

5. **Hydraulic Engineering Center's River Analysis System (HEC-RAS).** The HEC-RAS is the latest version of HEC-2 software. HEC-RAS incorporates several aspects of hydraulic modeling, including water surface profile computations, bridge hydraulics, sediment transport, one-dimensional steady and unsteady flow. The HEC-RAS modeling system was developed as part of the center's "Next Generation" (NexGen) hydrologic engineering software, and probably will replace several existing COE programs, including HEC-2 water

surface profile program and the HEC-6 erosion and sediment program. HEC-RAS is user-friendly, computationally efficient, and runs within and fully supports the Microsoft Windows environment.

6. **(HSP-F).** HSP-F is a continuous simulation model that simulates a long-term streamflow record from a long-term record of rainfall and evapotranspiration (Johanson et al. 1980). By simulating soil moisture changes between storms (i.e., water balance), HSPF automatically computes the antecedent moisture at the start of each rainstorm, thereby eliminating one of the more important assumptions for the other models, which only simulate a single design storm. HSPF's representation of urban drainage networks is not as sophisticated as SWMM's.

   The HSP-F model considers the following as input and/or output characteristics:

   a. **Catchment Hydrology.**
      - multiple catchment inflows
      - dry weather flows
      - input on several hyetographs
      - snowmelt
      - runoff from impervious areas
      - runoff from pervious areas
      - water balance between storms

   b. **Sewer Hydraulics.**
      - flow routing in sewers
      - upstream and downstream flow control
      - diversions
      - storage
      - printouts of stage
      - printouts of velocities

   c. **Miscellaneous.**
      - continuous simulations
      - choice of time interval
      - real-time control
      - computer program available

7. **Illinois Urban Drainage Area Simulator (ILLUDAS).** The ILLUDAS model (Yen, 1973) is an adaptation of the British Road Research Laboratory (RRL) storm sewer design model that accounts for the peculiarities of North American climatological conditions. It is a single storm event model, and is a fairly detailed design tool for storm sewer systems. However, it does not provide sophisticated representation of sewer and channel routing.

   The ILLUDAS model considers the following as input and/or output characteristics:

   a. **Catchment Hydrology.**
      - multiple catchment inflows
      - dry weather flows
      - input on several hyetographs
      - runoff from impervious areas
      - runoff from pervious areas
      - water balance between storms

   b. **Sewer Hydraulics.**
      - flow routing in sewers
      - storage

   c. **Miscellaneous.**
      - choice of time interval
      - computer program available

8. **Simplified Particulate Transport Model (SIMPTM).** The SIMPTM is an excellent water quantity and water quality model which could provide the basis for modeling the entire Sauquoit Creek watershed. The SIMPTM package is a group of PC-based programs which simulate pollutant loadings transported by urban stormwater on an event-by-event basis. The package consists of three programs: RAINEV, SIMPTM, and SUMMRY. RAINEV is a rainfall analyzer that characterizes significant rainfall events based on duration, depth, time, average intensity, maximum hourly intensity, etc. SIMPTM simulates stormwater discharges and pollutant loadings from developed lands using published, physically-based sediment transport equations. The overall effectiveness of strategies such as street sweeping, sediment trapping, catchbasins, and catchbasin cleaning can be outputs of SIMPTM. SUMMRY simulates per acre runoff and pollutant transport for each of the contributing land uses and combines the results by sub-basin or as basin-wide predictions.

9. **EPA's "Simple Method".** The Environmental Protection Agency's "Simple Method" esti-

mates pollutant loads and is intended for use on development sites less than a square mile in area. While the method sacrifices some precision for the sake of simplicity, it is considered precise enough to make reasonable and reliable nonpoint pollution management decisions at the site-planning level. The user of this method need only define five parameters, each of which are readily determined from site plan data or are constants. These parameters include: depth of rainfall, the fraction of rainfall that does not produce any measurable runoff (correction factor), the runoff coefficient, the site area in acres, and pollutant concentration ('C' value).

10. **Urban Catchment Model (P-8).** The P-8 model is capable of modeling watershed changes and the effectiveness of various management practices such as: swales, buffer strips, detention ponds, and infiltration basins. It also addresses and emphasizes water quality parameters. P-8 requires a minimum of input data, most of which is available from drainage plans, soil surveys, and other common local sources.

Hydraulic capabilities of models vary greatly. Some only look at steady state conditions (i.e., HEC-2), while other are much more dynamic (i.e., SWMM/EXTRAN). Different models have different capabilities with regard to: (1) watershed-wide and site hydrology; (2) watershed-wide hydraulic model; and (3) hydraulic model of site development.

A number of approaches and models are also available for modeling pollutants. Some pollutant loading models include: (1) the Simulator for Water Resources in Rural Basin-Water Quality (SWRRBWQ) NRCS, Version 3210SCS94a (USDA, 1995); and (2) HU/WQ Tool, Hydrologic Unit/Water Quality Tool NRCS, Version 1.4 (USDA, 1995).

The way to optimize these technologies is to utilize a combination of models and match the correct model to the intended purpose. Within the Sauquoit Creek basin, a combination of three or more models may be necessary. For example, programs such as SWRRBWQ may be used for agricultural lands; SIMPTM - for urban/suburban areas; and SWMM - for heavily urbanized areas.

Local governments could either rely entirely upon the SWMM model (both RUNOFF and EXTRAN) or link another hydrologic model to the hydraulic model (EXTRAN) in the SWMM package. Figure 5-3 presents a diagram of a stormwater modeling approach based exclusively on the SWMM model package and the linkages between the GIS data base, SWMM/RUNOFF, and SWMM/EXTRAN.

Since the COE has already used the HEC-1 and HEC-2 model for hydrologic and hydraulic studies (respectively), it makes sense to utilize these models. Even though SWMM/EXTRAN is the recommended hydraulic model for master planning studies, HEC-2 is a suitable tool for studies of localized problems (e.g., stream crossings) or other studies where assumptions of steady state conditions are appropriate. Figure 5-4 summarizes an approach to linking acceptable hydrologic and hydraulic models for the different types of studies being considered for the Sauquoit Creek basin. Other newer programs can make use of the HEC-1 and HEC-2 data. BOSS HEC-1 is a hydrology program that can utilize the existing HEC-1 into a digital terrain model by subbasin. The automation of hydraulic modeling works together with a Digital Terrain Model (DTM). BOSS HEC-2 with AutoCAD can bring in existing Corps of Engineers Section 22 study data and combine this information with a digital terrain model so that model changes can be readily incorporated. For example, stream channel cut and fill cross sections can be done from an engineers desk. AutoCAD based information can be incorporated directly into water quantity/quality modeling with SWMM.

SECTION 5.2

SUMMARY OF RECOMMENDATIONS FOR GETTING STARTED

As discussed above, there are many components, options, and methodologies available and necessary to establishing an effective basin-wide Geographic Information System. In summary, the following major recommendations and short/long term recommendations, were selected (based on the discussion above and the discussions within *Chapter 4 - Watershed Issues, Goals, and Objectives*) as a way to "get started" in regard to this element of watershed management within the Sauquoit Creek basin.

1. **Major Recommendation.** Establish a basin-wide geographic information system for the Sauquoit Creek watershed.

2. **Recommendations for Getting Started (Short-Term).**

   a. Investigate an institutional arrangement for managing and developing a GIS for the basin.

   b. Establish an operational prototype GIS based on existing data and PC ARC/INFO based software.

   c. Develop a computerized educational program as a pilot GIS project to illustrate the capabilities of GIS while educating individuals about issues within the Sauquoit Creek basin.

   d. Develop a digital base map for the basin.

   e. Identify and prioritize digital information necessary for a full-scale GIS system.

3. **Recommendations for Longer-Term Solutions**

   a. Establish a standardized process for collecting, analyzing, sharing, and updating GIS data.

   b. Initiate the development of a full-scale GIS for the Sauquoit Creek basin.

   c. Utilize a GIS to establish a stormwater user fee system based on the amount of impervious cover per parcel.

   d. Develop specific water quality models to evaluate impacts of stormwater runoff and pollutants from a variety of landuses.

