Keuka Lake Looking Ahead

A Community Listens to the Lake

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Watershed Project Committee

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LIST OF ACRONYMS

ABSTAT - a computer program to develop survey statistics
AEM - Agricultural Environmental Management
AG - Agriculture
AMU - animal units per farm
BMP's - Best Management Practices
BT - Brown Trout
C - degrees centigrade
CDM - Camp Dress and McKee
CCE - Cornell Cooperative Extension
CERCLA - hazardous waste municipal landfill site
CFS - cubic feet per second
CTH - Cooperating Timber Harvesters
DDT - banned pesticide that accumulates to toxic concentrations in fish and birds
DEC - Department of Environmental Conservation
DO - dissolved oxygen
1,2 Dichloroethane (1,2 DCE)-carcinogenic organic compound
ENB - Environmental Notice Bulletin
EQIP - Environmental Quality Incentives Program
EASI - Erosion and Sediment Inventory
F - degrees Farenheit
FASL - Feet Above Sea Level
FDA - Food and Drug Administration
FS - Feasibility study
GIS - Geographic Information System
GLPF - Great Lakes Protection Fund
GML - General Municipal Law
GWLF - Generalized Watershed Loading Function
HEL - Highly erodible soil
IPM - Integrated Pest Management
IRM - Intermediate Remediation Measure
KLA - Keuka Lake Association
KLF - Keuka Lake Foundation
KLLA - Keuka Lake Looking Ahead
KLW - Keuka Lake Watershed
KLOC - Keuka Lake Outlet Compact
KLWP - Keuka Lake Watershed Project
KWIC - Keuka Watershed Improvement Cooperative
LLS - Land Locked Salmon
LT - Lake Trout
mg/l - milligrams/liter
ug/l - micrograms/liter
MMHOS - unit of conductivity (electrical)
MOSF - Major Oil Storage Facility
NPS - Nonpoint source
NPURG - pesticide leaching model
NRCS - Natural Resources Conservation Services
NYSDEC - New York State Department of Environmental Conservation
NYSDOH - New York State Department of Health
NYSDOL - New York State Department of Law
NYSDOT - New York State Department of Transportation
OHM - unit of electrical resistance
PCS - Permit Compliance System
P:N - Phosphorus to nitrogen ratio
pH - scale measure of acid and base, (7.0-neutral; 6.0-acid; 8.0-base)
PPB - Parts per billion

LIST OF ACRONYMS (continued)

PBS - Petroleum Bulk Storage
PPM - Parts per million
PRAP - Proposed Remedial Action Plan
PRP - Potentially Responsible Parties
PWP (impairment) - Priority Watershed Program
PYMUB - Penn Yan Municipal Board
RAW - Remedial Action Worksheet
RCRA - Resource Conservation and Recovery Act
RI/FS - Remedial Investigation/Feasibility Study
ROW -Right of Way
RT - Rainbow Trout
RTK - Right To Know
RISE - Responsible industry for a Sound Environment
SCPD - Steuben County Planning Department
SRP - Soluble Reactive Phosphorus
SUNY - State University of New York
SWCD - Soil and Water Conservation District
TCE - Trichloroethylene
TKN - Total Kjeldahl Nitrogen
TP - Total Phosphorus
TSS - Total Suspended Solids
USDA - United States Department ofAgriculture
USEPA - United States Environmental Protection Agency
USGS - United States Geological Service
USLE - Universal Soil Loss Equation
VOC - Volatile Organic Compounds
WPC - Watershed Project Committee
WQCC - Water Quality Coordinating Committee
SPDES - State Pollutant Discharge Elimination System
YCPD - Yates County Planning Department

EXECUTIVE SUMMARY

The Keuka Lake watershed provides an outstanding quality of life for residents and visitors alike. The watershed is the area around the lake that drains 175 square miles of land area in Yates and Steuben county and includes an estimated 18,120 people in 1989. The lake provides high quality drinking water for nearly 20,000 people served by municipal sources and over 2,800 shoreline residences which draw water directly from the lake. Tourism and recreation is significant to the area's local economy and relies on the natural beauty and quality of the water. According to the Finger Lakes Association, the total economic impact of tourism and recreation in Yates and Steuben County nearly $80 million in 1995, much of which can be attributed to the beauty and quality of the lakes. There were also an estimated 135,000 fishing trips taken in 1988 on Keuka Lake with an estimated economic impact exceeding $5,000,000 (NYSDEC, 1990).

The assessed value of lakeshore properties is nearly $600 million, representing up to 70% of some of the town's tax base. Studies on Lake Champlain have shown that up to 20% of the value of lake property is directly related to lake water quality indicators. All of the economic benefits described clearly indicate the importance of maintaining and protecting water quality in the watershed. Of course, some values such as the scenic beauty of the lake, are difficult, if not impossible to quantify, yet they too are important to the quality of life in the watershed.

The quality of the lake, groundwater and streams depends on the activities which occur in the watershed. Seventeen potential sources of pollution were analyzed for their potential impact on the lake, watershed and 29 subwatersheds. For some pollution sources, insufficient data were available to make a detailed assessment; in other cases, good information was used to recommend appropriate measures. While the overall quality of water in the watershed is very good, documented evidence of pollution impacts and impairments suggests the need for a proactive approach to managing the watershed's resources. Furthermore, as more land is converted to residential uses, more stress and direct impact on water quality is likely.

Fortunately, many potential sources of pollution can be prevented or eliminated with the use of practical and economical measures defined as "Best Management Practices". Pollution Prevention Worksheets" (PPW) were developed in the report for each pollution source. Each PPW details a menu of activities to prevent pollution and/or studies to investigate the pollution source further.

In order to implement appropriate pollution prevention measures or initiate further studies to gather more information, an implementation plan is needed. The implementation plan will be the "blueprint" for what will be done, who will do it, and when it will be started and accomplished. The plan should be developed by those who have an interest (economic or otherwise) and/or responsibility for what goes on in the watershed. These stakeholders may include such entities as municipalities, agencies, organizations, businesses, and individuals. The State of the Lake Report provides the scientific guidance needed to formulated a community-based watershed implementation plan. Once completed, the actions will protect and improve the watershed resources for future generations while accommodating economic growth and development.

BACKGROUND

PROJECT HISTORY

Since 1956, the Keuka Lake Association (formerly the Keuka Shoreline Property Owners Association) has worked to enhance and protect the purity of Keuka Lake. In the early 1960's the Association was instrumental in helping the municipalities around Keuka form what was know as the "Perimeter Committee". This group was organized to help promote uniform regulation and enforcement of septic systems around the lake. Through the 1960's to early 1980's, one watershed inspector hired through Penn Yan, patrolled the perimeter of the lake and approved designs for septics. Each of the municipalities contributed an agreed upon share to Penn Yan to pay for the program and monthly meetings of the Committee were held, represented by the Chief Executive of each municipality. The watershed inspection program worked very well for a number of years and demonstrated a unique partnership between the municipalities in the watershed not seen elsewhere in New York State.

In the early 1980's, several of the towns pulled out from the Perimeter Committee inspection program. Several of the towns hired their own inspectors and passed different laws pertaining to septics. By the mid 1980's, there was a growing perception by the public that there was a lack of uniformity in the septic system area in the watershed. In the late 1980's, the Yates County Soil and Water Conservation District, working with Cornell University, conducted a number of surveys and investigations, as well as discussions to revive the Perimeter Committee or an analogous organization. At the time, some off the municipalities showed an interest in reviving a watershed organization, but the effort did not result in the formation of a watershed entity.

In 1989, the Keuka Lake Association conducted a poll of it's membership and found that water quality protection was the number one priority. They also found that the lack of uniformity in laws and enforcement was the biggest obstacle facing the long-term protection of the lake. In response, the KLA contacted a number of organizations, including the Soil and Water Conservation Districts, Planning Departments, Cornell University, Cooperative Extension, state legislators, Water Resources Institute, and other lake associations. The KLA determined that they were the only watershed-wide group that could take responsibility to try and correct this perceived problem and formed the Keuka Lake Watershed Task Force and started the Keuka Lake Watershed Project.

In 1991, the Task Force raised $150,000 for the two-year project and hired a Watershed Project Director. The mission of the Keuka Lake Watershed Project was to form a community supported watershed protection program to enhance and protect Keuka Lake. After two years of working with the municipalities, the municipalities formed the Keuka Watershed Improvement Cooperative by signing an inter-municipal agreement in December of 1993. The purpose of the KWIC is to protect and improve the purity of waters in the Keuka Lake watershed and the primary focus in on septic system management. The KWIC also has the authority to pursue appropriate actions to address other threats to Keuka Lake in a cooperative and uniform action, consistent with their home-rule authority.

In 1995, the Keuka Lake Association's nonprofit arm, the Keuka Lake Foundation, received funding of $50,000 from the New York State Great Lake's Protection Fund to undertake the development of a comprehensive watershed management plan. The project is the focus of this report and is entitled, "Keuka Lake Looking Ahead". KLLA is community-based cooperative effort between a number of organizations including the KWIC and the local county agencies. The development of the management plan for Keuka follows work completed for Canandaigua Lake where the first watershed planning guide was tested in 1994. A number of KLLA project participants also participated in the Keuka study and have helped to improve several of the methods found herein.

Watershed management will ultimately be carried out on a state-wide scale in New York as watershed protection and nonpoint source pollution prevention become increasingly important. Both the Canandaigua and Keuka Lake watershed projects serve as state-wide models demonstrating cooperative, community-based planning, assessment, and action to preserve and protect water resources from nonpoint source pollution.

A key component of watershed management planning is public education and involvement. A public policy education model emphasizing public awareness, concern, and involvement has been used by the Keuka Lake Looking Ahead Project as the basis for this part of the program.

PARTICIPANTS

The Keuka Lake Foundation is the lead organization for the project. The Keuka Lake Foundation is the nonprofit arm of the Keuka Lake Association. The KLA is a watershed member organization with nearly 2,000 individual, family and business members. The KLA and KLF have a Board of Directors and an Executive Committee, which provided overall direction and support for the project.

A Watershed Project Committee was formed by the KLF to conduct the Keuka Lake Looking Ahead study. Peter Landre of Cornell Cooperative Extension, was the Committee Chairman and Project Manager and Les Travis, Yates County Soil and Water Conservation District, served as Chairman for the Agriculture Subcommittee. Approximately two dozen other participants were on the WPC from county and state agencies, universities, KLA and other organizations. The Agriculture Subcommittee was primarily composed of farmers in the watershed and agriculture agency personnel.

At the beginning of the study, an agreement was sent out to potential stakeholders in the watershed for their review and response. The following is a copy of the agreement:

The Keuka Lake Watershed Study

A Call for Cooperation and Action

The Keuka Lake Foundation and the Keuka Watershed Improvement Cooperative offer an agreement for the Keuka Lake Watershed as a shared vision of the present and future condition of the watershed's lands and waters. **The purpose of the agreement is to encourage continued cooperation and participation in the development and implementation of a**

community-based watershed management plan. The management plan is being privately funded by the Keuka Lake Foundation using a $50,000 grant from the New York State Great Lakes Protection Fund.

Signers of this document support the ideals of the vision and agree to act consistently with the study's plan to protect the integrity of the watershed.

Representatives of agencies, local and regional governments, non-governmental organizations, private sector interests, and private individuals are encouraged to sign.

DEFINITIONS

The Keuka Lake Watershed is an outstanding local and regional resource, consisting of 100,800 acres of land area draining into the lake. The "hills" around the lake roughly define the lake and its boundaries can be located on topographic maps and confirmed in the field.

The Keuka Lake watershed comprises parts of Yates and Steuben Counties, the Towns of Barrington, Milo, Wayne, Urbana, Pulteney, Jerusalem, Potter, Benton, Wheeler, Bath and the Villages of Penn Yan and Hammondsport.

GOALS

- To promote a cooperative and comprehensive approach to the enhancement of the quality of life in the Keuka Lake watershed
- To protect and enhance the quality of Keuka Lake
- To encourage and improve management practices in the Keuka Lake watershed
- To successfully complete a locally-directed program of public policy education for water quality improvement by local adoption of a watershed compact and management plan
- To facilitate broad-based community involvement and support to protect and enhance water quality in the watershed
- To provide an educational program to increase awareness and appreciation and foster responsible use of watershed resources

STATEMENT OF VALUES AND INTERESTS

There are many legitimate interests in watershed lands and waters. These are some of the major ones.

- The highest and best use of Keuka Lake is as a pure source of public drinking water. Currently, twenty thousand persons rely on Keuka Lake for drinking water. About three-quarters of a million dollars in revenues were generated by Penn Yan and Hammondsport for drinking water in 1995. The cost of developing an alternative source has never been assessed.

- The lake is used for recreation by residents and attracts thousands of visitors. The estimated recreational value in 1995 is more than ten million dollars. There is no doubt that Keuka Lake is a major economic "engine" for the region. When multiplier factors are applied to the recreation and tourism dollars, the lake's value is staggering.

- About one hundred businesses were identified as operating wholly or partially in the Keuka Lake watershed.

- Over 400 farms, comprising more than 34,000 acres, depend on the continued fertility of watershed lands and cleanliness of its waters for the success of their agricultural ventures. There is no end in sight to society's need for food, fiber and clean water.

- Twenty thousand people reside in the Keuka Lake watershed, and many others own seasonal vacation homes. The assessed real estate value of lakeshore properties in 1991 is six hundred million dollars. Up to seventy percent of town taxes are derived from lakeshore properties and they have been shown to be sensitive to perceptions of water pollution.

Watershed land and water has many values; some may be calculated and others are beyond enumeration. Some of the values difficult or impossible to calculate, but nonetheless present, are scenic, aesthetic, climatic, habitat, healthful and ecological. Some of these values cannot be calculated from a solely human view-point.

PRINCIPLES

- All water in the landscape is interconnected. The water cycle not only runs past but through us.

- Water does not respect property lines or political boundaries. We cannot pollute water in one place and expect it to remain pure in another.

- Water is essential to life. The acknowledged highest and best use of Keuka Lake is as a pure source of drinking water.

- Many human activities intensify the normal "aging" processes of water bodies.

- Actions which may seem reasonable from an individual point-of-view will not always be responsible group behavior.

- Most people are unaware of the impact of their actions on water quality.

- Understanding the connections between actions and impacts will help people to choose to act in a more "water-friendly" way. Good stewardship requires active programs of public education.

- Prevention of pollution is almost always less expensive and more effective than the treatment of problems.

- By most standards, Keuka Lake remains relatively clean and healthy; water quality problems which exist in certain areas at certain times should be regarded as early-warning signs.

- People have a right to live in a healthy environment and to use natural resources within the sustaining limits of the environment's health and integrity.

- The economic well-being of human communities in the Keuka Lake watershed is interdependent with the health and integrity of the environment.

- Maintenance and improvement of the watershed's integrity should be a guiding principle for local decision-making.

- Practical, cost effective measures are available to prevent the degradation of Keuka Lake watershed's natural resources.

- We acknowledge the need for a coordinated research program to develop the best available research and historic data into a common sense watershed management plan. The plan will serve as blue-print for understanding and protecting the resource into the future and will be forwarded to the Keuka Watershed Improvement Cooperative for their review and action.

DISCUSSION

- No single entity regulates or manages Keuka Lake and its watershed; the responsibility is shared by many governments, agencies, organizations and individuals.

- "Shared responsibility" does not mean that no one is responsible; rather, it demonstrates the need for cooperation. The Keuka Watershed Improvement Cooperative represents a focus for intermunicipal cooperation vital to protecting and enhancing the purity of Keuka Lake.

- Voluntary compliance is the most effective means of caring for the watershed's resources. Regulations are best accepted by citizens who understand the reasoning behind the laws.

- Within a watershed, consistent enforcement of uniform regulations best protects water quality.

- Thorough discussions of policy and active public participation lead to good regulatory systems.

- Decisions about the location, density, and type of land use affect the environment, economy, and quality of life for all residents of the Keuka Lake watershed.

- Few individual land use decisions create profound changes, but cumulative effects of incremental decisions can drastically alter the watershed.

- Local governments have primary responsibility for land use planning and management decisions under the provisions of "home rule." Their powers are exercised to protect public health, safety and general welfare.

- Past development within the watershed, especially near Keuka Lake and along its upland tributaries, has contributed to the degradation of water resources.

- Though instances of degradation have been localized and temporary, they should be regarded as warnings that preventive and corrective measures are needed to protect the future of watershed lands and water.

- We should seek to re-affirm our ties to the watershed by encouraging development activities which are well-planned, visually pleasing, biologically sound and preserve the watershed's integrity.

- Integrity is the ability to self-organize and adapt to diverse changes and may be natural as in the watershed's wild areas, or cultural as in the proper stewardship of the watershed's wild areas, or cultural as in the proper stewardship of the watershed's developed areas. A measure of natural integrity is the abundance and diversity of native species living in natural communities and habitats.

AGREEMENT

Whereas we are in agreement with the goals of this study; and whereas we acknowledge the importance, value and integrity of Keuka Lake and its watershed area and our reliance on its natural resources; and

whereas we recognize and accept our responsibility to care for the resources of the Keuka Lake watershed so that they may be available for the use and enjoyment of present and future generations; and

whereas we realize that inaction and lack of proper stewardship can damage and diminish the value of Keuka Lake watershed resources; and

whereas we wish to associate and coordinate our activities in such a way as to have the most beneficial effect;

therefore we agree to cooperate for the long-term benefit of the watershed, its residents and users.

Three dozen groups signed the agreement as a gesture of their support. The following is a list of the signers of the agreement:

Cornell Cooperative Extension - Steuben County
Cornell Cooperative Extension - Yates County
Izaak Walton League
Keuka Lake Association
Keuka Watershed Improvement Cooperative

- Town of Barrington
- Town of Benton
- Town of Jerusalem
- Town of Milo
- Town of Pulteney
- Town of Urbana
- Town of Wayne
- Village of Hammondsport
- Village of Penn Yan

New York State Department of Environmental Conservation - Region 8
New York State Department of Health - Geneva District
New York State Soil and Water Conservation Committee
Finger Lakes Office of Parks, Recreation and Historic Preservation
Penn Yan Grange
Southern Tier Central Regional Planning and Development Board
Steuben County Soil and Water Conservation District
Steuben County Environmental Management Council
Steuben County Legislature
Steuben County Trout Unlimited
Sullivan Trail Resource Conservation and Development Office
USDA Farm Service Agency - Steuben County
USDA Farm Service Agency - Yates County
USDA Natural Resources Conservation Service - Steuben County
USDA Natural Resources Conservation Service - Yates County
Yates County Chamber of Commerce
Yates County Industrial Development Agency
Yates County Legislature
Yates County Soil and Water Conservation District
Yates County Water Resources Alliance

PROCESS

A Plan of Work was developed by the Project Manager and was submitted for approval by the KLF and Great Lakes Protection Fund. Several agencies were subcontracted to perform specific work tasks outlined in the Plan of Work. The Plan of Work for Phase I (1995-1996) was based on completing the first seven chapters of the management plan following the outline from the Canandaigua Lake report. The remainder of the plan was completed under Phase II (1996-1998) of the grant.

The overall objective of Keuka Lake Looking Ahead was to develop a management plan to preserve and enhance the water quality in the Keuka Lake watershed. To achieve the overall goal, the primary objectives were:

1) To organize a watershed task force made up of agency staff, local officials, citizens and non-profit organizations to cooperatively undertake the watershed study, outreach and make recommendations.

2) To inventory and evaluate existing water quality and potential sources of pollution and impact water quality.

3) To identify pollution prevention strategies to meet water quality goals and minimize water pollution.

4) To develop a management plan with recommendations for implementation that describe a coordinated program of effective actions.

FUNDING

The Keuka Lake Foundation received two grants totaling $50,000 from the New York State Great Lakes Protection Fund to develop the plan. In-kind services representing $150,000 were contributed to the project by local, county, state agency personnel and KLA volunteers.

SCOPE

Keuka Lake Looking Ahead-1996 was developed as part of the Keuka Lake Watershed Project; a project funded by the Keuka Lake Association since 1991. This document was prepared by the Watershed Project Committee utilizing the *Watershed Planning Handbook for the Control of Nonpoint Source Pollution,* a guide to assist communities in developing comprehensive plans for managing nonpoint sources of pollution within a watershed area and the *State of the Canandaigua Lake Watershed-1994.*

The purpose of this report is to provide information to citizens, businesses, elected officials, and community planners for implementing actions to protect the integrity of the watershed. The information can be used to make decisions regarding land and water resources and the "hows" and "whys" of land and water use protection and regulation.

Finding solutions to nonpoint source pollution problems is not a simple task. There are, nevertheless, certain logical steps leading to the preparation of a nonpoint source water pollution control plan that contains specific solutions or strategies for addressing problems.

Keuka Lake Looking Ahead is intended to be a guide, not a prescription, for understanding and protecting water quality. The KLA has identified additional nonpoint source areas that require further investigation and analysis. For example, the need for a more comprehensive stream monitoring program was identified by this project.

Keuka Lake Looking Ahead contains an enormous amount of detailed information and analysis that needs to be released and discussed by a broad range of watershed users or stakeholders. This document presents the required information to develop a watershed implementation plan to remediate existing nonpoint source problems and/or prevent new problems from occurring.

The release of this document is an enormous step forward in providing the necessary documentation and rationale for a formal watershed management plan. For the first time, a comprehensive watershed report has been prepared for Keuka Lake that inventories and evaluates sources of pollution and their impact on the lake.

While the need for additional assessment has been identified, *Keuka Lake Looking Ahead* provides sound rationale for the implementation of nonpoint source pollution prevention techniques, such as stormwater management and soil erosion and sedimentation control.

Effective watershed management requires a concerted, cooperative effort by the entire community - homeowners, business, farmers, developers, foresters, environmentalists, and local officials. All members of the watershed community share in the benefits of a high quality water resource which is critical to a community's health, aesthetic appeal and economic well-being. Together, the watershed community can protect the watershed integrity for present and future generations.

STATEMENT OF GOALS AND OBJECTIVES

KEUKA LAKE WATERSHED PROJECT

The Keuka Lake Association formed a watershed task force in 1991 to act as a catalyst for water resource protection efforts within the watershed. The task force initiated the Keuka Lake Watershed Project the same year and hired a project director. The first two years of the project focused on developing baseline information and developing intermunicipal cooperation. These efforts resulted in the formation of the Keuka Watershed Improvement Cooperative and the adoption of a uniform wastewater law. Since 1993, the Watershed Project has worked towards the development of a comprehensive watershed management plan. This efforts has been funded by a number of organizations including the Taylor Foundation, Open Space Institute, Keuka Lake Foundation, and a number of special events in the watershed. In 1995, the Foundation was awarded a Great Lakes Protection Fund grant for the project, Keuka Lake Looking Ahead, and this document represents the culmination of these efforts.

The Keuka Lake Foundation organized a Watershed Project Committee to serve as the multi-organization group to work on the plan. The WPC is made up of local citizens representing the municipalities within the boundaries of the watershed, staff people representing public and private agencies and members of private organizations that have a vital interest in watershed management activities and other interested parties.

The overall goal of the Keuka Lake Foundation is to coordinate a comprehensive approach to the protection of water resources and the enhancement of the quality of life in the Keuka Lake watershed by increasing awareness of the area's cultural, natural, and socio-economic resources. To meet this goal, the Keuka Lake Foundation functions as an umbrella organization to coordinate the efforts of public and private groups which have a stake in protecting Keuka Lake and its watershed.

The Keuka Lake Foundation seeks to:

- influence public policy to protect and enhance water quality in the watershed;
- facilitate broad-based community involvement and support through the public policy process;
- provide for an educational program to increase awareness and appreciation and foster responsible use of watershed resources.

OBJECTIVES OF THIS PLANNING GUIDE

The goal of this guide is to develop practical information which can be used by decision-makers and residents to protect and improve water quality in the Keuka Lake watershed. Specifically, the guide is designed to meet the following informational objectives:

- Provide a comprehensive inventory of watershed resources;

- Summarize and assess the physical, chemical, and biological conditions of Keuka Lake;
- Identify and prioritize sources of pollution within the watershed; and
- Identify appropriate strategies to reduce or prevent pollution from entering surface or groundwater in the watershed.

The inventory and recommendations which appear in the guide are based on the best available information. Information gaps and further studies are recognized and cited within the document. While more work can and should be done to verify certain problems, many of the recommendations can be implemented based on current knowledge and "common sense". The recommendations are intended for use by municipal officials, local organizations and agencies, and concerned citizens to help establish effective policies and practices that will protect watershed resources and sustain the economic viability of the region.

GENERAL DESCRIPTION OF THE WATERSHED

WATER RESOURCES

The principal water resource of the Keuka Lake watershed is Keuka Lake, in the center of the Finger Lake draining through Seneca Lake, Seneca River, Oswego River and ultimately into Lake Ontario (see Figure 5-1). Keuka is the third largest of the Finger Lakes in volume and size, occupying about 11,614 acres. The lake is 19.6 miles long, an average of 0.71 miles wide, a maximum of 186 and a mean of 100 feet deep, and contains about 375 billion gallons of water.

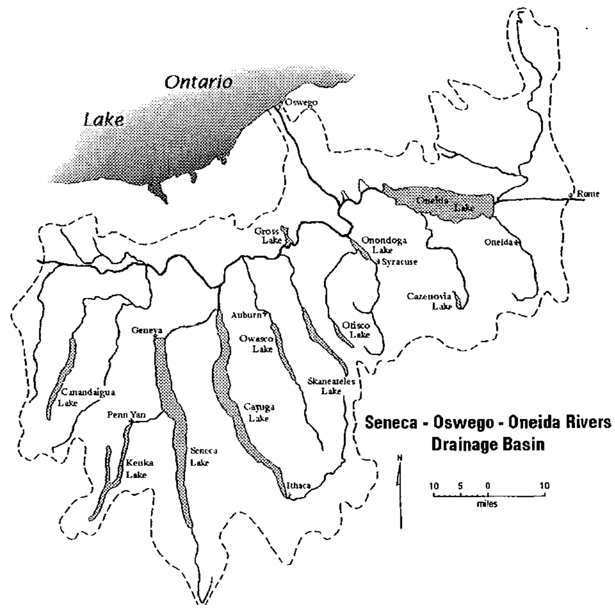

Figure 5-1. Finger Lakes drainage basin.

Keuka Lake is drained by the Keuka Outlet at Penn Yan. The Outlet is 8 miles long from Penn Yan to Dresdan on Seneca Lake. The elevation drop of the Outlet is 270 feet, creating an average gradient of 33.75 feet per mile, comparable to the Colorado River through the Grand Canyon.

The lake is controlled by a set of gates, owned by the Keuka Lake Outlet Compact (KLOC) and operated by the Village of Penn Yan's Municipal Utility Board. The KLOC is a board consisting of the eight supervisors and mayor of the municipalities around Keuka Lake. In 1994, three new six foot gates were added to the three existing gates (Birkett and two Andrews gates) to provide

The quantity and quality of water in Keuka Lake depends on the water draining into the lake from surrounding land or the watershed. The watershed boundary is often far away from the lake itself, crossing many political boundaries and roughly defined by the hills surrounding the lake.

Most of the water reaching the lake arrives via the major tributaries (see Figure 5-2). The tributaries further divide the watershed into definable hydrologic units or subwatersheds. In this guide, the entire watershed and each of the subwatersheds have been characterized and evaluated. The drainage basin of Keuka Lake, including the lake surface, measures 174 square miles or 111,360 acres. For the purpose of this study, the watershed has been divided into 29 subwatersheds. Principal streams flowing into Keuka Lake include: Sugar Creek, Chidsey Point, Knotty Pine, Wagener Glenn, Urbana Point, Glen Brook, Cold Brook, Mount Washington, Day Road, Eggleston Glen, Willow Grove, and Brandy Bay. Many more streams drain into Keuka Lake, however, most of these are small and intermittent. For the remainder of the watershed direct drainage areas were identified for separate study. The direct drainage areas include Branchport, Coryell, Boyd Hill, Armstrong Road, Pulteney, Urbana, Grove Springs, Keuka Village, Barrington, Milo, Jerusalem, East Bluff and West Bluff.

Many of the wetlands of the Keuka Lake watershed have been drained and/or filled for development and agricultural use. Upland, lakeside and streamside wetlands have been mostly eliminated, except for small remnants. The wetland system at the north end of the lake and along the outlet has been fragmented, channelized and developed for residential and municipal uses. Three lakeside wetlands, at Penn Yan, Branchport, and Hammondsport, exist today. A few wetlands exist in the Sugar Creek, Cold Brook, Chidsey Point, and Brandy Bay subwatersheds.

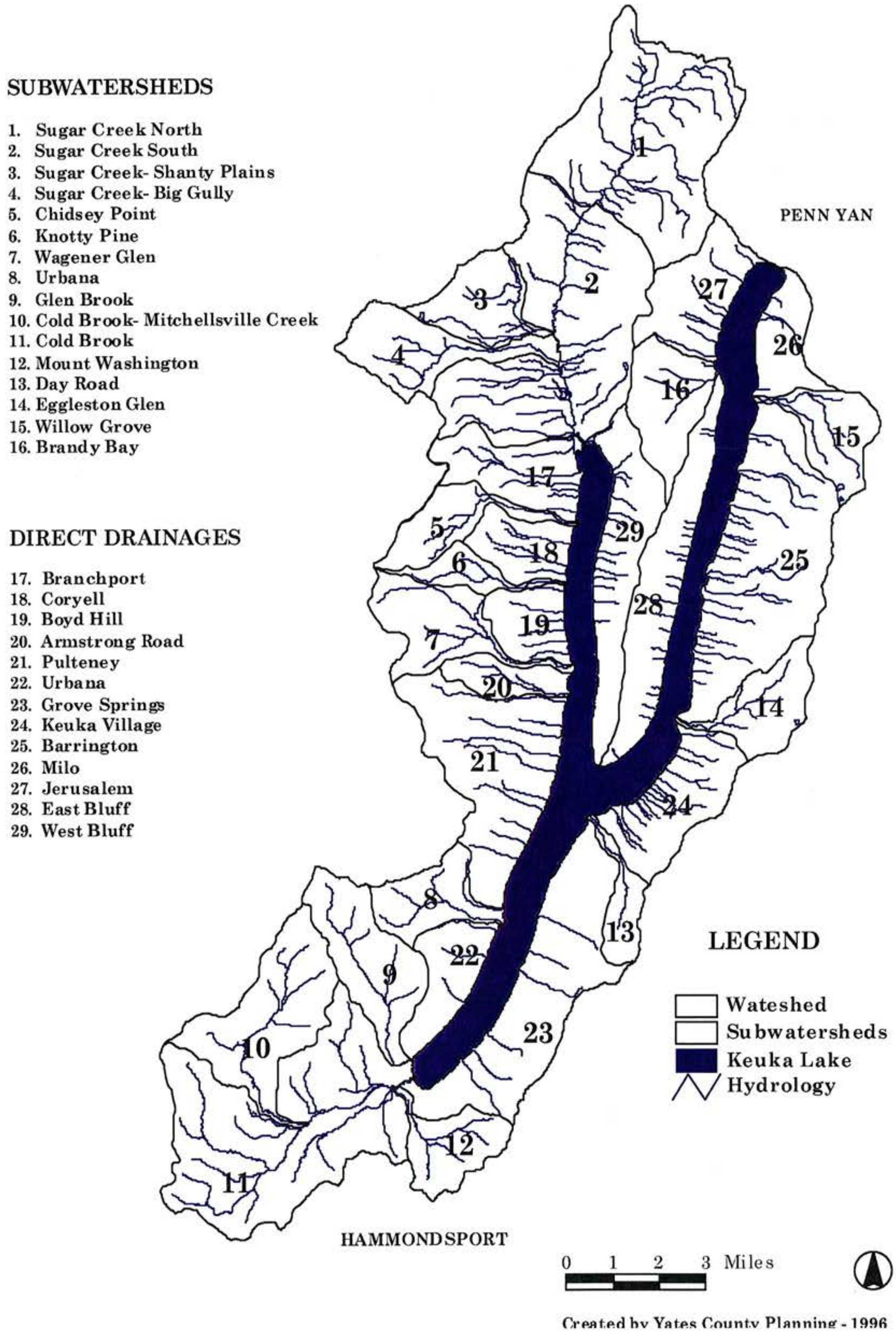

Figure 5-2. Keuka Lake watershed hydrology.

GROUNDWATER RESOURCES

New York State's increasing need to develop groundwater protection and management policies has led to an effort to identify and delineate the location and extent of significant unconsolidated aquifers—those that consist of sand and gravel and yield large supplies of water to wells. Bedrock aquifers, although significant in some areas, are not addressed in this report.

The groundwater maps illustrated in Figure 5-3 are derived from the digital soils database using soil parent material characteristics as the basis for groundwater potential. The base map scale of 1:24,000 is consistent with the soils information and the other data layers in the GIS. The groundwater map provides a regional view of the extent of productive and potential unconsolidated aquifers in the watershed. Productive areas on the map are those having potential water yields > 100 gallons per minute (gpm) and are active recharge areas. These areas were selected from the soils database if the parent material was one of the following: glacial outwash, post-glacial alluvial, beach and deltaic sands or ice contact stratified drift.

Potential aquifer regions are those areas with yield potential < 100 gpm and are active water recharge areas. These areas were selected from the soils database if the parent material was one of the following: ablation till, lacustrine over outwash, floodplain in outwash valleys and terraces, lake clay deposits overlying outwash or deltaic sands. The non-aquifer or bedrock areas have potential yields < 5 gpm are primarily areas of dense basal till over bedrock.

Within the Keuka Lake watershed there are two major aquifer regions and several smaller areas of productive and potential unconsolidated aquifers. Hammondsport and the Sugar Creek or Guyanoga Valley represent the major aquifer areas in the watershed. Smaller, but significant aquifer areas are found in Pulteney, Keuka Park and on several of the major deltas around the lake.

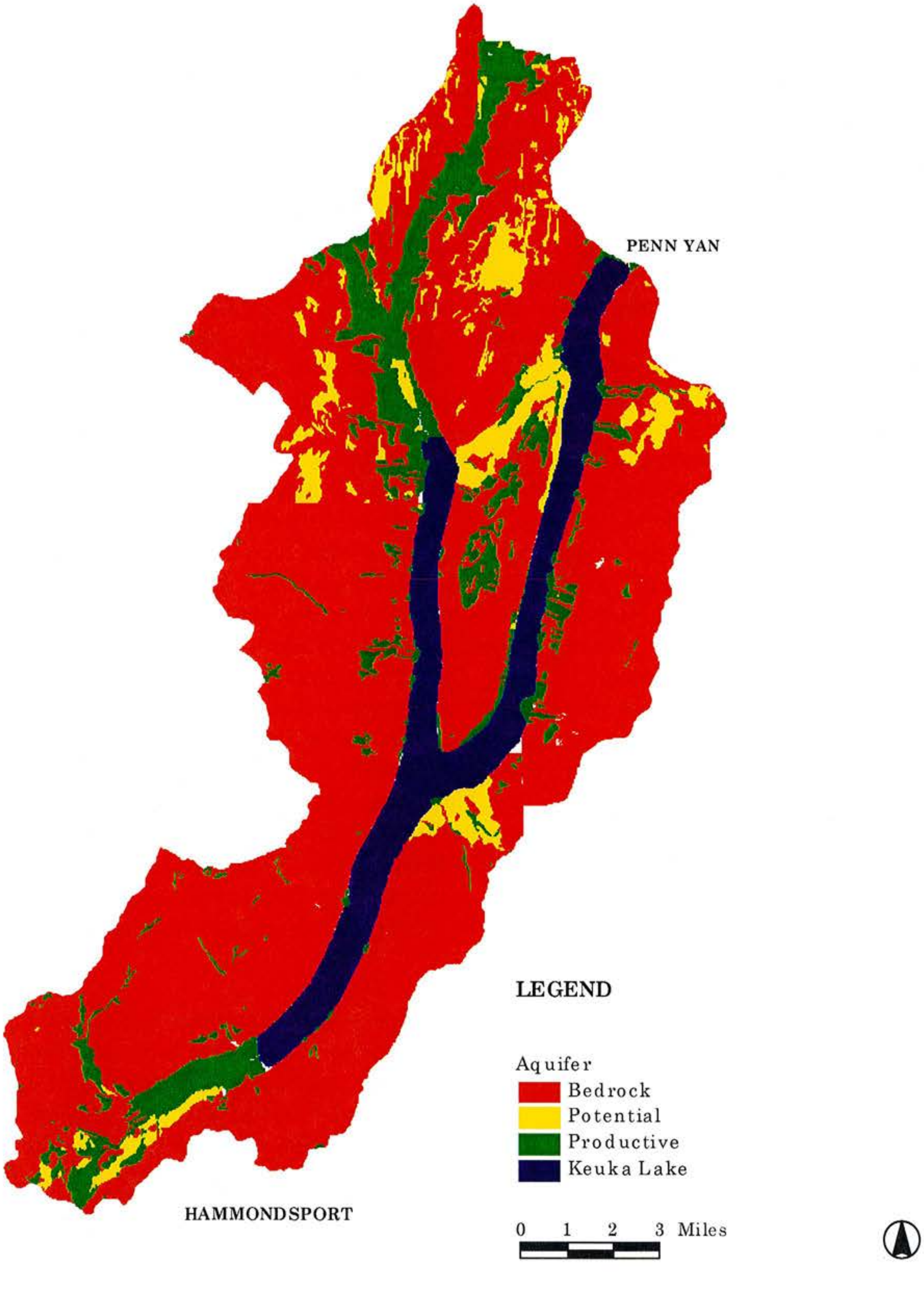

Figure 5-3. Keuka Lake watershed groundwater resources.

BEDROCK GEOLOGY

The bedrock of the Keuka Lake watershed consists of sedimentary rocks deposited as part of the extensive Catskill Delta from 375-360 million years ago during the Middle and Upper Devonian Period. Today this region is part of the hilly, glaciated Appalachian or Allegheny Plateau. Bedrock here consists largely of sandstones, siltstones and shales of the Genesee, Sonyea, and West Falls groups. The Genesee Group is composed mostly of black petroliferous shales exposed in stream valleys in the northwestern portion of the watershed and many gray silty shales and siltstones in the vicinity of the Village of Penn Yan. The Sonyea Group consists predominately of light to very dark gray shales and interbedded siltstones, and forms the steep slopes of Keuka Lake south of Penn Yan and Branchport. The hill top of the Bluff, the hills between Hammondsport and Bath, and ridges on either side of the lake are underlain by the West Falls Group, a series of interbedded gray shales, mudstones, silty shales, and siltstones. All these rocks dip gently to the south and west. Figure 5-4 illustrates the general location of the three groups, whose overall thickness exceeds 2,300 meters.

Following the deposition of the bedrock, the Allegheny Plateau was uplifted and eroded by streams which mainly drained southward reaching the Atlantic Ocean through the Susquehanna River system. The southward drainage of Keuka Lake is confirmed by the Y-shape of the lake as well as the fact that the valley becomes wider in that direction. During the Pleistocene Epoch of the Cenozoic Era, more commonly referred to as The Ice Ages, which commenced approximately two million years ago, a mile thick ice sheet advanced and retreated at least four times through the basin. The ice further deepened, widened, and straightened the existing valley giving it its characteristic U-shape. During the retreat of the final glacier, the ice front stabilized at the south end of the lake near Hammondsport depositing a steep, linear ridge of unsorted, unstratified glacial till known as the Valley Heads Moraine. This moraine effectively dammed the channel creating Keuka and most of the other Finger Lakes, including Canandaigua, Seneca, and Cayuga. In addition, this moraine today acts as a drainage divide separating streams, other than the Genesee River, which flow to the Atlantic via either the Great Lakes and St. Lawrence Seaway or the Susquehanna. Today Keuka Lake drains through the Outlet at Penn Yan into Seneca Lake, hence to Lake Ontario via the Seneca and Oswego Rivers, a route taken by all seven of the eastern Finger Lakes (Canandaigua eastward.)

SURFICIAL GEOLOGY AND SOILS

Recent mapping of the surficial geology of the Finger Lakes Region details six types of surface conditions within the Keuka Lake watershed (Figure 5-5.) At the northwest and south ends of the lake are broad bands of lacustrine (lake) silts and clays, as well as deposits of unoxidized organic (muck) and alluvial materials which are generally located along the swampy lowlands of Sugar Creek, north of the village of Branchport, and Keuka Inlet at Hammondsport. Most of the upland areas of the watershed are covered with unsorted glacial till deposits (ground moraine.) Thickness of this till ranges widely from a few feet to tens of feet. In many places the till is completely absent and Devonian bedrock is exposed at the surface. Glacial outwash, materials that have been somewhat stratified and sorted by meltwater (kames, eskers, kame terraces etc.), are found along Sugar Creek north of Branchport, and in the valley between Hammondsport and Bath, as well as an abandoned valley that was located between the village of Keuka Park and Keuka State Park. Steep bedrock valleys located along tributary streams of Keuka Lake are underlain by unconsolidated materials classified on Figure 5-5 as "eroded soil on steep and broken lands."

Soils vary considerably around the watershed (see Figure 5-5). In the valley areas, such as Hammondsport and Guyanoga, course glacial outwash and alluvial soils predominate, with areas of lacustrine soils along the valley sides. Chenango and Howard sand and gravel soils are common and have a moderate to low base status.

Much of the area along the lake on both the east and west sides are predominately deep, dense basal tills over sandstone, with areas of shallow to bedrock or pan material. On the steep hillsides near the lake, Lordstown and Arnot soils that are well drained, moderately deep and shallow overlying hard sandstone bedrock are common. In the areas above these steep lands, Mardin-Volusia-Lordstown soils on gently sloping to steep lands, moderately well-drained to poorly drained and overlying sandstone are common.

In the hamlet of Pulteney and on the large deltas on the lake of the East Branch, are permeable sand and gravel outwash and shaly silt loam alluvial fan materials. These soils include Howard (outwash) and Chagrin (alluvial), are moderate to low in lime and have good permeability. While these are some of the better soils for farming, most of the land has been used for housing.

Around the perimeter of the lake are hundreds of stream gulleys on steep and broken land. The soils associated with these tributary are deeply dissected and eroded from stream erosion. In some areas, the slopes are nearly vertical and have large amounts of rock outcrop. In other areas, the soils are deep and the soil material has a tendency to slip and slump down hill, causing tremendous amounts of erosion and sedimentation in the lake. The best use of these areas are in natural forest vegetation to maintain forest cover and mature roots to retain soil.

At the inlet of the lake in the area of Hammondsport and Branchport, Wayland silt loam soils are common. These very poorly drained floodplain soils are found along Cold Brook and Sugar Creek. Since these soils are periodically flooded and are wet most of the year, they provide excellent soils for wetland and wildlife habitat.

TOPOGRAPHY

The Keuka Lake watershed lies within the glaciated (Allegheny) portion of the Appalachian Plateau Physiographic Province. This region is characterized by broad, straight U-shaped valleys with steep side slopes which project upwards for several hundred feet and are capped by rounded to gently rolling hilltops. Hillsides are severely dissected by steep walled valleys, with slopes often exceeding 45%, particularly along the Bluff and western shore of Keuka Lake. The northern portion of the watershed has much lower elevations and slopes. Elevations increase from near 1,000 feet above mean sea level at Penn Yan and Branchport to almost 2,000 feet along the southern edge of the watershed. The mean elevation of Keuka Lake is 714 feet above sea level (fasl), but varies seasonally, from 712 to 714.5 fasl.

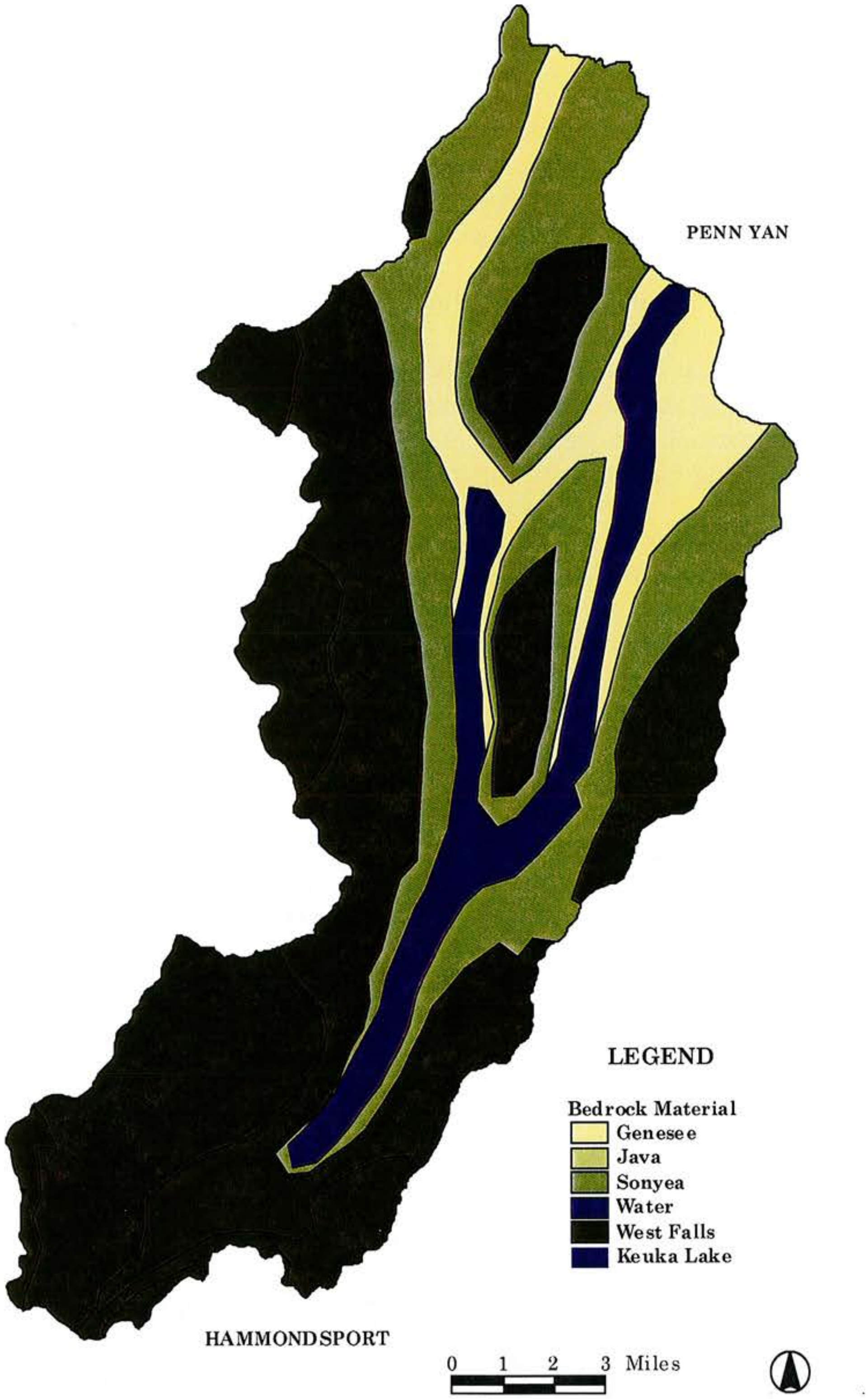

Figure 5-4. Bedrock geology and physiographic regions of the Keuka Lake Basin.

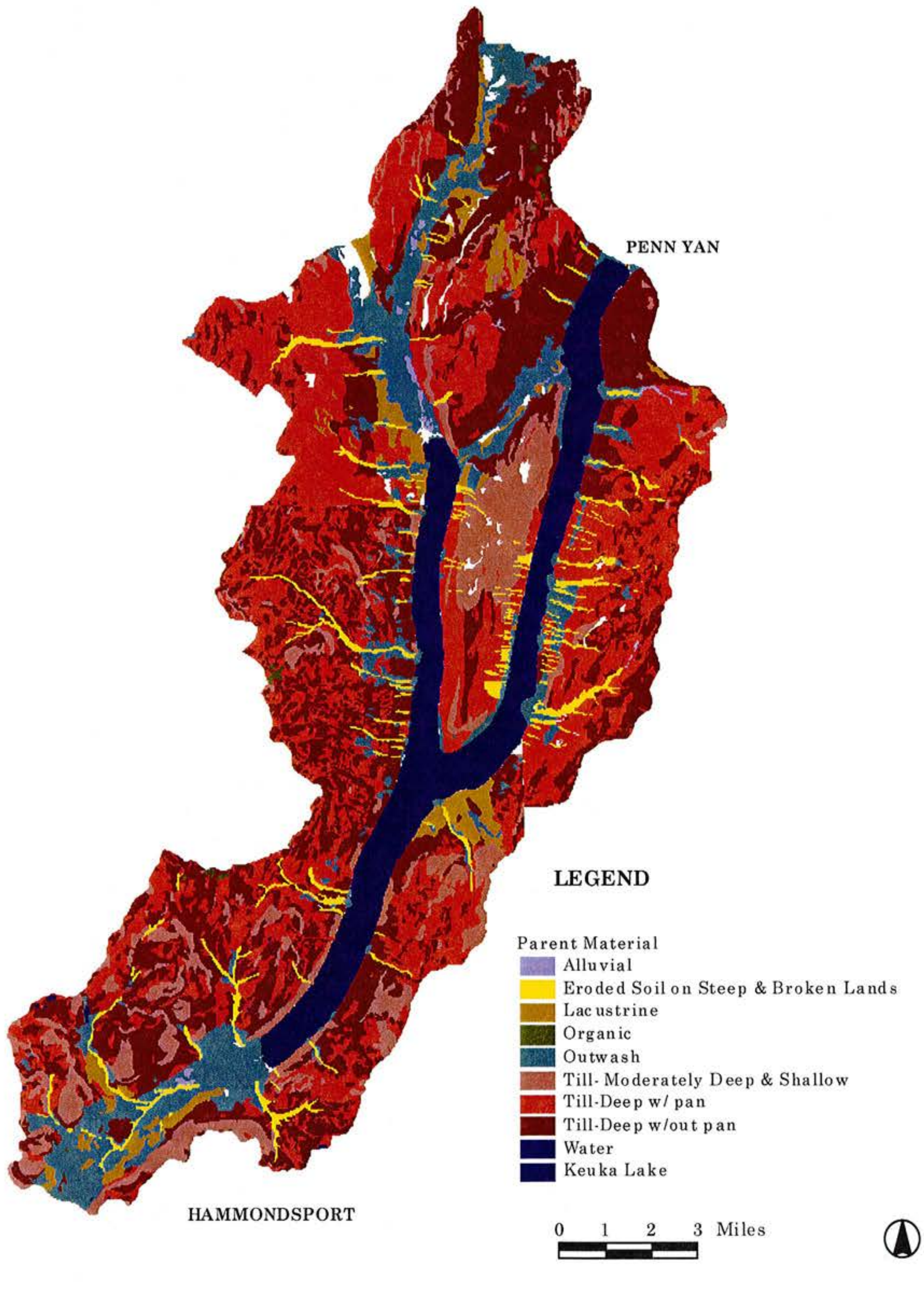

Figure 5-5. Surficial geology (soil parent material) of the Keuka Lake watershed.

CLIMATE

The climate of the Keuka Lake watershed is classified as humid continental with cool summers (Trewartha). The region is marked by a highly variable climate, with the possibility of rapid, frequent and extreme weather changes. The geographic location of the region contributes significantly to the unusual weather patterns affecting it. The center of the lake lies at 42 degrees, 39 minutes latitude and 77 degrees, 03 minutes longitude.

Mean annual temperature is 45.9 degrees F., ranging from 21.1 degrees F. for the month of February to 69.7 degrees F. for July. Average annual precipitation is 32 inches, with about 2/3 as rain and 1/3 as snow. There is a strong minimum of precipitation at mid-winter and a secondary minimum at mid-summer.

Air masses, having entered North America from the Pacific, travel eastward and are modified while crossing the western mountains, the Gulf of Mexico, the Atlantic Gulf Stream, Lake Erie and Lake Ontario. Any one of these sources of rain water can completely dominate a weather pattern at one time or another. The Finger Lakes do not influence weather patterns over the eastern United States but do affect the southern portions of this region.

Cool dry air usually arrives from the northwest, but occasionally it retrogrades from the northeast. Warmer and more humid air enters from the Gulf of Mexico, steered by the Sub-Tropical Jet. The Sub-Tropical Jet may rejuvenate remnant Pacific lows into powerful rain or snow and wind-makers, even tornadoes.

Mixing of cold polar air with warm tropical air develops a strong Polar Jet that reinforces the Sub-Tropical Jet. Together they aspirate new waves on the frontal surface. Stormtrack frontal cyclones, juvenile, mature and senescent, pass through at an average rate of two or three per week, more frequently in winter than in summer (Mooney, 1987).

LAND USE

The Keuka Lake watershed was settled by people almost as soon as the Ice Age ended, some 9,000 years ago. These first people supported themselves by hunting, fishing and gathering wild food. Archaeological remains from the vicinity of Lamoka Lake reveal their diet consisted of deer, turkey, passenger pigeon, bear, turtle, bullhead and the acorns from White oak trees.

Agriculture first appeared in the area nine hundred years ago with the Owasco people who brought the "Three Sisters" agriculture of interplanted corn, beans and squash. Early European explorers of the Keuka Lake watershed encountered the Iroquois, a group who are thought to have arrived five hundred years ago. The Seneca tribe of Iroquois remained in the area until they were driven out by colonists following the Revolutionary War. The Seneca called the area "O-go-ya-ga", which translated as "the promontory" and probably referred to Bluff Point. Other sources claim that "Keuka" can be interpreted as "bent elbow".

In 1770, the area was almost completely covered with forest. The original forests were mainly sugar maple, beech, hickory, red and white oaks, tulip poplar and black walnut. On the higher hills and ridges, white pine was common. Chestnut, white ash, butternut and basswood grew on the drier sites. In the valleys, elm, black ash, willow, poplar, and soft maple were common. Hemlock and gray birch grew in more shaded areas such as gullies.

In 1787, a committee from Rhode Island representing Jemima Wilkinson, the "Public Universal Friend", visited the area between Seneca and Keuka Lakes looking for land for their sect's new home. They found several colonists the Senecas had permitted to reside in the area. The committee was pleased by what they saw, and within two years moved more than sixty families of Wilkinson's followers into the area. They purchased deeds to their land from Charles Williamson, the land company agent located in Bath who had great influence over the whole area. Williamson contributed the name "Esperanza" to Bluff Point. Wilkinson's followers began by erecting dams and mills on the Outlet and a second colony led by the Potter family built on Sugar Creek, north of the present site of Branchport.

In the early nineteenth century, there was strong competition for most favorable locations for production and trade. "Summersite", an alternative to early Penn Yan, grew up to the south of the Outlet along the lakeshore. In 1809, the first published reference to "Pen Yang" appeared in local papers. The name aptly represents the meeting of influences from Penn's colony to the south and from the Yankees moving in from the east.

The 1830s were important years for Penn Yan and the lake. Penn Yan incorporated as a village in 1833, and in the same year the Crooked Lake Canal, which paralleled the Outlet, opened. Agricultural produce of the area could be floated through the 28 locks of the canal to reach Seneca Lake and the Erie Canal system. In 1836, the first vineyards in the Keuka Lake watershed were planted by J. W. Prentiss of the Town of Pulteney. In 1837, the *Keuka*, the first steamboat, began hauling passengers and produce on Keuka Lake. Traffic on Keuka Lake moved both north and south. Produce destined for Penn Yan could be transferred to barges on the Crooked Lake Canal or to cars on the Fallbrook Railroad, which connected with the New York Central system.

Produce carried to Hammondsport would be hauled by teams through Pleasant Valley to Bath where it would be floated down the Cohocton River on rafts or, later, loaded onto the Lehigh Valley Railroad. The steamboats were crucial for moving agricultural produce to market, and after the *Keuka*, a series of steamships followed including: *Steuben, George R. Young, Keuka, Yates, Lulu, Urbana, Farley Holmes, William L. Halsey, West Branch, Mary Bell, and the Cricket*. Docks and piers were built in Penn Yan, Branchport and Hammondsport to move the produce from lake to land transport. Large icehouses at the ports stored ice cut from the lake used to cool shipments to distant markets. Several steamboats ran into the 1920s for tours and excursions, but automobiles and good roads replaced them for other purposes.

From 1840 until the turn of the century, the production of grapes, first for fresh eating and later for wineries, boomed. By 1900, more than 10,000 acres of vineyards producing 15,000 tons of grapes each year ringed Keuka Lake in a band a half a mile wide and 50 miles long. In

1861, Charles D. Champlin established the first winery of the area, the Pleasant Valley Wine Company. Others such as Taylor (1880) and Empire (1896) followed.

The height of agricultural production occurred before the turn-of-the-century. There has been a gradual decline in agriculture since then, with only about half as much land worked now (approximately 31,000 acres). Obviously the vineyards and wineries were severely hurt by Prohibition and the Depression.

At the same time that agriculture was declining, tourism and recreational uses of the lake were increasing. In the 1850s, the old *Keuka* steamboat grounded south of Penn Yan and was converted into The Ark, the first resort on the lake. In the 1870s, the first summer cottages were built on the lakeshore- some were accessible only by steamboat, others could be reached by roads or by the electric trolley running between Penn Yan and Branchport. The 1880s saw the growth of retirement homes on the lakeshore as well as the establishment of Keuka College, the Keuka Lake Sanitarium, and other spas. In 1885, electric power generated by the Outlet began lighting the Village of Penn Yan, and common usage had changed the name of the lake from "Crooked" to "Keuka".

In the 1890s, competing steamboat companies carried more sightseeing passengers and less freight, numerous nature-study camps were established, and Electric Park, an amusement park on the Bluff, began operation.

After the turn-of-the-century, several industries sprang up in the Keuka Lake Watershed: Curtiss Aircraft in Hammondsport (1910) and Penn Yan Boat (1921). Glenn Curtis' 1908 flights in Red Wing and the June Bug were made from the ice of Keuka Lake. The success of automobiles and the growth of a modern road system changed the way Keuka's shore was developed. In 1938, NYS Route 54 was moved away from the eastern shore of the east branch to provide more room at the shoreline for residential development. Summer homes were constructed on the west sides of both northern branches, and several large tracts such as The Pines were subdivided.

Since the 1920s, much of the shoreline of the lake has been developed for cottages and second homes. Recent trends include development of steep or wet sites, conversion of summer homes to year-round use, demolition and rebuilding of structures, and development of woodland and lake-view parcels. The density of development and the existing utilities and services around the perimeter of the lake have resulted in an "urban corridor" surrounding the lake. The rate of development has been increased by the lake's proximity to urban centers and the availability of good highways. Development pressure on the land currently used for agriculture has increased.Fifty-four percent of the watershed land is covered with shrubs, early successional trees, and/or mature forests. Thirty-one percent of the watershed land is used for agriculture. Ten to fifteen percent of watershed land is between agricultural use and residential use, sold by farmers to developers who are waiting for market changes. Three to five percent of watershed and is used for residential, commercial and industrial purposes. See land use map illustrated in Figure 5-6.

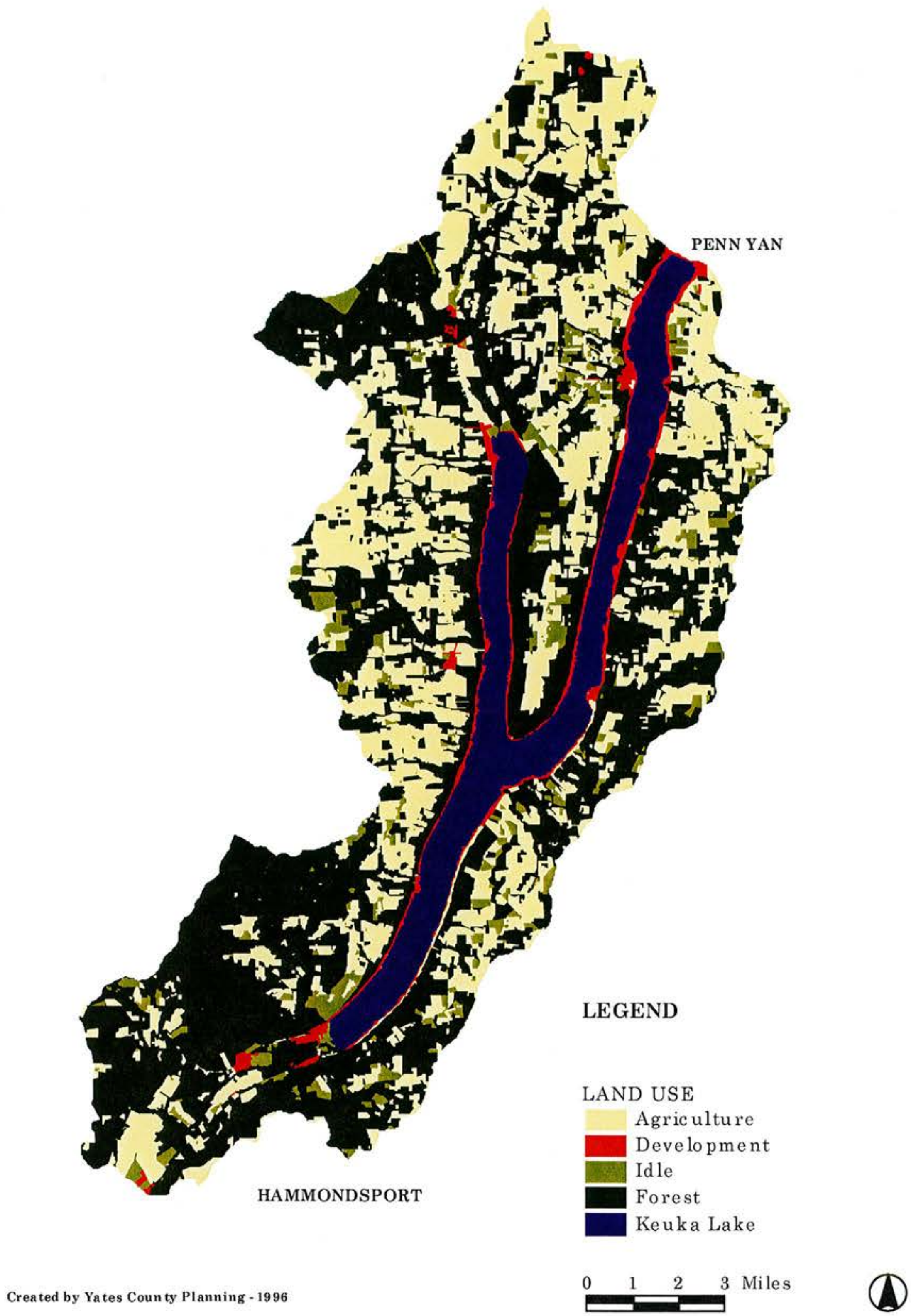

Figure 5-6. Keuka Lake watershed land use map.

VEGETATION

At the time of settlement in the 1780s and 90s, the land was heavily forested. The only openings in the forest were flooded areas such as marshes, lakes, and streamsides, burned areas, or areas kept clear by the Iroquois for their trails, villages and fields. The original forests were principally sugar maple, beech, hickory, red and white oaks, tulip poplar, and black walnut. On the higher hills, white pine was common. Chestnut, ash, butternut and basswood grew on the drier sites. On the alluvial soils of the valleys, elm, black ash, willow, poplar and soft maple were common. In the shaded areas, such as gullies, hemlock and grey birch were common.

No virgin timber or relic forest remain in the watershed. The present forests consist of second and third-growth stands of the original species. Chestnut and elm are missing as a result of disease. Locust and pine/spruce plantations are added to the mix of the original forest species. Most of the remaining mature forests are on wet or steep sites.

The land was cleared of forests progressively beginning in the 1790s and reached a maximum of cleared land in the late 1880s. 85-90% of the land was cleared and farmed, though some was but poor pasture.

Since 1880, there has been a gradual abandonment of farm land and corresponding re-growth of wooded land. Since the abandoned lands were generally the least productive for agriculture, the woods on these lands are of very low quality. At present, about 54% of the watershed land is forested. Much of this forest is in an early stage of succession: pines, poplar, red maple, hawthorn, pin cherry, and various dogwoods predominate. Forested areas in the watershed, particularly on steeper slopes to the south, provide many water quality benefits including stormwater retention and erosion and sediment control.

WILDLIFE

The Keuka Lake watershed encompasses a wide variety of wildlife habitats which support very diverse wildlife communities. Habitats range from wetlands to large blocks of unbroken forests. Agricultural areas provide food sources for wildlife and the many transitional areas provide cover and nesting areas.

The diversity of wildlife includes game species such as deer, turkey, pheasant, grouse, squirrel, rabbit, opossum, coyote and fox. Many non-game species such as song birds, hawks, accipiters, owls and occasionally ospreys and eagles visit the watershed. The watershed contains many small and one large wetland. The wetlands are important habitats which support waterfowl, mink, muskrats, beaver and amphibian production.

Well managed fish and wildlife populations provide residents and visitors with tremendous opportunities for nature study, hunting, fishing and trapping. Many people have established rural residences and manage their properties to enhance the opportunities to view wildlife in their backyards. Protecting our water resources will help to ensure healthy and dynamic wildlife populations for residents and visitors of the watershed to enjoy.

FISHERIES

The lake trout is the primary coldwater game fish in Keuka Lake. Rainbow trout produced by natural reproduction in Cold Brook support a good tributary fishery and a limited lake fishery. Stocked domestic brown trout and Atlantic landlock salmon also provide a significant contribution to the fishery and add species diversity.

Important warmwater species include smallmouth bass, largemouth bass, bluegills, yellow perch, chain pickeral, and brown bullheads. Smelt and alewives are the primary forage fish and are considered abundant. Lake whitefish and ciscoes are present, but very uncommon. Northern pike can also be found in limited numbers.

Lake trout are the dominant species. Prior to 1900, the lake trout's primary forage was the cisco. Since the introduction of the smelt and alewife by an unknown source in the 1950s, the alewife has substantially improved the condition of adult lake trout population. Today, lake trout continue to be the primary game fish in Keuka and their numbers are supported entirely by natural reproduction.

Rainbow trout were introduced from the western US around the turn of the century, but did not become well established until the 1930s. Today, a naturally reproducing population is being maintained in the lake. Cold Brook is the single significant spawning tributary for the rainbow fishery, however, Sugar Creek has a minor contribution. Fish begin to enter the creek in late fall and spawning occurs when the correct water temperature and day length is reached in March. The April 1st opening fishing day at Cold Brook has become a very popular and productive fishing site.

Brown trout and Atlantic landlocked salmon introductions occurred in the early 1970s and a good fishery is maintained today with annual stocking of hatchery-reared fish. There is no natural brown trout reproduction in Keuka Lake. The historical lake trout-cisco association has now been replaced by a lake trout, brown trout, rainbow trout, Atlantic landlocked salmon-alewife, smelt association.

Smelt were introduced in 1925 by the State Conservation Department and dramatically increased from 1935 to 1940. At one time, they were found in such abundance that they were removed by the barrel-full to feed trout at the Bath Fish Hatchery. Today, spring smelt runs occur in several of the smaller lake tributaries, Sugar Creek and Cold Brook, but they are not plentiful.

The lake presently supports an excellent smallmouth bass fishery. Rocky-gravelly substrate, an essential element for spawning success of smallmouths and lake trout, is moderately abundant. Largemouth bass and chain pickerel are found in good numbers at both the north and south ends of Keuka. Rooted aquatic plants there provide excellent habitat for these fish. Yellow perch, bluegills, sunfish, and rock bass are available along shoreline weedbeds throughout the summer.

POPULATION AND POLITICAL SUBDIVISIONS

There are 10 municipalities and 2 counties within the 112,755 acres or 176 square miles Keuka Lake watershed. Table 5-1 provides land area statistics for the municipalities in the Keuka Lake watershed (see Figure 5-7). The municipalities with the largest percentage of land areas within the watershed include: Jerusalem (31%), Milo (6%), Barrington(9%), Wayne (7%), Urbana (20%) and Pulteney (16%).

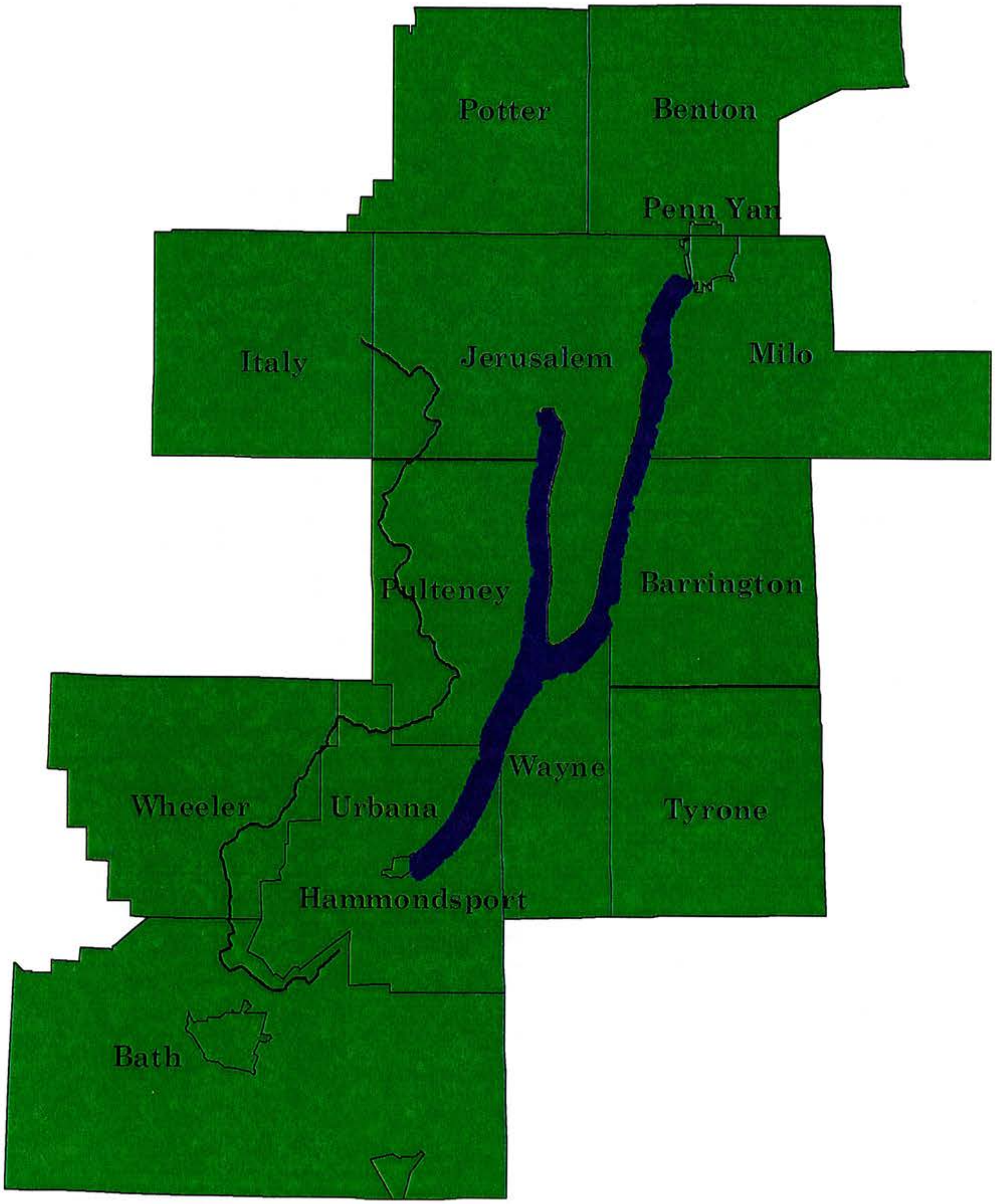

Figure 5-7. Keuka Lake watershed municipal boundaries.

Table 5-1. Land areas within the watershed by municipality.

County	Municipality	Square Miles	Acres	% of Watershed
Yates	Barrington	15.97	10,220	9.06
Yates	Benton	5.67	3,630	3.22
Yates	Italy	0.23	150	0.13
Yates	Jerusalem	54.52	34,890	30.94
Yates	Milo	11.02	7,050	6.25
Yates	Potter	6.28	4,020	3.57
Yates	Penn Yan	0.08	48	0.04
Steuben	Bath	2.34	1,503	1.33
Steuben	Hammondsport	0.37	234	0.21
Steuben	Pulteney	28.20	18,050	16.01
Steuben	Wayne	11.55	7,390	6.55
Steuben	Urbana	34.97	22,380	19.85
Steuben	Wheeler	4.98	3,190	2.83
Total	**Watershed**	**176.18**	**112,755**	**100.00**

POPULATION AND HOUSING

Of the ten municipalities within the watershed, eight municipalities have lake frontage. The primary municipalities has a total population of approximately 21,000 in 1990, which represents a slight decline from 1980. The estimated population residing in the watershed in 1990 is 17,878 which represents a 16.75 percent increase since 1970. There was a slightly larger percent increase during the 1980's as compared to the 1970's.

The data for housing units and density in Table 5-2 represent totals, including year-round and seasonal as well as vacant units for the entire town. There area an estimated 6,300 housing units in the 12 municipalities in the watershed in 1990 based on a count from the tax roles.

Table 5-2. Population and housing units for selected municipalities.

Municipality	Square Miles	Population 1980	Population 1990	% Change	Housing Units	Density
Barrington	35.7	1,091	1,195	9.5	903	33.5
Benton	41.5	1,981	2,380	20.1	906	57.3
Jerusalem	58.9	3,908	3,784	-3.2	2,359	64.2
Milo	38.4	6,732	7,023	4.3	3,288	182.9
Yates County	**338.2**	**21,459**	**22,810**	**6.3**	**11,629**	**67.4**
Pulteney	33.2	1,274	1,417	11.2	1,066	42.7
Urbana	41.9	1,917	1,872	-2.3	1,459	44.7
Wayne	21.0	1,066	1,029	-3.5	1,133	49
Hammondsport	0.4	1,065	929	-12.8	430	2,322.5
Steuben County	**1,393.0**	**99,217**	**99,088**	**-0.12**	**43,019**	**71.1**

The Keuka Lake watershed lies entirely within Yates and Steuben County. The watershed within Steuben County includes portions of the Village of Hammondsport, and the towns of Pulteney, Wayne, Urbana, Wheeler and Bath. The watershed within Yates County includes the Village of Penn Yan and the towns of Barrington, Milo, Jerusalem, Benton and Potter.

ECONOMIC PROFILE

In a report published in September 1994 by Paul Eberts, Socioeconomic Trends in Rural New York State, Yates County is described as a much smaller than average-sized rural-suburban county in which the manufacturing base is small, but stable, with 17% of the 1990 work force employed in manufacturing. The service sector is large with 72.4% of the 1990 work force engaged in service industries. The agricultural base is also large compared with other counties, having a value of $29 million in 1990. The report found that 40% of the work force commutes outside the county for employment. For many the commute is to the Rochester metropolitan area in Monroe County, an industrial manufacturing center with large employers including Eastman Kodak, Xerox, and Bausch and Lomb.

Steuben County is slightly above average size for a rural-urban county. The manufacturing base is large but slightly declining with 27.2% in manufacturing. The service sector is large employing 68.2% of the 1990 work force engaged in service industries. The agricultural base is much larger than average in total products sold with an adjusted 1987 value of $73.6 million. Only 17.6% of the workforce commutes outside of the county for employment.

The major industrial employers in the watershed are:

Company	Employees	County
Coach and Equipment Corp	75	Yates
Penn Yan Marine	30	Yates
Seneca Flight Operation	25	Yates
Penn Yan Aero	30	Yates
Keuka College	240	Yates
Badger nterconnect	80	Yates
Advocom	20	Yates
Birkett Mills	45	Yates
P&C	31 (71)	Yates
Soldiers and Sailor	401	Yates
Clearpass Containers	115	Yates
Iron Age Shores	55	Yates
Goulds Pump	15	Yates
Remee Casting/Roto Salt	15	Yates
North American Philips	700	Steuben
Mercury Aircraft	690	Steuben
Taylor Wine Company	105	Steuben
Bully Hill Vineyards	20	Steuben
Ira Davenport Hospital	440	Steuben

Table 5-3. Income and employment status in the Keuka Lake watershed, 1990.

Municipality	Median Household Income	% Below Poverty Level	% in Labor Force	% Unemployed
Yates County	$24,874	13.4	62.8	6.4
Barrington	$27,308	11.3	47.1	5.3
Benton	$28,462	11.2	49.0	4.5
Jerusalem	$27,701	13.1	47.4	3.5
Milo	$21,062	15.2	46.7	9.2
Steuben County	$25,312	13.5	62.0	7.4
Pulteney	$28,060	11.9	55.2	8.0
Urbana	$28,079	12.5	48.5	9.4
Wayne	$26,092	10.7	46.0	7.7
Hammondsport	$25,500	7.8	52.0	5.2
New York State	$32,965	13.0	63.6	6.6

Most recent unemployment rates for 1995 were as follows (Source: NYS Department of Labor):

Yates County	5.4% (1997)
New York State	6.3%

Table 5-4. Real property values in the Keuka Lake watershed, 1991.

Municipality	Full Assessed Value	Total Taxes	Lake Property Taxes	Lake Property Tax % of Total
Milo	$171,000,000	$3,700,000	$660,000	18% (1)
Barrington	$59,000,000	$1,600,000	$1,070,000	69%
Wayne	$58,000,000	$1,500,000	$830,000	55%
Urbana(2)	$107,000,000	$3,200,000	$870,000	27%
Pulteney	$65,000,000	$2,000,000	$1,370,000	70%
Jerusalem	$175,000,000	$3,800,000	$2,200,000	57%

(1) Includes Seneca Lake shorefront properties along with Keuka

(2) Includes Hammondsport values

MUNICIPAL WATER REVENUES

Over 20,000 people rely on Keuka Lake as a source of potable drinking water. Approximately 10,000 people draw water directly from the lake for domestic use. The remaining 10,000 people purchase water from the municipal purveyors in the watershed and include the Village of Hammondsport and Penn Yan, Keuka Park and Dresden. An estimated $750,000 is generated annually from water revenues from these sources (Source: Village of Penn Yan and Hammondsport, 1996).

