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Sauquoit Creek Basin Watershed Management Study

Volume 1
"INTRODUCTORY VOLUME
AND
PROJECT SUMMARY"

June 1997

The Sauquoit Creek Basin Watershed Management Study has been prepared by the Herkimer-Oneida Counties Comprehensive Planning Program with the assistance of private-sector consultants and in cooperation with agencies and municipalities within the basin. Partial funding has been provided by the New York State Department of Environmental Conservation under Section 604(b) of Public Law 100-4 (Federal Clean Water Act Amendments of 1987).

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Report preparation: This volume of the Sauquoit Creek Basin Watershed Management Study has been prepared by *The Herkimer-Oneida Counties Comprehensive Planning Program (HOCCPP)* and summarizes information from reports produced by: *Stearns and Wheeler: Environmental Engineers and Scientists; Clough, Harbour and Associates, and The Bukiewicz Organization*. Layout of this volume has been provided by *The Herkimer-Oneida Counties Comprehensive Planning Program*.

Introduction to the Watershed Management Study

SECTION 1.1

THE WATERSHED



The Sauquoit Creek watershed is approximately 63 square miles in size and is located primarily within Oneida County, New York, although a small portion of the watershed extends eastward into Herkimer County. The nearest incorporated city is Utica, New York and portions of the city actually fall within the watershed. Most of the watershed, however, lies south and southwest of the City of Utica (See Figure 1-1, Locational Map).

The Sauquoit Creek origi-

nates from several wetlands in the Town of Paris, and flows north for a distance of approximately 21 miles - discharging into the Mohawk River. As the creek flows northward, it passes through nine towns, villages, and cities including: the Town of Paris, the Village of Clayville, the Town of New Hartford, the Village of New Hartford, the City of Utica, the Village of New York Mills, the Village of Whitesboro, the Village of Yorkville, and the Town of Whitestown. In addition to these communities, the Sauquoit Creek watershed also extends into

the towns of Marshall, Bridgewater, Litchfield, Frankfort, and Kirkland (See Figure 1-2, Watershed Boundaries and Tributaries).

The upper watershed (southern portion) is primarily agricultural and residential in nature and is relatively undeveloped. The lower portion (northern area) of the watershed is highly urbanized - containing dense residential and commercial development. The mid portions of the watershed progress from rural to suburban as one moves from the south to north.

PURPOSE OF THE STUDY

Historically, the Sauquoit Creek basin has been the focus of many water resources initiatives at the local, county, regional, state, and federal levels. While many of these past activities are important, they have often been undertaken retroactively to relieve specific water resource problems in the basin, or were often completed independently of any larger basin perspective.

Traditional approaches to water resource management have not produced viable solutions to water quality and water quantity problems. Past efforts in the Sauquoit Creek basin reflect the limitations of these traditional approaches. For example, numerous investigations of the creek's hydrologic regime have been completed, yet severe flooding and stormwater management difficulties persist.

Many of these past activities have been pursued with relatively little consideration of such concerns as: 1) the relationship and use of these activities to overall water resources objectives in the basin; 2) the importance of these activities compared to other potentially higher priority projects; 3) the benefit of the action to the basin as a whole; and 4) alternative or more cost effective methods to achieve a similar result. Some examples of activities in the

basin illustrative of these points include: federal activities on flood control and modeling; wellhead protection within the basin; implementation of mitigation fees for stormwater management of private development; agricultural district reviews; creation of various data management systems; infrastructure improvements; and local land use management decisions and regulations.

Rather than continuing this individualized and segmented approach to water resource related activities and funding within the basin, it is the intent of this Sauquoit Creek Basin Watershed Management Study to develop an overall scoping process and implementation strategy for the basin which will lead to a coordinated, comprehensive, intergovernmental, and interagency, approach to basin management.

Several watershed management initiatives throughout the country, including the Chesapeake Bay Program, the Clean Lakes Program, and the Great Lakes Initiative, are beginning to illustrate the potential for using integrated watershed management approaches to solve complex water resource problems. A similar watershed management approach has been applied to the Sauquoit Creek basin and promotes holistic

planning, data collection, and management of the entire watershed. This approach is illustrated on Figure 1-3.

The Sauquoit Creek Basin Watershed Management Study provides the reader with an understanding of the many intricacies, complexities, and interrelationships involved in water resources management; outlines a number of common components of overall objectives within the basin; identifies specific tasks which need to be accomplished to meet these objectives; establishes a proposed priority for when those tasks should be completed in relation to other tasks; and suggests what agency or individual might be best suited to undertake each task.

This effort identifies a number of priority tasks within the basin where sources of future funding could be directed and provides an outline of specific tasks which could be singled out and implemented by any of the involved agencies as future funding becomes available. Most significantly, the study results in a series of easily referenced project summaries that can be used to implement coordinated actions within the basin. These projects can also be refined and expanded upon as issues are confronted and progress is made.

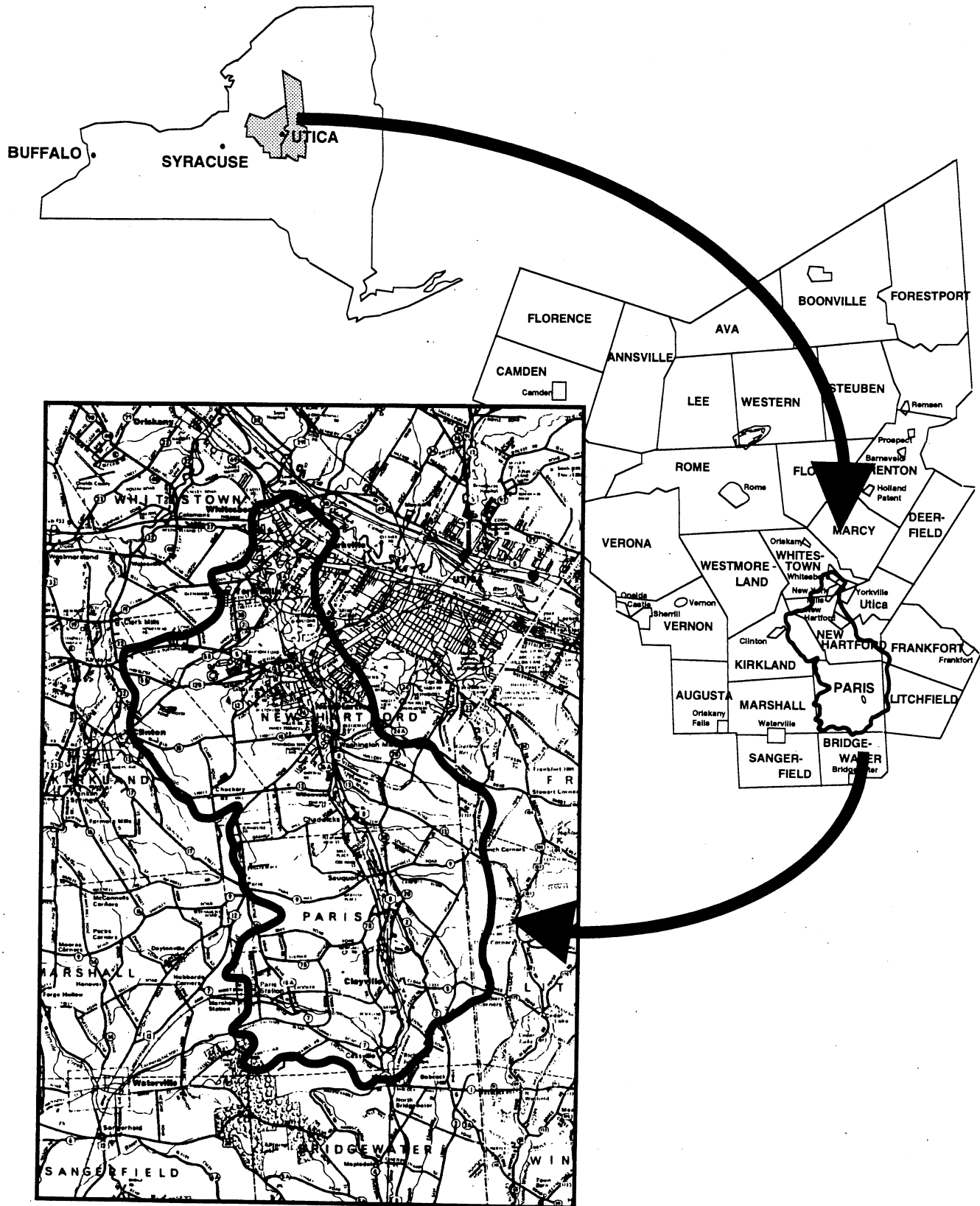


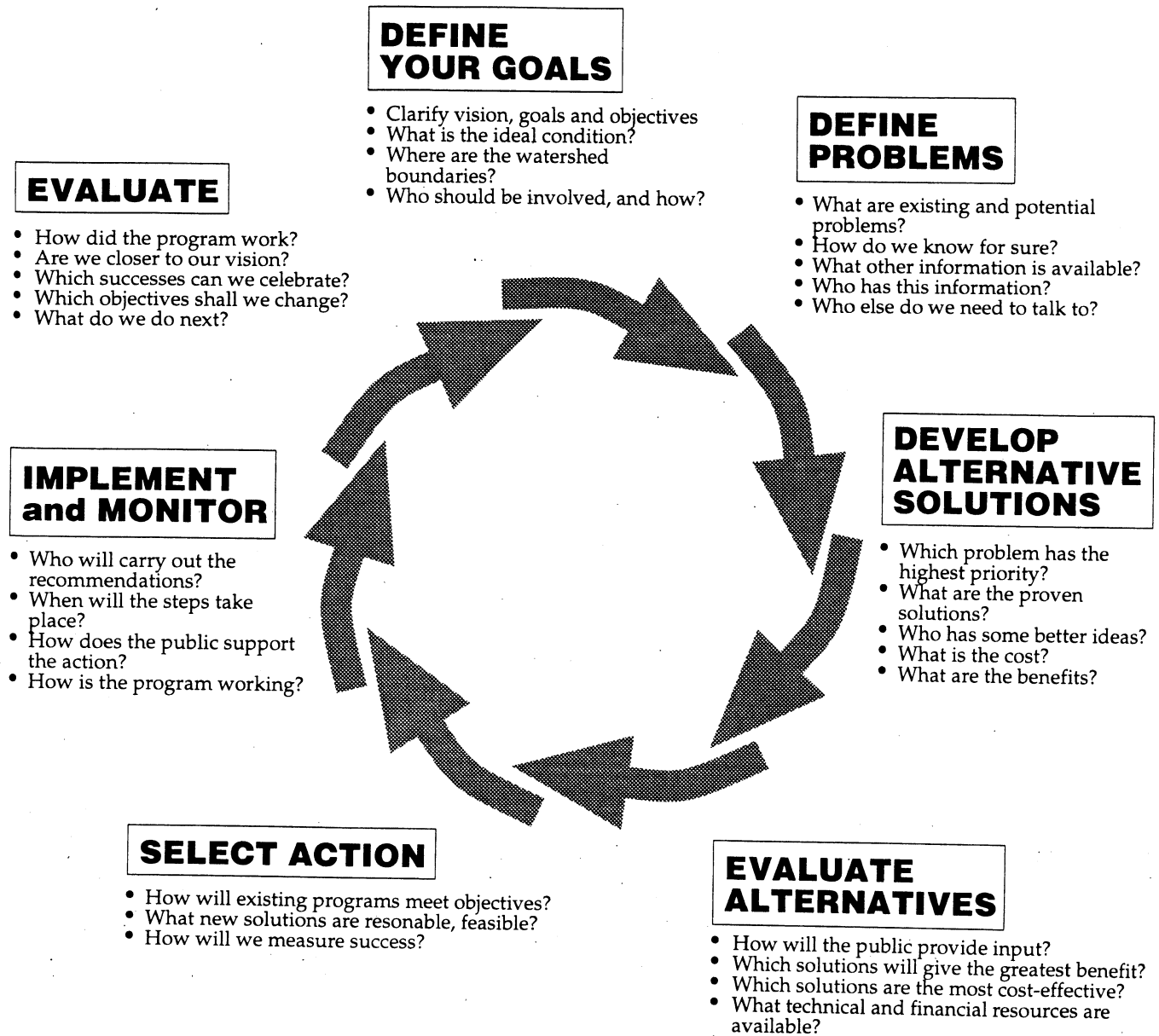
FIGURE 1
 "Index to
 Landscape
 Categories"