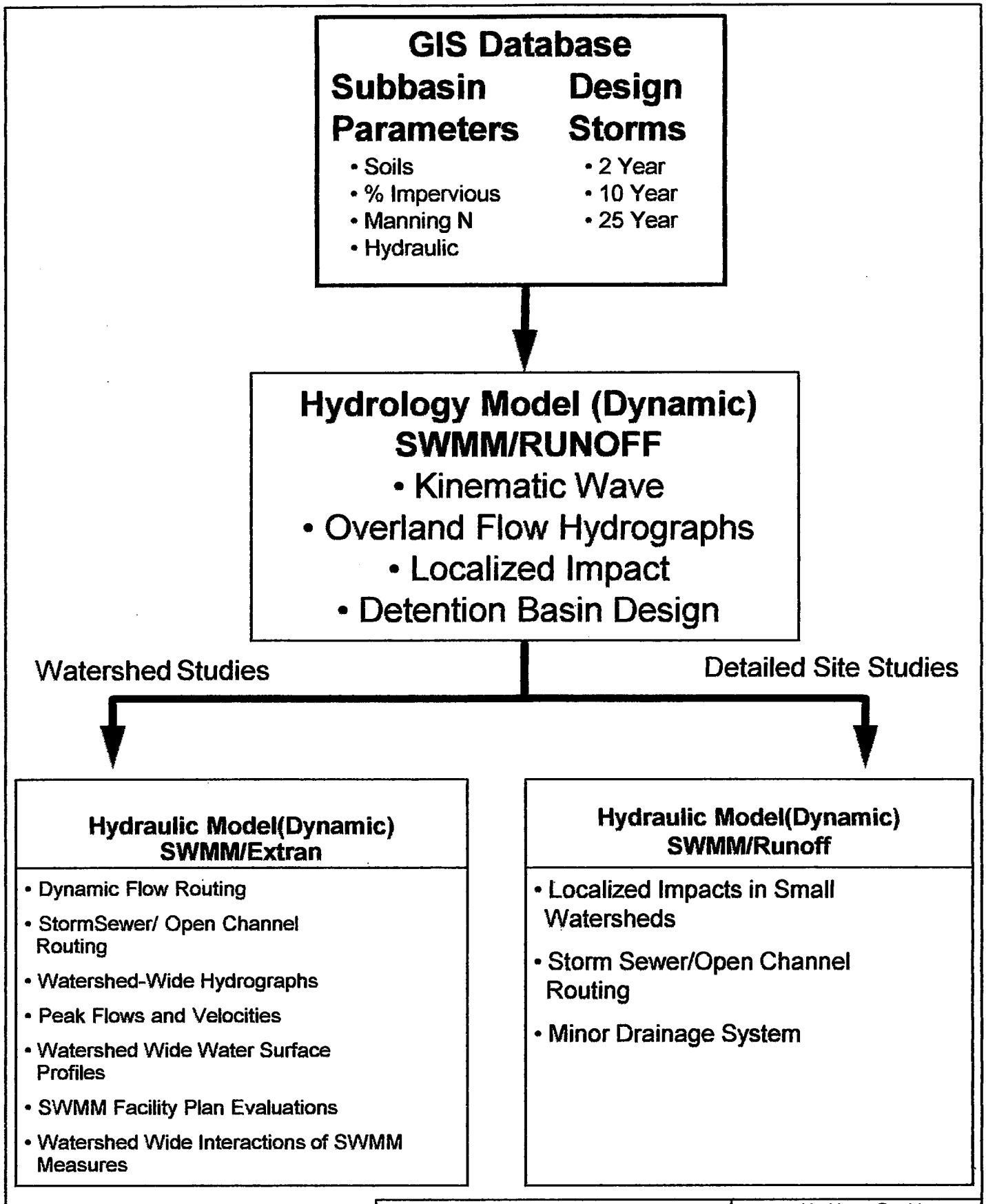


FIGURE 5-3
Stormwater Model Diagram

Herkimer-Oneida
Sauquoit Creek Basin

Stearns&Wheler,LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

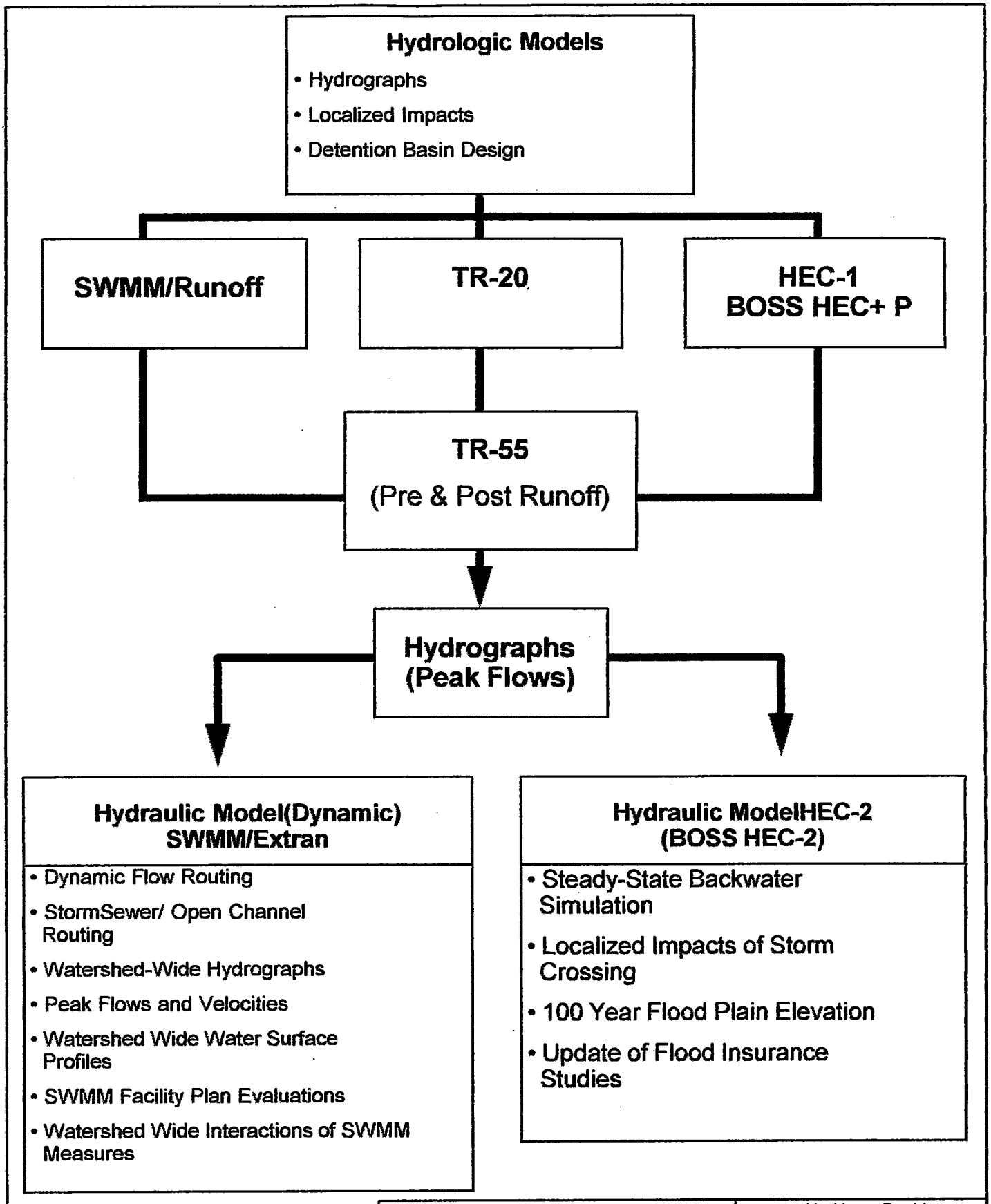


FIGURE 5-4
Stormwater Approach to Linking Hydrologic and Hydraulic Models

Herkimer-Oneida
Sauquoit Creek Basin

Stearns&Wheler,LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

SECTION 5.3

SPECIFIC PROJECTS AND PROGRAM RECOMMENDATIONS

This section outlines specific projects and program recommendations that are "ready made," fundable projects that would further the major recommendations and short/long term recommendations outlined above.

For each recommendation and specific project developed, the following steps need to be followed:

- obtain commitment of involvement from key decision makers
- set priorities for potential solutions
- develop a list of projects to be implemented for each solution
- set goals for accomplishing each project
- locate funding and technical expertise for projects that need it
- be practical
- evaluate progress

Each of the following specific projects have been subjectively evaluated based on a priority rating system, range of cost, and potential point agency. Factors which were evaluated include, but are not limited to: the overall benefit of the project to the watershed; the cost of the project and potential availability of funding; whether there is a logical point agency or individual; and, the ease of implementation.

Projects receiving a "high" priority include those that should receive immediate attention, obtain a commitment of involvement, and identify the appropriate point agency. Additionally, funding is likely to be attainable and activities to obtain such funding should begin immediately.

Projects with a "medium" priority rating include those activities which are slightly less urgent but action relating to agency commitment and a funding mechanism should begin within the next year.

Projects with a "low" priority should be targeted for a longer term implementation schedule such as a 10-year cycle. These projects may require or involve additional thought and planning, and could be postponed unless a particular funding source becomes available or a point agency is willing to champion its cause earlier.

In addition to the priority rating, projects are also identified as being short-term or long term projects. As such, there may be high priority, short-term projects, as well as, high priority long-term projects. Short-term projects are those which can be accomplished within a relatively short span of time (ie: within one to two years).

Long-term projects include those activities that: may require or involve additional thought, research, planning, or collection of base data; may continue to be implemented over a number of years; may require continuous activity; or may take a number of years to conclude.

In estimating project costs, this evaluation criteria includes subjective and approximate estimations for planning purposes only. The estimates of costs are, however, based on professional knowledge of similar projects implemented in other watersheds. Once a project has been identified and a commitment to proceed established, a new, more accurate estimate should be made during the project application process. The ranges of costs and cost categories used for the evaluation of the following specific projects include: projects with a relatively "low" cost ranging from $0 to $100,000; projects with a "medium" cost ranging from $100,000 to $500,000; projects with a relatively "high" cost of over $500,000.

As with the other priority rating criteria, the suggestions for a point agency or individual are subjective recommendations of who may be the logical entity that might initiate that particular project. Obtaining the

commitment of this agency would be the first step in initiating these projects. The agency's available resources and interest in the projects would ultimately determine if they would become the sole point agency, the point agency with other co-sponsors, or if they would not be involved at all. Of course other entities not listed can initiate the activity if there is an interest or funding source available.

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide GIS Program

Project Title: Management of the GIS

Project Description: Investigate an institutional arrangement for developing and managing a GIS for the basin.

Priority: High (Short-term)

Potential Activities:

Discuss and determine an acceptable institutional structure for the development, management, and continued functioning of a GIS for the basin. Considerations should include: the costs of development (including staff, hardware, software, and maintenance); maintaining the system in the public or private domain; licensing and data sharing; data standards; etc.

Point Agency or Individual:

- New York State Department of Environmental Conservation
- New York State Department of Transportation
- Herkimer-Oneida Counties Comprehensive Planning Program
- A newly established Sauquoit Creek watershed entity (see; Volume 6, Chapter 3)
- Private sector consultant(s)
- GIS coordinating group

Cost Estimate: Low (<$100,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide GIS Program

Project Title: Prototype Sauquoit Creek Basin GIS

Project Description: Establish an operational prototype GIS based on existing data and utilizing a PC-ARC/INFO system.

Priority: High (short-term)

Potential Activities:

Illustrate how an integrated Geographic Information System (GIS) can support a variety of water resource problem solving focusing on non-point source pollution, flooding, stormwater management, and overall watershed management. Specifically, model and analyze:

- flooding and flood plain encroachments,
- stormwater runoff,
- nutrient loadings,
- miscellaneous water quality characteristics,
- erosion and sedimentation,
- land use changes and associated impacts,
- cost/benefit ratios for various management and design scenarios, etc.

The technology demonstration should support and provide recommendations and the implementation of basin-wide management practices such as, but not limited to, the:

- location and preliminary design of regional stormwater facilities;
- creation of a stormwater utility;
- development of an emergency flood plain management program;
- targeting of BMPs for specific land uses such as agriculture;
- implementation of uniform management and operational guidelines
- creation of a greenway/natural drainageway system;
- education and involvement of the public; etc.

Point Agency or Individual:

- New York State Department of Environmental Conservation
- New York State Department of Transportation
- Herkimer-Oneida Counties Comprehensive Planning Program
- A newly established Sauquoit Creek watershed entity (see; Volume 6, Chapter 3)
- Private sector consultant(s)

Numerous agencies, individuals and/or organizations exist that can implement components of this project that relate to their respective areas of expertise.

Cost Estimate: High (>$500,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide GIS Program

Project Title: Educational Program

Project Description: Develop a computerized educational program as a pilot GIS project to illustrate the capabilities of GIS while educating individuals about issues within the Sauquoit Creek basin.