RECREATIONAL VALUE

The recreational value for Keuka Lake has not been measured directly, however, several statistics are available to derive a rough estimate of the economic value for tourism and recreation. The Yates County Chamber of Commerce and the Finger Lakes Association developed estimates for the value of tourism and recreation for Yates and Steuben county. The estimates cannot be broken down to watershed figures, but the total amounts are useful for this discussion. The 1987 tourism and recreation revenues in Steuben County was $59 million according to the Finger Lakes Assocation. The Yates County Chamber of Commerce estimated in 1996 that $14 million was spent in Yates County. These amounts do not include a "multiplier effect" expected when these dollors are spent three to four times over in the community. A conservative economic value for tourism and recreation in the watershed in 1996 dollars is estimated at $10 to $15 million (Mike Linehan, Yates County Chamber of Commerce).

A portion of the recreation dollars are spent on fishing and the NYS Department of Environmental Conservation estimated in 1988 the value of fishing alone on Keuka Lake was worth in excess of $5 million. At three percent growth per year, the 1997 value would be worth $6.7 million.

KEUKA LAKE LIMNOLOGY

INTRODUCTION

The quality of water in Keuka Lake depends on the activities which occur in the watershed. The impact of land use practices can be detected by monitoring and testing tributary streams, groundwater, and the lake itself. Over the past several decades, numerous water quality studies have been conducted on Keuka Lake and tributary waters. In this chapter, an interpretive summary of existing water quality information will be discussed and evaluated. Areas of future research will also be highlighted.

The ongoing Keuka Lake Watershed Water Quality Monitoring Program is sponsored by the Keuka Lake Association, in cooperation with Cornell Cooperative Extension-Yates County, Yates and Steuben County Soil and Water Districts, Department of Environmental Conservation and the Villages of Penn Yan and Hammondsport. In addition, numerous Keuka Lake Association volunteers help with the testing program. The program is coordinated by Peter Landre, Water Quality Agent, Cornell Cooperative Extension-Yates County and Dr. Al Wahlig, Chairman of the Keuka Lake Association's water testing committee.

The testing program builds upon many years of research to establish a baseline understanding of the water quality status of Keuka lake and it's tributaries. This report contains testing data through 1996, the fifth year of a comprehensive monitoring program where samples have been analyzed by a Department of Health certified laboratory. A solid understanding of the lake's water quality status is important for several reasons including: 1) identification of trends in water quality; 2) determination of sources and impacts of pollutants; and 3) evaluation of watershed management programs.

The following chronology outlines historical water quality studies conducted on Keuka Lake:
1972 - USEPA Eutrophication Study (USEPA, 1974)
1975 - Alfred University lake sampling (unpublished data)
1976 - Anne Breggy nutrient sampling (Alfred U. student work, unpublished data)
1977 - Alfred University Fish and Plant Survey (unpublished data)
1978 - Alfred University nutrient sampling (unpublished data)
1978 - Cornell University synoptic study (Schaffner and Oglesby, 1978)
1979 - Thomas Springett nutrient sampling (Alfred U. student work, unpublished data)
1980 - Dean O'Grady primary production survey (Alfred U. student work, unpublished data)
1982 - Judy Van Kuren primary production/chlorophyll sampling (Alfred U. student, unpub.)
1984 - Alfred University nutrient sampling (unpublished data)
1987 - Keuka Lake Shore Property Owners nutrient sampling (Wills, 1988; 1989)
1990 - Finger Lakes Community College nutrient sampling (McGrath, 1990)
1991 to 1997 - Keuka Lake Association watershed monitoring program (Landre, 1991-1996)

RESEARCH QUESTIONS

The Keuka Lake Watershed Water Quality Monitoring Program was designed to answer several research questions. The questions were developed from a series of meetings in 1991 to establish research priorities and direct program implementation. The forum included representatives from the Federation of Lake Associations, Keuka Lake Association, county and state agencies, and water quality specialists from academic institutions. The following research questions were identified as the most important to answer. All of these questions can be addressed by the combined efforts of this program.

1) What is the trophic status of Keuka Lake?
2) Is the water quality in the lake branches significantly different?
3) What is the status of zebra mussels in Keuka Lake?
4) What is the quality of untreated lake drinking water?
5) What is the quality of the tributaries, streams, and the outlet?
6) What are the status of the fish populations in the lake?

METHODS

The current (1991-1996) monitoring program consists of four major testing components: 1) pelagic zone (deep water); 2) littoral zone (shallow water); 3) bacteriological; and 4) zebra mussel and zooplankton monitoring. The components and methods of each program are summarized in Table 6-1. Additional methods description are found in Appendix A.

Table 6-1. Summary of monitoring 1991-1996 program methods.

Pelagic Zone Sites- Deep Water

1)**Location**- 1 site in each lake branch and off Bluff, 4 sites total
2)**Frequency**- Monthly, April - January
3)**Sampling Day** - Monday; Analysis Day - Tuesday at SUNY Brockport
4)**Parameters**
  a) total phosphorus, chlorophyll a, nitrate, pH, conductivity
  b) dissolved oxygen, temperature, secchi disk,
5)**Sampling Depth**- surface (1 meter) and near-bottom
6)**Samplers**- KLA volunteers, P. Landre, J. Balyszak

Littoral Zone Sites-Shallow Water

1)**Location**- 8 sites
2)**Frequency**- Monthly, April - January
3)**Sampling Day**- same as above
4)**Parameters**- same as above
5)**Sampling Depth** - surface (1 meter)
6)**Samplers**- KLA volunteers, P. Landre, J. Balyszak

Bacteriological Testing

1)**Location**- Approximately 50 sites along the shoreline and deep water sites
2)**Frequency**-Monthly June- September

3)**Sampling Day**- Flexible
4)**Parameters**- Fecal Coliform, fecal streptococcus follow-up samples
5)**Sampling Depth**- surface grab, nearshore (within 20')
6)**Samplers**- P. Landre, J. Balyszak

Zebra Mussels and Zooplankton
1)**Location**- Penn Yan, Hammondsport & West Branch
2)**Frequency**- Monthly
3)**Sampling Day**- same day as bacteria testing
4)**Parameters**- zebra mussel veligers and crustacean zooplankton
5)**Sampling Depth**- epilimnion
6)**Samplers**-P. Landre and J. Balyszak

SAMPLE COLLECTION SITES

Water samples were collected and analyzed from both shallow and deep water areas of the lake. Figure 6-1 illustrates the sample collection locations used for the 1996 season. Shallow water sites (littoral) were chosen to evaluate the likely impact of potential contamination sources such as a highly developed shoreline area or a mouth of a tributary through a field survey conducted by the in-lake monitor team and a review of pertinent literature, reports, and maps. The sites were sampled monthly, April through December. Samples were collected at a depth of 1 meter using an aluminum 1.2 liter Kemmerer Bottle.

Deep-water sites were sampled and analyzed to evaluate the overall trophic state or condition of the lake. The four deep water sites were approximately located at the deepest part of each lake branch (see Figure 6-1). At each site, both surface (1 meter) and near bottom (within 2 meters) samples were collected using a Kemmerer Bottle.

KEUKA LAKE WATERSHED CLIMATE AND LAKE LEVEL

Temperature and precipitation are important factors affecting the overall quality of water in Keuka. "Wet" weather years have higher than average precipitation amounts and result in higher water levels. Wet conditions may also lead to an increase of nutrient and sediment loading to the lake. The increase in nutrient and sediment concentrations may lead to higher algae levels and lower water clarity. In addition, water levels and precipitation directly affect recreation opportunities and shorefront property usage and damage. The 1995 weather year was below average in terms of precipitation and above average for air temperature, based on the weather station located in Bath (Penn Yan station was shut down). Unlike 1994, 1995 was a very dry year. Stream and groundwater levels were very low throughout the year and it wasn't until the late fall that the area received significant precipitation. Figure 6-2 and 6-3 illustrate the high and low air temperature and precipitation data for 1995.

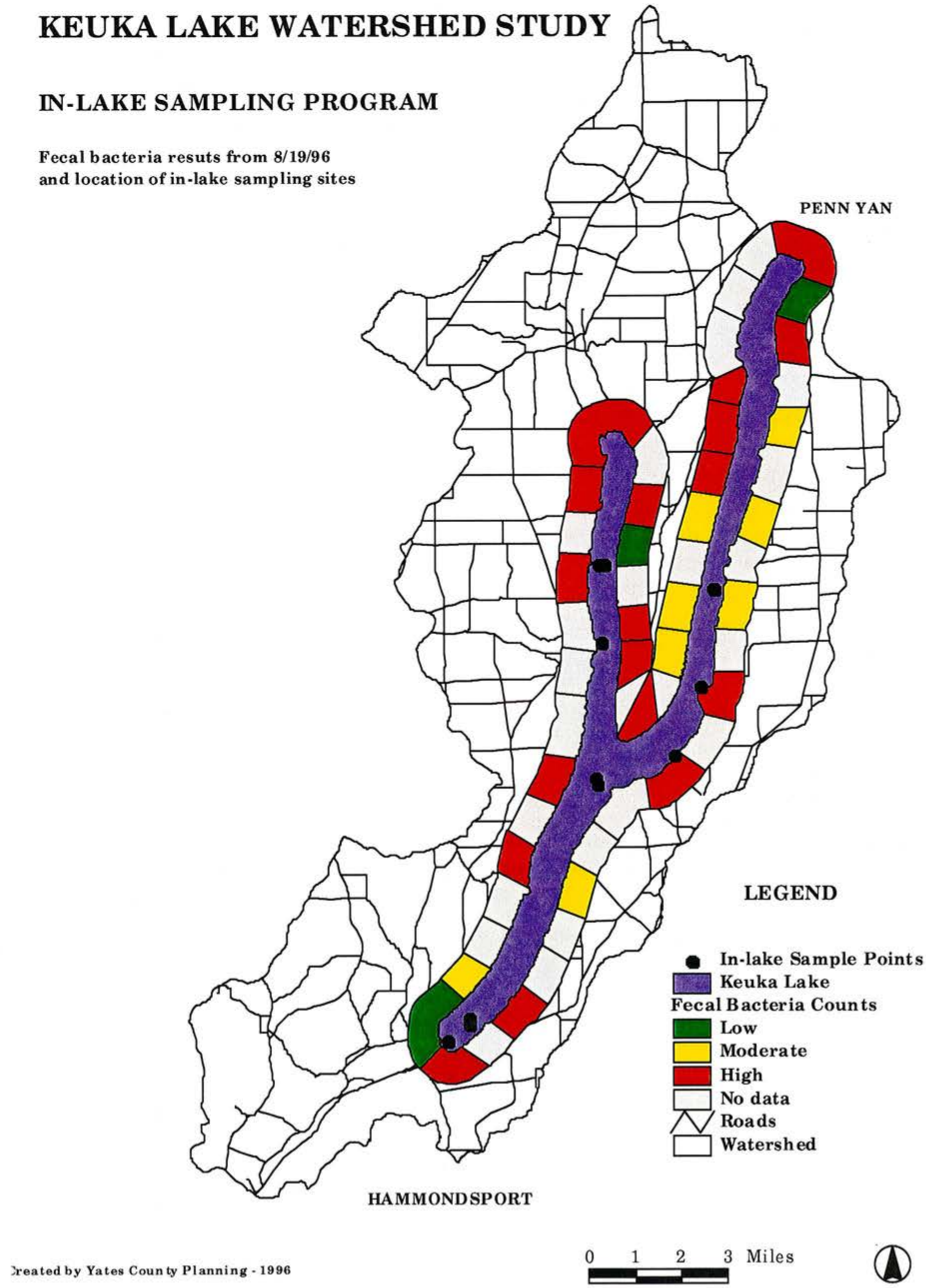

Figure 6-1. Keuka Lake water sample collection sites, 1996.

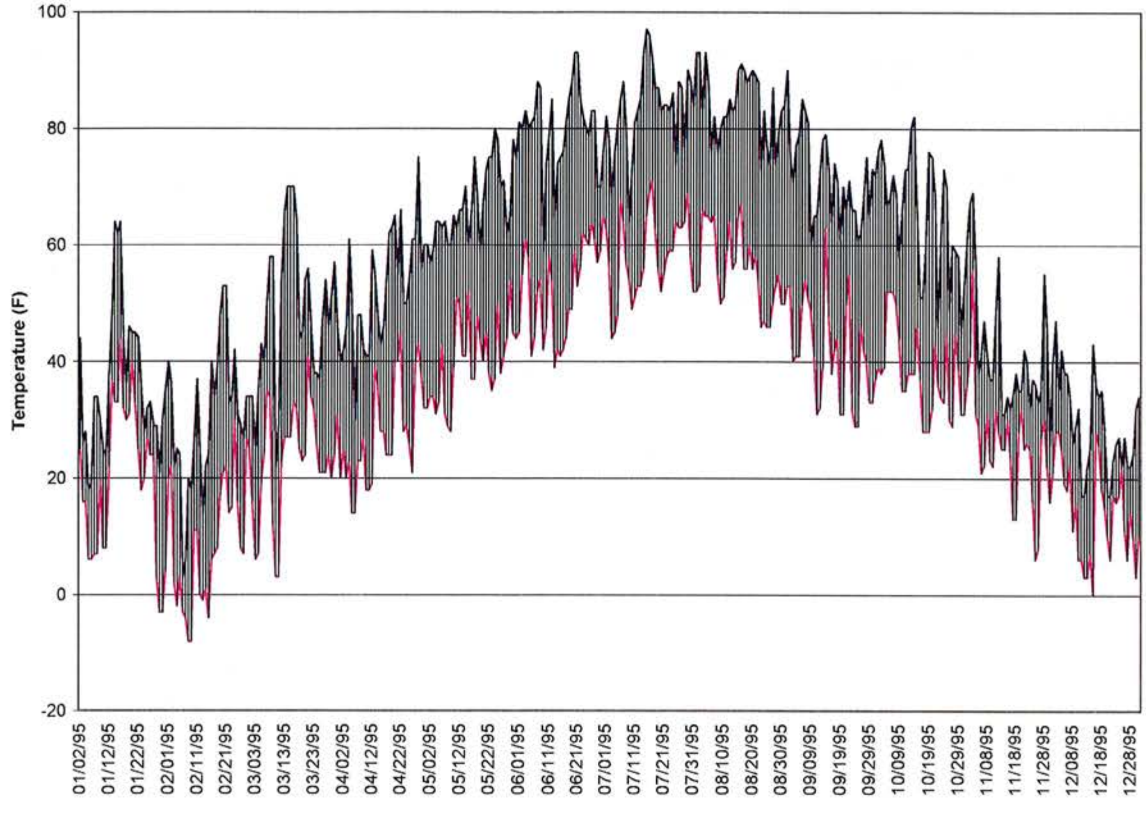

Figure 6-2. 1995 temperature data, Bath, NY.

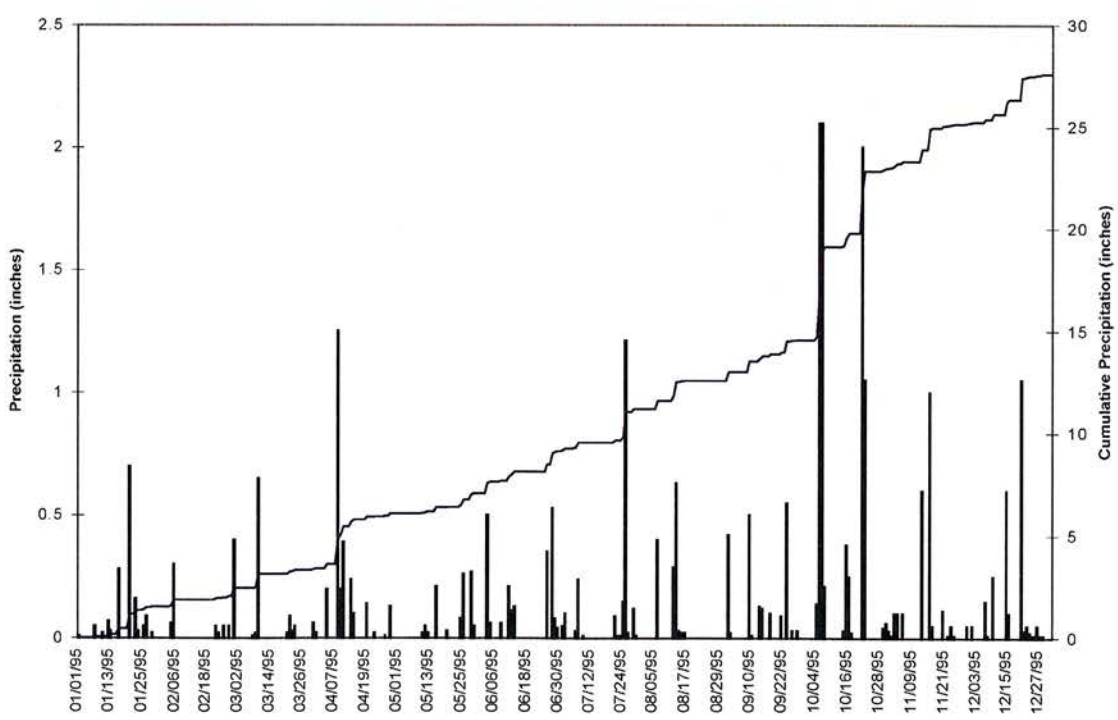

Figure 6-3. 1995 Precipitation data, Bath, NY.

WATER LEVEL

Keuka Lake water level is controlled by the amount of precipitation and runoff, evaporation and transpiration, and water outflow through the gates in Penn Yan on the Keuka Lake Outlet. The old gates had a maximum flow of 500 cubic feet per second (cfs). The three new gates installed in the fall of 1993 have a capacity of 1000 cfs, and in addition to the old, Andrews (#1 &2) and Birkett, bring the capacity up to near 1,500 cfs at a lake level of 716 feet above sea level. At lower lake levels, flow would be considerably less: at 712 FASL for example, 435 cfs is the maximum flow from the new gates. The gates are owned and maintained by the Keuka Lake Outlet Compact (KLOC) and operated by the Operations Supervisor of the Penn Yan Municipal Utility Board (PYMUB) in accordance with a recommended lake level "guide curve".

Minimum water flow of 20 cfs is required to operate Penn Yan's sewage treatment plant. While the new gates allow the lake level to be drawn down more quickly, flow will be controlled in accordance with other gate managers in the region to prevent downstream flooding. During flooding conditions, Penn Yan Municipal has agreed to cooperate with the other lakes in the Oswego River Basin to moderate flow and prevent further downstream flooding, however, flood prevention on Keuka Lake is the primary goal of the operation of the gates. The new gates will be particularly useful in drawing down the lake prior to snowmelt in anticipation of spring flood conditions.

The guide curve was established by the Army Corp. of Engineers to maximize public use of the lake during the summer months and minimize flooding potential during the spring months. A "new" quide curve was introduced in 1994 by PYMUB that clearly provides some benefits to the residents and users of the lake. The new guide curve maintains the same "high" and "low" water levels as the previous guide curve, but drops the water level more quickly in October and keeps it low until March 1. The rationale behind lowering the lake quickly after the recreation season is to obtain water storage capacity early so that mid-winter adjustments for snowpack can be made after the snow arrives. The old guide curve did not reach 712 feet until March 1, and then the level was raised immediately. The new guide curve should make lake level management considerably easier and provide better flood protection and recreation storage.

The water level tends to vary year to year depending upon the amount of precipitation and the general operation of the gates. The severity of the winter (snowfall and snowpack) and the amount of spring rain greatly influences the lake level. In saturated soil conditions or during frozen soil conditions, an inch of rain throughout the watershed can mean nearly a foot rise in lake elevation. Rarely does an inch of rain fall throughout the watershed at the same time, however, "major" events such as the flood of 1972 and the January flood of 1996 are not uncommon. The lake levels for 1995 and 1996 provide good examples of this variation (see Figure 6-4). The spring of 1995 was very dry and the lake never reached the desired summer holding level of 714.5 feet, however, summer thunderstorms and groundwater kept the lake near the desired level. The lake level curve for 1996 illustrates the impact of large storm events. The January flood raised the lake nearly two feet and would have caused significant flooding had it occurred later in the year. The fact the Keuka has a 2.5 foot window, between the winter low and summer high, afford the most flood protection of any Finger Lake.

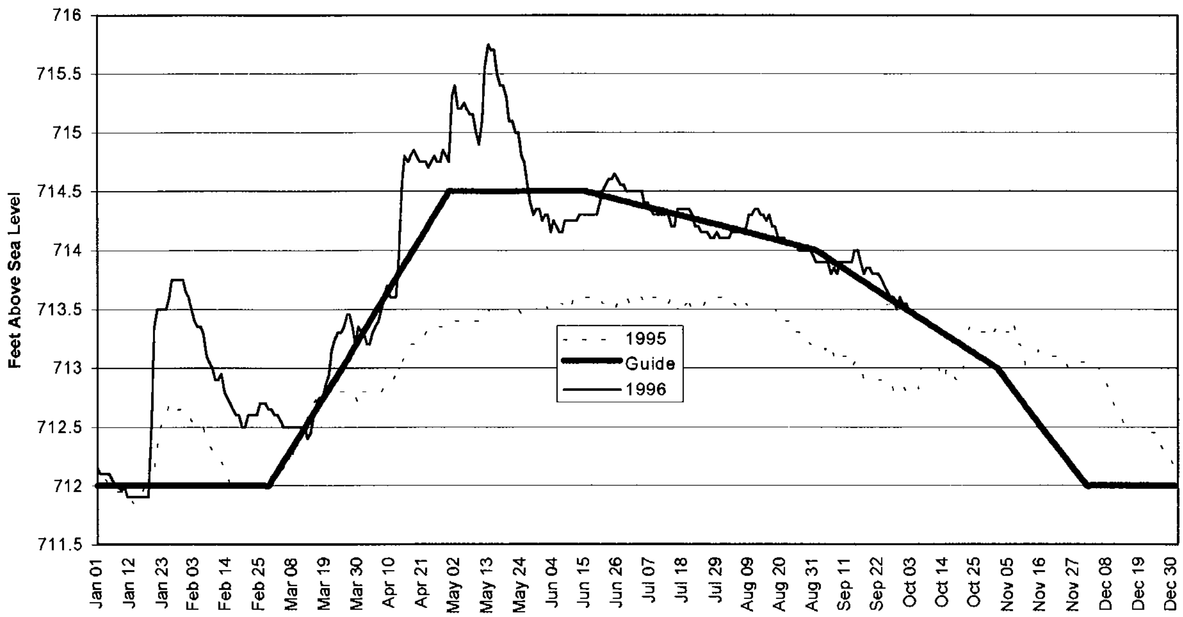

Figure 6-4. Water level of Keuka Lake for 1995 and 1996, and the new guide curve.

DISSOLVED OXYGEN AND WATER TEMPERATURE

Dissolved oxygen (DO) and temperature are dynamic factors which control biological activity in the lake. Oxygen is used by fish and other aquatic organisms for respiration. Each aquatic organism has its own unique tolerance for DO in the water. Low DO levels can result in low fish production rates or in severe cases, suffocation or a fish kill. DO depletion can occur when bacteria decompose excessive amounts of organic materials (dead algae, yardwastes, etc.) or during the winter in lakes covered by ice for prolonged periods. In Keuka Lake, DO depletion would probably only occur in some isolated bays that are infested with aquatic weeds. To date, this phenomenon has not been reported.

Although oxygen is abundant in the atmosphere (approximately 14.2% by volume), the concentration in water is several orders of magnitude lower (0 to 0.0015% by volume) due to the lower solubility of oxygen in water. As a result, oxygen is measured in parts per million (PPM) in water and the typical range in a productive lake is 4 -15 ppm.

DO and temperature were measured at all of the sampling locations at the surface and DO and temperature profiles were measured monthly, June through September. Figures 6-5 a, b, and c below illustrates the results from the vertical profiles. The profiles indicate that the lake is well oxygenated throughout the growing season and has adequate oxygen to support a productive fishery.

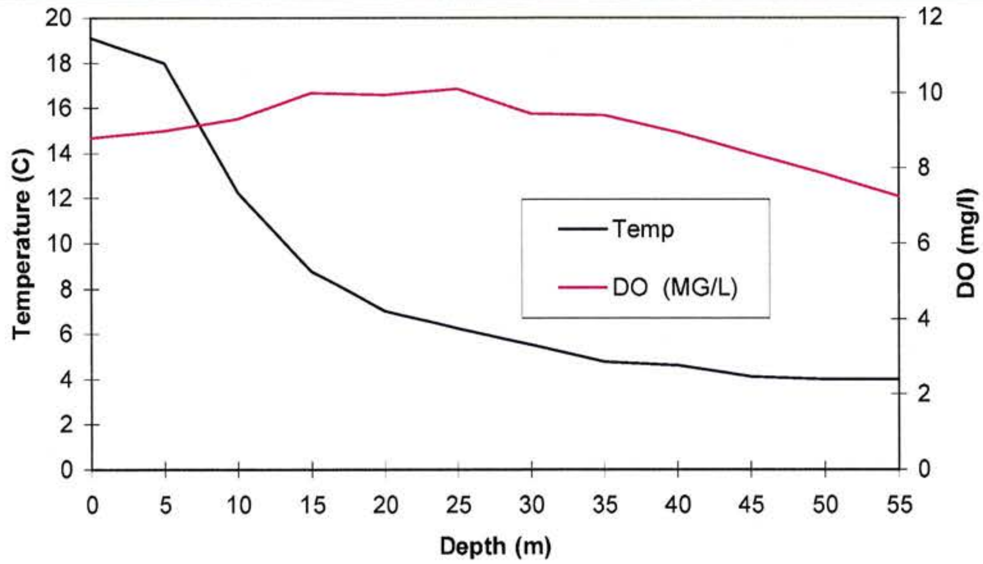

Figure 6-5a. Average Temperature/DO Profile for the Keuka Lake central deep in June

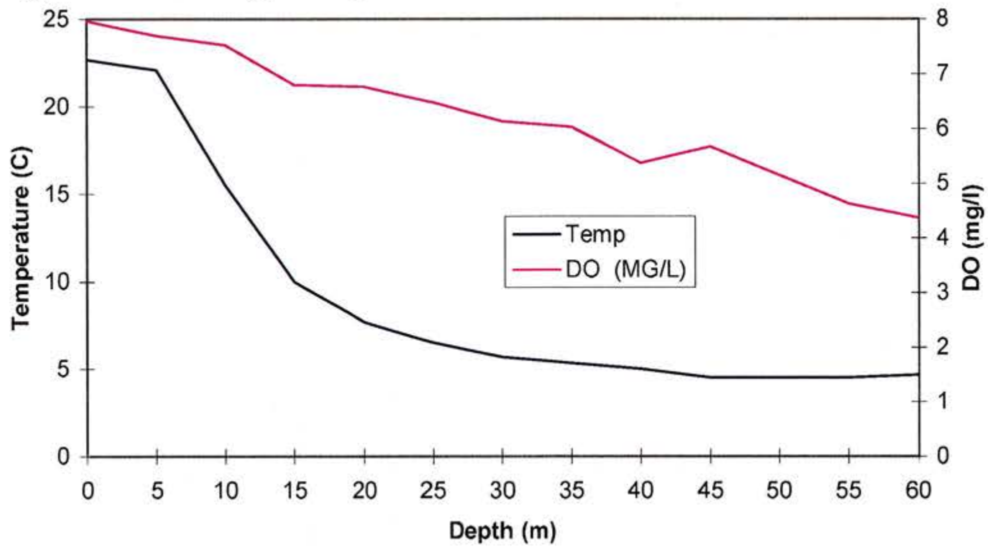

Figure 6-5b. Average Temperature/DO profile for the Keuka Lake central deep in July.

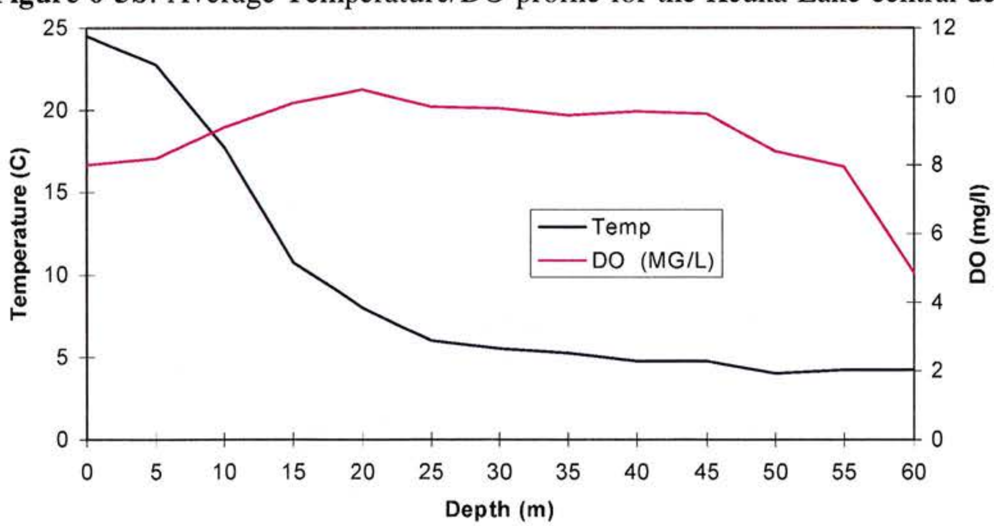

Figure 6-5c. Average Temperature/DO profile for the Keuka Lake central deep in August.

SECCHI DISK MEASUREMENTS

A secchi disk is a simple tool used to estimate the lake's transparency or clarity. The disk consists of a weighted 20 centimeter diameter disk painted black and white and attached to a measured line. Water transparency measurements are estimated by slowly lowering the disk through the water column until it disappears from view. The depth recorded is a good indication of the clarity and quality of water since transparency is affected by the concentration of inorganic suspended solids, algae, and zooplankton.

Secchi disk measurements for Keuka Lake have been recorded since 1979 and regularly since 1989 (see Figure 6-6). The early results differ little from today's readings. The long-term average secchi disk measurement for the lake is approximately 5 meters. There appears to be a slow, increasing trend in secchi disk water clarity, however, the increase is modest. This trend may rise rapidly with the spread of zebra mussels in the lake. Zebra mussels are known for their ability to filter the water column and greatly reduce the amount of algae and zooplankton, and increase water clarity. Both Seneca and Canandaigua Lakes have experienced tremendous increases in water clarity in 1995 and 1996, increasing from 4 to 10 meters in Seneca for example.

Secchi disk readings tend to vary greatly over the course of a year, with the highest readings observed in late fall and the lowest observed in mid-spring after the spring thaw. An example of this variation are the observed readings for sample site #3 for 1995: the May reading was 2.5 meters and the September reading was 8.5 meters. Over the 1991 to 1996 period, the lowest recorded secchi disk reading was 2.5 meters while the deepest reading was 9.0 meters.

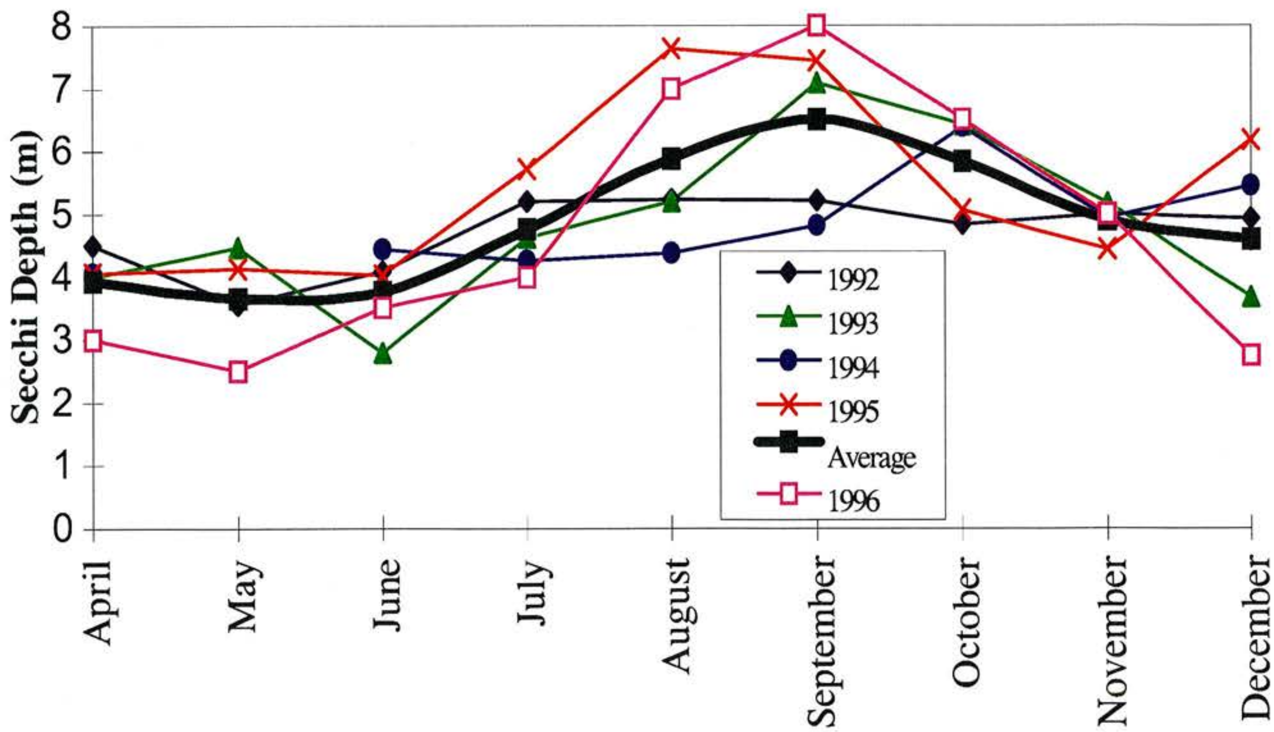

FIGURE 6-6. Average Secchi disk readings by month for Keuka Lake.

LAKE CHEMISTRY

CONDUCTIVITY

Conductivity is a measure of the ability of a water to conduct electricity and it is proportional to the concentration of ions in the water. In a bicarbonate-dominated lake such as Keuka, the conductivity primarily reflects the concentration of the major cations, calcium, magnesium, sodium, and potassium (Juday and Birge, 1933). The specific conductance of a lake is positively correlated to the natural buffering capacity (resistance to pH changes) of the water against the effects of acid precipitation (Strom, 1947). Natural uncontaminated waters have specific conductance measurements between 20 and 400 umhos/cm. Higher values may indicate salt contamination and lower values may result in low buffering capacity and less resistance to acid precipitation. The mean value for the central branch shallow site was 253 umhos/cm. These values are well within the acceptable range to buffer the effects of acid precipitation.

pH

The lake's pH level has been measured since 1975 and continues to be measured as part of the KLA lake monitoring program (see Figure 6-7). pH is a measure of acid and base material in water and is measured on a pH scale as shown below.

pH Scale

1	7	14
Acid Range	NEUTRAL	Alkaline Range

An acceptable range for pH in natural waters is between 6.5 and 8.5. The mean pH for the lake was 7.83. This pH value indicates that the lake is on the alkaline side and is in good condition. The historic pH trend indicates pH levels have gradually risen over the past 20 years. This trend could be the result of increased erosion due to development of the shoreline. It can be predicted that the pH levels will soon begin to level off. Given the moderately high conductivity values (conductivity is positively correlated with lake buffering capacity), the water should be able to buffer the effects of acid precipitation (pH 4 to 5) over the long-term.

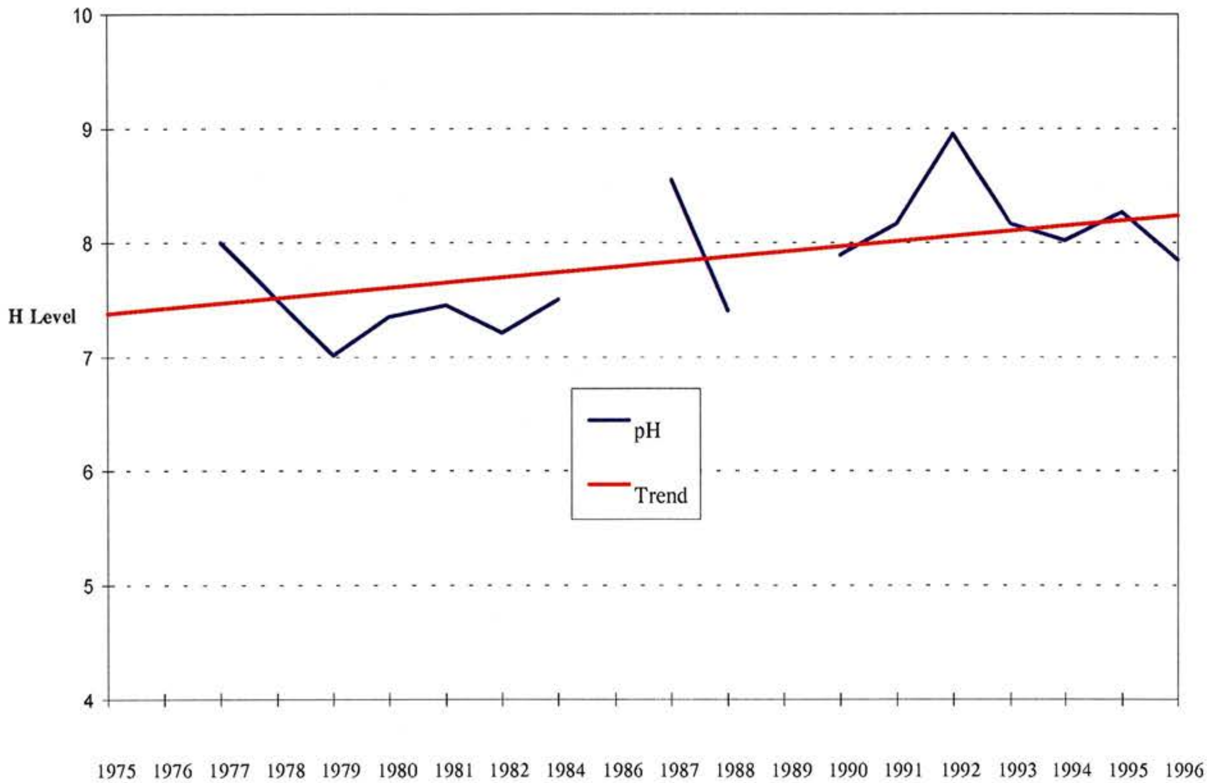

Figure 6-7. Historical pH levels on Keuka Lake.

NITRATE

Nitrate levels have been measured in Keuka Lake since 1975, however, the early measurements lacked accuracy due to the methods used. Since 1991 a more accurate method has been used to measure the nitrate levels in the lake (See Figure 6-8). The nitrate levels are tested at each site during the year at both surface and bottom sites. Normally, nitrate is not a serious problem in surface waters since it is readily available and not in limited supply as is the case with the nutrient phosphorus. Nitrate can be a major health problem in drinking water when the concentration approaches 10 ppm. At high levels, the nitrate molecule can replace iron in the hemoglobin of humans and causes "blue baby" syndrome in infants. In natural lakes, however, nitrate levels should remain under 1 ppm; higher levels may indicate sewage or fertilizer contamination. Other problems may arise when phosphorus levels are very low. Under these circumstances, algae blooms may be stimulated by elevated nitrate concentration. Figure 6-8 illustrates the mean nitrate levels for the littoral and pelagic(shallow and deep water) sites over the 1995 sampling season. These are typical curves. Both the littoral and the pelagic surface sites show a depletion of nitrate during the summer months, this is due to the algal use of this nutrient. The pelagic-bottom levels remain high due to the presence of the thermocline which prevents mixing of the cold deep waters and the warm surface waters. As a result the surface waters begin to deplete their nitrate stores. The fall turnover mixes the water layers and brings the levels for the different sites back towards similar values. The mean nitrate levels for the recent period from 1991 to 1996 is 0.14 ppm , indicating no problem with nitrate contamination in the sampling areas.

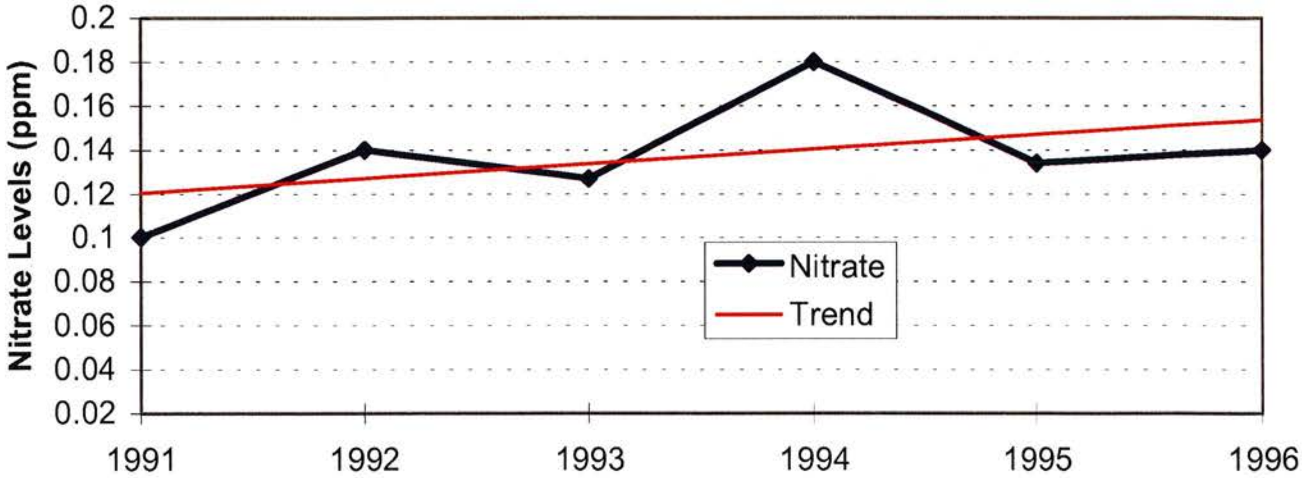

Figure 6-8. Historical nitrate levels in Keuka Lake.

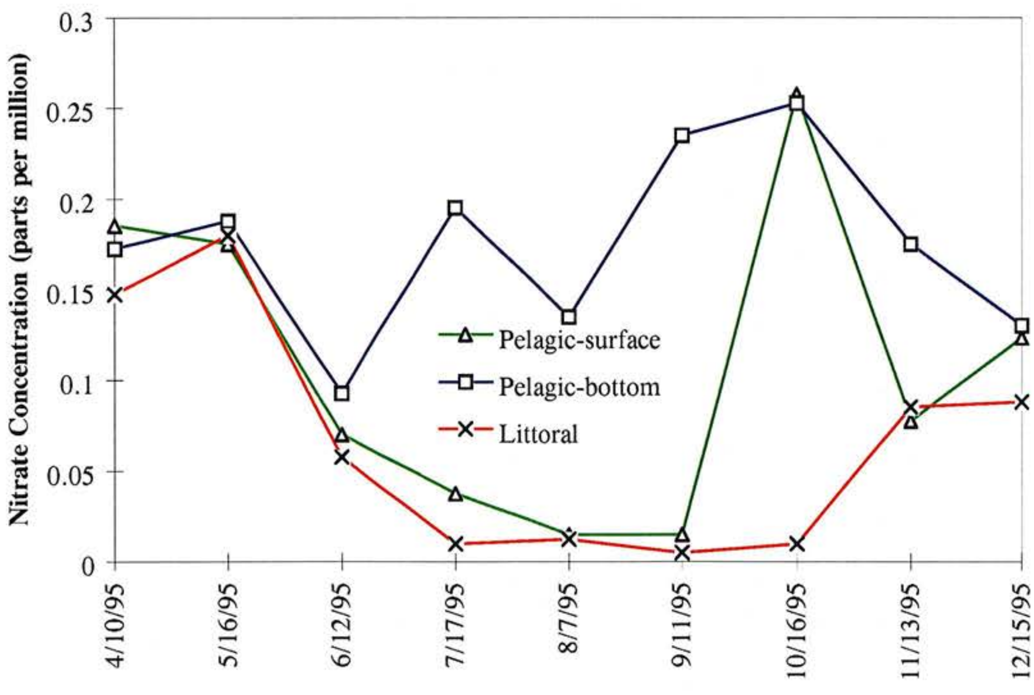

Figure 6-9. 1995 Nitrate levels at the pelagic and littoral sites.

PHOSPHORUS

Phosphorus testing has been carried out on Keuka Lake since 1975. The early testing sessions tested for orthophosphate. More recently the KLA testing program has been concerned with total phosphorus (TP) levels of the lake. Soluble reactive phosphorus was also tested by the KLA for 3 years, but the results were so low that they were undetectable (less than 0.2 ppb) by the current methods. Phosphorus is an important nutrient, along with nitrogen, that regulates algae and aquatic plant production in the lake. Generally, phosphorus is considered to be in limited supply relative to the demand by aquatic plants when the ratio of phosphorus to nitrogen is less than 1:7. In Keuka Lake, the average P:N ratio over the last five years is 1:12. These data indicate that the lake is "phosphorus limited". In practical terms, this means that excessive loading of phosphorus will result in algal blooms and lake eutrophication or aging. Lake phosphorus levels above 30 ppb can result in severe algal blooms. These conditions can create unsightly and foul smelling surface films, and in severe instances, deplete the DO supply in the lake to the point where fish mortality may occur.

Results form phosphorus testing are summarized in Table 6-2 and are illustrated in Figure 6-10. The difference between 1994, 1995 and previous years is perhaps weather related. 1994 and 1995 were relatively dry with limited spring runoff. There was significant spring runoff in 1993 resulting in a relatively higher TP mean for the year.

The average results suggest that the lake has very low phosphorus concentration, even in the shallow water areas. Values of TP under 10 ppb indicate "oligotrophic" lake conditions or water with low nutrient concentrations and productivity. Values between 10 and 26 ppb indicate "mesotrophic" conditions or moderate lake aging. More than half of the yearly averages fall below this distinction line for an "oligotrophic" lake.

There are limited accurate historical phosphorus data for Keuka Lake. Three samples were taken in 1973 by Schaffner and Oglesby (1978). TP values ranged between 8 and 20.4 ppb, with a mean of 12.4 ppb. SRP values ranged between 0.2 and 7.4 ppb. A second study in 1974 conducted by the EPA also only collected three samples. Mean TP and SRP values were 8 and 4 ppb respectively.

Table 6-2. Total phosphorus results for Keuka Lake from 1992-1996.

	Total Phosphorus (ppb)	
	Pelagic	**Littoral**
1992	8.83 (SD = 2.50)	12.52 (SD = 2.50)
1993	12.72 (SD = 8.35)	13.59 (SD = 4.48)
1994	7.71 (SD = 4.28)	6.90 (SD = 3.46)
1995	7.39 (SD = 3.91)	6.81 (SD = 3.47)
1996	7.47 (SD = 3.35)	9.70 (SD = 6.83
Average	8.82 (SD = 2.25)	9.90 (SD = 3.13)

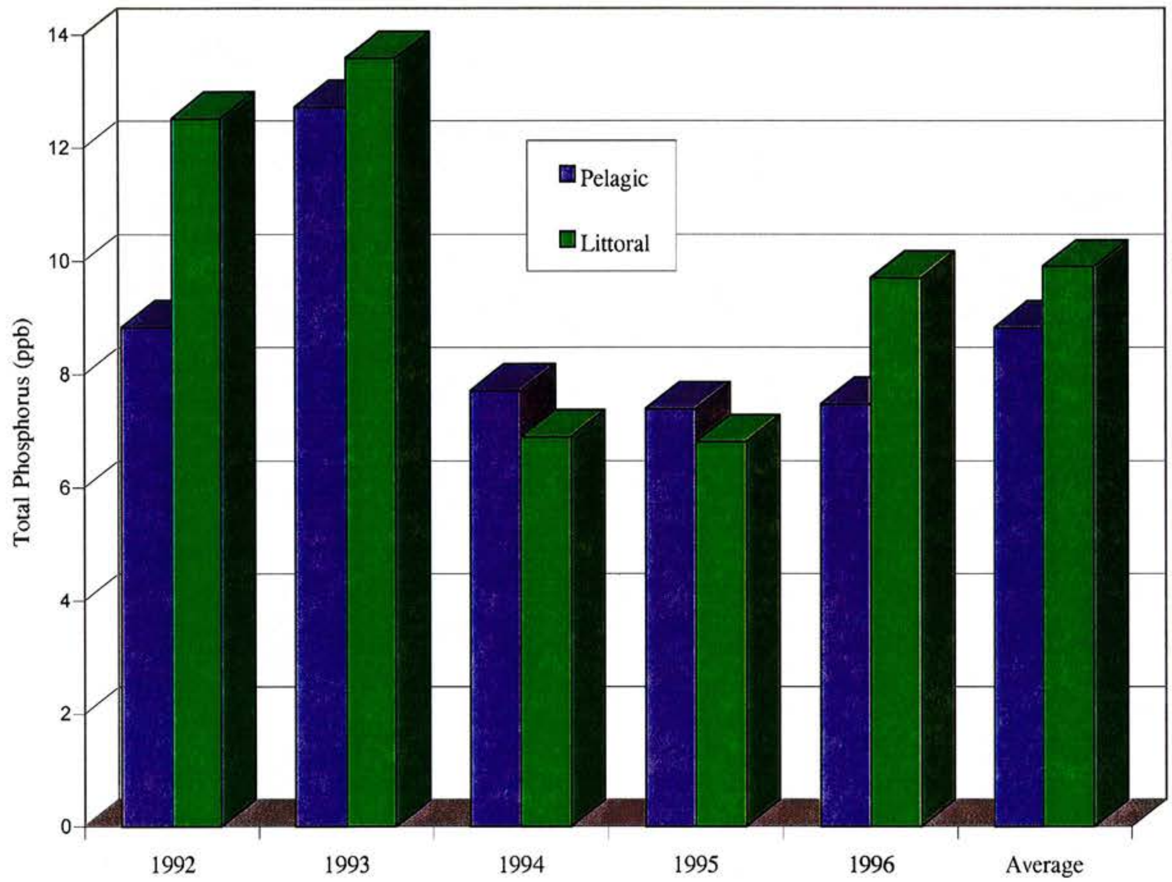

Figure 6-10. Mean total phosphorus levels 1992-1996.

LAKE BIOLOGY

ALGAE

Algae levels in Keuka Lake have been estimated using chlorophyll a measurements since 1991. Chlorophyll a is the primary plant pigment found in algae and the concentration of the pigment in the lake provides a good indication of algal abundance. The pigment concentrations can also be used to estimate the trophic status of the lake.

Yearly average chlorophyll a results for pelagic sites are illustrated in Figure 6-11. Overall, the levels observed indicate the lake is moderately productive. The mean algae concentration over the 1991-1996 period for Keuka Lake was 4.31 ppb. A moderately productive lake is classified as a mesotrophic lake. Carlson (1977) developed trophic indices for algae, phosphorus and secchi disk which will be discussed in more detail later in this chapter. For algae, however, Carlson's mesotrophic index range is between 30 and 50, the algae index average for the pelagic sites was 45.10. This value indicates that the lake has a good amount of algal productivity; more than may be expected given the phosphorus levels that supply the nutrients for algal growth. The algae concentrations directly benefit the food supply for the bottom of the lake food chain and in turn provide a larger forage base for the fish population.

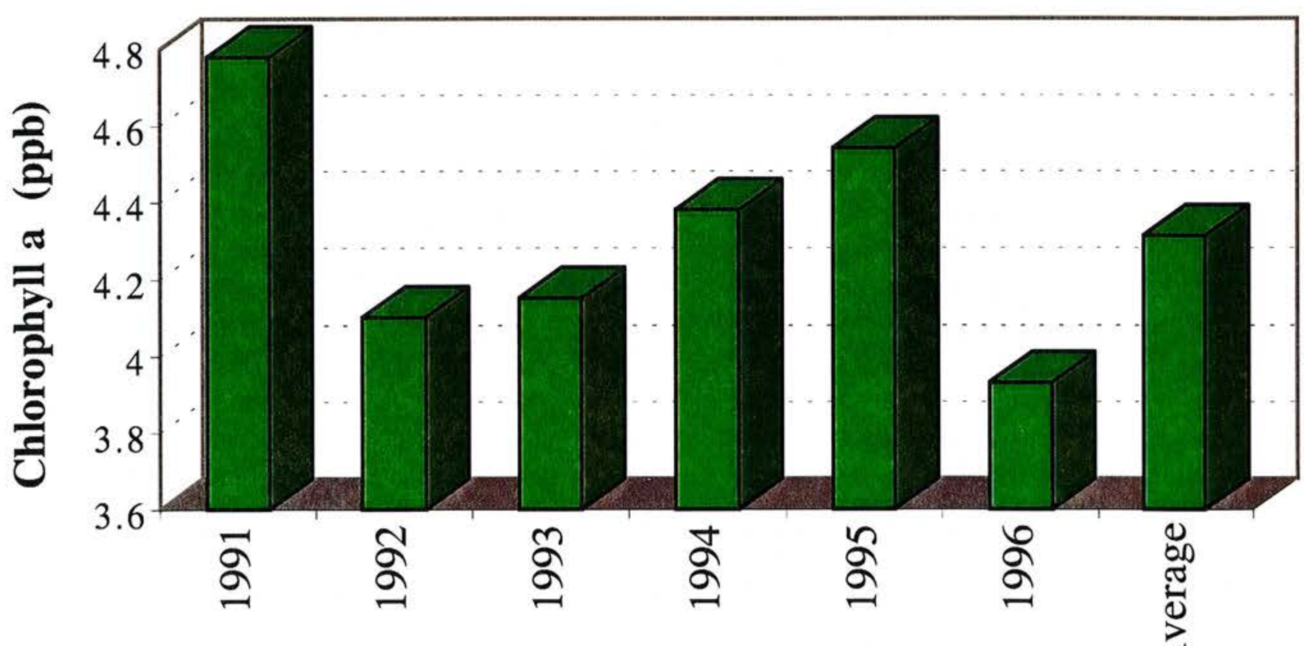

Figure 6-11. Chlorophyll a concentrations in Keuka Lake.

FECAL COLIFORM TESTING

Fecal coliform bacteria found in high concentrations in the lake indicate the presence of human or animal excrement. While fecal coliform bacteria are not harmful, their presence in water indicate that disease-causing bacteria or viruses may also be present.

Swimming or drinking water from a lake contaminated with human sewage can cause serious health disorders such as dysentery, giardiasis, typhoid and many other gastrointestinal infections. These waterborne diseases are serious and largely preventable with proper disposal and treatment of human wastes. Fecal coliform testing is a very important component of the program considering the lake serves as a drinking water source for nearly 3,000 homes, a good percentage of which use the water directly for drinking.

Fecal coliform tests are performed on 50 sampling sites distributed around the lake to determine if the water meets the Environmental Protection Agency's guidance level for surface waters used for drinking water supplies (20 colonies/100 ml) and the DEC's classification for a "AA" quality lake (50 colonies/ 100ml).

In general, the majority of the lake sampling sites show low fecal coliform counts, often meeting the drinking standard of less than 20/100 ml. Occasionally, a site will show a moderate increase, particularly after a heavy use weekend, such as the Fourth of July weekend. If these results remain high, corrective measures may need to be implemented. The site with the highest count was site 14 with a count of 4167 counts per 100ml. This result was very high as were the results for the entire lake in July of 1994 (see Figure 6-12). The reason for this high result is unknown, however, the results did return to normal levels in the following months samples.

Fortunately, few high levels of bacteria were found in Keuka Lake. The most likely source of bacteria in the lake is failing septic systems near the shoreline and tributaries. Other potential sources such as wildlife and animal concentrations in the watershed do not appear to coincide with high observed counts. It is difficult to determine how much a health threat the observed levels indicate. The elevated presence of fecal matter in the lake increases the probability and risk of encountering other pathogens. Drinking raw, untreated water from surface waterbodies is not recommended, regardless of KLA or homeowner testing results. All surface waters are considered "open systems" and are vulnerable to surface runoff contamination from a variety of sources from the entire watershed. Therefore, lakeshore residents are advised to disinfect lake water by chlorination, ultra-violet or some other Health Department recommended method. For more information on fecal contamination, please refer to the Onsite Wastewater System section in Chapter 7.

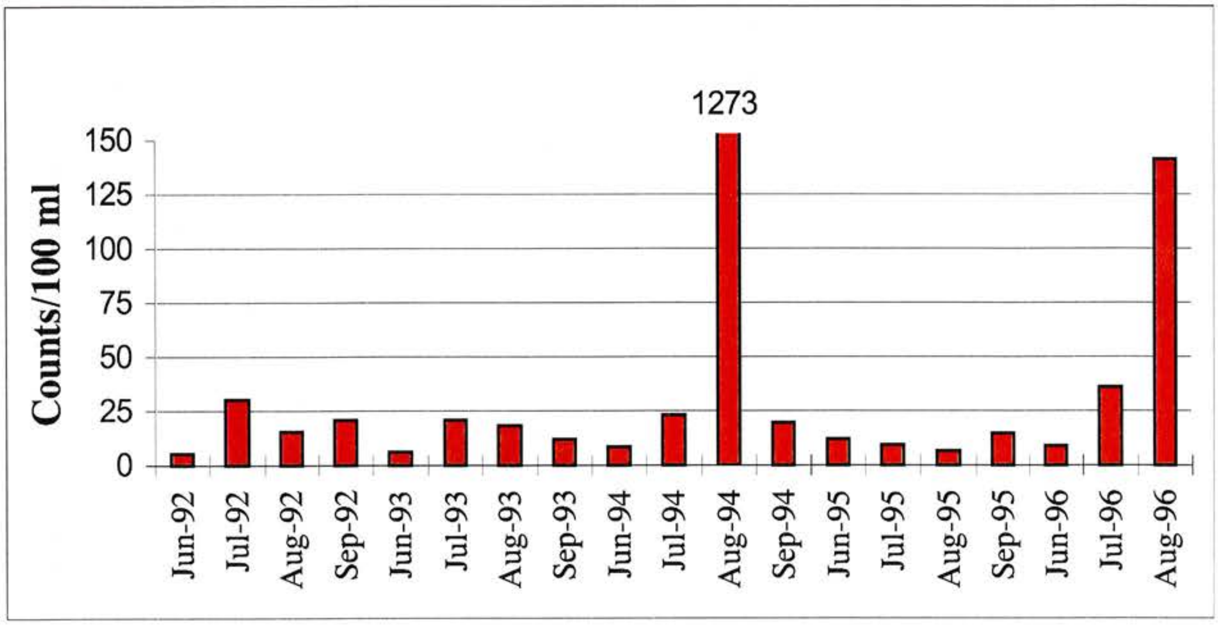

Figure 6-12. Geometric mean average fecal coliform testing results for Keuka Lake.

Table 6-3. Summary of fecal bacteria data, 1987 -1996.

Fecals/100 ml	1987	1988	1989	1991	1992	1993	1994	1995	1996
0	9 (26%)	20 (51%)	58 (36%)	21 (20%)	59 (33%)	10 (5%)	21 (11%)	118 (61%)	33 (23%)
1-4	2 (6%)	-	24 (15%)	28 (26%)	23 (13%)	41 (21%)	30 (16%)	34 (18%)	11 (8%)
5-20	3 (9%)	13 (32%)	18 (11%)	26 (24%)	39 (22%)	76 (40%)	39 (21%)	19 (10%)	24 (18%)
21-50	5 (14%)	-	13 (8%)	15 (14%)	31 (17%)	39 (20%)	15 (8%)	8 (4%)	21 (16%)
51-100	5 (14%)	4 (10%)	16 (10%)	8 (7%)	16 (9%)	12 (6%)	13 (7%)	4 (2%)	17 (13%)
101-200	6 (17%)	-	9 (6%)	5 (5%)	7 (4%)	8 (4%)	3 (2%)	3 (2%)	5 (4%)
201-1000	3 (9%)	3 (7%)	17 (11%)	4 (4%)	3 (2%)	6 (3%)	23 (13%)	5 3%)	11 8%)
over 1000	2 (6%)	-	6 (4%)	-	-		37 (20%)	1 (1%)	5 (4%)
Average					28	35	538	27	162
SD					66	86	1024	147	429
	n=35	n=40	n=161	n=107	n=178	n=192	n=183	n=194	n=133

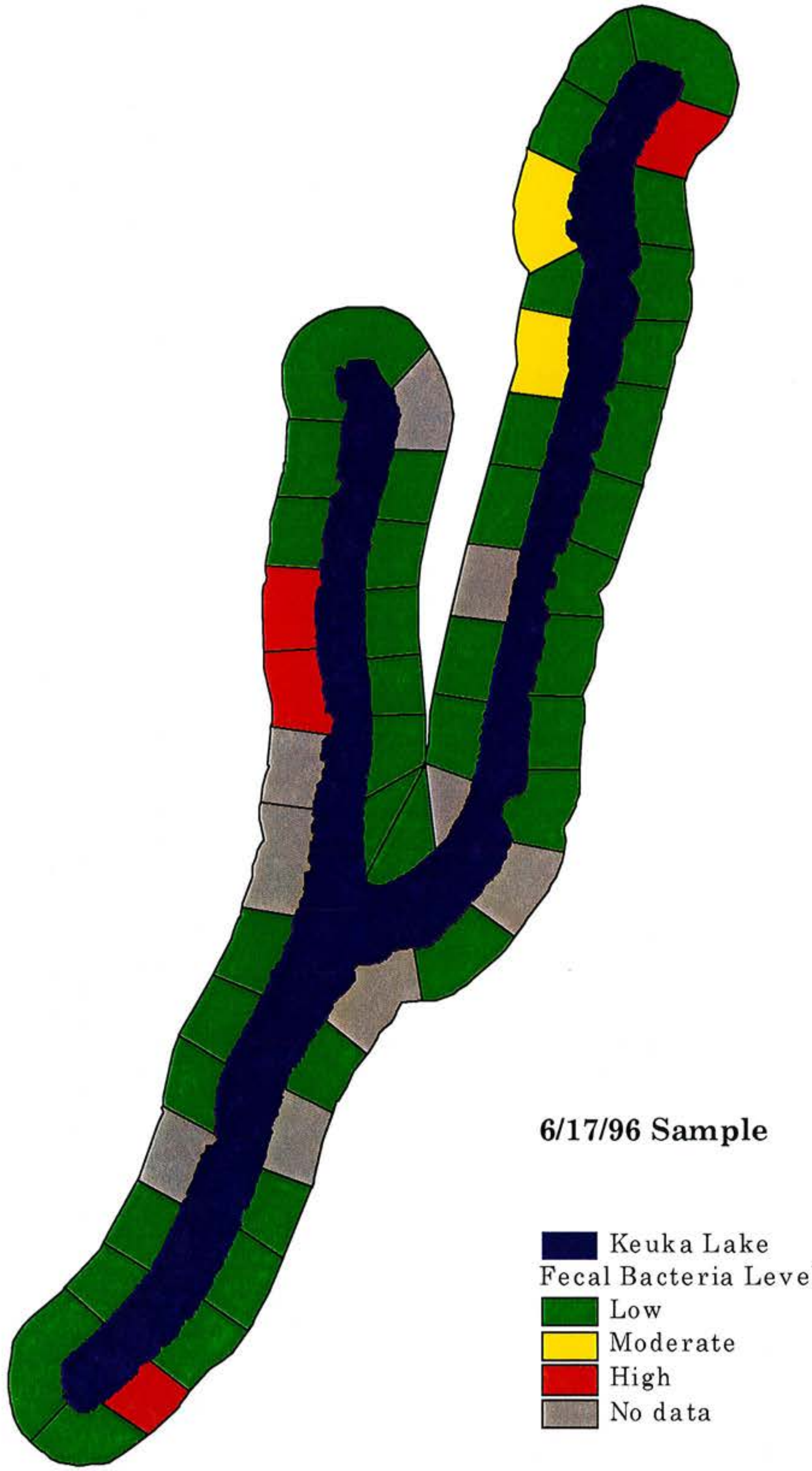

Figure 6-13. Fecal bacterial levels, June 17, 1996.

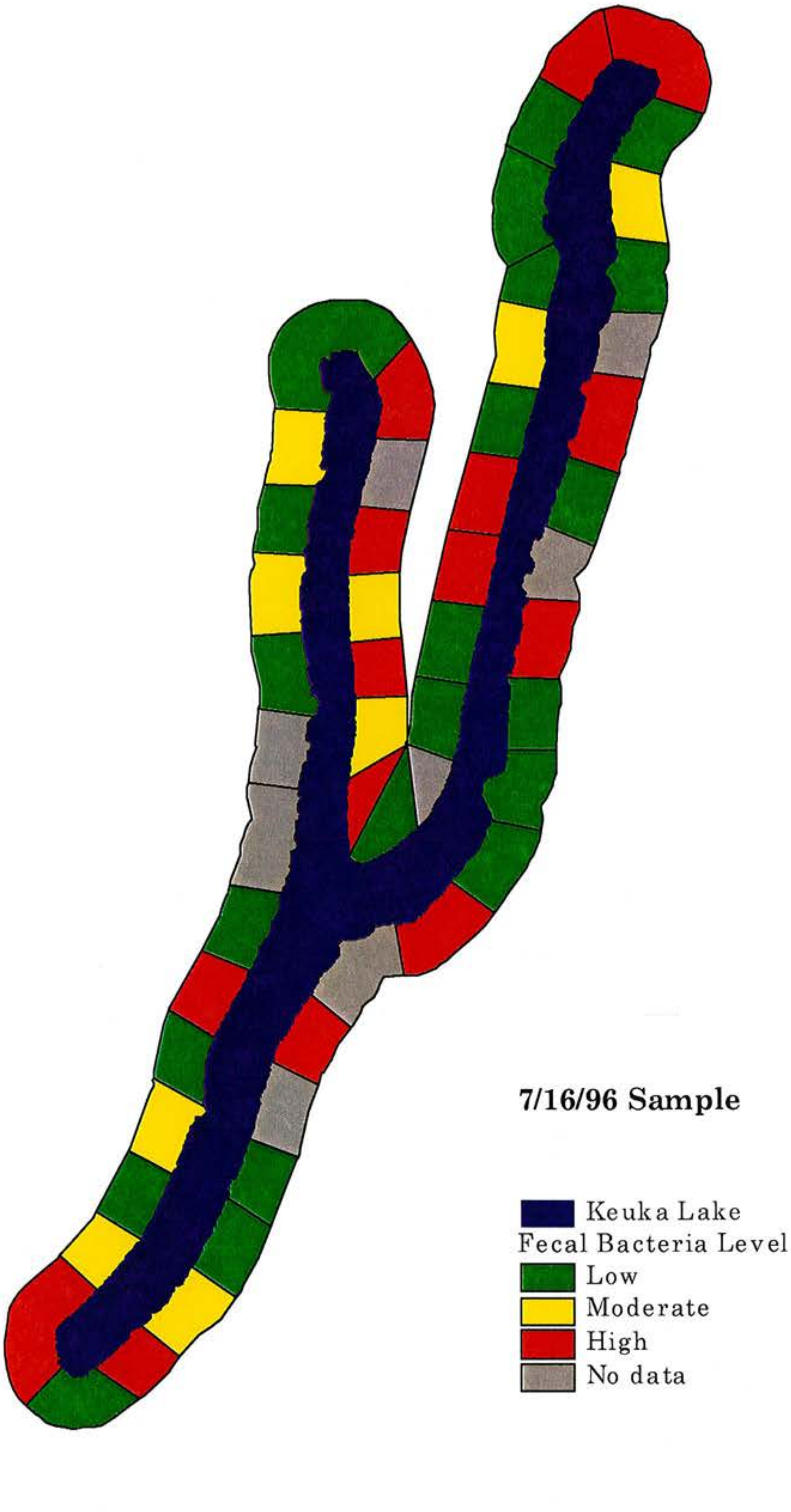

Figure 6-14. Fecal bacterial levels, July 16, 1996.

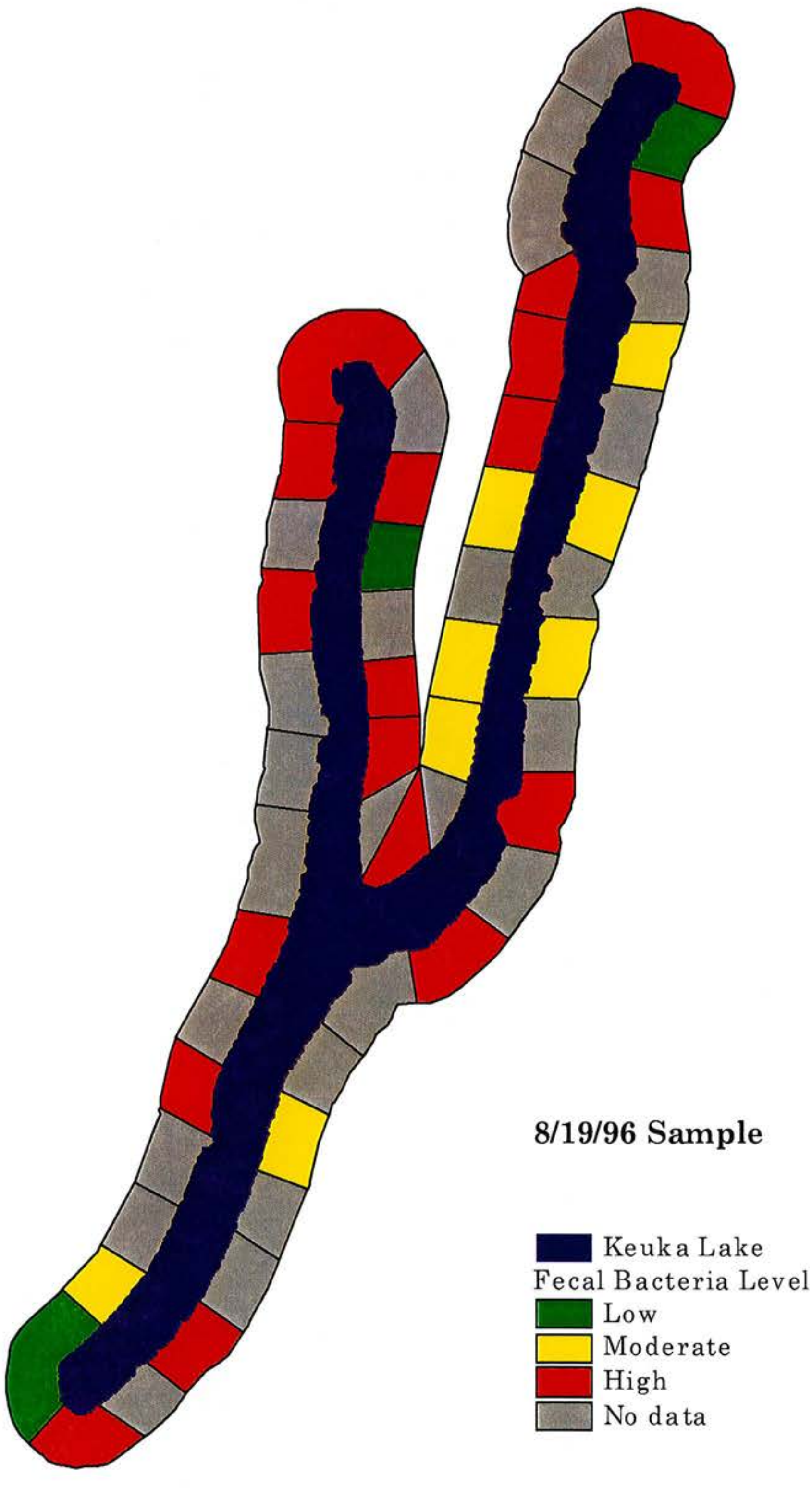

Figure 6-15. Fecal bacterial levels, August 19, 1996.

ZEBRA MUSSELS

Plankton tow samples have been routinely taken during the summer bacteria sampling sessions. To date only the August 1994 samples have shown the presence of zebra mussel (*Dreissena polymorpha*) veligers. However, several sightings of adult mussels have been made in the two northern branches of the lake. The first confirmed sighting of adult mussels was made in July 1995 on the Penn Yan municipal water treatment plant water intake line. Thirty seven post veliger zebra mussels were found in the sample. Since then, sightings have been made at Brandy Bay creek, Kelly's Marina, Rolf Point, and around 500 West Bluff Drive (see Figure 6-16).

Based on the rapid spread of zebra mussels throughout the United States and the other Finger Lakes, it is clear that the population will quickly expand and encrust on most hard surfaces in the lake in the next two to three years (1997-2000). While it is difficult to remove zebra mussels from boats transported from other lakes, boat cleaning is still prudent to prevent a more rapid spread of the mussel population.

At this time, it is difficult to predict how the zebra mussel population will affect fisheries and human uses on Keuka Lake. Keuka Lake is relatively "unproductive" (in terms of algae production and food availability for the mussels) and has a small littoral zone. As a result, mussel population densities may end up being relatively small. The algae levels are similar to Seneca Lake, however, and the mussels have thrived extremely well.

One final and interesting note regarding the spread of zebra mussels in Keuka Lake. At the time of this printing (1998), adult zebra mussels have been observed in low densities, mostly individual sightings, around most of the lake. No extensive colony or mat growth have been observed to date. While this apparent slow spread of mussels is good news, what explanation is there for this unique condition?

Discussions with Dr. Ed Mills at Cornell University and Charles O'Neill, Jr. at Sea Grant reveal Keuka Lake is not following the characteristic growth patterns found elsewhere.

Physical, biological, and chemical characteristics of Keuka are similar enough to Canandaigua and Seneca, that one would expect colony or mat growth by now. One possible explanation advanced by Dr. Mills is that zebra mussel larvae are perhaps being controlled by a large allewife and smelt population. The zooplankton size observations confirm an abundant allewife and smelt population based on similar work conducted on Lake Ontario (Mills, pers. comm., 1996) Mills speculates that the slow growth and lack of veligers in the water column may be due to non-selective feeding by allewife and smelt.

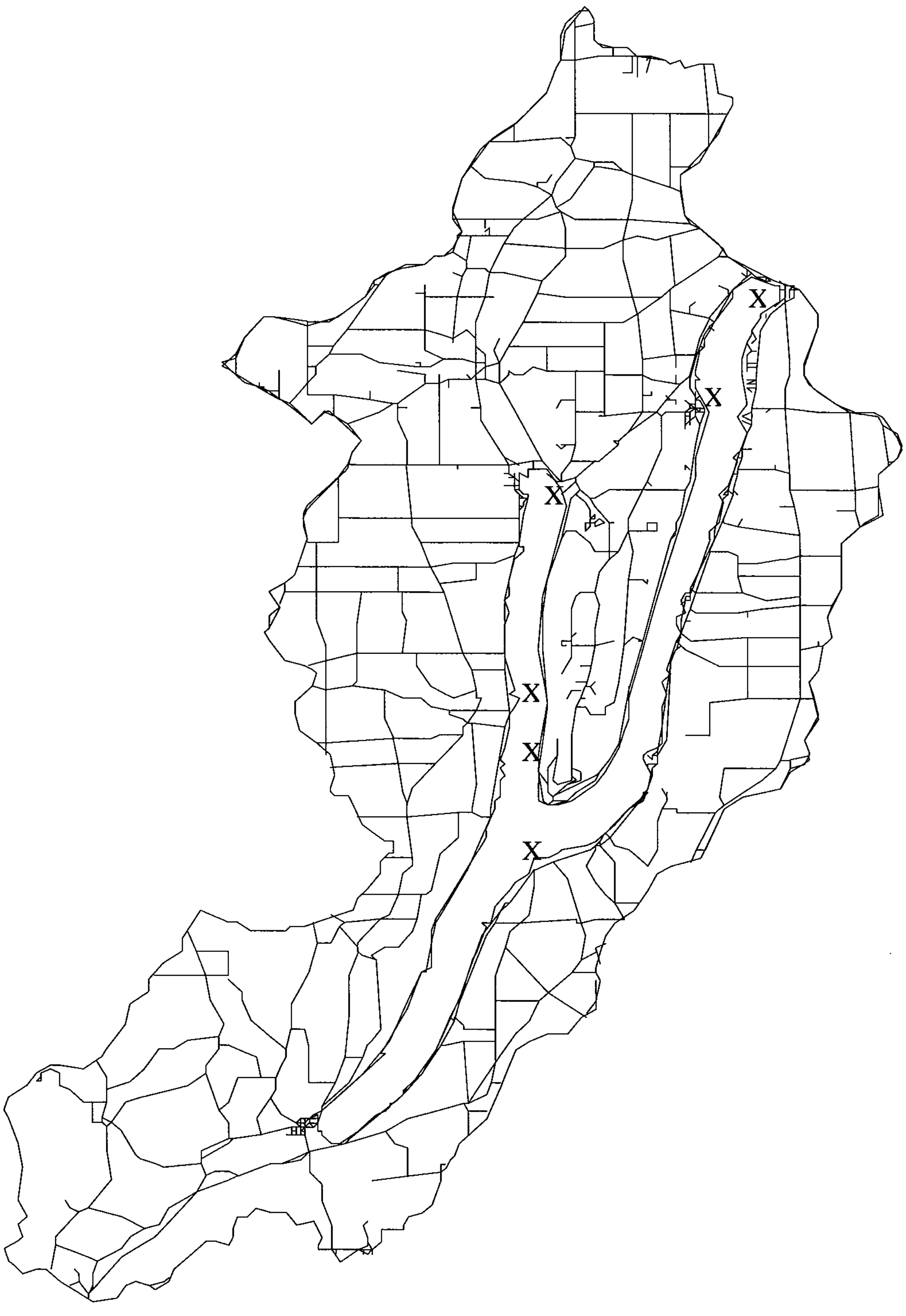

Figure 6-16. Reported adult zebra mussel sightings on Keuka lake, 1996.