Sauquoit Creek Basin
 Watershed Management Visual
 Survey Study



HERKIMER - ONEIDA COUNTIES COMPREHENSIVE PLANNING PROGRAM

FIGURE 1-3
Sauquoit Creek Basin Watershed Planning Process



Note: A watershed management plan is a process, not a report - it is more than just one person's opinion about a list of actions to be taken to improve a watershed. The different people who live, work and play in a watershed all have different ideas about how the watershed should be managed.

The Sauquoit Creek Basin Watershed Management Study should be a dynamic, ever changing, process-driven document that helps to define future direction for the watershed. Although the process illustrated begins with "Defining your goals," the "Evaluation" step should encourage a revisitation and refinement of the process (or steps in the process).

ORGANIZATION OF THE STUDY

The Sauquoit Creek Basin Watershed Management Study is organized into a series of individual yet interrelated volumes. Each volume discusses a major component of the overall study and can be used individually or in combination with others. However, each volume is related to others and is needed, along with the other volumes, to fully understand the process and analysis which was completed to reach the conclusions and recommendations presented.

While all the volumes relate to the overall study of the Sauquoit Creek basin, each has its own specific purpose and use. For example, an individual interested in the goals and objectives of the basin may not necessarily require the volume describing the visual survey of the creek corridor. However, it should be recognized the visual survey might provide further insight into fully understanding the goals and objectives which were developed for the basin. A similar relationship applies to other volumes, as well.

In addition to providing guidance, documentation, and recommendations that are specific to the Sauquoit Creek watershed, certain volumes and information have been developed primarily for educational purposes. Education that is not only geared to the local officials, agencies and residents directly impacted by issues

within the basin, but also education which outlines the process which was implemented to complete this study. The New York State Department of Environmental Conservation's publication; "Watershed Planning Handbook for the Control of Nonpoint Sources," was used to guide the development and implementation of this study. The results of this process are provided so that others interested in watershed management can apply all or parts of the process implemented during this study to a similar study in their locale.

A brief summary of each volume follows:

- **Volume 1 - Introductory Volume and Project Summary:** This volume outlines the purpose and organization of the overall Sauquoit Creek Basin Watershed Management Study. The "Project Summary" serves as a synopsis of major findings and recommendations contained in each volume.

- **Volume 2 - Visual Survey of the Creek Corridor:** This document includes a verbal, text representation of the visual character of the creek corridor and is supplemented with numerous photographs and maps which acquaint the reader with the location and visual sense of the creek's surroundings.

- **Volume 3 - The Basin Coordinating Committee:**

This volume summarizes the methodology involved in both the formation of and the activities of the Sauquoit Creek Basin Coordinating Committee. Included is a detailed outline of the process which was implemented to develop goals and objectives for the basin. Also included is a list of representatives and agency roles and responsibilities relating to water resources within the basin.

- **Volume 4 - Watershed Issues, Goals and Objectives:** This publication provides an in-depth discussion of the water resource issues affecting the basin and reveals the interrelationships among issues. In addressing these issues, this volume also discusses past efforts and future needs as related to the basin goals and objectives.

- **Volume 5 - Existing Development, Regulatory Controls and Development Potential:** This volume combines: demographic information; existing land use and land cover information; and existing regulatory controls, into an analysis to conclude on future development potential within the basin and potential impacts of development to water resources.

- **Volume 6 - The Watershed Management Strategy:** This document is the culmination of the watershed management study and specifically addresses each of the major issues identified in

Volume 4 to provide recommendations and projects that can be undertaken as future funding becomes available. Each recommendation/project includes the following: provides an approximate schedule or priority of when the project should be implemented; suggests what agency or individual may be best suited to undertake that activity; provides a cost estimate for that project; and identifies a number of smaller, realistic, and implementable tasks for each project.

The overall Sauquoit Creek Basin Watershed Management Study has been prepared by the Herkimer-Oneida Counties Comprehensive Planning Program (HOCCPP) with the assistance of private-sector consultants and in cooperation with agencies and municipalities within the basin. Within the table of contents for each volume, special recognition is given to those consultants, agencies, or individuals who have been principal contributors to developing that particular

volume. Figures, maps and photographs are duly credited on those documents themselves. Any figure not showing such credit has been provided and developed solely by the Herkimer-Oneida Counties Comprehensive Planning Program.

Partial funding for this study has been provided by the New York State Department of Environmental Conservation under Section 604(b) of the Federal Clean Water Act Amendments of 1987.

Project Summary

SECTION 2.1



GENERAL FINDINGS (The Methodology)

At its inception, the scope of the Sauquoit Creek Basin Watershed Management Study emphasized the intent to focus on providing a comprehensive investigation and implementation program that incorporated all of the primary water quality and water quantity issues affecting the basin. This intent evolved as a result of previous water resource studies completed by HOCCPP - specifically, a number of wellhead protection studies and implementation projects. During the completion of those wellhead protection studies, HOCCPP found it somewhat difficult to focus on a single issue such as wellhead protection - when the issue involved so many other water resource topics. For example, while wellhead protection typically focuses on source protection and regulation of certain types of potential contaminants, it may also be impacted by broader issues such as flooding, stormwater management, agricultural management practices, development and demographic factors, transportation systems, existing regulatory controls, institutional structures, funding availability, and so on. The same is obviously true in addressing watershed management. This point was put forth as the intent of the Sauquoit Creek basin

study - to focus on providing a comprehensive investigation and implementation program that incorporated all of the primary water quality and water quantity issues affecting the basin.

There are both pros and cons to addressing all water resource issues as part of a single watershed based study or effort. The following paragraphs describe some of the general findings concerning the methodology used during this study.

A comprehensive approach to watershed management allows an individual, agency or organization to effectively investigate, address and understand all issues and the interrelationship of issues within a watershed. For example, without a comprehensive look at all issues, it is unlikely that the relationships which exist within the basin that may involve flooding, land use development, stormwater management, stream corridor management and wetlands preservation, would be fully understood. Through this comprehensive approach to watershed management, these relationships become evident and result in the education of those individuals, agencies or organizations that make key decisions in that watershed.

Further, a comprehensive approach to watershed

management may result in a solution or recommendation that addresses more than just one issue. For example, retaining and protecting certain wetlands may not only provide wildlife habitat but may also reduce flooding, help in stormwater management, and may provide for recreational and open space uses.

With state and federal funding agencies emphasizing a need to prioritize and develop strategies for addressing the most significant water resource issues, it is of the utmost importance to investigate all issues that might potentially impact a watershed. Without a comprehensive approach to watershed management it is not only difficult to prioritize issues but it's more difficult to focus funding on the most important issues. Such difficulty and lack of a focused effort could reduce the success of securing future funding opportunities for targeted projects within that watershed.

However, a comprehensive approach to watershed management may become prohibitively expensive. To be successful in addressing and prioritizing all issues, including the necessary interrelationships that may lead to solutions, there is a need to invest and commit significant resources over an extended period of time.

Many locally based communities and organizations may not have a mechanism to do so. Further, investigating, addressing, and finding solutions to many water resource issues within a watershed can easily become overwhelming and too complex. It may be unrealistic to expect development of a comprehensive watershed management strategy or plan to occur as a locally based effort without a significant investment of time and resources from professionals within either the private or public sector. With regard to the Sauquoit Creek Basin Watershed Management Study, HOCCPP was able to make a significant investment through the assistance and grant provided by the NYS Department of Environmental Conservation.

After having gone through this watershed management effort, HOCCPP offers the following general recommendations concerning methodologies for completing watershed strategies or plans.

There are two basic methodologies available for watershed management that may help to address or resolve some of the difficulties discussed above. In defining the scope of a watershed project, one basic methodology involves the investigation of the entire, geographical extent of the watershed while limiting the investigation to only one or two issues that are either known or suspected to be priority concerns within that watershed. The primary advan-

tage to this methodology is that the issue is addressed uniformly within an area that is defined geographically, based on common physical and water resource characteristics - not one based on municipal boundaries. The disadvantage is that other contributing water resource issues, and the interrelationships of those issues, are not investigated or addressed - making it difficult to adequately prioritize issues.

The other basic methodology is to look at all issues and the interrelationships of those issues within a smaller, more narrowly defined geographical area such as a subwatershed. While this methodology addresses the interrelationship of issues within that smaller area, it may not offer a true perspective of the priority issues impacting the overall watershed. For example, within the Sauquoit Creek basin the priority issues vary from one sub-basin to another. In the southern portion of the watershed, sub-basins are primarily impacted by rural residential and agricultural non-point source problems. In other sub-basins, primary issues may involve flooding problems and non-point source problems associated with more urban areas.

A compromise methodology that falls somewhere between the two basic methodologies, which are discussed above, includes an investigation of an entire watershed that has a carefully defined

level of involvement including definable or expected products which will result from that investigation. While this may be the most difficult watershed management program to develop, it would allow for some logic in developing a strategy for an area that is tied together both physically and by the interrelationship of issues affecting it. Defining the level of involvement and the identifiable products is difficult because of a "thin line" that is often crossed between planning activities and the implementation of activities. For example, monitoring and assessment (implementation) on a particular stream would, no doubt, be very valuable to fully understanding water quality issues in that basin (basin planning). However, the decision must be reached - before a watershed program is even started - as to the cost versus the benefit of such information to the planning effort. Absent such conscious deliberation, the process may quickly evolve into "a black hole syndrome" whereby the apparent usefulness of such information quickly envelops available resources and the focus becomes more on implementation activities, rather than careful planning.