Priority: Low (short-term)

Potential Activities:

Develop a number of basic data bases or layers within a GIS system that are specific to the Sauquoit Creek basin and using an overlay system provide a combination of simple analyses to illustrate the capabilities of a GIS. The demonstrations should target key issues identified in Volume 4 of the Sauquoit Creek Basin Watershed Management Study.

These demonstrations can present the analyses at public meetings in an effort to educate individuals about issues within the Sauquoit Creek basin and GIS.

Basic data layers may include: roads, municipal boundaries, waterbodies, topography, wetlands, land use, tax parcel boundaries, etc.

Point Agency or Individual:

- New York State Department of Environmental Conservation
- New York State Department of Transportation
- Herkimer-Oneida Counties Comprehensive Planning Program
- A single municipality within the basin
- Oneida County Soil and Water Conservation District
- Private sector consultant(s)

Cost Estimate: Low (<$100,000)

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide GIS Program

Project Title: Digital Base Map

Project Description: Develop an accurate digital base map for the Sauquoit Creek watershed based on controlled and up-to-date aerial photography.

Priority: Medium (short-term)

Potential Activities:

- Discuss and identify base data necessary to illustrate on a base map and desired resolution.
- Establish ground control monuments throughout the watershed to allow accurate rectification of overflights and later data acquisition.
- Use the ground control to have controlled aerial photos flown and develop orthophotos for the watershed.

Point Agency or Individual:

- US Geological Survey
- New York State Department of Environmental Conservation
- New York State Department of Transportation
- Herkimer-Oneida Counties Comprehensive Planning Program
- Herkimer-Oneida Counties Transportation Study
- A single municipality within the basin
- Oneida County Department of Planning
- Oneida County Department of Public Works
- Private sector consultant(s)
- Utility companies

Cost Estimate: Low (<$100,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide GIS Program

Project Title: Digital Information

Project Description: Identify and prioritize information necessary for a full-scale GIS within the Sauquoit Creek watershed (see: Section 5.1, A and Table 5-2).

Priority: Medium (short-term)

Potential Activities:

- Discuss and identify existing digital data that is available and the agency or individual possessing such information.

- Identify additional data which is not currently available but is necessary to address issues within the basin and identify the logical agency which could develop such data.

Point Agency or Individual:

Numerous agencies, individuals and/or organizations exist that can implement components of this project that relate to their respective areas of expertise.

Cost Estimate: Low (< $100,000)

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide GIS Program

Project Title: Data Standardization

Project Description: Establish a standardized process and criteria for collecting, analyzing, sharing, and updating GIS data.

Priority: High (long-term)

Potential Activities:

- Consider factors for data identification information, quality control, spatial data organization, spatial reference information, entity and attribute information, distribution information, and "metadata" reference information.
- Develop specific processes for tracking and the creation of data such as: source, author, purpose, method, precision, accuracy and error ranges, constraints, projection, etc.
- Determine desired needs and necessary resolutions for data.
- Contact the NYS Forum for Information Resource Management for further information and potential activities.

Point Agency or Individual:

- A newly established Sauquoit Creek watershed entity (see; Volume 6, Chapter 3)
- Private sector consultant(s)

Cost Estimate: Low (<$100,000)

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide GIS Program

Project Title: Full-scale Geographic Information System

Project Description:

Initiate the development of a full-scale GIS for the Sauquoit Creek basin. Integrate all available and necessary spatial and tabular data such as: real property information; physical characteristics such as soils, topography, etc; infrastructure such as roads, water and sewer; appropriate models; etc.

Priority: High (Long-term)

Potential Activities:

As may be necessary purchase equipment including hardware such as terminals, digitizing tablets, plotters, printers, etc. and software programs.

Complete a comprehensive review of hydrologic, hydraulic, and stormwater management models and select the most appropriate combination for implementation within the basin.

Provide appropriate linkages between a variety of software packages to develop an appropriate and usable GIS for the Sauquoit Creek basin.

Point Agency or Individual:

- A newly established Sauquoit Creek watershed entity (see; Volume 6, Chapter 3) with the assistance of private sector consultants and/or other state, federal, regional, county, or local agencies.

Cost Estimate: High (>$500,000)

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide GIS Program

Project Title: GIS-Based Stormwater User Fees

Project Description: Utilize an existing GIS (in combination with establishing an institutional structure for stormwater management and proposed methods for financing stormwater management facilities) to establish a stormwater user fee system based on the amount of impervious cover per parcel.

Priority: High (Long-term)

Potential Activities:

Investigate and derive appropriate system for establishing an equitable fee structure. For example, agree on necessary factors to consider in calculations such as: runoff coefficients for specific categories of land uses; equivalent runoff units (ERUs) and single family equivalents (SFEs); charge per ERU/SFE; etc.

Calculate appropriate fee based on impervious cover - specific to each parcel. Estimate revenue requirements, total equivalent runoff units in service district; charge per service unit; and charge for individual parcels.

Implement a program to reinvest generated revenues to further the development of a GIS and stormwater management program. Insure appropriate and necessary legislation/ authorization exists to permit the implementation of user fees.

Point Agency or Individual:

- A newly established Sauquoit Creek watershed entity (see; Volume 6, Chapter 3)

Cost Estimate: Medium ($100,000 to $500,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Basin-Wide GIS Program

Project Title: Basin and Sub-basin Water Quality Modeling

Project Description: Develop specific water quality models to evaluate impacts of stormwater runoff and pollutants from a variety of landuses.

Priority: High (short-term)

Potential Activities:

- Develop a basin-wide water quality model simulating event based stormwater discharges and pollutant loadings from developed lands using published equations (eg: SIMPTM, P8, or other similar models).

- Develop a basin-wide water quality model specific to agricultural non-point source impacts using models such as AGNOPS< SWRRB, or other similar models.

- Model and evaluate multiple control strategies and models to reduce pollutant loadings to the basin (eg: SLAMM).

- Model and evaluate complex urban stormwater processes from the most highly developed and sewered portions of the basin utilizing models such as EPA's SWMM.

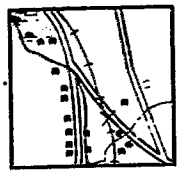
Point Agency or Individual:

Numerous agencies, individuals and/or organizations exist that can implement components of this project that relate to their respective areas of expertise.

Cost Estimate: High (>$500,000)

Chapter 6

Creating a Restoration and Enhancement Program



Examination of, and solutions to, many of the major issues and problems such as flooding, water quality degradation, and habitat loss can be simultaneously addressed through the development of a Sauquoit Creek restoration and enhancement program. Recent advances in bioengineering and structural methodologies by which natural stream systems can be restored have enabled municipalities to restore these waterways, and at the same time, return them to sustainable natural ecosystems.

The restoration and enhancement effort should reflect an integrated approach that includes: (1) an evaluation of how the stream system functions and what has interfered with its function in the past; (2) what are the best strategies for restoring the system to a healthy sustainable level; and (3) a process to measure the effectiveness of the restoration program. These elements are discussed in more detail below.

The key technical element of such a program is the adaptation of existing methodologies to specific site conditions within each restoration area. This effort should combine two major components - integration of the best technologies to respond to the requirements of that particular stream segment and preparation of a cost-benefit analysis of these alternative methods of restoration.

SECTION 6.1

EVALUATING THE STREAM SYSTEM FUNCTIONS

The first step to developing a restoration and enhancement program is to formulate a thorough understanding of the pollutants and sources of contamination within the watershed that may be posing a threat to the Sauquoit Creek. Much of this work has been completed and is included within the discussions in *Volume 4 - Watershed Issues, Goals, and Objectives*. Additionally, specific land use threats and generalized locations of these threats can be analyzed from the Land Use/Land Cover Survey map illustrated in *Volume 5 - Existing Development, Regulatory Controls and Development Potential*.

It is also necessary to develop a thorough understanding of the stream system and its related problems. Such data should be collected as early as possible in the planning process. Again, much of this work has been completed and is discussed in *Volume 4 - Watershed Issues, Goals, and Objectives*. However, as illustrated in Section 6.5, additional information is necessary before developing an appropriate stream restoration and enhancement program. Information such as hydrologic and hydraulic evaluations, classification of stream segments, completion and evaluation of all soil and vegetative conditions, and collection of data on wildlife and fisheries, is typically necessary for a restoration and enhancement program.

SECTION 6.2

DEVELOPING STRATEGIES FOR STREAM RESTORATION AND ENHANCEMENT

Once necessary data has been collected, a list of potential restoration techniques that would be applicable to specific areas should be compiled. In addition, it's necessary to document the requirements for each restoration technique. For an example, bioengineering combines biological elements with engineering design principles. Therefore, the requirements for both of these disciplines must be considered when planning and designing the most appropriate restoration and enhancement measures. As a more specific example, access to the stream for fisherman may require highly compacted soil, while vegetation to enhance fisheries may require relatively loose soil. It is important to direct fisherman to specific access areas, and create other riparian vegetation zones elsewhere to accommodate both sets of needs. Differing needs and requirements can be integrated through both creative approaches and the application of scientific principals.

It may also be necessary to investigate and fully understand the permitting requirements for each restoration technique. An integrated conceptual plan of the stream restoration or enhancement program should be developed to assist in the review and approval process.

The overall stream restoration program is likely to be complex - incorporating a number of differing techniques and considering a number of critical factors including hydrology, soils, geomorphology, hydraulics, structural components, and plant materials. When considering a bioengineering design, sufficient information and surveys need to be evaluated to identify the exact extent of flooding, effect of drainage upstream and downstream, the type of vegetation along the stream bank, stream hydrology (width, depth, length, cross-sectional area, resistance to flow, hydraulic gradient, velocity of flow, and volume of flow), etc. It is important to fit the bioengineering system to the site. It is also important to recognize that flow characteristics to optimize designs for wildlife, flood control and water quality are markedly different. Therefore, optimization must be balanced based on desired benefits.

A technical understanding of the system components, such as topography, geology, soils, vegetation, and hydrology should be used to select the best restoration technique and fit it into specific site considerations. For an example, regrading sensitive areas to a 3 to 1 slope may be required, as well as the installing flow deflectors, rip-rap, erosion control fabric, or shrubs in specific areas needing stabilization. In other areas where the stream is being eroded as a result of the return of flood waters, regrading and installation of a grass lined spillway with an erosion control mat may be recommended.