CRUSTACEAN ZOOPLANKTON

The predominant crustacean zooplankton species found during the summer sampling sessions are *Bosmina longirostris, Ceriodaphnia (quadrangula and longirostris)*, *Tropocyclops prasinus* (formerly *Cyclops bicuspidatus*) and Nauplii. Figure 6-17 below illustrates the seasonal variation in the density of the four major zooplankton species. The mean size for the four species is illustrated in Figure 6-18. Table 6-4 summarizes the zooplankton data for the 1992-1996 sampling period.

The mean size of zooplankton showed a steady decline from 1992-1995, however, in 1996, there was a dramatic increase from approximately 0.3 mm to 0.5 mm. While the 1996 average size represents an increase from previous years, they are still considered representative of a population under heavy predation by alewife and smelt. Average zooplankton densities remain highest in the July sampling period. A total of twelve copepod species have been identified in the summer sampling sessions. The zooplankton size were quite small throughout the summer and early fall. Studies on Lake Ontario have found the mean size of crustacean to be approximately 0.60 mm (Dr. E.R. Mills, pers. comm. 1993). The relatively small size ranges in the crustacean population indicate one of three scenarios: 1) selective feeding by an abundant planktivore or forage fish population (such as alewife and smelt); 2) an abundant invertebrate population such as *Mysis relicta*; 3) the combined presence of both planktivores and *Mysis*. Mills speculates there is an abundant forage fish population (periodic observation of alewife die-off in the spring) and *Mysis*, while present, probably feed on zooplankton primarily in the small immature stages (Dr. E.R. Mills, pers. comm., 1995).

Table 6-4. Summer zooplankton data for Keuka Lake.

Zooplankton Population Density (#/L)

	June	July	August	September
1992	56.95	48.80	43.24	40.44
1993	27.78	103.09	94.66	39.87
1994	43.54	135.29	49.78	53.20
1995	69.90	67.45	49.78	22.58
1996	89.01	84.13	43.34	no data
Average	57.44	87.75	56.16	39.02

Average Zooplankton Size (mm)

	June	July	August	September
1992	0.37	0.46	0.47	0.43
1993	0.49	0.44	0.43	0.39
1994	0.39	0.36	0.37	0.35
1995	0.32	0.33	0.30	0.32
1996	0.50	0.51	0.57	no data
Average	0..41	0.42	0.43	0.37

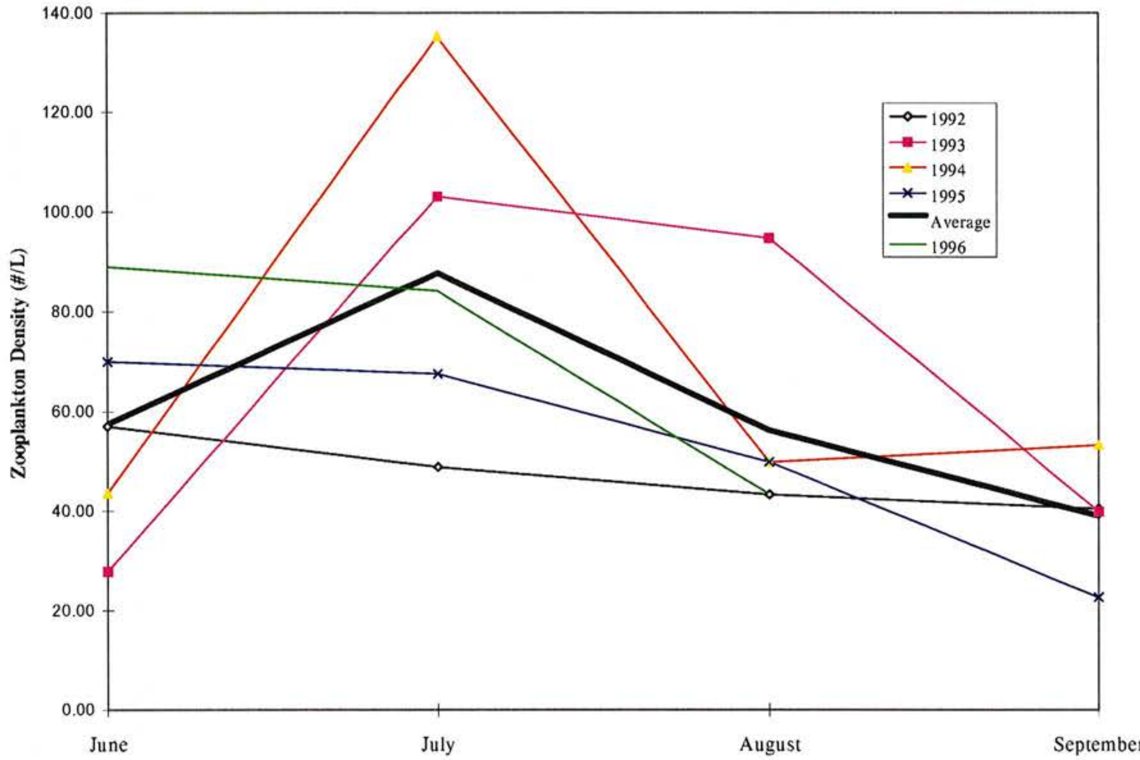

Figure 6-17. Average Summer zooplankton size in Keuka Lake.

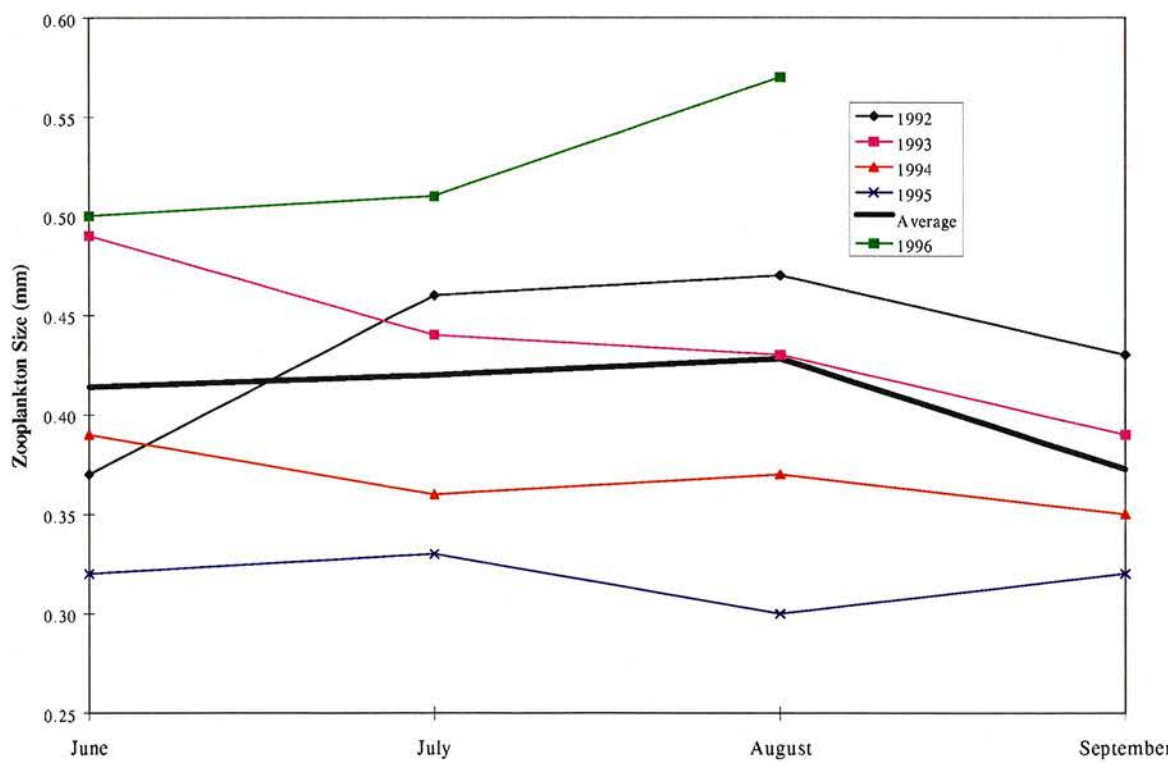

Figure 6-18. Average summer zooplankton density in Keuka Lake.

An interesting way to look at the observed small crustacean community in Keuka Lake is to consider the implications upon the food chain and nutrient cycling. A typical food chain for Keuka Lake is shown below. If the crustacean community consists primarily of small-sized individuals, the probable cause is an abundant forage fish population.

A large forage fish population is very good news for fishing enthusiast; a plentiful supply will support a healthy trout fishery. Also critical to the trout survival is the presence of Mysis or freshwater shrimp. These crustaceans are believed to be the primary food source for young trout, ages 1 to 4 years old. Recent studies by the DEC confirm that the trout fishery in Keuka Lake is very productive (Kosowski, pers. comm. 1994).

Another implication of the crustacean results is the affect upon algae and phosphorus. Since larger zooplankton "grazers" are being removed from the community, the algae or phytoplankton population is probably somewhat higher than would be expected considering the low nutrient status of the lake. The algal levels in the lake are higher than expected given the observed total phosphorus levels based on national eutrophication studies. The higher algae levels may also explain the lower than expected secchi disk readings.

The crustacean community observations may also have implications on understanding phosphorus loading. Additional phosphorus loading, either from natural or human sources, may result in even higher than expected algae levels and lower than expected secchi disk transparency, if the zooplankton grazers are kept at the same size levels. A potential mitigating factor not considered, however, is the impact that zebra mussels will have on the plankton community in Keuka Lake. The mussels may graze a significant amount of algae from the lake and impact the food chain dynamics described above.

On Seneca lake, preliminary data indicate that algal and phosphorus concentrations have been reduced in half and secchi disk transparency has more than doubled (from 4 to 10 meters, 1994-1996). This is a tremendous change for only a two year period! Fortunately, zebra mussels primarily live in the littoral zone, which represents only 10% of the surface area of Keuka Lake. Mills points out, however, that Quagga mussels survive quite well in deeper waters and they too will probably find their way into Keuka. What the final "steady state" in Keuka Lake will be once the zebra mussel have established themselves is difficult to predict at this point.

Phosphorus →algae →zooplankton →forage fish →adult salmonids
\ →Mysis →age 1-4 salmonids

FISHERIES

The fisheries of Keuka Lake are renowned in New York State. According to David Kosowski, Fisheries Biologist with the New York State Department of Environmental Conservation, Keuka Lake is one of the best salmonoid (trout) fisheries in terms of natural spawning habitat and recruitment and angler catch rate as documented by angler diaries. The NYSDEC monitors Keuka Lake fisheries using the following techniques:

1) **Standard gang lake trout gill netting** (every 3 years)
2) **Angler Diaries** (annual reporting)
3) **July Fishing Derby** (annual)
4) **Electrofishing of spawning rainbow trout in Cold Brook** (every 3 years)

From the DEC surveys much can be learned about the fisheries in Keuka Lake. The angler diaries are an important effort that utilizes sportsman participation and reveals important information on the salmonoid fishery. Table 6-5 below summarizes the angler diaries as compiled by the DEC (Kosowski, 1996) and Figure 6-19 and 6-20 illustrate the length to weight ratio for lake trout and overall catch rates respectively. Regarding the Keuka Lake fishing diaries Kosowski writes:

> *The last two year's catch rate, of 1.5 and 1.7 hours per legal salmonoid respectively, are the best catch rates since we began the diary program in 1968. These excellent catch rates are the result of a very abundant wild lake trout population with a few landlocked salmon, brown trout, and rainbow trout included for a little diversity. Lake trout continue to exhibit good growth rates, averaging close to tenty inches in length and three pounds in weight in the creel .*

The warm water fishery is also doing well and is dominated by yellow perch and smallmouth bass.

The second major piece of information gathered from the survey is feeding and forage data from stomach analysis. The DEC reports that the base of the salmonoid food chain is Mysis relicta or freshwater shrimp. Mysis are small (visible to the eye), but support a major portion of the diet of trout from ages 1 to 4 years old. Older fish feed on forage fish such as sculpin, alewife, and smelt. Understanding the population characteristics of Mysis and the forage fish (using hydroacoustic techniques) is needed sometime in the near future to help manage the salmonoid fishery.

In addition to the fishery surveys, the NYSDEC also stocks Keuka Lake with the following salmonoids:

Landlocked Salmon	22,300 yearlings
Brown Trout	9,400 yearlings
Lake Trout	none, completely supported by natural recruitment

Cold Brook remains the best nursery stream for rainbow trout. The rainbow fishery is considered all "wild" and doing fairly well. There does seem to be some problem with young recruitment and Kosowski speculates this is due to the abundant lake trout population feeding on the young rainbow trout entering the lake. Sugar Creek has a nominal contribution to the rainbow trout fishery. Sugar Creek has very good potential as a nursery habitat, but too many obstructions block the passage of spawning fish (beaver dams, logs, etc.). Significant habitat improvement is needed to restore Sugar Creek to the conditions found in Cold Brook.

The Landlocked Salmon are doing "OK" according to Kosowski and the stocking continues at 22,300 yearlings annually.

Table 6-5. Keuka Lake angler diaries.

			Total Salmonoids Kept (1)					Average Length of Fish Kept				Average Weight of Fish Kept				Length/Weight Ratios				
Year	Total Fishing Trips	Avg. Hours /Trip	LT	RT	BT	LLS	Total Fish	LT	RT	BT	LLS	LT	RT	BT	LLS	LT	RT	BT	LLS	Hrs to Catch 1 salmonoid
1968	1521		3	3			6	17.9				2.0				8.95				2.6
1969	1545	3.1	1919	11			1930	18.2				1.8				10.11				2.3
1970	1231	3.4	1306	2			1308	18.3				1.9				9.632				3.1
1971	953	3.1	974	6			980	19.2				2.4				8				2.9
1972	396	3.3	378	2			380	19.5				2.7				7.222				3.5
1973	626	3.3	590	12			602	20.8	19.3			3.1	3.1			6.71	6.226			3.4
1974	823	3.4	724	23			747	22.4	21.0			3.7	4.0			6.054	5.25			3.7
1975	1383	3.6	1356	73	3		1432	21.6	17.3			3.7	2.4			5.838	7.208			3.4
1976	1294	3.8	1293	81	1		1375	21.5	18.9			3.5	3.0			6.143	6.3			3.5
1977	1218	3.5	702	78	3		783	21.0	19.8			3.3	3.8			6.364	5.211			5.1
1978	1211	3.4	893	166	4		1063	20.4	17.8			3.0	2.6			6.8	6.846			3.8
1979	1265	3.4	921	194	4		1119	20.6	18.4			3.3	2.9			6.242	6.345			3.4
1980	1609	3.6	1307	144	2	2	1455	20.0	17.6			2.9	2.7			6.897	6.519			3.3
1981	2118	3.3	1498	211	59	22	1790	20.0	17.7	14.7	18.7	2.9	2.6	2.0	2.6	6.897	6.808	7.35	7.192	3.1
1982	2677	3.1	1913	135	147	55	2250	20.8	18.3	17.7	18.1	3.3	3.0	3.1	2.6	6.303	6.1	5.71	6.962	3.3
1983	2246	3.2	1313	128	200	100	1741	21.8	19.1	18.8	20.3	3.9	3.1	3.9	3.4	5.59	6.161	4.821	5.971	3.5
1984	1772	3.4	1070	142	132	41	1385	20.4	19.2	18.0	18.7	3.1	3.1	3.2	2.6	6.581	6.194	5.625	7.192	3.8
1985	1578	3.3	1359	71	82	114	1626	21.5	19.0	17.5	17.5	3.8	3.3	2.7	1.8	6.658	5.758	6.481	9.722	2.8
1986	1229	3.2	1027	36	36	61	1160	21.3	17.1	18.3	17.4	3.5	2.0	3.2	1.6	6.086	8.55	5.719	10.88	2.9
1987	1194	3.1	1125	31	25	40	1221	20.9	17.7	19.2	18.4	3.3	2.8	3.8	2.8	6.333	6.321	5.053	6.571	2.6
1988	1574	3.0	1410	36	132	212	1790	20.5	18.6	17.8	18.6	3.2	2.9	3.1	2.5	6.406	6.414	5.742	7.44	1.9
1989	1789	3.4	1490	86	339	146	2061	20.8	18.2	18.1	21.6	3.4	2.6	3.0	3.8	6.118	7	6.033	5.684	2.0
1990	1814	3.0	1572	43	183	17	1815	20.5	19.0	17.8	18.7	3.1	2.9	2.8	3.0	6.613	6.552	6.357	6.233	1.9
1991	1887	3.2	1503	57	102	58	1720	20.6	19.4	19.1	18.3	3.1	3.2	3.3	2.4	6.645	6.063	5.788	7.625	2.1
1992	1895	3.2	1174	37	87	31	1329	20.7	19.1	17.8	17.9	3.2	2.8	2.6	2.1	6.469	6.821	6.846	8.524	3.1
1993	1722	3.4	1273	32	62	29	1396	19.8	19.5	17.4	17.3	3.0	3.3	2.6	1.8	6.6	5.909	6.692	9.611	2.6
1994	2160	3.2	2215	23	164	68	2470	19.5	17.2	17.8	16.2	2.7	2.1	2.6	1.4	7.222	8.19	6.846	11.57	1.5
1995	2342	3.5	2285	28	158	95	2566	19.7	19.7	18.7	18.3	2.7	3.3	3.3	2.2	7.296	5.97	5.667	8.318	1.7

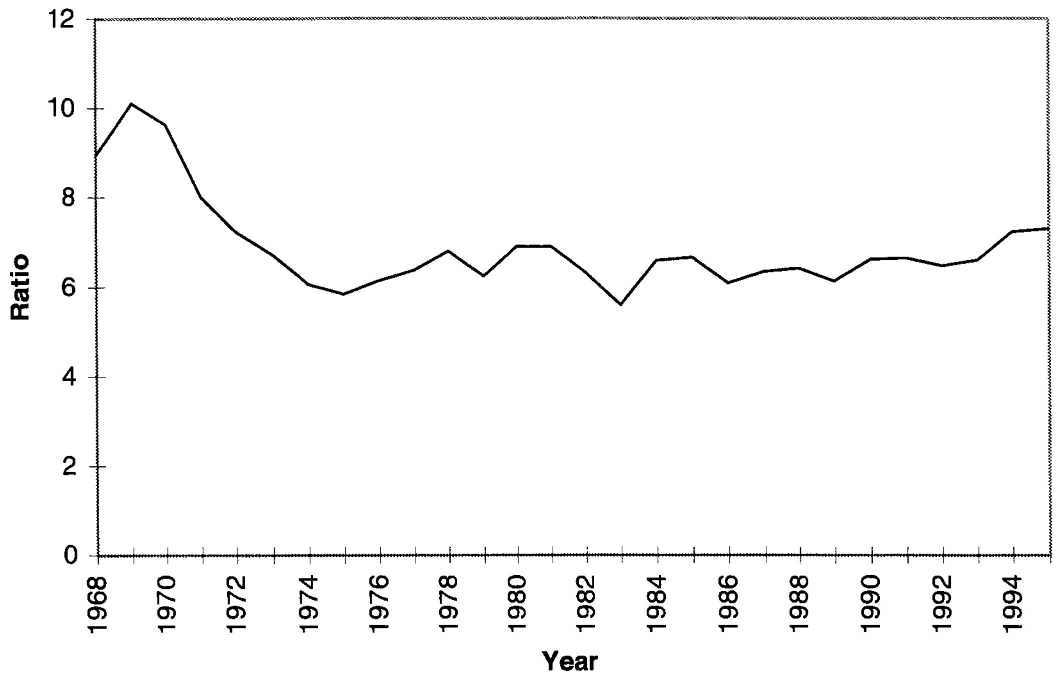

Figure 6-19. The length to weight ratio for Keuka Lake lake trout.

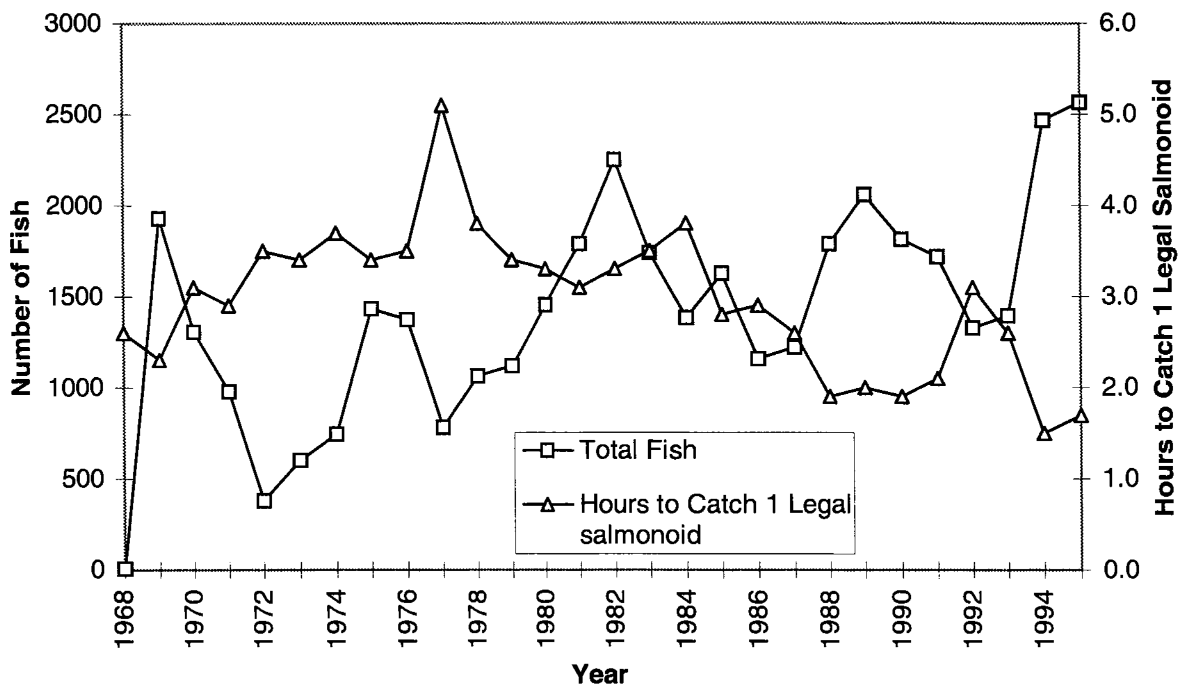

Figure 6-20. Historic total fish catches and the number of hours to catch one legal salmonoid.

FISH TISSUE CONTAMINATION

Toxic substances released in the environment over the past several decades have resulted in fish contamination in older fish. While the levels of toxic substance may be insignificant in ambient water, fish and other higher order animals bio-accumulate the material through the food chain because the substances are "fat soluble". Keuka lake trout are productive and plentiful, but have historically contained high levels of contaminants sufficient for the Department of Health to issue a "fish consumption advisory". The advisory suggests that no more than one fish per month over 25 inches be consumed and pregnant women and children should avoid eating trout altogether.

The NYSDEC monitors toxic substances found in trout through the Finger Lakes Fish Contaminant Surveillance program (Skinner, 1988). Fish are collected and analyzed once every three years to determine contaminant levels and trends.

DDT levels in lake trout were reported to reach unsafe levels in 1988. In the "Final Protocol - Finger Lakes Fish Contaminant Surveillance", Lawrence Skinner Writes:

> *Analysis of DDT and its metabolites in lake trout from several Finger Lakes during the period 1970 through 1976 showed a declining trend in DDT concentrations. However, beginning in 1978, DDT levels became stable or increased in some lakes (Canandaigua, Keuka, and Seneca Lakes). The change is in opposition to continued declines in DDT experienced statewide. In each affected water, the parent compound (p,P'-DDT) was present in significant quantities. This is in contrast to nearly all waters statewide.*
>
> *Use of DDT in watersheds containing lake trout was banned by the NYS Conservation Department in 1965. A statewide ban on DDT usage and sale was imposed July 1, 1971 by the Department of Environmental Conservation. At the time of the statewide ban, the recommended method of disposal of banned pesticides was land burial of existing stores by the user. The observed changes in DDT levels in lake trout may be due to leachates from past burial sites, landfill leachates or even illegal use of DDT. Another potential source is as a contaminant of permitted pesticides, e.g. dicofol.*

Data from the 1985 and 1988 contaminant trend surveillance clearly showed an increase in DDT in lake trout (see Figure 6-21). In older fish, such as the 8 year class, DDT was found to exceed the FDA's recommended safe level of 5 ppm for human consumption. In 1991, however, the DDT levels in trout dropped below the FDA limit (0.2 ppm average). Even with the lower levels found in 1991, the Department of Health has continued the fish consumption advisory. The 1994 results again showed a decline in the DDT levels in the 4 and 5 year classes, however, the larger 7 and 8 year classes were not sampled at the time. This lack of sampling of the larger fish classes leaves a void in the information about the larger fish. Sampling of the larger fish will need to be done at the time of the next sampling in order to determine DDT levels in these fish and whether or not to continue the health advisory.

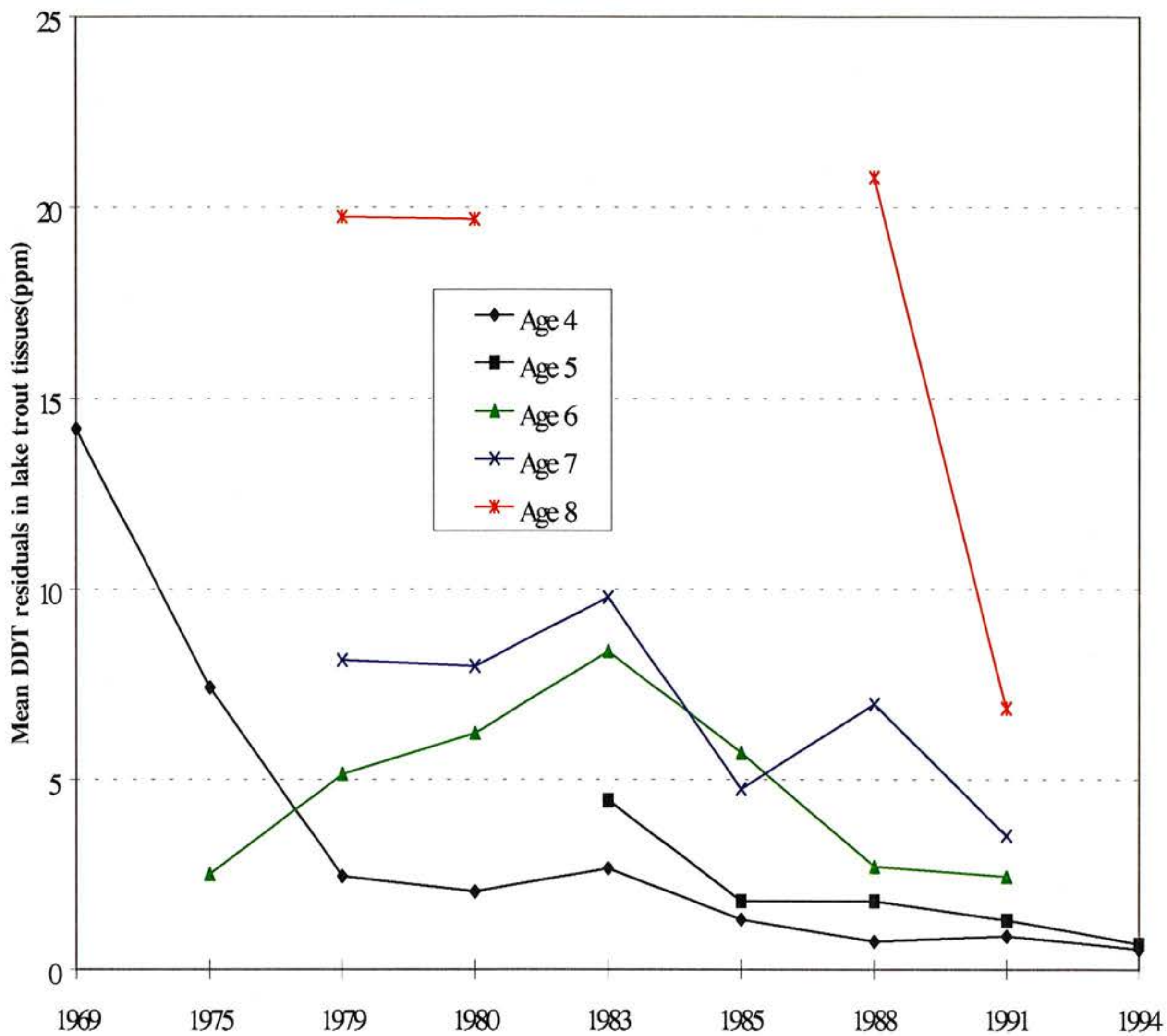

Figure 6-21. Mean DDT residuals in Keuka Lake lake trout tissue.

TRIBUTARY INFORMATION

Keuka Lake is rimed with 12 major tributaries and hundreds of smaller streams that only flow during the snowmelt period in the spring and during summer storm events. Altogether these streams contribute large amounts of sediments and nutrients into the lake. Sediment plumes can often be seen after periods of heavy rain or snowmelt. Along with sediments, large amounts of nutrients are dumped into the lake at these times. Figure 6-22 shows the nutrient levels found in the runoff from the major streams that enter into the lake. The 1994 stream testing data is presented as a baseline for comparison to the storm event samplings. The 1993 storm is a typical summer thunderstorm event. This event showed considerable increases in the amounts of nutrients that were present in the water that was entering the lake. January 1996 illustrates the effects of a major storm event that loaded very large amounts of sediments and nutrients into the lake. This storm event sent water into the lake with nutrient levels that were from two to thirty times the normal levels. The nitrate levels were more than double the normal levels, the total phosphorus levels were twenty times normal levels, and the total suspended solids content was thirty times the normal level. Had the January storm occurred during the warm summer period, a large algae bloom may have been result. This storm demonstrates the ability for the watershed to contribute very large amounts of sediments and nutrients into the lake in a short period of time.

DDT and other pesticide testing were conducted in 1996 by the Keuka Lake Association and the NYSDEC Bureau of Environmental Protection. Grab samples were collected during the 1996 flood from Brandy Bay and Wagener Gulley.

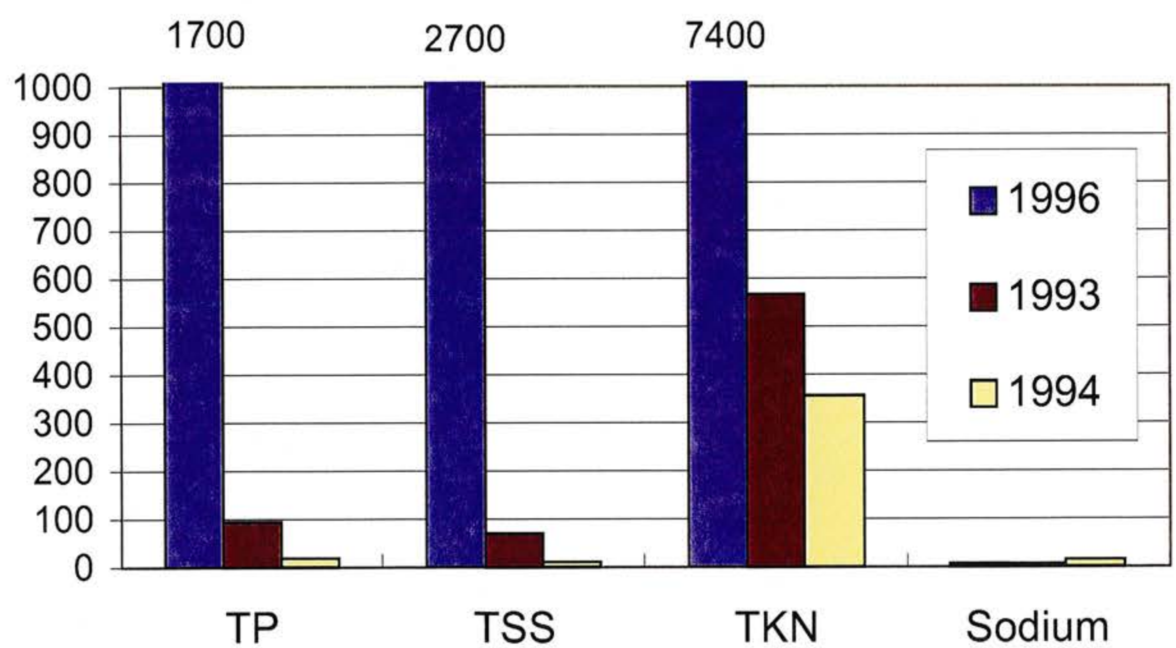

Figure 6-22. Tributary sampling results, 1994-1996.

Brandy Bay was selected because of the concentration of vineyards in the subwatershed and the detection of DDD (17 ppb) in a water sample collected in 1990 (Alfred U., 1990). Follow-up testing at various segments in the stream did not detect DDT or metabolites. Wagener Gulley was selected because of the high concentration of vineyards in the subwatershed. Samples were analyzed for DDT and metabolites, diuron and simazine. DDT, although banned, remains a concern because of the fish consumption advisory. Diuron and simazine are commonly used herbicides in vineyards. Samples were analyzed at Brockport State University using a gas chromatograph. Results from the testing indicate the presence of DDT in both Brandy Bay and Wagener Gulley and DDE in Wagener Glen. While the levels are quite low, less than a part per billion (the MCL is 5 parts per million), they may be high enough to cause the tainting of fish flesh in the lake. Studies have shown that ambient water or sediment levels of fat-soluble pesitcides like DDT can bioaccumulate through the food chain, concentrating an order of magnitude at each level. For example, zooplankton and crustaceans that feed off the bottom sediments may ingest DDT and concentrate it in their flesh to higher levels. Assuming 0.6 ppb in the sediment, Figure 6-23 illustrates a hypothesized bioaccumulation scenario. The resulting 6 ppm level corresponds with levels observed in Keuka Lake lake trout.

Table 6-6. Pesticide sampling results for Brandy Bay and Wagener Gulley, January 19, 1996.

Pesticide	Brandy Bay		Wagener Gulley	
Analyte	Sediment (ug/gm)	Aqueous (ug/ml)	Sediment (ug/gm)	Aqueous (ug/ml)
DDD	ND	ND	ND	ND
DDE	ND	ND	0.070	ND
DDT	0.610	ND	0.190	0.001
Diuron	ND	ND	ND	ND
Simazine	ND	ND	ND	ND

Sediment **0.6 ppb** → *Zooplankton* **6 ppb** → *Mysis* **60 ppb** → *Alewife* **0.6 ppm** → *Trout* **6 ppm**

Figure 6-23. Hypothetical DDT food chain bioaccumulation in Keuka Lake.

PISCES CONTAMINANT TRACKDOWN STUDIES

During the spring of 1996 and 1997, Timothy Preddice and Joseph Spodaryk from the Environmental Disturbance Investigation Unit of the NYSDEC deployed passive in-situ chemical extraction samplers, PISCES, for the detection of low-level sources of DDT and metabolites (Preddice, et al., 1997). Ten streams were surveyed over two, three week exposure periods in May and June. Preddice et al. concluded only Brandy Bay Creek had elevated exposure levels of DDT and DDE during the first exposure. Levels reached 0.012 ug. These levels are 2-3 times higher than those found in samples collected from the Fulton Chain of Lakes where DDT was used extensively for blackfly control (Spodaryk et al., 1995). During the second exposure period, no significant levels were detected, possibly due to low-water flow conditions. The high levels found in the first sample indicate an upland source and the significance of higher flows on DDT loading.

Follow-up sampling in the spring of 1997 by the NYSDEC found similar trends in DDT levels in Brandy Bay creek (Spodaryk et al., 1998). The purpose of the 1997 work was to investigate further sources of DDT in Brandy Bay creek by stream segment analysis and re-visit several other tributaries, such as Wagener Glen, for follow-up study. DDT uptake in 1997 was the same as in 1996, 1.1 ng/day. From the two-year study, the authors conclude:

a) Of the eleven tributaries studied, only Brandy Bay creek (tributary 64), appears to have problematic levels of DDT.
b) The mean DDT uptake rate in Brandy Bay was the same, 1.1 ng/day in 1996 and 1997.
c) It appears from the 1997 PISCES results that DDT is entering the creek largely via tributaries, KL64-2 and KL 64-4.
d) Recommendations are: 1) field inspection of the Brandy Bay drainage in the spring of 1998; 2) consider sending a drainage resident survey of DDT usage and disposal; and 3) consider conducting comparative soil analyses between this drainage and several others (Spodaryk et al., 1998).

GROUNDWATER

Groundwater in the Keuka Lake watershed has not been systematically tested. However, several studies and data from a local laboratory provide some clues as to the quality of groundwater in the Keuka Lake watershed. For a description of groundwater supplies in the watershed, please refer to Chapter 5, pages 5-4 and 5-5.

In July of 1994, several people in the Williams Hill Road, Town of Jerusalem, area became concerned over high lead readings in their groundwater. Two homes were found to have high lead levels (28 and 54 ppb) above the MCL (maximum contaminant level) of 5 ppb. Eight homes were studied, five in the Williams Hill Road area and three in the Himrod area. First draw and flowing samples were collected and analyzed by the Department of Health. Sample results indicated that all samples were below the 5 ppb threshold.

Bacterial levels in groundwater have not been systematically studies in the Keuka Lake watershed, however, results from statewide testing programs (Lemley et al., In press) and local laboratory results indicate that between 18 and 60% of private well water samples may be contaminated with bacteria. In the Yates County area, including Keuka Lake, sample results for 1995 and 1996, between 44 and 55% of samples had positive coliform, matt or dense growth of bacteria.

MUNICIPAL WATER PURVEYORS

Penn Yan and Hammondsport both draw water from Keuka Lake for drinking water purposes. Water is collected, treated and distributed to their respective village residents. Penn Yan also supplies water to Keuka Park and Dresden. In total, approximately 10,000 people are served by these municipal supplies.

As part of federal and state requirements, water for municipal systems are tested on a regular basis for a number of contaminants ranging from bacteria to pesticides, to radioactive by-products. Depending on the size of the facility and population served, specific testing is required under the Safe Drinking Water Act for both the parameters monitored and the frequency. These water quality data provide another clue as to the overall quality of water in Keuka Lake.

Table 6-7 below summarizes the monitoring protocol for the water supply systems for Penn Yan and Hammondsport. Since the late 1980's, no violations or elevated levels have been observed in the raw water samples analyzed, except for one low detection of cyanide in the Penn Yan sample and an elevated level of bacteria in the Hammondsport system in 1995. Subsequent samples did not detect any elevated levels. Water in the distribution system in Penn Yan exceeded the new EPA standards for lead and copper as a result of old waterlines and the new water treatment plant has incorporated corrosion control chemicals to address this issue.

The regional Department of Health offices in Geneva and Hornell, indicate the water is excellent overall as a supply of water for municipal purposes.

Table 6-7. Public water supply monitoring, Penn Yan, Hammondsport, and Keuka Park.

Contaminant	Sampling Location	Frequency	Remarks
Asbestos	distribution system	waived	
Radiological	distribution system	once every 3 years	
Inorganic Chemicals	entry point		
-12 IOCs		-annual	
-nitrate		-annual	
-nitrite		-waived	
VOCs	entry point	annual	
-53 halocarbons and aromatics			
SOCs	entry point	once every 3 years	
-Group I/II pesticides			
Coliforms	distribution system	6 per month	

SUMMARY AND CONCLUSIONS

The overall nutrient quality of Keuka Lake can be evaluated using a variety of methods. Table 6-8 summarizes the average total phosphorus, chlorophyll a, and secchi disk measurements for pelagic and littoral sites and compares the values with trophic state ranges found in *Diet for a Small Lake* (NYSDEC, 1990).

Table 6-8. Water quality measures and trophic status for Keuka Lake.

Standard/Measure	Trophic State Oligotrophic "Clean"	 Mesotrophic "Cloudy"	 Eutrophic "Swampy"
Total Phosphorus	< 10 ppb	10-26 ppb	> 26 ppb
1992 Pelagic Sites	**8.78 ppb**		
1992 Littoral Sites		**12.52 ppb**	
1993 Pelagic Sites		**12.71 ppb**	
1993 Littoral Sites		**13.59 ppb**	
1994 Pelagic Sites	**7.71 ppb**		
1994 Littoral Sites	**6.90 ppb**		
1995 Pelagic Sites	**7.39 ppb**		
1995 Littoral Sites	**6.81 ppb**		
1996 Pelagic Sites	**7.47 ppb**		
1996 Littoral Sites	**9.70 ppb**		
Keuka Lake- Overall	**9.63 ppb**		
Chlorophyll a	< 2 ppb	2-8 ppb	> 8 ppb
1992 Pelagic Sites		**4.14 ppb**	
1992 Littoral Sites		**4.09 ppb**	
1993 Pelagic Sites		**4.15 ppb**	
1993 Littoral Sites		**4.74 ppb**	
1994 Pelagic Sites		**4.54 ppb**	
1994 Littoral Sites		**4.23 ppb**	
1995 Pelagic Sites		**4.34 ppb**	
1995 Littoral Sites		**4.73 ppb**	
1996 Pelagic Sites		**3.93 ppb**	
1996 Littoral Sites			
Keuka Lake- Overall		**4.31 ppb**	
Secchi Disk	> 4.6 meters	1.9-4.6 meters	<1.9 meters
Keuka Lake- 1992	**4.75 meters**		
Keuka Lake- 1993	**4.94 meters**		
Keuka Lake- 1994	**4.86 meters**		
Keuka Lake- 1995	**5.44 meters**		
Keuka Lake- 1996	**4.27 meters**		
Keuka Lake- Overall	**4.83 meters**		

The overall results for Keuka Lake indicate the pelagic and littoral waters of the lake are in very good condition and within the oligotrophic range for secchi disk and total phosphorus, and mesotrophic for chlorophyll a. These results provide a better representation of the lake's overall condition as they take into account seasonal fluctuations of runoff and nutrient loading. Periods of high and low runoff can cause individual yearly results to vary a great deal. For example, in 1995 and 1994, there was a relatively "light" loading effect from the spring runoff period. 1993, however, was much more severe and the TP levels in the spring were elevated for nearly two months. Excluding the 1993 spring TP levels, the phosphorus levels are very similar for the summer and fall periods during the period of record.

The chlorophyll a and secchi disk readings indicate the lake is in very good condition. The relatively "high" concentration of chlorophyll a suggests that large and efficient "algae-eating" zooplankton (i.e., daphnia) have been removed by size-selective feeding by the forage fish (alewifes and smelt).

Another method used to evaluate the trophic status of a lake is to calculate Carlson Indices by incorporating the total phosphorus, chlorophyll *a*, and secchi disk measurements. Figure 6-24 illustrates the Carlson Index plots for the lake over the last 5 years. The plots clearly illustrate the lake would be considered mesotrophic for Chlorophyll a and secchi disk and oligotrophic (most of the time) for total phosphorus.

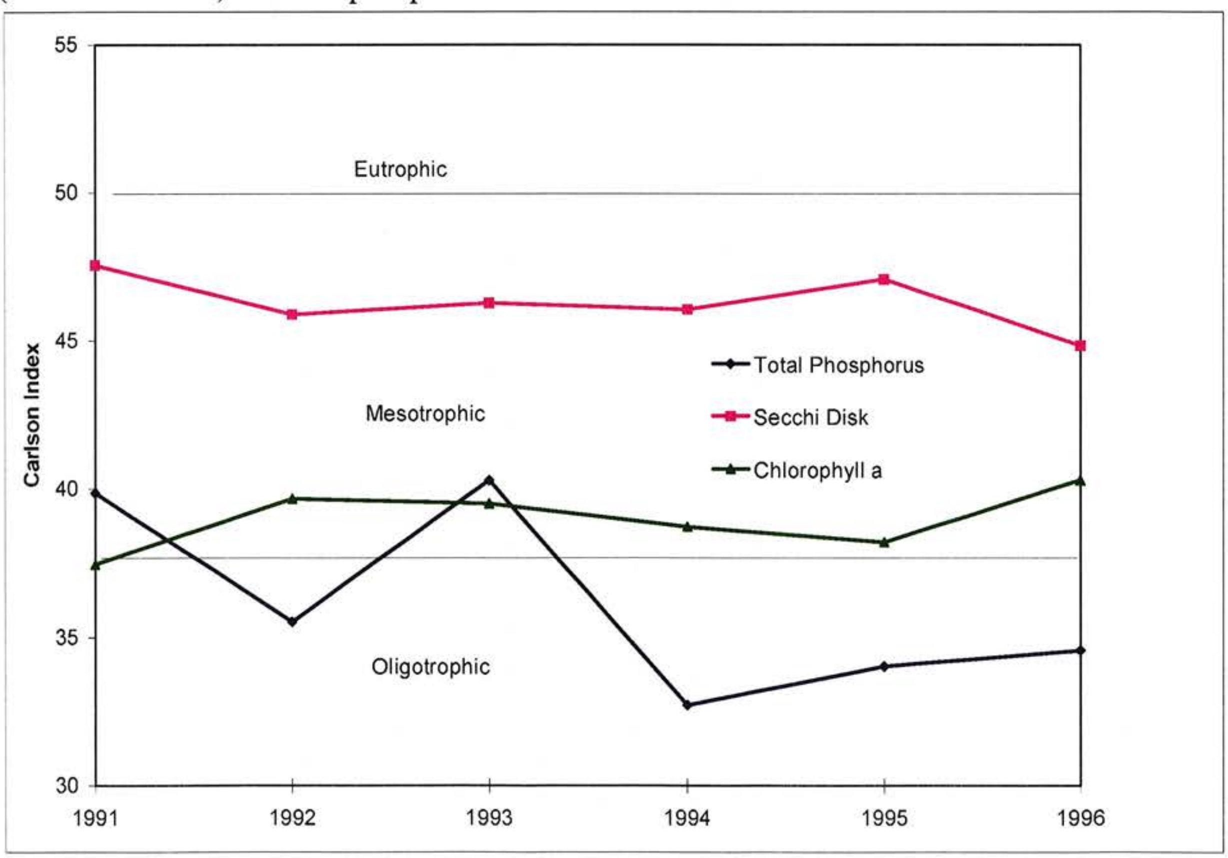

Figure 6-24. Trophic status of Keuka Lake 1991-1996.

Overall the deep water testing indicates that the lake is in very good condition. While no historical testing program has been as comprehensive as the 1992 through present testing program, comparison with the results in the early 1970's suggest the lake trophic status has not declined or changed significantly. Areas of concern continue to be the periodically high bacterial counts in the nearshore waters in the summer, high nutrient and sediment levels enter the lake from streams during storm events, and the continued concerns for residual levels of DDT in some streams and fish tissue.

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ANALYSIS OF SOURCES OF POLLUTION

INTRODUCTION

Many potential sources of pollution contribute to the total burden of pollution entering Keuka Lake. On a national basis, the Environmental Protection Agency estimates that 80% of the remaining water pollution problems are from nonpoint sources. In the Keuka Lake watershed, perhaps the figure is closer to 100% because few industrial and municipal wastewater treatment facilities are located within the boundaries. To understand the potential impact of nonpoint sources of pollution, sixteen sources of pollution were studied. For each source the text is organized with the following sections: introduction/background, methods, results and conclusion. Where feasible, the location of specific sources are identified within subwatersheds and ranking of priority areas are listed. In some cases good information was available to make an assessment. In other cases, information was gathered through field surveys and/or comparison with data in the scientific literature. The assessments represent a starting point for understanding the dimensions of the issues related to each source. Further assessment and research is needed. In Chapter 10, a summary of recommendations are found in the BMP and the remedial action worksheet sections.

AGRICULTURE

INTRODUCTION

The Keuka Lake watershed encompasses 100,800 acres of land. Forests represent the single largest land use with almost 55,000 acres. Agriculture is next with an estimated 34,300 acres, representing 34% of the land within the watershed.

Agriculture and related industries, such as vineyards and wineries, provide tremendous benefits to the watershed community. The nearly 365 farms and 34,300 acres provide jobs, tax base and tourism revenue for the local communities. As a land use, agricultural lands preserve open space, protect water quality and create the unique rural ambiance that is desirable for visitors and local residents. In addition, the vital and diverse local agricultural industry helps to maintain a locally available food supply for the region.

Keuka Lake supports a diversity of agriculture including vineyards, small dairy farms, orchards, small livestock operations, vegetable crops, cash crops and a few specialty crops. Within the watershed, the land devoted to agriculture has actually increased during the past twenty years in contrast to most areas of New York State which have seen decreases in agricultural lands. A large portion of this growth is the result of an increase in small to moderate size family dairy farms in the northern portion of the watershed.

Of the estimated 365 farm operations in the Keuka Lake watershed, approximately 37% report having livestock. The amount of agricultural land devoted to crops were reported as follows: 40% hay, 20% corn, 24% vineyard/orchard, 13% small grains and the remaining 3% in vegetables and other fruit.

To assess the pollution potential impact from agriculture on the watershed, current agricultural activity was collected using a survey mailed to all agricultural producers and by using the Generalized Watershed Loading Function (GWLF) computer model.

"AGRICULTURE IN THE KEUKA LAKE WATERSHED" SURVEY

To develop a general description of agricultural practices in the watershed, a written survey was sent to all of the watershed farmers by the Yates and Steuben County Soil and Water Conservation Districts.

The agricultural survey was sent to 365 farmers in the watershed and consisted of 37 questions and 122 variables including sections on crop acreage, livestock concentrations and manure practices, fertilizer and pesticide practices, best management practices and questions pertaining to the future status of the farm. The Tier I farmer questionnaire and Tier II Assessment Worksheets from the Skaneateles Lake Agricultural Program were used as a basis to develop the survey. Consistent with the goals of the New York State Agricultural Environmental Management (AEM) Tiered Planning Approach, the survey establishes basic farm information, identifies activities that are potential environmental concerns and evaluates the anticipated future use of the farm.

The survey was created by the Yates County Soil and Water Conservation District with the assistance and approval by the Keuka Lake Agricultural Advisory Committee representing a variety of agricultural commodities from both counties in the watershed. The committee placed importance on gathering information from a "user-friendly" and not overly time-consuming survey. After committee pre-testing and approval, the survey was sent to farmers in the watershed in July, 1996.

METHOD

The farmer mailing list was generated from SWCD newsletter mailing and USDA Farm Services Agency lists. The Agriculture Advisory Committee reviewed the lists and made corrections as needed. Further updates have been made to the mailing list as surveys were returned.

Several steps were taken to ensure a high response rate. Prior to receiving the survey, agricultural producers were sent a letter describing the Keuka Lake Looking Ahead Project and its objectives. The Dillman Total Design Method for implementing mail questionnaires was used (Dillman 1978). Each survey was numbered for mailing purposes only. This allowed returned surveys to be checked off and no further reminders sent. After two weeks, a follow-up letter was sent to non-respondents. After another two weeks, a second reminder letter and another copy of the survey was mailed to the remaining farmers who had not returned the survey. Complete confidentiality of all answers was assured.

To analyze the data generated from the survey, a pollution potential matrix was developed using 12 agricultural factors derived from the survey. The matrix used a factoring method to combine survey response data by subwatersheds/direct drainage areas for comparison and ranking of potential nonpoint source pollution. Table 7-1 illustrates how each agricultural factor was used to create the agricultural pollution potential matrix. Table 7-2 describes each of the agricultural pollution potential factors. Positive and negative practices were considered for each agricultural factor and values were assigned accordingly. A total of 12 agricultural factors resulted in the "pollution potential factor" for each subwatershed/direct drainage area.

Table 7-1. Pollution potential factors.

Barnyard/pasture factor	*presence of barnyard or feedlot; location of barnyard to stream; presence of pasture, rotational grazing; animal drinking water source*
Conservation best management practice factor	*BMP's on farm*
Crop factor	*acres of crops and types of crops*
Erosion factor	*presence of ephemeral and gully erosion and HEL (highly erodible land)*
Livestock factor	*possession of livestock; animal units per farm; number of dairy and beef < 6 months*
Manure management factor	*spreading practices; use of manure testing*
Milking washwater factor	*presence of milking herd; washwater disposal method*
Pesticide factor	*use pesticides; source for how much to apply; source for when to apply; unused pesticides on farm*
Petroleum product factor	*petroleum products on farm*
Silage factor	*storage of silage on farm*
Soil test factor	*use of fertilizers; soil testing practices; petiole testing*
Tillage factor	*tillage practices*

Table 7-2. Description of agricultural pollution potential factors.

Barnyard/Pasture Factor	The barnyard/pasture factor considers the presence of a barnyard or pasture on the farm and its proximity to the nearest stream. Rotational grazing and livestock watering practices are also included. *Equation: Barnyard/feedlot value + distance to stream value + pasture value + rotational grazing value + animal water source = Total Barnyard/Pasture factor*
Conservation Best Management Practice (CBMP) Factor	BMP factor recognizes best management practices (BMP's) as positive practices that reduce pollution potential on each farm. A BMP value is given for each of 9 potential practices. *Equation: Sum best management practices value for each practice = CBMP factor*
Crop Acreage Factor	Crops with similar characteristics are grouped and assigned a weighted factor based on the erosion potential for cultivated agricultural lands as listed in the USDA Engineering Field Manual. The total crop acres for each group are multiplied by the weight factor. The sum of all groupings yields the **crop acreage factor** for each subwatershed or direct drainage area. *Equation: (Total crop group acres) x (crop factor) = crop value* *Sum all crop values = Total crop acreage factor*
Erosion Factor	The erosion factor assigns a number value for ephemeral and gully erosion as well as highly erodible soils. *Equation: Sum of ephemeral and gully erosion and HEL (highly erodible land) values = Total erosion factor*
Livestock Factor	To account for the presence of livestock, animal units per farm amu/farm) value were calculated. Animal units is a unit of measurement for any animal feeding operation calculated by multiplying an assigned value per species by the number of animals in each species. The value will vary depending on the species and weight. One animal unit represents a 1000 pound animal. Slaughter and feeder cattle = 1.0 Sheep = 0.1 Mature dairy cattle = 1.4 Horse = 2.0 Dairy and beef cattle, less than six months = 0.3 Swine (over 55 pounds) = 0.4 Poultry = #/100 *Equation: (# of beef and dairy animals < 6 months x 0.3) + (# mature dairy cattle x 1.4) + (# slaughter and feeder cattle x 1.0) + (# Swine x 0.4) + (# sheep x 0.1) + (# Horses x 2.0) + (# Poultry/100) = Total animal units per farm*

Table 7-2. Description of agricultural pollution potential factors (continued).

	<u>*Livestock Factor*</u> *0-99 amu/farm = 1; 100-199 amu/farm = 2; 200+ amu/farm = 3* *Total of the livestock factors per farm for each subwatershed and direct drainage area = Total livestock factor*
Manure Management Factor	Accounts for manure storage, spreading & testing practices. *Equation: Manure storage value + manure testing value + sum of manure spreading value = Total manure management factor*
Milking/Washwater Factor	The milking/washwater factor assigns a value for the existence of a milking dairy herd on the farm and assigns a value for each washwater disposal method. *Equation: Sum of milking herd value + Sum of washwater disposal methods = Total milking/washwater factor*
Pesticide Factor	The pesticide factor considers pesticide usage, weed control method, information source for application rates, when to apply pesticides, and stored unused pesticides on the farm. *Equation: Weed control value + pesticides used value + when to use value + how much to use value+ unused pesticide value = Total pesticide factor*
Petroleum Product Factor	The petroleum product factor assigns a value for the presence of gas and/or diesel storage tanks on the farm. *Equation: Sum of yes responses for petroleum products stored on the farm = Total petroleum product factor*
Silage Factor	The silage factor considers whether silage is stored on the farm. *Equation: Sum silage storage value = Total silage factor*
Soil Test Factor	The soil test factor assigns values to fertilizer usage, soil pH, petiole testing, and soil/ manure testing to determine a total value. *Equation: Fertilizer use value + Soil test/manure test value + soil pH test value + petiole test value = Total soil test factor*
Tillage Factor	The tillage factor takes into account the tillage methods applied on the farm. *Equation: Sum of tillage method values = Total tillage factor*

RESULTS

Respondents returned completed surveys to the Yates County Soil and Water Conservation District and the data were entered into a statistical computer program called ABSTAT. Statistical summaries were made for each variable, for the entire watershed, and for the 29 subwatershed/direct drainage areas. Several combinations of variables were also analyzed for the entire watershed and for each subwatershed and direct drainage area. The 12 agricultural factors were calculated and ranked in descending order. In addition, the 12 factors were totaled to give a Pollution Potential Factor for each subwatershed and direct drainage area.

OVERALL WATERSHED SUMMARY

- There was a 53.7% survey response rate. See Table 7-3.
- The percentages were calculated on the data from the number of producers responding either yes or no to the question, rather than from the total 196 surveys returned.
- 179 surveys indicated current agricultural activity.
- Survey respondents represented owning or operating on 21,242 acres.
- Total tillable acres reported are 12,984 acres.
- Livestock are present on 37.4% of the farms in the watershed.
- Highest animal concentrations by animal unit measurement are in subwatershed 1, direct drainage 25 and direct drainage 27 (see Table 7-4). The Livestock Factor ranks the watersheds for animal concentrations by animal units.
- Returned surveys report a total of 4,294 animals for the entire watershed.
- Milking Dairy herds are reported in 9 subwatersheds or drainage areas.
- No surveys were returned from subwatershed 8 and subwatershed 10.

RANKING OF SUBWATERSHEDS AND DIRECT DRAINAGE AREAS

Using the 12 agricultural factors, the pollution potential rankings were grouped into high, moderate and low categories. The highest pollution potential value was 1,662. This value was divided by three to establish ranges for each category. The resulting number 554, was used to create three pollution potential ranges: values between 0 and 554 were labeled "low", values between 554 and 1108 were labeled "moderate", and values above 1108 were labeled "high".

Table 7-4 summarizes the ranking for each subwatershed/direct drainage area. In Table 7-5, the subwatersheds and direct drainage areas are ranked in descending order according to their total pollution potential factor value. High values indicate high pollution potential and low values indicate low pollution potential. A map of all of the subwatershed and direct drainage areas and their pollution potential ranking is illustrated in Figure 7-1. Part II of the Keuka Lake Looking Ahead Agricultural Survey Manual 1996, shows the equations and rankings for each of the twelve factors that make up the pollution potential value and is available from the Yates County Soil and Water Conservation District. A copy of the survey is presented in Appendix A of this document.

FUTURE STATUS OF FARMS

The survey contained several questions regarding future farm modifications and intentions.

- 48.4% of the respondents indicate their farm is supported by off the farm income.
- The average age and years of farming experience is 53.6 and 27.5 respectively.
- Retirement was the most frequent response to future farm modifications at 19%.
- 78% believe it is likely or very likely that their farm will still be in production in 10 years.
- 51% believe it is likely or very likely that their farm will still be in production in 25 years.

The above results are a strong indication that agriculture will continue to have a significant economic and environmental role in the Keuka Lake watershed. The recent migration of Mennonite farmers to the watershed has increased the acreage of land in active production and has prevented marginal farms from going out of production. This is in great contrast to the Canandaigua Lake watershed, which has seen a 20% reduction in agriculture since 1980.

Table 7-3. Agricultural survey response rate for each subwatershed/direct drainage.

Subwat./Dir. Drainage	Returned	Not returned	% returned
1	17	16	52%
2	11	10	52%
3	2	3	40%
4	1	0	100%
5*	2	0	100%
6*	2	0	100%
7*	4	0	100%
8*	0	0	0%
9*	6	0	100%
10*	0	2	0%
11*	4	7	36%
12*	1	0	100%
13*	1	1	50%
14	1	0	100%
15	4	2	67%
16	2	3	40%
17	11	6	65%
18	3	0	100%
19*	1	0	100%
20*	3	1	75%
21*	17	7	71%
22*	2	1	67%
23*	6	0	100%
24	6	1	86%
25	13	11	54%
26	6	1	86%
27	12	7	63%
28	13	4	76%
29	1	3	25%

*indicates Steuben County subwatershed or direct drainage.

Table 7-4. Agricultural pollution potential ranking for all subwatersheds and direct drainage areas.

Drainage	Respns	Acres	Crop	Livestock	Manure	Silage	Milk/Wash	Barnyard	Tillage	Erosion	Soil test	Pesticide	BMP(-)	Petroleum	Pollution	Category
1	21	2855	1359	64	43	11	26	41	23	20	29	82	48	12	1662	high
2	13	1009	263	15	17	1	3	13	11	12	18	44	33	7	371	low
3	2	55	18	0	1	0	0	0	1	1	5	13	9	1	31	low
4	1	400	43	1	3	0	0	3	2	3	0	8	3	0	60	low
5	5	324	446	4	2	1	0	5	8	2	5	17	10	2	482	low
6	2	174	8	1	0	0	0	4	2	0	6	9	6	1	25	low
7	6	619	3	0	0	0	0	0	0	5	9	20	16	3	24	low
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
9	6	950	117	10	11	1	0	6	0	2	8	13	11	2	159	low
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
11	9	213	25	1	6	0	0	1	4	5	8	14	4	2	62	low
12	1	50	2	0	0	0	0	0	0	0	1	8	3	0	8	low
13	4	353	99	6	2	1	3	5	3	1	4	8	6	1	127	low
14	1	87	21	4	3	1	0	3	1	0	1	0	3	0	31	low
15	5	636	488	26	12	4	5	10	7	6	6	12	13	4	567	moderate
16	2	60	21	0	2	0	0	0	0	0	1	12	3	0	33	low
17	11	1438	195	9	6	0	0	9	7	7	18	38	29	5	265	low
18	4	683	306	13	5	1	4	3	1	5	10	19	15	4	356	low
19	1	25	1	0	0	0	0	0	0	0	1	7	3	1	7	low
20	3	160	0	1	5	0	0	4	0	3	8	17	8	2	32	low
21	19	2554	575	20	14	2	0	24	11	9	33	58	41	10	715	moderate
22	3	1821	215	0	0	0	0	0	0	1	4	14	7	1	228	low
23	8	839	129	4	4	0	0	7	0	2	18	20	16	4	172	low
24	4	338	200	6	4	1	1	6	4	7	3	23	20	3	238	low
25	17	1930	684	27	22	6	11	25	20	14	26	73	69	15	854	moderate
26	4	467	209	5	4	1	5	4	1	16	9	22	4	2	274	low
27	12	1648	732	38	19	2	4	21	10	7	24	83	42	11	909	moderate
28	13	1426	370	3	5	1	0	12	2	13	33	91	45	7	492	low
29	2	128	49	1	4	0	0	0	4	2	2	10	5	2	69	low
TOTAL	179	21242														

Table 7-5. Agricultural pollution potential ranking by descending order.

Subwatershed/Direct Drainage	Pollution Potential Value	Category
1	1662	high
27	909	moderate
25	854	moderate
21	715	moderate
15	567	moderate
28	492	low
5	482	low
2	371	low
18	356	low
26	274	low
17	265	low
24	238	low
22	228	low
23	172	low
9	159	low
13	127	low
29	69	low
11	62	low
4	60	low
16	33	low
20	32	low
3	31	low
14	31	low
6	25	low
7	24	low
12	8	low
19	7	low
8	0	low
10	0	low

Survey Watershed Ranking:

High Pollution Potential

Subwatershed: 1

Moderate Pollution Potential

Subwatersheds: 15, 21, 25, 27

Low Pollution Potential

Subwatersheds: 28, 5, 2, 18, 26, 17, 24, 22, 23, 9, 13, 29, 11, 4, 16, 20, 3, 14, 6, 7, 12, 19, 8, 10

NONPOINT SOURCE POLLUTION COMPUTER MODELING

In addition to the survey, a nonpoint source computer model was used to estimate nonpoint source loading, providing a secondary source of information for comparison. The computer simulation model was used to predict the potential loss of sediments and nutrients from watershed lands. The model was developed at Cornell University by Doug Haith, Department of Agricultural and Biological Engineering, and is called the Generalized Watershed Loading Function model or GWLF. GWLF estimates the amount of sediment and nutrients delivered to a waterbody from the various activities within the watershed.

Estimation of sediment loads from the watershed is an important component of nonpoint source pollution studies. Sediment is a major water pollutant; serving as a transport medium for adsorbed and/or precipitated chemicals including nutrients, pesticides and metals. Sediment yields are generally obtained by determining gross soil erosion for the watershed and applying a sediment delivery ratio to this amount based on watershed characteristics.

The GWLF model was tested and verified by comparing model predictions with water quality sampling data in the West Branch Delaware River Basin in New York. This basin has similar land use and physical characteristics as the Keuka Lake watershed. GWLF was most recently used to predict sediment and nutrient yields in the Canandaigua Lake watershed and preliminary validation studies indicate a reasonable agreement between observed and predicted sediment and nutrient loading.

Model input requirements include land use, soil type, slope percentage, slope length, hydrologic condition and parcel size for each area. Additionally, daily precipitation and temperature data are required. All watersheds were analyzed using a ten-year weather record providing long-term sediment and nutrient predictions.

Land use information was derived from 1990 aerial photography of the watershed obtained from the Unites States Department of Agriculture (USDA). Land uses were visually identified and delineated from aerial photography (1"=1000' scale) and then digitized into a Geographic Information System (GIS). The GIS was then used to overlay each data layer to provide soils, slope, slope length and other information for each parcel. These data were exported as a text file for each subwatershed for input into the GWLF model.

Model accuracy is limited by the empirical nature of the Universal Soil Loss Equation (the USDA standard method of determining erosion) and applied sediment delivery ratios. The total sediment yield is the product of soil loss from upland sheet and rill erosion and the watershed delivery ratio. Streambank, gully and streambed erosion are not taken into account with this model. Erosion from these sources can be significant and are evaluated in a separate section of this chapter.

The model predicts the amount of sediment and nutrients delivered to the lake from each of the 29 subwatersheds. However, without extensive tributary monitoring over a number of years, it is difficult to verify the accuracy of the model results. While it is assumed that the loading values are reasonably accurate, based on similar work in the Canandaigua Lake watershed, the greatest value of the GWLF model is its use as a qualitative tool to compare and evaluate all 29 subwatersheds in a uniform manner. The model predictions may be high or low as compared to actual conditions, but they will be uniformly high or low for all 29 subwatersheds.

Results from the model were used to compare and prioritize subwatersheds for their potential to contribute sediment and nutrients from agricultural sources.

For the agricultural lands within a subwatershed, the model predicts erosion in tons/acre/year, total erosion, the amount of erosion delivered to the lake as sediment (sediment delivery ratio) and the amount of phosphorus reaching the lake attached to the sediment and dissolved in the water as runoff. See Table 7-6.

In studies of nonpoint source pollution, one of the most important considerations is the amount of erosion that is delivered to the lake as sediment. Although pollutants can be dissolved in water runoff, most of the nutrient and chemical pollution is transported to a waterbody by sediment particles.

The following is a description of how the GWLF model derives predictions for erosion and sediment:

Erosion: is predicted using standard methods developed by the U.S. Department of Agriculture using the Universal Soil Loss Equation (USLE). The USLE uses soils, slope and hydrologic condition information for each specific parcel identified as agriculture.

Sediment: the amount of sediment delivered to the lake is a portion of the total erosion occurring in the subwatershed. The model predicts this percentage based on the individual subwatershed characteristics and this percentage ranges from 15.2% to 23.0% for the subwatersheds surrounding Keuka Lake. Erosion is generated on the land during each rainfall, but only a portion of this is delivered to the lake. Table 7-6 summarizes the modeling results for each subwatershed. Table 7-7 ranks the modeling results in descending order based on tons of total erosion.

The GWLF model was used to uniformly analyze and compare all 29 subwatersheds for erosion, sediment delivery and nutrient delivery. The greatest value of the GWLF model is that all 29 subwatersheds are compared and evaluated in a uniform manner.

Table 7-6. Computer model estimates of erosion, sediments and nutrients from agriculture.

Subwatershed	Area (ac)[1]	% Agricult.[2]	Erosion (tons)[3]	Sed. Del. Ratio[4]	Sediment (tons)[5]	Total Phos. (tons)[6]
(1)Sugar Cr. N	8,288	56%	44,019	0.159	6,999	9.17
(2)Sugar Cr. S.	9,332	42%	26,263	0.154	4,045	5.38
(3)Sugar Cr. Shanty Plains	2,168	9%	1,066	0.250	267	0.3
(4)Sugar Cr. Big Gully	2,630	13%	1,868	0.219	409	0.52
(5)Chidsey Pt.	1,782	64%	4,661	0.233	1,086	1.42
(6)Knotty Pine	952	63%	2,631	0.250	658	0.92
(7)Wagner Gully	2,665	22%	3,370	0.206	694	0.93
(8)Urbana	1,929	13%	1,766	0.238	420	0.55
(9)Glen Brook	3,317	11%	3,204	0.194	622	0.83
(10)Cold Brook Mitchellsville	4,404	10%	4,250	0.180	765	1.04
(11)Cold Brook	9,909	18%	22,388	0.152	3,403	4.09
(12)Mt. Washington	1,887	18%	2,680	0.233	624	0.79
(13)Day Road	1,065	46%	3,542	0.242	857	1.19
(14)Eggleston Glen	2,072	31%	4,629	0.222	1,028	1.36
(15)Willow Gr.	1,952	58%	6,182	0.228	1,409	1.82
(16)Brandy Bay	2,419	36%	7,226	0.217	1,568	2.01
(17)Branchport	2,547	63%	7,534	0.200	1,507	2.06
(18)Coryell	1,629	49%	4,997	0.239	1,194	1.52
(19)Armstrong Rd.	1,559	45%	4,759	0.227	1,080	1.49
(20)Boyd Hill	1,137	40%	2,400	0.261	626	0.8
(21)Pulteney	5,943	51%	18,083	0.173	3,128	4.17
(22)Urbana	1,942	33%	4,988	0.231	1,152	1.44
(23)Grove Springs	6,210	31%	11,517	0.165	1,900	2.66
(24)Keuka Vil.	3,081	20%	5,152	0.200	1,030	1.34
(25)Barrington	7,983	37%	23,305	0.161	3,752	4.98
(26)Milo	1,678	51%	7,949	0.230	1,828	2.35
(27)Jerusalem	2,710	53%	13,046	0.207	2,701	3.49
(28)East Bluff	3,913	28%	9,790	0.188	1,841	2.44
(29)West Bluff	3,646	18%	5,165	0.188	971	1.31
TOTALS			258,430		47,564	

[1]Area of subwatershed in acres.
[2]Percentage of land in subwatershed in agriculture
[3]Model prediction of total tons of erosion per year from agricultural sources in the subwatershed.
[4]Model prediction of portion of erosion delivered to lake as sediment (sediment delivery ratio).
[5]Model prediction of sediment delivered to the lake from erosion on agricultural land.
[6]Model prediction of tons of total phosphorus from agricultural sources in the subwatershed.

Table 7-7. Computer model estimates of erosion, sediment and nutrients from agricultural sources. Ranking in descending order based on total erosion.

Subwatershed	Area (ac)[1]	% Agric.[2]	Erosion (tons)[3]	Sed. Del. Ratio[4]	Sediment (tons)[5]	Tot. Phos. (tons)[6]
1) Sugar Cr. N	8,288	56%	44,019	0.159	6,999	9.17
2) Sugar Cr. S	9,332	42%	26,263	0.154	4,045	5.38
25) Barrington	7,983	37%	23,305	0.161	3,752	4.98
11) Cold Brook	9,909	18%	22,388	0.152	3,403	4.09
21) Pulteney	5,943	51%	18,083	0.173	3,128	4.17
27) Jerusalem	2,710	53%	13,046	0.207	2,701	3.49
23) Grove Springs	6,210	31%	11,517	0.165	1,900	2.66
28) East Bluff	3,913	28%	9,790	0.188	1,841	2.44
17) Branchport	2,547	53%	7,534	0.200	1,507	2.06
26) Milo	1,678	51%	7,494	0.230	1,828	2.35
16) Brandy Bay	2,419	36%	7,226	0.217	1,568	2.01
15) Willow Grove	1,952	58%	6,182	0.228	1,409	1.82
29) West Bluff	3,646	18%	5,165	0.188	971	1.31
24) Keuka Village	3,081	20%	5,152	0.200	1,030	1.34
18) Coryell	1,629	49%	4,997	0.239	1,194	1.52
22) Urbana	1,942	33%	4,988	0.231	1,152	1.44
19) Armstrong Rd.	1,599	45%	4,759	0.227	1,080	1.49
5) Chidsey Point	1,782	64%	4,661	0.233	1086	1.42
14) Eggleston Pt.	2,072	31%	4,629	0.222	1,028	1.36
10) Cold Br.(M.C.)	4,404	10%	4,250	0.180	765	1.04
13) Day Road	1,065	46%	3,542	0.242	857	1.19
7) Wagner Gully	2,665	22%	3,370	0.206	694	0.93
9) Glen Brook	3,317	11%	3,204	0.194	622	0.83
12) Mt.Washington	1,887	18%	2,680	0.233	624	0.79
6) Knotty Pine	952	63%	2,631	0.250	658	0.92
20) Boyd Hill	1,137	40%	2,400	0.261	626	0.80
4) Sugr Cr. (B.G.)	2,630	13%	1,868	0.219	409	0.52
8) Urbana	1,929	13%	1,766	0.238	420	0.55
3) Sugar Cr. (S.P.)	2,168	9%	1,066	0.250	267	0.30

[1]Area of subwatershed in acres.
[2]Percentage of land in subwatershed in agriculture
[3]Model prediction of total tons of erosion per year from agricultural sources in the subwatershed.
[4]Model prediction of portion of erosion delivered to lake as sediment (sediment delivery ratio).
[5]Model prediction of sediment delivered to the lake from erosion on agricultural land.
[6]Model prediction of tons of total phosphorus from agricultural sources in the subwatershed.

MODELING WATERSHED RANKING

HIGH potential for agricultural contributions of sediment and nutrients.
Subwatersheds: 1, 2, 11, 21, 25, 27

MODERATE potential for agricultural contributions of sediment and nutrients.
Subwatersheds: 5, 14, 15, 16, 17, 18, 19, 22, 23, 24, 26, 28

LOW potential for agricultural contributions of sediment and nutrients:
Subwatersheds: 3, 4, 6, 7, 8, 9, 10, 12, 13, 20, 29

CONCLUSIONS

The Agricultural Survey was used to collect data on general farm operations including animal units, cropping, and various management practices in the watershed. The modeling program provided a second method for analyzing potential erosion based on land use.

The two evaluation methods were useful for developing a clearer picture of agriculture activity in the watershed. Four of the top six subwatersheds for pollution potential were identified in both methods. These results provide more support for selecting priority subwatersheds as well as evaluating the data from both methods for discrepancies. Figure 7-1 illustrates the final ranking of agricultural pollution potential in the watershed.

High pollution potential subwatersheds in both methods are:
Subwatersheds: 1, 2, 11, 15, 21, 25, 27, 28

Higher animal concentration units, associated manure management issues and more intensive cropping operations predominate in these watersheds. Farm planning and implementation activities should target these areas first.

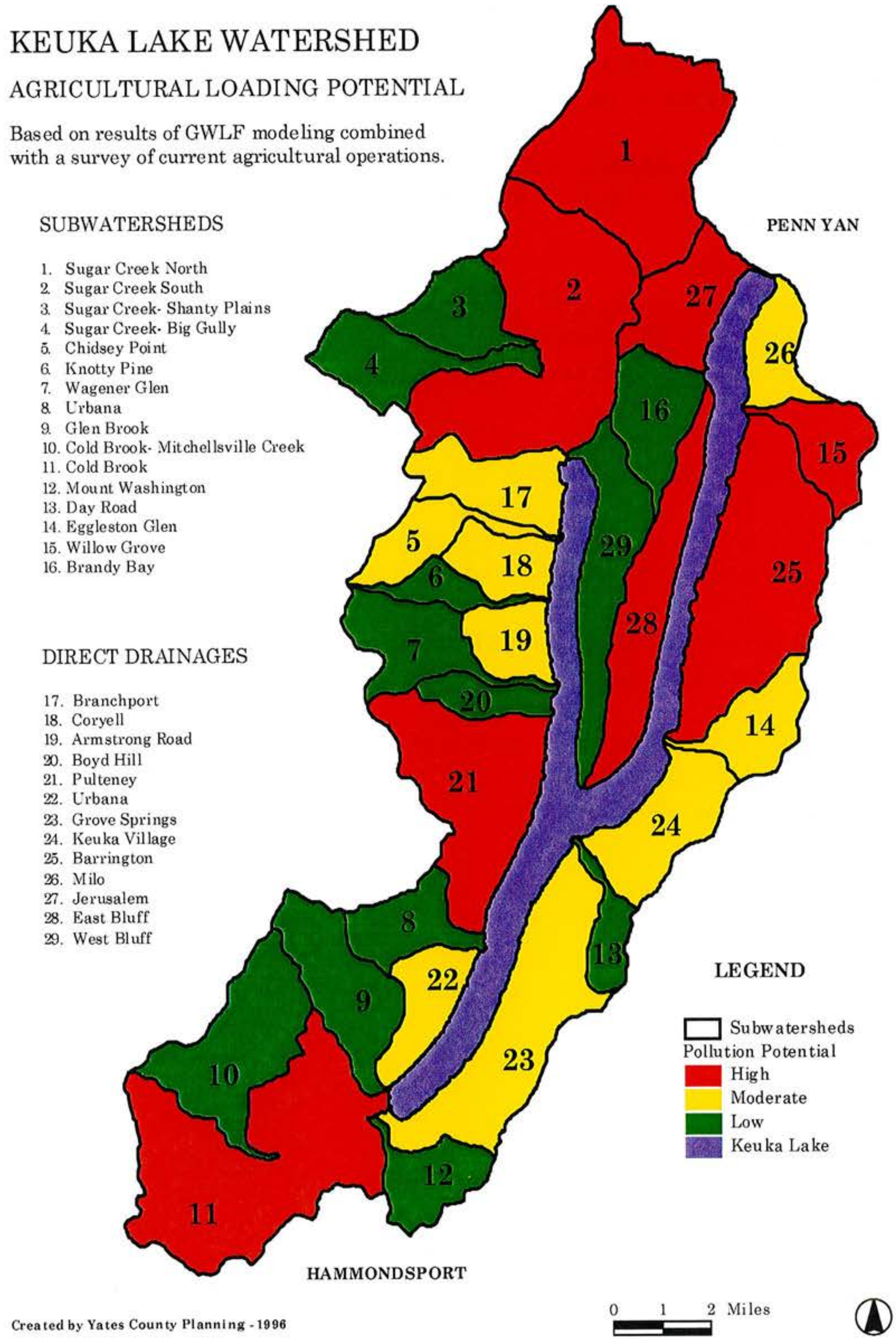

Figure 7-1. Agricultural loading potential for the Keuka Lake watershed.