In conclusion, before beginning a watershed management effort, a community or organization must carefully choose one of the methodologies discussed above and be careful not to go beyond the scope of the project as defined.

SPECIFIC FINDINGS OF THE STUDY

The following paragraphs summarize the results of the Sauquoit Creek Basin Watershed Management Study as discussed in more detail within respective volumes.

This summary provides many of the findings and recommendations that are specific to issues within the Sauquoit Creek watershed.

However, this summary is not inclusive of all findings. Specific volumes should be referenced to obtain more insight and understanding.

A) Summary of the Visual Survey (Volume 2)

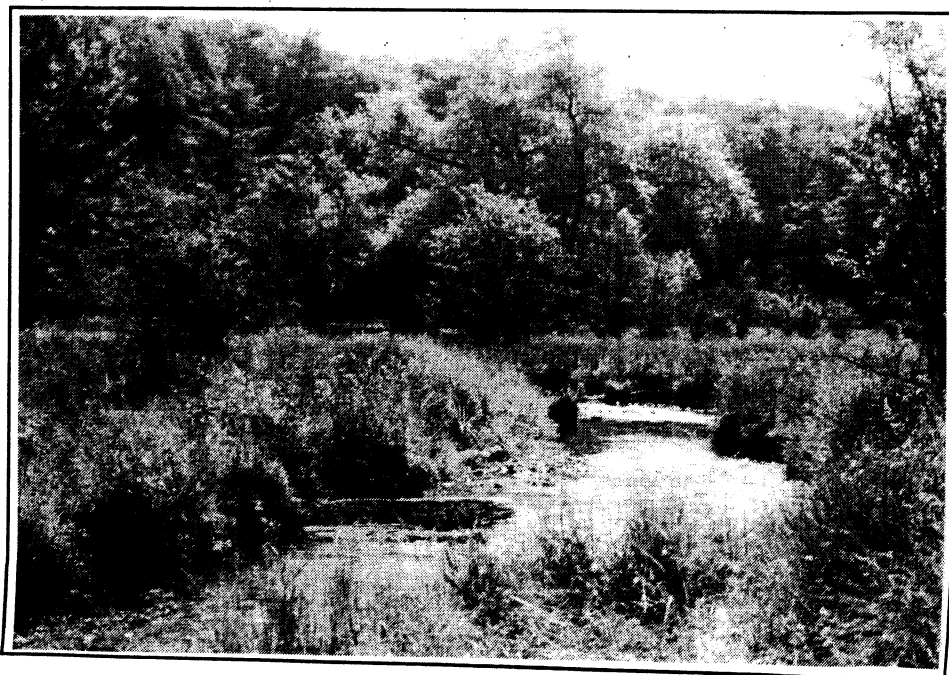
Although the Sauquoit Creek basin is large and diverse, the creek itself acts as a unifying element that connects the entire watershed. The *Volume 2-Visual Survey of the Sauquoit Creek Corridor* expands the perspectives of residents within the basin from the small segments they are most familiar with to allow them to visualize the changing character of the entire creek corridor.

Eight visual landscape categories were established to group areas along the corridor according to their visual value and common attributes. Observations specific to the type, density and condition of both vegetation and development that abuts the stream corridor were used, along with observational characteristics of the creek itself, to define these categories. The categories include: headwaters areas having an intermittent flow; headwater areas having a more constant flow; hamlet areas that contain low intensity development; areas predominated by highways and stabilized creek banks; natural areas within residential surround-

ings; natural areas that are somewhat preserved and relatively untouched by surrounding development; channelized stream banks within urban areas; and urban areas that contain high intensity development.

Many of these visual landscape categories are found within more than one area within the corridor. For example, although a superficial investigation might identify the "preserved headwaters" of the Sauquoit, more indepth investigation reveals that there are areas in the northern portion of the watershed that have also

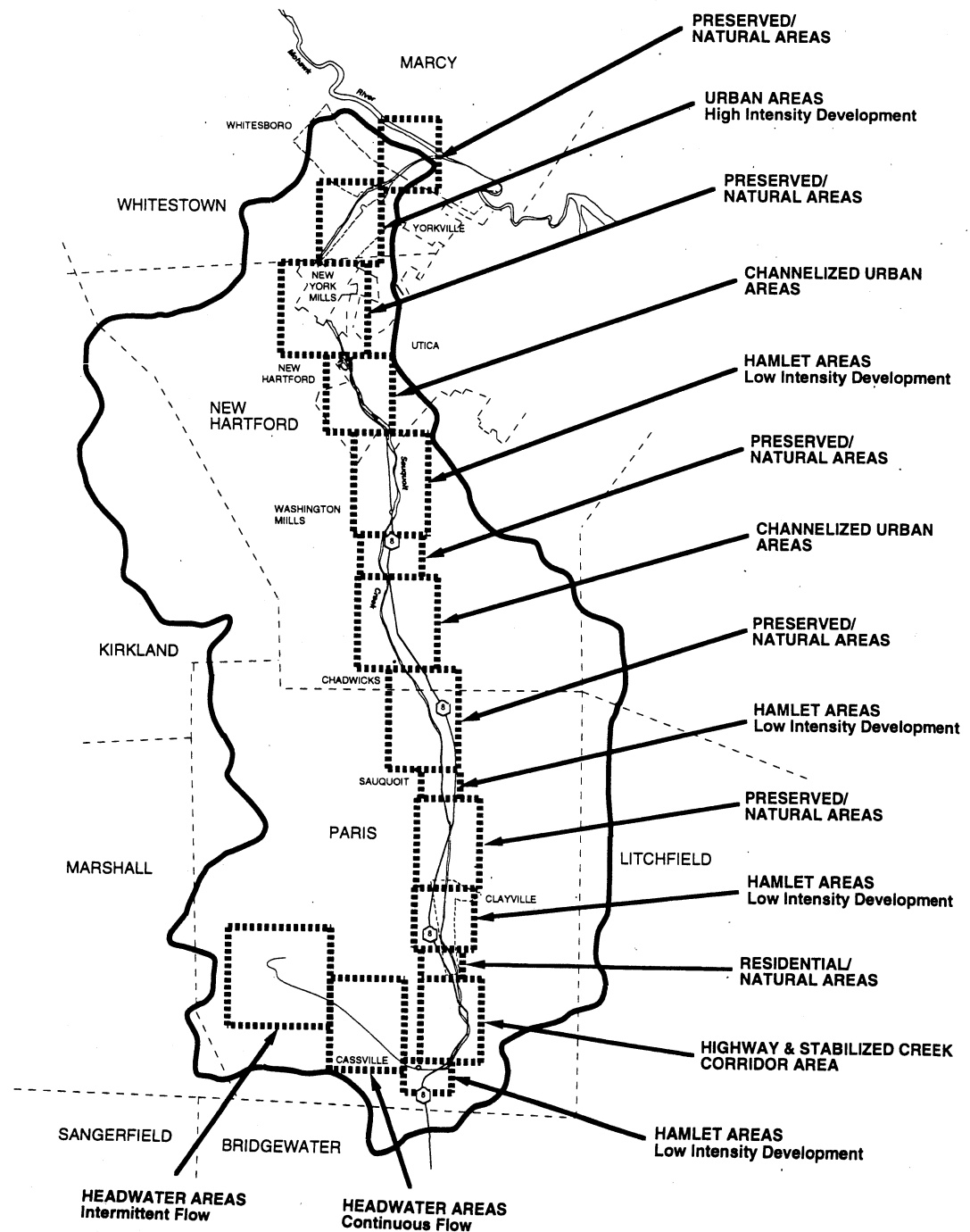
retained a natural character similar to that of the headwaters. Some of these areas are significantly large, and are typically located between areas of higher development density. Maintaining and connecting these natural areas along the corridor via greenways or trails would serve the dual purpose of 1) protecting open space and natural drainage ways along the corridor and 2) promoting awareness of recreational aspects in the basin. As such, this visual analysis can significantly contribute to the potential future development of a greenway plan within the basin.



How development, vegetation and the characteristics of the creek come together on a site largely determines how that landscape will be visually perceived. For example, a portion of the Sauquoit corridor that is shaded by overstory tree canopy and has minimal development may be given a high landscape or visual value, while a section

dominated by an abandon facility with sparse vegetation may be considered to have a low perceived visual value. Coincidentally, the area containing significant vegetation with minimal areas of built development may also be considered to have a high value relative to the quality and quantity of water resources.

Development or vegetation (and lack of vegetation) can produce a variety of impacts on the water resources within the corridor. Vegetated areas can serve many purposes - filtering pollutants from adjoining land uses, visual aesthetics, water quality, and providing small pockets of forest that can be retained for recreational activities and wildlife



habitat. For example, a vegetative buffer along the stream may be visually pleasing while also providing a benefit for wildlife habitat, erosion control, filtering of storm water runoff, and protection against thermal pollution. Conversely, intensive development may, in addition to being visually unpleasing to the eye, negatively impact water resources by increasing the amount of permeable surfaces with a resultant increase in contaminants from urban runoff or thermal pollution.

Those areas of the creek corridor that are noteworthy for having either high or low visual value are described below.

In the more natural areas, the affect of development may be high, since there is currently little (if any) development in these areas. For example, if development were to occur in these areas, it would not only disrupt the natural ecosystem within the

area, it may also visually stand out from the dense vegetation surrounding it. It could be argued, however, that the dense vegetation could perhaps absorb more development if that development were sited in such a way as to blend into the landscape. This approach may be more costly.

Consequently, the areas of the Sauquoit Creek corridor that are least visually vulnerable to future development are those that are currently located within the more urbanized areas. New York Mills, Commercial Drive, Washington Mills, and the other more developed nodes along the Sauquoit are each defined by the built-up environment that surrounds them, such as Clayville.

Although there are tangential non-point pollution issues associated with the high density of development within these areas, redevelopment or expanded development will cause the least visual damage to the overall character of the Sauquoit.

Infilling current development is more favorable than sprawling construction over areas that were previously undeveloped. Not only may this have the least visual impact, but there are economic benefits as well.

Namely, the infrastructure and economic base often already exists in areas that have been previously developed. Beyond the visual and economic reasons, there is also an awareness that if development were to be permitted to sprawl, there would soon be little green space surrounding Sauquoit Creek. As previously discussed, the vegetative areas provide a number of key benefits. Because of their recreational potential, separate tracts of greenspace should be connected in the future to form a greenway corridor along the stream. If future development were to proceed in or around these tracts, it should be done in such as way as to preserve a vegetative corridor.