The examination of existing structural components of the stream (i.e., dikes, debris dams, water control structures, etc.) may also assist in developing an appropriate stream restoration and enhancement program. For an example, stream restoration and enhancement measures that involve structures as simple fencelines can provide a number of benefits. Moving a fenceline further away from the stream may help to keep livestock from having direct access to the Sauquoit Creek - preventing additional bank erosion and protecting riparian vegetation.

Any recommended bioengineering techniques should be applied according to the bioengineering design recommendations. Since the Sauquoit Creek is a trout stream, particular emphasis should be placed on ways to minimize impacts on the existing water quality, such as: retaining existing vegetation whenever possible; limiting removal of existing vegetation, stockpiling and protecting topsoil; protecting areas exposed during construction; diverting, draining, or storing excess

water; and, utilizing silt fences where possible.

Any design, construction, and construction management services utilized for a Sauquoit Creek restoration and enhancement program should be integrated into a community, watershed-wide educational program (see Chapter 7 - Establishing a Community Education and Citizen Involvement Program).

SECTION 6.3

MEASURING THE EFFECTIVENESS OF THE PROGRAM

As part of the overall program, a cyclical program for assessing and evaluating specific stream restoration and enhancement projects should be developed. It is often necessary to evaluate the relative success or failure of the selected stream restoration or enhancement activity. As necessary, adjusts must be made and decisions on future steps must be determined. The effectiveness evaluation should include both: (1) baseline monitoring; and (2) periodic monitoring. For example, a monitoring and assessment program might include a rotation and evaluation of various techniques on a five-year cycle - with the first cycle providing baseline data.

The NYS Department of Environmental Conservation has a similar program - the Rotating Intensive Basin Survey (RIBS) program - which establishes baseline data and is used to monitor the overall health of Sauquoit Creek. Other existing NYS DEC programs that are useful to establishing baseline data and periodic monitoring on the Sauquoit Creek include: macroinvertabrate sampling which is completed by the Bureau of Monitoring and Assessment; and use of a PISCES sampler which mimics the uptake of PCBs in fish.

Similar programs could be established for creeks and tributaries within the entire Sauquoit Creek watershed to establish baseline data and to measure the effectiveness of a stream restoration and enhancement program or other specific programs and recommendations contained in this study.

SECTION 6.4

SUMMARY OF RECOMMENDATIONS FOR GETTING STARTED

As discussed above, there are many components, options, and methodologies available and necessary to establishing an effective creek restoration and enhancement program. In summary, the following major recommendations and short/long term recommendations were selected (based on the discussion above and the discussions within *Chapter 4 - Watershed Issues, Goals, and Objectives*) as a way to "get started" in regard to this element of watershed management within the Sauquoit Creek basin.

1. **Major Recommendation.** Develop and implement an integrated stream restoration and enhancement program within the entire Sauquoit Creek watershed.

2. **Recommendations for Getting Started (Short-Term).**

   a) Establish management boundaries within the Sauquoit Creek basin in which to implement restoration and enhancement projects.

   b) Evaluate stream system functions, establish baseline data, and prioritize specific segments of the stream corridor based on the need in which restoration or enhancement activities should occur.

   c) Inventory and integrate existing structural and historic resources into restoration and enhancement projects.

   d) Develop guidelines to insure restoration and enhancement activities minimize impacts to water quality and quantity.

   e) Enhance recreational opportunities and protect sensitive areas through the preparation of a comprehensive basin-wide recreation plan.

   f) Maintain and enhance habitats for and populations of fish and wildlife.

3. **Recommendations for Longer-Term Solutions**

   a) Identify site-specific restoration and enhancement technologies to respond to the requirements of each particular stream segment and prepare a cost-benefit analysis of these alternatives.

   b) Develop a program that can be used to measure the effectiveness of restoration and enhancement practices.

   c) Implement miscellaneous restoration activities along the Sauquoit Creek such as restoring natural meanders and stream banks.

   d) Implement a number of restoration and enhancement strategies specifically focused on soil and erosion control.

SECTION 6.5

SPECIFIC PROJECTS AND PROGRAM RECOMMENDATIONS

This section outlines specific projects and program recommendations that are "ready made," fundable projects that would further the major recommendations and short/long term recommendations outlined above.

For each recommendation and specific project developed, the following steps need to be followed:

- obtain commitment of involvement from key decision makers
- set priorities for potential solutions
- develop a list of projects to be implemented for each solution
- set goals for accomplishing each project
- locate funding and technical expertise for projects that need it
- be practical
- evaluate progress.

Each of the following specific projects have been subjectively evaluated based on a priority rating system, range of cost, and potential point agency. Factors which were evaluated include, but are not limited to: the overall benefit of the project to the watershed; the cost of the project and potential availability of funding; whether there is a logical point agency or individual; and the ease of implementation.

Projects receiving a "high" priority include those that should receive immediate attention, obtain a commitment of involvement, and identify the appropriate point agency. Additionally, funding is likely to be attainable and activities to obtain such funding should begin immediately.

Projects with a "medium" priority rating include those activities which are slightly less urgent but action relating to agency commitment and a funding mechanism should begin within the next year.

Projects with a "low" priority should be targeted for a longer term implementation schedule such as a 10-year cycle. These projects may require or involve additional thought and planning, and could be postponed unless a particular funding source becomes available or a point agency is willing to champion its cause earlier.

In addition to the priority rating, projects are also identified as being short-term or long term projects. As such, there may be high priority, short-term projects, as well as, high priority long-term projects. Short-term projects are those which can be accomplished within a relatively short span of time (ie: within one to two years).

Long-term projects include those activities that: may require or involve additional thought, research, planning, or collection of base data; may continue to be implemented over a number of years; may require continuous activity; or may take a number of years to conclude.

In estimating project costs, this evaluation criteria includes subjective and approximate estimations for planning purposes only. The estimates of costs are, however, based on professional knowledge of similar projects implemented in other watersheds. Once a project has been identified and a commitment to proceed established, a new, more accurate estimate should be made during the project application process. The ranges of costs and cost categories used for the evaluation of the following specific projects include: projects with a relatively "low" cost ranging from $0 to $100,000; projects with a "medium" cost ranging from $100,000 to $500,000; projects with a relatively "high" cost of over $500,000.

As with the other priority rating criteria, the suggestions for a point agency or individual are subjective recommendations of who may be the logical entity that might initiate that particular project. Obtaining the

commitment of this agency would be the first step in initiating these projects. The agency's available resources and interest in the projects would ultimately determine if they would become the sole point agency, the point agency with other co-sponsors, or if they would not be involved at all. Of course other entities not listed can initiate the activity if there is an interest or funding source available.

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Restoration and Enhancement Program

Project Title: Defining Restoration and Enhancement Areas

Project Description: Establish management boundaries for the Sauquoit Creek and/or its tributaries in which to implement restoration and enhancement projects. An overlay stream conservation and management corridor should be established for any planned creek restoration work and the permanent protection of the creek and sensitive areas.

Priority: Medium (short-term)

Potential Activities:

The restoration or enhancement area boundaries can vary in width according to the location of important natural resource features and environmental constraints that exert a strong influence on the character and quality of the stream and its surroundings (DEC, 1986). The boundary will thus be considered a "floating boundary." Wooded areas, wetlands, floodplains, scenic vistas, and areas having land-use constraints, such as steep hillsides or soils having high erosion potential, should be included within the boundary. Section 3.2, paragraph C and Figure 3-1 Schematic Example of Watershed Management Zones, provide additional detail regarding the establishment of appropriate management areas.

Point Agency or Individual:

- New York State Department of Environmental Conservation
- Herkimer-Oneida Counties Comprehensive Planning Program
- Cornell Cooperative Extension of Oneida County
- Oneida County Soil and Water Conservation District
- USDA Natural Resource Conservation Service
- A newly established Sauquoit Creek watershed entity (see; Volume 6, Chapter 3)

Municipalities with the assistance of respective state, county, regional and local agencies or private sector consultants.

Cost Estimate: Low (< $100,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Restoration and Enhancement Program

Project Title: Stream System Functions and Baseline Data

Project Description: Evaluate how the stream systems function and identify factors that have interfered with how each system has functioned in the past. Establish baseline conditions for the Sauquoit Creek and tributaries, of water quality, water quantity, and habitat conditions that can be used to measure the effectiveness of management, restoration, and enhancement practices and other watershed recommendations.

Priority: Medium (short-term)

Potential Activities:

- Inventory and formulate a thorough understanding of pollutants and sources of contaminants (see: Chapter 4). Identify specific land use threats and analyze the locations of these threats. The Land Use/Land Cover Survey (HOCCPP, 1996) can be used, in combination with a GIS, to analyze clusters of similar land use threats and conclude on best management practices specific to each area.
- Collect and supplement *Volume 4 - Watershed Issues, Goals, and Objectives* with additional information on hydrologic and hydraulic evaluations, stream classifications, soil and vegetative characteristics, fish and wildlife inventories, etc.
- Conduct a biological survey of the Sauquoit Creek and its tributaries to understand water quality conditions.
- Conduct a fisheries and wildlife habitat survey of the creek and riparian zones - identifying critical limiting factors to trout and other important fish and wildlife.
- Conduct an in-stream biological survey of macroinvertabrates within Sauquoit Creek and its tributaries.
- Prioritize specific segments of the stream corridor based on the baseline data and need in which restoration or enhancement activities should occur.

Point Agency or Individual:

- New York State Department of Environmental Conservation
- Herkimer-Oneida Counties Comprehensive Planning Program
- Cornell Cooperative Extension of Oneida County
- Oneida County Soil and Water Conservation District
- USDA Natural Resource Conservation Service
- A newly established Sauquoit Creek watershed entity (see; Volume 6, Chapter 3)
- Special interest groups

Municipalities with the assistance of respective state, county, regional and local agencies or private sector consultants.

Cost Estimate: Medium ($100,000-$500,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Restoration and Enhancement Program

Project Title: Identification of Site-Specific Restoration and Enhancement Practices

Project Description: In response to identified threats and baseline conditions, identify existing restoration and enhancement practices that may help to manage those conditions so improvements can be made. Integrate a combination of management techniques to best suit the needs and desired benefits at individual sites.

Priority: Medium (Long-term)

Potential Activities:

List potential restoration and enhancement techniques that may be applicable to specific areas within the basin. Document the specific requirements for each restoration and enhancement technique and consider such factors as: the integration of creative techniques with the application of scientific principals; the permitting requirements for each management technique; the creation and review of an integrated conceptual plan of each potential restoration and enhancement project; various physical site characteristics; and the cost/benefit ratio.

Point Agency or Individual:

Municipalities with the assistance of respective state, county, regional and local agencies or private sector consultants.