COMPARISON OF AGRICULTURE TO OTHER LAND USES

A comparison was made of estimated amounts of erosion occurring from six major land uses in the watershed. The estimates from agriculture, forest land, idle land and residential land were generated by the GWLF computer model. The estimates for roadbanks and streambanks were obtained from their respective sections in this chapter. Table 7-8 summarizes the results of this comparison. An estimated 303,500 tons of erosion are produced per year. The following is an estimated percentage breakdown by land use:

Agriculture	85%
Forest Lands	6%
Roadbanks	4%
Streambanks	4%
Idle land	<1%
Residential	<1%

Forest lands contribute 6% of the estimated total erosion. As forest lands occupy 54% of the total watershed, the amount per acre is relatively small. Roadbanks and streambanks contribute approximately 4% each. These two sources occupy a relatively small area resulting in a high erosion rate per acre. Table 7-9 ranks the six land uses in descending order, indexed by agriculture.

In developing an overall nonpoint source pollution reduction program, there should be a focus on reducing erosion from agriculture, roadbanks and streambanks.

Table 7-8. Estimated total erosion (tons) by land use.

Subwatershed[1]	Agriculture[2]	Forest[3]	Idle[4]	Residential[5]	Road[6]	Stream[7]
1	44,019	668	99	60	342	465
2	26,263	1,318	111	83	322	657
3	1,066	255	27	2	202	367
4	1,868	450	6	1	160	270
5	4,661	127	4	1	322	266
6	2,631	54	0	1	396	370
7	3,370	312	91	3	558	486
8	1,766	446	12	7	788	347
9	3,204	838	14	7	1190	659
10	4,250	1,415	56	17	240	436
11	22,388	4,288	0	98	118	500
12	2,680	511	71	4	518	334
13	3,452	36	36	3	80	386
14	4,629	354	23	5	199	363
15	6,182	119	31	25	568	501
16	7,226	168	252	80	834	510
17	7,534	282	0	21	126	361
18	4,997	145	0	8	234	302
19	4,759	66	0	1	98	214
20	2,400	87	15	9	148	295
21	18,083	466	76	31	620	305
22	4,988	419	421	11	384	215
23	11,517	1,004	150	26	938	302
24	5,152	427	56	8	310	314
25	23,305	1,261	121	48	1274	299
26	7,949	84	132	21	104	221
27	13,046	332	53	41	290	223
28	9,790	1,220	249	21	758	250
29	5,165	1,683	274	15	614	340
Totals	258,340	18,838	2,380	658	12735	10561

Legend:
[1]Subwatershed identification number.
[2]Estimated tons of erosion from agricultural land within the subwatersheds.
[3]Estimated tons of erosion from forested land within the subwatersheds.
[4]Estimated tons of erosion from idle land within the subwatersheds.
[5]Estimated tons of erosion from residential land within the subwatersheds.
[6]Estimated tons of erosion from roadbanks within the subwatersheds.
[7]Estimated tons of erosion from streambanks withing the subwatersheds.

Table 7-9. Estimated total erosion (tons) by land use, in descending order, sorted by agriculture.

Subwatershed[1]	Agriculture[2]	Forest[3]	Idle[4]	Residential[5]	Road[6]	Stream[7]
1	44,019	668	99	60	342	465
2	26,263	1,318	111	83	322	657
25	23,305	1,261	121	48	1274	299
11	22,388	4,288	0	98	118	500
21	18,083	466	76	31	620	305
27	13,046	332	53	41	290	223
23	11,517	1,004	150	26	938	302
28	9,790	1,220	249	21	758	250
26	7,949	84	132	21	104	221
17	7,534	282	0	21	126	361
16	7,226	168	252	80	834	510
15	6,182	119	31	25	568	501
29	5,165	1,683	274	15	614	340
24	5,152	427	56	8	310	314
18	4,997	145	0	8	234	302
22	4,988	419	421	11	384	215
19	4,759	66	0	1	98	214
5	4,661	127	4	1	322	266
14	4,629	354	23	5	199	363
10	4,250	1,415	56	17	240	436
13	3,452	36	36	3	80	386
7	3,370	312	91	3	558	486
9	3,204	838	14	7	1190	659
12	2,680	511	71	4	518	334
6	2,631	54	0	1	396	370
20	2,400	87	15	9	148	295
4	1,868	450	6	1	160	270
8	1,766	446	12	7	788	347
3	1,066	255	27	2	202	367
Totals	258,340	18,835	2,380	658	12,735	10,558

Legend:

[1]Subwatershed identification number.
[2]Estimated tons of erosion from agricultural land within the subwatersheds.
[3]Estimated tons of erosion from forested land within the subwatersheds.
[4]Estimated tons of erosion from idle land within the subwatersheds.
[5]Estimated tons of erosion from residential land within the subwatersheds.
[6]Estimated tons of erosion from roadbanks within the subwatersheds.
[7]Estimated tons of erosion from streambanks within the subwatersheds.

CHEMICAL BULK STORAGE FACILITY PERMITS

INTRODUCTION

In an effort to prevent improper storage and handling of hazardous substances, the New York State Legislature passed Article 40 of the Environmental Conservation Law, the Hazardous Substances Bulk Storage Act of 1986. This law requires NYSDEC to develop and enforce State regulations governing the sale, storage, and handling of hazardous substances, as needed to prevent leaks and spills in New York State. Controls established by the laws include: registration and inspection of storage and handling facilities; design, construction and operation standards; requirements for reporting leaks and spills and corrective action to be taken; and requirements for proper facility closure. The laws apply to both underground and aboveground tanks and prohibit sales of hazardous substances to unregistered facilities.

Hazardous substances subject to regulation are listed in Part 597 of the Chemical Bulk Storage (CBS) regulations. Over 1000 solids, liquids, and gases which are toxic, known or suspected carcinogens, explosive or otherwise dangerous when improperly handled or stored are included on the list. Under Part 596 of the CBS regulations, hazardous substance storage tanks (or bins if solids are being stored) must be registered with NYSDEC. Tank registration is valid for two years, after which renewal is required. Only stationary tanks are registered at this time. Owners must register all underground tanks regardless of size, and aboveground tanks with capacity of 185 gallons or more. If a tank is temporarily out of service, it must be registered until it is permanently closed.

RESULTS

There are 2 CBS facility permits listed in the Keuka Lake Watershed, **(1) Penn Yan Marine** and **(2) Philips Lighting**. Chemical bulk storage facility permits and tank listings and their respective subwatershed location are listed in Table 7-10 and illustrated in Figure 7-2.

Table 7-10. Chemical bulk storage facilities in the Keuka Lake watershed.

	PHILLIPS LIGHTING	PENN YAN MARINE
Address	RD 2 Bath Hammondsport Rd	Waddell Ave.
Municipality	Bath	Penn Yan
Subwatershed	11	26
Site Type	Manufacturing	Manufacturing
Site Status	1- Active	2- Unregulated
Number of Tanks	4	1
Total Capacity	34,500	---
Tank Location	Above ground, in a rack	Below ground
Tank Type	Steel/Carbon Steel/Fiberglass Reinforced Plastic	Steel/Carbon Steel
Chemicals	Ammonia 12,000 gal Phosphoric Acid 7,500 gal Sodium Hydroxide 7,500 gal Hydrochloric Acid 7,500 gal	Propane 5,000 gal
Date of Expiration	07/25/97	07/12/95

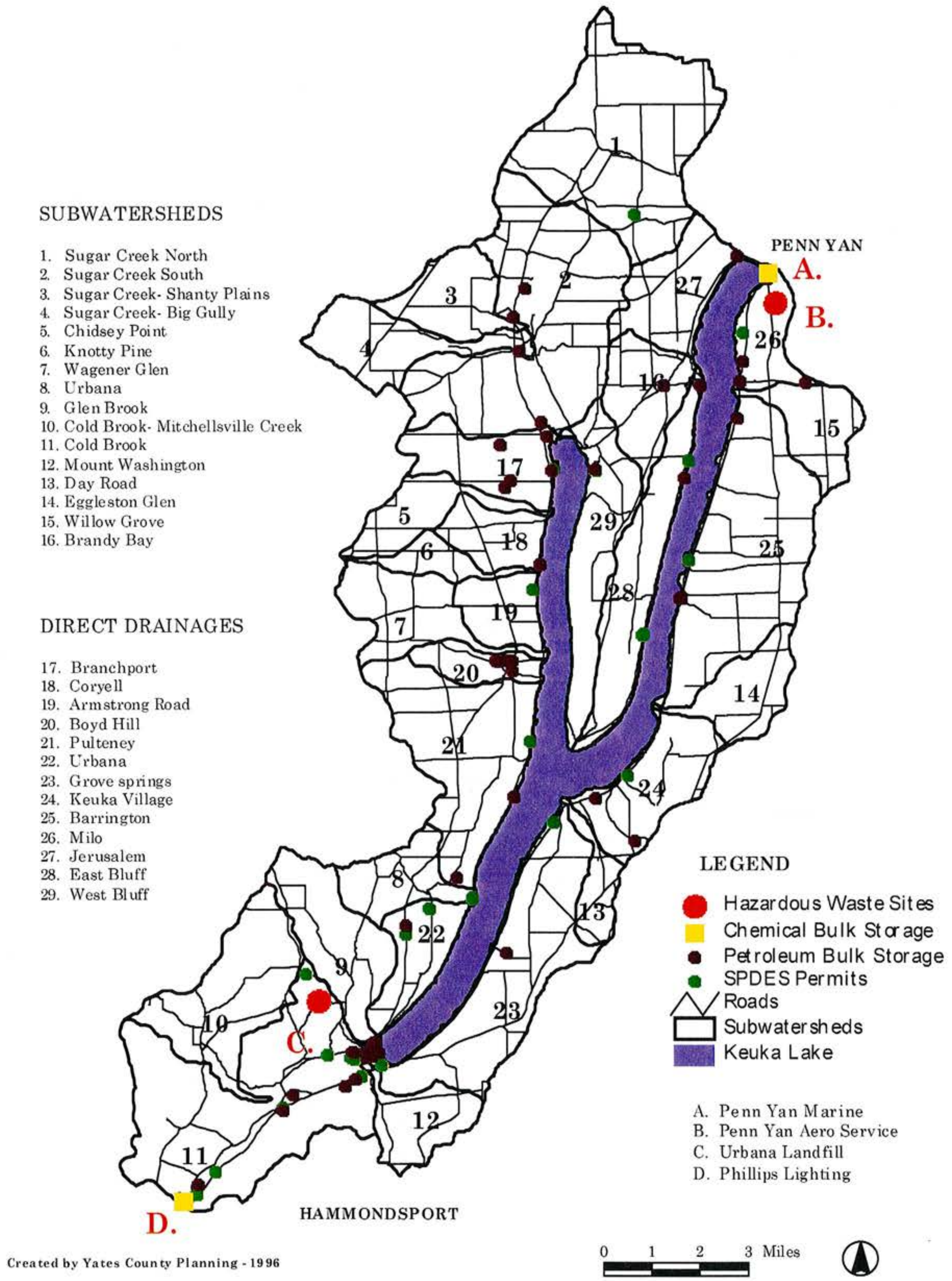

Figure 7-2. Chemical, petroleum bulk storage, SPDES facilities, and hazardous waste sites.

DEICING SALT

INTRODUCTION

Deicing salt, commonly know as road salt, is used to help deice road surfaces during the colder months of the year, usually from November through April. In the Keuka Lake watershed, the responsibility for winter road maintenance falls on the municipalities, Yates and Steuben County, and the New York Department of Transportation. Deicing salt or common rock salt, primarily contains sodium chloride and is the preferred type of deicing agent used in the watershed. Generally the salt is mixed with sand, the ratio depending on weather conditions and municipality preference. Each highway department has individual policies and procedures regarding salt application, salt/sand mixtures and storage. Salt application for some highway departments begins very early in a storm to establish a brine solution on the road surface. Others wait until approximately an inch of snow has fallen. Salt mixtures can vary from straight salt, used by the State under certain conditions, up to one part salt to fifteen parts sand. Some municipalities make their own mix while others purchase the product pre-mixed. Five salt/mix storage piles are located in the watershed — all five of these are exposed, although Barrington, Pulteney, Wayne and Urbana are currently have either completed or are in the construction phase.

There are several environmental concerns regarding the use of deicing salts. After application, salts are highly soluble in water and easily wash off pavement into surface waters and leach into soil and eventually groundwater. High concentrations of salt can damage and kill vegetation, disrupt fish spawning in streams, reduce oxygen solubility in surface water, interfere with the chemical and physical characteristics of a lake, pollute groundwater making well water undrinkable, disintegrate pavement, and cause metal corrosion of bridges, cars and plumbing.

SALT PILES

There are five salt storage pile sites within the Keuka Lake watershed (see Figure 7-3). All five piles are categorized as municipal storage facilities. The five salt piles are all exposed directly to the weather. An investigation of the salt storage sites by subwatershed reveals that they tend to be located towards the ends of the lake. These sites are dependent upon the location of municipal distribution and maintenance facilities.

Two legislative activities related to the control of stormwater runoff from uncovered salt storage piles are currently being discussed. The first is a bill that is on hold in the New York State legislature that would require that all salt storage piles be covered. This law would effectively eliminate one of the contributing sources of nonpoint source pollution to Keuka Lake.

A second source of legislative activity for the control of stormwater runoff from uncovered salt storage piles is the recently adopted federal stormwater management permit regulations. The Environmental Protection Agency has delegated this authority to the NYSDEC. The stormwater management permit regulations are covered under Article 17, Title 7 & 8, and

Article 70 of the Environmental Conservation Law. Part 3, Section 8 of these regulations indicate that salt storage piles of deicing or other commercial or industrial applications shall be in compliance with these regulations by August 1, 1996. It is assumed that this regulation covers the five salt pile storage sites in the Keuka Lake Watershed. These regulations became effective as of February 1, 1994, and it will be the responsibility of the NYSDEC to determine the applicability of these regulations to salt storage piles in the watershed.

During the spring of 1995, the Keuka Lake Association mailed a survey to highway departments in Yates and Steuben Counties regarding deicing salt usage and storage. The response and cooperation by the departments was very good. The results from the survey are summarized in Table 7-11 and Table 7-12.

Table 7-11. Keuka Lake watershed 1994-95 winter deicing salt information.

Municipality or Agency	Total Road Mileage Maintained	Mileage within Watershed	% Within Watershed	Total Amount Salt Used (tons)	Salt Used Within Water-shed	Tons/mile	Storage Pile in Water-shed
Barrington	74.50	11.36	15.25	185.00	28.21	2.48	Y
Benton	50.00	10.23	20.46	150.00	30.69	3.00	N
Jerusalem	109.00	87.35	80.14	550.00	440.76	5.05	Y
Milo	57.00	0.00	0.00	0.00	0.00	0.00	N
Potter	48.80	12.43	25.47	360.00	91.70	7.38	N
Prattsburgh	N/R	1.70	N/R	700.00	N/R	N/R	N/R
Pulteney	69.90	42.33	60.56	300.00	181.67	4.29	Y
Urbana	61.40	51.61	84.06	400.00	336.22	6.51	Y
Wayne	48.00	12.26	25.54	350.00	89.40	7.29	Y
Wheeler	N/R	2.84	N/R	N/R	N/R	N/R	N/R

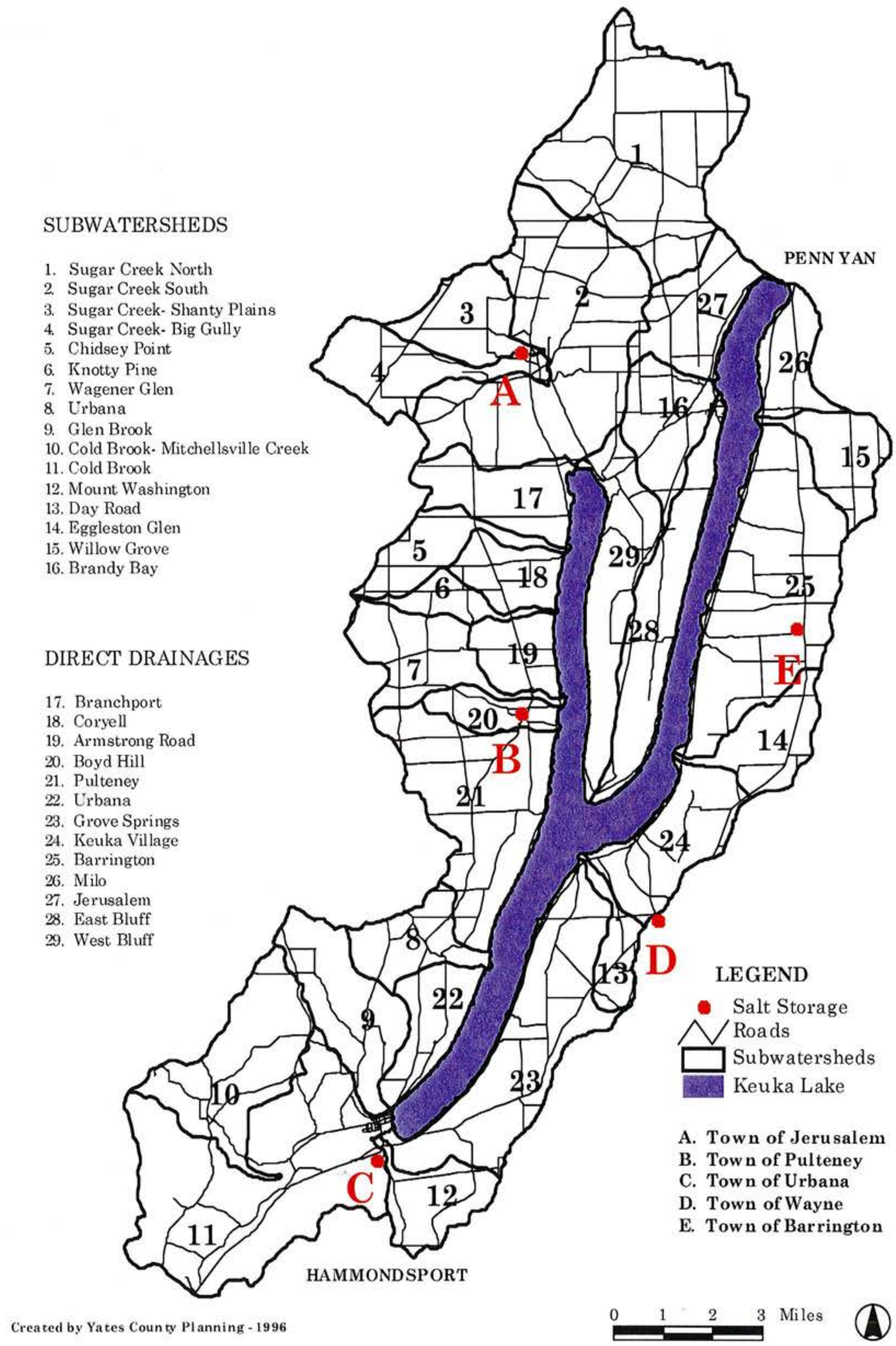

Figure 7-3. Exposed salt storage facilities in the Keuka Lake watershed.

Table 7-12. Deicing salt usage and storage piles by subwatershed.

Subwatershed	Mileage Salted		1994-95 Salt Applied (tons)		Salt/Mile (tons)	Exposed Salt/Mix Storage Piles
	miles	percent	miles	percent		
(1) Sugar Creek North	22.66	9.96	122.39	10.21	5.19	no
(2) Sugar Creek South	23.16	10.18	116.96	9.76	5.05	no
(3) Sugar Creek-Shanty Plains	3.91	1.72	19.75	1.65	5.05	yes (1)
(4) Sugar Creek-Big Gully	6.46	2.84	32.63	2.72	5.05	no
(5) Chidsey Point	1.70	0.75	8.59	0.72	5.05	no
(6) Knotty Pine	2.00	0.88	8.58	0.72	4.29	no
(7) Wagener Glen	9.30	4.09	39.90	3.33	4.29	no
(8) Urbana	7.27	3.19	47.33	3.95	6.51	no
(9) Glen Brook	6.86	3.01	44.66	3.73	6.51	no
(10) Cold Brook-Mitchellsville Creek	6.12	2.69	39.84	3.32	6.51	no
(11) Cold Brook	13.39	5.88	87.17	7.27	6.51	yes(1)
(12) Mount Washington	4.36	1.92	28.38	2.37	6.51	no
(13) Day Road	3.27	1.44	23.83	1.99	7.29	no
(14) Eggleston Glen	4.69	2.06	11.63	.97	2.48	no
(15) Willow Grove		0.00	0.00		0.00	no
(16) Brandy Bay	5.04	2.21	25.45	2.12	5.05	no
(17) Branchport	5.18	2.28	26.16	2.18	5.05	no
(18) Coryell	4.68	2.06	20.08	1.68	4.29	no
(19) Armstrong Rd	4.47	1.96	19.18	1.60	4.29	no
(20) Boyd Hill	3.48	1.53	14.92	1.25	4.29	yes (1)
(21) Pulteney	18.40	8.09	78.94	6.59	4.29	no
(22) Urbana	3.97	1.74	25.84	2.16	6.51	no
(23) Grove Springs	16.64	7.31	113.77	9.49	6.75	no
(24) Keuka Village	6.11	2.68	24.73	2.06	4.88	yes (1)
(25) Barrington	2.55	1.12	6.32	0.53	2.48	yes (1)
(26) Milo		0.00	0.00		0.00	no
(27) Jerusalem	5.40	2.37	27.27	2.28	5.05	no
(28) East Bluff	21.16	9.30	106.86	8.92	5.05	no
(29) West Bluff	15.34	6.74	77.47	6.46	5.05	no
Total:	227.57	100	1170.44	100	5.22(avg)	5

METHODS

Highway departments were asked to provide information on total mileage maintained during the winter and total amount of salt in tons used for the 1994-95 season. From this, salt application rates were calculated in tons/mile/year so that rates could be compared. Application rates do not take into account the terrain in the municipalities, varying snowfall amounts or different salt to sand mixes used. These considerations could account for some variations in application rates.

The highway departments were also asked for the locations of salt/mix piles and if they are exposed or covered. The locations of the piles were mapped using a GIS mapping program and are illustrated in Figure 7-3. Policies and procedures used by the different municipalities and the State were also surveyed.

Using a watershed boundary map, the miles of public roads within the watershed were estimated for each municipality. The percentage this represented of the total mileage maintained was calculated and applied to the total salt used to determine the amount of salt applied within the watershed by each highway department.

For the purposes of this report, the deicing salt information was further broken down by subwatershed. This information can be found in Table 7-13. Using a subwatershed map prepared for this study, the public road mileage each municipality maintains during the winter was calculated for each subwatershed. By multiplying the mileage by the salt application rate, the salt tonnage each municipality contributed to the subwatershed was determined. By summing the contributions of all highway departments applying salt within the subwatershed, a total salt load (in tons) was determined. The percentage that each subwatershed contributes to the total applied to the watershed was calculated by dividing the total salt applied by the total mileage maintained. It was also noted if an exposed salt/mix storage pile existed in the subwatershed.

RESULTS

Salt application rates by municipality varied from 2.48 - 7.29 tons/mile/year, averaging 5.22.

For ranking purposes, the subwatershed data were compiled in Table 7-14 showing which have HIGH, MODERATE, or LOW application rates and which contribute HIGH, MODERATE, or LOW amounts of salt to the watershed. The presence of exposed salt/mix storage pile(s) were also a consideration in ranking.

Data suggests subwatersheds 1, 2, 11, 15, 21, 23, 28 and 29 are relatively HIGH contributors of deicing salt to Keuka Lake. See Figure 7-4.

Subwatersheds 4, 7, 8, 9, 10, 12, 16, 17, 18, 22, 24, and 27 are ranked as MODERATE contributor of salt. Subwatershed 13 is also considered MODERATE because of HIGH application rates, which are the highest of all of the subwatersheds (7.29 tons/mile/year), but an overall low rating for total contribution.

The town of Milo was the main exception, as they reported not using any deicing salt on its roads in the winter. Milo uses sand only in the maintenance of its roads. As are result, subwatersheds 15 and 26 have no road salt applied to them through the winter.

Table 7-13. Keuka Lake salt survey.

	Bar-rington	Jeru-salem	Milo	Pratts-burgh	Pulteney	Urbana	Wayne	Potter
Superintendent	M. Brace	J. Walker	B. Fullagar	G. Robbins	M. Tietjen	D. Bailey	L. Day	
Deicing Material	Salt & sand	Salt & Sand	Cinders & Sand	Salt & Sand	Salt & Sand	Salt & Sand	Salt & Sand	Salt & Sand
Record of Annual use	170-200 tons	550 tons	none	700 tons	300 tons	400 tons	350 tons	360 tons
Record of Salt/Mile	2 ton/mile							
Application mix (salt/sand)	1 salt/7 sand	1 salt /7 sand		1 salt/7 sand	1 salt/10 sand		1 salt/15 sand	1 salt/4 sand
Miles Maintained	60 town/14.5 county	109 miles	48 town/9 county		52.9 town/17 county	61.4 miles	48 miles	48.8 miles
Salt Location	Bath Rd Gray Rd	2672 Guyanog a Rd		Outside Watershed	Mill St.	Route 54	Silsbey Rd	Town Pit Phelps Rd
Exposed?	yes	yes	no salt	yes	yes	yes	yes	yes
Policies for Rate of Application	Snow: sand hills, corners & intersection sIce: full length	Depends on tempera-ture	Depends on ice and temperature	paved roads: sand as needed; Dirt roads: sand hills, curves & intersec-tions, unless ice	none	none	same amount for all conditions	begin salting after 1/2" to 1" of snow has fallen

Table 7-14. Subwatershed ranking for deicing salt for winter 1994-95.

Subwatershed	Salt Application Rate in Tons/Mile/Year: High (>7.0)	Moderate (7.0-4.5)	Low (<4.5)	Total Salt Contribution in Tons/Year: High (>100.0)	Moderate (100-50.0)	Low (<50)	Exposed Storage Pile(S)	Overall Rank
(1) Sugar Creek North		X		X			No	H
(2) Sugar Creek South		X		X			No	H
(3) Sugar Creek-Shanty Plains		X				X	Yes (1)	L
(4) Sugar Creek-Big Gully		X				X	No	M
(5) Chidesy Point		X				X	No	L
(6) Knotty Pine			X			X	No	L
(7) Wagener Glen			X			X	No	M
(8) Urbana		X				X	No	M
(9) Glen Brook		X				X	No	M
(10) Cold Brook-Mitchellsville Creek		X				X	No	M
(11) Cold Brook		X			X		Yes (1)	H
(12) Mount Washington		X				X	No	M
(13) Day Road	X					X	No	M
(14) Eggleston Glen							No	L
(15) Willow Grove			X			X	No	H
(16) Brandy Bay		X				X	No	M
(17) Branchport		X				X	No	M
(18) Coryell			X			X	No	M
(19) Boyd Hill			X			X	No	L
(20) Armstrong Road			X			X	Yes (1)	L
(21) Pulteney			X		X		No	H
(22) Urbana		X				X	No	M
(23) Grove Springs		X		X			No	H
(24) Keuka Village		X				X	Yes (1)	M
(25) Barrington			X			X	Yes (1)	L
(26) Milo			X			X	No	L
(27) Jerusalem		X				X	No	M
(28) East Bluff		X		X			No	H
(29) West Bluff		X		X			No	H

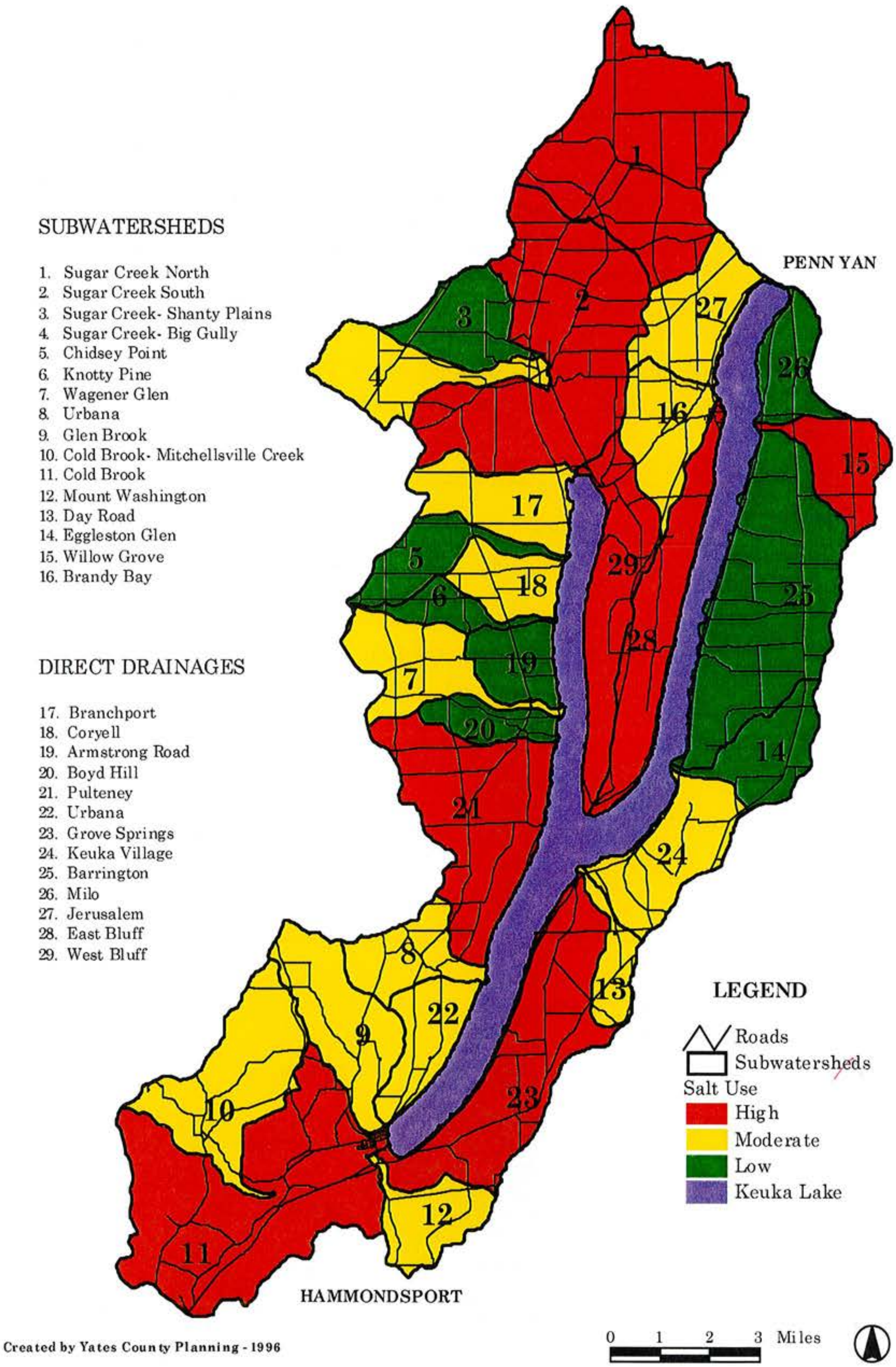

Figure 7- 4. Potential impact from salt usage.

DEVELOPMENT

LAND USE

Land use data were collected by visual interpretation of 1990 aerial photography as part of the GWLF modeling process. Fifty-eight, 17"x 17" panchromatic (black and white) aerial photographs at a scale of 1:1,000 made up the watershed. Photos were obtained from the USDA Cartographic Center in Utah. Vellum sheets were overlaid on the photos and land use polygons were traced and then hand-digitized into ARC/INFO GIS for analysis. While labor intensive, the method provided a detailed and updated description of land use. Single parcels of land may be described as containing several land uses such as crop, forest, a rural home, and a pond.

The 100,000 acre Keuka Lake watershed was divided into 3,300 polygons using one of 15 land use designations. As a separate data field, these uses were grouped into four general categories

Table 7-15. Land use/land cover in the Keuka Lake watershed.

1. FOREST	2. AGRICULTURE	IDLE	4. DEVELOPMENT
• Forest	• Unknown Crop	• Idle	• Low Density Residential
	• Vineyard	• Park	• High Density Residential
	• Orchard	• Wetland/Pond	• Commercial
	• Rural Home	• Grassland	• Golf Course
			• Institutional
			• Quarry

LAND USE	ACRES	% OF KLW LAND AREA
1. Forest	55,977	55.5 %
2. Agriculture	37,106	36.8 %
3. Idle	5,390	5.3 %
4. Development	2,332	2.3 %

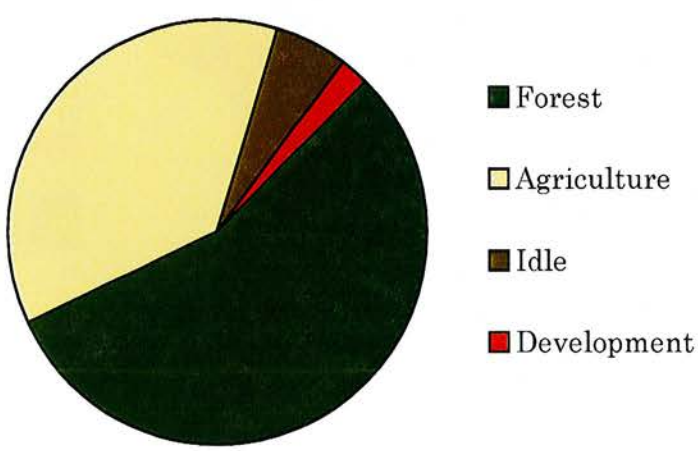

Figure 7-5. Land use composition in the Keuka Lake watershed.

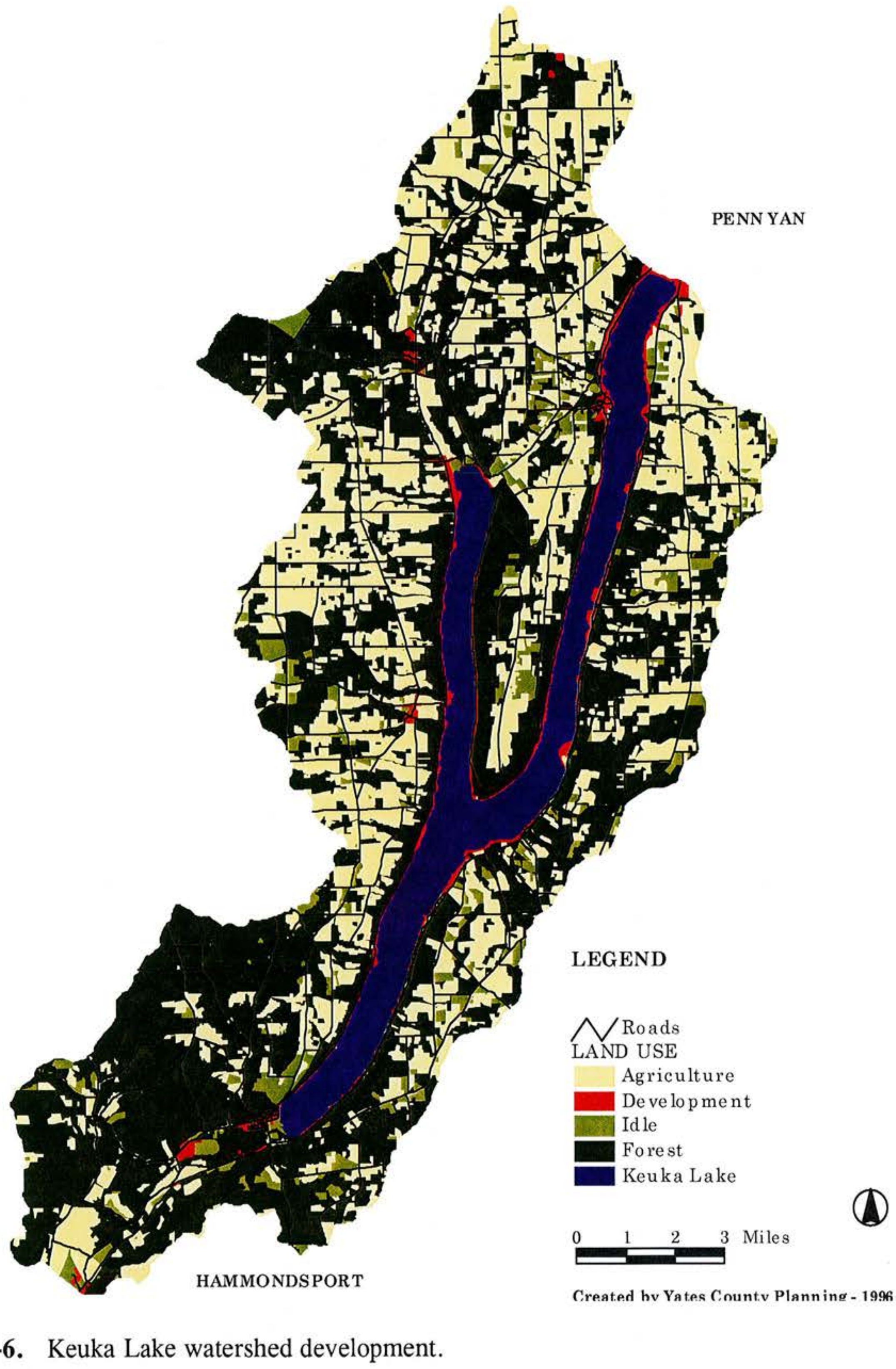

Figure 7-6. Keuka Lake watershed development.

CONCLUSION

Development makes up a very small percentage of the total acreage in the Keuka Lake Watershed (2.3%). Further, the large majority of this development is residential, as opposed to more intensive commercial or industrial operations. Therefore, the impact of "development" in the Keuka Lake watershed is essentially the sum of numerous individually-constructed, detached, single-family homes. Figure 7-6 clearly illustrates the concentration of residential development within a dense band along the lakeshore. The impact of construction on these lakefront sites is often further heightened by steep slopes, poor soils and large homes on small lots.

The significant, nonpoint impact of residential land use is recognized in the GWLF model, which indicates that "high-density residential" has a larger per acre nutrient and contaminant contribution than properly managed agricultural land. While this model looks specifically at nutrient and sediment loading, the sources of nonpoint source pollution from residential land use includes; failing septic systems, degraded stormwater runoff from roofs and driveways, erosion and sedimentation during and after construction of homes and driveways (especially on steep slopes), improper lawn care practices (nutrients and pesticides) and potential pollutants associated with private docks.

The following section reviews existing local land use laws in the watershed.

LAND USE REGULATIONS

ZONING

All towns and villages in the Keuka Lake watershed have adopted zoning codes. Zoning, as empowered under Article 16 of Town Law of New York State, empowers towns to regulate size, density and use of structures, for the purpose of promoting health, safety, and general welfare of the community.

Based on the relatively recent adoption of these codes, the zoning pattern of use and density largely reflects the current land use pattern in these towns.

Municipality	Original Zoning
Town of Benton	1971
Town of Potter	1979
Town of Jerusalem	1974
Town of Milo	1974
Town of Barrington	1980
Town of Pulteney	1991
Town of Wayne	1974
Town of Urbana	1988
Village of Hammondsport	1986

The zoning districts established in these towns tends to be simple. Most towns have only three or four zone districts with the large majority of land zoned in a flexible "agricultural-residential" zoning. Most waterfront towns also include a residential district that acknowledges the dense, residential development found here and also a district acknowledging the denser development found in unconsolidated hamlets.

Zoning in the watershed is summarized in Tables 7-16 and 7-17 and illustrated in Figure 7-7 and consolidate the many different district titles and regulations into fairly uniform classifications.

Table 7-16. Zoning districts in the Keuka Lake watershed.

ZONE DISTRICT		ACRES	% OF LAND
AC	Agricultural Conservation	3,847	3.8 %
AR	Agricultural Residential	91, 101	90.3 %
C	Commercial	129	.1 %
H	Hamlet/Village	283	.3 %
I	Industrial	241	.2 %
LC	Land Conservation	891	.9 %
R1	Medium-Density Residential	648	.6 %
R2	Lake Residential	3,779	3.4 %

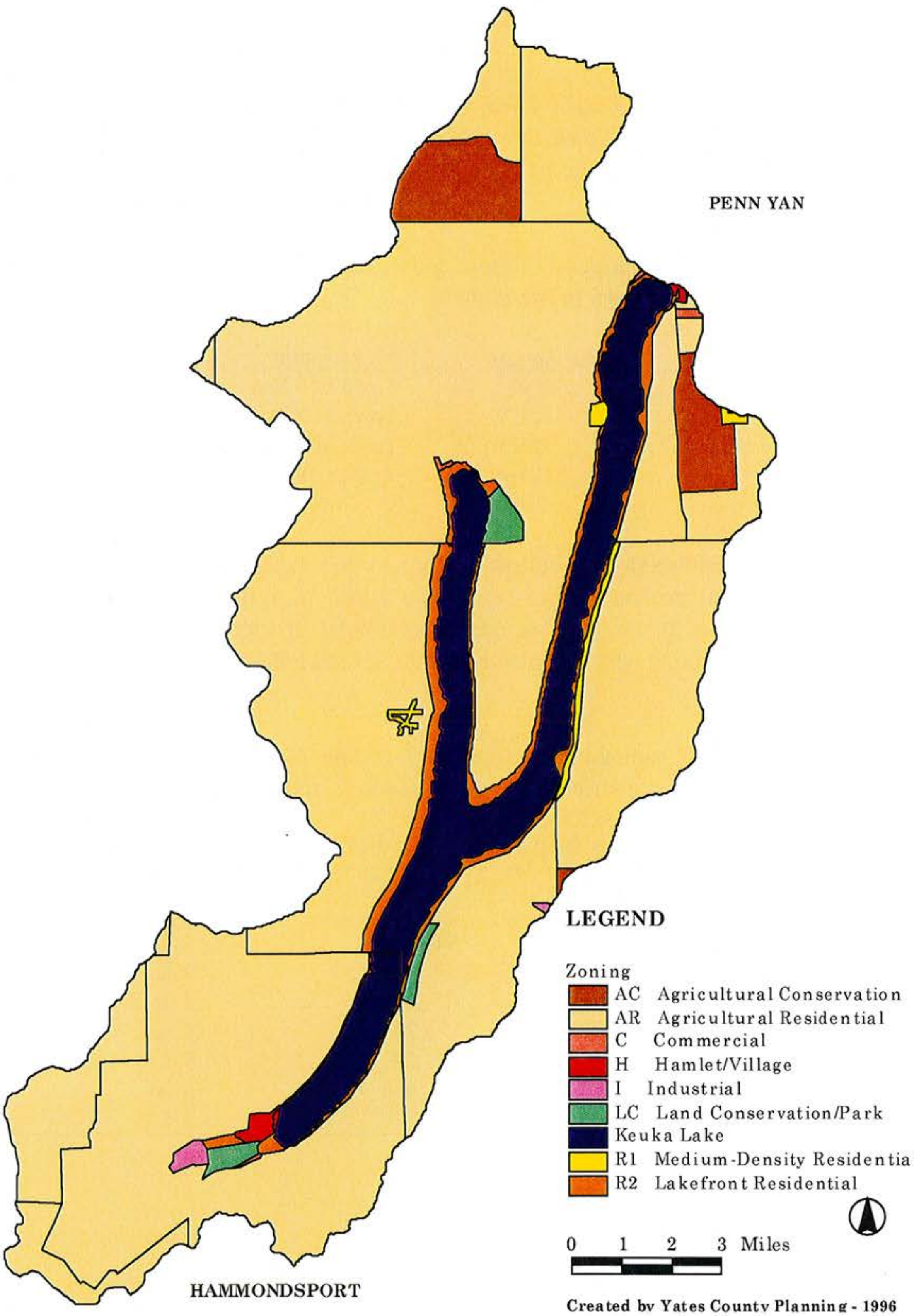

Figure 7-7. Keuka Lake watershed zoning.

Table 7-17. Description of zone districts in the Keuka Lake watershed.

ZONE DISTRICT	PRIMARY USES	SPECIAL USE	AREA REGULATIONS
AC Agricultural Conservation	Agriculture Single-family Residence Agricultural Business	Campsites Recreation	1 - 3 Acres 100-300 Ft. Frontage
AR Agricultural Residential	Agriculture 1-2 family Residence	Mobile Homes Campsites Commercial Industrial	1 Acre 100-200 Ft. Frontage
C Commercial	Retail and Office Commercial	Gas Station	20,000 SF - 40,000 SF 100 - 150 Ft. Frontage
H Hamlet/Village	Mixed Use Multi- Family Retail Restaurants	Gas Station	15,000 - 40,000 SF 100 - 150 Ft. Frontage
I Industrial	Industrial Light Industrial		1 A 100 - 150 Ft. Frontage
LC Land Conservation	No structures Agriculture*	Recreation (golf)	2 A
R1 Medium-Density Residential	1-2 family Residence Mobile Homes	Commercial	20,000 SF - 40,000 SF 100 - 150 Ft. Frontage
R2 Lake Residential	Single-family Residence Two-family Residence *	Marinas Bed & Breakfast Restaurants* Gas stations*	0 - 20,000 SF 50-100 Ft. Frontage Water setback 15-25 Ft.

* Applies in some towns

CONCLUSION

Currently, the zoning ordinances throughout the watershed correspond to the prevailing land use pattern. This suggests that current development patterns are appropriate by measures of intensity and scale and are consistent with the needs and expectations of each community.

Most codes, however, do not take into consideration carrying capacity of the landscape or identify specific environmental constraints to development. Note in the above descriptions that only a few towns recognize a "Land Conservation" zone district even though, as the following sections illustrate, much of the land in the Keuka Lake watershed is environmentally sensitive.

Perhaps the greatest concern related to zoning in the Keuka Lake watershed is the inherent flexibility of development allowed in the Agricultural-Residential zone districts. While this flexibility does provide many benefits, it also may undermine the intentions of zoning in the majority of the watershed.

Minimum lot sizes in most agricultural zone districts do not exceed 1 acre. Permitting 1 acre zoning without provisions for clustering or agricultural/open space preservation could allow for significant residential subdivisions in areas that may not be suitable for such development. These districts also allow a wide variety of uses by Special Use Permit. In most towns in the watershed, Agricultural-Residential districts allow ANY industrial or commercial use after a simple approval

by a Planning or Zoning Board. In fact, it could be argued that such a board may not disapprove any such use that
meets only the most rudimentary of development standards. Development pressures in the watershed on the contrary have been limited; however, the potential for undesired growth is possible with the current zoning flexibility.

SUPPLEMENTAL LAND USE REGULATIONS

Beyond traditional zoning, a cursory survey has been completed of supplemental land use regulations present in the Keuka Lake watershed. Table 7-18 provides an overview of the application of Comprehensive Plans, Subdivision Regulations, Site Plan Review Law, Stormwater Management, Erosion & Sediment Control Laws in the watershed.

Table 7-18. Supplemental land use regulations in the Keuka Lake watershed.

Municipality	Comprehensive /Master Plan	Subdivision Regulations	Site Plan Review	Erosion Control
Barrington, Yates County	1976	-	-	-
Benton, Yates County	1991	-	Yes	-
Jerusalem, Yates County	1992	-	-	-
Milo, Yates County	1971	-	-	-
Potter, Yates County	Yes	1996	-	-
Pulteney, Steuben County	Yes	1991	-	-
Wayne, Steuben County	Yes	-	-	-
Urbana, Steuben County	-	1985	1992	-
Hammondsport, Steuben County	-	1990	1991	-

COMPREHENSIVE/MASTER PLAN

"Town Comprehensive Plan" means the materials, written and/or graphic, included but not limited to maps, charts, studies, resolutions, report and other descriptive material that identify the goals, objectives, principles, guidelines, policies, standards, devices and instruments for the immediate and long range protection, enhancement, growth and development of a town located outside the limits of any incorporated village or city."

NYS Town Law §*272a*

Through a process of significant public input, the Town Comprehensive Plan should attempt to document the goals and visions of a community and serve as the basis for all future land use regulation and public investment.

Most towns in the Keuka Lake watershed have adopted a Comprehensive Plan that in some way acknowledges Keuka Lake as an amenity that greatly enhances the municipality. Most plans state general goals of protecting Keuka Lake, yet few make specific implementation recommendations related to this goal. There are a number specific ways that local plans could be expanded to ensure the integrity of the town and water quality.

SUBDIVISION REGULATIONS

"A set of land use regulations enacted by the local planning board to guide the division of any parcel of land into a number of lots, blocks or sites, either with or without streets or highways, for the purpose of sale, transfer of ownership, or development. Such regulations are concerned with adequate facilities to produce a serviceable building site with basic improvements in place."

NYS Legislative Commission on Rural Resource

Under the authority of NYS Town Law § 276 a town board may authorize a planning board to review the subdivision of land "for the purpose of providing for the future growth and development of the town and affording adequate facilities for the housing, transportation, distribution comfort and convenience, safety, health and welfare of its population".

Subdivision regulations are the specifications by which a local planning board executes this authority. Subdivision review is fairly unique in that it allows a review of a multiple lot development plan usually well before these lots are to actually be developed. As such, the review tends to be more concerned with issues of a broader scope than individual site design. Subdivision regulations usually include sections specifying "Development Standards", such as recommended street patterns and block layout; "Required Improvements" such as culverts, storm drains, sidewalks, or street lighting; and "Procedures", that define the process of project review and filing of approved plats. New York State now requires that any division of property filed with the County Clerk, contain the subdivision approval certified by the Chair of the local planning board or a statement that no subdivision review is required locally.

Subdivision regulations may also be a tool for towns to enact regional open space preservation policies such as "clustering" (authorized in Town Law §281) whereby the potential for residential development can be concentrated on an appropriate portion of a large site leaving the remainder undeveloped and held in perpetuity.

In the absence of local subdivision authority, New York State Law through the Department of Health and Department of Environmental Conservation, review subdivisions in their ability to provide adequate drinking water and sewage disposal. State law only applies to projects that will create four or more building lots, each of which is less than four acres.

Subdivision regulations tend to be more common in metropolitan municipalities that see more suburban-type subdivisions. Within the rural Keuka Lake watershed, only Potter, Pulteney, Urbana, and Hammondsport have subdivision regulations, none of which include provisions for clustering residential development.

SITE PLAN REVIEW

"A regulatory technique which requires municipal approval of the layout and design of development when it occurs on a single parcel of land....involves the discretion by a municipal board to approve applications on a case-by-case basis, using general site design criteria set forth in the zoning ordinance or in a site plan approval law."

-All You Ever Wanted to Know About Zoning...

Under the Authority of Town Law §274-A, a town board may authorize a site review for certain development proposals. Within the local zoning ordinance or as a free-standing local law, a town must identify what uses shall require site plan approval and identify the elements of the plan to be reviewed.

Within the Keuka Lake watershed, site plan review is prompted by proposed uses. For example, review is required for all special use permit requests or commercial developments. Although it is not being used in the watershed, an alternative method allows site plan review to be required for all developments in certain geographic areas, for example, steep slopes or proximity to a waterbody.

Site plan review laws must also specify what elements of the plan are to be reviewed. These elements typically include location and dimension (sometimes design) of buildings, access, parking, landscaping, lighting, signage, and impact on adjacent land uses. Some codes include review of stormwater management, erosion and sediment control within their site plan review law, others have this as a separate law.

Within the Keuka Lake watershed, only Benton, Urbana, and Hammondsport have site plan review laws. These codes require review for certain commercial and industrial uses, however, none of the towns require site plan review for single-family homes.

STORMWATER MANAGEMENT, EROSION & SEDIMENT CONTROL

Stormwater Management, Erosion & Sediment Control ordinances are enacted for the following purposes:

1. Flood prevention
2. Maintain streambank integrity
3. Control erosion and sedimentation in receiving waterbodies (Keuka Lake)
4. Facilitate proper removal of pollutants

While ordinances that regulate development for the purposes of stormwater management, erosion and sediment control are not explicitly mentioned in New York State Enabling Legislation, towns may adopt ordinances under the general authority of Town Law Article 9, which states that municipalities are allowed to regulate "...such elements as may reasonably be related to the health, safety and general welfare of the community". Certainly a law that protects lives, property and water quality meets this standard.

A Stormwater Management, Erosion & Sediment Control Law attempts to hold new development to the performance standard; "the quality and quantity of stormwater runoff is not to be substantially altered from pre-development conditions." To meet this performance standard, an applicant proposing land clearing, grading or alteration of existing drainage patterns may need to prepare a Stormwater Management, Erosion & Sediment Control plan that mitigates any adverse impacts. A law may or may not exempt certain actions, such as land clearing under a given area (i.e., 10,000 ft^2), and may or may not exempt agricultural activities or operations of public highways departments.

A Stormwater Management, Erosion & Sediment Control plan will contain calculations of the volume of storm runoff in pre-development and post-development conditions, the quality of runoff (i.e., identify potential sedimentation or pollutant loading) and then develop a scheme to mitigate any adverse impacts. This is usually done by employing temporary construction practices such as silt fencing or straw-bale dikes or by designing permanent elements such as retention/detention basins, swales or culverts.

While this type of ordinance has the closest link to preserving water quality and limiting the potential for nonpoint source pollution, no towns or villages in the watershed have adopted a Stormwater Management, Erosion & Sediment Control Law.

SOILS INTERPRETATION

OVERVIEW
A soils information database was developed by recompiling and digitizing the county soil surveys according to USDA-NRCS standards on USGS 1:24,000 scale topoquads. The database was manipulated using an ARC/INFO geographic information system (GIS) to identify conditions that might impede physical development. In most cases, limiting soil characteristics would not completely prohibit development, but require more complex, often more costly, construction practices. At the very least, local municipalities may consider instituting a more careful review of construction on limiting sites to safeguard against nonpoint source pollution.

This analysis includes interpretation of the following soil characteristics: **Slope**, **Drainage**, and **Depth to Bedrock.**

METHODS
The soils interpretation for the Keuka Lake watershed was complicated by the differences in soil surveys between Yates County (Ontario and Yates Counties, New York-Series 1949, No. 5) and the more recent soil survey of Steuben County (Soil Survey of Steuben County, New York, 1978). Therefore, two separate databases were compiled for these purposes. A total of 283 unique soil types are present in the watershed, 177 soil types in Yates County and 106 soil types in Steuben.

The orthographically-corrected, digital maps were developed by USDA-NRCS soil scientists at Cornell University. This recompilation was done according to USDA Soil Conservation Service standards to eliminate the distortion errors found in the photography of the original surveys.

The final product is a seamless coverage of more than 3,300 soil areas or polygons identified by soil type and an accompanying attribute database. Each soil type contains dozens of attributes including slope, drainage, and depth to bedrock.

SLOPE
Within the soil survey, percent slope is represented as a range, such as, 3%-15%. Within the digital attribute database this is represented by two fields "Slope Low" and "Slope High". To assign a single average slope value for soil polygons in the watershed, a third field was using the slope low and high values. For example, a soil type with a slope range of 3% to 15%, was assigned a value of 9%.

In Figure 7-8 below, the watershed was then categorized into three slope classifications based on the limitations for development (Green: less than 7%; Yellow: 7-15%; and Red: greater than 15%).

SLOPE ANALYSIS
Slope classification within the watershed occurs in fairly easy to identify patterns. The watershed is typified by the unique Y-shaped basin, with the lake valley extending a short distance south of

Hammondsport and a significant distance north of Branchport in what is known as the Guyandoga Valley. Also evident are the narrow red fingers that indicate the steep gorges that line the many tributaries running perpendicular to the east and west branches of Keuka Lake.

Approximately 25% of the total watershed consists of slopes greater than 15%, with the majority of these lands in close proximity to Keuka Lake. While almost half the watershed consists of more gentle slopes of less than 7%, most of these areas are found further from the lake, near the top of the watershed.

Figure 7-8 clearly illustrated a nearly flat ribbon of land along the lakes entire perimeter. This shoreline area corresponds to the most densely populated area of the watershed where residential lots are developed with as little as 50 feet of frontage. The adjoining steep slopes represent the "tier two" development sites that are now emerging due to the high demand for residential property with lake access. The lucrative real estate of the "Bluff" is an example of these emerging steep-slope residential sites.

Note that traditional centers of development, the villages and hamlets, tend to fall in areas of gentle slope. For example the Village of Hammondsport stands out, being located on the flat lake valley surrounded by steep slopes.

SLOPE IMPACT ON DEVELOPMENT

Construction on steep slopes provides a challenge to developers. While these sites are often coveted for their breath-taking lake views, additional planning is necessary to ensure that negative impacts of disturbing steep slopes are mitigated. The largest of these challenges is stormwater management and erosion control during and after construction. Architecture and construction practices may need to be adapted to capitalize upon the topography, yet at the same time, limit environmental impacts. Special attention is needed for design and construction of driveways and in the use of stabilizing land cover or even retaining walls to avoid post-construction erosion.

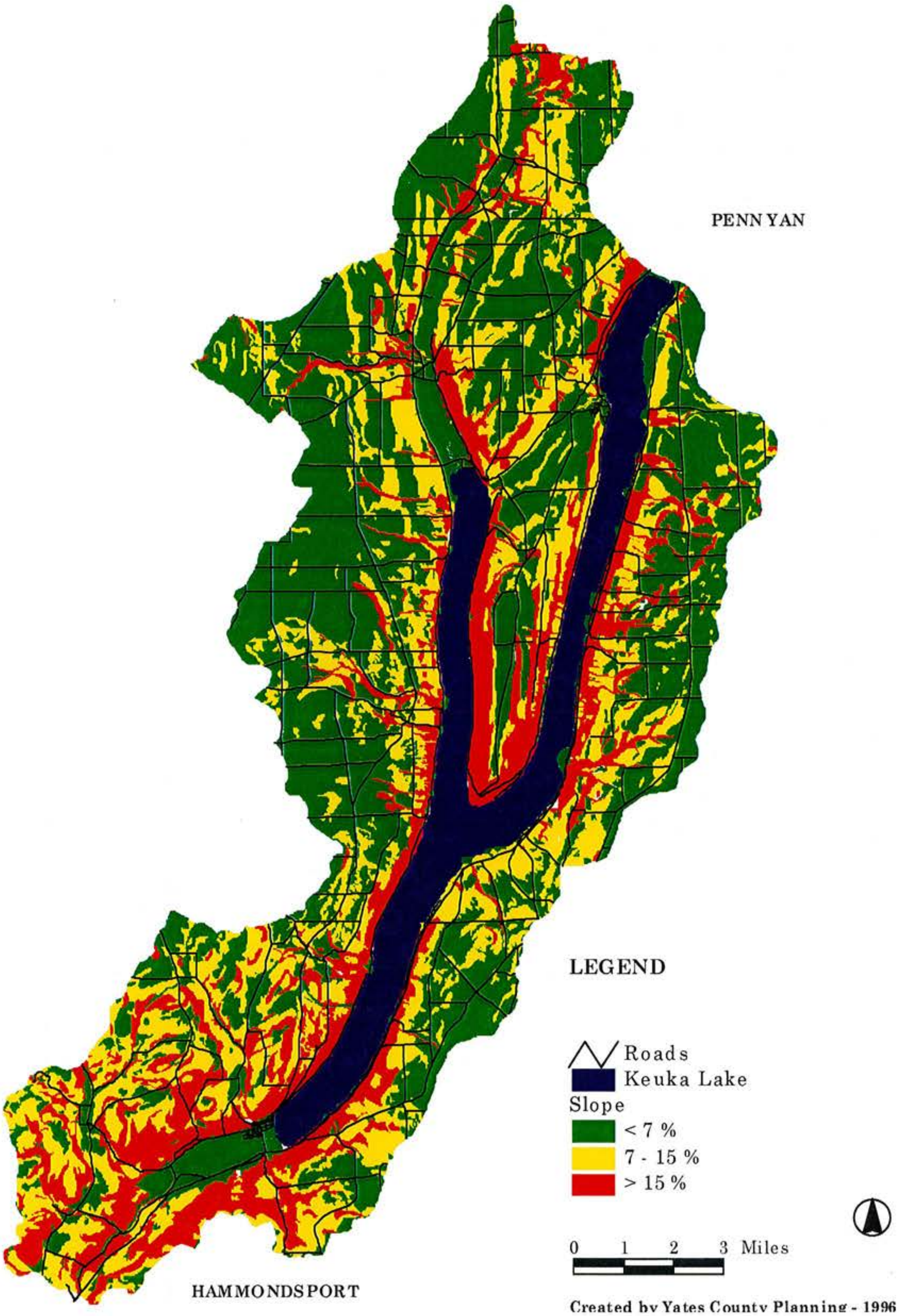

Figure 7-8. Keuka Lake watershed soil interpretation for slope.

DRAINAGE

Drainage is the soils ability to drain off excess water by percolation. Descriptions for drainage or attribute, differs substantially between the Yates-Ontario and the Steuben County Soil Survey. Where the more recent Steuben County uses a six-category assignment, the older Yates-Ontario survey uses a ten category classification. Again, for the purposes of this study, a new field was created where a "High-Medium-Low" analysis could be employed.

Table 7-19. Soil drainage classification for the Keuka Lake watershed.

Poor	Moderate	Well
• Very Poor • Poor-Very Poor • Poor • Somewhat Poor	• Moderately Well • Moderately Well - Somewhat Excessive	• Well • Well- Somewhat Excessive • Somewhat Excessive - Well • Somewhat Excessive

DRAINAGE ANALYSIS

The mapping of drainage characteristics in Figure 7-9 clearly illustrates the different techniques used in soil classification between the surveys for Yates-Ontario and Stueben Counties. The overall pattern of attributes tends to be clearer in the Yates County portion of the watershed, with a significantly higher percentage of well-drained soils than in the Steuben portions. Overall, 40% of the watershed is well drained, 25% is moderately drained and 35% is poorly drained.

An obvious "seam" appears south of Branchport at the Yates-Steuben line. Here a soil is given different labels on either side of the County line, and even different drainage characteristics, being considered "well drained" (indicated as green for "well drained") in the Yates-Ontario survey, yet only "moderately well-drained" in the Stueben County survey (indicated as yellow for "moderate drainage").

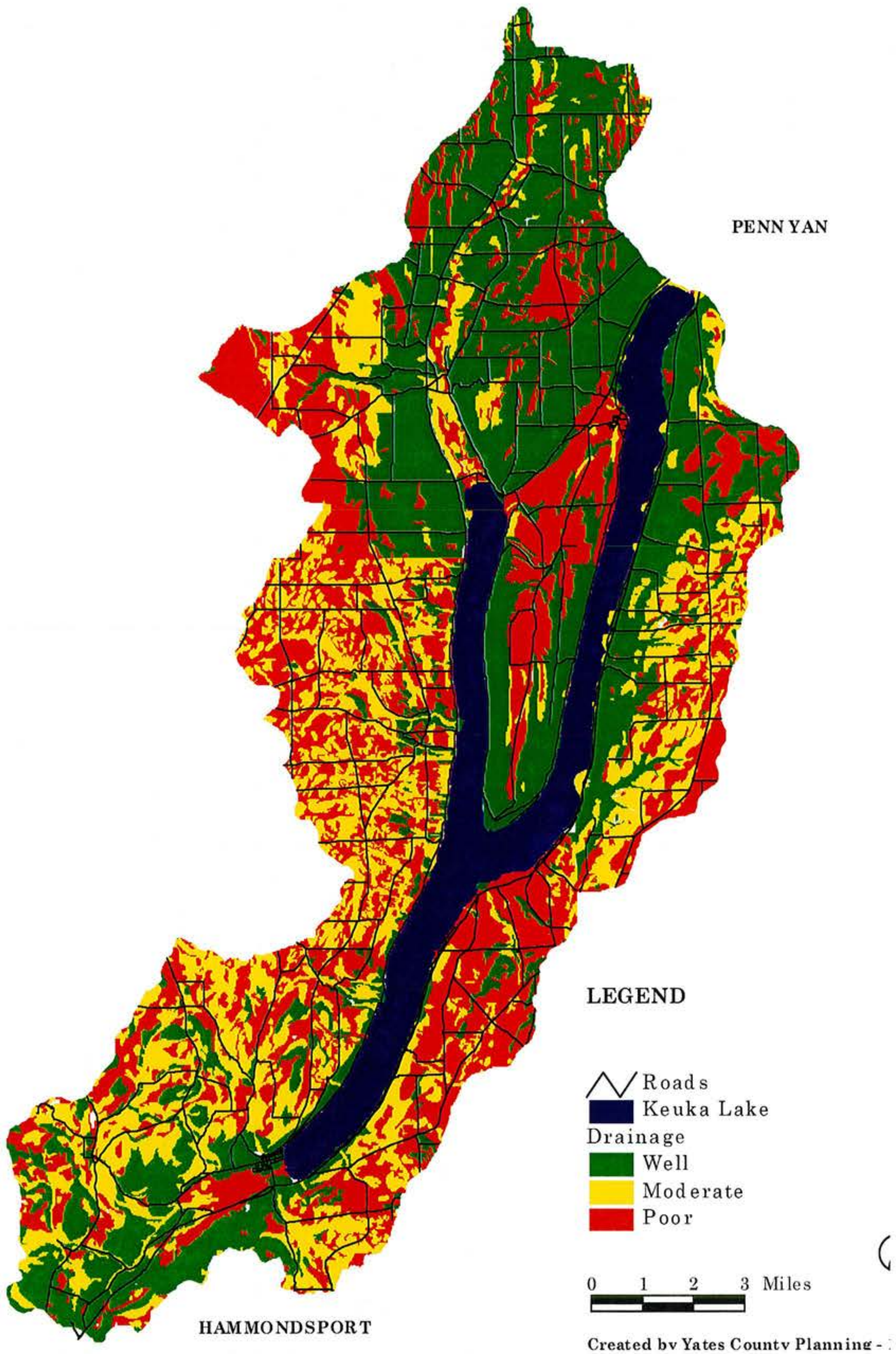

Figure 7-9. Keuka Lake watershed soil interpretation for drainage.

DRAINAGE IMPACT ON DEVELOPMENT

Poorly drained soils will usually not prohibit construction, unless the site actually contains protected wetlands. However, poorly drained soils, and even many of the moderately-drained soils in the watershed may increase the cost of development by requiring additional or alternative construction practices. Larger sites, for commercial or multi-family uses may be required to construct additional stormwater management devices such as detention-retention ponds. Even smaller sites for single-family homes on poor soils may find the costs of grading and site preparation increased to properly handle poor drainage. But the most significant development concerns associated with poorly drained soils is likely to be increased costs of constructing a functional septic system. A conventional system which uses a septic tank and absorption system for water dispersal in the native soils may not be functional in the poorly-drained soils, or even many of the moderately drained soils, common in the Keuka Lake watershed. The construction of alternative septic systems, such as a raised-bed or sand filter systems using off-site fill material, are much more expensive to design and construct than traditional septic systems. These so-called "alternative systems" are not new to the Keuka Lake watershed; indeed they have been installed and used effectively for years on limiting sites both near and away from the lakeshore. While the soils of a particular site may require the use of an alternative septic system, it will not usually preclude the development of a site.

DEPTH TO BEDROCK

Depth to bedrock is a soil characteristic which describes the expected vertical distance between the ground surface and bedrock material. This attribute is represented in the soil surveys as a range in inches of depth. Depth to bedrock for soils found in the Keuka Lake watershed are represented as one of the following; "10-20 inches", "20-40 inches", "60 inches and greater". These categories were used to derive the map illustrated in Figure 7-10.

DEPTH TO BEDROCK ANALYSIS

More than 90% of the watershed has at least 60 inches of usable soil above bedrock. The few soils that are of greatest concern, those with only 10-20 inches to bedrock, are mostly found on the steep and broken lands along the tributaries. In general, soils in the southern part of the watershed contain a larger percentage depth to bedrock limitations. Town of Wayne, specifically, seems to have an inordinate amount of soils that have only 10-20 inches to bedrock. There is also a large area of 20-40 inch bedrock soils on the Bluff in the Town of Jerusalem.

DEPTH TO BEDROCK IMPACT ON DEVELOPMENT

A limited depth to bedrock will hinder any excavation associated with development including the construction of foundations and basements. Even typical footers for "on grade" construction require a depth of 36 inches. Lack of usable soil also limits the ability to install a conventional wastewater system. Such system require 48 inches of usable soil. Again, a depth to bedrock of less than 60 inches may not preclude development, but the increase in design and construction costs may make some sites prohibitive for residential construction.

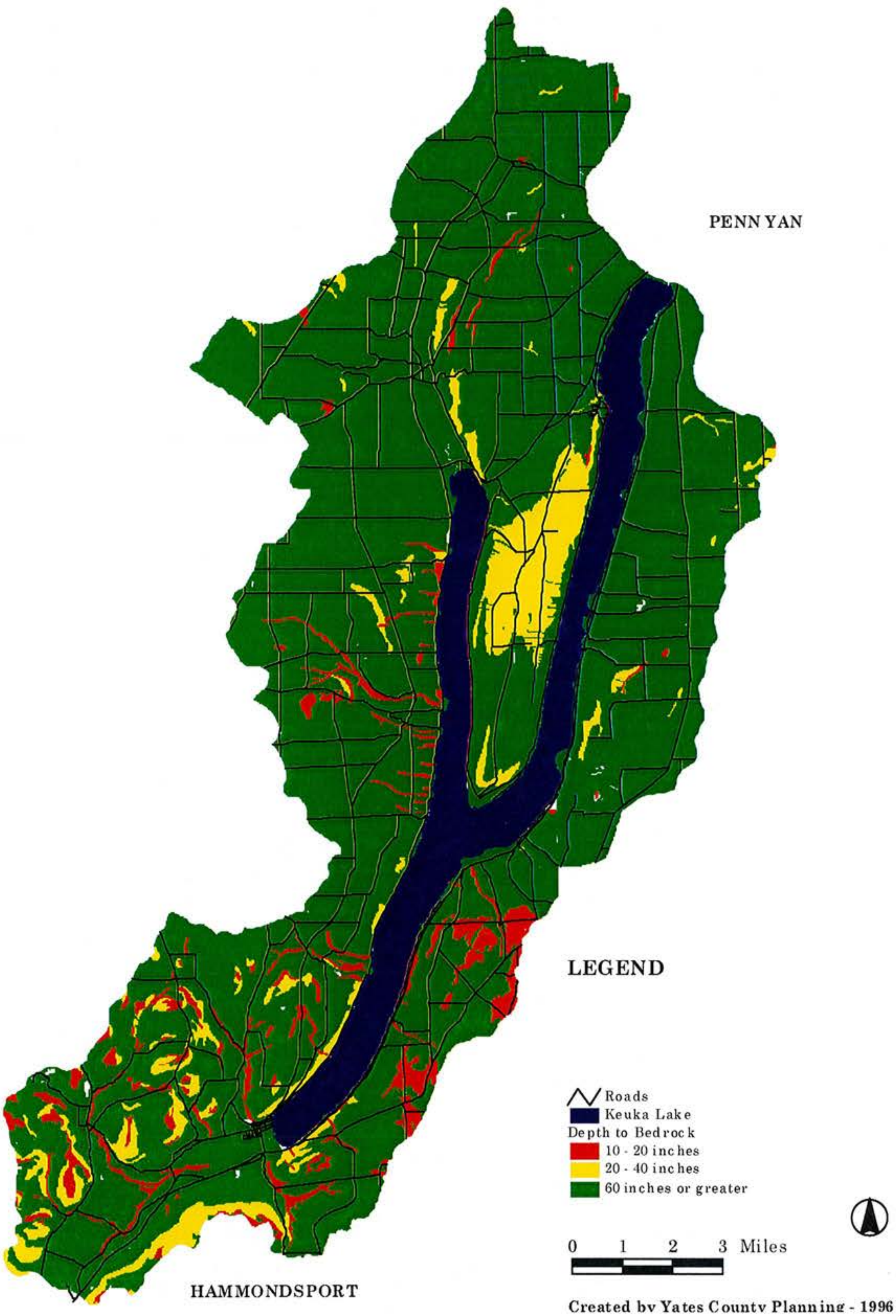

Figure 7-10. Keuka Lake watershed depth to bedrock soils interpretation.

SOIL CONSTRAINTS COMPOSITE

As a final level of analysis, an attempt was made to consider all three constraining soil characteristics: steep slopes, poor drainage, and limited depth to bedrock. For this, all three characteristics were overlaid to form another three-color thematic GIS map.

"Severe Constraint" (Red) is defined as an area with slopes greater than 15% or poor drainage or bedrock depth of less than 20 inches. An area of "No Constraint" (green) would have slopes of less than 7% and soils that drain well or excellent, and a depth to bedrock of at least 60 inches. "Moderate Constraint" (yellow) are any areas that have at least one moderately limiting characteristic. For example, an area of slopes of 7-15% even if the area has well drained soils, and sufficient depth to bedrock.

SOIL CONSTRAINTS COMPOSITE ANALYSIS

The mapping of a composite of slope, drainage, and bedrock characteristics (Figure 7-11) clearly shows that the majority of soils in the watershed have limitations for "conventional" development. 60% of the watershed have soils containing "Severe Constraints" to development, 25% have "Moderate Constraints", and 15% have "No Constraints".

The area with no constraints tends to be limited to the Yates County portions, which again, largely reflects the differences in soils interpretation between Yates and Steuben Counties for drainage.

SOIL CONSTRAINTS COMPOSITE IMPACT ON DEVELOPMENT

The Constraints Composite map allows one to compare different types of limitations. Where a site may have excellent drainage, this might simply be the result of extreme slope. For example, the banks of a ravine drain quite well, but certainly have severe development limitations.

Again note that traditional centers of development—the villages and hamlets are located in the few areas of no soils constraints. The Village of Hammondsport, the largest development center in the watershed, is located in one of the few areas in the southern part of the watershed that has no constraints to development. In contrast, the Bluff is composed almost exclusively of soils that have severe constraints of one type or another. It may be that the demand for a dwindling supply of undeveloped land in close proximity to Keuka Lake causes developers to go to greater and greater extremes in building on constrained sites. However, this potential for nonpoint source pollution from flooding, soil erosion, or septic systems, increases with each new construction on a sensitive site. Developers should follow best management practices on marginal lands before, during and after construction to ensure that water quality is not compromised from pre-development conditions.

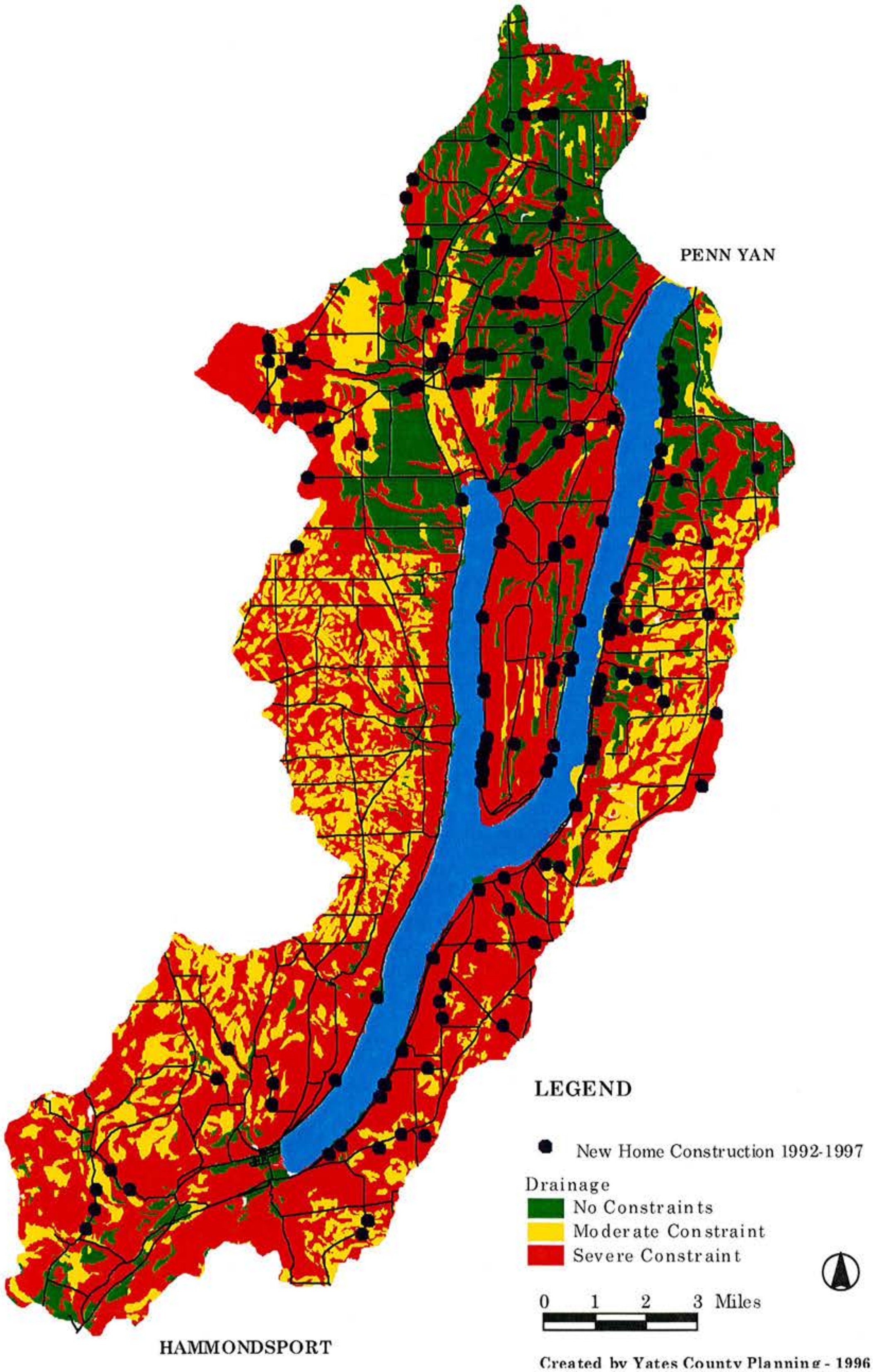

Figure 7-11. Keuka Lake watershed soil constraints composite.