B) Summary of the Basin Coordinating Committee (Volume 3)

An initial step that formed the basis, and was the pivotal point, for subsequent steps of this study, involved a major effort to identify all potential issues and topics which relate to water resources management within the Sauquoit Creek basin. All topics affecting water resources and those having a significant influence on the future requirements for

water resources management within the Sauquoit Creek watershed were identified and discussed, including those issues relating to land use, regulatory controls, water quality, water quantity, etc.

Prior to this study, existing agencies and local governments had no mechanism to reach consensus on what the

key basin issues and topics were. Additionally, since the identification of issues and topics, and finding solutions to them, effects and involves the public at large, support for implementation requires a well informed public that recognizes and agrees on the problems and a need to take action. Toward that end, an intermunicipal basin coordinating committee was

formed which consisted of local elected and appointed officials from each municipality within the basin as well as appropriate county, regional, state and federal representatives, and associated groups including business, citizen, and agricultural organizations.

The overall objective of establishing the Sauquoit Creek Basin Coordinating Committee was two-fold.

The first was envisioned as a process whereby the committee would be used to facilitate activity and concern throughout the basin and spark initiatives and involvement from the various members. The second objective focused on using the committee to identify

and reach a broad consensus on issues which need to be addressed further in subsequent volumes of this study. The effort was successful in obtaining involvement from committee participants and in identifying twelve major issues. These specific issues and the relationship of these issues are described in more detail within *Volume 4 - Watershed Issues, Goals, and Objectives*.

The committee was organized as an advisory and coordinating board at its inception but this has not precluded the potential for the committee to be empowered with expanded authorities in the future. The *Watershed Management*

Strategy (Volume 6) recommends future action to investigate, first, the areas where certain authority might be relegated to the committee. The basin coordinating committee could easily function as a permanent entity. This continued role will ensure a bottom-up approach to basin management; provide for a more effective delivery of county, regional, state and federal programs; provide specific expertise and broad perspectives on topics impacting the basin; assist in and sanction specific implementation efforts; and keep the general public informed on the progress of the basin management and implementation program.

C) Summary of Watershed Issues, Goals and Objectives (Volume 4)

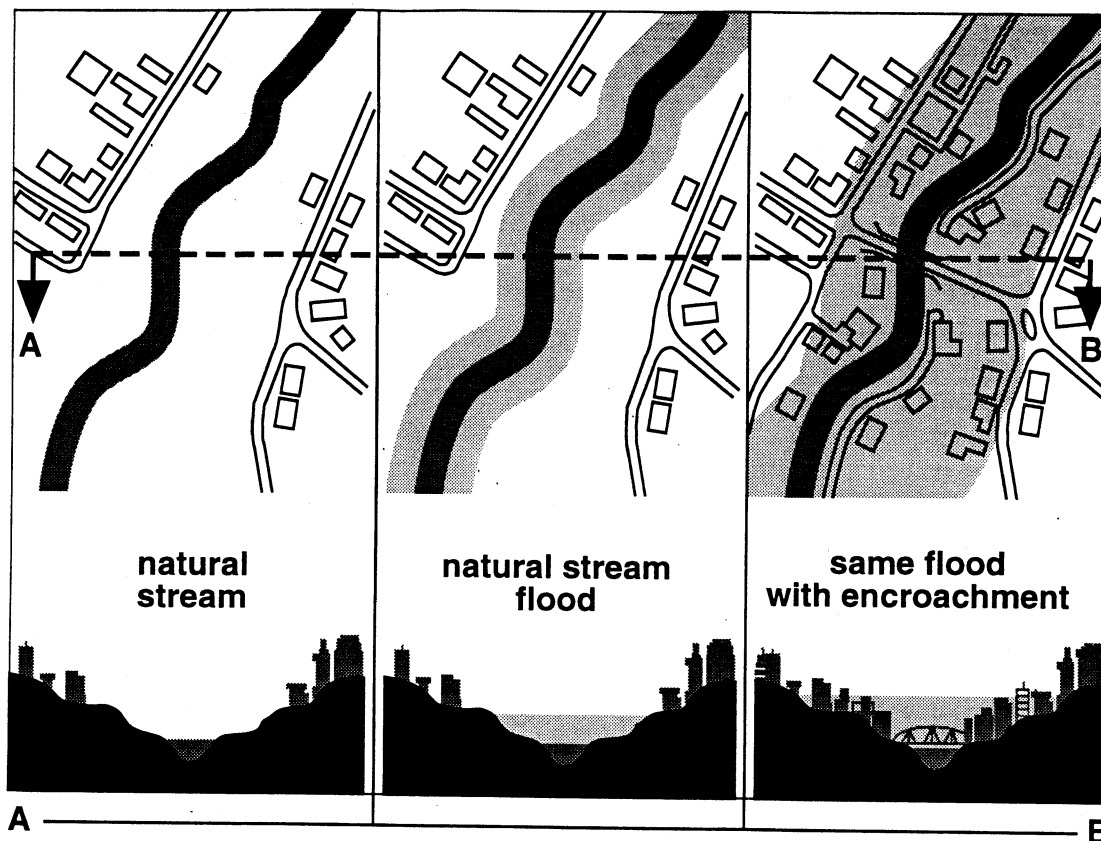
Following the efforts of the Sauquoit Creek Basin Coordinating Committee, numerous personal interviews, and a broader based public participation process (as discussed in *Volume 3 - The Basin Coordinating Committee*) a total of twelve major issues emerged as primary concerns within the Sauquoit Creek watershed. These include: water quantity (primarily flooding and stormwater management) issues; water quality issues; agricultural issues; fish and wildlife issues; recreational issues; issues related to natural character; wetland issues; development issues; highway and transportation issues; groundwater and drinking water issues;

regulatory controls and institutional issues; and, community education and citizen involvement issues.

This volume provides an investigation into these issues and elaborates further on the probable cause(s) of these concerns. This volume specifically provides the following: a broad characterization of the issue as identified by committee participants; a more detailed discussion of each topic, issue, or problem; the interrelationships of these issues; general locations of these issues within the basin; potential cumulative impacts of these issues; past histories of how these issues have been treated within the

basin; and broad goals and objectives for managing these issues into the future.

In order to link these major issues to watershed-wide solutions, a working model was needed regarding how the issue functions in the watershed. A series of questions were utilized to apply a watershed-level analysis to the Sauquoit basin. Each issue was subjected to the following six questions: How does the respective issue function within the watershed/ ecosystem? How does this issue relate to other issues? How has the issue been treated in the past and are there any trends? What is the current status or condi-



tion of the resource? What are the future ambitions or goals and objectives for addressing the issue? and, How do we achieve these goals and objectives?

It should be noted that these questions are answered in both the broad, generic sense (ie: how the issue typically functions, relates, etc. in any watershed) and, also, how the issue functions specifically within the Sauquoit Creek watershed (ie: taking into account and documenting any unique circumstances within the basin).

1. Water Quantity: With regard to water quantity issues within the Sauquoit Creek basin, flooding along the creek and its tributaries is one of the most important and immediate problems in the watershed, particularly for downstream communities. The hazards associated with flooding events have

included: over bank flooding, damage to property, closing of schools and roads, and problems at the Oneida County Water Pollution Control pump station. Flooding has also caused physical changes to the Sauquoit Creek, such as channel bank erosion, channel migration, and channel bed degradation and aggregation (accumulation), which threaten public facilities and private property. In the downstream areas, where flooding has had the greatest impact, there have been two primary types of flooding: (1) over bank flooding from both the Mohawk River and the Sauquoit Creek that is caused by excessive rainfall, snow melt, or ice jams; and (2) sewer system backups and basement flooding caused by excessive infiltration and inflow in the sanitary collection systems.

As outlined by the Sauquoit Creek Basin Coordinating Committee, the broad goals and objectives for dealing with water quantity issues all focus on the reduction of flooding in the basin, and particularly the impact of flooding on downstream communities. Managing water quantity on a basin-wide and intermunicipal level while facilitating intermunicipal cooperation are major goals for this issue. The reduction of inflow and infiltration into sewers resulting from illicit connections or breaks in the sewer system was also a significant goal.

The committee formulated numerous objectives for meeting these goals, such as the implementation of development guidelines - perhaps in the form of local laws or ordinances to protect uses from flooding and to help reduce typical causes of

flooding such as filling flood plain areas. Such laws or ordinances also have the potential to accomplish these goals by addressing the elimination of illicit sewer connections and the destruction of wetlands. Other general objectives include: the development of basin-wide stormwater management through the use of computer modeling via Geographic Information Systems (GIS); the prediction and analysis of maximum development build-out; and, the quantification of the impact that increased stormwater runoff will have on stream capacity.

2. Water Quality: Although industrial pollution and the county wastewater treatment plants have been mentioned in relation to water quality, most of the concern focuses on the causes and impacts of nonpoint source pollution.

Both groundwater and surface water contamination are concerns. Potential causes for this contamination within the basin are suspected to include malfunctioning septic systems, agricultural practices, and stormwater runoff from roadways, parking lots, residential and commercial areas, and other impervious surfaces. The resulting types of water contamination include sediment deposition in the lower segments of the Sauquoit Creek, subsequent flooding and stream bank erosion, fewer fish and wildlife, and excessive plant growth within drainage ditches, the creek itself, and its tributaries.

The broad goals for improving water quality in the Sauquoit Creek basin emphasize the management, protection and improvement of the resource. More specifically, the committee formulated additional goals including; the development of basin-wide water quality controls, the establishment of buffer strips, minimization of erosion, and the replacement and/or removal of leaking fuel tanks.

Stated objectives provide concrete ways of achieving these goals, such as the development of a basin-wide stormwater management plan, whole farm planning, stabilization of stream banks, and the education of the public on water quality issues.

3. Agriculture: Although there have been marked improvements in the farming methods used in the basin, there is still evidence of water resource impacts from agriculture along the creek.

It is recognized that the use of Best Management Practices (BMPs) throughout the basin has been inconsistent, and some individuals have suggested that stronger enforcement of codes may be required. The concerns include nonpoint source pollution from poor management of agricultural chemicals and nutrients (manure and other fertilizers), and from farm field drains discharging these nutrients. The use of chemical pesticides and herbicides has had a negative impact on the fauna and flora of the creek

basin. In addition, there has, literally, been a loss of farmland due to soil erosion.

Many alternative farming practices have also been suggested; particularly whole farm planning as a tool to help farmers assess and improve farm practices that may have an environmental impact. Integrated pest management (IPM) reduces the amount of chemicals applied by farmers, which in turn reduces contamination. Contour plowing prevents channeling of overland flow and the transport of sediment into streams. Livestock can be kept away from the water courses to prevent nonpoint source pollution. Unfortunately, while many programs and practices exist, farmers are under very tight economic constraints and, therefore, may be reluctant to take up new practices that may create additional economic burdens. Economic incentives for agriculture (e.g., tax breaks) may help to encourage environmentally sound farming practices.