Numerous agencies, individuals and/or organizations exist that can implement components of this project that relate to their respective areas of expertise.

Cost Estimate: Low (<$100,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Restoration and Enhancement Program

Project Title: Integration of Existing Structural and Historic Resources

Project Description: Inventory existing structural and historic resources within the basin and, as appropriate, integrate these components into specific restoration and enhancement projects.

Priority: Low (short-term)

Potential Activities:

- Review and supplement information within *Volume 2 - Visual Survey of the Sauquoit Creek Corridor*.

- Inventory structural and historic components such as: dikes, dams, detention basins, holding/cooling ponds, fencelines, diversion channels, etc.

- Consider and, as appropriate, combine restoration techniques with recreational and educational components - especially where historic structures have been integrated into restoration and enhancement projects.

Point Agency or Individual:

- Special interest groups

Municipalities with the assistance of respective state, county, regional and local agencies or private sector consultants.

Cost Estimate: Low (< $100,000)

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Restoration and Enhancement Program

Project Title: Water Quality and Quantity Guidelines

Project Description: Develop and maintain water quality and water quantity guidelines to insure restoration and enhancement activities provide sufficient support for fisheries, wildlife, and other stream system functions.

Priority: Medium (short-term)

Potential Activities:

- Inventory riparian zones and develop guidelines which will promote the retention of existing vegetation.
- Inventory and complete a functional assessment of wetlands.
- Conduct a hydrologic analysis of the creek and its tributaries (Rosgen stream classification).
- Provide sufficient flows to comply with NYSDEC's water quality standards, including the application of antidegradation standards for the Sauquoit Creek.
- Establish uniform, basin-wide, channel, bank, and wetland alteration guidelines to avoid all new alterations to the creek's channel, banks, and adjacent wetlands that would degrade their natural appearance and function, unless such an alteration is clearly in the interest of public health, safety, and welfare, and no feasible and prudent alternative exists. Such guidelines may suggest: stock piling and protecting topsoil; protecting areas exposed during construction; diverting, draining, or storing excess runoff; utilizing silt fencing; etc.
- Complete a flow study to be used as a primary source of information regarding flows required to maintain in-stream resources.

Point Agency or Individual:

Municipalities with the assistance of respective state, county, regional and local agencies or private sector consultants.

- New York State Department of Environmental Conservation
- A newly established Sauquoit Creek watershed entity (see; Volume 6, Chapter 3)

Cost Estimate: Low (<$100,000)

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Restoration and Enhancement Program

Project Title: Effectiveness Evaluation

Project Description: Develop a program that can be used to measure the effectiveness of management, restoration, and enhancement practices or other watershed recommendations.

Priority: Medium (long-term)

Potential Activities:

- Develop a program based on a rotating cycle (ie: every five years) that evaluates different management, restoration, and enhancement practices within each of the sub-basins.

- Identify the criteria and evaluation technique which will be used to appraise the effectiveness of each management practice (ie: macroinvertabrate sampling, pollutant load modeling, etc.).

Point Agency or Individual:

- A newly established Sauquoit Creek watershed entity (see; Volume 6, Chapter 3)

Municipalities with the assistance of respective state, county, regional and local agencies or private sector consultants.

Cost Estimate: Low (<$100,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Restoration and Enhancement Program

Project Title: Miscellaneous Restoration Activities

Project Description: Implement various activities in an effort to work toward the restoration of Sauquoit Creek and/or its tributaries to their original, historic or improved conditions.

Priority: Low (long-term)

Potential Activities:

- Using bioengineering techniques, restore natural meanders and stream bank conditions to their original conditions, if known.
- Install bioengineered bank stabilization and replant riparian zones.
- Use stream classification system and habitat mapping to reconstruct stream beds and banks.
- Insure the integration of both wetlands and flood plains in restoration efforts.

Point Agency or Individual:

Numerous agencies, individuals and/or organizations exist that can implement components of this project that relate to their respective areas of expertise.

Cost Estimate: Low (<$100,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Restoration and Enhancement Program

Project Title: Soil and Erosion Control Program

Project Description: Implement a number of management strategies specifically focused on soil and erosion control.

Priority: Medium (long-term)

Potential Activities:

- Conduct periodic stream surveys of active erosion and sedimentation problems.
- Conduct periodic surveys of active land surface and construction site erosion.
- Purchase of property and land acquisition within the 100-year floodplain.

Point Agency or Individual:

Municipalities with the assistance of respective state, county, regional and local agencies or private sector consultants.

- New York State Department of Environmental Conservation
- Oneida County Soil and Water Conservation District
- Special interest groups

Cost Estimate: High (>$500,000)

An example of potential costs for such surveys and the purchase of property or acquisition of land within the 100-year floodplain, is illustrated below.

Cost estimates associated with periodic stream surveys are calculated based on the assumption that 4 miles of stream can be surveyed per day at a cost of approximately $200 to $700/day. To survey the Sauquoit Creek only, includes approximately 21 miles of stream at a cost of $1,000 to $3,600 per survey.

In regard to surveys of active land surfaces and construction sites, cost estimates are based on the assumption that 2-square miles of area can be surveyed in one day at a cost of $400 to $600/day. Given that the basin is approximately 63 square miles, costs may range from $12,600 to $18,900 per survey.

Cost estimates for land acquisition are based on recent, average land costs of $4,000 to $10,000 per acre. Purchase of land will likely include a price range. For the purchase of 50 acres of land for soil and erosion control purposes, total costs may range from $200,000 to $500,000.

Additionally, the estimated price range for acquisition of housing units and lots ranges from $40,000 to $90,000. Therefore, for the purchase of six homes and lots, total costs may likely range from $250,000 to $600,000.

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Restoration and Enhancement Program

Project Title: Recreation Plan

Project Description: Enhance recreational opportunities while protecting sensitive areas within the basin.

Priority: Low (short-term)

Potential Activities: Develop a comprehensive recreation plan that fully supports and integrates restoration and enhancement activities. The plan should consider the following activities:

- Inventory existing recreational facilities and potential resources.
- Make recommendation as to placement of recreational facilities.
- Integrate stream restoration and enhancement activities into proposed recreational developments or enhancements.
- Manage recreational development to avoid degradation of land or water resources.
- Acquire and manage lands to provide access to the river.
- Promote the use of stormwater management basins as recreational amenities (eg: trials, playgrounds, openspace, etc.).

Point Agency or Individual:

Municipalities with the assistance of respective state, county, regional and local agencies or private sector consultants.

- Herkimer-Oneida Counties Comprehensive Planning Program

Cost Estimate: Low (<$100,000)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Restoration and Enhancement Program

Project Title: Fish and Wildlife Improvements

Project Description: Maintain and enhance fish and wildlife habitat and populations of sensitive species, including trout and birds.

Priority: Medium (short-term)

Potential Activities: While the NYS DEC will likely continue to be the primary agency responsible for fish and wildlife management (as discussed in *Volume 5 - Existing Development, Regulatory Controls, and Development Potential*), local agencies and individuals can implement a variety of activities to improve populations of fish and wildlife, and their habitat. A number of suggested activities are outlined below.

- Inventory the fish and wildlife resources of the watershed.
- Establish a monitoring network on a watershed basis to evaluate water flow, wetlands, chemical and biological factors (benthic invertebrate monitoring).
- Conduct a stream corridor/riparian zone assessment focusing on habitat protection and restoration.
- Restore stream segments to enhance habitat and remove limiting factors.
- Ensure construction of facilities (ie: stormwater management basins) or improvements are designed to provide or enhance natural spawning of trout in the Sauquoit Creek and its tributaries.

Point Agency or Individual:

- New York State Department of Environmental Conservation

Municipalities with the assistance of respective state, county, regional and local agencies or private sector consultants.

Cost Estimate: Low (<$100,000)

Chapter 7

Establishing a Community Education and Citizen Involvement Program

As explained in *Volume 4 - Watershed Issues, Goals, and Objectives*, a community education and citizen involvement program is an essential element to adequately address each of the watershed issues and is the foundation of a successful watershed management effort in the Sauquoit Creek basin. This is particularly true if the watershed management effort is to: 1) involve many different municipalities; 2) encourage basin-wide participation in the management program; and 3) address both downstream and source controls.

An effective community education and citizen involvement program has two basic but integrated components which are discussed in more detail below. The first involves a continuing and "non-targeted" educational program. For example, existing agency programs and newsletters continuously inform various groups about relevant issues within the basin. The second component involves public awareness campaigns that are "targeted" at a specific topic, such as flooding or institutional controls, and/or are "targeted" at specific audiences. As part of the Sauquoit Creek Basin Watershed Management Study, a community education and citizen involvement program has already been initiated (see *Volume 3 - The Basin Coordinating Committee* and *Volume 4 - Watershed Issues, Goals, and Objectives*).

SECTION 7.1

THE "NON-TARGETED" EDUCATIONAL PROGRAM COMPONENT

Previous volumes of this study illustrate how different segments of the population are interested in different aspects of an overall watershed management program (e.g., the development community might be more interested in regulatory aspects). To accommodate and inform general audiences about watershed issues, the framework of the educational program component needs to be reflective of each groups interests (see Chapter 3 of this Volume and *Volume 4 - Watershed Issues, Goals, and Objectives*).

Different levels of involvement of various groups form a basic hierarchy and framework for the overall watershed management program and, therefore, somewhat dictate the emphasis of the educational program. These levels include:

- **Key "Staff" and Decision Makers.** These people are responsible for carrying out the overall watershed management program, have primary involvement in decision making, and may find it necessary to seek the assistance of technical consultants. It is critical that these representatives are well informed.

- **Stakeholders, Political Leaders, and Advisory Committee Members.** Most of these people are advisory to the success of the overall watershed management program, and it is important that the watershed management program and individual projects have their full support. As part of the educational program component, it is important to know who the elected officials are and to keep them informed. One

drawback that effects this group, however, is that many of these individuals do not have a lot of time to invest in specific educational and implementation projects. The challenge for the educational program is to insure that these individuals remain involved in the overall watershed management project and that they are kept informed with concise yet detailed information.

- **The Press and Media.** This group is important for publicizing important milestones of the watershed management program. As part of the educational program, a variety of techniques can be used to get information out to the public, including press releases, articles, photos with captions, talk shows, news programs, public service announcements, newsletters, and public notices to publicize messages.

- **Special Interest Groups.** Groups such as Trout Unlimited, the Isaac Walton League, state associations of conservation groups, college faculty, public employees, developers, civic organizations, or youth groups, and other public or private organizations can be a tremendous resource for implementing the watershed management program. The educational program should focus messages and presentations specifically to these groups, as appropriate.