DEVELOPMENT TRENDS

Previous sections explored existing land use patterns related to development and the impact of development on water quality. To gain a better perspective of development in the Keuka Lake watershed, an analysis of development trends was conducted. Building permit data were collected from local Building Inspectors for the previous five years (1992-1996). The permits history in these towns was almost exclusively residential alterations (roofs, decks, windows, etc.) and a small percentage of the total permit activity consisted of new home construction. Figure 7-11 illustrates with blue dots the spatial distribution of this activity and Table 7-20 summarizes these data by town and year.

Table 7-20. Keuka Lake watershed building permit data, 1992-1996.

TOWN		1992	1993	1994	1995	1996	5 YR Total	Annual Av.
Barrington, Yates County	Total	7	17	16	11	8	59	11.8
	KLW*	4	9	5	6	2	26	**5.2**
Benton, Yates County	Total	10	6	15	11	13	55	11
	KLW*	2	3	2	2	0	9	**1.8**
Jerusalem, Yates County	Total	29	24	21	18	18	110	22
	KLW*	29	24	21	18	18	110	**22**
Milo, Yates County	Total	20	23	23	14	11	91	18.2
	KLW*	6	9	9	4	3	31	**6.2**
Potter, Yates County	Total	11	7	9	4	10	41	8.2
	KLW*	2	2	2	2	3	11	**2.2**
Urbana, Steuben County	Total	5	4	6	8	5	28	5.6
	KLW*	5	4	6	8	5	28	**5.6**
Wayne, Steuben County	Total	6	4	6	7	9	32	6.4
	KLW*	4	3	4	5	5	21	**4.2**
TOTALS	**Total**	88	85	96	73	74	416	83.2
	KLW*	47	50	43	37	31	208	**41.6**

KLW Dwelling Units constructed in the Keuka Lake Watershed*

The results of this study projects a continued slow rate of development in the Keuka Lake watershed, with no drastic changes in population or land use expected in the near future. Fifty or less homes were added in the busiest years, while in the most recent years (1995, 1996), less than forty new homes were constructed in the watershed annually.

The new home construction was then plotted over the maps showing soil constraints for development (Figure 7-11). At least half of the new home construction in the Keuka Lake watershed has occurred in the northern "upland" areas, where development is more sparse and there are less soil constraints. However, there are noticeable concentrations of new construction on the east shore of the east branch of Keuka Lake (Town of Barrington), and at the western tip of the Bluff (Town of Jerusalem). These concentrations are occurring in areas that have severe constraints to development. Such developments may need to be more closely monitored by the local governments based on the potential for nonpoint source pollution.

FOREST RESOURCES

ACKNOWLEDGMENTS

This review of forest resources and the impact on water quality in the Keuka Lake watershed was compiled from information provided by Region 8 DEC Foresters: Jim Peek, Supervising Forester; Billy Morris, Senior Forester; Jim Pitt, Senior Forester and Jim Balyszak, Yates County SWCD Forester.

HISTORICAL

The Keuka Lake watershed was almost entirely forested in pre-colonial times. Settlement and clearing progressed rapidly after the Revolutionary War and reached a peak around 1900 as agriculture and pasture animals dominated the landscape.

Changing economics, increased mechanization and depletion of the soil led to the abandonment of steep farmlands. A small percentage of these abandoned farms were planted to softwood trees but the majority reverted back to native hardwood forests. The forests of the watershed now occupy 54,600 acres which is 54% of the watershed land. This acreage is almost entirely privately owned with only one tract of public forest lands, the Urbana State Forest, that encompasses about 2,200 acres.

CURRENT FOREST CONDITIONS

New York's forests are maturing as the growth of timber exceeds the harvest by a factor of 3:1 or more. Timber quality is expected to increase as trees become larger. Within the Keuka Lake watershed, however, overall quality is less than optimal due to heavy clay soils, repeated ice storms, injuries due to severe wind, a history of grazing in woodlots and repeated poor timber harvesting practices that removed only valuable trees and left unacceptable growing stock behind.

BENEFITS TO WATER QUALITY

Forest lands provide a great deal of protection to our streams and lakes by hindering the erosive forces of rainfall and runoff. Trees intercept rainfall, leaf litter and humus protect the soil surface from erosion and trees are believed to act as a nutrient sink. Many of the steep lands within the watershed have reverted back to forest cover. This may be the best use of these steep lands for the protection of water resources. Forest buffer zones along stream corridors and lakes reduces the amount of sediment and nutrients reaching these water bodies.

FOREST PRODUCTS

Hardwood lumber is the major product from forests in the watershed. Although there are no major forest product companies located within the watershed, there are good markets for the timber locally.

The forests in the watershed consist of a variety of upland commercial hardwoods that include maple, ash, oak, cherry, hickory and others.

Most of the hardwood lumber from the watershed is used for furniture, molding, paneling, flooring and pallets. Many of the veneer quality logs are exported to foreign markets.
Softwood lumber from the watershed forests are usually used locally for homes, barns, sheds and similar structures.

It is very difficult to estimate the volume and value of timber within the watershed as the most recent and reliable data is based on regional statistics. The following estimates are based upon interpretations of local, regional and state forest inventories.

The estimated volume of timber is 2,850 board feet per acre (International 1/4" Log Rule). Multiplying this volume by 54,600 acres gives an estimate of 155 million board feet of timber within the Keuka Lake watershed. See Figure 7-12.

Estimating the value of this timber is also difficult. The range of values per thousand board feet is $10 (the low end for beech and aspen) to $1100 (the high end for black cherry and walnut). An estimate of average value per thousand board feet, taking into consideration all species, sizes, quality and accessibility, is $150. Therefore, 155 million board feet valued at $150 per thousand board feet equals $23,000,000.

FOREST MANAGEMENT AND TIMBER HARVESTING

New York City spent considerable time and money studying its watershed in an effort to protect its drinking water supplies. Policy recommendations from their report state that, "Well managed forests provide the most beneficial land cover for water quality protection."

Timber harvesting is an integral part of managing forest lands. Without the periodic income from timber harvesting, many landowners would probably sell these forested lands for building lots or convert the land to more profitable uses that might not be as desirable for water quality, wildlife and green space.

Most water quality concerns arise on forested lands during timber harvesting. Timber harvesting activities involve the use of heavy equipment in the removal of trees. The major areas of concern during harvesting are the condition of landings, skid roads, skid trails and stream crossings. During harvesting, forest leaf litter is disturbed and soil is exposed, increasing the risk of erosion and sediment delivery to streams and the lake. Proper harvesting techniques and job supervision can significantly reduce these potential threats.

The responsibility for proper timber harvesting rests with both the landowner and the timber harvester. A variety of technical assistance is available to ensure a satisfactory job is completed.

Some forest landowners are knowledgeable about silviculture, timber markets, contracts and erosion control to manage a successful timber sale, however, many are not. The best procedure for a landowner selling timber is to request the services of a DEC forester. A DEC forester has no financial interest in the timber sale and can provide unbiased information on which trees are ready for sale, landing and skid trail locations, erosion control measures, obtaining competitive bids and a variety of related topics. The landowner may then choose to handle the timber sale on their own or hire a private consulting forester. A list of consulting foresters is available from the DEC. A consulting forester charges a fee; usually based on a percentage of the gross receipts, and can oversee the tree marking, competitive bidding process, sale contract, timber harvesting and erosion control.

The timber harvesters should implement the Silvicultural Best Management Practices as developed by the NYS DEC. Adherence to these practices will protect the forest, soil and water resources and avoid potential problems with adjacent "downstream" landowners. Environmental protection through adherence to these best management practices should also prove to be a good business practice for timber harvesters.

THE CHALLENGE

Properly managed woodlots within the Keuka Lake watershed can provide many benefits. Well managed woodlots return revenues to the landowner and may forestall conversion of these forests to other uses. These same woodlots also protect our water resources, provide valuable wildlife habitat and allow for thousands of hours of recreational activities each year. The key to all of these benefits is proper forest management which includes timber harvesting at the correct times.

Timber harvesting is normally an infrequent event for most forest landowners. Even on highly managed industrial forest lands, harvesting schedules typically run 10 to 12 years apart or longer. On private, non-industrial forest lands, harvesting may only occur once or twice during the life of the owner. The biggest challenge is to make sure the forest owner has the necessary information or professional assistance to protect the resources and maximize profits at the time of harvest.

WATERSHED BENEFITS

A forest landowner who follows best management practices and obtains the needed advice from a professional forester, should provide the following landowner/watershed benefits:

- maximize timber sale revenues, providing an incentive to maintain lands in forest production.
- reduce the potential for nonpoint source pollution from timber sale activities by ensuring the use of best management practices.
- increase the utilization of a renewable resource from a non-industrial private forests.

The challenge is to maximize the number of timber harvesting operations that implement the silvicultural best management practices.

RECOMMENDATIONS

1) Encourage all forest landowners in the watershed contact the following for initial timber harvesting advice:

Yates and Steuben county forest landowners contact:
Billy Morris, Senior Forester
NYS DEC
7291 Coon Road
Bath, NY 14810 607-776-2165

Steuben county forest landowners contact:
Jim Pitt, Senior Forester
NYS DEC
7291 Coon Road
Bath, NY 14810 607-776-2165

Yates county forest landowners may contact:
Jim Balyszak
Yates Co. Soil & Water Conservation District
110 Court St.
Penn Yan, NY 14527 315-536-5188

2) Provide the following resource information in the Yates and Steuben Soil & Water Conservation District offices:

- DEC list of Cooperating Consulting Foresters
- Silvicultural Best Management Practices Catalog
- Master Forest Owners Program referral list
- New York Forest Owners Association information and list

The Yates and Steuben Soil & Water Conservation Districts should promote the availability of these resources through such means as District newsletters.

3) Forestry Workshop: biannual educational workshop should be held watershed forest landowners. These workshops could be sponsored through the DEC, SWCD's, CCE and NY Forest Owners' Assoc.

APPENDIX A

The following organizations and programs provide assistance in responsible forest management within the Keuka Lake watershed:

Department of Environmental Conservation: Direct forest management assistance and BMP advise to landowners. The DEC also administers the following programs:

> Cooperating Timber Harvesters (CTH) Program: Voluntary program that trains harvesters in silvicultural Best Management Practices (BMP's) that they agree to follow. In return, the DEC provides this list to landowners. There are 89 CTH's willing to work in the Keuka Lake watershed.
>
> Cooperating Consulting Forester (CCF) Program: Private consulting foresters meeting minimum professional requirements and agreeing to operate under a code of ethics. They can provide forest management advice and administer timber sales for land owners. A list of CCF's is available from the DEC with 36 willing to work in the Keuka Lake watershed.
>
> Forest Tax Law (480a): Provides substantial reduction in property taxes to owners of 50 acres or more of forest lands that are willing to actively manage their property on a long term basis to produce forest products.

Yates County Soil & Water Conservation District: forest landowners in Yates County can obtain direct forest management assistance and BMP advise.

Master Forest Owners Program: These are volunteer forest owners who provide initial advice to landowners based on their first-hand experience and training. This program is administered by Cornell Cooperative Extension.

New York Forest Owners' Association: This is an educational group that was organized to encourage the wise management of private woodland resources. Members receive a magazine and can get advice via a toll free telephone number and can attend workshops and meetings sponsored by the organization.

US Department of Agriculture: This federal agency administers a number of cost-sharing programs that include forest management planning, tree planting, timber stand improvement, establishment of windbreaks, erosion control through design and layout of forest roads and other practices that promote stewardship of forest lands.

Trained Logger Certification: This program is administered through a partnership of the Empire State Forest Products Association, DEC and several other organizations. Harvesters that volunteer for the program are trained in best management practices, silviculture and safety.

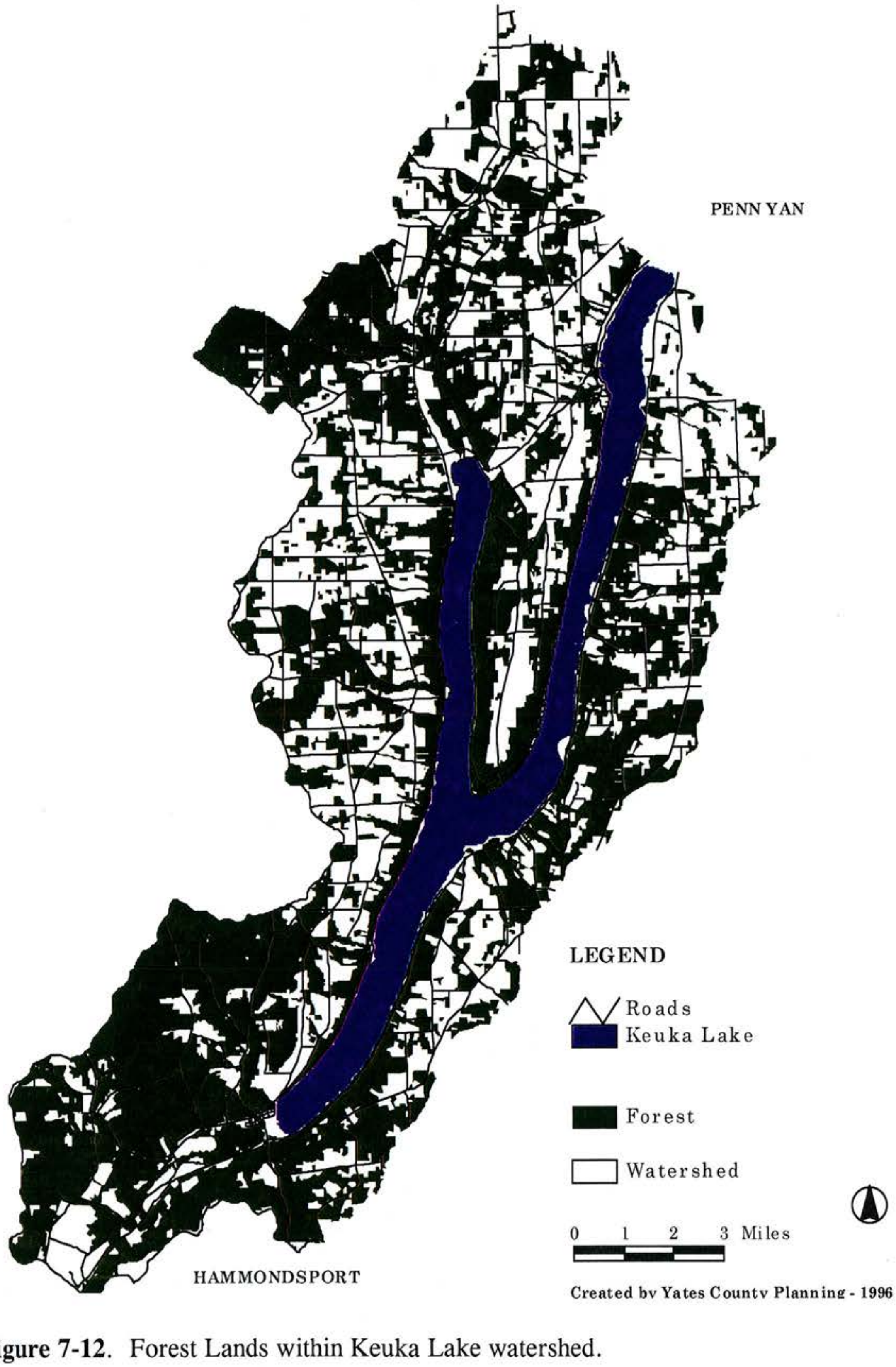

Figure 7-12. Forest Lands within Keuka Lake watershed.

HAZARDOUS WASTE SITES

INTRODUCTION

The NYS DEC Division of Hazardous Waste Remediation maintains a record of all reported hazardous waste disposal sites and conducts investigations on the cause and extent of contamination sites. The Keuka Lake watershed falls within the jurisdiction of NYS DEC Region 8, located in Avon, New York and provided the following information through the Freedom of Information Act.

RESULTS

There are two inactive hazardous waste disposal sites within the Keuka Lake watershed. (1) Urbana Landfill and (2) Penn Yan Aero Services, Inc. Additional information on the Urbana Landfill can be found in the Landfill section of this chapter.

Hazardous waste disposal site data are summarized in Table 7-21 and illustrated in Figure 7-13.

Table 7-21. Hazardous waste sites.

MAP NO.	SITE CODE	CLASS	NPL STATUS	SITE NAME	MUNICIPALITY	COUNTY	SUBWATER SHED
1	8-51-007	2	---	Urbana Landfill	Urbana	Steuben	11
2	8-62-007	2a	---	Penn Yan Aero Services, Inc.	Milo	Yates	26

CLASS: Each hazardous waste site is assigned a classification according to the following code:

I. Causing or presenting an imminent danger of causing irreversible or irreparable damage to the public health or environment - Immediate action required

II. Significant threat to the public health or environment - action required.
    A. Temporary classification assigned to sites that have inadequate and/or insufficient data for inclusion in any other classification.

III. Does not represent a significant threat to the public health or the environment - action may be deferred.

IV. Site is properly closed, no evidence of present or potential adverse impact - no further action is required.

THE URBANA LANDFILL

The Urbana Landfill is located on Crow's Nest Road in the Town of Urbana, and falls within the Cold Brook Subwatershed (#11). This property was leased as a town dump between 1968 and 1978. During this period 12 acres of this site were used for the disposal of household wastes and roughly 16,000 gallons of oil, solvents, and paint residue from the Town of Urbana and the Village of Hammondsport residents and commercial customers including several businesses, including Mercury Aircraft. The site was partially closed with an incomplete soil cover in 1979.

In 1982 the site was listed on NYS Registry of Inactive Hazardous Waste Disposal Sites. In 1985 RECRA Research conducted a Phase II investigation. The analysis of site groundwater, surface water, soil and air showed elevated levels of 1,2-dichloroethene (770 ppb), thichlorothine (560 ppb), vinyl chloride (250 ppb), phenol (15 ppb), and zinc (8600 ppb). High levels of VOC were found in adjacent tributaries suggesting groundwater contamination. However, testing of private homeowner wells adjacent to the site showed no site-related contamination. In July of 1994 NYS DEC reclassified the site as a Class 2, meaning the site has "Significant threat to the public health or environment - action required".

In April of 1996, Camp Dresser & McKee submitted an approved work plan for a Remediation Investigation and Feasibility Study at a cost of $720,000. Field work should take place in the Fall of 1996 and a Feasibility Study should be available in the Spring of 1997. The current schedule calls for Public meetings in the Summer of 1997 and the determination of a cleanup strategy in the Fall of 1997.

PENN YAN AERO SERVICE, INC.

Penn Yan Aero Service, Inc. located approximately one-half mile south of the village of Penn Yan on County Route 17, operates a small business repairing, overhauling and providing servicing for airplane engines. From the mid 1960s until 1988, a drywell on the site was used for disposal of spent solvents from the aircraft refurbishing business. The drywell consists of a buried 270 gallon steel tank with the bottom of the tank resting six feet below grade.

In 1988, through an Order of Consent, a remedial investigation took place. At that time, the drywell contained some liquid and had a distinct chemical odor. In 1990, H & A of New York conducted a Phase II investigation including soil vapor testing, an excavation test pit, and soil sampling. They found elevated levels of tetrachloroethylene in close proximity to the well, yet no increased levels beyond a fifteen-foot diameter of the well. However, the report concluded that; "VOC concentrations in the vicinity remain a source of residual contamination which could potentially impact groundwater quality." Later correspondences from NYS DEC found that private wells down-gradient from the site showed low-level concentrations of solvents.

Upon the claim that as much as 14,000 gallons of hazardous material were knowingly disposed of in an unlawful manner, the corporation plead guilty to two misdemeanor charges and paid $15,000 in civil penalties. Wastewater is now removed from the site by a licensed hazardous waste contractor.

In July of 1996, the NYS DEC accepted a remediation work plan from the owner that consisted of removing the drywell, any associated drains, and reducing contamination levels in the adjacent soil to acceptable levels. This work was to be completed by August 1, 1996. NYS DEC is currently drafting the final inspection report for this remediation.

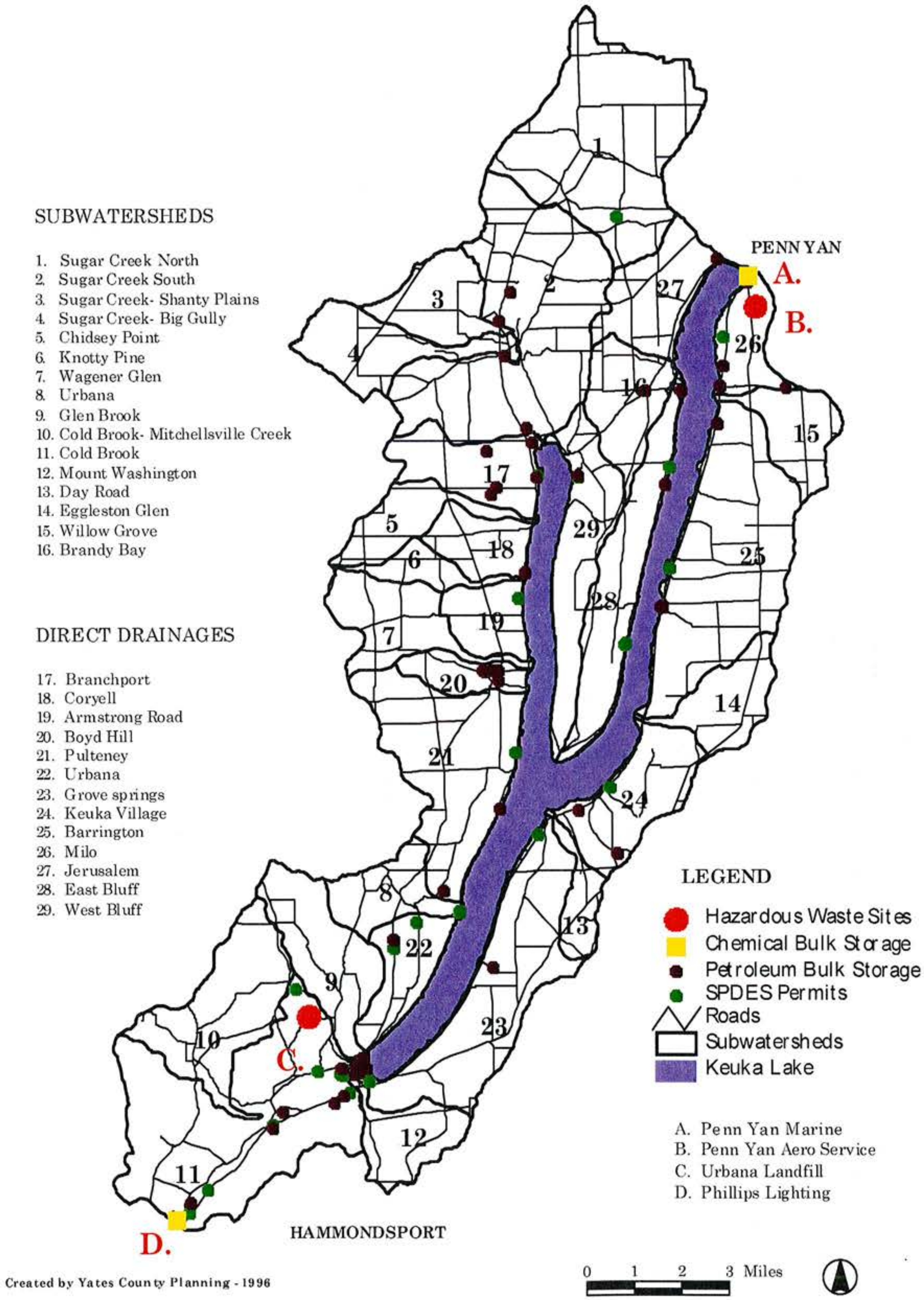

Figure 7-13. Hazardous waste sites, chemical & petroleum bulk storage and SPDES permits.

HAZARDOUS WASTE SPILLS

INTRODUCTION

The NYS DEC Spill Prevention and Response Data Section maintains a record of all known spills reported and conducts follow-up investigations. The hazardous waste spills reporting data contained in this report were obtained from the NYS DEC Section 8 office in Avon, New York. For the purpose of this report, only selected fields were used from the original database. There are over 60 fields of information for each spill. There were over 8,000 spills reported in NYS DEC Region 8 from 1974 to 1996.

RESULTS

There were 114 hazardous waste spills within the Keuka Lake Watershed reported to the NYS DEC since 1974. The data base has been sorted to show the spills by subwatershed. Due to the nature of the reporting of waste spills, data are not always link to a specific address, so some spill locations were estimated. An attempt was made to locate each spill and assign each to a specific subwatershed. Table 7-22 summarizes the total number of spills reported per subwatershed or waterbody. Figure 7-14 illustrates spill locations. The Cold Brook subwatershed, which includes a portion of Village of Hammondsport, has the most reported spills with 43, accounting for more than one third (38%) of the total Keuka Lake watershed hazardous waste spills. The other subwatesheds reporting significant numbers of spills tend to be those containing hamlets and higher population densities or more intensive uses such as marinas. The Pulteney subwatershed reported nine spills, the Sugar Creek South subwatershed, which includes Branchport reported eight, and Grove Springs and East Bluff subwatersheds each reported seven spills.

Table 7-22. Total number of spills by subwatershed.

SUBWATERSHED NAME	SUBWATERSHED NUMBER	NUMBER OF SPILLS
(1) Sugar Creek South	2	8
(2) Urbana	8	2
(3) Cold Brook	11	43
(4) Willow Grove	15	2
(5) Brandy Bay	16	1
(6) Branchport	17	5
(7) Coryell	18	2
(8) Boyd Hill	19	1
(9) Armstrong Road	20	4
(10) Pulteney	21	9
(11) Urbana	22	2
(12) Grove Springs	23	7
(13) Keuka Village	24	3
(14) Barrington	25	5
(15) Milo	26	3
(16) Jerusalem	27	6
(17) East Bluff	28	7
(18) West Bluff	29	4
	TOTAL	**114**

Table 7-24 provides a more comprehensive listing of the reported spills including type and quantity of materials spilled. Petroleum-based products are the most common hazardous material spilled. Such spills account for 95 of the 114 total spills (83%). However, of special note are the large quantity spills of hydrogen chloride and muriatic acid in 1988 through 1992 by Phillips Lighting in the Cold Brook Subwatershed (#11).

The amount or quantity of material spilled is not always reported. Within the reports surveyed, a "0" is entered for unknown quantities, often giving the false impression that the spill was inconsequential. An unknown quantity is reported for 70 of the 114 cases. Therefore, the figure for total quantity is deceptively low.

An attempt has been made to survey the average quantity of each type of spills. Table 7-23 below summarizes the average quantity for all reported spills of known quantity. The cases where a quantity of "0" was reported were not averaged. Gasoline spills tend to be relatively small with only one spill of known quantity over 100 gallons. Spills of #2 Fuel tend to be larger with many over 100 gallons and one spill of 4000 gallons reported from the Taylor Wine Company in the Cold Brook Subwatershed (#11).

Table 7-23. Total number of spills by type and quantity.

PRODUCT	NUMBER OF SPILLS	TOTAL QUANTITY* (gallons)	AVERAGE QUANTITY OF KNOWN QUANTITY SPILLS (gallons)
1. #2 Fuel	30	5,595+	75
2. #4 Fuel	2	50+	50
3. #6 Fuel	2	50+	50
4. Diesel	7	355+	28
5. Gasoline	19	175+	12
6. Hydrogen Chloride	6	9,090	2,000
7. Kerosene	1	150	150
8. Muriatic Acid	3	4,545	2,000
9. Non-PCB Oil	2	25+	25
10. Waste Oil	12	148	8
11. Unknown petroleum	20	???	???
12. Unknown material	5	???	???
13. Other Material	5	---	---
TOTAL(S)	**114**	**20,183+**	**NA**

- Total Quantity is a sum for known quantity spills, which account for less than half of all spills.

Up to this point, the frequency and quantity of spills reported within the Keuka Lake watershed has generally not been known and has not been considered a significant problem. However, hazardous waste spills are potentially a major source of pollutants particularly for fuel oil and other petroleum products. Figure 7-14 illustrates the location of all spills in the watershed.

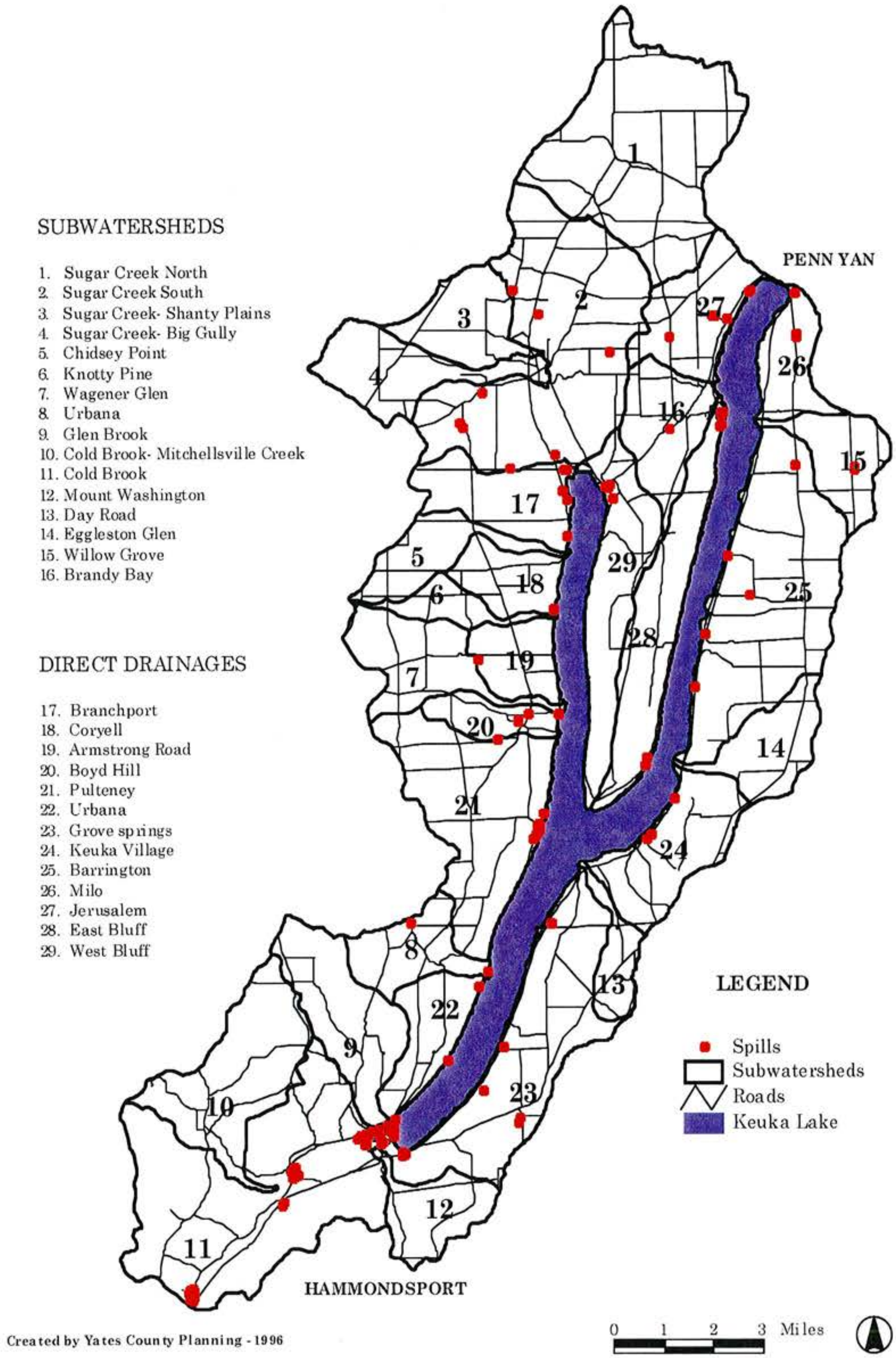

Figure 7-14. Location of hazardous waste spills.

Key for table 7-24. Hazardous waste spills.

FIELD	DESCRIPTION	FIELD	DESCRIPTION
MAP NO :	References following map	LOCATION:	Street address where the spill took place
STATUS:	The status of the spill A - Active spill (on going) C- Complete	COUNTY:	County where spill occurred.
SPILL NO.:	A unique sequential seven digit number assigned by the Oil Spill Hot Line	MUNICIPALITY :	Municipality where the spill took place.
SPILL DATE:	Date spill is known to have occurred. If unknown, the first date DEC was notified	SUBWATERSHED :	Number code for subwatershed where spill occurred
CLOSE DATE:		QTY: MATERIAL:	Amount spilled in gallons Type of material spilled.

Table 7-24. Hazardous waste spills

SPILL NO.	SPILL DATE	CLOSE DATE	SITE NAME	ADDRESS	MUNICI-PALITY	COUN-TY	SUB SHED	QTY	MATERIAL
9110000	9/15/91	10/28/91	Branchport School	Guyanoga Road	Branchport	Yates	2	0	#2 Fuel Oil
9400000	5/2/94	5/11/94	Gorsky Property Fishkill	Willet Road	Jerusalem	Yates	2	0	Unknown Petroleum
8900000	6/19/89	6/19/89	Teers (Leon) Residence	Armstrong Road	Jerusalem	Yates	2	0	Unknown Petroleum
9510000	8/15/95	11/14/95	Guyanoga Road	Guyanoga Road	Jerusalem	Yates	2	0	Waste Oil
9300000	5/18/93	5/18/93	Bradt Residence	4022 Belknap Road	Jerusalem	Yates	2	2	Gasoline
8080000	11/25/80	1/1/83	Lott Motor Lines	Italy Hill Road	Jerusalem	Yates	2	100	Waste Oil
9320000	3/24/94	5/11/95	Hayes (Phyllis) Residence	4269 Friend Road	Jerusalem	Yates	2	145	#2 Fuel Oil
8900000	6/19/89	6/19/89	Teers (Leon) Residence	Armstrong Road	Jerusalem	Yates	2		Unk Hazardous Mat.
9310000	1/21/94	12/5/95	Klapp Res/Miller Property	398 West Lake Road	Urbana	Steuben	8	0	#2 Fuel Oil
9100000	7/2/91	12/5/95	Wright Road (Elmbois)	Wright Road	Pulteney	Steuben	8	0	Unknown Petroleum
7980000	1/11/79	2/1/79	Frey and Campbell	Mitchelville Hill Road	Urbana	Steuben	11	0	#2 Fuel Oil
9300000	5/23/93	12/5/95	15 North Main Street	15 North Main Street	Hammondsport	Steuben	11	0	#2 Fuel Oil
8610000	12/4/86	1/15/87	Mercury Aircraft	17 Wheeler Avenue	Hammondsport	Steuben	11	0	#2 Fuel Oil
8300000	1/1/84	7/7/88	Hammondsport Central School		Hammondsport	Steuben	11	0	Gasoline
9210000	9/10/92		Hammondsport Central School	Route 54A	Hammondsport	Steuben	11	0	Gasoline
9110000	11/8/91	11/14/91	Lake Country Citgo	Lake Street & East Main	Hammondsport	Steuben	11	0	Gasoline
8800000	5/9/88	5/9/88	Wheeler & Davis Streets	Wheeler & Davis Streets	Hammondsport	Steuben	11	0	Gasoline
9110000	12/20/91	2/7/94	Taylor Wine	County Route 88	Urbana	Steuben	11	0	Gasoline
8400000		6/1/86	Keuka Lake Fishkill	Keuka Lake	Hammondsport	Steuben	11	0	Unk. Hazardous Mat.
7880000		2/6/78	Frey and Campbell, Inc	Behind Frey & Campbell	Urbana	Steuben	11	0	Unknown Petroleum
9400000	4/5/94	4/5/94	Mercury Aircraft-Cold Brk	Davis & Wheeler Avenue	Hammondsport	Steuben	11	0	Unknown Petroleum
8600000	8/10/86	8/11/86	Keuka Lake	Concrete Wall-S Keuka Lake	Hammondsport	Steuben	11	0	Unknown Petroleum
9210000	3/23/93	9/29/95	Urbana Town Garage	Liberty & Mill Streets	Hammondsport	Steuben	11	0	Unknown Petroleum

SPILL NO.	SPILL DATE	CLOSE DATE	SITE NAME	ADDRESS	MUNICI-PALITY	COUN-TY	SUB SHED	QTY	MATERIAL
9310000	8/16/93	5/30/95	Bussman (Richard) Home	81 Sheather Street	Hammondsport	Steuben	11	0	Unknown Petroleum
7480000	4/9/74	4/9/74	Mercury Aircraft	Mercury Aircraft, Inc	Hammondsport	Steuben	11	0	Waste Oil
9010000	10/23/90	4/25/91	Keuka Lake-South Outlet	Southwest End Keuka Lake	Hammondsport	Steuben	11	5	Waste Oil
8600000	6/24/86	3/31/87	Hammondsport Water Dist	Reservoir Road	Hammondsport	Steuben	11	10	Water Purifying Tablets
9400000	7/6/94	11/13/95	Shimkus Residence	112 Lake Street	Hammondsport	Steuben	11	13	#2 Fuel Oil
8810000	10/24/88	10/24/88	Frey & Campbell Inc	14 Sheather Street	Hammondsport	Steuben	11	25	#2 Fuel Oil
8800000	7/26/88	7/26/88	Taylor Wine	Taylor Wine	Urbana	Steuben	11	30	Diesel
9000000	4/10/90	4/10/90	Phillips Lighting	Bath-Hammondsport Rd	Bath	Steuben	11	45	Hydrochloric Acid
9000000	4/10/90	4/10/90	Phillips Lighting	Bath-Hammondsport Rd	Bath	Steuben	11	45	Hydrogen Chloride
9000000	4/10/90	4/10/90	Phillips Lighting	Bath-Hammondsport Rd	Bath	Steuben	11	45	Muriatic Acid
8500000	1/21/86	6/1/86	Taylor (Walter) Property 60	Walter Taylor Property 60	Hammondsport	Steuben	11	50	#2 Fuel Oil
8700000	4/16/87	8/4/89	Taylor Wine	Taylor Wine Co	Urbana	Steuben	11	50	#4 Fuel Oil
8600000	5/28/86	9/3/86	Ultra Main Products	17 Wheeler Street	Hammondsport	Steuben	11	50	#6 Fuel Oil
7380000	2/15/74	4/15/74	Hammondsport Jr/Sr High	Hammondsport Jr/Sr High	Urbana	Steuben	11	150	Gasoline
7980000	3/29/79	3/30/79	Gold Seal Wine Co.		Urbana	Steuben	11	300	#2 Fuel Oil
8080000	2/6/80	2/6/80	Hammondsport Wine Co.	Lake Street	Urbana	Steuben	11	500	#2 Fuel Oil
9200000	6/29/92	7/1/92	Phillips Lighting	Route 54 North	Bath	Steuben	11	2000	Hydrochloric Acid
9200000	6/29/92	7/1/92	Phillips Lighting	Route 54 North	Bath	Steuben	11	2000	Hydrogen Chloride
9200000	6/29/92	7/1/92	Phillips Lighting	Route 54 North	Bath	Steuben	11	2000	Muriatic Acid
8910000	10/11/89	10/11/89	Phillips Lighting	Route 54	Bath	Steuben	11	2500	Hydrochloric Acid
8910000	10/11/89	10/11/89	Phillips Lighting	Route 54	Bath	Steuben	11	2500	Hydrogen Chloride
8910000	10/11/89	10/11/89	Phillips Lighting	Route 54	Bath	Steuben	11	2500	Muriatic Acid
7880000	2/24/78	2/27/78	Taylor Wine	Taylor Wine Co	Urbana	Steuben	11	4000	#2 Fuel Oil
8810000	10/24/88	10/24/88	Frey & Campbell Inc	14 Sheather Street	Hammondsport	Steuben	11		#2 Fuel Oil
8610000	12/4/86	1/15/87	Mercury Aircraft	17 Wheeler Avenue	Hammondsport	Steuben	11		#2 Fuel Oil
8700000	4/16/87	8/4/89	Taylor Wine	Taylor Wine Co	Urbana	Steuben	11		#4 Fuel Oil
8600000	5/28/86	9/3/86	Ultra Main Products	17 Wheeler Street	Hammondsport	Steuben	11		#6 Fuel Oil
8800000	7/26/88	7/26/88	Taylor Wine	Taylor Winte	Urbana	Steuben	11		Diesel
8600000	8/10/86	8/11/86	Keuka Lake	Concrete Wall-S Keuka Lake	Hammondsport	Steuben	11		Unknown Hazardous Mat.
8710000	11/12/87	11/17/87	Route 14A - MVA	Route 14A	Milo	Yates	15	25	Diesel
8710000	11/12/87	11/17/87	Route 14A - MVA	Route 14A	Milo	Yates	15		Diesel
8180000	7/9/81	7/21/81	Route 54A	Route 54A	Jerusalem	Yates	16	10	Waste Oil
9310000	2/22/94	4/20/94	Butcher (Bill) Residence	296 West Lake Road	Jerusalem	Yates	17	0	#2 Fuel Oil
9310000	7/28/93	5/11/94	Jensen Marine Service	47 West Lake Road	Branchport	Yates	17	0	Gasoline
8810000	10/4/88	10/14/88	Branchport Automot Gas St	Route 54A	Branchport	Yates	17	0	Gasoline
9000000	7/14/90	7/14/90	Francis Bercume	40 West Lake Road	Jerusalem	Yates	17	0	Unknown Petroleum
8810000	10/4/88	10/14/88	Branchport Automot Gas St	Route 54A	Branchport	Yates	17		Gasoline
9200000	4/11/92	4/23/92	Kelley's Marine	289 Route 54A	Pulteney	Steuben	18	0	#2 Fuel Oil

SPILL NO.	SPILL DATE	CLOSE DATE	SITE NAME	ADDRESS	MUNICI-PALITY	COUN-TY	SUB SHED	QTY	MATERIAL
9100000	7/27/91	7/30/91	Kelley's Marine Service	289 West Lake Road	Pulteney	Steuben	18	0	Gasoline
9510000	8/31/94	10/17/95	FMHA Rooks Property	Armstrong Road	Pulteney	Steuben	19	0	Waste Oil
9510000	1/22/96		Egresi/Eckel (John) Res	10865 County Route 78	Pulteney	Steuben	20	0	#2 Fuel Oil
8600000	4/16/86	7/30/87	Nichol Inn	485 West Lake Road	Pulteney	Steuben	20	0	Unknown Petroleum
8610000	2/26/87	9/2/87	Pulteney Highway Dept	Paddock Rd Near Baughman	Pulteney	Steuben	20	300	Diesel
8610000	2/26/87	9/2/87	Pulteney Highway Dept	Paddock Rd Near Baughman	Pulteney	Steuben	20		Diesel
8500000		6/1/86	Wilder Residence, Arthur	Arthur Wilder Cottage, 63	Pulteney	Steuben	21	0	#2 Fuel Oil
9100000	6/21/91	6/24/91	Keuka Lake 703 West Lake	703 West Lake Road	Pulteney	Steuben	21	0	Exoskeletons
8600000		3/31/87	Commisso, Jim	666 West Lake Road	Pulteney	Steuben	21	0	Gasoline
8600000	6/2/86	6/3/86	Keuka Lake Yacht Club	W Lake Rd Bet Hammon.	Pulteney	Steuben	21	0	Unknown Petroleum
8900000	7/11/89	7/11/89	Keuka Lake	964 West Lake Road	Pulteney	Steuben	21	0	Unknown Petroleum
9100000	7/29/91	7/29/91	Keuka Lake @ West Lake Road	709 West Lake Road	Pulteney	Steuben	21	1	Foam
9510000	10/15/95		Schultz/Wright Residencw	8264 Stone Road	Pulteney	Steuben	21	25	Non PCB Oil
8600000		3/31/87	Commisso, Jim	666 West Lake Road	Pulteney	Steuben	21		Gasoline
8600000	6/2/86	6/3/86	Keuka Lake Yacht Club	W Lake Rd Bet Hammon.	Pulteney	Steuben	21		Unknown Hazardous Material
9410000	8/30/94	8/30/94	Boyians Boat	Route 54A-Jakes Boat Liv	Urbana	Steuben	22	0	Gasoline
9200000	5/21/92	5/28/92	Snug Harbor	Route 54	Urbana	Steuben	22	0	Unknown Petroleum
8800000	8/10/88	8/10/88	Keuka Maid	Champlain Beach,Route 54	Urbana	Steuben	23	0	Non PCB Oil
9000000	1/15/90	12/24/90	Wendlandt (Rick) Residence	Box 572 County Route 87	Urbana	Steuben	23	0	Unknown Petroleum
9400000	5/31/94	5/31/94	Keuka Maid at Boat Launch	Route 54 at Boat Launch	Urbana	Steuben	23	1	Diesel
8800000	8/30/88	2/27/89	Draper, Wendell	Everett-N Urbana Hill Rd	Urbana	Steuben	23	2	Waste Oil
9410000	8/18/94	8/19/94	Stafford Motor Boat	648 East Lake Road	Wayne	Steuben	23	18	Gasoline
8800000	8/10/88	8/10/88	Keuka Maid	Champlain Beach, Route 54	Urbana	Steuben	23		Oil Based Sealer
8800000	8/30/88	2/27/89	Draper, Wendell	Everett-N Urbana Hill Rd	Urbana	Steuben	23		Waste Oil
9010000	8/14/90	4/4/91	Ambrosia Farm	1182 Route 54	Wayne	Steuben	24	0	Unknown Petroleum
9300000	4/30/93	4/30/93	NYS Electric & Gas Keuka	East Lake Road	Wayne	Steuben	24	1	Waste Oil
9010000	10/10/90	4/25/91	Rapp (Robert) Cabin	1148 East Lake Road	Wayne	Steuben	24	50	#2 Fuel Oil
9110000	1/2/92	5/12/92	Pfendt (Henry) Residence	968 Lower East Lake Road	Barrington	Yates	25	0	#2 Fuel Oil
8500000		6/1/86	Keuka Lake	Keuka Lake, Along East Sh	Jerusalem	Yates	25	0	Unknown Petroleum
9010000	1/17/91	1/18/91	Fullager (Lnace) Home	Old Bath Road	Milo	Yates	25	10	#2 Fuel Oil
8600000	10/1/86	3/31/87	Bullock (Ila) Residence	820 East Lake Road	Barrington	Yates	25	150	Kerosene
9300000	2/5/93	12/5/95	Griffith Oil-Covert Home	2366 Sturdevent Road	Barrington	Yates	25	250	#2 Fuel Oil
8700000	6/21/87	6/22/87	Happy Anchor Trailer Park	Happy Anchor Trailer Park	Milo	Yates	26	0	Unknown Petroleum

SPILL NO.	SPILL DATE	CLOSE DATE	SITE NAME	ADDRESS	MUNICI-PALITY	COUN-TY	SUB SHED	QTY	MATERIAL
8800000	4/21/88	4/26/88	Penn Yan Aero Service	Old Bath Road	Milo	Yates	26	0	Waste Oil
8800000	4/21/88	4/26/88	Penn Yan Aero Service	Old Bath Road	Milo	Yates	26		Waste Oil
9500000	7/21/95	11/14/95	Penn Yan WWTP	151 West Lake Road	Jerusalem	Yates	27	0	Benzene
9500000	7/21/95	11/14/95	Penn Yan WWTP	151 West Lake Road	Jerusalem	Yates	27	0	Benzol
8900000	6/22/89	7/1/89	Clapp, James	2774 Wager Hill Road	Jerusalem	Yates	27	0	Unknown Petroleum
8910000	3/9/90	3/9/90	Toni Guidice Residence	Rt 54A Near Wager'sApple	Jerusalem	Yates	27	0	Unknown Petroleum
8500000	10/17/85	6/1/86	Ira Wyman, Inc.	Coats Rd, 1/4 Mile North	Jerusalem	Yates	27	5	Gasoline
8900000	6/22/89	7/1/89	Clapp, James	2774 Wager Hill Road	Jerusalem	Yates	27		Unknown Hazardous Material
9500000	7/18/95	11/14/95	Thuman (Mike/Carol)Camp	1137 East Bluff Road	Jerusalem	Yates	28	0	#2 Fuel Oil
9410000	1/19/95		Keuka College	Keuka Park Keuka College	Jerusalem	Yates	28	0	Gasoline
8800000	8/18/88	8/19/88	Keuka Lake Near Keuka Col	Keuka Lake Near Keuka Col	Jerusalem	Yates	28	0	Unknown Petroleum
9510000	8/31/95	9/6/95	Bechhoeffer (Arthur) Home	1128 East Bluff Drive	Jerusalem	Yates	28	2	#2 Fuel Oil
9520000	2/21/96		Potter Residence	450 East Bluff Drive	Jerusalem	Yates	28	50	#2 Fuel Oil
7780000	9/20/77	9/20/77	Keuka College	Keuka College	Jerusalem	Yates	28	100	#2 Fuel Oil
7880000	2/28/78	3/31/78	Les Athawes	470 East Bluff Drive	Jerusalem	Yates	28	100	#2 Fuel Oil
9400000	4/12/94	1/23/95	Keuka Lake State Park	Route 54A Camp Comfort St	Jerusalem	Yates	29	0	#2 Fuel Oil
9400000	4/12/94		Keuka Lake State Park	Route 54A Camp Comfort St	Jerusalem	Yates	29	0	#2 Fuel Oil
9510000.	10/27/95		Keuka State Park	3370 Pepper Road	Jerusalem	Yates	29	0	#2 Fuel Oil
8180000	7/21/81	7/27/81	Keuka Lake State Park	Keuka Lake State Park	Jerusalem	Yates	29	30	Waste Oil

INACTIVE LANDFILLS AND DUMPS

INTRODUCTION

In 1988, the NYS DEC introduced strict guidelines for engineering and siting sanitary landfills so that they could receive hazardous waste as well as sludge and solid waste. There are no county or NYS DEC regional sanitary landfills in the Keuka Lake watershed. Even if there were, they would not present a significant environmental risk because of their impermeable bottoms and sides and their environmentally correct closure procedure. There are, however, a number of older, inactive non-engineered dumps in the watershed which have the potential to contaminate water quality.

For centuries, communities have disposed of their wastes in land depressions (gravel pits), wetlands, streams and shallow portions of the lake. There are many testimonials and old photos of Hammondsport that verify these statements. Fortunately, this practice does not continue today.

Open dumping is defined as the dumping of residential and construction waste on flat or slightly sloped land to eventually create a huge mound. Open dumping also occurs in land depressions to form landfills. The abandoned town dumps in the watershed were created by these two methods. In at least one instance, a town dump is within the excavated depression of a gravel pit as well as having mounds of waste on the surface covered with earth.

After a pit or gully was filled, a new open dump would open elsewhere. These inactive town dumps are, along with landfills at the southern end of the lake, the remaining known deposits of the watershed's waste stream.

There are no accurate records for the opening and closure of municipal dumps. Dates given for opening and closure, while not precise (i.e., 1950's) are the best figures available. The importance of dating the period of operation provides an indication of the methods of operation and closure. Dumps operated until 1977 were regulated by NYS Department of Health (DOH). Regulations were minimal, with the emphasis on controlling health vectors such as flies and rats. The closure procedures involved the spreading of an earth cover, which often was not done properly or at all. The DOH later instituted pesticide spraying to kill flies and rats and covering with earth more frequently. In 1977, NYS DEC was given the responsibility for environmental regulation of town dumps. They increased the operating and closing standards markedly, and by 1981, all town sanitary landfills were closed because of the burdensome cost of operating them.

REVIEW OF THE KNOWN LANDFILLS AND DUMPS

The status of inactive landfills and dumps in the Keuka Lake watershed is summarized in Table 7-25. The landfills and dumps listed are those where most of the municipal waste was dumped up to about 1980. They include town and private dumps. The privately run dumps tended to use wetlands and were operated for a shorter period of time than the town dumps. During operation, evidence suggests the demand to make a profit caused the private commercial dump owner to accept all types of waste, regardless of the potential hazard. Since regulation was minimal, the DEC now has a greater concern for the inactive private commercial dumps in the watershed.

JUNK YARDS

Junk is the salvable portion of the solid waste stream. Recyclable junk has reduced the disposable portion of the solid waste stream. There is still solid waste that is not recycled at the curbside, but is for sale at second hand clothes and furniture stores, antique stores and the like for resale. These types of operations are usually small and well managed.

It must be kept in mind that keeping junk on one's property, especially old cars and farm machinery, or dumping solid and liquid waste on someone else's property illegally is still fairly prevalent. Obtaining knowledge of the extent of this type of pollutant generation is difficult since the greater proportion is distributed and hidden.

There is one type of salvage operation that is not small and not undercover. It is the automotive junk yard. Section 136 of the NYS General Municipal Law refers to automobile junk yards and is called out by most of the towns. The legally permitted automotive junk yard is usually large, outdoors and contains inoperable automobiles, recreational vehicles, trucks, buses, portions of these vehicles and other scrap.

Salvageable parts are stripped from vehicles and are resold. The remainder of the vehicle is crushed and the metal is sold or taken to a sanitary landfill. When a junk yard is operated, monitored and enforced by the law, there is little pollution risk to the watershed.

As in all human endeavors, the procedures are not always followed. This has led to abandoned vehicles and equipment in small numbers at many places in the Keuka Lake watershed. Not only are abandoned vehicles eyesores, they can also be potential health hazard when abandoned near a creek or in a gully. The extent of this problem in the watershed is unknown, however, through the course of the research to identify mines and landfills, a number of abandoned cars were found near streams in the waterhsed.

Section 136 of Town Law requires that when two or more inoperable vehicles are in a lot, the lot is called a junk yard, a permit is required and a fee assessed. There is unfortunately no upper limit in Section 136 or in any town law to the number of vehicles allowed on site at any one time.

Although there appear to be many small collections of junk, there are few that are large, commercially operated and requiring a permit. There are two in the watershed of interest, one of which has a permit pending. Both are automotive junk yards.

The first of the known automotive junk yards is on Yatesville Road in the Town of Jerusalem. The location is 0.3 mile north of the intersection with County House Road on the west side of the road. Nearby are east-west feeders that drain into Sugar Creek. It is in subwatershed 2. There are 30-40 cars, trucks and campers in total next to the road. The Town has been trying to have the private owner install the required eight foot fence to obscure the junk yard for aesthetic considerations.

The largest automotive junk yard is in the Town of Urbana. It is on a gradual slope that abuts a steep slope which descends to Mitchellsville Creek. Mitchellsville Creek in turn feeds Cold Brook and then enters Keuka Lake. Geographically the junk yard is on Mitchellsville Road (Route 89), on the left side, 1.2 miles from the intersection with Route 88. It is located in subwatershed 10. Such a location will quite likely deliver the pollutant loadings to Mitchellsville Creek whether the soil is permeable or not permeable. If permeable, the groundwater will reach the creek. If not permeable, the runoff will reach the creek.

The junk yard contains from 300 to 500 vehicles at any one time.* There are also mounds of scrap which can be seen from the entry road. The junk yard has a license to sell vehicles posted. Also, the privately owned junk yard employs an operator of a portable crusher to come and crunch the vehicles and haul them away. Currently, the Town of Urbana is negotiating* with the new owner to reduce the number by having the permit pending until properly reduced to 30-40 at any one time.

Other information about this junkyard is included in Table 7-25.

In summary, although junk yards contain various types of junk for resale, they do not accumulate large quantities like current county sanitary landfills or the original (now inactive) town dumps. However, an automotive junk yard does become large and maintains a large number of inoperable vehicles for parts for resale. A large automotive junk yard does exist in Urbana near Mitchellsville Creek. It should be considered a potential pollution risk because of its location and the diverse potential contaminants (Reference 1). They include chemical cleaning compounds, metals, petroleum, paint products, etc. which are hazardous.

Table 7-25. Inactive Landfills in the Keuka Lake Watershed

Town & Map #	Location	Date	Material	Permitted	Regulate	Closure	Sub Shed	Soil/Description
Jerusalem 1	Jerusalem old town dump: just north of Hemlock Road, .5 miles east of Italy-Friend Road intersection; owned by town	Closed in 1981	G,ST,CM,B,CL	none	DEC Regulated	Capped with dirt and vegetated	4	Ve: Volusia channery silt loam
Jerusalem 2	Eaves Garbage Dump: south of Willett Road, between Shipman Road and County House Woods Road; owned by Eaves	Closed in 1981	G,S,T,CM,B,CL	none	none	none	2	VA: Vales gravelly silt loam
Pulteney 3	Town Dump: just north of Obey Road, about 100-200 feet west of County Road 78	Closed in 1979	G,S,T,CM,B,CL	none	DEC regulated	Capped with dirt and vegetated	7	OCR: Ontario fine sandy loam
Urbana 4	Urbana Landfill: on Crow's Nest Road, north side ¼ mile west of Van Nests Road; Town and Francis Smith owned and leased land	Closed in 1978	G,S,T,SM,SP,CM,B,MS,CL,HW Hazardous waste class 2	none	Regulated and currently under remedial consideration	Hazardous chemicals detected in ground and surface water. No closure	11	Md: Mardin channery silt loam
Urbana 5	Reservoir Hill Road: north of intersection of Reservoir and Glen Brook Roads; Private dump known as Putts	Established in the fifties, operated for 3 decades	G,S,T,CM,B,CL (MS?)	none	none	Closed and overgrown with grass and trees	9	Hr: Howard and Mardin gravelly loam
Urbana 6	Hadley's junk yard: Mitchellville Hill Road. The waste is on the surface of the land and handling of fluids is not known.	Current	Old autos; 300-500 waiting to be crushed; Town wants him to reduce to 30-40	none	Regulated as a junk yard by the town	On the land surface, earth roads, bare earth and some grass	10	MdR: Mardin channery silt loam

Table 7-25. Landfills - continued

Wayne 7	Town Dump: South of Route 230, about ¼ mile from Romig Road, across from cemetary; large dump; owned by Town of Wayne	Inactive in 1981	G,S,T,CM,B,CL	none	DEC Regulated	Capped with dirt and vegetation	24	OvB: Ovid silt loam
Barrington 8	Town Dump: West of 17 (Bath Road), North of town offices; owned by town	Inactive in 1981	G,S,T,CM,B,CL,S P	none	DEC Regulated	Capped with dirt and vegetation	25	Me: Mardin channery silt loam
Hammondsport 9	#1 Right north of Keuka Lake inlet #2 Other dumps and landfill for railroad tracks	Used over 30 years & closed in the mid-1950's	G,S,T,CM,B,CL,S P,SM,MS	none	none	Covered with dirt	11	Ch: Cayuga silt loam
Hammondsport 10	Private dump operation: on Cold Brook side of intersection of Wheeler and Davis Roads	1960-1975	Various heating & cooling equipment	none	none	Covered with dirt	11	Ch: Cayuga silt loam
Benton 11	Town Dump: 1.2 miles east of Voak Road (Co. Rd. 27) and 3/8 miles south of Havens Corners Road (Co. Rd. 14); owned by Town	Inactive in 1981	G,S,T,CM,CL	none	DEC Regulated	Capped with dirt and vegetation	1	Pf: Palmyra and Howrd gravelly loam

* Definition of symbols given in Table 7-24

** See Wendel Report (Reference 1) Figure 7-15. Wendel has recommended a complete study of the landfill directly north of the inlet. This particular area, #1, has been subsequently studied by another engineering firm for the owners of the property. The test results of the water and soil quality data are not available at this time. However, the other areas on the lakeshore have been used for oil storage; The Sanborn map of 1916 indicates also possible sources of chemical pollution and a substantial amount of land filling out from the original shoreline.

Table 7-25. Landfills - continued

Town & Map #	Slope	Permeability	Bedrock Depth	Cover (land use)	Distance to Hydro (feet)	Risk Rank*	Numerical Rank**
Jerusalem 1	0-3%	Slow	10-30 meters	trans	300	Low	9
Jerusalem 2	5-15%	Moderate	10-30 meters	trans	<100	Low	8
Pulteney 3	3-10%	Moderate	10-30 meters	forest	<100	Medium	4
Urbana 4	8-25%	Moderate	10-30 meters	trans	streambank	High	1
Urbana 5	3-12%	Moderately Rapid	10-30 meters	forest	300	Medium	4
Urbana 6	15-25%	Moderate	10-30 meters	forest	900	High	3
Wayne 7	2-6%	Slow	1-50 meters	trans	100	Medium	7
Barrington 8	3-8%	Moderate	1-50 meters	ag	1100	Low	10
Hammondsport 9	3-8%	Slow	10-30 meters	hamlet or village	on shore	High	1
Hammondsport 10	3-8%	Slow	10-30 meters	hamlet or village	500	Medium	4
Benton 11	15-25%	Very Rapid	10-30 meters	forest	1300	Low	11

* See Table 7-30.
** See Table 7-31.

Key to Table 7-25. Waste entities.

TYE OF SOLID WASTE	*SYMBOL*
GARBAGE: Kitchen Refuse	G
SCRAP: Old Cars, Appliances, Etc.	S
TRASH: Plastics, Paper, Etc.	T
SEWAGE SLUDGE: Municipal, Private	SM, SP
CONSTRUCTION MATERIALS	CM
BIOLOGICAL REFUSE	B
INDUSTRY: Manufacturing Sludge	MS*
CONTAINERS WITH LIQUIDS: Barrels, Tanks	CL*
HAZARDOUS WASTE	HW*

* HW is known; MS and CL might contain HW.

The location of dumps by town are: two in Jerusalem, one in Pulteney, one in Benton, one in Barrington, two in Urbana (with a major junkyard) and at least three dump landfills in Hammondsport. There are none in Milo or on the Bluff in Jerusalem.

The pattern of dump locations in the watershed is important; the ends of the lake have more dumps and landfills than the sides. The greatest potential source of pollution is the southern end in Urbana and Hammondsport because of the manufacturing that has been underway for over a century. There is a high probability of hazardous materials in these dumps and has been verified for the Urbana Landfill. Branchport, in contrast, has not had much manufacturing (box factory and wineries) and is less likely to have hazardous materials landfilled. The manufacturing in Penn Yan does not affect Keuka Lake because, surprisingly, it drains into the Keuka Lake Outlet and into Seneca Lake.

There are two distinct types of landfill closure. One method involves covering the dump with dirt and growing vegetation. This method was used by all of the watershed dumps except the Urbana Landfill, where the cover material and vegetation was done haphazardly. The other type of closure is capping the dump with an impermeable material and, if necessary, removing hazardous waste that is contaminating surface or groundwater.

Other than Hammondsport and Urbana landfills, the other watershed landfills are not likely to be considered for remediation, unless: 1) common toxins such as trichloroethylene (TCE) or dichloroethylene (DCE) are found in residential water supplies; 2) water quality testing of nearby tributaries detects toxins that may be from a landfill; or 3) there is a strong suspicion that toxic waste was put into a dump based upon testimony from private individuals or from a responsible commercial firm. Another reason for suggesting a dump be considered a potential hazard is that it be operational during a time period where it could have received toxic waste. The Urbana Landfill (D) is currently under a Class 2 DEC investigation and was found to have received manufacturing waste from 1968-1978. Where wastes were deposited previous to and after this time period is a legitimate question. The Urbana dump (E) was operating near to the Urbana Landfill (D). The Wendel Report (Reference 1) suggests strongly that one landfill north of the inlet (I) be considered for water and soil quality testing because it was receiving waste previous to the operation of the Urbana Landfill (D) and because of private citizen testimonials indicating hazardous waste dumping. The owners of the property on which this landfill is situated are currently in the process of evaluating the landfill, however, the results are not available at this time.

URBANA LANDFILL - A CASE STUDY

The following is a case study of the Urbana Landfill (D on Figure 7-16) and will include a description of the landfill, construction, operation and closure. The information is drawn from the DEC *Fact Sheet*, May 30, 1996 (Reference 4), and *The Final Work Plan, Urbana Landfill* by Camp Dresser and McKee (CDM), N.Y., N.Y., March 1996, Revised April 1996 (Reference 5).

The following excerpt is from the May 30, 1996 *Fact Sheet.*

> *The New York State Department of Environmental Conservation (NYSDEC), in conjunction with the New York State Department of Health (DOH), have begun a Remedial Investigation/Feasibility Study (RI/FL) at the Urbana Landfill inactive hazardous waste disposal site . . . . In 1994 the NYSDEC reclassified the site on the New York State Registry of Inactive Hazardous Waste Disposal Sites as a class 2 site, indicating the site poses a significant threat to public health and/or environment, and remedial actions are required.*

The *Fact Sheet* continues to give precise location, size, land character and wastes of concern.

> *The Urbana Landfill is located on Crows Nest Road, Town of Urbana, Steuben County* (see Figure 7-10*). The site is an inactive landfill approximately 12 acres in size located in a predominantly rural area. The landfill was operated between 1968 and 1978 for the disposal of municipal and industrial waste and waste from local wineries. The site was partially closed in 1979.*

CDM provides more details on the hazardous wastes disposed in the landfill.

> *It is reported in the Phase II Investigation that the site received municipal waste from the Town of Urbana and the Village of Hammondsport. Local wineries in the area reportedly used the landfill for disposal of winery waste. The Phase II Report further indicates that hazardous waste was received from Mercury Aircraft. Approximately 16,000 gallons of assorted cutting oils, solvents, paint residue and halogenated still bottoms were disposed each year the landfill was operational. Hazardous and municipal wastes were reportedly co-disposed in trenches and deposited on top of the bedrock and below the water table.*

The reasons for requiring remedial actions are given in the excerpt below from the *Fact Sheet.*

NYSDEC conducted sampling at the Urbana Landfill in 1984, 1988, and again in 1992. Analysis included site groundwater and surface water. Surface water samples collected during 1992 showed elevated levels of 1,2-dichloroethane (28 ppb) and trichloroethylene (4 ppb) in a small stream located directly adjacent to the landfill. Groundwater samples collected at the landfill in the spring of 1992 indicated that selected volatile organic compounds (VOCs) and inorganic compounds (heavy metals) exceeded New York State Groundwater Standards. A summary of the groundwater analytical results is listed in Table 7-25.

Selected private homeowner wells adjacent to the site have been tested by the NYSDOH and, to date, no site related contamination has been observed. However, local residents use the groundwater as the primary drinking water source and additional information as to the nature and extent of the groundwater contamination is required.

Table 7-26. Maximum groundwater concentrations in the Urbana Landfill, Site #8-51-007.

CONTAMINANT	*CONCENTRATION* ppb*	*NYS GROUNDWATER STANDARDS** ppb*
1,2-dichloroethane	*770*	*0.8*
trichloroethylene	*560*	*10*
vinyl chloride	*250*	*5*
phenol	*15*	*2*
zinc	*8600*	*300*

* Measured leachate concentrations
**These are maximum contaminant levels (MCL) for Class GA groundwater (those used for drinking water purposes) as listed in Reference 6, Section 702.3(b) and Table 3.

Acting on the information in July 1994, NYSDEC reclassified the site to a class 2 and offered potentially responsible parties (PRPs) the opportunity to implement a remedial action program. The PRPs declined, thus New York State is conducting the investigation using State Superfunds.

The actual site is sketched in Figure 7-15. This is the present state of closure which is extremely poor. The discussion of the site, its relationship to Keuka Lake and its inlet and the soil (overburden) is presented in the Final Work Plan by CDM and repeated below.

The site is presently partially covered with soil. Solid waste, white goods, junk cars and other debris litter the site and adjacent areas. There is no site fencing or gate to restrict site access, and there is evidence of trespassing and illegal dumping. The site appears to be located on a surface water divide. The northern and western side of the site drains directly to an unnamed Class D stream (*Class D is the lowest classification. It may be suitable for fishing, but will not support fish propagation). This stream consistently shows elevated levels of trichloroethylene and other volatile organic* *compounds in the 25 to 50 ppb range. The unnamed stream flows about ½ mile to Keuka Inlet stream, and Keuka Lake is a class AA drinking water source. The remainder of the site drains to field and forest which border the site.*

The landfill presently is graded into three terraces. The upper terrace slopes steeply to the west to the unnamed stream and slopes to the south to a lower terrace of the landfill. The steep westerly slope to the stream is littered with debris and drums. The lower terrace slopes gently to the south and southwest to an irregular bottom level.

The bottom level shows evidence of incomplete grading and remnant trenches.

The soil is reported as a reddish brown to gray, silty clay to clayey silt derived from glacial till. Occasional gravel and sand lenses are reported. Hydraulic conductivities of the overburden average 2.8 x 10^{5}cm/s. The depth of the overburden ranges from 5 to 15 feet and overlies a medium gray shale of the West Falls formation. The upper five feet of the bedrock is reported to be highly fractured and weathered.

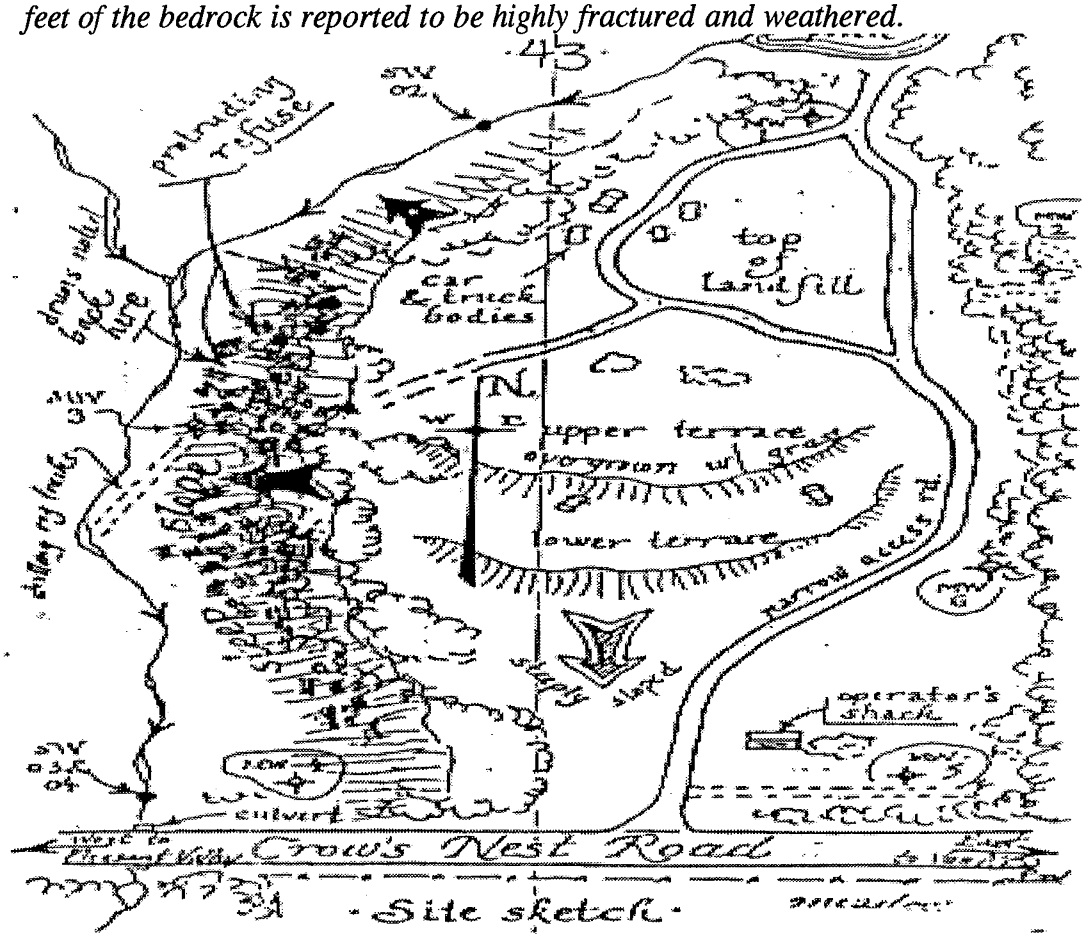

Figure 7-15. Urbana landfill site sketch.

Since the Urbana Landfill is the only hazardous landfill under remediation in the Keuka Lake watershed, it is instructive to present CDM's presumptive remedy approach. It can be seen that they will contain and treat the source and not conduct off-site remediation. Their approach follows.

*Presumptive remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection and EPA/NYSDEC's scientific and engineering evaluation of performance data on technology implementation. The objective of the presumptive remedy approach is to use past experiences to streamline site investigation and speed selection of cleanup actions. EPA has determined that presumptive remedies are appropriate for CERCLA** municipal landfill sites.*

*The presumptive remedy for CERCLA municipal landfill sites relates primarily to containment of the landfill mass and collection and/or treatment of landfill gas and leachate. In addition, measures to control affected groundwater at the perimeter of the landfill, and/or upgradient groundwater that is causing saturation of the landfill mass may be implemented as part of the presumptive remedy. EPA points out that the presumptive remedy approach does not address exposure pathways outside the source area (landfill), nor does it include long-term groundwater response actions. Investigation of off-site impacts and evaluation of off-site remedial actions would follow a detailed RI/FS*** approach.*

Specific response actions for the presumptive remedy may include the following:

- *Landfill cap*
- *Source area groundwater control to contain plume*
- *Leachate collection and treatment*
- *Landfill gas collection and treatment*
- *Institutional controls to supplement engineering controls*

*For the Urbana landfill site, the presumptive remedy approach is applicable, and shall be followed, for source containment. Off-site impacts to surface water, sediments, and off-site groundwater will not be included under the presumptive remedy process, but may be addressed as a separate operable unit (not included in the scope of work). Based on available site information, the following media specific remedial alternatives are anticipated to be evaluated under the FS***:*

1. *No Action*
2. *Landfill Capping*
   - *6NYCRR Part 360 Cap*
3. *Leachate Collection and Treatment*
   - *Physical/Chemical Treatment*
   - *Biological Treatment*
4. *Leachate Discharge*
   - *Discharge to Central Facility*
   - *Recharge to Groundwater*
5. *Landfill Gas Collection and Treatment*
6. *Source Area Groundwater Containment*

** CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act), better known as Superfund, was enacted to give EPA the authority and money to take corrective measures to clean up hazardous waste sites.

*** RI/FS means Remedial Investigation/Feasibility Study

A concern is expressed by both DEC and CDM that the off-site groundwater might have high levels of TCE and DCE. An additional concern is that a similar disposal practice was conducted for dump (E), The Reservoir Hill Dump, a short distance away and the landfill north of the inlet on the lakeshore in Hammondsport (I).

The Reservoir Hill Dump (E) was in operation beginning in the early fifties for about three decades. The lakefront landfilling operation ran from the last century to the early 1960's. The extent of TCE and DCE pollution in the groundwater at the inlet and the lake water at the southern end of the lake is not known, however, Hammondsport raw water sampling by the DOH has not shown any detectable amounts.

A recent article in *Science News* enhances the above concern*. One of the most common groundwater pollutants is TCE, once used in dry cleaning and as a degreasing agent. It is not banned. According to the State of Washington's Department of Ecology, it has about 10,000 contaminated sites.

Other volatile organic compounds have been detected in excessive concentrations. 1,2-dichloroethylene (DCE) and vinyl chloride exceeded the maximum concentrations found for TCE. Phenol exceeded the New York Standard by 15 to 1. The one metal tested, zinc, exceeded the standard by 30 to 1 for its maximum detection concentration.

These levels, and particularly the type of pollution, is presented because a serious groundwater deterioration could exist. Does this potential risk carry over to the inlet and lake water? The inlet and the lake should be tested for TCE and zinc as markers beyond the current testing by village of its municipal water.

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INACTIVE LANDFILL RANKING

TYPE OF THREAT

Old (fifteen or more years), inactive landfills pose a potential human health risk from exposure to toxic and pathogenic contaminants. These contaminants include heavy metals, pathogens, nutrients and a wide variety of organic chemicals. Heavy metals and organic chemicals can remain toxic for years, while pathogens and nutrients are generally not considered a major threat from landfills.

THE NEED FOR RATING AND RANKING TOXIC RISKS

In recent years, there is a growing recognition by the public and elected officials that inactive landfills are a potential threat to human health and water quality. The remediation of a landfill is an expensive process and the money available from the federal and state governments is in high demand. Therefore, one has to rate and rank the ten inactive landfills in the Keuka Lake watershed and one operating auto junkyard to determine how best to allocate available funding.

PROBLEMS IN DEVELOPING THE METHOD

Some of the calculation development problems are:

1. Generally the types of specific toxics that each kind of waste contains are known. It is not known, however, which wastes are present in a specific landfill. Information from witnesses, the actual polluters, or from water quality measurements, are necessary to begin an engineering assessment study. This baseline information is needed to create enough evidence to start a more expansive study.

2. It is important to know the quantity and timing of waste disposal. This information is needed to determine waste degradation. The information in #1 can provide, in some instances, the necessary information from good records or sampling.

3. The list of potential toxics can be long unless the waste is identified. Broad spectrum testing is expensive, but necessary for the sake of properly containing a known dump. Testing will not likely be done unless compelling evidence of a problem exists (i.e. the dump is leaching into adjacent land, groundwater or wells).