The Sauquoit Creek Basin Coordinating Committee identified three broad based goals relating to agricultural issues within the basin. These include: reducing water quality impacts from agricultural runoff, maintaining the open space character of the upper watershed, and providing technical and educational assistance to the farm community. The implementation of whole farm planning, the establishment of buffer strips (as illustrated

on Figure 1-4), identification of funding mechanisms, and the education of residents about potential nonpoint source pollution problems resulting from agriculture will support these goals.

4. Fish and Wildlife: Although fish and wildlife issues did not directly dominate the discussion of watershed issues, many of the problems plaguing the Sauquoit Creek basin eventually affect the fish and wildlife resources. Not only are fish and wildlife important in their own right, but they are powerful indicators of a clean, well-balanced watershed.

One of the principal observations was the critical link between riparian zones and the preservation of fish and wildlife within the watershed. As a result, the maintenance and preservation of riparian areas and other significant habitats was a primary goal. Other goals include maintaining natural drainage ways and reducing the water quality and habitat impacts of development. These goals can be achieved through the preservation of riparian areas and prevention of increases in stream temperature, erosion, and sedimentation.

Many residents feel that new and improved access points to the Sauquoit Creek are needed. An additional concern that was raised focuses on a need for clarification regarding public fishing rights along the entire creek.

The evaluation of these goals emphasized solutions which

include providing stream buffers, removal of development from the floodplain, and integration of habitat protection to guide development as part of basin-wide planning. The principal management strategies promote the development of a greenway system along the river, and the establishment of a stream corridor management plan. The latter strategy would involve the establishment of a stream corridor management boundary, with variations in width determined by important natural features and environmental constraints. Specific goals could be established within this boundary and management guidelines could be developed to protect sensitive habitat or riparian areas.

5. Recreation: There are several important recreational issues and concerns within the Sauquoit Creek watershed, such as the lack of focused recreational opportunities and the need to provide for fishing, hunting, bird watching, and other types of recreation. There have been suggestions about integrating landscaped, multi-use, bike/walking trails around the Sauquoit Creek and its tributaries. Recreational opportunities should be planned with a sensitivity to the watershed, with the twin goals of providing recreational opportunities and preserving nature.

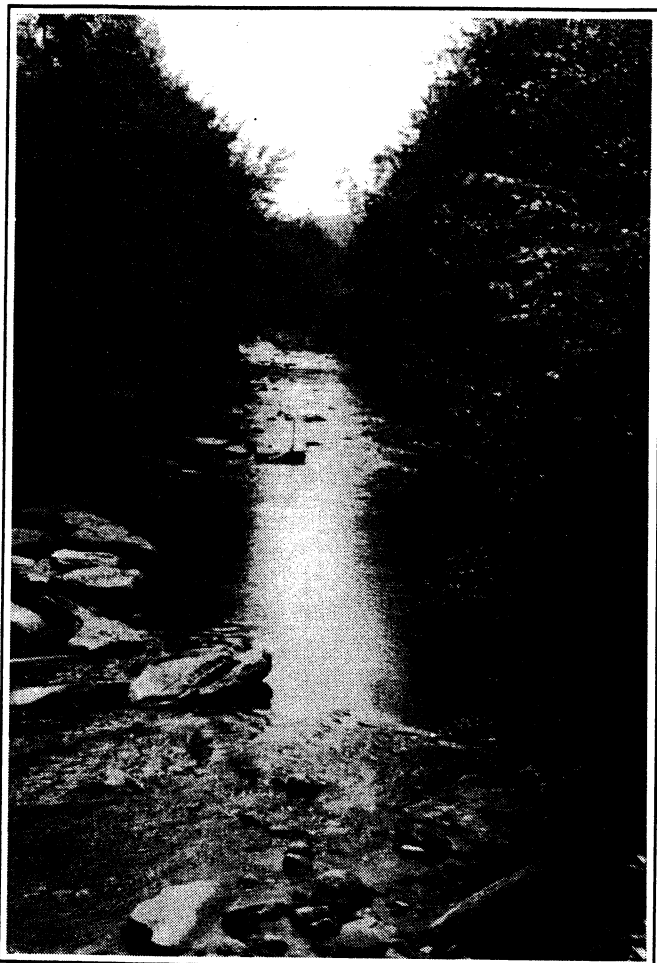
The recreational goals combine both the preservation of natural habitats (to maintain fish, wildlife, and aesthetic character) and

provision of access to these resources (either through stream access or corridors and links to these resource areas). Stated objectives reinforce this with the suggestion of acquisition of property adjacent to the Sauquoit Creek and the development of a multi-use, integrated trail system. Developing sources of funding for this effort was also identified as an important objective.

Additional management strategies include: 1) designing networks of greenways so that there are opportunities for both short and extended recreational visits; 2) establishing management zones along the Sauquoit Creek for a variety of uses; 3) increasing buffer zones as the sensitivity of the creek and the natural resources within them increases; 4) locating recreational facilities (trails, access points) to enhance recreational experiences as well as minimize environmental impact; and, 5) discouraging off-trail use.

6. Natural Character: Issues pertaining to natural character relate both to the watershed and to the stream itself. While open space and rural character are important to the natural character of the watershed as a whole, the natural character of the creek itself is preserved by protecting the banks, riparian vegetation, and linear continuity of the stream.

The upper watershed of the Sauquoit Creek has a uniquely appealing agricultural and rural open space character (see *Volume 2 -*



Visual Survey of the Creek Corridor). There is concern within the Sauquoit Creek basin about maintaining and enhancing the natural character of this attractive area. Many opportunities have been identified and discussed which would enhance this natural character, such as the establishment of scenic overlooks that could be "adopted" and improved by civic organizations. Reasonable land-use, design standards, and guidelines could be adopted to ensure that future development reinforces this natural character and better landscaping of development areas such as shopping malls and parking lots would also help to protect the natural character of the area.

The natural character of the creek itself depends highly on the maintenance of riparian areas along the stream. A noticeable loss of open space along the major drainage ways of the basin is evident, and there appears to be an absence of public policy aimed specifically at protecting and preserving the visual character of the stream. As discussed in *Volume 2 - Visual Survey of the Creek Corridor*, development too close to the creek generally compromises the visual character.

Goals relating to natural character issues within the basin focus on: maintaining riparian zones, main-

taining open space character, and maintaining and restoring natural drainage ways and creeks. A primary objective which was developed as a possible way of meeting many of these goals emphasized the development of regulatory controls and memoranda of understanding to restore and preserve the natural character of the upland open space and stream drainage ways.

The realization of the goals relating to natural character depends on the integration of ecological goals with natural character goals and restoration efforts throughout the watershed. Different strategies are needed for different parts of the watershed and range from strict protection of existing natural

character to restoration efforts in developed areas.

A focused ecological stream restoration program would provide the most benefit for restoration of the natural character of the Sauquoit Creek. A greenway integrated open space preservation plan would best protect the open space character of the upland areas.

7. Wetlands: Over the years, wetlands have become a major consideration within the Sauquoit Creek watershed. There are concerns about both conserving wetlands, and balancing the need for wetland conservation with the need for continued development within the basin.

The role of wetlands in the reduction of flooding is recognized, as well as their value as both aquatic and wildlife habitat. As such, an emphasis is placed on the importance and multifunctional aspect of wetlands and the need to preserve many of the remaining wetlands in the watershed. The preservation of the basin's wetlands may also increase available open space and recreational opportunities.

Other related concerns associated with wetlands in the Sauquoit Creek basin focus on making allowances for reasonable wetland crossings and encroachments when development is determined to be necessary and permitted. Specifically, there have been a number of suggestions to provide in-line wetland stormwater retention (such as proposed

in the Town of New Hartford, near the Seneca Turnpike/Commercial Drive area) to mitigate some of the potential impacts caused by continued development in the area.

An emphasis is also placed on finding viable ways to recover and regain lost wetlands, and restoring wetlands which may have been drained for agricultural purposes. During the investigation of issues within the basin, some individuals felt that wetlands that have been previously filled or degraded have the greatest potential for enhancement and/or restoration, and may provide great value to the watershed.

The Sauquoit Creek Basin Coordinating Committee identified a number of broad based goals relating to wetland issues within the basin that focus on ways to reduce the loss of wetlands, particularly in riparian ecosystems and natural drainage ways. Goals for wetland issues were directly tied to their relationship with development issues and, in fact, many of the same goals can be found in the discussion of development issues. Recognition is also given to the value wetlands have in the basin, including wildlife habitat and flood reduction.

The objectives which were developed as possible ways of meeting many of these goals emphasized the preservation, restoration, and creation of wetland areas. The objectives themselves can be accomplished by identifying valuable wetlands and guiding development

through state or municipal acquisition and protection of key wetland areas.

8. Development: There is a strong desire within the basin for environmental issues to be balanced with development concerns. More specific concerns suggest that development along the Sauquoit Creek is threatening existing wetlands, and that the filling of wetlands will have negative impacts on water quality in the creek itself.

There is general agreement that development has created significant problems in the watershed. Development has increased flooding problems by increasing runoff and has encroached on the floodplain along the creek. Further, water quality problems have resulted from the destruction of wetlands and from nonpoint source pollution contained in stormwater runoff.

The infrastructure supporting much of the existing development, such as highways and sewers, has also contributed and created significant concerns. Infiltration from groundwater and illicit inputs to the sanitary sewers have created a multi-million-dollar problem for the part-county sewer district.

The interrelationships between development and the watershed are complex and multifaceted, as are the concerns that have resulted from some development. Not all of these concerns are tied to the physical landscape or watershed. Many

relate directly to the institutional structure and existing regulatory controls. However, of those concerns that are linked to the physical aspects of the watershed, most appear to be the result of a mismatch between land use and environmental characteristics. Such conflicts seem to be the result of: 1) poor land-use decisions, such as building a house on an unstable slope or within the floodplain; 2) environmental change after a land use has been established, such as a home subject to flooding because upstream development has increased the flood level; or 3) social or technological change after the land use has been established, such as water quality degradation resulting from the use of pesticides. Part of understanding the interrelationship between development and the watershed involves a recognition of the cumulative effects of these mismatches.

Goals relating to development issues within the basin focus on the desire to ensure that future or proposed land uses are consistent with sound management practices. Specific suggestions include identifying alternative stormwater management techniques for new development, reducing the loss of wetlands resulting from development pressures, and minimizing the impact of development on the visual character and quality of the basin.

Objectives which were developed as possible ways of meeting many of these

goals emphasized: the preservation of natural drainage ways to allow for conduits for stormwater management; the creation of development guidelines; the education of municipal boards; the recognition of the relationship of transportation issues and transportation networks to development; and the recognition of the relationship of wetlands preservation to development.