- **General Public.** These people are the final recipients of benefits provided by an overall watershed management program, and at the same time may be the ones financially supporting the program. As part of the educational program it is important to encourage as much public involvement as possible, and to keep the public as informed as possible. It is important to realize that any materials used to communicate ideas and information to the general public need to be user-friendly, non-technical, and easily accessible.

The following is provided as a specific example to illustrate how different levels of involvement from various groups may dictate the emphasis of an educational program. For instance, one severe inadequacy within the Sauquoit Creek basin is a low percentage of flood insurance policies. Specifically, the Town of New Hartford has approximately 160 structures located within the floodplain and only 27 of those structures maintain a flood insurance policy. Similarly, the Village of Whitesboro has 360 structures in the floodplain and only 56 flood insurance policies. An educational program specifically geared toward a combination of the following groups may provide some benefit in these communities. These groups include: the general public who have residential properties in the floodplain; the local decision makers in respective communities; the banks and lending institutions; and the insurance companies.

SECTION 7.2

THE "TARGETED" PUBLIC AWARENESS CAMPAIGN

It is of utmost importance to fully evaluate and plan a "targeted" community education and citizen involvement program. Not only are the targeted audience and topic of discussion critical, but factors such as timing, cost and responsibility must be considered. A public awareness plan may help to define these considerations and should describe in detail the objectives, activities, sequencing, timing, costs, and responsibilities for every aspect of the community education and citizen involvement program (Debo, 1995). The public awareness plan needs to be carefully defined and carried out as a high priority program with full-time commitment.

The development of such a plan is important for a number of reasons. First, it forces a careful analysis of how the community education and citizen involvement program fits within the overall watershed management program. Second, it brings together, in planning and agreement, all entities and agencies that will be involved in the development of the comprehensive watershed management program. Finally, it communicates to the public that they are of vital importance and that the watershed management entity is "contracted" to involve them (EPA, 1990).

A) Elements of a Public Awareness Plan

The public awareness plan is best developed as a group participation activity. However, certain stakeholders who are interested in very specific elements should also be involved at times. At a minimum, the plan should include the elements listed below (Debo, 1995):

1. Describe the history of the effort, the major players, and the causative events.
2. Describe the objectives and goals of the program and potential major issues likely to emerge in a campaign or in a general public awareness program.
3. Estimate the likely or desired level of public awareness, and develop ways to gauge public reaction or program effectiveness.
4. Identify potential stakeholders including their level and type of concerns. Some of these stakeholders may be the same as those represented on the Sauquoit Creek Basin Coordinating Committee. Others might be people particularly interested in the public education and participation aspects of the Sauquoit Creek basin and could include area neighborhoods, local media, elected officials, government staff, developers, environmental groups, and the general public.
5. List and describe specific phases of the community education and citizen involvement program that require public support. This list can be derived from the watershed recommendations and priorities established in the Sauquoit Creek Basin Watershed Management Study. Also, list specific activities the public will undertake to support these phases.
6. Outline a sequential and interrelated schedule of these activities.
7. List milestones showing when the public awareness plan will be reassessed and mid-course corrections made, if appropriate.
8. Estimate costs and the level of effort required for each step outlined in the public awareness plan.

The public awareness plan needs to be tailored to parallel and support the watershed management strategy and all phases of its activity. This is particularly true of the major recommendations, the institutional framework, the stormwater management plan (including greenway plan), the GIS system, and the Sauquoit Creek restoration plan.

SECTION 7.3

TECHNIQUES FOR IMPLEMENTING A COMMUNITY EDUCATION AND CITIZEN INVOLVEMENT PROGRAM

With respect to the continued implementation of a community education and citizen involvement program, several techniques need to be tried and evaluated, and the successful ones continued. It is important to recognize that different aspects of the community education and citizen involvement program may require different techniques. Some of these techniques might include:

- Using the media through the development of a media kit and/or white paper, hosting a media tour, providing news releases, encouraging feature stories on watershed problems, and developing video footage for local news or talk show segments, public access programming, or video presentations.

- Developing written material such as paid advertisements or pamphlets that can be distributed by agencies or as bill stuffers.

- Creating presentations that are visually appealing through the use of slides, transparencies or video. These presentations can be made available to speakers' bureaus, for political meetings, booths, and special neighborhood or stakeholder meetings.

- Sponsoring specific workshops or a series of informational workshops.

- Establishing a telephone Hotline or Website to provide answers to common questions or direct users to other available technical assistance.

- Creating a formal identity for a community education and citizen involvement program through the design of a logo, letterhead, vehicle markings, T-shirts, etc.

- Creating and using volunteer programs to implement both community education activities and specific watershed management projects. For an example, groups like the Isaac Walton League have been using volunteers since 1927 and have completed many successful programs, such as stream monitoring. For additional information concerning volunteer programs, the EPA has compiled a resource book on citizen involvement and educational materials specifically geared toward water quality improvements (EPA, 1993a; EPA 1993b).

One of the more effective potential public educational and citizen involvement avenues for the Sauquoit Creek basin is the integration of watershed-based projects with educational or public participation programs. One wellknown example that is specific to the Sauquoit Creek basin involves the stream monitoring program carried out in the New Hartford School District, with assistance from the NYSDEC. This program provides valuable water quality information while educating students about sampling techniques and the effects of certain pollutants on stream habitat.

Other examples of similar types of activities might also include the establishment of a watershed demonstration park as a permanent feature within the watershed. This technique has been used very successfully in other areas (e.g., Maryland) and provides an excellent opportunity for testing various "best management" techniques such as grassed swales, wetponds, bioretention areas, or created wetlands. These facilities often encourage visitation by area residents that provides additional educational opportunities.

Within the Sauquoit Creek basin, it would be relatively easy to locate a watershed demonstration park in a highly visible area such as within an existing public park, in close proximity to the creek, within a proposed

greenway or, perhaps, near a proposed basinwide detention facility. A variety of best management practices, such as an extended detention pond, bioretention concept, wet pond, and grass swale with check dam could be demonstrated with each management technique accompanied by a description and discussion of how it operates, when it should be used, and in what way it protects the environment. The park could be tied into educational and research efforts to test and demonstrate BMPs and other structural and nonstructural nonpoint source control measures specific to the Sauquoit Creek basin.

As discussed in Chapter 6 of this volume, the development of a stream restoration project for the Sauquoit Creek or for an impacted wetland could also promote community education and citizen involvement. For example, other municipalities have established an "Adopt a Stream Program" whereby local industry or businesses sponsor and fund a company, student or local neighborhood project.

There are a variety of other stewardship/educational programs administered by the NYS Department of Environmental Conservation, other government agencies, and/or special interest groups. A brief description of these programs and contacts are included within Appendix B - Stewardship Programs.

Regardless of which technique is used to implement a community education and citizen involvement program, two necessary goals of the program are to build the credibility of technical information in the eyes of the public; and to improve the relevance of technical studies to public concerns (EPA, 1990). The fundamental way to do this is to create visibility and participation on the front end of an activity and to continue the public participation throughout the project.

SECTION 7.4

SUMMARY OF RECOMMENDATIONS FOR GETTING STARTED

As discussed above, there are many components, options, and methodologies available and necessary to establishing an effective community education and citizen involvement program. In summary, the following major recommendations and short/long term recommendations were selected (based on the discussion above and the discussions within Chapter 4 - Watershed Issues, Goals, and Objectives) as a way to "get started" in regard to this element of watershed management within the Sauquoit Creek basin.

1. **Major Recommendation.** Develop a long-term community education and citizen involvement program.

2. **Recommendations for Getting Started (Short-Term).**

   a. Initiate and evaluate several techniques to discover successful methods for community education and citizen involvement in the basin such as initiating demonstration projects, developing citizen guides, etc.

   b. Investigate and implement appropriate stewardship programs within the basin.

3. **Recommendations for Longer-Term Solutions**

   a. Develop a public awareness plan for the Sauquoit Creek basin that addresses and supports recommendations for establishing a watershed-wide institutional structure and regulatory framework, developing a comprehensive basin-wide stormwater management program, developing a basin-wide GIS, and creating a restoration and enhancement program.

SECTION 7.5

SPECIFIC PROJECTS AND PROGRAM RECOMMENDATIONS

This section outlines specific projects and program recommendations that are "ready made," fundable projects that would further the major recommendations and short/long term recommendations outlined above.

For each recommendation and specific project developed, the following steps need to be followed:

- obtain commitment of involvement from key decision makers
- set priorities for potential solutions
- develop a list of projects to be implemented for each solution
- set goals for accomplishing each project
- locate funding and technical expertise for projects that need it
- be practical
- evaluate progress.

Each of the following specific projects have been subjectively evaluated based on a priority rating system, range of cost, and potential point agency. Factors which were evaluated include, but are not limited to: the overall benefit of the project to the watershed; the cost of the project and potential availability of funding; whether there is a logical point agency or individual; and, the ease of implementation.

Projects receiving a "high" priority include those that should receive immediate attention, obtain a commitment of involvement, and identify the appropriate point agency. Additionally, funding is likely to be attainable and activities to obtain such funding should begin immediately.

Projects with a "medium" priority rating include those activities which are slightly less urgent but action relating to agency commitment and a funding mechanism should begin within the next year.

Projects with a "low" priority should be targeted for a longer term implementation schedule such as a 10-year cycle. These projects may require or involve additional thought and planning, and could be postponed unless a particular funding source becomes available or a point agency is willing to champion its cause earlier.

In addition to the priority rating, projects are also identified as being short-term or long term projects. As such, there may be high priority, short-term projects, as well as, high priority long-term projects. Short-term projects are those which can be accomplished within a relatively short span of time (ie: within one to two years). Long-term projects include those activities that: may require or involve additional thought, research, planning, or collection of base data; may continue to be implemented over a number of years; may require continuous activity; or may take a number of years to conclude.

In estimating project costs, this evaluation criteria includes subjective and approximate estimations for planning purposes only. The estimates of costs are, however, based on professional knowledge of similar projects implemented in other watersheds. Once a project has been identified and a commitment to proceed established, a new, more accurate estimate should be made during the project application process. The ranges of costs and cost categories used for the evaluation of the following specific projects include: projects with a relatively "low" cost ranging from $0 to $100,000; projects with a "medium" cost ranging from $100,000 to $500,000; projects with a relatively "high" cost of over $500,000.