4. A ten acre landfill with several terraces may provide several pathways of pollution: point source leachates, nonpoint source runoff and entry into the groundwater. The type of soil enclosing the landfill and the type of closure, if any, is significant in restricting toxic contaminant movement. The top, bottom, and sides at the boundary of a landfill can vary in leakage and the bottom and buried sides may not be shown to seep without core tests.

5. A difficult problem to understand is the impact of a landfill on groundwater and wells because so little data is available about private wells. Groundwater monitoring is expensive and is not conducted until the engineering studies are underway to assess the extent of remedial action required. An attempt is made here to consider groundwater in the ranking, however, the information used should be considered preliminary.

6. The transport of pollutants to a receiving water body (tributary or lake) is extremely complex, and the process can differ from one toxic to the next. This complexity is shown in Table 7-27.

7. Over long travel distances, toxic contaminants may move from surface waters (a stream) to groundwater (in a recharge zone) and back to surface water (a lake). It may also be intercepted by a private drinking water well.

Table 7-27. Transport of contaminant in water.

Factors Affecting Movement of Water and/or Soil	**Factors Affecting Movement of Contaminants in Water**	**Changes in Contaminant in Moving Water**
Moving Water	Chemical Nature	Dilution
Distance to First Waterbody*	Initial Concentration	Binding to Soil Particles
Depth to Bedrock*	Temperature	Change to Other Chemicals
Soil Permeability*	Degradation Rate	
Degree and Length of Slope*		
Ground Cover in Pathway*		

Table 7-27 demonstrates the complexity in the movement of water, the contaminant movement within the moving water, and the changes in the chemical itself as it moves. To compare and rank the landfills, it is assumed that contaminant levels are equal and the movement of contaminants can be evaluated. Five factors, noted with a "*", affecting water and/or soil movement are used to rate the landfills. There are much more sophisticated models available, however, these require more expense to develop the necessary input data and were beyond the scope of this study. The rating method was simplified to match those parameters for which data was available.

SIMPLIFICATION OF THE RATING METHOD

1. Only toxics (heavy metals and organics) are considered.

2. Surface and groundwater movement is considered. Dilution is not considered.

3. Only factors affecting movement of the water are considered, e.g., not chemical change.

4. Of the receiving waterbodies, such as recharge zones, aquifers, creeks/tributaries, lake or wetlands, only creeks/tributaries and the lake are considered. Creeks enter tributaries and tributaries enter the lake.

5. The types of discharge from the landfill are not distinguished between nonpoint or point, steady or sporadic, and surface or ground. The assumption is made that the nearer the landfill is to a waterbody, the more likely toxics will reach the waterbody either through surface or groundwater movement.

The simplified rating factors are given in three major categories: contaminant generation, contaminant transport, and significance of the receiving waterbody.

The assumption is also made that the three are equal to one another in importance. The contaminant is generated and leaves the landfill to be transported by water to the receiving waterbody. The three category ratings are totaled for each landfill, added, and a ranking is made.

Development of the Ranking Tables

The first category is summarized in Table 7-28, contaminant generation ratings. The following questions were considered in developing this category: 1) What is the level of health significance for the toxics generated by the type of waste thought to be in general or known in particular to be in the landfill? 2) What level of confidence exists for the particular type of toxics thought to be in the landfill? 3) What is the degree to which it is expected that the toxic will leave the landfill? This rating parameter is called Degree of Closure.

The assignment of ratings (high, medium and low) and the associated numerical value (5, 3, 1, and 0) for each category (Level of Confidence, Significance and Degree of Closure) are also summarized in Table 7-28. Assigned values were the same for both surface and groundwater.

Table 7-28. Contaminant generation ratings.

Level of Confidence that a Toxic is Present	Category	Surface Value	Ground water
From government water quality testing	High	5	5
Significant toxics suspected from witnesses, polluters or strongly related inference ie. town dumps	Medium	3	3
General knowledge of limited amounts for a residential/farm dump	Low	1	1
Known to be completely non-hazardous		0	0
Significance			
Carcinogenic organic compounds	High	5	5
Heavy metals and non-carcinogenic compounds	Medium	3	3
After testing, no elevated measurements of significant contaminants	Low	1	1
Degree of Closure			
Open and uncovered	High	5	5
Partially covered with vegetation and dirt	Medium	3	3
Completely covered with vegetation and dirt	Low	1	1
Properly capped according to DEC		0	0

The second ranking category is Contaminant Transport in Water. It includes five rating parameters: distance to waterbody, soil permeability, slope, depth to bedrock and type of vegetative cover in the pathway to the waterbody (see Table 7-29). This category answers the question: How likely is it that the leachate will reach the receiving waterbody?

The third rating category is the significance of the receiving waterbody. It answers the question: Will the toxic have an immediate impact on a waterbody with a high use classification? The lake has the highest New York State waterbody classification, "AA", which means its best use is for drinking water; a fishing stream or major tributary is next with a "C" rating, and a feeder or creek to the tributary has the lowest as these are usually not rated. A major tributary has the same ranking as a fishing stream because of the high probability of transporting a toxic to the lake (see Table 7-30).

Table 7-29. Contaminant transport in water.

DISTANCE TO WATER BODY	Category	Surface Value	Ground Water
Lake shoreline or next to stream	High	3	3
Less than 101"	Medium	2	2
101" - 300"	Low	1	1
Greater than 300"		0	0
SOIL PERMEABILITY			
Impermeable	High	3	3
Slow	Medium	2	2
Moderate	Low	1	1
Moderately rapid, rapid, very rapid		0	0
SLOPE			
Greater than 15%	High	3	3
8-15%	Medium	2	2
Less than 8%	Low	1	1
DEPTH TO BEDROCK			
Less than 3 meters	High	3	3
3 meters to 10 meters	Medium	2	2
Greater than 10 meters	Low	1	1
VEGETATIVE COVER*			
Hamlet/village or bare earth	High	3	3
Agriculture	Medium	2	2
Transition	Low	1	1
Forest		0	0
*vegetative cover is that between the dump and the nearest waterbody			

Table 7-30. Receiving waterbody significance.

Lake	High	15
Fishing Stream or Major Tributary	Medium	10
Feeder to Tributary	Low	5

APPLICATION OF THE LANDFILL RANKING CHARTS

Table 7-31 summarizes the rating of the landfills. The information is drawn from Table 7-25 and Tables 7-28—7-30. The judgment of such factors as level of confidence, significance, and degree of closure is the analyst's which is based upon information from local citizens and officials, volunteer information, DEC, and aerial photography. Conforming to the entries for Table 7-29, contaminant transport in water is based on the following:

- Under slope: 3-8% is less than 8%; 3-12% is considered 8-15%; 5-15% is 8-15%; 8-15% is greater than 15%.
- Under depth to bedrock: 10-30 meters is greater than 10 meters; 1-50 meters is considered 3-10 meters.
- Under vegetative cover: ag means agriculture; transition means agriculture is no longer underway and weeds and bushes are growing and filling in.

Table 7-31. Comparison of landfill risk to surface and groundwater.

Town or Village and Map #	Jerusalem		Pulteney	Urbana			Wayne	Barrington	Hammondsport		Benton
	A**	B	C	D	E	F	G	H	I	J	K
Ranking Factors	S G*	S G	SG	SG	SG	SG	SG	SG	SG	SG	SG
Contaminant Generation											
Level of confidence	1 1	1 1	5 5	5 5	3 3	3 3	1 1	1 1	3 3	1 1	1 1
Significance	3 3	1 1	3 3	5 5	5 5	5 5	3 3	3 3	5 5	3 3	3 3
Degree of closure	1 1	5 5	3 3	5 5	1 1	5 5	1 1	1 1	3 3	5 5	1 1
Subtotal	5 5	7 7	11 11	15 15	9 9	1313	5 5	5 5	11 11	9 9	5 5
Contaminant transport											
Distance to water	1 1	2 2	3 2	1 1	1 1	0 0	2 2	0 0	3 3	0 0	0 5
Soil permeability	2 2	1 1	2 3	1 3	0 3	1 3	2 2	1 3	2 2	2 2	0 3
Slope	1 1	2 2	2 1	3 3	2 2	3 3	1 1	1 1	1 1	1 1	3 3
Depth to bedrock	1 3	1 1	2 3	1 3	1 3	1 3	2 2	2 2	1 3	1 3	1 3
Vegetative cover	1 0	1 1	0 0	3 0	0 0	0 0	1 0	2 0	1 0	3 0	0 0
Subtotal	6 7	7 7	9 9	9 10	4 9	5 9	8 7	6 6	8 9	7 6	4 9
Receiving water Body Significance	5 5	5 5	10 10	10 10	10 10	1010	10 10	5 5	15 15	10 10	5 5
Total	17 17	19 19	26 30	34 35	26 28	2832	23 22	16 16	34 35	26 25	14 19
Rank	9 10	8 8	4 4	1 1	4 5	3 3	7 7	10 11	1 1	4 6	11 9

* "S" refers to surface water and "G" refers to groundwater rating

***A Town*
B Eaves
C Town
D Town Class 2
E Putt's
F Hadley's
G Town
H Town
I Village Lakeshore
J Village Private
K Town

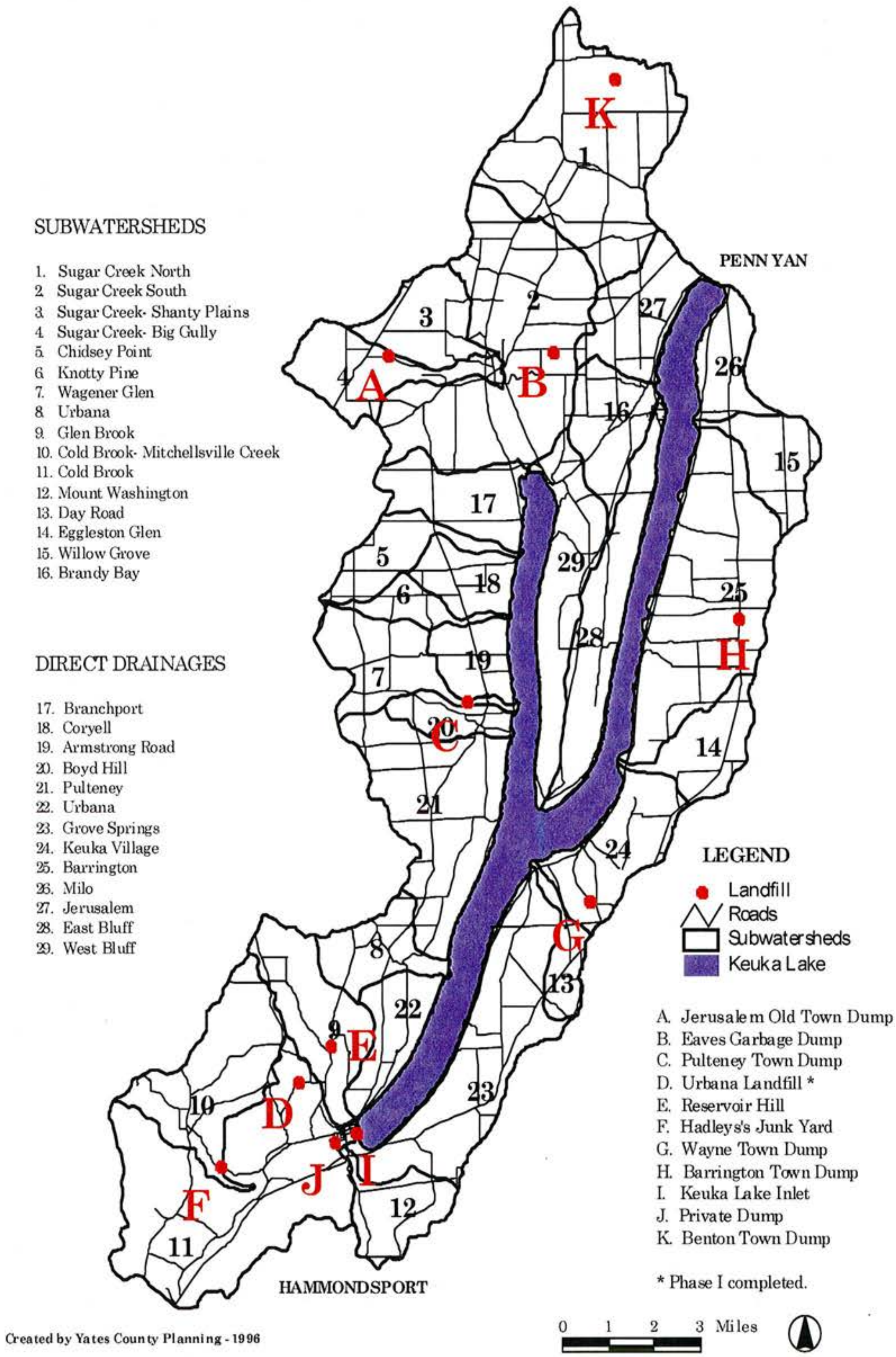

Figure 7-16. Dumps and landfills in the Keuka Lake watershed.

The next step is to take the difference between the highest and lowest values found in Table 7-29 and divide by three to obtain high, medium and low ranking categories for surface and groundwater pollution potential. Thus the arrangement is as follows:

Surface Water Risk	**Groundwater Risk**
34 through 28 is **High**	35 through 29 is **High**
27 through 21 is **Medium**	28 through 22 is **Medium**
20 through 14 is **Low**	21 through 16 is **Low**

Using these ranges, the Keuka Lake watershed landfill rankings are summarized in Table 7-32.

Table 7-32. Keuka Lake watershed landfill/dump pollution potential ranking.

Map ID	Town	Name	Rating	Rank	Numerical Rank
			S G*	S G	S G
D	Urbana	Landfill	34 35	High High	1 1
I	Hammondsport	Lakeshore	34 35	High High	1 1
F	Urbana	Hadey's	28 32	High High	3 3
C	Pulteney	Town Dump	26 30	Medium High	4 4
E	Urbana	Reservoir Hill	26 28	Medium Medium	4 5
J	Hammondsport	Private	26 25	Medium Medium	4 6
G	Wayne	Town Dump	23 22	Medium Low	7 7
B	Jerusalem	Eaves	19 22	Low Low	8 7
A	Jerusalem	Town Dump	17 17	Low Low	9 10
H	Barrington	Town Dump	16 16	Low Low	10 11
K	Benton	Town Dump	14 19	Low Low	11 9

*"S" refers to surface water and "G" refers to groundwater

The last two columns of Table 7-32 are entered at the end of Table 7-25.

Some findings of note from Tables 7-31 and 7-32 are:

1. Overall, the ranking changed little between surface and groundwater, based on the input information available.

2. The Hammondsport landfill is ranked as high as the Urbana landfill. This landfill is located on the lake front north of the inlet. The rating is as high because the Wendel survey strongly suggested it should be done. Subsequently, the owners of the property have had the landfill tested for the quality of the soil and the water in the landfill. The results are not available at this time. Its possible that after thirty to thirty-five years, the longest lived toxics and the heavy metals have leached out and/or degraded.

3. Five of the first six ranked landfills are in either Hammondsport or Urbana. Three are considered to be a high pollution potential risk and two are a moderate threat.

4. One change noted using the groundwater rankings is that the Pulteney Town Dump (C) becomes a "High" instead of a "Medium risk". After a physical examination of the site, it appears that groundwater could readily migrate to Wagener Glen tributary. The dump is on an old gravel pit not far from Wagener's Glen and DDT was recorded in Wagener's Glen by KLA water quality testing at 54A. The presence of DDT in the dump is considered a distinct possibility as landfill disposal was a common DDT disposal practice at that time. Additional water testing will be conducted by both the KLA and DEC based upon this survey adding information to the initial positive detection.

5. Two dumps remained at medium (Resevoir Hill, E; Hamondsport, J) and one dropped to low (Wayne, G), based on groundwater considerations. The four dumps (Jerusalem, B; Jerusalem, A; Barrington, H; and Benton, K) at low remained low.

6. The findings indicate a strong similarity in the pattern of toxic risk for the dumps in the watershed between surface and groundwater movement of leachate.

7. Because the Urbana dump on Reservoir Hill conceivable received industrial waste before, during and/or after the operation of a nearby class 2 hazardous Urbana landfill, it is reasonable to expect the rating to be higher than medium. It isn't higher overall because it rates low as seen in Table 7-31 in contaminant transport. This is because it is far from Glen Brook, apparently well covered, well drained, with a mix of gradual (3%) and somewhat steep (12%) slopes as shown in Table 7-25. Precipitation isn't likely to create surface leachate and what little it does, may not readily reach Glen Brook in any amount. The concern could be that ground water may move to a recharge zone such as a well. This concern has not been addressed to date.

8. The Wayne town dump rates medium because it is nearer to a major tributary to the lake than the remaining dumps (except Pulteney). These dumps are similar in contaminant generation.

9. The four dumps which ranked low do not represent a threat. If one includes the area of Milo which has no town dump, the northern portion of the lake is not under any threat from town dumps in the watershed.

COMMENTS

The information found in this study should be considered qualitative and providing information for prioritizing dumps for further study. The ranking analysis suggests that further study is needed to refine the pollution potential of the landfills not currently under remediation (all except the Urbana hazardous waste site). A low-cost, logical next step is to physically observe the sites by a volunteer geologist who is familiar with the hydrogeology of the area and obtaining more detailed information on land cover, depth to bedrock, private well locations, historical waste disposal practices, and water quality monitoring. The Urbana landfill, the Hammondsport landfill and the Pulteney landfill have been walked and physically evaluated. Hadley's junkyard, Hammondsport landfill (J), Urbana Reservoir Hill (E), and the Wayne landfill (B) could be investigated next. The remaining four town dumps are the lowest priority based on this ranking.

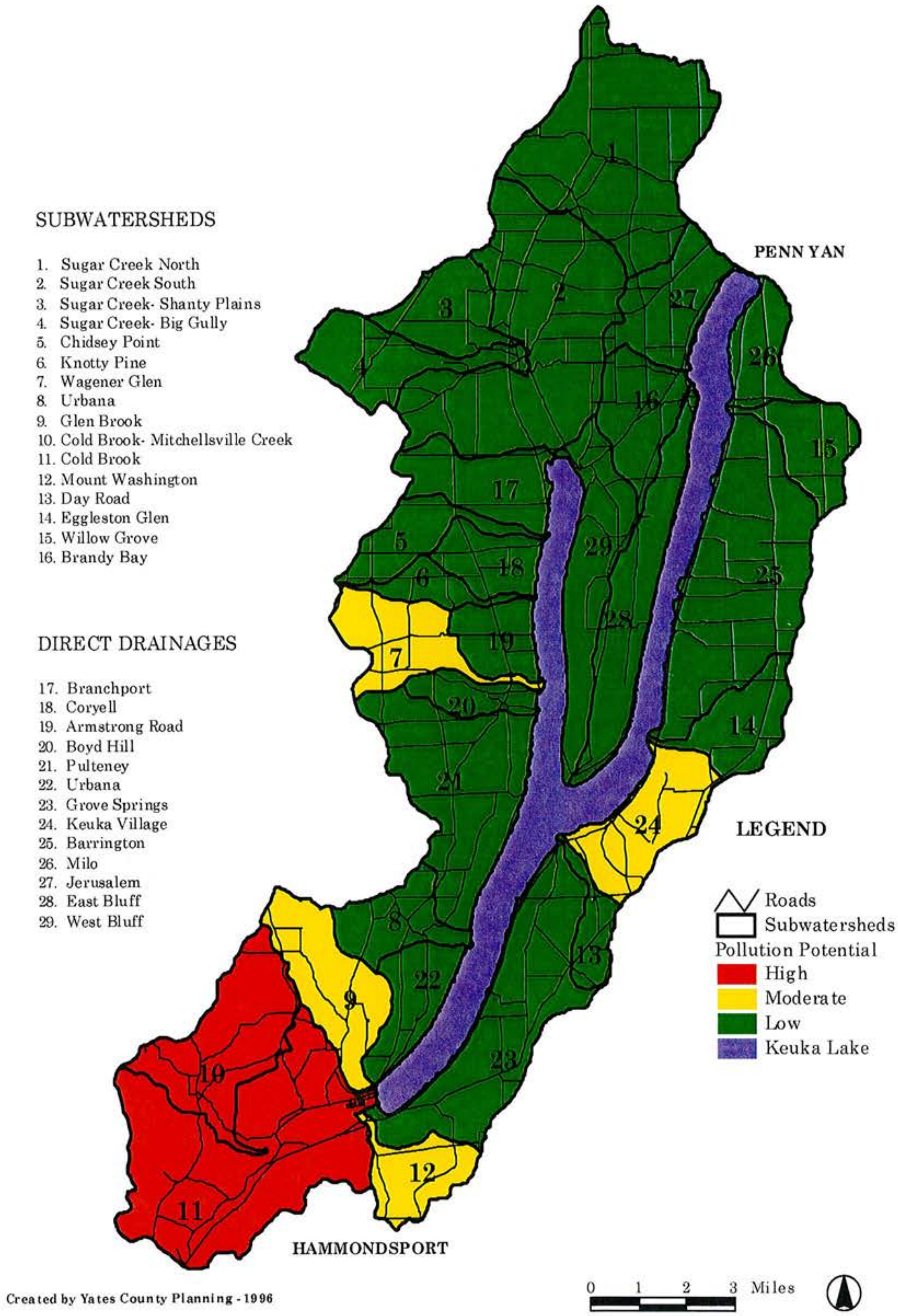

Figure 7-17. Landfill pollution potential in the Keuka Lake watershed.

MINED LANDS

INTRODUCTION

In the Keuka Lake watershed there are only sand and gravel mining operations because of the bedrock and glacial geology. Although this type of mining is not considered a major nonpoint source pollution threat, there are some pits in the side of hills and deep gullies which may create erosion problems or more significantly, a public safety hazard or a groundwater threat from illegal dumping.

This section draws much of the discussion from *The State of the Canandaigua Lake Watershed-1994* report (Landre, et al., 1994).

The NYS DEC has only recently required permits (last twenty years) for mining operation and reclamation. Many gravel pits in the watershed were operated and abandoned before the permit system was started. Even with the current permit system, plans for reclamation of mines have not provided sufficient bonding to cover the cost of reclamation. Many mine owners have abandoned their mines and bonds, and the State has seldom used the forfeited bonds for proper closure and reclamation.

NON-PERMITTED MINES

There are considerably more abandoned, non-closed gravel pits in the Keuka Lake watershed than permitted pits. Scanning 1991 aerial photographs*, there is an estimated 27 mines with 6 large abandoned mines, and numerous smaller ones, in the Keuka Lake watershed. Two large mines in Urbana, adjacent to Hammondsport and three large mines in the complex along Guyanoga Road are of interest because of the presence of a number of small unpermitted mines and permitted mines in those two regions. The largest unpermitted mine is above Camp Arey on the east side of the east branch of Keuka Lake. It can be seen when boating.

Non-reclaimed mines can cause several different kinds of problems. First, and most serious, they are a direct public safety hazard. Caving banks, steep slopes and unmarked cliffs have led to numerous tragedies.

Second, uncontrolled runoff from the steep and unvegetated banks of gravel pits contributes large quantities of sediment to adjacent streams and other water bodies.

Third, and most threatening in the long run, unsecured and abandoned gravel pits have been considered by some to be good, cheap places to dump waste. As disposal costs rise, those environmentally irresponsible will seek out such places. Unfortunately, the porous nature of the soils underlying gravel pits practically ensures the infiltration of leaking toxics into groundwater and, ultimately, neighboring drinking water wells.

*A comparison of 1974 and 1991 aerial photographs indicates the extent of reclamation of the batch of gravel pits along Guyanoga Road. Little reclamation is underway which agrees with the data in Table 7-22.

Unpermitted pits will only be addressed by the NYS DEC Bureau of Minerals under two conditions: 1) if there is a contravention of New York State water quality standards or, 2) if a previously unpermitted pit is re-opened to mining in quantities of over one thousand cubic yards per year. Citizens living in the vicinity of these pits who wish to see them reclaimed should monitor activity in the mines. Documented surface water quality problems from runoff, renewed mining activity, or well-water test results indicating illegal dumping may trigger regulatory action.

An effort should be made to inventory the mines, mostly gravel pits, of the Keuka Lake watershed. Owners should be identified and, if possible, contacted. Even if structural reclamation measures are not carried out, proper closure and safety marking of pits can be encouraged by municipal officials.

PERMITTED MINES

The NYS DEC maintains a mined land reclamation database for mining activities that are subject to state regulation (the NYS Legislation covering mined land reclamation permitting is in the Environmental Conservation Law, Article 23, Title 27, and Environmental Conservation Regulations, 6NYCRR Subsection D, Parts 420-425). The mined land reclamation data for this project was obtained from the Region 8 Office of the NYS DEC and contains the status of all permits as of 6/7/96 for the Yates County portion and 6/13/96 for the Steuben County portion of the watershed.

A mined land reclamation permit is required by any person who mines, or proposes to mine, more than 1,000 tons or 750 cubic yards, whichever is less, or mines or proposes to mine, over 1,000 cubic yards of minerals from or adjacent to any body of water not subject to the jurisdiction of Article 15 (Article 15 refers to a NYS statute which provides for the protection of water quality based on classification of the waterbody, i.e., Keuka Lake is rated "AA" for drinking water. Article 15 requires that activities in the watershed not degrade the lake from its pure and natural condition). Applications for permits may be submitted for annual terms not to exceed five years.

Major changes to the mined land reclamation law were enacted in August of 1991. The new provisions specify the role of local governments in reviewing or regulating mining activity. Local governments may enact and enforce laws of general applicability, except they cannot regulate mining and/or reclamation activities regulated by state statute. Local governments may enact and enforce local zoning laws defining permissible uses in zoning districts. When mining is designated as a permissible use in a zoning district, conditions placed on special use permits are limited to the following:

1. Entrance and exit to and from the mine roads controlled by the local government.

2. Identification and approval of haul roads controlled by the local government.

3. Enforcement of reclamation requirements and special conditions listed on a DEC mining permit concerning setbacks, public thoroughfare right-of-way, natural or manmade barriers to restrict access, dust control, and hours of operation.

4. Enacting or enforcing local laws or ordinances regulating mining or the reclamation of mines not regulated by the State.

Upon receipt of a complete application for a property not previously permitted, a notice must be sent by the NYS DEC to the chief administrative officer of the local government. The town or local government may make a determination on the application with regard to: setbacks, barriers to restrict access, dust, hours of operation, and whether mining is prohibited at the site. The town has 30 days to review the application and recommendations must be accompanied by supporting documentation justifying any determinations. The NYS DEC must incorporate those conditions or notify the local government as to why the conditions they specified will not be incorporated in the permit.

There are nine NYS DEC mined land reclamation permits listed within the Keuka lake watershed. The mines are primarily located in the northern portion of the watershed; four are in the Town of Jerusalem, clustered around the intersection of Guyanoga and Hemlock roads; two are in the Town of Benton, two in the Town of Urbana in the hills surrounding Hammondsport, and one in the Town of Pulteney. Six are in the Sugar Creek watershed and the other three are in separate subwatersheds.

The specific mined land reclamation permit listings, along with their respective subwatershed location, are listed in Table 7-33 and depicted on Figure 7-18.

Mined land reclamation permits by subwatershed.

SUBWATERSHED	NO. OF PERMITS
1	2
2	2
4	2
11	1
12	1
19	1

The NYSDEC mines are in varying stages of excavation. Of the nine NYSDEC mining permits, three are inactive, six are active permitted mines, and one has expired with reclamation not approved; two are used for industry, and four by municipalities. Eight of nine locations were permitted for the mining of sand and gravel.

The NYS DEC reviews each mine application and makes a determination of its potential environmental impact. For the purposes of environmental impacts, the NYS DEC has classified each of the mines as minor. The four mines located within the Town of Jerusalem are divided among two subwatersheds; however, these subwatersheds ultimately drain to Sugar Creek.

In summary, two interesting observations might be drawn from Table 7-33. The first, as noted above, is that a large number of mines (six) are in the Sugar Creek watershed. The second, is that no active mine acreage is shown as being reclaimed. This probably is misleading because of the involved process of getting NYS DEC approval for reclaimed lands. The owner must apply for approval and NYS DEC must visit the site and approve. Walking some of the sites has indicate that some of the acreage is reclaimed. Also note that the two industrial mines that are inactive have been reclaimed and approved.

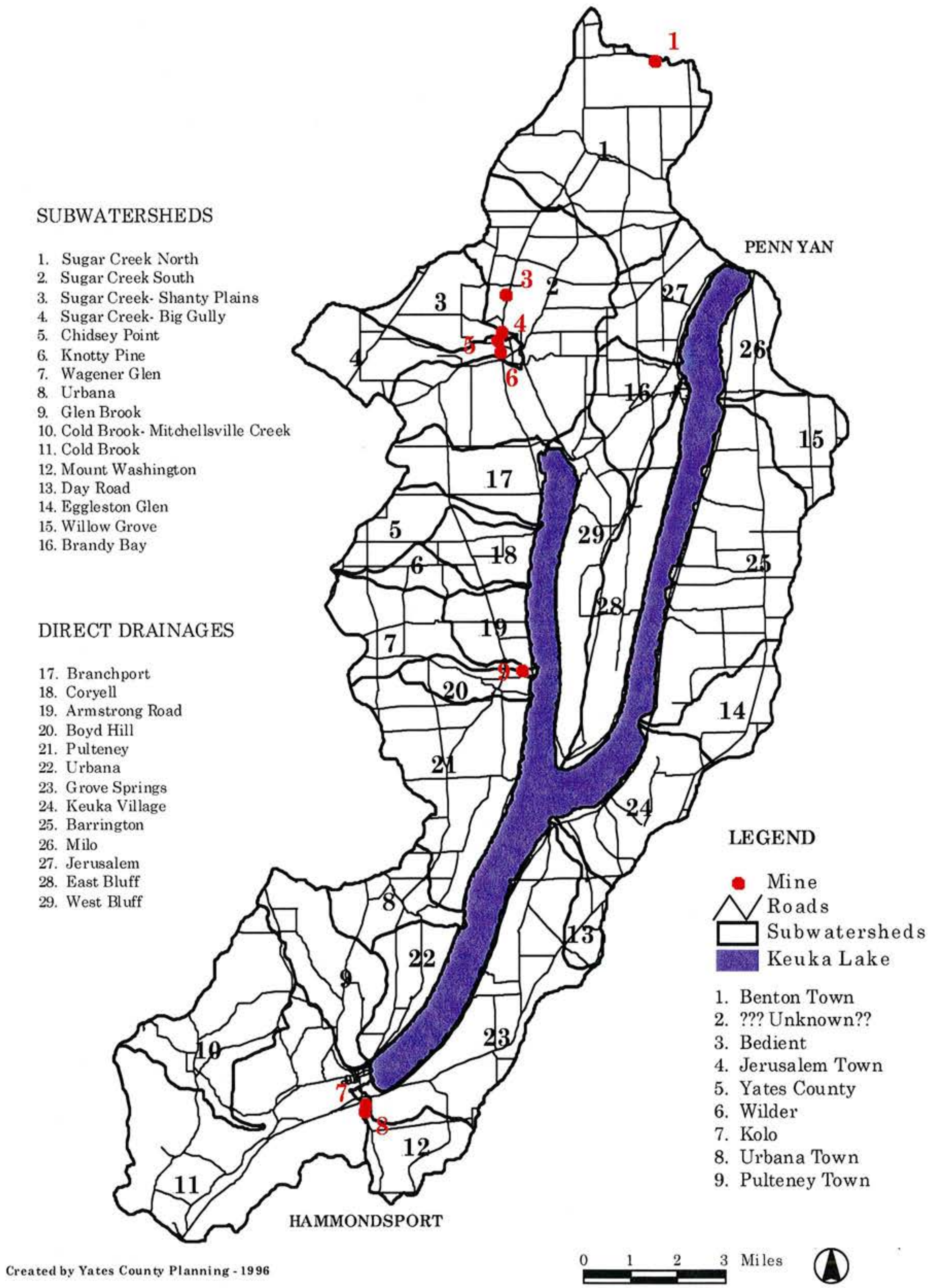

Figure 7-18. Keuka Lake permitted mines.

Table 7-33. Mined Lands.

MAP	MLR FILE #	FACILITY	OWNER OR CONTACT	PHONE NUMBER	CONT	AFA	REC	BB	LOM	STATUS	DATE	TOWN	TYPE	SUB-WATERSHED NO.
1	0200	Benton Hwy. Dept.	Bruce Moorhouse	(315)536-4601	70	15	0	15	18	A	12/7/96	Benton	Town	1
2	0249	?	?	?	5	5	5	0	5	Inactive Not Perm		Benton	Industry	1
3	0087	Bedient	Bedient	?	4	4	4	0	4	Inactive		Jerusalem	Industry	2
4	0100	Town of Jerusalem	James Walker	(315)585-2707	18	18	0	18	18	A	7/1/99	Jerusalem	Town	2
5	0007	Yates County	Gordon Mills	(315)536-2336	31	31	0	31	31	Inactive Rec Not Approved	12/27/91	Jerusalem	Town	4
6	0282	Wilder/Botsfor d	Art Wilder	(607)292-3717	37	7	0	7	8	A	9/16/95	Jerusalem	Industry	4
7	0288	Kolo	Ray Kolo	(607)569-3587	14	5	0	5	5	A	4/5/2000	Urbana	Industry	11
8	0159	Town of Urbana	Gardiner	(607)569-3369	9	9	0	9	9	A	3/1/99	Urbana	Town	12
9	0179	Town of Pulteney	Michael Yastremski	(607)868-4222	17	7	0	7	17	A	3/23/99	Pulteney	Town	19

NOMENCLATURE

CONT -- Acres contained, total land owned by owner
AFF -- Acres affected and unreclaimed since 1975 through current permit form
REC -- Acres reclaimed since 1975
BB -- Acres bonded and billed (AFF - REC = BB)
LOM -- Life of mine in years
A -- Active, permitted mine

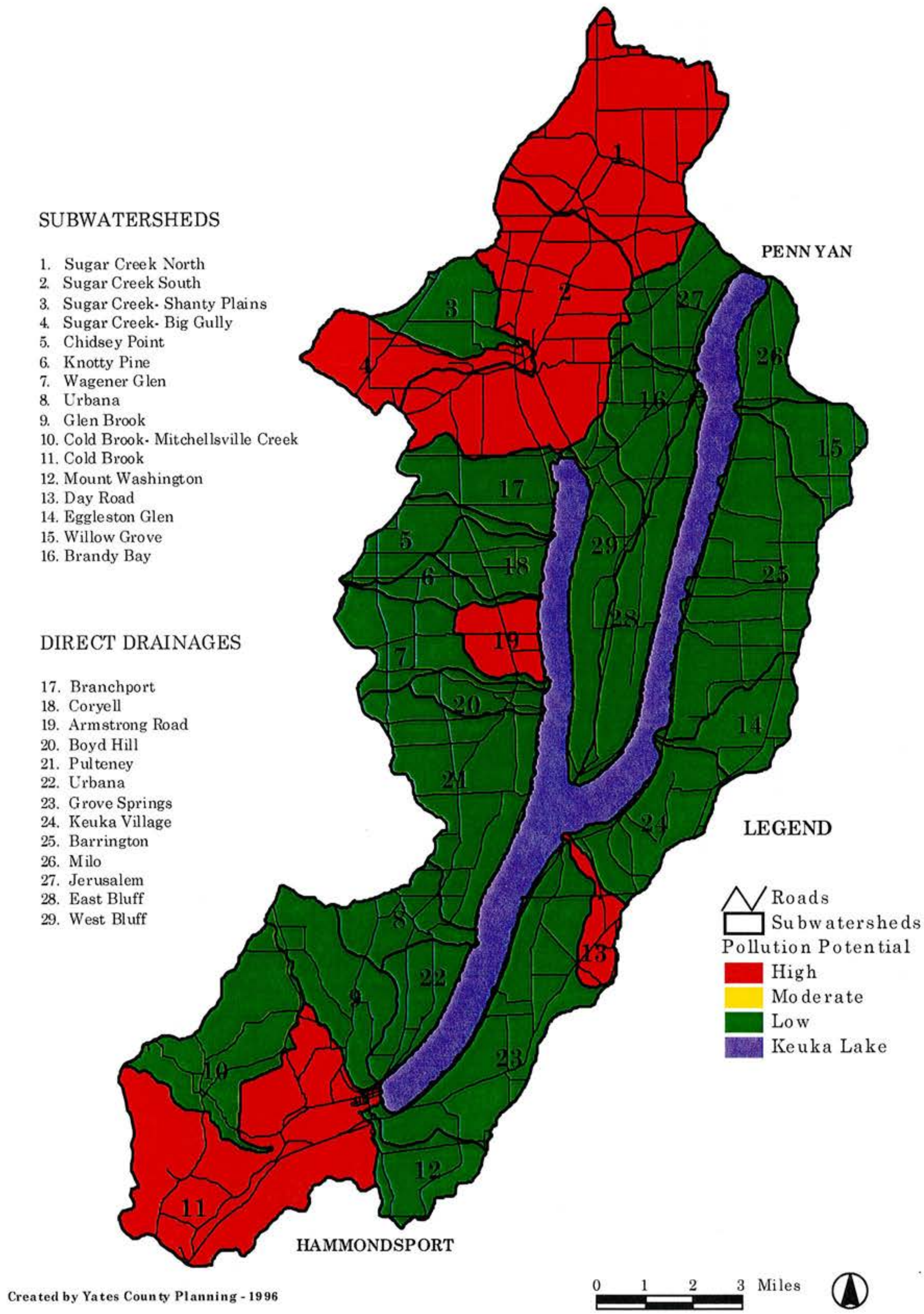

Figure 7-19. Mined lands pollution potential.

REFERENCES

Landre, P.T., W. Hart, S. Lewandowski, J. Balyszak, D. Gillette, M. Atkins, S. Sherwood, and R. Evans. 1994. The State of the Canandaigua Lake watershed-1994, A guide for understanding and protecting our vital resource. Canandaigua Watershed Task Force, Canandiagua, NY. 600 pp.

ON-SITE WASTEWATER TREATMENT

INTRODUCTION

On-site wastewater septic systems are the one nonpoint source of pollution for which an organized watershed-wide remediation and management program currently exists. In the early to mid-1980's this program began with in-lake water testing measuring for the presence of fecal coliform bacteria. The testing program continues today (1997) and is sponsored by the Keuka Lake Association in cooperation with the Yates County Soil and Water Conservation District, Cornell Cooperative Extension-Yates County, and the towns and villages bordering the lake. An early attempt was made to draw a correlation between high fecal bacteria levels and failing septic systems along the lake perimeter. In 1988, a survey was conducted by reviewing septic system records and interviewing homeowners in the watershed (Powell, 1988). The results of the survey indicated a majority of systems (62%) were very old (greater than 20 years), undersized (compared to current DOH standards) and not maintained (inspected or pumped).

In 1991, the Keuka Lake Association (KLA) initiated the Keuka Lake Watershed Project with the purpose of developing a cooperative watershed management program to enhance and protect the quality of the lake. The KLA raised funds and hired a Project Director with responsibilities for working with the communities, agencies, and other organizations over a two-year period to develop the program. In 1993, after dozens of public meetings and hearings, the Keuka Watershed Improvement Cooperative (KWIC) was formed by an intermunicipal agreement to oversee a newly adopted wastewater law in all eight municipalities and consider other threats to Keuka Lake as they may arise.

The authority for KWIC the program lies with two complimentary actions: the first was the adoption in each municipality of a uniform wastewater law and the second was the establishment of a cooperative agreement amongst those municipalities (Barrington, Hammondsport, Jerusalem, Milo, Penn Yan, Pulteney, Urbana and Wayne) to uniformly enforce and implement the authorities of the wastewater law.

The purpose of the uniform law is preservation of surface and groundwater quality and protection of public health. It recognizes the highest and best use of the lake as a supply for public and private drinking water. To this end, it requires a permit for construction or alteration of any on-site septic system not already subject to continuous review by the NYS Departments of Health Environmental Conservation. Standards for design and construction are referenced and penalties for violations are established. Of considerable importance is the creation of an on-going inspection program. Septic system inspections and approvals are required for all systems in Zone One, "the critical water quality protection zone", consisting of all land within 200 feet of the lake or its major tributaries. Inspections are also required for all real property transfers, building permit applications requiring bedroom expansion and for high maintenance systems such as aerobic treatment devices and holding tanks. The intent of the program is to identify and correct existing problem systems and enforce strict adherence to current design standards for new projects.

The cooperative agreement provides the authority to hire staff and a policy making board for the implementation of the authority in the wastewater law. Policy making rests with the Board of Directors, consisting of the chief executive officer (supervisor or mayor) from each municipality. The position of Watershed Manager is established in the agreement to oversee program implementation, design or review septic system standards, issue permits for system construction and development of a uniform inspection standard for all municipalities. Each municipality is responsible for hiring a Watershed Inspector, whose duties include septic system inspections and assistance with septic tank or system replacement inspections under the direction of the Watershed Manager.

Implementation of the program began in July of 1994. A summary of work completed in 1996 is presented in Table 7-34. This is the first year in which a good inventory of aerobic treatment devices and holding tanks, both subject to a demanding inspection schedule, has been available. All townships were involved in the Zone One inspection process in 1996. Some difficulties encountered during the year have been scheduling problems created by a greater than average number of construction and building projects and poor weather at the start of the construction/inspection season.

Table 7-34. Keuka Watershed Improvement Cooperative 1996 wastewater system construction permit and inspection report.

Construction Permits

	Bar-rington	H'port	Jeru-salem	Milo	Pult-eney	Urbana	Wayne	**Total**
Applications Received	13	1	34	13	9	7	12	89
Site Evaluations	13	1	34	13	9	7	13	90
Permits Issued	14	1	37	14	11	8	12	97

Inspections Performed

	Bar-rington	H'port	Jeru-salem	Milo	Pult-eney	Urbana	Wayne	**Total**
Real Property Transfer	18	15	56	33	20	19	4	165
Zone One	51	7	135	62	24	58	11	348
Request	0	0	0	1	0	0	1	2
Construction	9	6	52	22	6	17	4	116
Aerobic System	0	0	1	0	0	0	0	1
Holding Tank	0	0	1	1	1	7	0	10
Complaints	0	0	0	0	0	0	0	0
Tank Replacement	20	1	22	20	6	12	1	82
Other	0	1	7	1	0	1	4	14
Total by Town	98	30	274	140	57	114	25	738

Inventory Of Sites Requiring Regular Inspection Or Regulatory Review

	Bar-rington	H'port	Jeru-salem	Milo	Pult-eney	Urbana	Wayne	**Total**
Holding Tanks	7	0	41	11	4	18	10	91
Aerobic Devices	12	0	36	12	24	15	6	105
Zone One	410	59	759	366	620	346	461	3021

FECAL COLIFORM BACTERIA LEVELS IN KEUKA LAKE

Since 1989, the Keuka Lake Association cooperative sampling program has tested fecal coliform bacteria levels in surface waters along the lake perimeter (for a complete description of the sampling program and results, please refer to Chapter 6). Fecal coliform bacteria can only successfully reproduce and grow in the intestinal tracts of warm blooded animals. Significant levels in surface or groundwater indicate human or animal fecal contamination. Coliform bacteria are used as an "indicator organism"; their presence while not a direct health threat, indicates the possibility of other pathogenic or disease-causing organisms. A mean count of 50 colonies per 100 ml in five or more samples is considered by New York State surface water regulations as a maximum recommended level of fecal coliform bacteria in "AA" classified waters such as Keuka. Again, "AA" classified lakes are those considered suitable for drinking water supplies where disinfection is to be routinely practiced.

The fecal coliform data were presented in Chapter 6, but were re-organized here by location and date, so trends in a geographic area, or for any particular month of the year, could be observed. Of the 64, mile-long segments identified, 4 segments produced samples whose geometric mean exceeded the 50 count per 100 ml sample threshold. The other 60 segments are below the recommended threshold. It is interesting to note that of those 4 segments, 3, 0 to 100 E. Lk. Rd, (PY), 101-200 W. Lk. Rd (PY), and the Keuka Outlet, are contiguous or in close proximity. At this time though, however, no particular explanation is available as to why this has occurred.

When considered as a function of time, there is a significant increasing bacteria level trend through the summer. Samples are collected June through September during each year. During this period, June results are lowest, with a mean sample value of 7.6 counts per 100 ml. August samples are the highest having a mean value of 47.6 counts per 100 ml., nearly exceeding the recommended maximum level. By September, the levels have dropped back down near the June levels. These data confirms the expectation that bacteriological contamination in Keuka Lake is greatest at the peak of the summer recreational season, when the lakefront population and water-based recreation is greatest.

ON-SITE WASTEWATER TREATMENT FOR ARES OF CONCERN

Several areas within the watershed are identified where soils are poor and the design and construction of reliable, effective on-site wastewater treatment systems has proven difficult. Figure 7-20 illustrates the septic system construction problem areas in the watershed.. These areas do not coincide with any of the 4 lake perimeter segments where high fecal coliform bacteria levels have been observed. Rather, they are areas where septic system design and construction practices cannot meet all the needs or expectations that property owners or occupants may reasonably have. A description of each area is described below.

BRANCHPORT

Nearly all residences and business structures are occupied in the hamlet of Branchport on a year-round basis. Soils in much of the hamlet are poorly drained silts and clay. Water supplies in the hamlet are also generally poor; most are shallow, low-yielding and vulnerable to contamination. The total acreage of the 112 lots identified in the hamlet is 78.96 acres, yielding an average lot size of 0.7 acres, not nearly enough to routinely provide adequate separation distances between water supplies and leach systems. Many residents are known to rely on bottled or trucked in water for their drinking water supply for reasons of quantity and quality. The current lack of satisfactory water supplies in the hamlet, and the limited capacity of current septic systems, suggests that the availability of public water without providing municipal sewer services could result in widespread septic system failure.

CRESCENT BEACH

Crescent Beach is a developed strip of narrow land along the northern tip of the lake's west branch. Thirty seasonal dwellings and year-round homes have been built on small lots. Most lots are less than one quarter acre and are bisected by an access road. Soils are well drained or excessively well drained sands and gravels. The depth to the water table, virtually identical to the lake level is two feet or less during the summer period, and separation distances to the lake are limited. Some sites depend on holding tanks for waste management. Given no other alternatives for waste management, properties on Crescent Beach need to use either holding tanks or aerobic treatment systems in order to protect Keuka Lake from microbiological contamination. The 1981 Yates County Water Quality Management Plan identified Crescent Beach and nearby Branchport as ideal locations for development of a small community wastewater treatment system, an alternative more likely to protect Keuka Lake and support improvement and redevelopment of properties on Crescent Beach than individual on site systems.

PULTENEY

Pulteney is a rural hamlet located about three hundred feet vertically above the lake on the west side. About half of the hamlet lies on well-drained gravely loam soils, and the other half on poorly-drained clay till. Individual water supplies in the hamlet vary greatly. Some residences depend on shallow dug wells. Many drilled wells are shallow. Total acreage identified for 108 parcels equals 188.3 acres, with the average lot size being 1.74 acres. A significant number of wells are expected to be in close proximity to leach fields. Previous experience of the watershed inspector, and examination of deicing salt contamination in groundwater under the hamlet suggests very rapid water movement in the soil, with the possibility of drinking water contamination from septic system leachate.

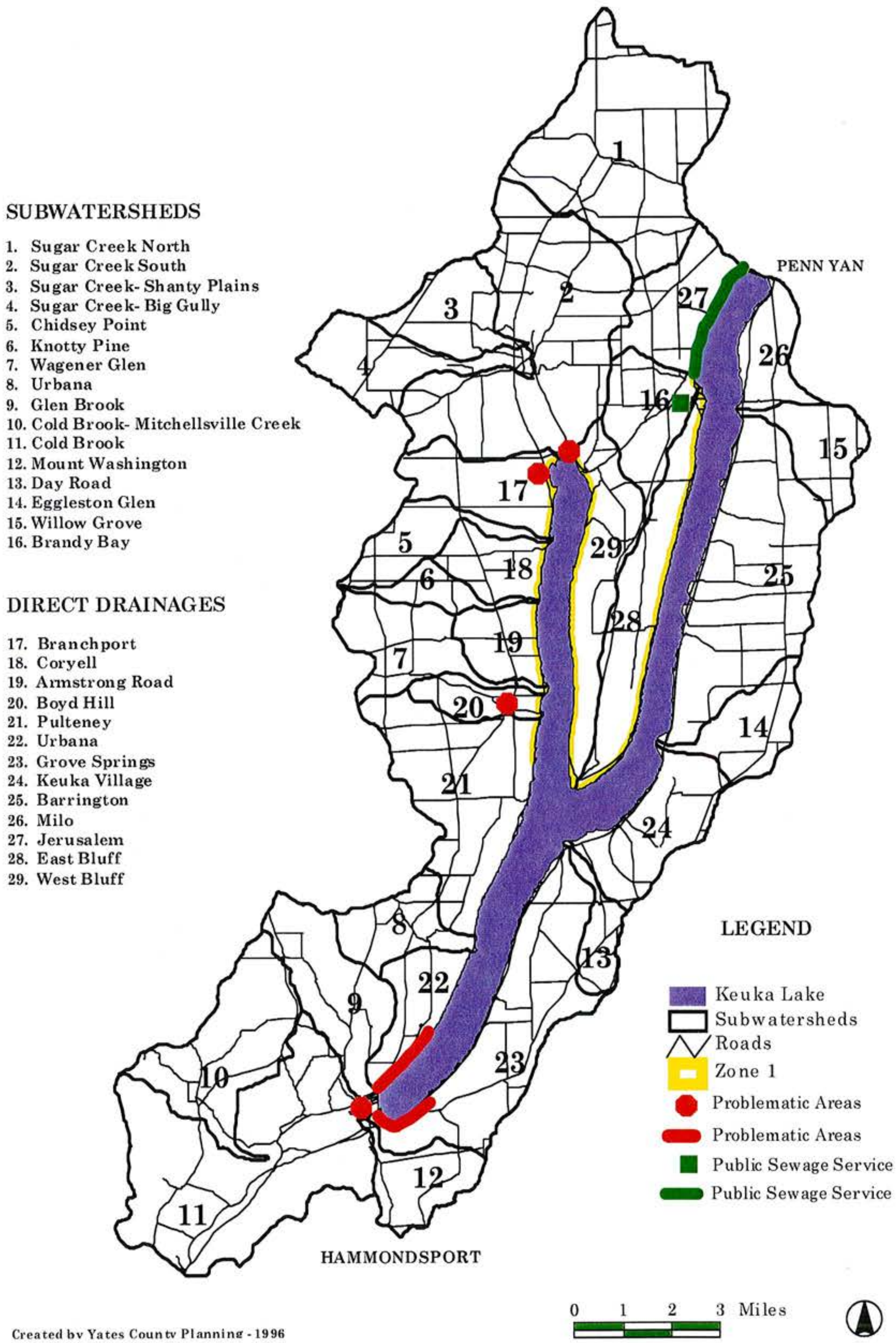

Figure 7-20. Septic systems areas of concern.

HAMMONDSPORT

Most of the village of Hammondsport lies on a deep deposit of glacial outwash sand and gravel. Nearly all of the commercial and residential lots were developed many years ago. There are approximately 412 individuals parcels in the village, and while the size of most parcels are not identified on current tax maps, it is clear that the great majority of residential and small business parcels have extremely limited area for septic system construction or repair. Municipal water supply, available since before W.W.II, has eliminated immediate concerns about the potability of groundwater under the village. The vast majority of wastewater systems in the village, as observed from inspection records, are septic tanks discharging to seepage pits (a covered pit with a perforated lining that accepts effluent from a septic tank and allows it to infiltrate the surrounding soil). Cesspools (a perforated concrete or wooden structure that receives household sewage directly does not follow a septic tank; not considered by the NYS Dept. of Health as an acceptable treatment system) are regularly discovered in the village. Watershed inspection work has even found domestic wastewater discharges into abandoned dug wells. Groundwater conditions in the village are undocumented, and the effect on the lake itself is unknown. Hammondsport, and the adjacent commercial and business district adjacent to the village, represents the greatest concentration of residents and activity within the watershed. Certain property uses, such as restaurants, laundromats, or manufacturing will be able to maintain or grow only with great difficulty and still meet current regulatory and societal expectations for wastewater treatment. New commercial or business development may come only with extreme difficulty in meeting current state standards. Development of a regional sewage collection and treatment system is probably the only complete way to address water quality protection and economic growth over the long term.

SOUTH PERIMETER OF KEUKA LAKE

Watershed inspection records and site evaluation data indicate that a large number of properties at the south end of the lake in the Town of Urbana do not have area desirable soil and site conditions according to sanitary code standards for construction of on-site systems. While other areas around the lake have steep slopes or poor soils that require costly or complex treatment systems, this area in particular poses severe conditions for septic system construction. As a whole, the town contains the greatest concentration of aerobic wastewater treatment devices and holding tanks in the watershed. With the exception of a few deltaic gravel deposits at tributary mouths where soils tend to be suitable for septic system construction, most lots have steep slopes and poorly drained soils. Shallow depth to bedrock is common, along with ground water flow at the bedrock/ soil interface. This is particularly true on the west side of the lake, from the village of Hammondsport up to the 300's on West Lake Road. Like Crescent Beach, the possibility of most or all properties eventually being encumbered by holding tanks or aerobic wastewater treatment devices for wastewater management clearly indicates the superiority of a public sewage collection system for this area.

REFERENCES

Powell, J.R., J.H. Herring and T. Anderson. 1988. Keuka Lake Septic System Survey. Yates County Aquatic Vegetation Committee. Penn Yan, New York.

PETROLEUM BULK STORAGE FACILITY PERMITS

INTRODUCTION

In an effort to prevent petroleum leaks and spills, the New York State Legislature passed the Petroleum Bulk Storage (PBS) Law (Article 17, Title 10 of the Environmental Conservation Law) requiring the NYS DEC to develop and enforce a State code for the storage and handling of petroleum. The resulting regulations are Parts 612, 613, & 614 of Title 6 of the New York State Code of Rules and Regulations.

Under Part 612, owners must register petroleum storage facilities with NYS DEC, notify NYS DEC of substantial modifications to a facility, re-register when facility ownership changes, and renew registration every 5 years. Under Part 613, owners must periodically inspect aboveground storage systems and report test results to NYS DEC. Any equipment found leaking must be repaired or replaced in accordance with Part 614, the standards for new or substantially modified facilities, or closed in accordance with section 613.9. Under the law, owners of regulated facilities (not operators) are responsible for registration.

Only liquid non-waste petroleum-based oils suitable for use as a fuel to produce heat or energy or as a motor lubricant, such as gasoline, heating oil, heavy residual fuel oils, kerosene or reprocessed waste oil used as fuel or lubricant, are regulated.

Any facility with a combined capacity which exceeds 1,100 gallons but is less than 400,000 gallons, must be registered. More than 400,000 gallons is considered a major oil facility and is licensed under the Major Oil Storage Facility (MOSF) Program. There are no Major Oil Storage Facilities located within the Keuka Lake watershed. Only stationary tanks and associated pipes and equipment are regulated. A facility can be one or more stationary aboveground or underground tank systems at the same site.

Facilities must register with the NYS DEC Regional Office having jurisdiction over the facility. The Keuka Lake watershed is located within Region 8 of the NYS DEC.

RESULTS

There are 46 petroleum bulk storage facility permits listed in the Keuka Lake watershed. Of the 47 listings, 18 are sites that have volumes under 1101 gallons. The following table provides a breakdown of petroleum bulk storage facility permits by subwatershed:

Table 7-35. Petroleum bulk storage facility permits by subwatershed.

SUBWATERSHED NAME	SUBWATERSHED #	NUMBER OF FACILITIES
Sugar Creek South	2	5
Cold Brook	11	13
Brandy Bay	16	2
Branchport D.D.	17	4
Armstrong	19	1
Boyd Hill	20	1
Pulteney D.D.	21	5
Urbana D.D.	22	1
Grove Springs D.D.	23	3
Barrington D.D.	25	2
Milo D.D.	26	4
Jerusalem D.D.	27	1
East Bluff D.D.	28	2
West Bluff D.D.	29	1

Table 7-35 summarizes petroleum bulk storage facilities by subwatershed and reveals the greatest number of facilities are located within the Cold Brook subwatershed totaling 13 facilities. Five facilities are found in Sugar Creek South and Pulteney subwatersheds.

The 47 petroleum bulk storage facility permits contain a total of 104 active petroleum storage tanks and 78 closed or removed tanks.

Table 7-36, shows a more comprehensive listing of petroleum bulk storage facility permits, sorted by subwatershed. Figure 7-21 illustrates the location of these facilities.

Table 7-36. Petroleum Bulk Storage Facilities in the Keuka Lake Watershed

PBS #	STAT	SITE NAME	ADDRESS	MUNICIPAL-ITY	COUN-TY	SUB SHED	OPEN TANKS	CLOSED TANKS	CAPAC gallons	TANK LOCATION	PROD.	TANK TYPE	EXPIR DATE
007374	A	Branchport CSD Elementary	Route 54A	Jerusalem	Yates	2	1	2	6000	4	3	5	
071420	A	Town of Jerusalem Highway Dept.	2672 Guyanoga Rd	Jerusalem	Yates	2	4	2	2750	2,4	2,3,6,9	1	12/30/96
431834	A	Frareyland Farms, Inc.	2453 Guyanoga Rd	Jerusalem	Yates	2	4	0	2700	2,4	2,6	1	2/25/98
106658	A	Guyanoga Valley Sunco	2885 Guyanoga Rd	Jerusalem	Yates	2	3	0	2000	4	1,2,5	1	4/16/97
060658	A	Branchport Automotive	Route 54A	Jerusalem	Yates	2	3	0	8500	4	5,2	1	12/18/96
407631	C	Bath & Hammondsport Railroad	Liberty St	Hammondsport	Steuben	11	0	1	0	0	0	0	6/30/92
079952	A	Lake Country Econo Gas	Lake & Main St	Hammondsport	Steuben	11	5	0	25100	4	1,2,5,9		
126829	A	Mercury Aircraft - Hammondsport	17 Wheeler Ave	Hammondsport	Steuben	11	6	2	6050	1,4	1,2,3,6	1	3/24/97
126802	A	Mercury Aircraft - Plant #4	17 Wheeler Ave	Hammondsport	Steuben	11	2	0	4000	2,4	3	1	
126799	C	Mercury Aircraft - Plant #2	17 Wheeler Ave	Hammondsport	Steuben	11	1	0	<1101	1	6	1	3/19/92
038008	C	NYSEG-Hammondsport Serv. Cntr.	9 Main St	Hammondsport	Steuben	11	1	1	1000	1	6	1	10/17/91
106607	A	Sugar Creek Store #54	Lake & Main St	Hammondsport	Steuben	11	5	0	20000	4	1,2,5,6	5	3/24/97
434280	A	Village of Hammondsport DPW	Route 54 Back Valley	Urbana	Steuben	11	2	0	1500	4	2,6	1	5/19/98
000647	A	Hammondsport - CSD	Main St	Hammondsport	Steuben	11	5	2	32000	4	2,3,6	1	4/15/01
444545	A	Town of Urbana	4 Liberty St	Hammondsport	Steuben	11	2	3	4000	2,4	2,6	1	8/18/97
231681	A	Mercury Aircraft Inc.	8231 Co. Route 88	Hammondsport	Steuben	11	5	7	28555	1,2,4	2,3,6	1	11/6/00
463795	A	Frey & Campbell Inc.	87 Lake St	Hammondsport	Steuben	11	5	0	27550	2,4	2,3,5,6	1	1/18/99
058807	A	Ira Davenport Mem. Hospital	Route 54	Urbana	Steuben	11	2	0	16000	4	3	1	12/2/96
457922	C	Merry-Go-Round	2966 Route 54A	Jerusalem	Yates	16	0	3	0	0	0	0	8/23/93
431850	C	Keuka College	Keuka Park	Jerusalem	Yates	16	0	11	0	0	0	0	3/28/98
298182	C	Hunt Farms	4021 Italy Hill Rd	Jerusalem	Yates	17	0	3	0	0	0	0	6/5/92
444375	A	Clearview Farms	4019 Stever Hill Rd	Jerusalem	Yates	17	3	0	3500	2,4	2,6	1	5/19/98
118249	A	Vince & Jim Bediant	Steven Rd	Jerusalem	Yates	17	3	2	10000	1	6,2	1	2/5/97
445258	C	Jensen's Marine Services	47 West Lake Rd	Penn Yan	Yates	17	1	1	1000	1,4	1,2	1	7/28/93
600213	A	Kelly Marine	289 West Lake Rd	Branchport	Steuben	19	1	0	2000	2	2	1	4/19/99
380954	A	Town of Pulteney	Box A	Pulteney	Steuben	20	3	0	4500	4	2,3,6	1	6/18/97
231746	C	Taylor Wine Company	Lower Middle Road	Pulteney	Steuben	21	0	4	0	0	0	0	5/7/92
231665	C	Taylor Wine Company	Middle Road	Pulteney	Steuben	21	0	2	0	0	0	0	5/7/92
231711	C	Taylor Wine Company	Middle Road	Pulteney	Steuben	21	2	0	<1101	4	2,6	1	5/7/92
231657	C	SMS Partners	G.S.West Farm	Pulteney	Steuben	21	3	0	<1101	4	2,6	1	7/20/97
101893	A	Jake's Boat Livery	666 West Lake Rd	Urbana	Steuben	21	3	1	4250	1,4	2,3	1	7/5/99

PBS #	STAT	SITE NAME	ADDRESS	MUNICIPAL-ITY	COUN-TY	SUB SHED	OPEN TANKS	CLOSED TANKS	CAPAC gallons	TANK LOCATION	PROD.	TANK TYPE	EXPIR DATE
027154	C	Bully Hill Vineyards, Inc.	8843 GreytonTaylor Mem.	Urbana	Steuben	22	1	3	1000	2	6	1	3/19/97
058815	C	Clark Specialty Co., Inc.	8440 Route 54	Hammondsport	Steuben	23	1	0	<1101	1	3	1	12/2/91
231703	A	Joseph R. Frissora	Gold Seal East Farm	Urbana	Steuben	23	2	0	2000	4	2,6	1	7/16/92
380911	A	Town of Wayne- HWY. Garage	Silsbee Rd	Wayne	Steuben	23	2	2	3000	2	1,6	1	6/18/97
394629	A	Charlie's Marina/Charles Brown	823 East Lake Rd	Milo	Yates	25	0	1	0	0	0	0	7/20/92
486493	A	Froggy's Country Store	823 East Lake Rd	Milo	Yates	25	3	0	5000	4	1,2	1	6/16/97
426326	A	Town of Milo Highway Dept.	1991 Second Milo Rd	Milo	Yates	26	4	3	2600	2,4	2,3,6	1	1/7/98
226467	A	Morgan Marina/Land & Sea Propr.	100 East Lake Rd	Penn Yan	Yates	26	2	0	2000	4	1	1	3/24/97
027146	A	Niagara Asset Corporation	311 East Lake Rd	Penn Yan	Yates	26	3	0	4500	2,4	3	1	3/10/99
027316	C	Con-Way Eastern Express	98 West Lake Rd	Penn Yan	Yates	27	0	13	0	0	0	0	9/19/91
486310	A	East Bluff Harbor Marina	654 East Bluff Drive	Jerusalem	Yates	28	3	0	4000	1	1,3	1	6/23/99
048310	T	East Bluff Harbor Marina	654 East Bluff Drive	Jerusalem	Yates	28	3	0	4000	1	1,3	1	6/23/99
264423	C	NYS Parks- Keuka Lake Park	Keuka Lake State Pk.	Jerusalem	Yates	29	2	7	825	2,4	2,6	1	6/30/97
422878	A	Finch's General Store	1320 East Lake Rd		Steuben		3	0	2750	1,4	1,2,5	1	9/19/97
079898	C	Peter F. Jackson	373 East Lake Rd	Penn Yan	Yates		0	2	0	0	0	0	12/30/91

KEY TO TABLE XX :

SITE STATUS
A - Active Facility
C - Closed Facility
T - Transferred Facility

PRODUCT
0 - Empty
1 - Leaded Gasoline
2 - Unleaded Gasoline
3 - Nos. 1,2 or 4 Fuel Oil
4 - Nos. 5 or 6 Fuel Oil
5 - Kerosene
6 - Diesel
A - Lube Oil
9 - Other

TANK TYPE
1 - Steel/Carbon Steel
2 - Stainless Steel Alloy
3 - Fiberglass Coated Steel
4 - Fiberglass Reinforced Plastic
5 - Plastic
6 - Equivalent Technology
9 - Other

TANK LOCATION
1 - Aboveground
2- Aboveground on saddles, legs, stilts, rack, cradle.
3 - Aboveground: 10 % or more below ground
4 - Underground
5 - Underground, vaulted, with access

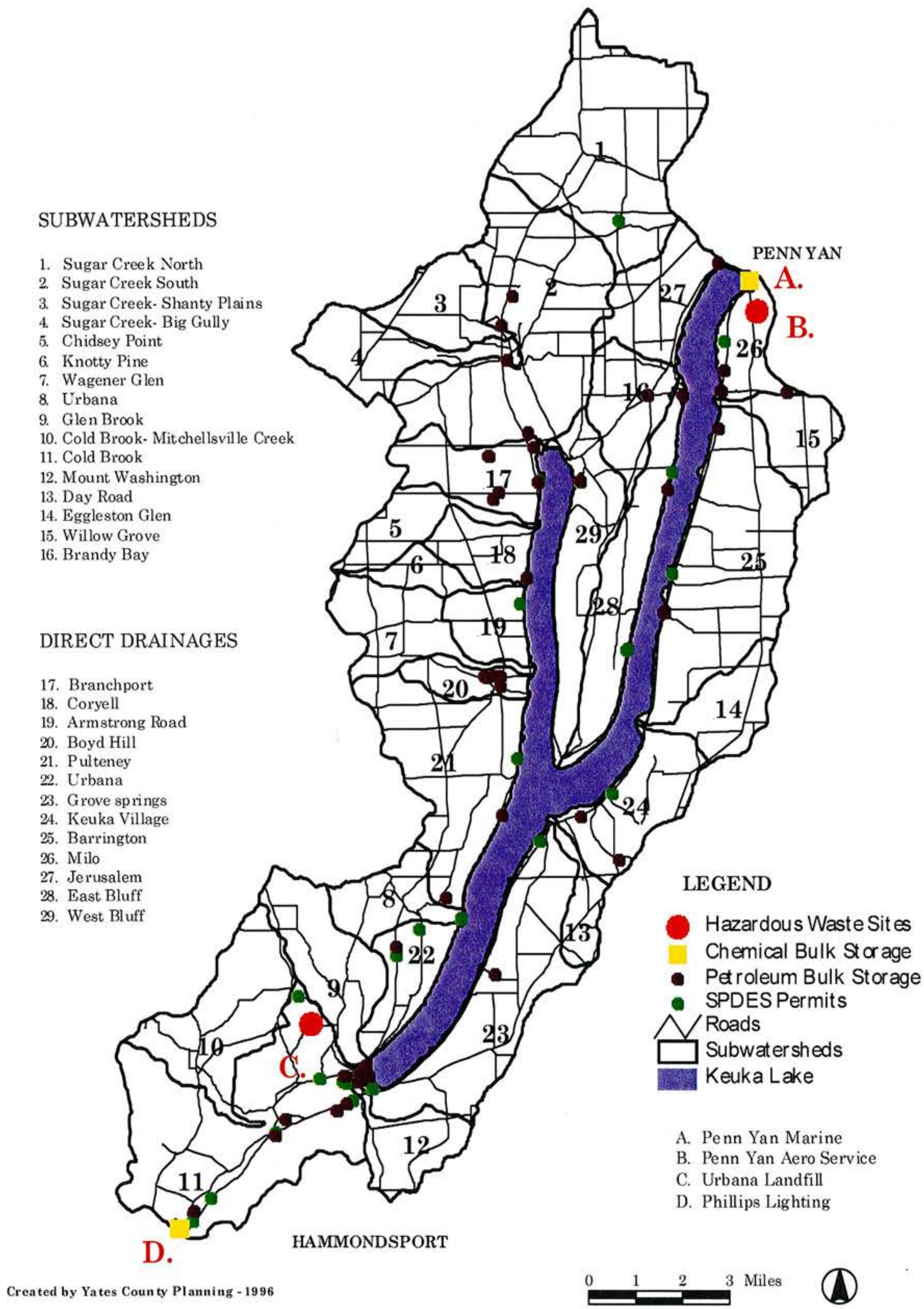

Figure 7-21. Location of petroleum bulk storage facilities.

RECREATION

INTRODUCTION

Keuka Lake and it's 110,000 acre watershed provide a diversity of outdoor recreation opportunities. On the lake, people swim, powerboat, jet ski, scuba dive, canoe, fish, water ski and sail. Along the shore, people hike, bike, swim, fish, sight see, relax, observe nature and hunt. In the winter, the watershed offers new forms of recreation including cross-country skiing, ice-fishing, snowmobiling, ice boating, and ice skating.

Water-based recreation produces an estimated 15 million dollars in local revenues (Finger Lakes Association, 1996), and nearly 5 million from fishing alone (Connelly et al.1997). For this assessment, a broad range of activities will be reviewed, however, attention will be focused on motorized boating.

In New York State, there are 262,089 outboard and 159,990 registered inboard powered boats. To enthusiasts and the local economy, the benefits of power boating are tremendous: freedom of movement, skipping across the water on skis, racing on jet skis, traveling to a restaurant with friends, or fishing for lunker trout. Motorized boating does come with a cost, however. Concerns over fuel spillage, exhaust, noise, sediment pollution from wave action, conflicts with other recreational pursuits, safety, visual impacts and poor sanitation (human or fish waste and boating debris) raise several important issues needing to be addressed in the management plan (Wagner, 1991).

DISCUSSION

In the summer of 1997, a recreation survey was sent to members (N=1,500) of the Keuka Lake Association in the newsletter to determine recreation activity and perceptions on problems. A 30% response rate was achieved (531 returned surveys) and the data were entered into a spreadsheet for statistical analysis.

The results are summarized in three sections for this report: a) overall responses to each of the questions are found in the original survey format in Table 7-37 ; b) issues and concerns identified in the comment sections were reviewed and are summarized in Table 7-38 ; and c) the potential loss of fuel from motorboat usage was estimated based on survey responses.

Respondents reported having 1,308 boats or 31% of the total observed fleet of 4,178. Only 41 jet skis or personal watercraft (PWC) were owned by respondents, representing 16% of the observed fleet of 253. Therefore, the survey may be biased in favor of those not owning these watercraft.

The average length and horsepower of motorboats was 18.1 feet and 132.8 horsepower respectively; considerably larger than national averages (16.9 feet and 86.7 horsepower).

The top rated uses for boats on Keuka are: 1) sight-seeing, 2) water skiing and 3) fishing. Respondents reported using their boats an average of 2.3 days / week and 4.5 months per year. Most boaters (81%) are out for short trips of 2 hours or less.

Over 90% of the boaters believe there are safety problems related to boating and list PWC, "riding too close to shore" and "reckless operation" as the top three concerns. Since most people use their boats for sight-seeing, it is not surprising that these concerns are raised. Weekends and holidays were perceived to have the most problems related to safety.

Sixty-seven percent of respondents use the lake for fishing with 40% perceiving some problems. The top problems listed for fishing were again, PWC, speed boats, and water skiers.

Only 13% of the respondents hunt in the watershed, mostly for deer, small game and turkeys. Only two people said they trap in the watershed.

Swimming is the most popular recreation activity, enjoyed by 98% of the respondents. Over 74% cited problems related to swimming, citing PWC, "boats too close to shore" and weeds/algae as the top three problems.

KLA members were also asked about other recreational pursuits and "enjoying the view", "sitting and watching the weather" and hiking were listed as the top three. Asked what problems prevent them from enjoying these pursuits, respondents ranked noise pollution, boat wakes and "none" as the top three choices. While not listed as a choice, PWC were listed a number of times in the comment section and the noise and boat wakes concerns are probably related to PWC use since it was the greatest concern identified in other sections.

The majority of respondents (44%) felt there is an adequate amount of recreational lands for public use and only 17% said more was needed. In addition, 66% feel there are a sufficient number of public boat launch facilities, whereas 10% feel more are needed. This is not surprising since most respondents already have access needs satisfied and most concerns center around jet skis, boat noise, etc. which may be perceived to be exacerbated by additional public facilities.

Table 7-37 . Summary of the Keuka Lake recreation survey.

1. What types of boats do you own? Please check all that apply.
   - **261** power inboard/outboard
   - **253** sailboat
   - **216** power outboard
   - **210** rowboat
   - **199** canoe/kayak
   - **81** power inboard
   - **47** other
   - **41** personal watercraft (jet ski)

2. Motorboat length: **18.1 feet**; Motor horsepower: **132.8**

3. What is your boat used for? Please rank in order of importance: 1-most important....

1 sight seeing
2 water skiing
3 fishing
4 nature observation
5 other
6 swimming
7 scuba diving
8 hunting

4. How many days per week do you use your motorboat? **2.3 days**

5. What is the average length of time you spend in your boat during an outing?
385 0 - 2 hours
84 2 - 4 hours
8 4 - 6 hours

6. Does your boat require the use of a pump-out station?
23 yes (5%) **462 no**

7. How many months of the year do you use your motorboat? **4.5**

8. Do you feel there are safety problems associated with boating?
456 yes (90%) **49 no**

If yes, please rank in order of importance. 1-most important....10-least important
1 jet skiers (personal wtaercraft)
2 too close to shore
3 reckless operation
4 speed
5 drinking
6 density of boat traffic
7 unlighted boats at night
8 water skiers
9 weeds
10 other
11 lack of PFD's
12 unmarked shallows
13 floats

9. At what time of day do you see problems?
    368 especially weekends
    271 especially holidays
    186 daytime
    108 evening
    65 night
    29 no difference

10. As a resident, or non-boater, do you see any problems relating to boating?
    197 yes (74%) 69 no

FISHING

1. Does your family use the lake for fishing?
    356 yes (67%) 172 no

2. What types of fishing do you do?
    292 from shore, your property
    229 casting, e.g. bass fishing
    152 trolling
    95 pan fishing
    27 smelting
    16 stream fishing
    16 ice fishing

3. Do you see problems relating to fishing?
    166 yes (40%) 249 no

If yes, please rank in order of importance: 1-most important.....10-least important
    1 jet skiers
    2 speed boats
    3 water skiers
    4 other
    5 low numbers of fish
    6 unseen boats at night
    7 variety of fish
    8 water quality
    9 access to fishing area

4. When do you see problems relating to fishing?
    110 weekends
    88 daytime
    45 no difference
    21 night
    18 weekdays

HUNTING/TRAPPING

1. Do you hunt in the Keuka Lake watershed?
   64 yes (13%)   445 no

2. Where do you hunt?
   41 your own property
   36 a friend's property
   15 public lands
   11 the lake

3. For what do you hunt?
   59 deer
   35 small game
   27 turkeys
   19 waterfowl

4. Do you trap? **2 yes   300 no**

5. As a residential or non-hunter, do you see any problems related to hunting?

   63 yes (28%) 163 no

6. What problems do you see related to hunting?
   52 safety
   44 none
   14 access to hunting area
   19 other

SWIMMING

1. Does your family use the lake for swimming? **520 yes (98%) 9 no**

2. Do you see any problems that relate to swimming? **386 yes (74%) 135 no**

If yes, please rank in order of importance: 1-most important......10-least important

1 jet skis
2 boats too close
3 weeds/algae
4 water quality, cloudy or murky
5 water skiers
6 oil on surface

7 other
8 ducks/waterfowl
9 crowded conditions
10 access
11 cost

3. As a water skier, what problems, if any, do you see?
   Other boats and jet skis

OTHER

1. What other recreational activities do you enjoy involving the Keuka Lake watershed?
   1 enjoying the view
   2 sitting around watching the weather
   3 hiking
   4 photography
   5 biking
   6 birding
   6 picnicking
   8 charter boat tours
   9 other
   10 cross country skiing
   11 ice boating
   11 snowmobiling

2. What problems do you see that prevent you from enjoying your pursuits or hobbies around the lake?

Please rank in order of importance:
1 noise pollution
2 boat wakes
3 none
4 weeds
5 water pollution
6 other;________________________
7 airplanes
8 air pollution
9 access to the lake

3. What is your opinion in regards to land set aside for recreational use within the watershed?
   228 there is already enough
   184 don't know
   88 more is needed
   13 there is too much

4. What is your opinion in regards to public boat launch access to Keuka Lake?
   350 there is already enough
   82 don't know
   54 more is needed
   42 there is too much

COMMENTS

1. What concerns do you have that the Keuka Lake Association might help with?
   See comment summary

2. Do you see a greater need for education regarding lake-based recreational activities?
   239 yes (82%) 54 no

3. Do you see a greater need for enforcement of rules and regulations?
   273 yes (67%) 136 no

4. If you call the sheriff for an emergency, he or she may come by boat. Do you have a property number on both the lake side and the road side for easy identification?
   265 yes (54%) 224 no

INFORMATIONAL

1. What is your town or village of residence?
   All towns represented

2. Do you own lakefront property?
   500 yes (94%) 25 no

3. Please include any additional comments in the space provided below.
   See comment summary

RECREATION SURVEY COMMENT SECTION SUMMARY

There were sixteen comment sections in the survey. The first twelve were summarized on the survey sheet as appropriate. The last four comment sections were based on open-ended questions and provided the most detailed responses. Overall, 1,392 comments were recorded in the survey or 2.6 comments per survey. Of the 531 surveys, 390 people provided comments in the last four open-ended questions. These comments were grouped into 8 categories for analysis and the results are presented in Table 7-38 .

Table 7-38 . Keuka Lake watershed recreation survey comment section summary.