9. Transportation: Concerns that are associated with the highway and transportation network in the Sauquoit Creek basin fall into three major categories. The first category centers on the design and location of highways with related impacts on the environment. For example, the mere existence of highways (absent any maintenance activities) may have impacts which include nonpoint source pollution from highway runoff. With regard to design issues, the existence of an improperly designed bridge or culvert may back-up stormwater and cause flooding. Additionally, the location of a highway, whether through a steep grade or following along a stream corridor, may pose threats to the surrounding environment such as erosion or bank stabilization issues.

The second category of issues center around the necessity to keep the roads maintained and operational (particularly during floods and inclement weather). Typical operation and maintenance activities

include salting and sanding, ditching, repaving, and bank stabilization. These activities may contribute to nonpoint source runoff and increased erosion and sedimentation.

The third category of issues relate to institutional structure, regulatory controls, and land use development. While better transportation management practices are generally recognized by entities within the basin, funding, which is necessary to implement many of these practices, is often lacking - especially at the local level.

In regard to regulatory controls, the presence of three different levels of public works departments (local, county, and state) that are involved in road design, construction and maintenance within the basin, creates a lack of uniform guidelines and standards. There is also a lack of uniformity in local land use management which is further compounded when improved transportation and access encourages more development.

Perhaps the broadest goal - which, if accomplished, would address many transportation issues - is the identification of funding strategies to implement environmentally sensitive highway practices. The reduction of erosion and sedimentation caused by highway maintenance practices is also a significant goal, as is the replacement or removal of all abandoned or leaking underground fuel storage tanks at public highway facilities. Other

goals emphasize the development of design guidelines and mechanisms that can be applied basinwide and intermunicipally.

10. Groundwater and Drinking Water: There are two levels of understanding regarding the preservation of groundwater and drinking water supplies. To the majority of those residents in the southern portion of the basin (where a large percentage of people rely on groundwater as a source of drinking water supply), there is generally a recognition of the need to protect and manage groundwater resources. In the northern portion of the basin and corridor areas, where residents rely on a public water supply, there is apparently less of a concern. This issue is compounded throughout the basin because groundwater (unlike surface water) is hidden from view - as are subsequent impacts. These concerns point to a need for continuing (and broad reaching) public education on groundwater issues.

Educational efforts should be geared, not only toward land owners and residents but toward municipal officials who are involved in local land use decisions. Land uses can adversely impact individual wells and municipal groundwater supplies. Groundwater can also be impacted by roads, agriculture, and other land-use practices.

Specific goals include: preserving the maximum amount of natural

drainageways to allow for the recharge of groundwater; reducing the potential impact of contamination resulting from the storage and use of chemicals; and public education.

11. Regulatory and Institutional Issues: Concerns about regulatory controls and institutional arrangements in the Sauquoit Creek watershed tend to fall into one of five categories relating to: master planning, regulation, financing, technical guidance for decision making, and an institutional framework or centralized managing entity that fosters a basin-wide approach to decision making. In regard to master planning issues, there is a general belief that development must be accomplished in concert with transportation, environmental, and economic planning. Specifically, mixed-use development (office, business, residential) should be encouraged to occur in conjunction with land preservation, and preservation of existing open space. It is also recognized that communities need to adopt uniform stormwater and floodplain management measures that work in conjunction with a comprehensive watershed plan. This is especially true in those areas of the watershed that are nearing a finite capacity for development.

Institutional issues that relate to regulatory concerns within the basin focus on; the complexity of some regulations, the lack of certain regulations, ineffec-

tive methods of enforcement, and the lack of uniformity. There is a general recognition and agreement that many regulatory controls are reactive (using penalties to encourage compliance) rather than being preemptive and proactive (using education and volunteerism as the preferred method of compliance). There was also a general recognition that regulatory controls must be revised to be consistent from community to community and throughout the entire basin.

Concerns relating to financing questions were raised throughout the discussion of all of the issues and were commonly identified as the major obstacle which prevents the implementation of many solutions and management practices. It is recognized that, not only are funding programs relatively limited, but that the implementation of management practices can negatively impact business profits and operating budgets of public and private entities. Education and further financial analysis of specific circumstances may be beneficial to illustrate a more favorable cost/benefit ratio that encourages the implementation of best management practices.

In regard to technical guidance for decision making, there is a general need to use more accurate and appropriate sources of technical information when making land-use decisions in the watershed. In general, there is an overwhelming need to identify and imple-

ment a variety of both water quantity and water quality models in varying locations throughout the basin. Education also plays a key role in providing technical guidance for decision making.

Perhaps the most important institutional concern that relates to all other issues within the basin is the lack of a framework or mechanism that allows issues to be addressed based on the "good of the many" and the watershed as a whole. Basin communities will need to decide what administrative vehicle is most appropriate to address watershed issues, to determine how to best use available technical information, and how to guide land-use decisions in the watershed.

There are several possible options that can be used to establish a basin-wide institutional framework which are discussed in detail within Volume 6. There are also several considerations in the establishment of an effective institutional framework within the watershed. These include: the need for an identifiable administrative vehicle that has the ability to address issues from a basin-wide perspective; a need for specific and uniform regulations to provide standards, guide land use decisions, implement strategies, and provide direction for the leadership in the watershed; a need for a technical understanding of the watershed; and a need for continued financing.

As outlined by the Sauquoit Creek Basin Coordinating Committee, the broad goals and objectives for addressing regulatory and institutional issues within the basin generally focus on creating a uniformity of controls and an intermunicipal approach to management. It is also recognized that long-term planning and financing are key ingredients necessary to accomplish these goals.

12. Education: Community education, citizen involvement, participation, and cooperation are the cornerstones of any successful watershed management effort and are essential for obtaining broad-based support for proposed recommendations. Involving an educated

community in the decision making process can bring other important benefits as well. As outlined in the NYS DEC's Watershed Planning Handbook for the Control of Nonpoint Source Pollution (NYS DEC and NYS SWCD, 1994), community education and citizen involvement can lead to better overall decisions. Especially when these decisions take into account the perspectives, values, and knowledge of the community for which those decisions were made. Involving the public can also lead to greater support for future policies, programs, and projects. With regard to implementation and compliance issues, community involvement can provide a mechanism to encourage

independent action by individuals while working toward a common goal. Although there is some level of community education and citizen involvement currently taking place within the Sauquoit Creek basin, it is recognized that many of these activities are fragmented and focus only on very specific topics or existing programs.

Goals for education issues were directly, and primarily, related to the basic need to more fully understand the issues impacting the basin. The objectives which were developed as a possible ways of meeting many of these goals emphasized education concerning specific topics.

D) Summary of Existing Development, Regulatory Controls and Development Potential (Volume 5)

Effective, systematic, and institutionalized control of development activities is a key component of any plan to address water resource issues. Many layers of control already exist within the Sauquoit Creek basin. However, even with these layers of controls, it is still possible to implement development projects at a variety of scales without substantive review. Given the high probability and relatively unrestricted nature of development occurring in the basin, an analysis of development and development potential was necessary to inventory those areas where development has already occurred, identify where higher levels of

development densities are permitted, and target where those higher density developments are likely to occur in the future.

Volume 5 includes a detailed analysis of land use, development, land use controls, and development potential within the Sauquoit Creek basin. The analysis included the following steps: 1) the collection, review, and organization of existing land use plans, studies, and regulations obtained from a variety of sources including local, state, and federal agencies; 2) the analysis of demographic characteristics to provide insight into the general characteristics of the basin's population and how

these characteristics influence development (and, subsequently, the basin's water resources); 3) the inventory, mapping and analysis of existing land uses and land cover within the basin; 4) the review of applicable regulatory controls in regard to consistency with the goals and objectives of the Sauquoit Creek Basin Watershed Management Study and whether they address water resource issues impacting the basin; 5) the combined evaluation and analysis of development controls, demographic characteristics, and growth patterns so that likely development patterns could be mapped within the basin; 6) the identification of

geographic areas and municipalities where the combination of development pressure and absence of certain development controls combine to make effective management of water resource issues more difficult; and, 7) the formulation of guidance documents which recommended changes to land use controls relative to the water resource issues identified within the basin.

With regard to the analysis of demographic information, the

1990 Census for population, age, housing characteristics, income, employment and occupations was analyzed to obtain a better understanding about the age and distribution of residents within the basin; the general location and density of housing units within the basin; future development projections within the basin; how existing and future development may impact water resources within the basin; and the potential recreational use of resources within the basin.

The basin includes a total population of approximately 36,000 people. The lower portions of the basin (see Volume 5 for a definition of study areas) represents approximately 31% of the entire basin population and only 15% of the total land area. The upper basin includes only 12% of the entire basin population yet encompasses approximately 45% of the land area within the basin. The middle basin

has more of a direct relationship and contains approximately 55% of the entire basin population and 40% of the land area. Not surprisingly, similar patterns exist when examining the distribution of housing units within the basin.

The 1994 population estimates indicate that the upper

only 57% of the total housing units are connected to public sewer (compared to 90% to 99% in the other study areas), the other 42% of housing units in the upper basin rely on individual septic systems and/or cesspools. This concern is magnified by the fact that more than 40% of the housing units in the upper

| CENSUS CHARACTERISTICS | BASIN TOTAL | LOWER BASIN | MIDDLE BASIN | UPPER BASIN | CORRIDOR AREA | UPLAND AREA |
|------------------------|-------------|-------------|--------------|-------------|---------------|-------------|
| Population | 36,444 | 11,436 | 20,550 | 4,458 | 12,617 | 23,827 |
| Pop. Density/sq. mi. | 578 | 1,210 | 815 | 157 | 1,001 | 473 |