As with the other priority rating criteria, the suggestions for a point agency or individual are subjective recommendations of who may be the logical entity that might initiate that particular project. Obtaining the

commitment of this agency would be the first step in initiating these projects. The agency's available resources and interest in the projects would ultimately determine if they would become the sole point agency, the point agency with other co-sponsors, or if they would not be involved at all. Of course other entities not listed can initiate the activity if there is an interest or funding source available.

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Community Education and Citizen Involvement

Project Title: Evaluation of Education/Involvement Techniques

Project Description: Initiate and evaluate several techniques to discover successful methods for community education and citizen involvement in the basin including: initiating demonstration projects, developing citizen guides, etc.

Priority: High (short-term)

Potential Activities:

- Develop citizen guides to outline and illustrate common management practices for: construction sites, developed areas, backyard practices, septic systems, sand and gravel pits, farms and golf courses, woodlots, chemical and petroleum storage, hazardous waste storage, etc. Develop a list of actions residents can take to accomplish each of these management practices and develop a guide to additional information sources.

- Develop a management guide for the proper management and maintenance of riparian areas along the Sauquoit Creek.

- Develop and distribute educational information about the basin's special features, opportunities to better protect it, how the management strategy should function, etc.

- Develop a specifically targeted educational program for the general public, decision makers, banks and lending institutions, and insurance companies regarding the benefits of participating in the flood insurance program.

- Establish a demonstration project(s) to integrate recommended watershed management projects with educational efforts. Include an evaluation of locational criteria to maximize visibility, access, and usefulness. Choose a demonstration project(s) that will illustrate a variety of watershed management techniques.

- Develop a stream restoration project or wetland restoration project to promote and encourage community education and citizen involvement efforts.

Point Agency or Individual:

Numerous agencies, individuals and/or organizations exist that can implement components of this project that relate to their respective areas of expertise.

Cost Estimate: Low (<$100,000/technique)

SAUQUOIT CREEK BASIN
WATERSHED MANAGEMENT STRATEGY

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Community Education and Citizen Involvement

Project Title: Stewardship Programs

Project Description: Investigate and implement appropriate stewardship programs within the basin to further community education and citizen involvement efforts.

Priority: Medium (short-term)

Potential Activities:

- Implement appropriate programs outlined in Appendix B that would be applicable to the Sauquoit Creek basin.
- Develop a volunteer water quality monitoring program with students, residents and local service organizations.
- Promote creek-related activities in local schools, with service organizations, and with other groups.
- Establish an awards program to recognize conservation achievement of landowners, towns, students, agencies, etc.
- Provide hands-on opportunities for the public to experience the watershed (e.g., nature hikes, canoe trips) and to help improve it (e.g., stream clean-ups).
- Initiate a volunteer program to plant appropriate vegetation to prevent erosion on banks or upland slopes.
- Conduct an opinion survey about watershed issues.
- Produce a video about the watershed and present it to local groups.

Point Agency or Individual:

Numerous agencies, individuals and/or organizations exist that can implement components of this project that relate to their respective areas of expertise.

Cost Estimate: Low (<$100,000/program)

Multi-Purpose Projects and Program Recommendations

Primary Category/Issue: Community Education and Citizen Involvement

Project Title: Public Awareness Plan

Project Description: Develop a public awareness plan for the Sauquoit Creek basin that addresses and supports recommendations for establishing a watershed-wide institutional structure and regulatory framework, developing a comprehensive basin-wide stormwater management program, developing a basin-wide GIS, and creating a restoration and enhancement program.

Priority: High (long-term)

Potential Activities:

- Identify the targeted audience and major players for each element of the plan.
- Identify potential stakeholders and their level and type of concern.
- List and describe specific phases and milestones of the public awareness plan and which phases require public support.
- Outline a sequence and schedule for these phases.
- Estimate costs for each phase and responsible agencies or individuals.

Point Agency or Individual:

- A newly established Sauquoit Creek watershed entity (see; Volume 6, Chapter 3)

Cost Estimate: Low (<$100,000)

Appendix A

FUNDING AND FINANCING PROGRAMS FOR WATERSHED ISSUES

Appendix A

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APPENDIX A

FUNDING AND FINANCING PROGRAMS FOR WATERSHED ISSUES

INTRODUCTION

A number of New York State agencies, organizations, and authorities facilitate the procurement of loans and loan guarantees, provide technical assistance, lease collateral, purchase leaseback agreements, provide tax exempt bonds, and offer tax credits.

New York State also provides state income tax credits and certain exemptions for pollution control and wastewater treatments facilities. Additional state aid is available for environmental control, emergency assistance, and watershed projects.

Tax exempt industrial revenue bonds, various tax credits, and technical assistance are available at the local level, as well as tax abatements for up to 10 years. However, these mechanisms may or may not be available depending on the type of project (eg: stormwater detention basins).

Many of these agencies and organizations provide for multiple funding and financing programs. Other than the more commonly contacted departments within the state (such as Health, Environmental Conservation, Transportation, etc), a general listing of some of these "lesser known" NYS agencies and organizations that may provide funding for watershed management include:

- **The New York Business Development Corporation**

  Address : 41 State Street
  PO Box 738
  Albany, New York 12201-0738
  Telephone: (518) 463-2268

- **Empire State Development Corporation**

  Address: 633 3rd Avenue
  New York, NY 10017
  Telephone: (212) 803-3615

- **Environmental Facilities Corporation**

  Address: 50 Wolf Road, Room 502
  Albany, New York 12205-2603
  Telephone: 800-882-9721

- **NYS Dormitory Authority (Facilities Development)**

  Address: 161 Delaware Avenue
  Delmar, New York 12054
  Telephone: (518) 475-3000

More specific state, federal and private funding programs are listed on the following pages.

- **Revolving Loan Funds:** These are based on the "fund recapture" guidelines in the Urban Development Action Grant, Community Development Block Grant, and Economic Development Administration programs, and are available through these programs and other sources.

Revolving Loan Funds can finance projects in the public sector through the establishment of interlocal agreements, in which one community borrows from another using the loan program.

Privately owned structures (eg: dams) can be renovated using debt capital from a Revolving Loan Fund which has been established with federal, state, local, and private funds.

- **Small Cities Community Development Block Grants:** Although traditionally utilized to spearhead job creation and retention, this program can be used to fund urgent public works projects.

Projects are generally awarded based on an evaluation of proposals, although public works projects can be given increased consideration if they address an urgent threat to public safety and welfare, if they provide benefits to low and moderate income persons, and/or slums or blighted areas, or if they are part of a commercial district revitalization.

- **Certified Development Companies:** These are low-interest lending institutions at the state and local level which can provide debt financing to small businesses under the Small Business Administration's 503 program.

Various private rehabilitation projects can be financed in this way. Multipurpose facilities (eg: those that provide items such as recreational benefits in combination with job creation and manufacturing) are given preference.

A listing of state and local Certified Development Companies may be available through the local Small Business Administration Office, the State Department of Commerce, or the Department of Economic Development.

- **Small Business Investment Companies:** Small business investment companies are private venture capital firms which can be a practical mechanism to fund projects involving wastewater treatment, hydropower generation, irrigation, recreational uses, water supply, and other needs.

- **Local Industrial Revenue Bonds:** This method of financing may be extremely attractive due to the bonds' tax exempt status, and their ability to create low interest loans for the construction or renovation of commercial and industrial facilities. Local industrial revenue bonds are intended to create greater community involvement in local economic viability, job retention/creation, and expansion of the local tax base.

A community can issue such bonds either directly, or through a local economic development corporation.

- **Tax Increment Financing:** This method of financing public improvements can be based on anticipated property tax revenue increases. It is particularly promising for communities wishing to increase property tax values, create jobs, promote growth, and remedy serious infrastructure needs.

Tax increment financing is implemented through the establishment of a local Tax Increment Financing Authority, or through an existing Downtown Development Authority (in this case, a Downtown Development Authority can utilize tax increment financing without the necessity of appointing a Tax Increment Financing Authority).

- **Downtown Development Authorities:** In general, these entities are quasi-public corporations which are empowered with tax increment financing powers, the authority to issue bonds, and the ability to levee taxes within a downtown development district. Downtown Development Authorities are particularly useful to finance multi-purpose objectives stemming from existing infrastructure such as dams and/or hydropower.

- **Tax Abatements:** Freezing property tax values at pre-construction levels can be used by a community to influence commercial and industrial renovation.

A district must first be established followed by an application for tax abatement, and necessitating public hearings.

- **Tax Benefits and Incentives:** The Internal Revenue Code allows an 11% non-refundable energy credit for hydroelectric generating property, dam rehabilitations, and such items as fish ladders. Additionally, Investment Tax Credits can be utilized to renovate structures, old commercial development, and dams/canalways which appear on the National Historic Register.

- **Farmers Home Administration (FmHA):** Several programs are available to finance various water resource related efforts:

    1) Water Supply and Waste Disposal Program: To provide loans and grants for the development of water supply and wastewater facilities to promote growth in rural areas. The fund may be utilized to rehabilitate dams, stormwater management ponds, water supply systems, and wastewater stabilization ponds, purchase of water rights, and legal and engineering fees associated with such projects.

    2) Soil and Water Loans: Up to $100,000 may be available for a variety of water resource projects.

    3) Community Facility Loans: These monies are available for construction of public facilities, and the provision of community services, utility extensions, industrial park sites, and access ways.

    4) Resource Conservation and Development Loans: Funds may be available for soil and water conservation efforts, local water storage, and shift in land use facilities.

    5) Recreation Facility Loans: These loans can be made available to large farm owners who wish to develop a portion of their land as income generating recreational use.

6) Watershed and Flood Protection Loans: Can be used to pay the local share of capital for flood damage prevention, irrigation, drainage, water quality management, sediment control, fish and wildlife development, water storage, and public water-based recreation.

7) Business and Industrial Loan Program: Intended to improve the economic and environmental climate in small cities through loan guarantees to business and industry. It works by providing loan guarantees to private lenders from $500,000 to $50 million.

8) Irrigation, Drainage, and Other Soil and Water Conservation Loans: Up to $300,000.00 may be available for various projects related to irrigation, drainage, and other soil or water conservation efforts.

9) Section 504 - Very Low Income Home Repair: Grants and loans to very low income elderly (aged 62 or over) through the Farmers Home Administration. Generally used to improve the sanitary conditions of water supply and wastewater disposal systems.

- US Environmental Protection Agency: Several programs are available to finance various water resource related efforts:

1) Section 319 of the Clean Water Act: Nonpoint source implementation grants are awarded each year through this program administered by the United States Environmental Protection Agency, through the New York State Department of Environmental Conservation. The program goal is to support projects which implement nonpoint source pollution control measures to protect and improve the quality of New York's water resources.