Concern	# of respondents	% of respondents
Personal Watercraft	143	37%
Boating Issues	132	34%
Water Quality	103	26%
Septic/Sewers	65	17%
Taxes	42	11%
Zebra Mussels	36	9%
Development	22	6%
Lake Level	6	2%

PWC were mentioned most often as a source of concern (143 responses). Many points of view were expressed that expand beyond the concerns identified in the rankings discussed above: noise, reckless driving, boat wakes, too close to shore and high rates of speed were some of the concerns. People also identified an expressed need for better enforcement/education for PWC users.

Boating issues followed next in importance and included speeding, driving too close to shore, enforcement of navigation laws, traffic, navigation lights, noise, and large boats. Boating issues may or may not have been connected with PWC use. Again, many identified education and enforcement of existing rules as a way to improve the situation.

Water quality enhancement was the next most significant topic identified. People mentioned trash in the water, erosion, burning on the shoreline, weeds, etc. and the need to continue educational and research efforts.

Septic and sewers followed with 65 comments. Many people identified expanding or studying sewers, while others mentioned the need for ensuring the uniformity of the existing septic system inspection/pumping program. Taxes were mentioned 42 times as a frustration and a deterrent to long-term property ownership. Zebra mussels were identified 36 times and comments suggested a need for continued information on the problem and the available options. Development was a concern raised 22 times and comments varied from wanting to control development to relaxing restrictions on development or the permit process. Lake-level was mentioned 6 times as a concern for residents.

STATEWIDE BOATING SURVEY

In 1990, a statewide survey of boating use at public launch sites in New York State was conducted by the NYSDEC and Office of Parks, Recreation and Historic Preservation (Major et al., 1992).

The survey found that on Keuka Lake in the summer, 917 boat trips were taken on weekdays and 2,029 trips were taken on weekends. On 42 percent of summer weekends, access sites were filled to capacity, 11 percent were filled on all days during the summer.

A purpose-of-trip survey showed that the primary purpose of 46% of Keuka Lake boaters was fishing. Pleasure boating and then skiing were the second and third most common reasons for boat usage. The 1997 KLA survey found similar results, except pleasure boating was ranked first, followed by skiing and fishing. Outboard motorboats were the most widely used boat, followed by in/outboard motorboats, then sailboats and inboards.

Another conclusion of this study, though not specific to Keuka Lake, was that State Boat launches do not significantly impact the average density of use of New York State's lakes. This conclusion may not hold true for Keuka Lake. Proponents of public launches emphasize that more launches spread out traffic and reduce perceived congestion. The KLA survey results do not agree with perception.

Contribution of state public waterway access sites to whole lake boating activity as determined from number of vehicles at public sites and number of boats present on the lake during the 1990 boating season is presented in Table 7-39.

Table 7-39. 1990 NYSOPRHP boating survey.

		Public Sites-Vehicles		Boats Present			Boats in Use	
Date	Time	With Trailers	Without trailers	In Use	Not In Use	Camp-ground	% of All Present	From Public Site (%)[1]
5/8/90 (weekday)	1430	1	0	14	3013	0	0	7
5/19/90 (weekend)	1305	12	1	57	1079	1	5	21
8/15/90 (weekday)	1354	11	6	151	3776	6	4	7
7/7/90 (weekend)	1152	49	40	330	2362	9	12	15
10/16/90 (weekday)	946	1	0	16	2385	1	1	6
10/7/90 (weekend)	1115	115	5	146	3371	3	4	80

[1]Because of the difficulty in distinguishing cartop from non-boating vehicles from the air (for vehicles without trailers), the number of boats originating from the state access site was calculated as the number of trailered units observed plus an additional number calculated as the lesser of: 1) the number of non-trailered units present, or 2) the number of trailered units multiplied by the ratio of cartop vehicles to trailered vehicles. The ratio was determined for each site by total counts recorded by roving agents or campground entry gate personnel. The number of boats originating from the state access site was then divided by the number of boats observed in use on the lake to calculate the percentage of boats in use originating from the state site, up to a maximum of 100%.

A summer water quality intern counted boats in wet storage and in use to update the 1990 NYSDEC boating survey on Keuka Lake in the summer of 1997. Boats in wet storage were counted from a boat that traveled along the perimeter of the lake. An aerial count of boats in use from a small airplane was performed to determine the number of motorboats, sailboats, and PWC that were using the lake on a Saturday afternoon in July. The results of the boat counts are summarized in Table 7-40 .

Table 7-40 . 1997 summer Keuka Lake boat count.

1997 Count of Boats in Wet Storage			
Motorboats	Sailboats	Personal Water Craft	Sea Planes
3,187	739	253	3

1997 Count of Boats in Use on Keuka Lake (July 26, 3-4PM, sunny, 79F)		
Motorboats	Personal Watercraft	Sailboats
261	62	37

MOTORIZED BOATING CONCERNS

According to Wagner (1990), "Motorized boating is many things to many people. To enthusiasts, it is freedom of motion, skipping across the water on skis, access to favorite fishing sites, and port-hopping with friends. To other lake users, including fish and wildlife, it is a safety hazard, noisy annoyance, and source of water pollution. As a general rule, the negative impacts of boating outweigh benefits in terms of lake ecology alone, without consideration of social and economic factors. Negative influences are often consequences of illegal or irresponsible boating."

Impacts of motorized boating appear to be largely density dependent, with the majority of impacts occurring in marina areas. Impacts from other sources (roadbanks, agriculture, parking lots) may overshadow those from motorized boating, however, the impacts vary tremendously from one lake to another (Wagner 1990).

Wagner (1990) identified a number of potential environmental impacts from motorized boating (Table 7-41). Actual impacts depend on a number of characteristics of the motor craft (Table 7-42) and lake ecosystem (Table 7-43).

Table 7-41 . Potential motorized watercraft impacts on water resources and associated biota.

Altered water quality
Increased turbidity
Increased nutrient levels
Increased hydrocarbon concentrations
Increased metal levels
Increased oxygenation
Increased contamination by pathogens
Changes in taste and odor

Altered sediment quality
Redistribution of particles
Shoreline erosion
Littoral zone changes
Increased nutrient accumulations
Increased hydrocarbon accumulations
Increased metals accumulation

Altered flora
Epilimnetic mixing of plankton
Inhibition of algal growth
Stimulation of algal growth
Inhibition of rooted plant growth
Direct damage
Indirect suppression
Dispersal of rooted plants

Altered fauna
Collision-induced mortality
Reduced reproductive success
Changes through food resource modification
Changes through habitat modification
Physical habitat
Chemical habitat
Flesh tainting

Table 7-42 . Characteristics of motorized watercraft that influence ecological impact on lakes.

Type of engine
Two cycle
Four cycle
Jet propulsion

Engine design/age
Conventional (most pre-1977 engines)
Modified for fuel efficiency

Size of engine
Small (< 20 hp)
Medium (20-100 hp)
Large (> 100 hp)

Crankcase size (relative to engine size)
Small
Large

Engine condition
Tuned
Untuned

Fuel ratio (gas:oil) and oil type
Meets engine specifications
Differs from specifications

Speed of engine operations
Idling or trolling (< 1500 rpm)
Cruising (1500-2500 rpm)
Racing (> 2500 rpm)

Speed of watercraft operation
Slow (< 5 mph)
Medium (5-15 mph)
Fast (15-30 mph)
Very fast (> 30 mph)

Displacement of water
Low (< 5 cubic yards)
Medium (5-15 cubic yards)
Large (15-30 cubic yards)
Very large (> 30 cubic yards)

Density of motorized watercraft
Low (> 25 ac/boat
Medium (10-25 ac/boat)
High (5-10 ac/boat)
Very high (< 5 ac/boat)

Frequency of traffic
Rare (< 100 passes/yr)
Low (100-1000 passes/yr)
Medium (1000-2000 passes/yr)
High (2000-4000 passes/yr)
Very high (> 4000 passes/y
Also consider daily/weekly/seasonal pattern of use).

Table 7-43 . Characteristics of lake that influence ecological impact by motorboats.

Lake area	**Shallowness ratio**(area< 5 ft deep total area)
Low (<20 ac)	Low (<0.10)
Medium (20-100 ac)	Medium (0.10-0.25)
Large (100-300 ac)	High (0.25-0.50)
Very large (>300 ac)	Very High (>0.50)
Epilimnetic volume	**Shoreline development** (Shoreline length/circumference of circle)
Low (<130 million gal)	Low (<1.5)
Medium (130-653 million gal)	Medium (1.5-3.0)
Large (653-1960 million gal)	High (>3.0)
Very large (>1960 million gal)	
Hydraulic residence time	**Littoral zone bottom coverage by rooted plants**
Low (<21 days)	Low (<25%)
Medium (21-90 days)	Medium (25-50%)
High (90-365 days)	High (50-75%)
Very high (>365 days)	Very high (75-100%)
Shoalness ratio(area <20 ft deep/total area)	**Substrate type**
Low (<0.25)	Cobble
Medium (0.25-0.50)	Gravel or sand
High (0.50-0.75)	Silt or clay
Very high (0.75-1.00)	Organic muck

MOTORBOAT POLLUTION FROM FUEL COMBUSTION

There is a fair amount of scientific debate on the direct pollution impact of motorboat fuel combustion. Some aspects, however, are well understood. Both air and water are directly impacted by fuel combustion. Air pollution in the form of hydrocarbon exhaust is significant and well studied. According to an USEPA study in 1991, motorboat engines produce as much as 27% of the hydrocarbon pollution produced by all cars, buses and trucks in the country, while consuming less than 1% of the fuel. The EPA made the comparison that a car would have to drive 250 hours to equal the total hydrocarbon pollution from one hour of use by a two cycle outboard engine. In a landmark government/business partnership, the EPA and the marine industry recently passed regulations to reduce emissions up to 75%, starting in new engines sold in 1998. The regulations are to be phased in by the year 2007. Fuel efficiency is also expected to increase by 30-40%.

Direct water pollution from marine engine combustion has been studied for a number of years with very little direct evidence of environmental impact. Average loss of fuels were estimated to be 10 to 27% for all outboard motors in the 1970's (Jackivicz and Kuziminski, 1973a). Since the fuel crisis of the early 1970s, tremendous advances in technology have improved combustion efficiency so that a modern, outboard engine will typically waste less than 1% of fuel (Wagner, 1990). Mele (1993), however, contends that fuel losses from outboard motors average 25%. With the 1998 EPA regulations, two-cycle fuel losses should also decline dramatically. Older two cycle outboards currently in use are the remaining concern that pose a threat to lake ecosystems.

No conclusive data have been obtained on the direct effects of outboard motors from recreation (Sachell, 1976), Lagler reported no effects on populations of fish in experimental ponds, and Jackivicz and Kuzminski (1973b) conclude under normal use there is nothing to suggest that there is a problem. Others writers, including Andre Mele (Polluting for Pleasure), Dr. John Farrington (Woods Hole Oceanographic Institute), John T. Hardy (Western Washington State University) and Brian Swinn (Newsweek), have written about outboard engine combustion fuel losses producing polycyclic aromatic hydrocarbons (PAH's), which are known carcinogenic and mutagenic substances.

PAH's can accumulate on the surface and around the edges of water bodies, collecting as a microlayer at the surface and in the shallows and in the littoral zone, which is the base of an extensive food chain and nursery for the young of many species. The affects of PAH's on organisms include deformation, reduced energy for bodily functioning and breeding, mortality of eggs and young, and mortality of adults. Of these effects, probably the suppression of reproduction is most critical. Different organisms have distinct sensitivities to PAH's though researchers have identified a critical range of .03-1 ppm. Some PAH's have been shown to mimic the materials of which hormones are built, thus affecting growth, reproduction, and energy flows (Mele, 1993). No conclusive studies to date, however, demonstrate this potential or describe what concentration of boating activity may cause direct pollution problems.

FUEL LOSS ESTIMATES FOR KEUKA LAKE

Several surveys have been conducted in an effort to determine the potential amount of hydrocarbon pollution released into Keuka Lake by motorboats. Keuka's motorized fleet is estimated at 3,440boats. Of this number, approximately 30% are powered by outboard engines. This number was obtained through a count done in 1997 of the boats stored in the lake or on shore. The 1997 KLA Recreational Survey showed on average, motorboats on Keuka were taken out 41.4 times per season, are 18 ft. long, have a 133 horsepower engine, and are used for 1.5 hours per trip.

Using these figures, local marina owners and operators estimate that about 10 gallons of fuel would be used during each trip. The Mercury Corporation conducted a study of two cycle outboard engines which showed that at least 8.3% of the fuel mixture is blown out of the engine unused. According to a study done by the U.S. EPA, 25% of the fuel mixture in a two cycle outboard engine is blown out of the engine unused. A conservative figure of 15% was used for calculations and only included the outboard. The amount of unspent fuel that is spilled into Keuka Lake was determined using the # of motorboats x the # of trips per season x the gallons of fuel used x the % spillage. 3187 boats x 41.4 trips x 10 gallons x 15% spillage produces approximately 197,913 gallons spilled per season and 126 gallons of unspent fuel per day.

What is the impact of this fuel loss? Perhaps not much at all, at least in terms of those aspects of water quality the KLA and water purveyors (Penn Yan and Hammondsport) measure. Fish populations and tissue health, water clarity and algae levels, and drinking water supplies do not indicate problems related to motorboat fuel losses. Clearly, the current testing programs don't test for everything (sediment samples are not analyzed for example) and the true impact is unknown at this point. Wagner (1991) contends that if there are problems, they would be observed in marina areas, and this would be a logical place to investigate potential PAH's contamination. If no impact were found in marina areas, he contends that it could be assumed that the remaining portion of the lake would be unaffected.

THE IMPACT OF SPILLS AND BOAT WASTE

Accidental spills happen. Anyone who has reviewed the Hazardous Spill Data collected by the NYSDEC realizes that spills happen regularly, without much public notice or concern. After reviewing the spills information, however, it is reasonable to be concerned about the prospect of spills polluting the watershed's wetlands, streams, aquifers, and the lake itself. Even if the impact of a single spill is not dramatic or significant (due in part to the lake's large capacity for dilution), the cumulative impacts and synergistic effects may be long-lived and significant, but due to their gradual onset, they may go unnoticed. In the case of the lake, if the spills are direct, there may be no way to retrieve spilled materials. Greater concern and caution would seem to be indicated, and yet concern and caution in the loading of fuels for recreational excursions is probably lessened by the perceived casualness and pleasure of the occasion (Lewandowski, 1994).

The only pumpout facility for marine waste holding tanks and portable toilets on the lake is located at the NYS Park in Branchport. Floating waste has not been noticed as a significant problem on Keuka Lake, but may exist as a minor concern.

TURBIDITY AND PHOSPHORUS LOADING

Wagner (1990) found in four Massachusetts ponds that high motorized watercraft activity over a 48 hour period strongly influenced turbidity in shallow water. He noted the density of boats that resulted in unsatisfactory conditions ranged between 14 and 50 acres per boat. Interestingly, this density is generally considered an acceptable ratio for safety and conflicts from other uses.

Severe bank erosion along sandy river banks has been shown to be caused by motorboats in several studies (Nanson 1994, Bhowmik and Demissie, 1983). When speed restrictions were put in place, erosion dramatically declined. Wagner also noticed similar results in relation to turbidity: prohibiting watercraft within 150 feet of shore reduced turbidity. On Keuka Lake, a 200 feet restriction applies and this should be adequate to prevent erosion and turbidity.

Increased nutrient loads from the motor itself, occupants, and resuspension and recycling of previously settled nutrients may be an issue. Engineering advances have minimized the release of phosphorus in exhaust, however, additives for older engines may still be a threat in small lakes (probably not Keuka).

Inputs from watercraft occupants have been identified elsewhere, but only in harbor areas with large boats, largely a consequence of illegal or irresponsible behavior of people and not the watercraft.

Schloss (1990) found P load increases from motorized craft ranged from 8-80 ug/L, and where internal loading is a primary P source, motorized craft can be very influential. Fortunately, Keuka Lake would not be susceptible to this process.

France and Albright (1994) found a high correlation (R^2=0.83 and 0.92) between boating activity and total phosphorus and turbidity levels in Oneonta Lake. On heavy traffic days (weekends and holidays), phosphorus and turbidity levels rose to unacceptable levels. Whether this is a problem on Keuka Lake is not known, however, water sample results following holiday weekends have not shown excessive levels in either phosphorus or turbidity.

SHORELINE MODIFICATION AND EROSION

Based on an estimate derived from an inventory of properties at the Keuka Watershed Improvement Cooperative Office, there are 2,977 parcels of land with frontage on Keuka Lake. Some owners of the residential lakeshore parcels have constructed retaining walls either under permits from the NYSDEC or prior to the requirement of permits. Generally, property owners claim that these retaining walls are for erosion prevention. It is not clear that they perform this function, and probably the actual reason for retaining walls is to "make more ground" for relatively small lakeshore lots and to draw a clear straight line between lake and land for aesthetic purposes.

Unfortunately, the cumulative effect of many retaining walls at the lakeshore is the reduction of natural wetland and littoral ecosystems. As the shoreline is progressively sealed off by retaining walls and fill, we can expect a corresponding decline in the productivity of species which rely on beaches and shallows.

Through the seasonal and longer term fluctuations of water level, a lake "builds" beaches. Typically, lighter and finer materials within the water's reach slump and/or are transported away from shore by wave action, stream action, and lake currents, and heavier, larger materials are left to receive wave energy.

Prior to the installation of structures to regulate water level in the Finger Lakes, the typical seasonal fluctuations, as shown by natural beaches and characteristic wetland vegetation such as wild rice, must have been five to six feet. After the installation of the dams and gates to regulate Keuka Lake's level in about 1900, an attempt was made to restrict the lake's seasonal fluctuations to about two feet. The decisions to regulate lake levels and to allow development within the zone which would have been affected by the greater fluctuations were made independently and without understanding that the lake's beaches and littoral zone would be affected.

The replacement of natural beaches with retaining walls has had several undesirable effects including damage to the natural functions of the lake's littoral zone. A significant function lost is the zone's ability to contain extra water from minor floods without damage to properties; the erection of retaining walls exacerbates flooding. During periods of high water levels and significant lake ice, the retaining walls are overwhelmed or undermined and "retained" soil materials are swept into the lake. As far as total shoreline erosion is concerned, it probably makes little difference whether sediment is washed in a little at a time or during large single incidents.

CONFLICTING USES

Optimum boating density is dependent on the viewpoint of individuals, however, some studies have identified a carrying capacity of one boat per 25 acres as minimum sufficient for all recreational boating activities (Zwick, 1990), this does not take into account the viewpoint of those people who want to enjoy solitude or other passive forms of recreation.

At 11,000 acres, the carrying capacity of Keuka would be 440 boats, assuming they would all be equally spaced about the lake. Of course, this never happens and higher densities tend to be found in certain developed areas such as Hammondsport, Penn Yan and Branchport, as well as the shoreline area. Results from boat surveys in 1997 and 1990, Keuka approaches this threshold only on crowded holiday weekends.

Conflict between passive uses and PWC is a primary concern for many recreational users surveyed by the KLA. The KLA survey identified sightseeing and enjoying the views as the highest rank pursuit, so it isn't surprising that PWC were ranked as the #1 threat preventing enjoyment of these activities.

Obviously, some recreational uses do preclude others. Generally, more active uses (PWC) preclude more passive ones (enjoying the view). Ironically, more active uses require more lake surface area. The large majority of lake users who say that they like to sit quietly and enjoy the scenery and weather are troubled by the presence of PWC. The overcrowding of Keuka Lake has been perceived first as a conflict between these active and passive users and will not be reflected in user-acreage figures.

Additionally, different age groups of property owners and recreationists will tend to see different problems with the use of the lake. For example, the young owner of a large power boat will be bothered by lake speed limits if he/she can never open the throttle all the way. On the other hand, an older property owner sitting on shore will be annoyed by the noise and speed of PWC operating in the vicinity of his/her property. Boat races are another issue that cause conflicting views. Most businesses profit from the tourists drawn to the lake by the boat races while homeowners around the lake might be disturbed by the increased noise levels, crowding and inconvenience caused by the same races.

PERSONAL WATERCRAFT-JETSKIS

PWC have become the most exciting, dangerous, popular and unpopular watercraft to splash the market in years. The KLA survey found PWC to be the #1 concern threatening other recreational pursuits. Nationwide, the National Park Service and other lakes are moving towards partial restrictions to instituting all out bans as is the case on Lake Tahoe to minimize the negative impacts.

According to Whiteman (1997), running a typical PWC for an hour creates as much air pollution as driving a car 800 miles. They also emit up to 30% of unburned fuel into the water and while fuel injected machines are 80% more efficient, they only represent 600 of the 1.2

million PWC fleet. Noise pollution is a major concern as PWC emit about 80 decibels of noise, which is roughly equivalent to that of a running vacuum cleaner.

Finally, PWC safety issues are a great concern, particularly in light of the power and speed of the craft. PWC can travel at speeds up to 70 -80 miles an hour and can turn on a dime. People riding the craft are often unaware of others around them and many accidents have resulted from quick turns at high rates of speed. A component of the accident equation is the young age (12) at which children are allowed to drive these high performance motor craft. Sheriff patrols point out another problem: children are required to take a boating safety course, adults (over 18) are not, and they are often given tickets for breaking rules regarding PWC use. As a result of these factors, horrific PWC accidents have been documented across the country. And, while PWCs represent only 10% of recreational boats nationwide, they account for 30 to 50% of the accidents (Whiteman, 1997).

BOATER SAFETY

The Yates County Sheriff's Department owns 3 boats and a jet ski. One boat and the jet ski are on Keuka Lake for 8 hours a day. Personal watercraft are the biggest concern of the Yates County Sheriff. Often, the drivers don't know the laws and many young children operate these machines. The PWC's often get too close to boats while jumping their wakes.

The Steuben County Sheriff's main concern is the lack of boater education. Youth are required to take a boater safety course, but adults aren't, so a large number of boat operators don't know the laws. Steuben County has 2 boats that operate on Keuka, each for 40 hours per week.

For information concerning boating or PWC laws, you can contact your local sheriff's department, the local branch of the US Coast Guard, or:

NYS Parks & Recreation & Historical Preservation
Bureau of Marine & Recreational Vehicles
Empire State Plaza
Agency Building Number 1
Albany, NY 12238
(518) 474 - 0445

Adults who take the boater safety course receive an official letter stating that they completed the course. Depending on the insurance agency, it may be possible to obtain a reduction on his or her boater liability insurance.

FISHING

Keuka Lake's reputation for great fishing attracts literally thousands of fishers each year. The results of a New York Statewide Angler Survey conducted in 1988 and 1996 by the DEC's Division of Fish & Wildlife are shown in Table 7-44. The Survey found that a total of 20,500 anglers, local and otherwise, fished in Keuka during the 1988 season, creating an estimated

$5,105,490 of expenditures. Events such as the Fall Fish Frenzy and the Salmon/Trout Derby are held annually. Bass and Lake Trout are the two fish primarily sought after. The current regulations and stocking of young fish should ensure that fishing enthusiasts have continued good fishing in the future (assuming that zebra mussels don't hurt the fish population).

Table 7-44 . New York State angler survey-Keuka Lake.

	Anglers		Angler Days	
Region of Residence	Number	Confidence Limits +/-	Number	Confidence Limits +/-
8	14,990	1,350	145,820	33,550
Other	5,520	1,350	32,950	13,830
Total	20,500	2,810	178,140	36,000

Estimated Expenditures	Total (avg./day)	Confidence Limits +/-
At Location	3,154,860 (17.71)	839,930
En Route	2,005,860 (11.26)	922,630
Total	5,105,490 (28.66)	1,491,250

Species Primarily Fished For	**Percent of Days**
Bass	31.2
Lake Trout	21.1
Rainbow/Steelhead Trout	5
No Specific Type	22.1
Other	20.6

Estimated number of trips	135,510 (+/- 29,750)
Mean number of trips per angler	6.6 trips
Mean trip length	1.9 days
Mean distance traveled	69 miles

CONCLUSIONS

Keuka Lake watershed is a tremendous recreational resource, supporting a number of important recreational and economic pursuits. The 1997 KLA recreational survey clearly identifies a number of important issues including: conflicting uses, spills and boat waste, shoreline modification and erosion, and motorboats and hydrocarbon pollution. The KLA Recreation Committee will receive this report and will work with industry and the regulatory community (Sheriff's Boat Patrol) to develop practical recommendations. Beyond this, individual responsibility and concern will prove to be the most important factors in the protection of Keuka Lake.

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RESIDENTIAL LAND USE

PURPOSE

A homeowner survey was conducted to collect information on fertilizer and pesticide usage by homeowners and to learn more about the attitudes of lakeshore residents in the Keuka Lake Watershed.

METHOD

A written survey was mailed to the Keuka Lake Association membership in their quarterly newsletter. A total of 2,000 surveys were mailed. Follow-up letters were not sent to non-respondents. The homeowner survey consisted of 16 questions and 38 variables. Table 7-45 contains the questions found in the survey. The survey contained sections on fertilizer and pesticide usage and management practices, yard waste disposal methods and drinking water sources.

Completed surveys were returned to the Yates County Soil and Water Conservation District. The surveys were entered into a statistical computer program called ABSTAT. Statistical summaries were made for each question on the survey. Combinations of variables and questions were also analyzed. Frequencies, percentiles and averages were the primary statistics generated.

RESULTS

Of the 2000 surveys mailed, 803 were returned, yielding a 40% response rate. Results from the survey were calculated from the number of homeowners responding to each variable rather than from the 803 returned surveys since not all questions were answered by each respondent.

- 57% of respondents (452 out of 795) indicated they used fertilizers at their lakeshore residence for lawns, gardens and ornamentals.
- The majority of respondents manage yard waste materials by leaving them on the lawn, composting or mulching.
- 47% of respondents indicated using pesticides at their lakeshore residence, primarily for weed control and garden insect management.
- 85% of pesticide users follow the label instructions.
- 87% of the respondents apply their own pesticides.
- 36% of the respondents (288 out of 795) use both fertilizers and pesticides.
- 58% of survey respondents (460 out of 787) listed the lake as their primary drinking water source.
- 49% of the respondents (215 out of 460) indicated using the lake as a source of drinking water and applying pesticides at their lakeshore residence.
- 39% of the respondents (181 out of 460 lake water drinkers) indicated using the lake as a source of drinking water and apply fertilizers at their lakeshore residence.
- Groundwater and municipal water account for 15% of residential drinking water sources while the remaining purchase bottled water or bring water from a permanent residence .

- 86% of the respondents (49 out of 57) with unwanted pesticides would like a pesticide collection day.
- 50% of the respondents (240 out of 478) would like to have a pesticide clean-up day for a reported 525 pounds of unwanted pesticides.

Table 7-45. Summary of Keuka Lake homeowner survey.

1. Do you use fertilizers for your lawn?	310	Yes	39%	Out of 795
Do you use fertilizers on your garden?	211	Yes	26%	Out of 800
Do you use fertilizers on your ornamentals?	248	Yes	31%	Out of 799
Do you compost lawn and garden materials?	306	Yes	38%	Out of 800
Do you irrigate or water your lawn?	391	Yes	49%	Out of 801
2. What do you do with grass clippings and leaves?				
	88	landfill	7.7%	
	275	compost	23.9%	
	409	leave on lawn	35.5%	
	200	burn	17.4%	
	60	put on bank	5.2%	
	119	other	10.3%	
Most common other responses were "put in woods" and "use for mulch."				
3. Do you use pesticides?	367	yes	47%	Out of 788
4. Which pesticides do you use?				
	166	herbicides	43%	Out of 386
	60	fungicides	16%	Out of 383
	48	other	13%	Out of 384
	255	insecticide	66%	Out of 384
	56	rodenticide	15%	Out of 384
5. Who applies the pesticides?				
	348	self	87%	Out of 400
	69	contractor	16%	Out of 400
	5	other	1.2%	Out of 401
6. What problems do you use pesticides for?				
	71	plant disease control	18%	Out of 400
	147	other	37%	Out of 403
Most common other responses were "ants, wasps and moths				
7. How do you determine application rates?				
certified applicator decides		66	16%	Out of 407
follow label instructions		346	85%	Out of 407
develop my own mixture		10	3%	Out of 407
Cooperative Extension		12	3%	Out of 407
Store salesperson		14	3%	Out of 408

8. How many pesticide and fertilizer applications do you apply or have applied to your lawn each season?

0 /year	239	41%	Out of 579
1/year	158	27%	Out of 579
2/year	126	22%	Out of 579
3/year	34	6%	Out of 579
4/year	17	3%	Out of 579
5/year	3	0.5%	Out of 579
6/year	1	0.2%	Out of 579
7/year	1	0.2%	Out of 579

9. Do you have pesticides stored at your property in the Keuka Lake Watershed?

256	yes	35%	Out of 733

10. Do you have pesticides that you do not plan to use?

57	yes	8%	Out of 718

11. What do you do with unused pesticides?

55	Store them
31	Use them up
26	Landfill

12. Would you like a pesticide collection day where you could dispose of unused pesticides?

240	yes	50%	Out of 478

13. What types of pesticides do you have to dispose of?____________________

None	50%
Insecticides	30%
Other	20%

14. What quantity of pesticides do you have to dispose?

116	< 1 pound	66%	Out of 177
11	1 to 5 pounds	6%	Out of 177
42	6 to 10 pounds	17%	Out of 177
4	> 10 pounds	2.%	Out of 177

15 What is your drinking water source?

460	lake	58%	Out of 787
61	groundwater	8%	Out of 787
57	municipal	7%	Out of 787
209	other	27%	Out of 787
105	Bottled water	50%	
94	carry in	45%	

16. How close is your house to the lake?

664	within 200 feet	85%	Out of 786
85	200 - 1000 feet	11%	Out of 786
37	over 1000 feet	5%	Out of 786

CONCLUSIONS:

Responses to the survey indicate that most Keuka Lake residents are using pesticides and fertilizers responsibly. The majority of individuals using fertilizers and pesticides are using them according to label recommendations (85%). In principle, the amount of nutrients applied will be used by the grass. However, 85% of the lakeshore residences are within 200 feet of the lake; a critical area where improper practices or poor timing can have an immediate and significant impact. Applications should not be made when the ground is frozen, the grass still dormant or when heavy rains are expected.

Fertilizers and pesticides are used on approximately 50% of lakeshore residences. Although applications are according to recommended rates, this may represent a significant potential pollution source. For example, label recommended rates need to be combined with actual soil nutrient levels as determined by a soil test to minimize possible impacts. Lakeshore residents (68%) indicate an awareness of this potential impact on the lake and make only one application per year for lawn care.

To compare lawn care practices to another land use in the watershed (agriculture), an estimate of lawn care application rates is made here: if it is assumed that (1) an average lakeshore lot is (70' x 100'); (2) 50% of the lots are applying fertilizers at the manufacturers rate; and (3) 1.8 applications per year are being made, then it can be concluded that fertilizer is being applied at the rate of 88 pounds of nitrogen and 7.5 pounds of phosphorus. By comparison, economic production of corn requires nitrogen application rates of 150 pounds per acre. Phosphorus application rates are minimal. While lawn care rates compare favorably to application rates for corn, other factors as mentioned above—the close proximity to the lake, timing, grass condition, etc., indicate a need for continued education and awareness on the subject of lawn care.

Seventy percent of the yard waste materials are managed properly by composting, leaving on the lawn or mulching. Yard waste management education is still needed to reach the 30% who are burning, landfilling or depositing yard waste on streambanks. Burning and dumping on streambanks can have the greatest direct impact on lake water quality.

While only 8% of the respondents reported having unused pesticides, 50% of the pesticide users would like to have a pesticide collection day to dispose of unused pesticides. Presently, a fish consumption advisory is in effect on Keuka Lake due to accumulations of toxins in fish flesh. Removing excess, banned or unusable pesticides such as DDT from the watershed benefits and protects the water supply.

Fifty-eight percent of the lakeshore residents use the lake as their drinking water source. Of the same residents that use the lake for drinking water, 49% use pesticides and 39% use fertilizers. Drinking water is the prime and best use of the lake and use of these chemicals should be used carefully and judiciously.

Homeowners need to be educated on the potential environmental concerns associated with using lawn fertilizers and pesticides. Information on problem assessment, determining possible solutions and appropriate application rates needs to be made more widely available. Articles in the lake association newsletter, newspaper, public forums, and a special homeowner publication, such as a lake book, are education options. This information needs to be repeated regularly.

ROADBANK EROSION

INTRODUCTION

A survey of public roads maintained in the Keuka Lake watershed by municipalities, counties and the State of New York was undertaken by a summer water quality intern sponsored by the Keuka Lake Foundation, Inc. and the Yates County Water Resources Alliance.

The conditions of public roadbanks were evaluated and estimates of soil losses due to erosion were calculated. The methodology for this study is based *on Survey of Erosion Connected with Roads of the Canandaigua Lake Watershed, 1993,* which found roadbank erosion rates between 8.2 to 30 tons per mile.

Road construction and maintenance is one of many potential pollution sources reviewed in the watershed study. The intention is to fairly and accurately portray the condition of watershed roads and road ditches and to provide data which will allow comparisons between various forms of water quality impairments.

Remedial and mitigative actions are listed in the report. Not all are equally feasible or economical. The author recognizes competing claims are made on limited highway budgets but hopes that further refinements of the Keuka Lake Watershed Management Plan will lead to specific recommendations based on feasibility and cost effectiveness. Experienced highway professionals will recognize that some of the report's recommendations can be quickly and easily implemented.

METHODS

Road and topographic maps of the watershed area were compared to correlate the incidence of roads on or adjacent to steep slopes. The frequent crossing of streams and drainage ways across relatively flat roads was also noted. A preliminary list of problem areas was arranged by town. Each road in the watershed was visited, field checked, measured and annotations were made as to road condition on a USGS topoquad. Additional photographs were taken of some of the problem areas. Confirmed problem areas were also recorded on subwatershed maps of the Keuka Lake watershed and digitized into computer mapping program (Arc/Info GIS) for graphic output.

In the case of stream crossings, pools near many of the culverts serve as debris basins. These basins need yearly maintenance and are often in a disturbed condition. During periods of heavy flow, these disturbed areas are heavy contributors to stream turbidity.

In the case of roads on steep slopes, the disturbances in road ditches were categorized as moderate, severe, and very severe. The categorization reflected both subjective and objective standards. Areas identified on the base maps as probable problems were field checked. Photographic examples of the three categories are offered as standards and appear at the end of this document.

The designation of "very severe" conditions implies bare and cut banks, collapsing banks, exposed roots, "blow-out" holes in ditch bottoms, and gully erosion of soils with losses in the 50-100 tons per mile range. Using an average loss of 2-1/2 inches over a three foot bottom, a figure of 82 tons per mile was calculated and used. Usually, the "very severe" condition accompanies slopes of over 8%.

The designation of "severe" conditions implies bare bank and ditch bottoms, depositions of larger stones, and some cutting of banks and bottoms with a probable soil loss range of 25-50 tons per mile. Using an average loss of 1 inch over a three foot bottom, a figure of 33 tons per mile was calculated and used. Usually, "severe" conditions occur in road ditches with slopes of 5-8%.

The "moderate" condition designation implies a bare channel for considerable length and evidence of some cutting and deposition. This condition usually occurs on roads with slopes of less than 5%. The range of soil losses for such conditions are from 10-25 tons per mile. Using an average loss of 1/2 inch over a three foot bottom, a figure of 16.4 tons per mile was calculated and used.

In calculating sediment loading from road ditch sources, a base figure of 8.2 tons per mile (equivalent to the scouring of 1/4 inch from a three foot ditch bottom) was used for all roads not designated as moderate, severe, or very severe.

The method used to calculate erosion stemming from road ditch sources is intended as an indicator of relative severity. Its scope is limited, however, in that it does not account for losses from the road surfaces themselves nor from the cut banks adjacent to the road ditches. Losses from the latter sources, in particular, can be very severe.

The erosive potential of an area is based on factors including the erodibility of the soil, land use, slope, concentration of flows, and length of slope. The management of water near roads exacerbates several of these factors.

Roads must rapidly spill water collected on their impervious surfaces. Road ditches often collect water that would otherwise leave the area in small, distinct rills and streams. Once collected, the water has much more energy to erode soil. Ditches are graded to convey flows to centrally located culverts. On both sides of the culverts, the flows may be more turbulent and erosive.

In the natural landscape of the Finger Lakes area, lengths of slope are relatively short. For a slope of over 8%, the length of slope will seldom exceed 250 feet. Roads alter the picture, carrying water for some distance along contours to centrally located culverts. The lengths of slope associated with road ditches are usually greater than natural slopes, and consequently the erosive potential of water in road ditches exceeds natural conditions.

RESULTS

This survey found that the Keuka Lake watershed has a total of 381.52 miles of public roads. Of the total, 66.09 miles of roads were identified as having moderate erosion potential, 36.66

miles were identified as having severe erosion potential, and 24.15 miles were identified as having very severe erosion potential (Table 7-46 and Figure 7-22).

Roads within the Eggleston Glen subwatershed were identified with the highest average sediment loss per mile of 46.67 tons/mile. The Barrington Direct Drainage was estimated to have the highest total yearly erosion losses of 638 tons.

The overall ratings of the subwatersheds and direct drainages are listed in Table 7-47 and illustrated in Figure 7-23. Roadbank erosion potential is calculated as an indicator of relative severity. Subwatershed and direct drainage ranking was determined by comparing miles of very severe erosion, total tons of erosion and average tons per mile of erosion.

A **High** ranking was assigned to subwatersheds or direct drainage areas that were in the top eight for two out three of the above categories. A **Moderate** ranking was assigned to those areas that have two or more of the following: 1) greater than 0 and less than one mile of very severe erosion; 2) greater than 160 tons of total erosion; and/or 3) greater than 13 tons of erosion per mile. A **Low** ranking was assigned to those areas that have two or more of the following: 1) no very severe erosion; 2) less than 160 tons of total erosion, and/or 3) less than 13 tons of erosion per mile.

HIGH potential for roadbank erosion

Subwatersheds: 8, 9, 10, 11, 14, 23, 25, 28

MODERATE potential for roadbank erosion

Subwatersheds: 2, 3, 4, 6, 7, 12, 18, 21, 22, 29

LOW potential for roadbank erosion

Subwatersheds: 1, 5, 13, 15, 16, 17, 19, 20, 24, 26, 27

Table 7-46. Assessment of public road ditch erosion in the Keuka Lake Watershed.

Subwatersheds	Public roads w/o problem	Moderate problem	Severe problem	Very severe problem	Total miles in subwatershed	Total erosion	Average tons/mile
(1) Sugar Creek N.	24.07	3.98	0.64	0	28.69	283.77	9.89
(2) Sugar Creek S.	24.79	5.11	2.34	0.64	32.88	416.78	12.68
(3) Shanty Plains	2.56	1.56	2.34	0.57	7.03	170.54	24.26
(4) Big Gully	6.47	2.91	0.57	0.50	10.45	160.59	15.37
(5) Chidsey Point	3.33	1.78	1.35	0	6.46	101.05	15.64
(6) Knotty Pine	1.56	0.78	0.57	0.43	3.34	79.65	23.85
(7) Wagener Glen	6.04	1.35	2.70	0	10.09	160.77	15.93
(8) Urbana	3.06	0.92	1.42	1.35	6.75	197.74	29.29
(9) Glen Brook	3.63	0	2.27	2.13	8.03	279.34	34.79
(10) Mitchellsville Cr.	3.44	4.83	1.99	2.70	12.96	394.49	30.44
(11) Cold Brook	17.96	1.92	0.43	4.90	25.21	594.75	23.59
(12) Winding Stairs	1.56	2.56	1.28	0.28	5.68	119.98	21.12
(13) Day Road	4.34	0.85	0.28	0	5.47	58.77	10.74
(14) Eggleston Glen	2.27	0.43	0	2.84	5.54	258.55	46.67
(15) Willow Grove	4.83	0	0	0	4.83	39.61	8.20
(16) Brandy Bay	9.94	0.78	0	0	10.72	94.30	8.80
(17) Branchport	7.74	0	0	0	7.74	63.47	8.20
(18) Coryell	4.12	2.91	0	0.43	7.46	116.77	15.65
(19) Armstrong Rd.	4.69	0.64	0	0	5.33	48.95	9.18
(20) Boyd Hill	4.69	0.78	0	0.28	5.75	74.21	12.91
(21) Pulteney	14.77	6.39	2.56	0	23.72	310.39	13.09
(22) Urbana	6.82	1.92	0.71	0.99	10.44	192.02	18.39
(23) Grove Springs	24.78	1.99	3.2	1.56	31.53	469.35	14.89
(24) Keuka Village	11.47	2.59	0.57	0	14.63	155.34	10.62
(25) Barrington	23.53	7.46	1.99	3.13	36.11	637.62	17.66
(26) Milo	5.68	0.07	0.14	0	5.89	52.34	8.89
(27) Jerusalem	11.07	2.56	0.36	0	13.99	144.64	10.34
(28) East Bluff	6.96	7.1	2.7	1.42	18.18	379.05	20.85
(29) West Bluff	8.45	1.92	6.25	0	16.62	307.03	18.47
Totals	**254.62**	**66.09**	**36.66**	**24.15**	**381.52**	**6361.84**	**17.60**

Table 7-47. Overall roadbank survey results by subwatershed

	Average Tons Per Mile				Total Erosion (tons/year)				
Subshed	**Very Severe**	**Severe**	**Moderate**	**Minor**	**Very Severe**	**Severe**	**Moderate**	**Minor**	**Overall Rank**
	>30	20-30	10-20	<10	>350	200-350	100-200	<100	
1				X		X			**L**
2			X		X				**M**
3		X					X		**M**
4			X				X		**M**
5			X				X		**L**
6		X						X	**M**
7			X				X		**M**
8		X					X		**H**
9	X					X			**H**
10	X				X				**H**
11		X			X				**H**
12		X					X		**M**
13			X					X	**L**
14	X					X			**H**
15				X				X	**L**
16				X				X	**L**
17				X				X	**L**
18			X				X		**M**
19				X				X	**L**
20			X					X	**L**
21			X			X			**M**
22			X				X		**M**
23			X		X				**H**
24			X				X		**L**
25			X		X				**H**
26				X				X	**L**
27			X				X		**L**
28		X			X				**H**
29			X			X			**M**

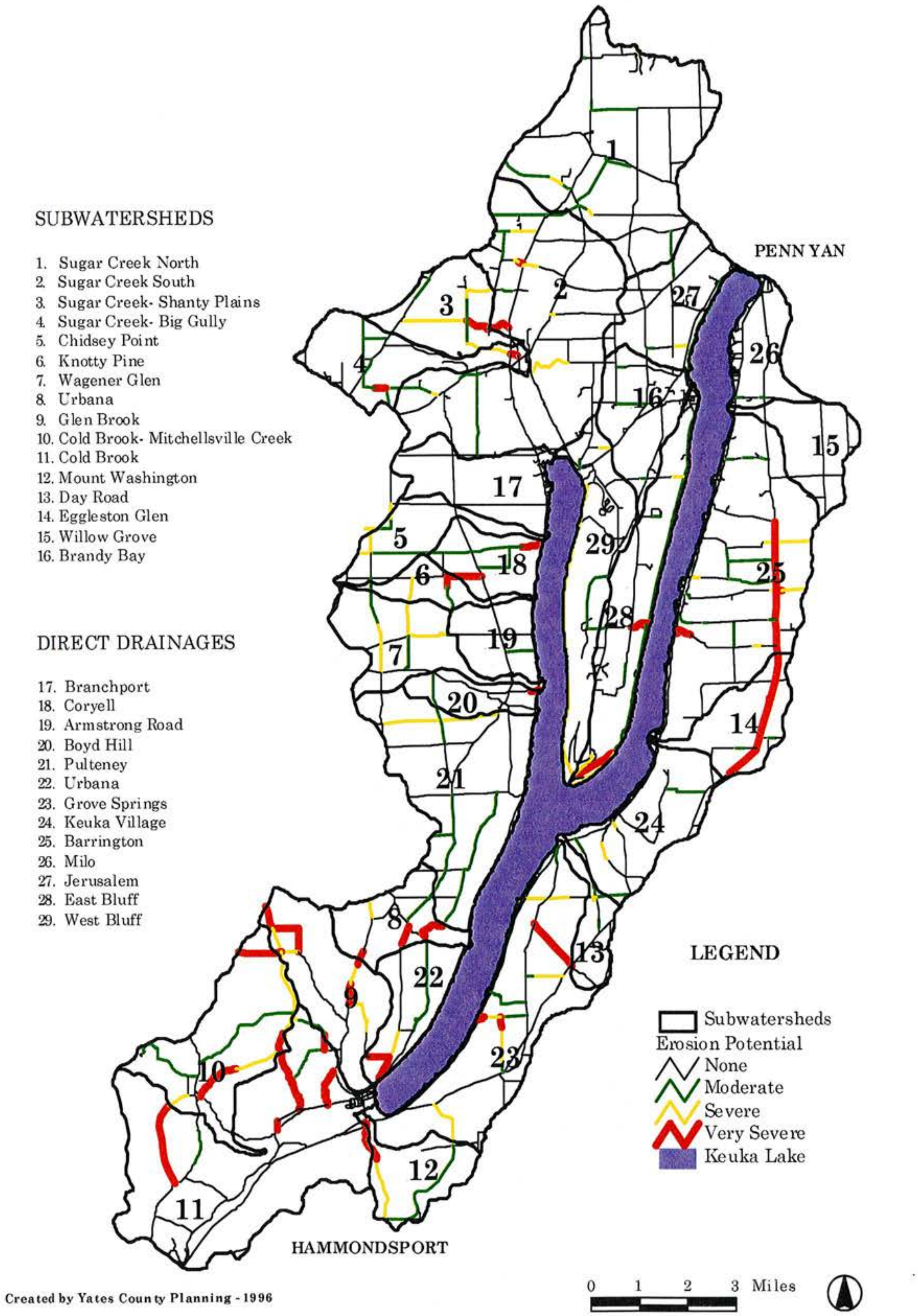

Figure 7-22. Roadbank erosion potential by road segment.

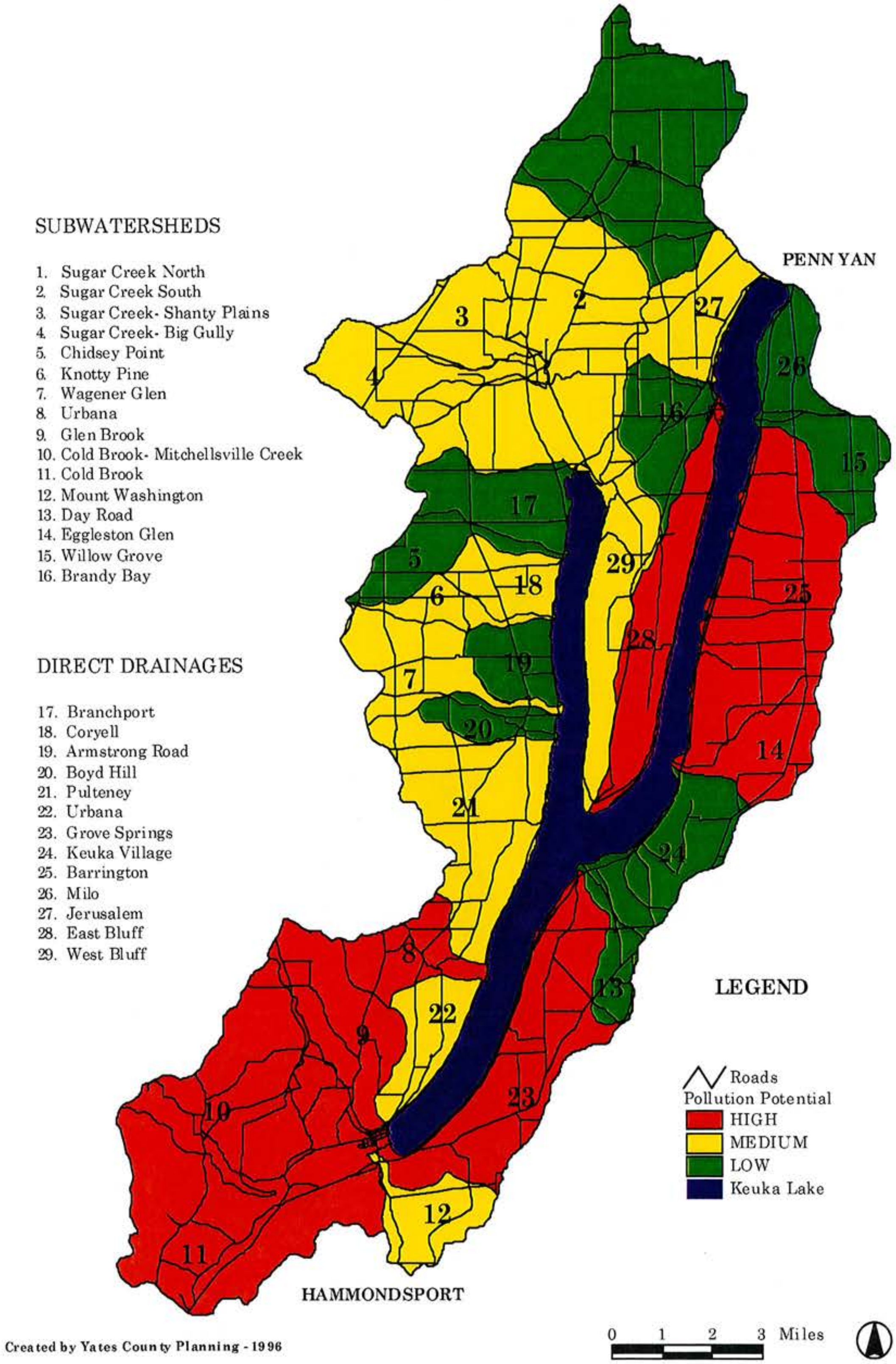

Figure 7-23. Overall roadbank erosion potential

Table 7-48. Analysis of public roads by municipality.

Town	Road Name	Moderate	Severe	Very Severe	Totals
Barrington	Ballard Rd.	0.50			
	Bath Rd.			5.47	
	Bellis Rd.		0.28	0.36	
	Bill Bailey Rd.	0.21			
	Buckle Rd.	1.00			
	East Lake Rd.	2.00			
	Fred Taylor Rd.	0.71			
	Goodwin Rd.	0.92			
	Gray Rd.	0.43			
	Hobson Rd.		1.00		
	Keuka Vista Rd.	0.21			
	Route 54	1.14			
	Sturdevent Rd.	1.00	0.14		
	Welker Rd.	0.21	0.57	0.14	
	Totals	**8.33**	**1.99**	**5.97**	**16.29**
Benton					
	Havens Corners Rd.		0.07		
	Petersburg Rd.	0.43			
	Route 364.	0.43			
	Totals	**0.86**	**0.07**		**0.93**
Jerusalem					
	Barnes Rd.	1.07			
	Belknap Hill Rd.	0.57			
	Brown Hill Rd.			0.43	
	Champlin Rd.		1.35	1.14	
	Comstock Rd.	0.28	0.57		
	Corwin Rd.	1.63			
	County House Rd.		0.07		
	East Bluff Drive	6.39	0.71	1.00	
	East Bluff Dr. Ext.			1.28	
	Esperanza Rd.	0.21			
	Friend Hill Rd.		0.71	0.14	
	Friend Rd.	0.14			
	Hemlock Rd.	0.64		0.14	
	Italy Friend Rd.	2.00			
	James Rd.	0.07	0.14		
	Keech Rd.	1.42			
	Little Church Rd.	0.50			
	Lounsberry Rd.	0.64			
	Merritt Hill Rd.	0.21			
	Morrison Rd.	1.07	0.14	0.28	
	Prosser Rd.	0.21	0.28		
	Scott Rd.	1.70			

Table 7-48. Continued.

Town	Road Name	Moderate	Severe	Very Severe	Totals
	Shanty Plains Rd.	0.85	1.21		
	Sid White Rd.		1.00		
	Skyline Dr.			0.57	
	Tinney Rd.	1.14			
	West Bluff Drive		5.89		
	West Lake Rd.	2.00			
	Williams Rd.	0.21	0.36		
	Yoder Rd.	0.71			
	Totals	**23.66**	**12.43**	**4.98**	**39.86**
Milo					
	G Fullagar Rd.	0.50			
	Second Milo Rd.	0.07	0.14		
	Totals	**0.57**	**0.14**		**0.71**
Potter					
	Bell Rd.	1.14	0.28		
	Hamm Rd.	1.07			
	Old County Rd.	0.43			
	Petersburg Rd.	0.50			
	Route 364.	0.14			
	Stryker Rd.	0.14	0.21		
	Voak Rd.	0.21			
	Totals	**3.63**	**0.49**		**4.12**
Pulteney					
	Briglin Rd.	0.43			
	Brown Rd.		1.21		
	Browns Corners Rd.	0.64			
	Chidsey Hill Rd.	1.14		0.43	
	Coryell Rd.	1.07			
	Depew Rd.		0.43		
	Ford Rd.	1.56	0.43		
	Gay Rd.			0.71	
	Gloades Corners Rd.	1.00	1.42		
	H'port Pulteney Rd.	2.98			
	Middle Rd.	3.27		0.28	
	Paddock Rd.	0.28	0.21		
	Romig Rd.			0.21	
	Stone Rd.		2.49		
	Thomas Rd.	1.56		0.28	
	Wisse Rd.	0.92			
	Totals	**14.85**	**6.19**	**1.91**	**22.95**
Wayne					
	Alderman Rd.			1.14	
	Coryell Rd.	0.57			

Table 7-48. Continued.

Town	Road Name	Moderate	Severe	Very Severe	Totals
	Day Rd.	0.71			
	Keuka Hill Rd.		0.14		
	Rose Rd.	0.14	0.57		
	Route 230.		0.43		
	Silsbee Rd.	0.71	1.14		
	Silver Nail Rd.	0.28	0.57	0.28	
	Smith Rd.	0.57			
	Totals	**2.98**	**2.85**	**1.42**	**7.25**
Urbana					
	Beers Hill Rd.			0.71	
	Bully Hill Rd.		0.71	0.92	
	Coryell Rd.		0.28	0.14	
	Crows Nest Rd.	1.00			
	Dineharts Rd.		0.36	0.57	
	Germania Rd.			0.14	
	H'port Pulteney Rd.	2.13			
	House Rd.			0.50	
	Longwell Cross Rd.		0.71	0.43	
	Middle Rd.			0.43	
	Mitchellsville Rd.	0.57			
	Argus Hill Rd	2.41	1.14		
	Newton Rd.			0.21	
	Randallville Rd.	1.63			
	Reservoir Hill Rd.		0.36	0.71	
	Runner Rd.			0.50	
	School Cross Rd.		0.21		
	Two Rod Rd.		2.77	1.42	
	Urbana Rd.			0.50	
	Van Ness Rd.	0.43	0.50	0.21	
	Vogt Rd.			1.35	
	Winding Stairs Rd.		1.21	0.85	
	Wixom Rd.			0.28	
	Totals	**8.17**	**8.25**	**9.87**	**26.01**
Wheeler					
	Carey Rd.	1.42			
	Colgrove Hill Rd.			0.50	
	Dineharts Rd.			0.28	
	Newton Rd.	0.64		1.42	
	Randallville Rd.	0.64			
	Totals	**2.70**	**0.00**	**2.20**	**4.90**

BEST MANAGEMENT PRACTICES

A Town Highway Superintendent put it very well: "First, we need to get the water off the road as quickly as possible. Then, you want us to slow it down as much as possible."

He was right. That's an accurate assessment of the problems faced by highway departments. Their first concern must be the adequacy and safety of the highway system. After they are certain that the roads are sufficiently and safely maintained, they are willing to look at other problems. Often, they feel they lack the resources, not simply in finances but in spatial terms, to solve the water quality problems associated with roads. Also, they correctly point out that not all the water quality problems originate with roads. They are asked to solve problems that originate in adjacent land uses as well. The road-based water quality problems which can be solved through highway department's use of innovative practices will be discussed here.

Numerous published documents emphasize the severity of erosion and other forms of pollution originating on roads and in road ditches. Many publications offer standards for remedial actions to be used during road construction and maintenance procedures.

A synopsis of publications normally found in local offices of the Soil and Water Conservation District Office follows in this section. On-site advice and technical services are available from the respective SWCD staff at: (315) 536-5188 in Yates County and (607)-776-7398 in Steuben County.

Another important source of information and training for highway professionals is the Cornell Local Roads Program, 416 Riley-Robb Hall, Cornell University, Ithaca, N.Y. 14853-5701 directed by Lynne H. Irwin. The Local Roads Program serves as a library of printed and audio-visual materials for loan, publishes "Nuggets and Nibbles", a newsletter for local highway officials, and organizes training sessions at numerous locations throughout New York State. Basic construction standards can be obtained from the Local Roads Program. Past training sessions have focussed on drainage, and the Local Roads Program has been responsive to requests for assistance and training on particular topics, such as water quality.

A Guide to Conservation Plantings on Critical Areas for New York published by the U.S.D.A. Soil Conservation Service, Syracuse, NY in June 1991 contains a set of recommendations for construction sites and rights-of-way:

1. Soils should not be exposed for more than fifteen days unless construction is to resume within 30 days. If construction is suspended, areas should be seeded and/or mulched without delay.

2. Select plant species adapted to the site and the purpose for which they are to be used.

3. Do not burn or otherwise remove the protective vegetative litter from the site. Bare areas are vulnerable to erosion

4. Grade to a slope that allows for ease in planting and maintenance.

5. Stockpile topsoil for use on the areas that need it for establishing vegetation.

6. Limit removal of vegetation to the smallest possible area to accomplish construction needs.

7. If the site is to be broadcast seeded, it should be done while the bulldozers are still on site to provide tracking services.

8. Old roadbanks should be scarified or regraded if riled or gulled. This may be accomplished using a drag chain, disk or chisel, brush rake or a dozer. Lime and fertilizer should be applied after scarification.

9. New roadbanks should be limed and fertilized, seeded, and mulched as soon as possible after earth work is completed. If not seeded within 24 hours after construction, scarify the surface before seeding.

10. Woody plant suppression is a secondary goal of many right-of-way plantings. Flatpea and crownvetch are the most successful plants for this purpose. Neither species is tolerant of poorly drained soils. On poorly drained sites, reed canary grass is the best choice.

11. On shady sites, shade tolerant plants must be chosen. If the canopy creates 50% or more shade cover, crownvetch probably will not grow vigorously enough to provide adequate woody plant suppression. Flatpea is more vigorous on shady sites.

The Nonpoint Source Management Program published by the NYS Department of Environmental Conservation in January, 1990 acknowledges nonpoint pollution problems associated with roadway and r-o-w maintenance as a "generic problem in many parts of the State". Problems are not frequently identified, however, because of "the intermittent nature of the source". The un-timely "cleaning" of road ditches and lack of re-planting is emphasized as a practice that promotes water pollution. Table III-3 of Candidate Management Practices lists management practices for minimizing road-based pollution including:

1. Construction contracts should contain erosion and sediment control requirements;

2. Deicing minimized consistent with highway safety;

3. Impervious base in salt storage facilities;

4. Pesticide use controls;

5. Proper sheltering of salt storage;

6. Salt storage located safe distance from water bodies;

7. Sheltering of salt and sand mixing areas;

8. Vegetative buffer strip between road and water body;

9. Vegetated road ditches.

The publication recommends "technology transfer" as the most appropriate control for road-based pollution. Educational and training materials should be developed to demonstrate to highway superintendents and engineers that roadbank erosion is a problem and that there are practical solutions available to reduce the impact on water quality.

Four publications, while not addressing the issue of road-based pollution separately and directly, offer numerous specific standards for mitigating road-based pollution.

Stream Corridor Management: A Basic Reference Manual published by the NYS DEC Division of Water in January, 1986 focuses on the protection of water bodies but acknowledges roads as major sources of pollution. It states "roadbank erosion... contributes substantially to stream and lake sedimentation in many communities in the state. The problem is aggravated by a lack of vegetative cover along roadbanks and in roadside ditches" (pg. 26). Further, the document notes problems related to highway runoff after the winter application of salt and sand. The document focuses on the protection of "stream corridors" but acknowledges that some watershed-wide polluting practices cannot be treated in or near the streams. The discussions of stormwater control and management (pp. 78-82) are applicable to problems originating from roads and road ditches.

Towns Highway Superintendents Roads and Water Quality Handbook developed by Yates and Steuben County SWCD and water quality coordinating committee to provide technical guidance to highway superintendents regarding road construction and maintenance to prevent nonpoint source pollution.

Reducing the Impacts of Stormwater Runoff from New Development published by the NYS DEC Division of Water in April, 1992 includes chapters on the preparation and implementation of erosion and sediment control and stormwater management plans. Performance standards and specific practices are outlined in Chapters 5 and 6. Though the orientation of the publication is toward general construction practices, it is immediately and easily applicable to highway construction and maintenance projects.

Highway superintendents and engineers seeking standards, specifications, and designs for vegetative and structural measures to control erosion and sedimentation from roads will find them in the so-called "blue-book", Guidelines for Urban Erosion and Sediment Control- New York published by the U.S.D.A. Soil Conservation Service, Syracuse, in March, 1988 (since revised and reprinted).

A Final Report of the Irondequoit Basin Study was issued by the Irondequoit Bay Pure Waters District under the Nationwide Urban Runoff Program in April, 1983. Though this study focused on urban and suburban locations and phosphorus loading of Irondequoit Bay, some sections, such as Technology Assessment (pp. 101-115), would be directly applicable to the abatement of road-based water pollution in the Keuka Lake watershed. The study categorizes "housekeeping" practices such as street sweeping, "preventative" practices such as the use of porous pavements, stormwater infiltration and erosion controls, and "storage option" practices such as detention/retention basins and in-stream impoundment's. The practices are also assessed for efficacy of phosphorous removal and relative cost/benefit .

In more highly urbanized parts of the Keuka Lake watershed, such as the village of Hammondsport , road ditches are replaced with storm sewers.

With the drainage system buried and contained, the necessity to avoid water pollution becomes more pressing, since no treatment will be available in the storm sewer system. Accordingly, regular investigations for accidental cross-connections between storm and sanitary sewers or storm sewers and septic systems are necessary.

In urban areas, one of the best pollution-avoidance programs is the regular use of street-cleaning equipment. Regular street-cleaning will reduce the toxicity of stormwater "first flushes" after storms.

SUMMARY

Of the many recommendations and practices discussed here, the following are highlighted:

1. All road construction and maintenance projects, whether to be carried out by the municipality or through private contract, should include provisions for the assessment of environmental impact and for supplying sediment and erosion control in the initial plan and/or bid document.

2. Road projects should not begin if sufficient resources are not allocated to finish the project in a timely fashion. The "finished" condition of a road project should include stabilized road ditches and banks and the re-establishment of roadside vegetation. If, in some cases, highway projects cannot be accomplished within existing rights-of-way, additional easements or property should be obtained. Conversely, municipalities should review the status of roads and consider abandonment or reclassification (seasonal use, limited use).

3. Timely re-vegetation of road ditches and banks is the single most effective deterrent to water pollution originating from roads and road ditches. Re-vegetation often requires extra work in grooming, fertilization, seeding and mulching. The costs incurred, however, will be repaid through the avoidance of water pollution and increased stability (and lower maintenance costs) of road banks and ditches.

4. Properly located and designed salt storage facilities and prudent use policies will allow highway departments to avoid instances of water pollution.

5. Well-planned road projects can include inexpensive preventative measures and vegetative solutions that will eliminate the need for costly structural measures. In the event, however, that structural measures such as stone-lined ditches, riprap, gabions, or sediment basins are needed for a project, it is better to plan, design and execute an adequate measure than to continue to "fix" inadequate measures.

6. Good practices can save money. Sometimes, higher initial project costs will be offset by long-term savings. To know the difference between simply expensive practices and practices which will save money in the long-term requires training. Highway

superintendents are requested to take advantage of the training opportunities afforded by the Cornell Local Roads Program and Soil and Water Conservation Districts.

REFERENCES

Lewandowski, S.D. 1993. *Survey of Erosion Connected with Roads of the Canandaigua Lake Watershed, 1993.* Canandaigua Lake Watershed Task Force. Canandaigua, NY.

STATE POLLUTANT DISCHARGE ELIMINATION SYSTEM (SPDES) PERMITS

INTRODUCTION

The SPDES permit is a contract between the New York State Department of Environmental Conservation and any facility discharging wastewater directly into surface or groundwater. SPDES permit data is contained within the State Permitting System on a computerized system called the Permit Compliance System (PCS). SPDES permit data for this report was obtained from the NYSDEC regional and central offices and represents the status of SPDES permits as of 1997.

SPDES permits are divided into two categories: significant and non-significant. Significant discharges are those facilities with large amounts of wastewater discharge or wastewater which includes toxic substances.

SPDES permits are issued for five years, and the public can examine and comment on the permit's conditions and limits prior to issuance and/or during renewal. The permit renewals appear in the NYS Publication, entitled, Environmental Notice Bulletin (ENB). Non-significant SPDES permits are administratively extended/renewed without review by the NYSDEC; however, public comment is still permitted during this period.

SPDES permits classified as significant require the permit holder to sample, analyze and report regularly to the NYSDEC the amount of permit-controlled pollutants they discharge, which are also the only pollutants they are allowed to discharge. Only significant SPDES permits are entered in the NYSDEC Central Office's computer. The NYSDEC inspects each significant SPDES permit facility on a yearly basis. The NYSDEC also spot checks permit holders' waste samples and conducts independent sampling. State certified laboratories must be used for all wastewater analysis. Owners or operators of these facilities must treat wastewater so as not to exceed the limits listed in the SPDES permit.

SPDES permits classified as non-significant also require the permit holder to sample and analyze but do not require reporting to the NYSDEC. The sampling data is required to be kept on site with the facility permittee. As a result, the actual sampling results of the wastewater from non-significant facilities are not available for review. The NYSDEC Regional Offices keep the original hard copy application on all of the non-significant facilities.

RESULTS

There are 27 significant SPDES permits listed on the State's Permit Compliance System within the Keuka Lake watershed.

SPDES facilities discharge to two types of receiving waters: groundwater and surface water. Of the 27 SPDES permits, 14 discharge to groundwater (i.e., to a leach field system) and 13 discharge to surface waters, 5 of which discharge directly into Keuka Lake. Table 7-49 summarizes the issued SPDES permits by subwatershed. Figure 7-24 illustrates the location of the SPDES facilities.

Table 7-49. SPDES permits by subwatershed.

SUBWATERSHED	NUMBER OF PERMITS
1	1
8	2
11	9
17	1
19	1
21	1
22	2
23	2
24	1
25	1
26	2
28	3
29	1

KEY TO SPDES PERMITS :

FIELD	DESCRIPTION	FIELD:	DESCRIPTION	FIELD	DESCRIPTION
Class	Industrial (01,03) Non-significant Industrial (04) Municipal (05,07) Institutional (09) Private (02)	Toxicity	Toxic (T) Non-toxic (N)	Design Flow	The maximum amount of waste water discharge permitted for each SPDES permit in millions of gallons per day (i.e.- . 00030 = 300 gal)

Table 7-50. SPDES Permits in the Keuka Lake Watershed.

PERMIT#	FACILITY	ADDRESS	COUN-TY	SUB SHED	RECEIVING BODY	CLASS	TOX	DESIGN FLOW
NY-061594	Gaffney Residence	Rd- Sutton Rd	Yates	1	Trib. of Sugar Creek	2	N	0.00
NY-0071471	Crooked Lake Campsites	Rd # 1	Steuben	8	Groundwater	2	N	0.00
NY-0160938	Crooked Lake Court Facility	Rd # 1	Steuben	8	Groundwater	2	N	0.00
NY-0159514	Glenn Curtiss School	Main St	Steuben	11	Groundwater	2	N	0.00
NY-0068390	Vinifera Wine Cellar	Rd # 2	Steuben	11	Groundwater	2	N	0.00
NY-0109177	Clark Specialty Co. Inc.	Rte 54	Steuben	11	Keuka Inlet & Cold Brook	1	T	0.01
NY-0108979	Mercury Aircraft Inc.	17 Wheeler Ave	Steuben	11	Keuka Inlet & Cold Brook	1	T	0.18
NY-0001007	New VICI, Inc.	8231 Co. Rte. 88	Steuben	11	Trib. of Cold Brook	1	N	0.12
NY-0035424	Bath State Fish Hatchery	Hatchery St	Steuben	11	Cold Brook	2	N	1.56
NY-0034801	Ira Davenport Mem. Hospital	NYS Rte 54	Steuben	11	Cold Brook	2	N	0.03
NY-0159450	Main Street School	Main St	Steuben	11	Keuka Lake Inlet	2	N	0.02
NY-0160610	Frey & Campbell Inc.	87 Lake St	Steuben	11	Reservoir Creek	4	N	0.00
NY-0162892	Camp Good Days & Special Times	Route 54A	Yates	17	Groundwater	2	N	0.00
NY-0084433	Chateau Dugas Restaurant	Rd #1 Route 54A	Steuben	19	Groundwater	2	N	0.00
NY-9501	Lakeside Restaurant	800 West Lake Rd	Steuben	21	Groundwater	2	N	0.00
NY-0098566	Bully Hill Vineyards Inc.	Bully Hill Rd	Steuben	22	Groundwater	1	N	0.00
NY-0104183	Heron Hills Vineyard	County Rte 76	Steuben	22	Groundwater	4	N	0.00
NY-0160270	Hammondsport Fire Hall	NYS Route 54	Steuben	23	Groundwater	2	N	0.01
NY-0093076	Switzerland Inn	1249 East Lake Rd	Steuben	23	Keuka Lake	2	2	0.00
NY-0074195	Blondies On the Lake	1242 E. Lake Rd	Steuben	24	Groundwater	2	N	0.00
NY-0082252	Viking Motel	Route 54	Yates	25	Keuka Lake	2	N	0.00
NY-0063550	Camp Lawrence Cory (YMCA)	Route 54	Yates	26	Keuka Lake	2	N	0.01
NY-0228371	Penn Yan Cold Storage	Route 54, Mace St Ext.	Yates	26	Keuka Lake	4	N	0.00
NY-0227471	Camp Iroquois	1000 East Bluff Dr	Yates	28	Groundwater	2	N	0.00
NY-9501	Camp Iroquois NYSSAI Summer	1000 East Bluff Dr	Yates	28	Groundwater	2	N	0.00
NY-0159549	Pep's Landing	587 East Bluff Dr	Yates	28	Keuka Lake	4	N	0.00
NY-0087521	Keuka Lake State Park	Route 54A	Yates	29	Groundwater	2	N	0.03

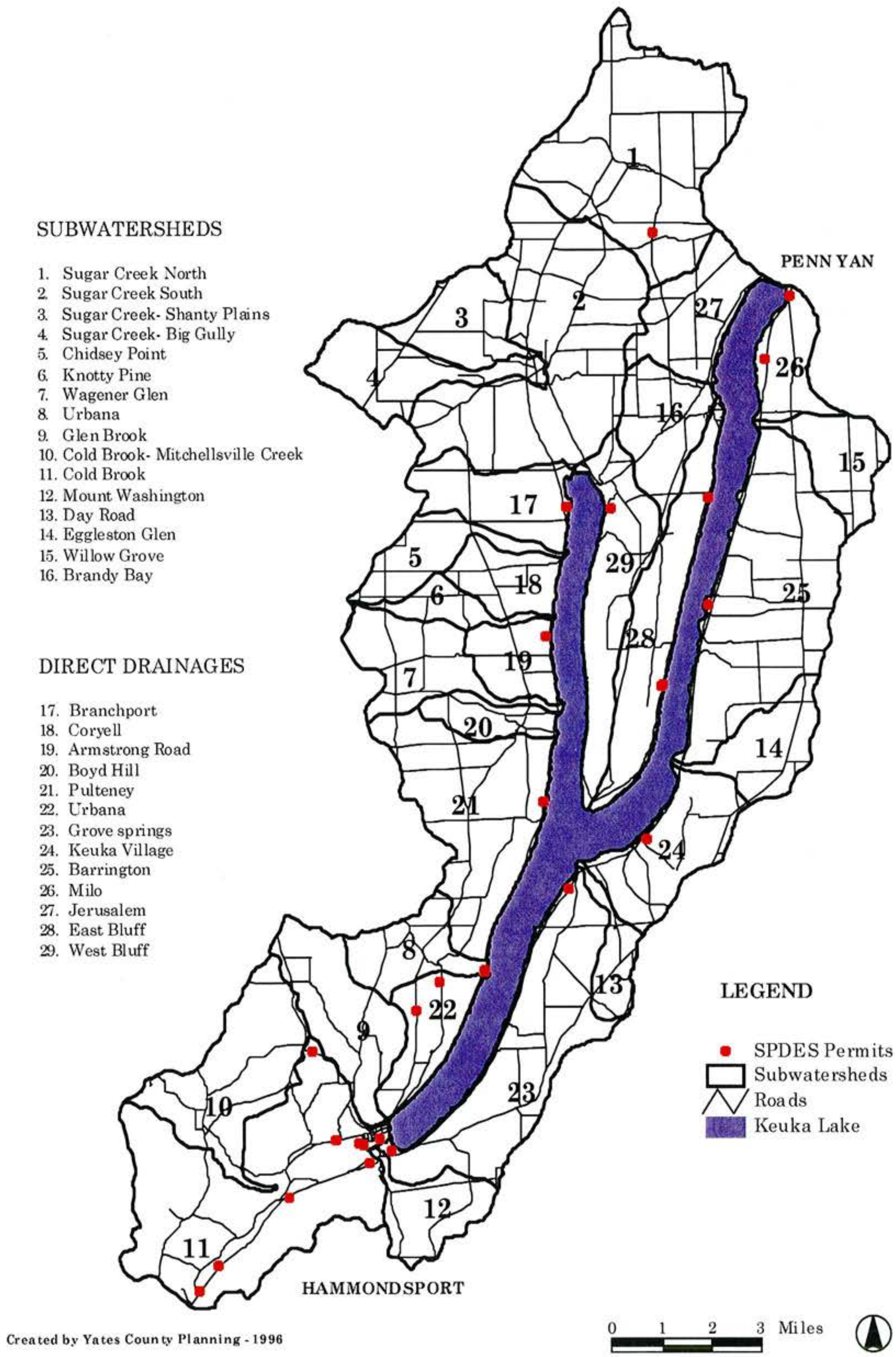

Figure 7-24. Location of SPDES facilities.

STREAMBANK EROSION

INTRODUCTION

Erosion of streambanks is one source of sediment loading into Keuka Lake. The purpose of this study was to estimate sediment yield from each subwatershed and direct drainage area and prioritize those having the highest pollution potential. The Keuka Lake watershed was divided into 16 subwatersheds and 13 direct drainage areas that comprise 132 tributaries that enter Keuka Lake. The 132 tributaries studied represent 308 miles of streams in the watershed.

The Erosion and Sediment Inventory (EASI) conducted in 1974 by the USDA Soil Conservation Service estimated 157 miles of actively eroding streambank in the watershed (USDA-SCS, 1974). The estimated sediment contribution from the 157 miles of streambank averaged 78 tons of sediment yield/mile/year. The total sediment yield from streambanks was estimated to be 3% of the total for the watershed (USDA-SCS, 1974). Streambank erosion was also named a high priority nonpoint source pollution in the Water Quality Management Plan for Yates County, 1981. Keuka Lake, Big Gully, Sugar Creek and many unnamed tributaries were listed as impacted water resources from streambank erosion in the 1981 study. The current (1997) county water quality strategies for Yates and Steuben County also name streambank erosion as a high priority nonpoint source.

METHOD

The method used to determine the erosion potential for subwatershed and direct drainage areas was developed by the Yates County Soil and Water Conservation District and reviewed by DuLac Engineering. The erosion potential method utilizes information from USGS topographic maps, the Manning velocity formula and site visits throughout the watershed (USDS-SCS, 1954).

The USGS maps were used to determine stream gradient and tributary miles. Over 90 sites were visited in the watershed to collect the required information (see Figure 7-25). The data collected at each site includes: evaluation of stream, bottom material, vegetative condition of the streambanks, side slope condition of streambanks and cross section measurements of the stream.

To rank the streambank erosion potential, the following formula was used:

Erosion Potential Index Number =	**Bottom Material Value(rock, gravel or soil bottom) + Side Slope Condition Value(stable, moderate erosion, eroded) + Vegetative Condition Value(good, moderate, poor vegetation) + Average Velocity * Number of Tributaries Miles).**

An Erosion Potential Index (EPI) was calculated for each site and averaged for the respective subwatershed or direct drainage area. Three sites per drainage area were used to calculate the EPI. Higher EPI values represented a greater potential for streambank erosion and sediment delivery.

RESULTS

The subwatersheds and the direct drainage areas were ranked separately due to the differences in tributary size and length. Table 7-51 summarizes and Figure 7-25 illustrates the EPI ranking for both subwatersheds and direct drainage areas.