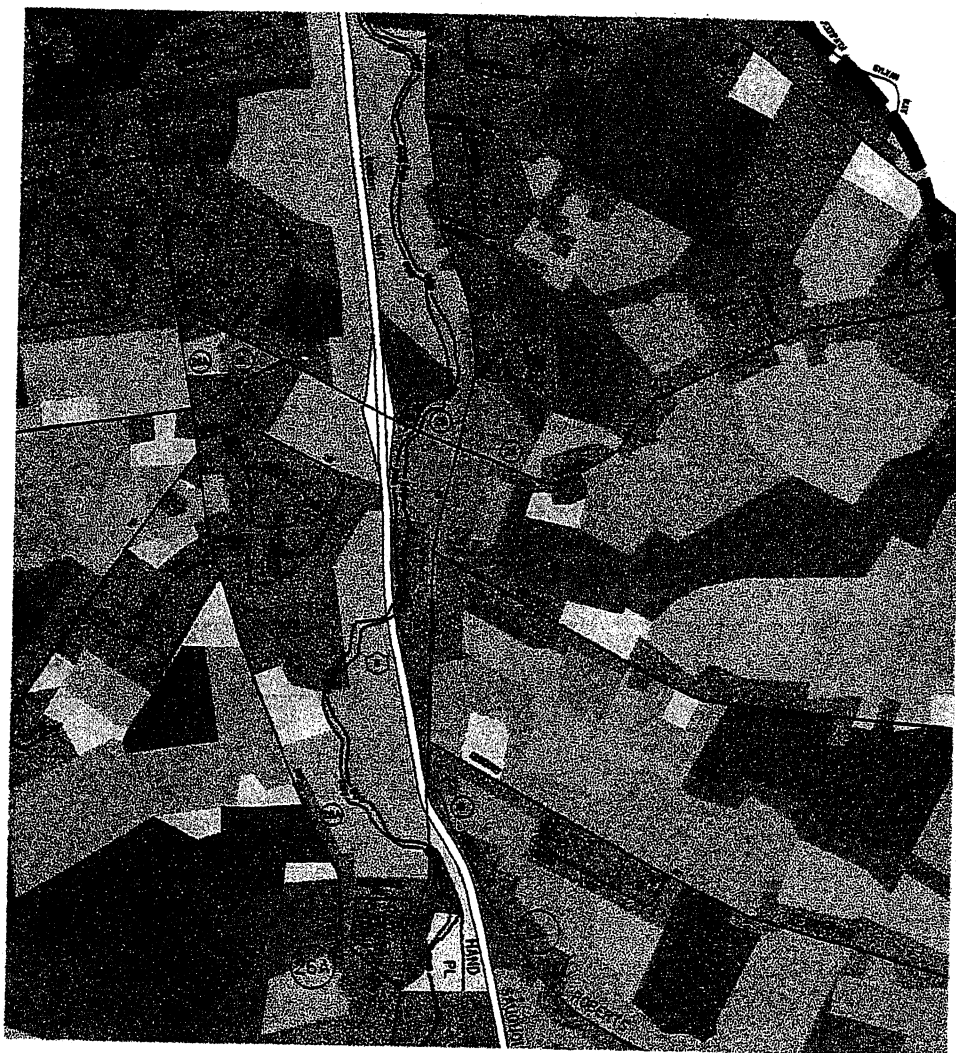
basin area is growing at a far more rapid rate than the middle or lower basins. The estimates reveal a 10.53% population growth in the Town of Paris (upper basin), compared to a .83% decline in the Town of New Hartford (middle basin), and a 1.13% growth in the Town of Whitestown (lower basin). It should be noted, however, that most of the estimated growth within the Town of Whitestown may likely be outside the basin boundaries. With this population and projected growth, these areas of development are likely to have the most impact on water resource issues within the basin.

The availability of infrastructure may itself promote more rapid growth in an area and, where infrastructure is lacking, it may also be an indicator of potential impacts to the environment such as from individual septic systems or use of groundwater in wells. For example, in the upper basin,

basin also rely on groundwater as a water supply from drilled wells, dug wells, and springs.

In regard to existing land use, a land use and land cover inventory can provide an overall characterization of groundcover types and patterns of development within the basin. Potential non-point pollution sources, such as areas with excessive stormwater runoff or agricultural runoff can also be identified. Understanding land use information and the percent of impervious surfaces associated with these land uses is an essential foundation for any watershed management program - including future water quantity and quality modeling.

A Land Use and Land Cover Survey map is provided in Volume 5 to illustrate current development patterns within the Sauquoit Creek basin. Agricultural land uses account for ap-



proximately 38% of the acreage within the basin. Scrub/brush, woodlands and open space total approximately 41% of the land area. In comparison, residential development accounts for approximately 16% of the basin's acreage.

In regard to limitations to land use development (whether physical or regulatory), an analysis was undertaken to assist in the prediction of the locations and types of future development. For example, in geographic areas where the combination of increasing development pressure and absence of development controls are combined, specific watershed manage-

ment techniques may be needed or may be more difficult to obtain. Naturally occurring or man-made physical characteristics of the watershed may also dictate where and what types of development occur within the watershed. Examples of these physical limitations include, but are not limited to: steep slopes, soil limitations, high water table, wetlands, floodplains, and the absence of water and sewer service. Some physical limitations are also subject to additional regulatory controls. For example, several levels of regulatory controls for development exist at the federal and state level.

With regard to local land use controls, all of the municipalities within the basin have enacted varying levels of land use controls. In most cases, the land use regulation includes a zoning law or zoning ordinance that governs the development of property based upon an areas' classification (ie: zone or district).

A comprehensive review of the respective zoning regulations has resulted in a summary illustrating the relative effectiveness of whether those controls addressed each of the issues identified within the basin. Specifically, the review: investigated the presence (or absence) of certain regulations; examined the procedures (ie: presence or absence of review criteria) established for local permitting and review processes; and concluded on the applicability of the regulations and processes to each of the twelve issues.

In addition to specific conclusions about each community, three broad categories were developed to characterize each community's need for water resource management in local land use controls and to provide an emphasis for modifications to their controls. These include:

- Essentially Built Out Areas - These municipalities may contribute little to an increase in water quantity because there is likely to be a negligible net increase in impervious surfaces as a result of development or redevelopment activities.

However, since most of these communities are in the lower, northern portions of the basin they will be most affected by water quantity issues originating in upstream communities (specifically the effects of flooding and stormwater runoff). Water quantity issues can be adequately addressed in "Essentially Built Out" communities through the development of institutional mechanisms. Similarly, agricultural, natural character, and wetland issues are of limited concern in these areas because of the urban character of the communities but these areas will experience the effects of these uses in upstream areas. Water quality issues should be addressed (specifically from stormwater runoff) and opportunities for recreational activities should be provided. Recreational activities and facilities may provide multi-purpose benefit to natural character, flooding, fish and wildlife, and water quality issues, as well (see *Volume 4 - Watershed Issues, Goals and Objectives* for a discussion of the interrelationship of issues). These types of communities include the City of Utica, Village of New Hartford, Village of Yorkville, Village of Whitesboro, Village of New York Mills, and the Town of Whitestown.

- Rural-Agricultural Areas - These municipalities will have little or no impact on water quantity (other than

naturally occurring stormwater runoff and drainage) due to the relatively low percentage of impervious surfaces, lack of significant development pressure, and the provision for regulated low density development. Within these communities, water quality issues such as those that may result from agricultural practices, those that relate to natural character and wetland issues, and those related to groundwater issues, will assume a greater importance. Additionally, transportation construction and maintenance practices should be addressed more specifically in these communities. These types of communities include the towns of Frankfort, Kirkland, Bridgewater, Marshall, and Litchfield.

- Potential Impact Areas - These municipalities fall within one or more of the following categories: 1) those that are experiencing ongoing development pressure; 2) those that are possessing readily developable land currently zoned for medium or high density development; and/or 3) those that are located within the urbanized corridor (possessing utility services and immediate access to major transportation networks) along Route 8. These are the municipalities that need to focus most on water quantity, quality, institutional, recreational, natural character, transportation, groundwater, and wetland issues. These types of communities

include the Town of New Hartford, Town of Paris, and Village of Clayville. Additionally, because of the presence of agriculture in both towns, these areas should address agricultural best management practices, as well.

With regard to managing land uses more consistently and more effectively with respect to water resource issues within the basin, there are a number of mechanisms available to municipalities. For example, institutional arrangements could be used - ranging from establishing a new governmental entity for the specific purpose of watershed management, to giving existing political institutions (such as county or municipal governments) new responsibilities for implementing regional strategies in the watershed.

There are also several methods currently available that could be used (singly or in combination with others) to more directly manage land use activities. These include: intermunicipal agreements; comprehensive/master planning; land use zoning including cluster development, planned unit development, incentive zoning, conditioned zoning, and overlay zoning; subdivision review; land acquisition/development rights; etc.. These methods are discussed more fully within *Volume 6 - The Watershed Management Strategy*.

Two specific methodologies are implemented within this volume to assist communities in managing land uses

more consistently and more effectively within the basin. First, detailed Guidance Memorandums were provided to each community suggesting ways to amend or otherwise modify existing

regulatory controls. Secondly, because stormwater has been recognized as a primary issue that is managed best uniformly and on a watershed basis, a model stormwater management

and erosion control regulation was developed. The model regulation was provided to each municipality as an attachment to respective Guidance Memorandums.

E) Summary of the Watershed Management Strategy (Volume 6)

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 provides for a more effective delivery of programs; reduces duplication of efforts and agency "turf battles"; identifies program gaps; clarifies agency roles and responsibilities; provides a means of identifying and obtaining future funding opportunities; and results in the overall enhancement of water resources within the Sauquoit Creek basin.

The Watershed Management Strategy (Volume 6) is the culmination of the Sauquoit Creek Basin - Watershed Management Study (Volume 1 through Volume 6) and specifically focuses on each of the major issues identified in *Volume 4 - Watershed Issues, Goals, and Objectives* in an effort to provide program recommendations and projects that can be undertaken as future funding is identified or becomes available.

The 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 program recommendations and projects

included in *Volume 6 - Watershed Management Strategy* provides the following: a brief description of the general purpose of the 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.

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 solving that specific water resource problem. 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. Following this exercise, an examination of all of the issues and their individual recommendations yielded five common programs that: would solve the greatest number of problems (multi-purpose); would

satisfy the majority of goals and objectives identified; and 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:

- Establishing a watershed-wide institutional structure and regulatory framework.
- 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 wetland in areas best suited to provide the necessary ecological functions; and (c) a floodplain management strategy.
- Implementing an integrated geographic information system (GIS) for the basin.
- Creating a Sauquoit Creek restoration and habitat enhancement program.
- Establishing a community education and citizen involvement program.

The following paragraphs summarize the primary findings and suggested projects relating to each of these multi-purpose recommendations.

1. Watershed-wide Institutional Structure and Regulatory Framework:

Municipalities, individuals, 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. Additionally, an institutional structure and regulatory framework is critical as it influences all other issues within the basin.

Previous volumes of this study note the goals and future actions needed to address each issue - regardless of the institutional structure. Volume 4 and Volume 6 note some of the detailed projects and steps necessary to meet these goals.

With regard to an institutional structure and regulatory framework, there are several options to consider in the establishment of an effective framework for watershed management. These are discussed in more detail within Volume 6 and are summarized in the following paragraphs.

First, one option considers the appropriateness of a more formal administrative vehicle that provides the framework to encourage a basinwide approach to decision making. 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 Volume 6, Section 3.2). 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.

Third, watershed protection efforts must be funded on a continuing basis, so that the established framework can be maintained (discussed within Volume 6, Section 3.3). 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 such as: slight increases in user fees; increases in local property or property transfer taxes; etc., are also possibilities.

In regard to land acquisition, methods of financing might include: donations and "bargain sales"; purchase by conservation oriented groups; and conservation easements. Similarly, 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.

A number of factors must be considered in deciding upon which methods of financing should be used. The scope and type of specific program to be funded must be fully understood. The funding mechanisms which are ultimately selected should be targeted toward the particular size and type of a specific project. There is the need to insure that a watershed entity has the standing, through state or local statutes, to impose a particular funding method. The ease at which financing can be obtained must be considered and may depend upon the general financial health of the local government and constituents.