2) Section 604B of the CleanWater Act: Nonpoint source planning and implementation monies are made available by the United States Environmental Protection Agency through the New York State Department of Environmental Conservation, usually in the form of pass-through funding to regional planning agencies.

3) Hardship Grants Program for Rural Communities: Established by the United States Environmental Protection Agency through the Congressional Appropriations Act of 1996, this 50 million dollar grant program may provide funding through the states to improve wastewater treatment services in poor, rural communities with populations of 3,000 or fewer where such services are generally inadequate.

Address: The United States Environmental Protection Agency
Attn: Stephanie vonFeck (4204)
401 M Street, S.W.
Washington, D.C. 20460

Telephone: (202) 260-2268

Internet: vonfeck.stephanie@epamail.epa.gov

4) EPA - Consolidated Research Grants: Operated by the US Environmental Protection Agency, a series of grants may be available related to the social, economic, and environmental effects of energy as it relates to water quality.

- U.S. Department of Commerce-Economic Development Administration: Several programs are available to finance various water resource related efforts:

  1) EDA - Grants for Public Water and Development Facilities: A number of infrastructure improvements can be made through grants available from the U.S. Department of Commerce - Economic Development Administration, including water and sewer systems, transportation facilities, industrial parks, energy projects, flood hazard prevention, and other water resource related projects.

  2) EDA - Public Works Impact Projects: Provided through the Economic Development Administration, these grants have been made available for water and sewer systems, road repair, building renovation, historic preservation, and energy conservation.

- Department of Housing and Urban Development: Several programs are available to finance various water resource related efforts:

  1) HUD - Community Development Block Grants: Available through the Department of Housing and Urban Development to entitled cities and counties, this program provides grant monies to remove hazardous threats to a community, provide low-cost hydroelectric power, provide municipal or industrial water supply, expand on occupational and recreational opportunities, and/or to satisfy local development objectives.

  2) HUD - Urban Development Action Grants: Administered by the Department of Housing and Urban Development, these grants provide flexible funding alternatives which can be used to finance dam rehabilitation, land acquisition, site improvements, infrastructure improvements, rehabilitation work, and building improvements.

- Small Business Administration (SBA): Several programs are available to finance various water resource related efforts:

  1) Small Business Administration 7A Loan Guarantee Program: Unlike the 503 program, 7A loans are delivered directly through local lenders, with no special administrative structure needed. Although holding a slightly higher interest rate, it is useful for entrepreneurial enterprises which might require infrastructure improvements.

  2) Small Business Revitalization Program: Additional loan funds for a variety of projects can be made available through this program jointly administered by HUD, the SBA, and the National Development Council (NDC).

  3) Physical Disaster Loans: Direct loans, guaranteed loans, and insured loans are provided through the SBA.

- U.S. Department of the Interior, Bureau of Reclamation: Several programs are available to finance various water resource related efforts:

  1) Wildlife Habitat Management Technical Assistance: The U.S. Department of the Interior, Bureau of Land Management's Wildlife Habitat Management Technical Assistance Program offers grants for specific habitat improvement projects, including dams, dikes, flood and erosion prevention, and sedimentation.

2) Irrigation Distribution System Loans: These are direct loans from the U.S. Department of the Interior, Bureau of Reclamation for the construction of drainage improvements, industrial and municipal water supply distribution, and irrigation.

3) Small Reclamation Projects: The Bureau of Reclamation funds irrigation, drainage, flood control, water supply, fish and wildlife habitat, recreational development, and/or hydroelectric power through the Small Project Loan Program. Grants are also awarded to projects of general public benefit.

- Rural Development Loan Fund: Administered by the US Department of Health and Human Services, this program provides loans and loan guarantees to fund the establishment, expansion, or preservation of community development projects such as dam rehabilitation, infrastructure improvements, industrial parks, and the creation of enterprise zones.

- Cooperative Forestry Assistance: Up to $5 million in grants assistance may be available through the US Forest Service for forestry-related ventures: production and distribution of timber, forest fire prevention and control, efficient utilization of wood products, planning and operation of urban forest management programs, the improvement and maintenance of fish and wildlife habitat, and forestry-related dam rehabilitation/construction.

- Resource Conservation and Development Program: Monies are allocated to Resource Conservation and Development Districts on a state-by-state basis for the planning and construction of flood protection, erosion control, agricultural water use, water quality management, and water-based recreation, fish, and wildlife facilities. The construction of reservoirs for municipal and industrial water supply have been funded, for example.

- NYS Clean Water - Clean Air Bond Act (1996): Administered through the combined efforts of the Governor's Office, NYS Department of Environmental Conservation, NYS Department of Health, etc., the bond act provides a portion of respective funding for Safe Drinking Water Programs ($400 million); Clean Water Programs ($625 million) including Water Pollution Control, Dam Safety, Great Lakes Cleanup, Flood Control, Finger Lakes Cleanup, Other Waterbodies; Open Space Programs ($150 million); Solid Waste Initiatives ($175 million); Urban Environmental Restoration ($200 million); and Green Growth Projects ($100 million).

- The NYS Environmental Protection Fund: This is a state assistance program for non-agricultural nonpoint source abatement and control projects, promulgated through Section 17-1409 of the Environmental Conservation Law. The project must be proposed for implementation by a municipal corporation, or by a district at the request of such corporation. Contact the NYS Department of Environmental Conservation, Division of Water.

- NYS State Revolving Fund (SRF): This fund is intended to implement wastewater and nonpoint source projects that are essential to the maintenance of the state's water quality. Interest subsidized loans are made, the rate of interest which will be two thirds of the market rate at which tax exempt revenue bonds are sold for the project. Any municipality or wastewater financing authority may be eligible.

  State Revolving Fund grants can also be applied to wellhead protection programs and other ground water projects such as back-up water supply systems, sewer line extensions in vulnerable ground water resources, and remediation of groundwater contaminant problems.

Address: 50 Wolf Road, Room 502
Albany, New York 12205-2603

Telephone: 800-882-9721

- The Finger Lakes - Lake Ontario Watershed Protection Alliance (member item grant): In past years the Alliance has received up to 1.2 million dollars as a member item grant to support water quality initiatives. The money is disbursed through their member county soil and water conservation districts, or county Water Quality Coordinating Committees.

- The Great Lakes Commission: The Commission, in concert with the U.S.D.A. Natural Resources Conservation Service, annually funds projects which protect and improve Great Lakes water quality by controlling erosion and sedimentation; limiting the input of associated nutrients and toxic contaminants; and minimizing sources of sediment which cause off-site damage to harbors, streams, fish and wildlife habitat recreation facilities, and the basin's system of public works.

  Projects which support the program goals and request $15,000.00 or less may be funded.

  Address: Great Lakes Commission
  Attn: Thomas Crane
  Argus Building II
  400 Fourth St.
  Ann Arbor, MI 48103-4816

  Telephone: (313) 665-9135, e-mail glc@great-lakes.net

- Appalachian Supplemental Grants: Sixteen counties within New York State are eligible for supplemental grants from the Appalachian Regional Commission. Funds can be utilized for water and sewer projects, industrial site development, and other public projects. These funds are utilized to supplement funds made available from another grant program.

- The Great Lakes Protection Fund: Grants are awarded annually to non-profit organizations, government agencies, private individuals, and proprietary entities for projects within the Great Lakes basin which provide a benefit to its ecosystem health.

  Address: Great Lakes Protection Fund
  35 East Wacker Drive, Suite 1880
  Chicago, Illinois 60601

  Telephone: (312) 201-0660

- The Great Lakes Protection Fund - Small Grants Program:

  Address: Great Lakes Research Consortium
  SUNY ESF
  24 Brag Hall
  Syracuse, New York 13210

- Miscellaneous Private Sources of Financing: Many privately sponsored agencies and organizations provide for funding and financing programs related to watershed management issues. Some of these agencies and organizations might include: private foundations, life insurance companies, pension funds, commercial banks, savings institutions, and

mortgage bankers who may function to direct capital from large institutions to real estate developers.

More specific private funding programs and institutions are listed on the following pages.

- The AKC Fund, Inc.: This private corporation funding program emphasizes general conservation projects.

  Address: AKC Fund Inc.
  Attn: Ann Brownell Sloan
  Administrator
  145 East 74th Street, Suite 1C
  New York, NY 10021

  Telephone: (212) 737-1011

- The George F. Baker Trust: Private source of funding which may provide general purpose and matching funds of up to $50,000.00 for conservation projects.

  Address: The George F. Baker Trust
  767 Fifth Ave, Suite 2850
  New York, NY 10153

  Telephone: (212) 755-1890

- The Ford Foundation: Private funding which may be available for projects relating to conservation of natural resources and rural development.

  Address: The Ford Foundation
  Attn: Barron M. Tenny, Secretary
  320 East 43rd Street
  New York, NY 10017

  Telephone: (212) 573-5000

- Gannett Foundation, Inc.: General conservation projects may be funded.

  Address: Gannett Foundation, Inc.
  Attn: Chief Executive, Observer Dispatch
  221 Oriskany Plaza
  Utica, New York 13501

  Telephone: (315) 792-5000

- Griffiss Foundation, Inc.: General conservation projects may be funded.

  Address: Griffiss Foundation, Inc.
  101 West 57th Street, Rm 9F
  New York, NY 100198

  Telephone: (212) 759-8693

- The Continental Corporation Foundation: Nearly 18 million dollars in assets, grants are made available annually for community funds, colleges and universities, health, and social welfare.

  Address: The Continental Corporation Foundation
  180 Maiden Lane
  New York, NY 10038

  Telephone: (212) 440-7729

- Cornell (Peter C.) Trust: Approximately 3.9 million dollars in grants may be provided for operating budgets, support, campaigns, seed money, emerging funds, building funds, equipment, land acquisition, and matching funds.

  Address: Cornell Trust
  1600 Main Place Tower
  Buffalo, NY 14202

  Telephone: (716) 856-5500

- Corning Glass Works Foundation: Although funding is provided primarily in communities where the company maintains manufacturing facilities, support for education, civic, cultural, health, and social service institutions, special interest to improve the social and visual environment may be available. Scholarships and fellowships are also available in selected educational fields.

  Address: Corning Glass Works Foundation
  Attn: Kristen A. Swain, Exec. Dir.
  MP-MF-02-1
  Corning, NY 14831

  Telephone: (607) 974-8719

- The Foundation Center: An independent national service organization established to provide a source of information on private philanthropic organizations.

  Telephone: 1-800-424-3836