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 Volume 6, Section 3.4). It is important for decisions about appropriate land-use control mechanisms to be guided by reliable technical information. 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. 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, a 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.

Specific projects and activities that focus on an institutional structure and regulatory framework and which are recommended within the Strategy empha-

size: the establishment of a temporary watershed based entity or committee; designation of key staff; enhancement and refinement of the Sauquoit Creek Coordinating Committee and its activities; incorporation of watershed-wide concerns into present building and zoning regulations; development of new watershed-wide guidelines; establishment of financing for a watershed entity/committee; and investigation of a structure for a permanent institutional framework.

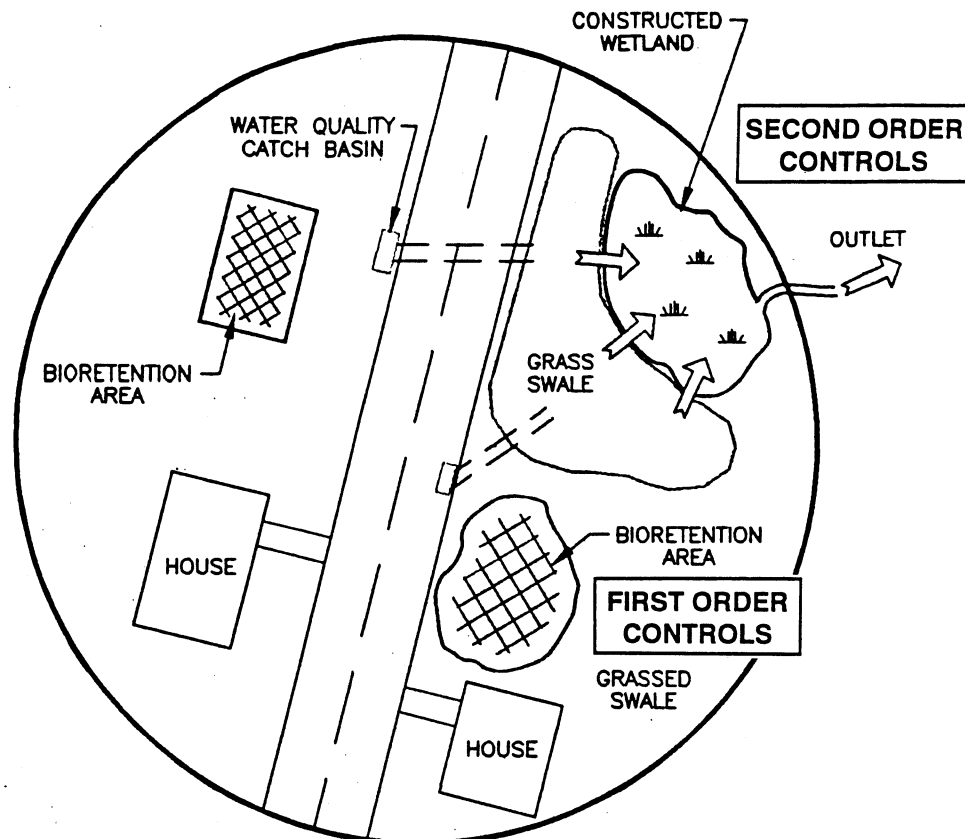
2. Comprehensive, Basin-wide Stormwater Management Program: An effective basin-wide stormwater management program should be focused on the management of both stormwater quantity and quality, and should integrate knowledge about: sources of pollutants; the movement and processing of pollutants within the hydrologic cycle; the effects of these pollutants on receiving waters and receptor communities; and how to alleviate impacts through a variety of mechanisms.

Additionally, the stormwater management program should merge the watershed perspective with the site-specific perspective. As described in *Volume 6 - Watershed Management Strategy*, this general approach can be implemented through a four-tiered classification system. This four-tiered system or "orders of

control" range from addressing activities on a site-specific basis to implementing activities at a basin-wide and regional scale. For example, on-site first-order 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 and grassed swales.

Second-order controls include BMPs that are more remotely situated (ie: at the downstream edge of a site or sites) and provide regulation of stormwater from these combined sites before it 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 a nearby creek or tributary.

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.

Fourth-order controls (such as basin-wide wetlands and/or detention facilities) provide final water quality polishing in addition to maximum flood reduction. These are almost always downstream controls and are usually less costly to construct, maintain, and operate than the equivalent benefits provided by several smaller facilities that typically result from the utilization of first-order controls. However, fourth-order controls generally require more land, and site selection may be complicated by a number of factors including public opposition.

As it relates to regulatory controls, 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 - particularly at the site plan review stage. Specific preconstruction criteria are discussed in more detail within Volume 6.

Additionally, Volume 6 suggests the development of plans and the implementation of a greenway buffer system as a pilot project. Such a project would immediately benefit a broad cross-section of the community and would build a greenway constituency. The project would demonstrate what a greenway is and what it has to offer. A number of

suggestions are included for setting up a successful greenway pilot project within the Sauquoit Creek basin.

Other recommended projects and activities that focus on the development of a basin-wide stormwater management plan and which are recommended within the Strategy emphasize: the development and implementation of a model stormwater management ordinance; the integration of watershed-wide stormwater management concerns into existing local land use controls; the identification of criteria and desired benefits for establishing a four-tiered management approach within the basin; and the identification of probable locations for first-, second-, third-, and fourth-order controls.

3. Integrated Geographic Information System

(GIS): A geographic information system (GIS) can greatly assist to accomplish 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.).

Basic components of a geographic information system should include -

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.

With regard to the GIS database, is important to establish an ongoing process for identifying what data is available. Data layers and information can be added or modified as needed. However, there has been very little standardization in the collection of data. As such, there is a need to establish a framework for policies, standards, guidelines, and procedures for the development, functioning, management and maintenance of a geographic information system. An operational prototype GIS should be established first to test the preprocessing, analysis, and postprocessing of data. 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.

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.

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.

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 important for the evaluation of impacts of proposed land-uses and alternative control measures.

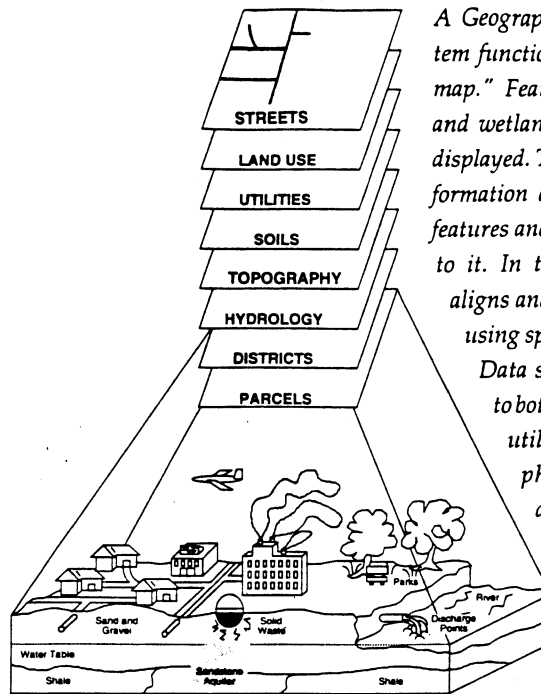
Specific projects and activities that focus on the development of an integrated GIS and which are recommended within the Watershed Management Strategy emphasize: the investigation of an institutional arrangement for managing a GIS for the

basin; the designation of an individual or point agency to begin to develop the GIS system for the basin; the establishment of a pilot GIS system based on existing data and PC ARC/INFO; the development of a digital base map for the basin; and the prioritization of digital information necessary for a full-scale GIS system.

4. Restoration and Habitat 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. 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.

In regard to evaluating stream system functions, it is necessary to develop a thorough understanding of the stream system, sources of contamination, and location of these pollutants that may be posing a threat to the watershed. Much of this work has been completed and is included within the discussions in



The real world consists of many geographies

A Geographic Information System functions as an "intelligent map." Features such as streets and wetlands can be stored and displayed. The GIS also stores information associated with these features and provides easy access to it. In this illustration, GIS aligns and overlays map layers using specified combinations. Data sets may include (top to bottom) streets, land use, utilities, soils, topography, hydrology, districts and parcels. The map on the bottom combines all of these elements.

Volume 4 - Watershed Issues, Goals, and Objectives.

Additional 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 also necessary for a restoration and enhancement program.

Once necessary data has been collected, a list of potential restoration techniques and the requirements for each restoration technique that would be applicable to specific areas should be compiled. For example, bioengineering can be used as a methodology to restore natural meanders and stream bank conditions to their original conditions. Specific requirements might include the installation of

bioengineered bank stabilization and the replanting of riparian zones. 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.

As part of the overall program, a cyclical program for assessing and evaluating specific stream restoration and enhancement projects should be developed.

Specific projects and activities that focus on the development of a restoration and habitat enhancement program and which are recommended within the Watershed Management Strategy emphasize:

establishing management boundaries in which to implement restoration and enhancement projects; evaluating stream system functions; establishing baseline data; prioritizing specific segments of the stream corridor in which restoration or enhancement activities should occur; inventorying and integrating existing structural and historic resources into restoration and enhancement projects; developing guidelines to minimize impacts to water quality and quantity; enhancing recreational opportunities; protecting sensitive areas through the preparation of a comprehensive basin-wide recreation plan; maintaining and enhancing habitats for fish and wildlife; etc..

5. Community Education and Citizen Involvement Program:

An effective community education and citizen involvement program has two basic but integrated components. 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.

Previous volumes of this study illustrate how

different segments of the population are interested in different aspects of an overall watershed management program. These 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: 1) key "staff" and decision makers; 2) stakeholders, political leaders, and advisory committee members; 3) the media; 4) special interest groups; and 5) the general public.

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.

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. The public awareness plan is best developed as a group participation activity.

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 outlined above, including: the institutional framework, the stormwater management plan (including greenway plan), the GIS system, and the Sauquoit Creek restoration plan.

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. The full text of Volume 6 outlines some of these techniques.

One of the most 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. For example, the establish-

ment of a watershed demonstration park as a permanent feature within the watershed is one possible avenue. 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.

Additionally, 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 busi-

nesses 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 is included in Volume 6.

SECTION 2.3

THE NEXT STEPS

The Multi-purpose Projects and Program Recommendations found at the end of each respective chapter 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 in Volume 6.

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.

The HOCCPP staff is available to assist communities and agencies within the basin that are interested in the initial organization and start-up of a basin steering committee. This committee 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.

HOCCPP staff is able to assist the committee in meetings and provide administrative support which 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; development of meeting agenda; the documentation of initial meeting minutes; etc.. Important goals for the committee will be to establish a continuing, long-term structure that is agreeable to basin municipalites 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.

In an effort to support such activities, HOCCPP staff will continue to investigate

potential funding sources and has already initiated some of the activities outlined

in Volume 6 - Watershed Management Strategy.