The Erosion Potential Index for subwatersheds ranged from 177.5 to 71.5. The difference between these values were divided by three to obtain three separate EPI categories. An EPI above 143 is considered HIGH; between 142 and 108 is MODERATE; and values below 108 were assigned LOW potential for erosion. The subwatersheds were ranked as follows:

SUBWATERSHED RANKING

HIGH potential for streambank erosion

Subwatersheds: 2, 9

MODERATE potential for streambank erosion

Subwatersheds: 1, 7, 10, 11, 15, 16

LOW potential for streambank erosion

Subwatersheds: 3, 4, 5, 6, 8, 12, 13, 14

The EPI values for direct drainage areas ranged from 97.2-57.6. The difference between these values were divided by three to obtain three separate EPI categories. An EPI above 85 is considered HIGH; between 72 and 84 is MODERATE; and values below 71 were assigned LOW potential for erosion. The direct drainage areas were ranked as follows:

HIGH potential for streambank erosion

Subwatersheds: 17, 24, 29

MODERATE potential for streambank erosion

Subwatersheds: 18, 20, 21, 23, 25

LOW potential for streambank erosion

Subwatersheds: 19, 22, 26, 27, 28

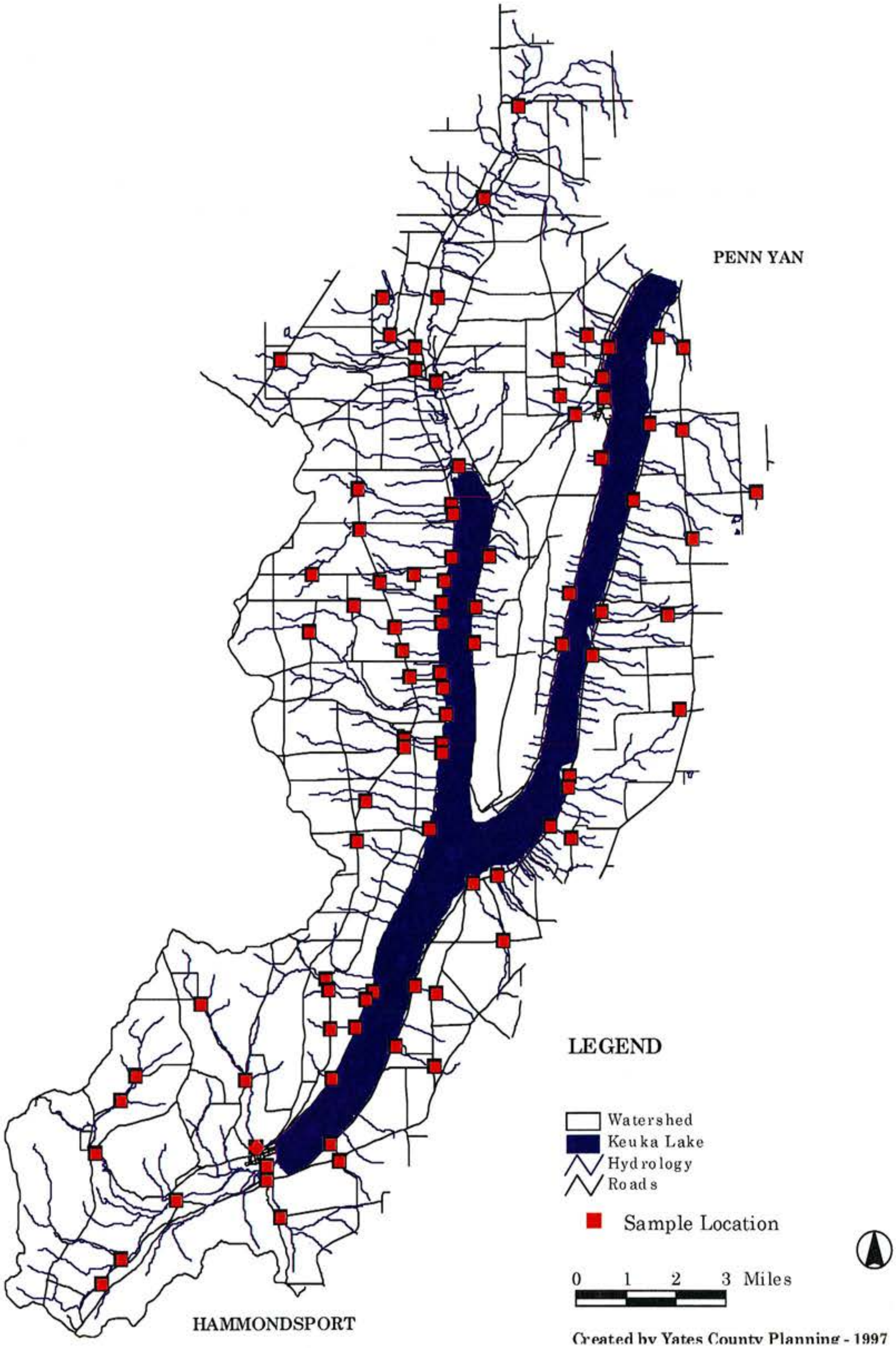

Figure 7-25. Streambank erosion sampling sites.

Table 7-51. Streambank erosion potential for the Keuka Lake watershed.

Subwatershed	Bottom Material[1]	Side Slope Condition[2]	Vegetative Condition[3]	Velocity [4]	Trib Miles[5]	Index Value	**Rank**
#9 Glen Brook	16.7	26.7	26.7	13.4	8	177.5	**1**
#2 Sugar Creek	20	25	27.5	3.3	31.5	177.0	**2**
#16 Brandy Bay	23.3	20	20	6.0	4.1	137.2	**3**
#15 Willow Gr.	13.3	13.3	13.3	14.4	6.6	135.0	**4**
#11 Cold Brook	22.5	22.5	22.5	2.4	28.5	134.6	**5**
#7 Wagner Glen	10	30	30	10.7	5.7	130.8	**6**
#1 Sugar Creek	25	15	10	3.2	23.9	125.3	**7**
#10 Cold Brook	26.7	26.7	20	4.6	9.6	117.3	**8**
#13 Marlena Pt.	20	30	30	8.7	2.8	104.3	**9**
#6 Knotty Pine	23.3	26.7	26.7	6.2	3.7	99.7	**10**
#3 Shanty Plains	20	16.7	23.3	4.4	8.9	98.8	**11**
#14 Eggleston	20	20	20	7.4	5.1	97.7	**12**
#8 Urbana	10	20	15	7.3	6.6	93.3	**13**
#12 Mt.Wash.	20	25	20	4.6	5.5	90.0	**14**
#4 Big Gully	20	15	10	3.5	7.9	72.7	**15**
#5 Chidsey Pt.	23.3	13.3	13.3	4.7	4.6	71.5	**16**

Direct Drainage Areas	Bottom Material	Side Slope Condition	Vegetative Condition	Velocity	Trib Miles	Index Value	**Rank**
#17 Branchport	20	26.7	23.3	9.3	2.9	97.2	**1**
#29 West Bluff	23.3	30	30	13.6	0.6	91.5	**2**
#24 Keuka Vil.	15	27.5	25	9.9	1.7	84.4	**3**
#21 Pulteney	20	30	20	6.5	2.8	82.3	**4**
#23 Grove Spr.	30	10	10	4.2	1.5	81.4	**5**
#18 Coryelle	13.3	26.7	23.3	7.0	2.6	81.3	**6**
#25 Barrington	22.5	15	15	10.8	2.6	80.6	**7**
#20 Armstrong	20	20	20	6.9	2.8	79.3	**8**
#28 East Bluff	20	23.3	23.3	8.8	0.6	67.2	**9**
#27 Jerusalem	20	15	17.5	5.1	1.5	60.0	**10**
#26 Milo	25	15	15	3.8	1.2	59.5	**11**
#22 Urbana	15	22.5	15	5.3	1.0	57.8	**12**
#19 Boyd Hill	22.5	15	15	4.6	1.1	57.6	**13**

[1] At each sample site the predominant bottom material (Rock, Gravel, Soil) was chosen and sample values were averaged for each subwatershed.

[2] At each sample site the stream side slope condition was evaluated(Stable, Moderate erosion, severe erosion).

[3] At each sample site the overall vegetative growth was evaluated(good vegetative growth, Moderate, Poor)

[4] Velocity was calculated using Manning formula, combined with field and topographic data.

[5] Tributary miles were calculated using the Yates County Geographic Information System, from USGS topoquads.

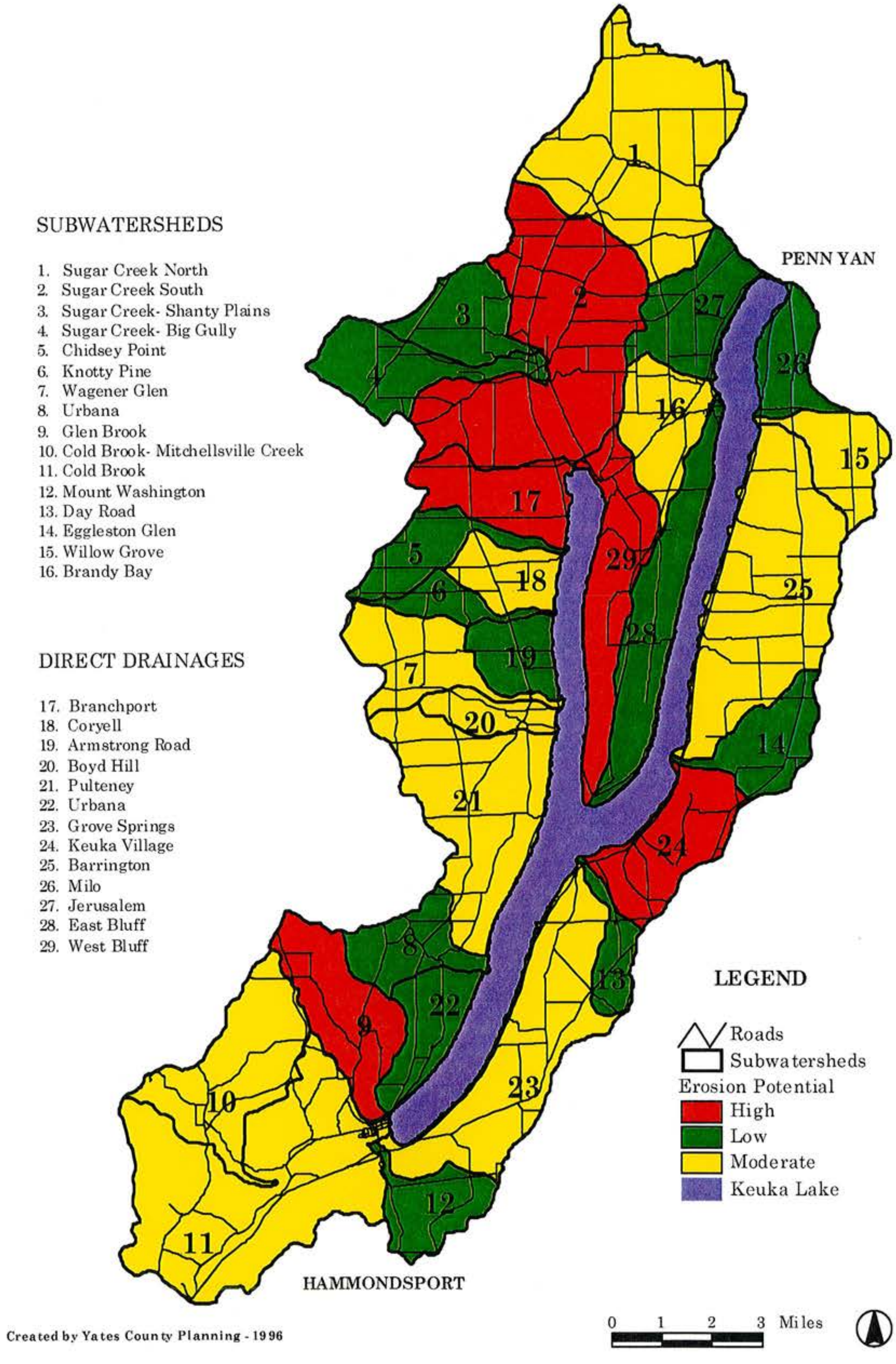

Figure 7-26. Streambank erosion potential.

REFERENCES

USDA-SCS. 1974. *Erosion and sediment inventory in New York.* USDA-SCS, Syracuse, New York.

USDA-SCS. 1954. *Handbook of channel design for soil and water conservation.* Technical Bulletin SCS-TP-61. USDA-SCS, Washington, DC.

SUBWATERSHED ANALYSIS

POLLUTION POTENTIAL MATRIX

Evaluation of pollution loading by pollution source and by subwatershed was attempted in Chapter 7 where appropriate. Table 8-1 below summarizes the findings in Chapter 7 for each pollution source and subwatershed. Each subwatershed is ranked high, medium or low, based on the research found in Chapter 7. A description of the ranking rationale is found at the end of the table.

SUMBWATERSHED MAPS

Each of the subwatershed have been mapped in the figures below. The maps include roads, streams and political subdivisions. From this project, a number of significant computer mapping products have been developed and can be printed out at any scale, including the subwatershed level. These include soils, land use, topography, streams, wetlands, geology and all the pollution interpretation maps. In addition, the soils database has a number of interpretative fields that may be of interest to local planning boards including: slope, depth to bedrock, permeability, hydric soils, and depth to water. These and other factors can be combined into interpretative tables for suitability for development/septic systems, roads, etc. These map products are available on request from the Yates County Planning Department.

Table 8-1. Summary matrix of pollution potential from land use sources in the Keuka Lake Watershed.

Sub	Ag	Res	Dev	Salt	Forest	Dump	Mine	Chem	Haz	Spill	Petro	Septic	Stream	Road	Spdes
1	H	L	L	H	L	L	H	L	L	L	L	L	M	M	L
2	H	L	L	H	L	L	H	L	L	M	M	H	H	M	L
3	L	L	M	L	L	L	L	L	L	L	L	L	L	M	L
4	L	L	H	M	L	L	H	L	L	L	L	L	L	L	L
5	M	L	H	L	L	L	L	L	L	L	L	L	L	M	L
6	L	L	H	L	L	L	L	L	L	L	L	L	L	M	L
7	L	L	H	M	L	M	L	L	L	L	L	L	M	H	L
8	L	L	H	M	L	L	L	L	L	L	L	L	L	H	M
9	L	L	M	M	L	M	L	L	L	L	L	L	H	H	L
10	L	L	M	H	L	H	L	L	L	L	L	L	M	M	L
11	H	L	M	H	L	H	H	H	H	H	H	H	M	L	H
12	L	L	H	M	L	L	L	L	L	L	L	L	L	H	L
13	L	L	H	M	L	L	H	L	L	L	L	L	L	L	L
14	M	L	H	L	L	L	L	L	L	L	L	L	L	L	L
15	H	L	M	H	L	L	L	L	L	L	L	L	M	M	L
16	L	L	M	M	L	L	L	L	L	L	M	L	M	H	L
17	M	L	L	M	L	L	L	L	L	M	M	H	H	L	L
18	M	L	M	M	L	L	L	L	L	L	L	L	M	M	L
19	M	L	H	L	L	L	H	L	L	L	L	L	L	L	L
20	L	L	M	L	L	L	L	L	L	M	L	H	M	L	L
21	H	L	M	H	L	L	L	L	L	M	M	L	M	M	L
22	M	L	H	M	L	L	L	L	L	L	L	H	L	M	M
23	M	L	H	H	L	L	L	L	L	M	M	H	M	H	M
24	M	L	M	M	L	M	L	L	L	L	M	L	H	L	L
25	H	L	M	L	L	L	L	L	L	M	L	L	M	H	L
26	M	L	L	L	L	L	L	M	M	M	M	L	L	L	M
27	H	L	L	M	L	L	L	L	L	M	L	L	L	M	L
28	H	L	H	H	L	L	L	L	L	M	M	L	L	H	L
29	L	L	H	H	L	L	L	L	L	M	L	L	H	M	M

LEGEND FOR TABLE 8-1

Ag-Agriculture Ranking
Two separate data collection and evaluation methods were used to determine the pollution potential for agriculture. The Agricultural Survey collected data from the farm operator for the entire farm operation-animal units, cropping, and various management practices. The GWLF modeling program analyzes data using aerial photography for land uses and soils to determine the potential for erosion.

HIGH ranking was given to the top six subwatersheds represented from both methods. Four of these top six subwatersheds were represented in both methods. High animal concentrations, associated manure management issues and more intensive cropping operations, such as vineyards are predominate in these watersheds.

MODERATE ranking was given to those subwatersheds representing the middle third for erosion potential and pollution potential value. Eight of the eleven were represented by both methods. Percentage of active agricultural land and estimated erosion were also taken into consideration.

LOW ranking was given to those subwatersheds that were represented in the lowest third for erosion potential and pollution potential value. Eight of the ten were represented by both methods.

Res-Residential Pesticide Ranking
All subwatersheds and direct drainage areas were given a LOW ranking. The homeowner survey was not correlated to specific subwatershed areas. Respondents were not asked to identify which subwatershed their property was located in.

Dev-Development
Rankings were based on the predominate rank for each subwatershed from a composite of drainage, slope, and bedrock soil constraints.

Chem-Chemical Bulk Storage
Only two sites were ranked HIGH, Phillips lighting in #11 is considerable larger than PY Marine in #26. All others ranked as LOW.

Haz-Hazardous Sites and Spills
Only two sites. Urbana landfill #11 being much more significant than PY Aero #26. If spills are to be considered here as well then #11 jumps out with 43 spills and is given the only HIGH. Others pale in comparison, with fairly random break between MODERATE and LOW. Anything with more than one or two spills (or at least four) gets a moderate ranking. #26 was the only one with three spills but with PY Aero thrown in ranks a Moderate.

Petro-Petroleum Bulk Storage
11 stands out again with 13 and is given the only HIGH. Anything with more than one gets a MODERATE ranking.

Road-Roadbank Ranking
Roadbank erosion potential is calculated as an indicator of relative severity. Subwatershed and direct drainage ranking was determined by comparing miles of very severe erosion, total tons of erosion and average tons of erosion per mile.

HIGH ranking was given to those subwatersheds and direct drainage areas that were in the top eight for at least two out of three of the categories identified above.

MODERATE ranking was assigned to those areas that have two or more of the following: (1) less than one mile of very severe erosion and/or (2) greater than 160 tons of total erosion and/or (3) greater than 15 tons of erosion per mile.

LOW ranking was assigned to those areas that have two or more of the following: (1) no very severe erosion, and/or (2) less than 160 tons of total erosion and/or (3) less than 15 tons of erosion per mile.

Forest-All subwatersheds were ranked LOW for pollution potential due to forest practices based on the small amount of logging activity in the watershed.

Dump-Subwatershed 10 and 11 were ranked HIGH due to . Three other subwatersheds were ranked MODERATE 7, 9 and 24 due to . The remaining 24 subwatersheds were ranked LOW because of absence of dumps.

Mine- Subwatershed 1, 2, 4, 11, 13 and 19 were ranked HIGH due to the amount of mining activity and the proximity to streams. The remaining subwatershed were ranked LOW due to the absence of mines.

Salt-Salt pollution potential was based on application rates, total salt u sed and the presence of uncovered salt storage piles. HIGH ranked subwatersheds included 1, 2, 10, 11, 15, 21, 23, 28, and 29.

Septics- Of the 29 sub-watersheds, 23 have been identified as having a low potential to generate water quality impacts from septic systems. 6 watersheds are rated as having a high potential. This conclusion was reached based on knowledge of the following conditions and circumstances in the watershed: 1) appropriate replacement systems can commonly be constructed in those subwatersheds ranked low, 2) appropriate sanitary code standards must be frequently violated in construction of replacement systems in those watersheds ranked high, 3) the severe cost of development of appropriate systems in certain portions of the watersheds ranked high suppresses the improvement or redevelopment of many residential or commercial properties, and generally represents a drag on economic value.

SPDES

11 stands out again with 9 and is given the only HIGH. Anything with more than one gets a MODERATE ranking.

Stream-Streambank Ranking

The Erosion Potential Index Number was calculated for each subwatershed and direct drainage area. The higher the index number the greater the erosion potential. The difference between highest to lowest was calculated and divided by three.

High ranking was assigned to those subwatershed areas with an erosion value greater than 142 and direct drainage areas with an erosion value greater than 85.

Moderate ranking was assigned to those subwatershed areas with an erosion value between 108-142 and direct drainage areas with an erosion value between 72-84.

Low ranking was assigned to those subwatershed areas with an erosion value less than 107 and direct drainage areas with an erosion value less than 71.

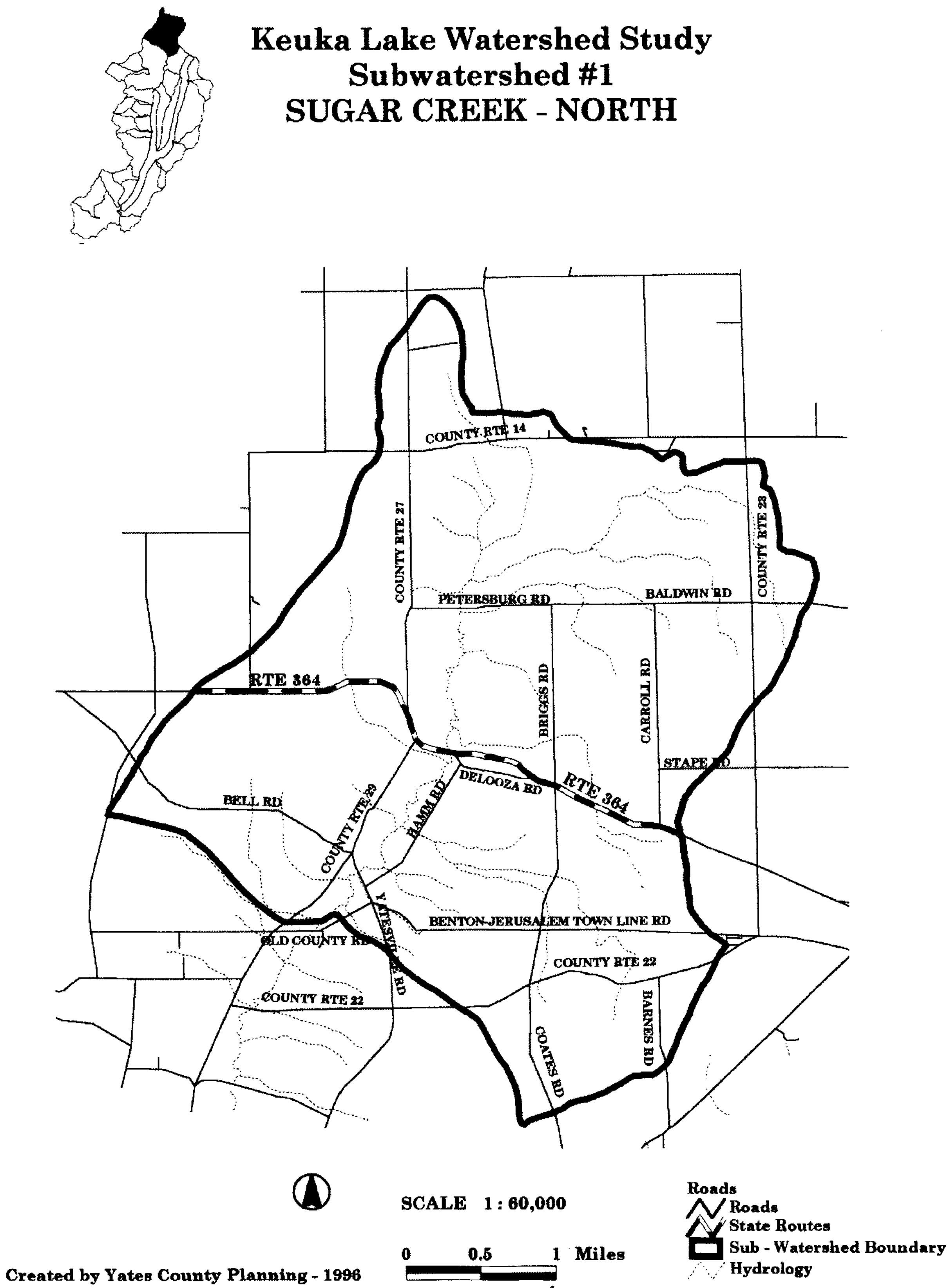

Figure 8-1. Keuka Lake Watershed Study, Subwatershed #1 Sugar Creek - North.

Figure 8-2. Keuka Lake Watershed Study, Subwatershed #2 Sugar Creek - South.

Keuka Lake Watershed Study
Subwatershed #3
SUGAR CREEK - SHANTY PLAINS

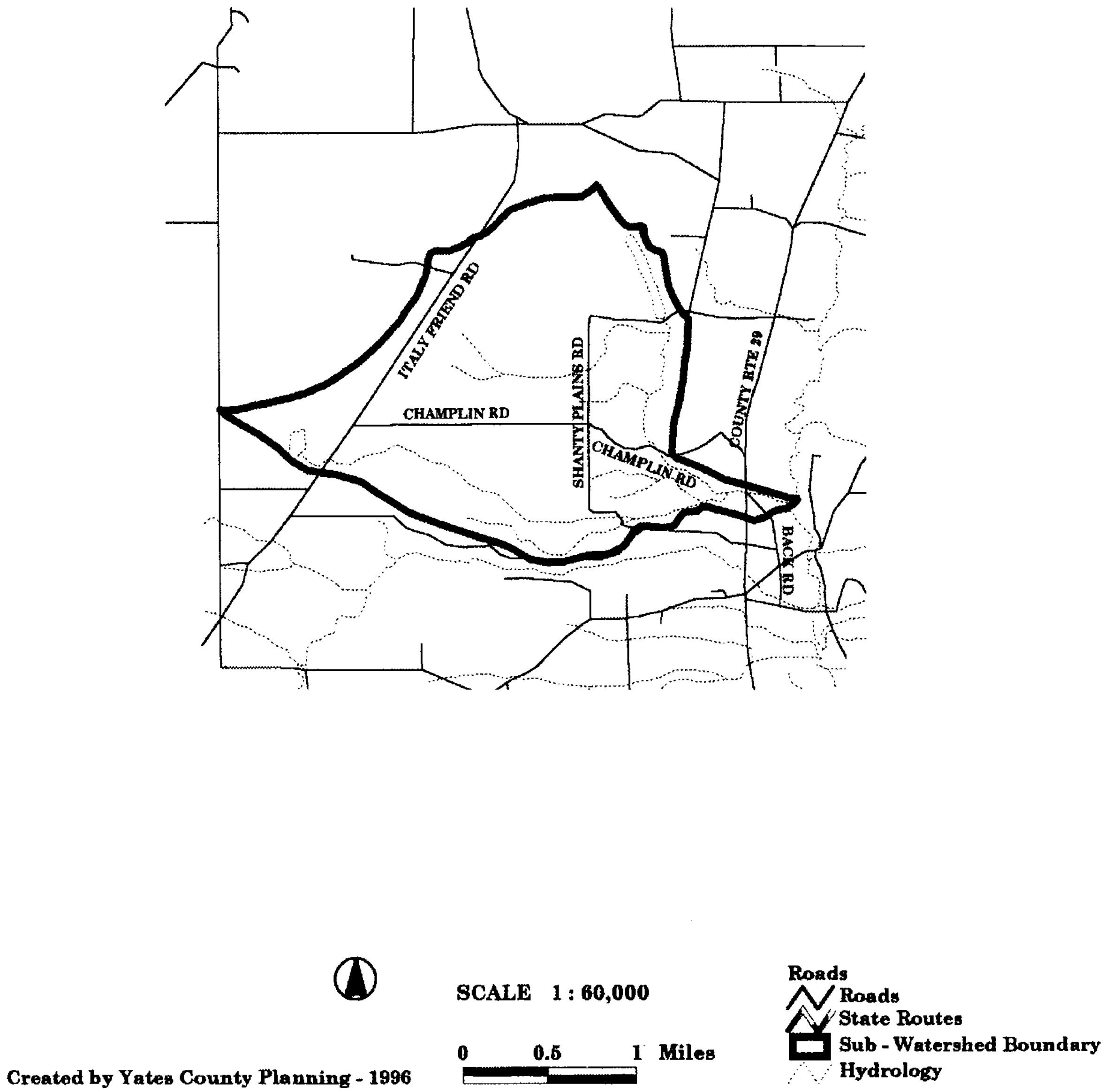

Figure 8-3. Keuka Lake Watershed Study, Subwatershed #3 Sugar Creek - Shanty Plains.

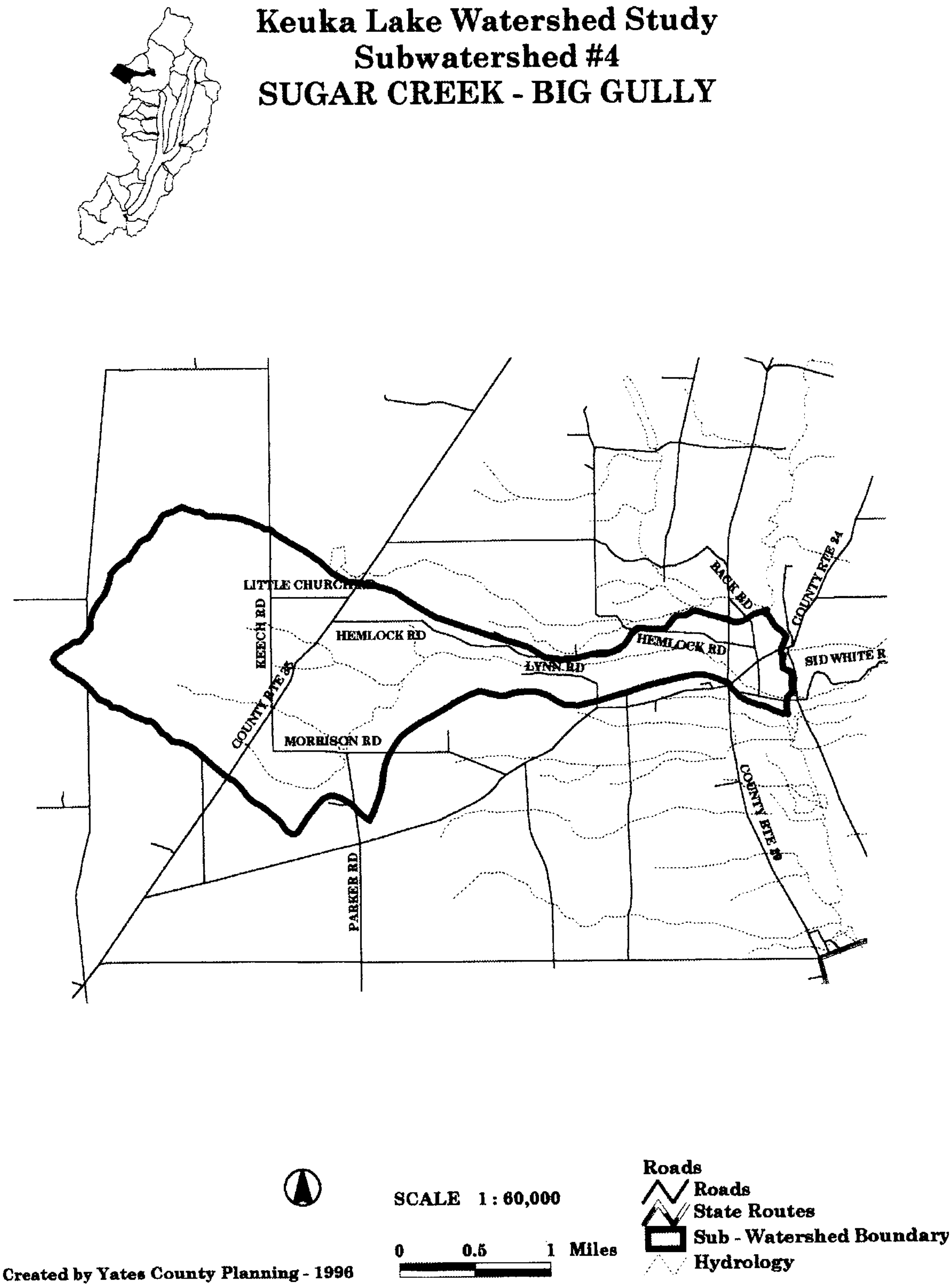

Figure 8-4. Keuka Lake Watershed Study, Subwatershed #4 Sugar Creek - Big Gully.

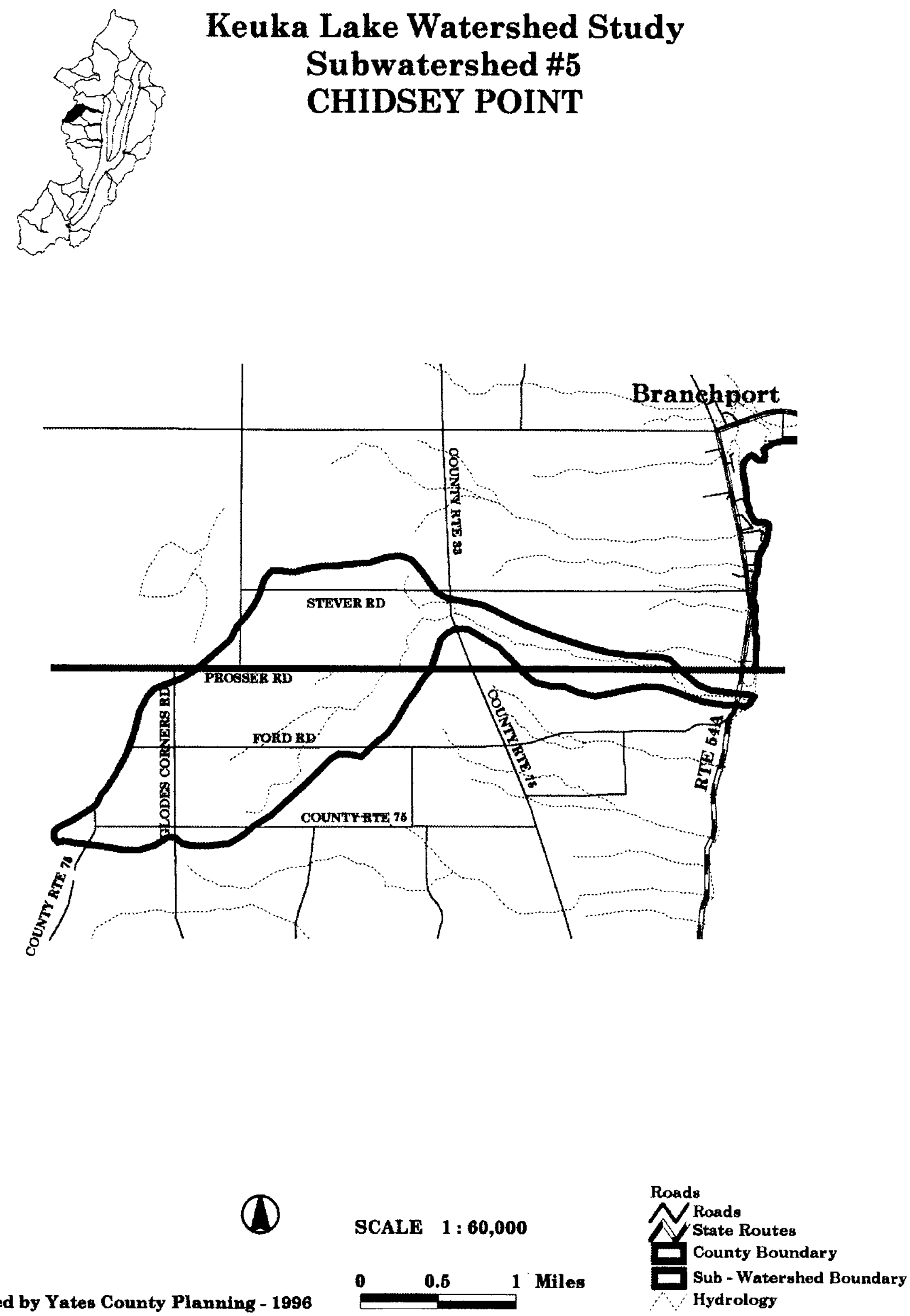

Figure 8-5. Keuka Lake Watershed Study, Subwatershed #5 Chidsey Point.

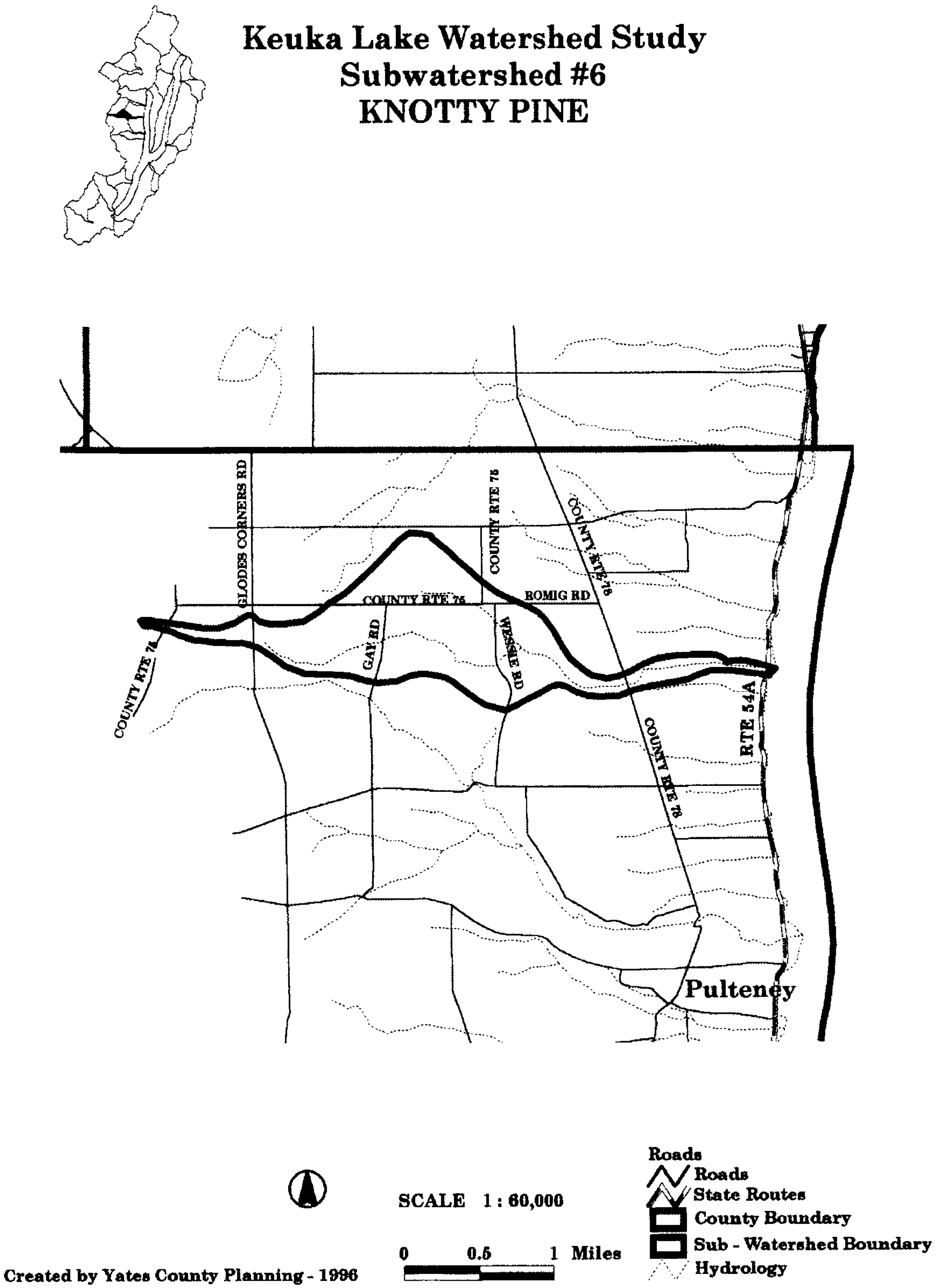

Figure 8-6. Keuka Lake Watershed Study, Subwatershed #6 Knotty Pine.

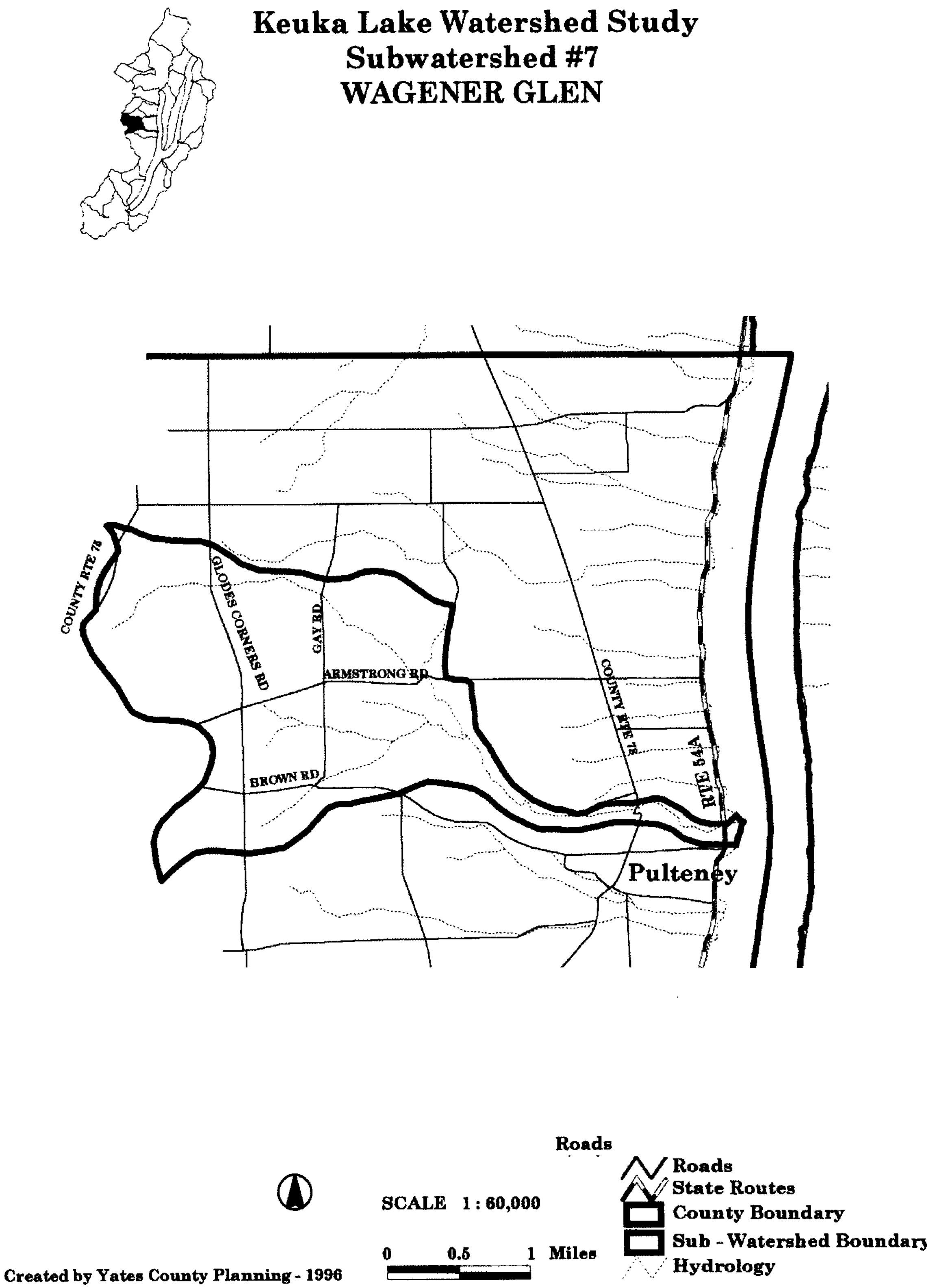

Figure 8-7. Keuka Lake Watershed Study, Subwatershed #7 Wagener Glen.

Figure 8-8. Keuka Lake Watershed Study, Subwatershed #8 Urbana.

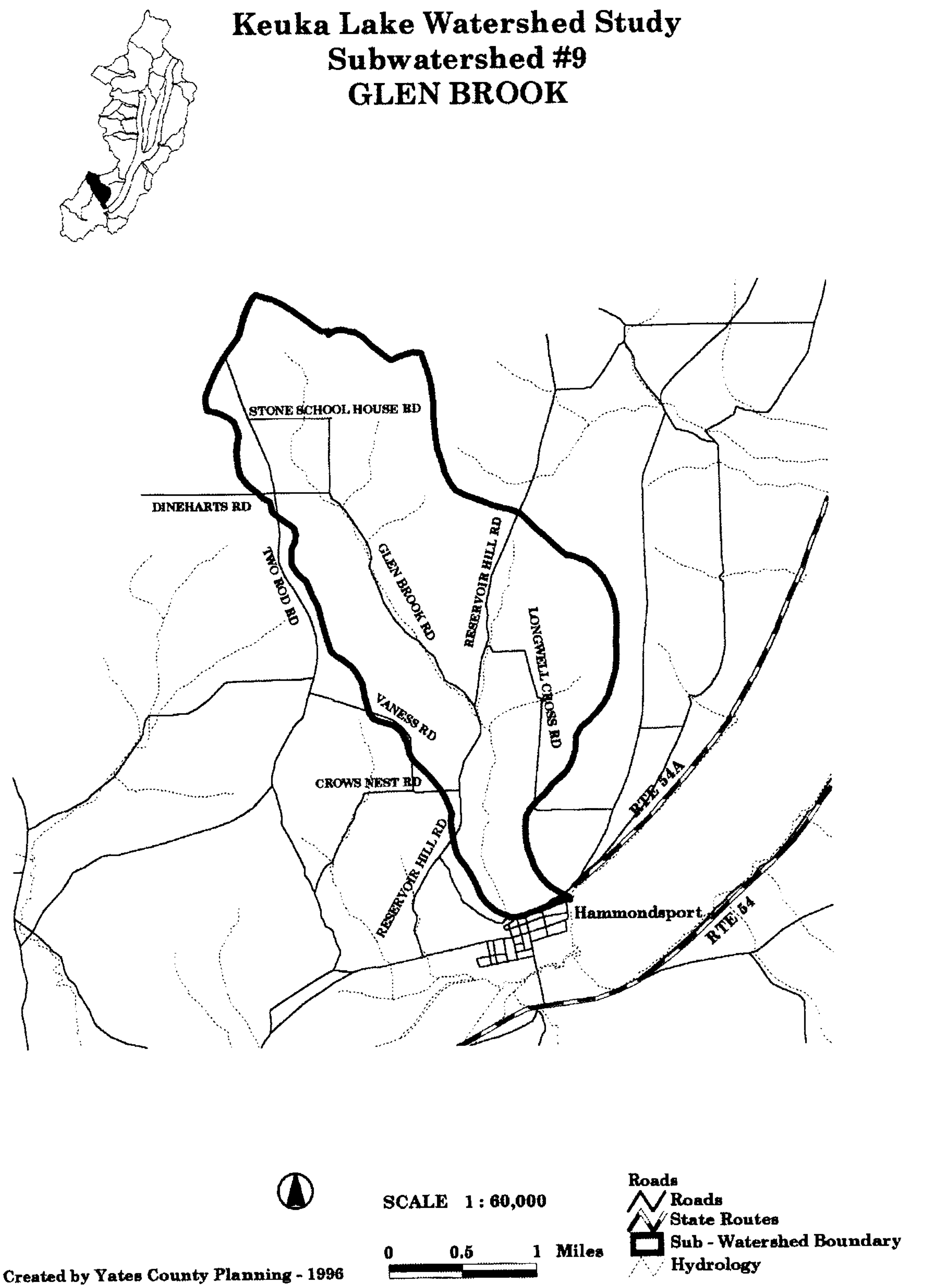

Figure 8-9. Keuka Lake Watershed Study, Subwatershed #9 Glen Brook.

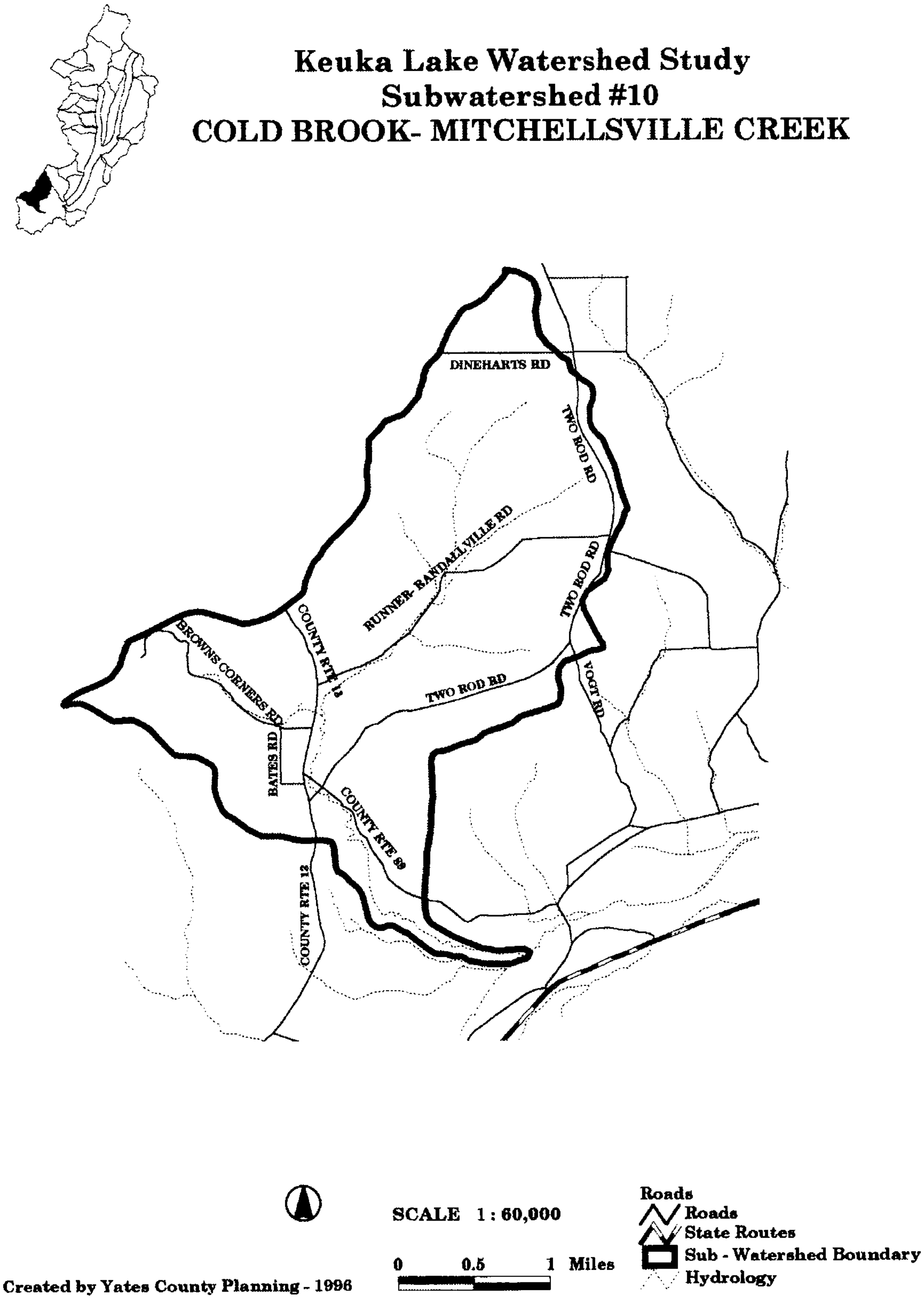

Figure 8-10. Keuka Lake Watershed Study, Subwatershed #10 Cold Brook - Mitchellsville Creek.

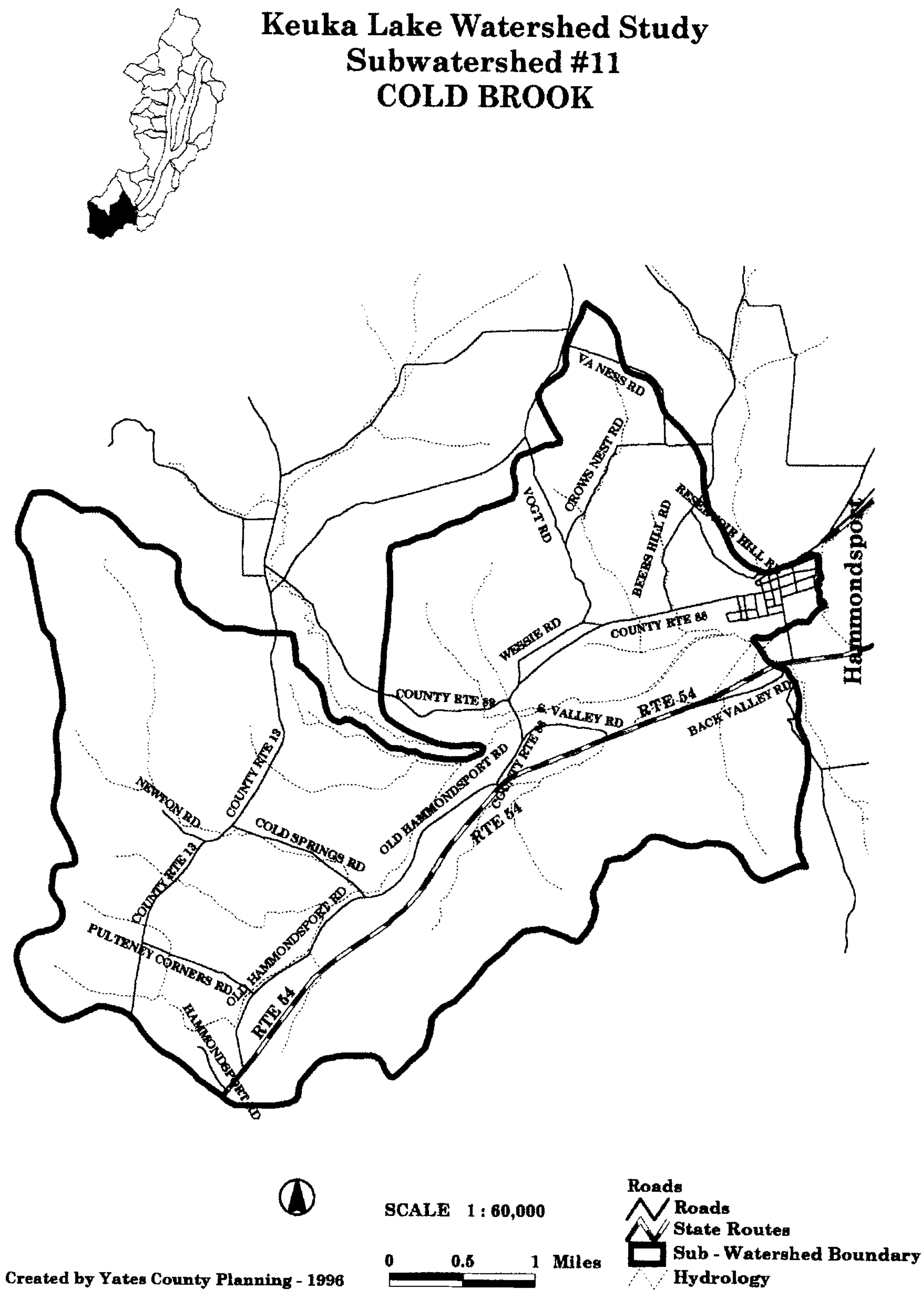

Figure 8-11. Keuka Lake Watershed Study, Subwatershed #11 Cold Brook.

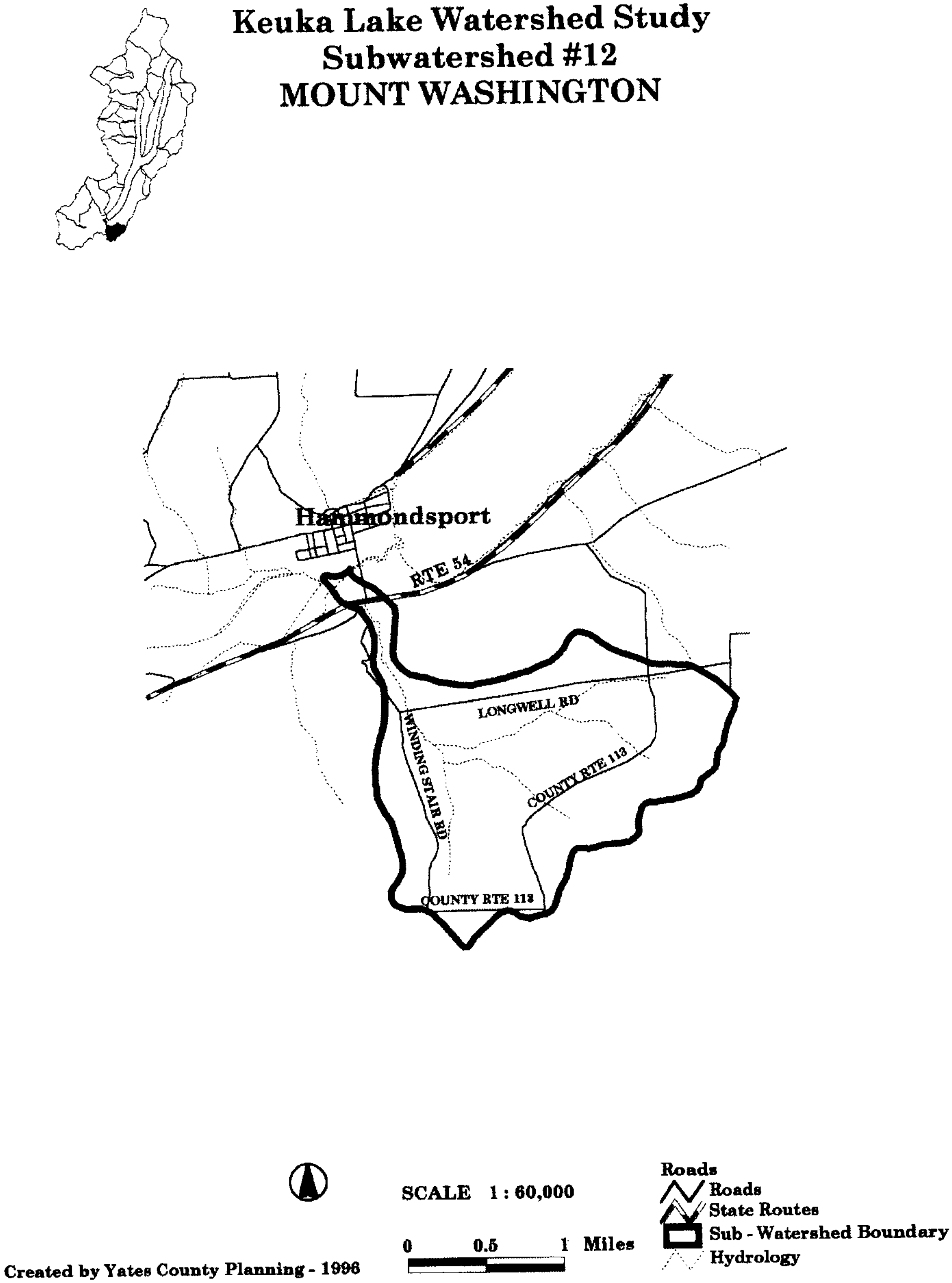

Figure 8-12. Keuka Lake Watershed Study, Subwatershed #12 Mount Washington.

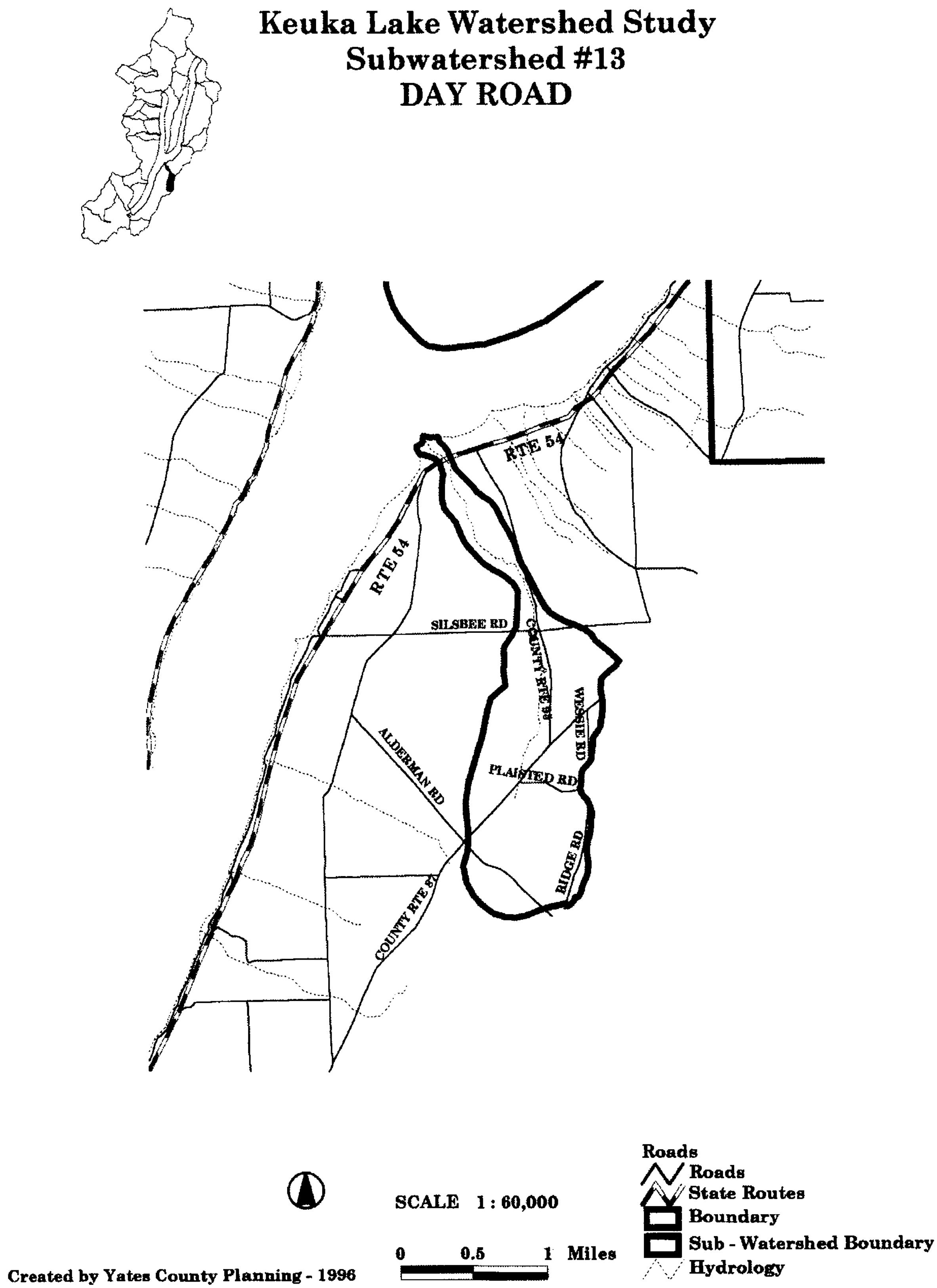

Figure 8-13. Keuka Lake Watershed Study, Subwatershed #13 Day Road.

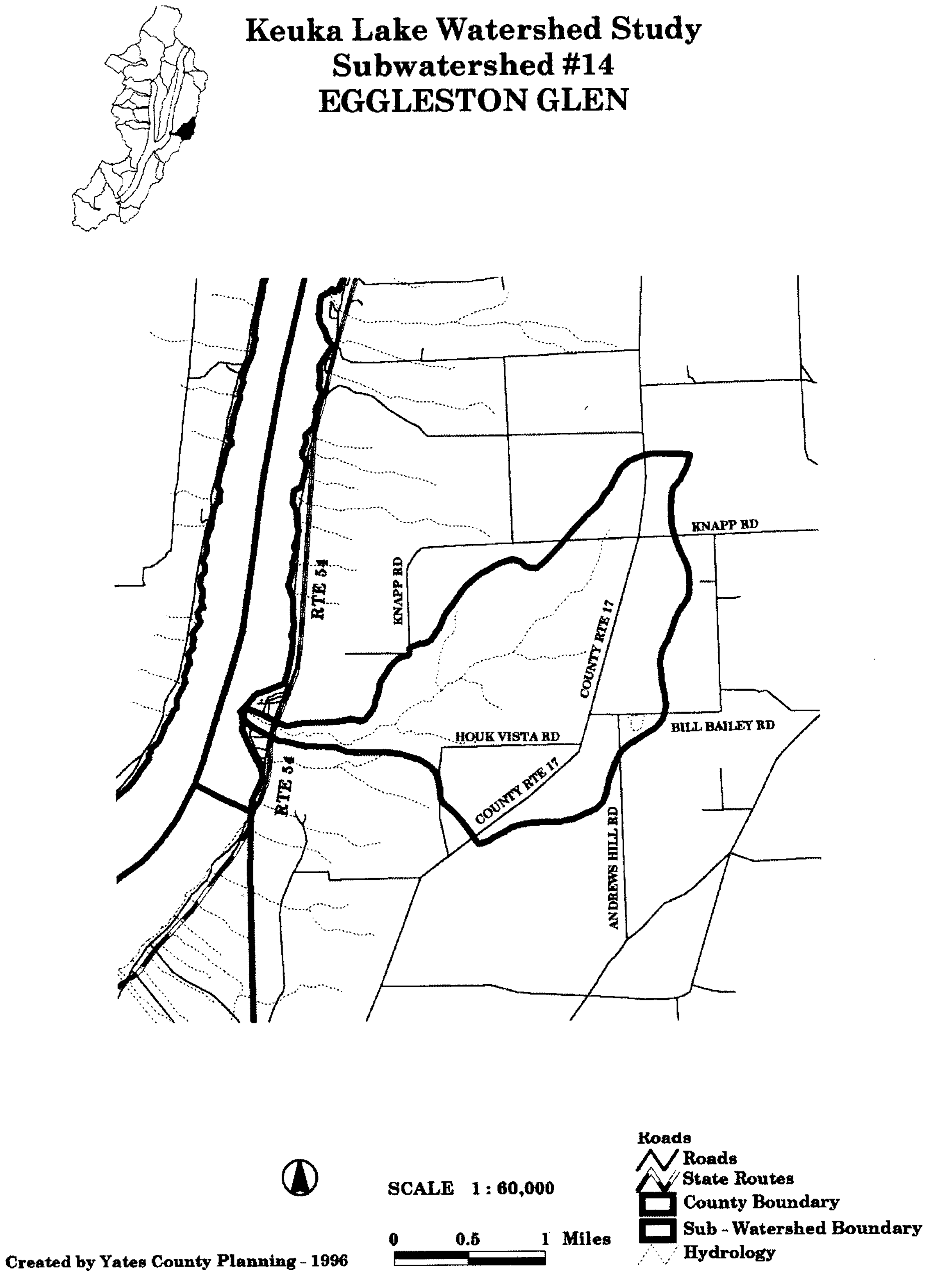

Figure 8-14. Keuka Lake Watershed Study, Subwatershed #14 Eggleston Glen.

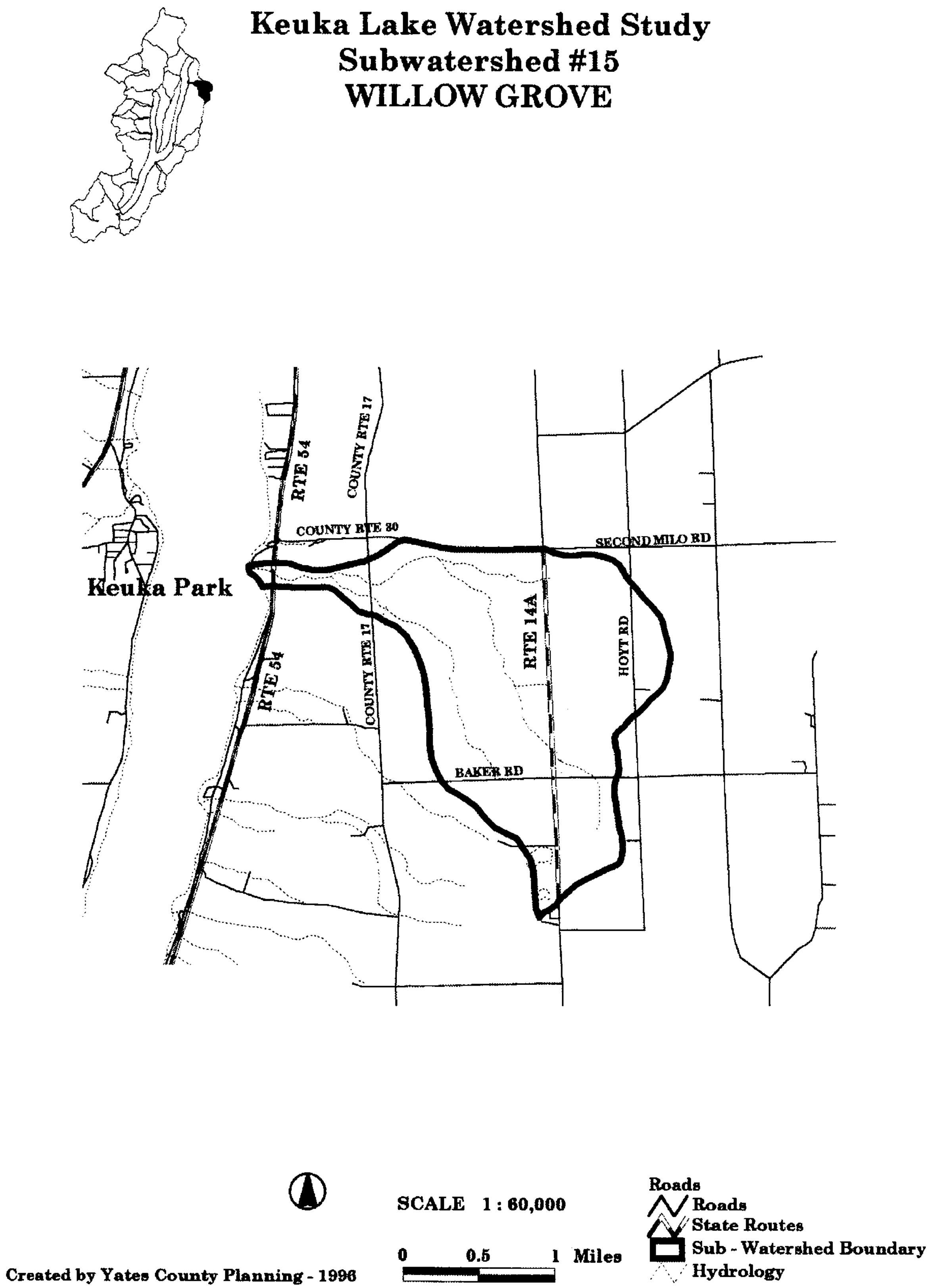

Figure 8-15. Keuka Lake Watershed Study, Subwatershed #15 Willow Grove.

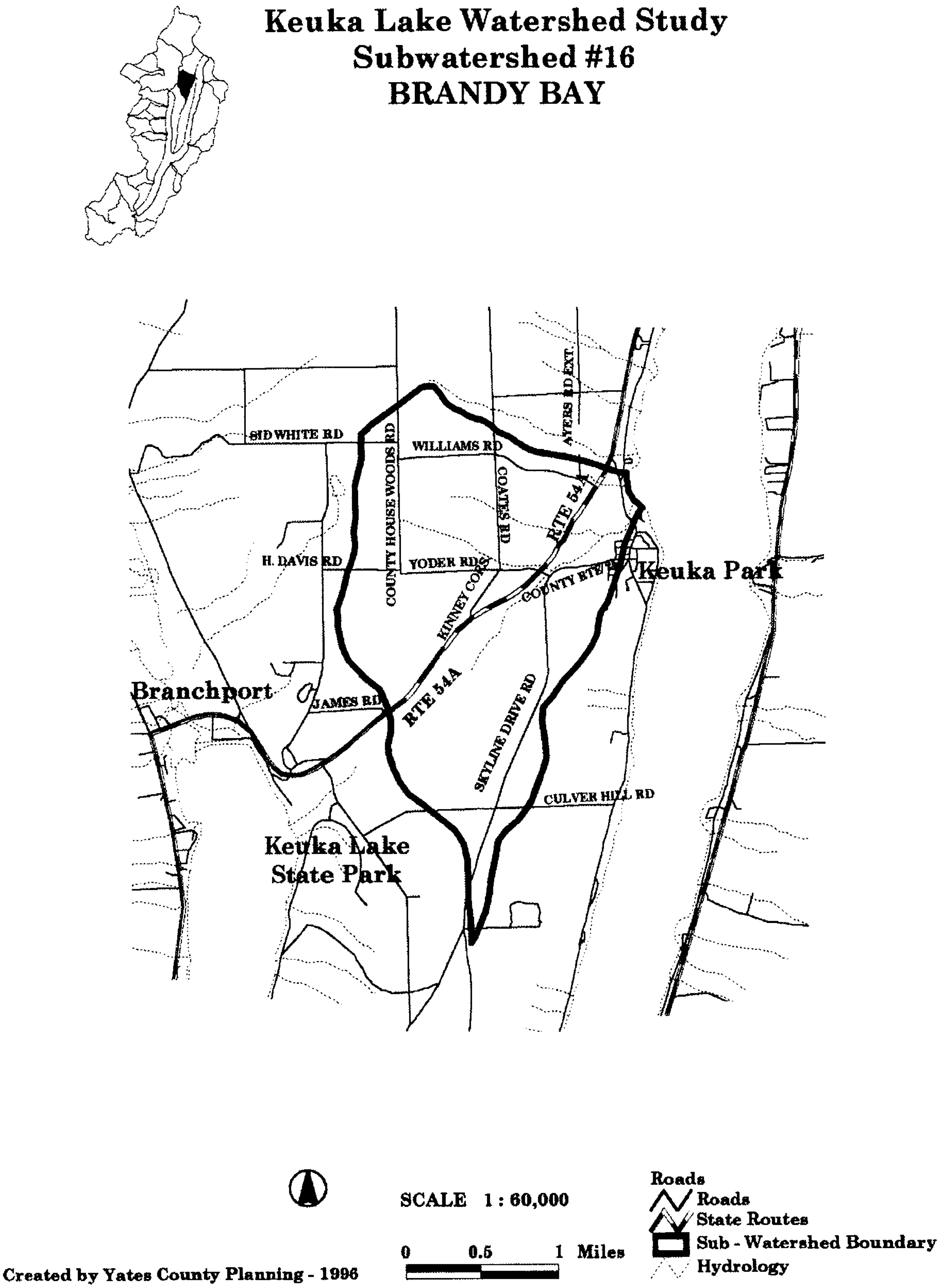

Figure 8-16. Keuka Lake Watershed Study, Subwatershed #16 Brandy Bay.

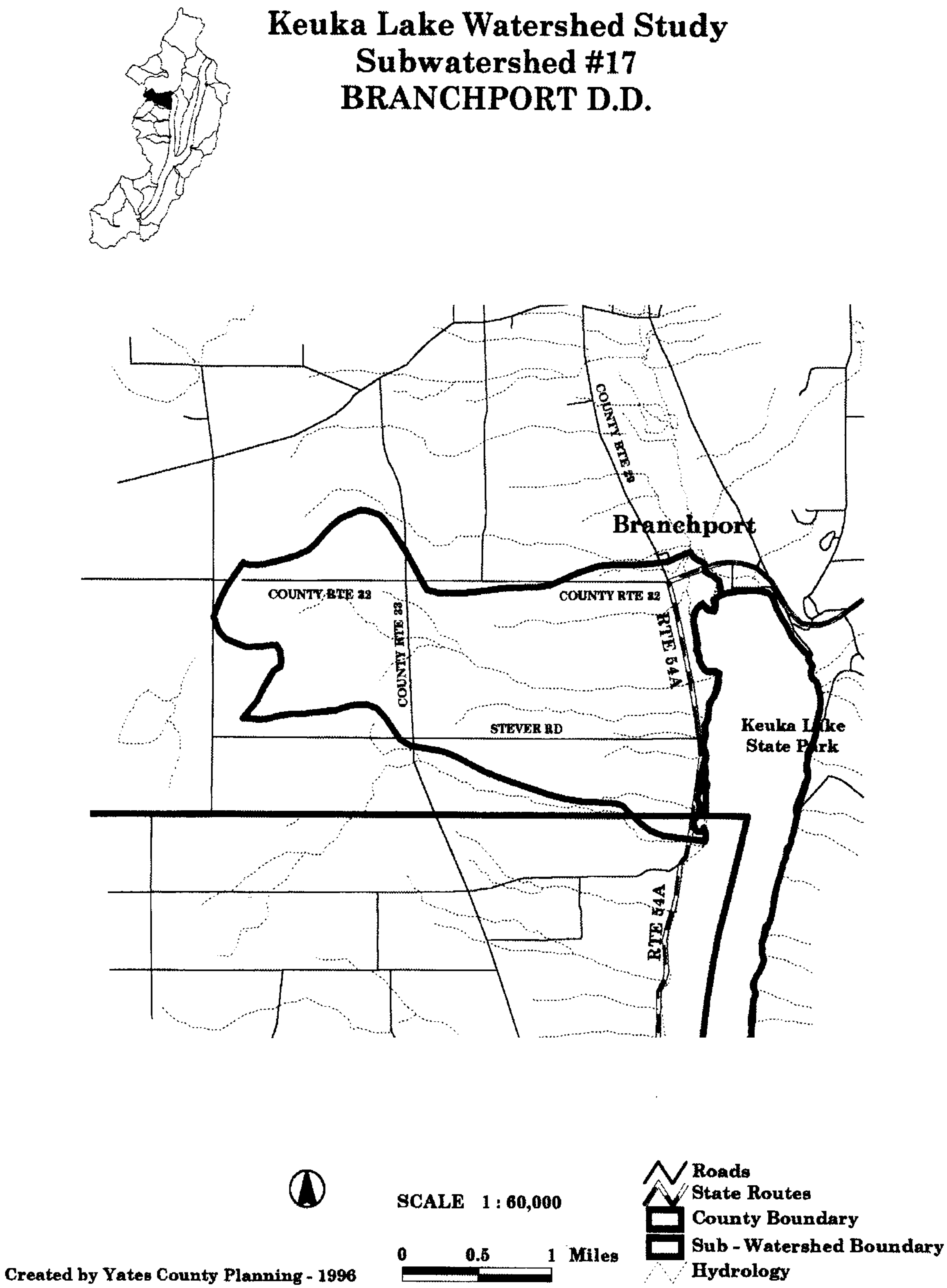

Figure 8-17. Keuka Lake Watershed Study, Subwatershed #17 Branchport D. D..

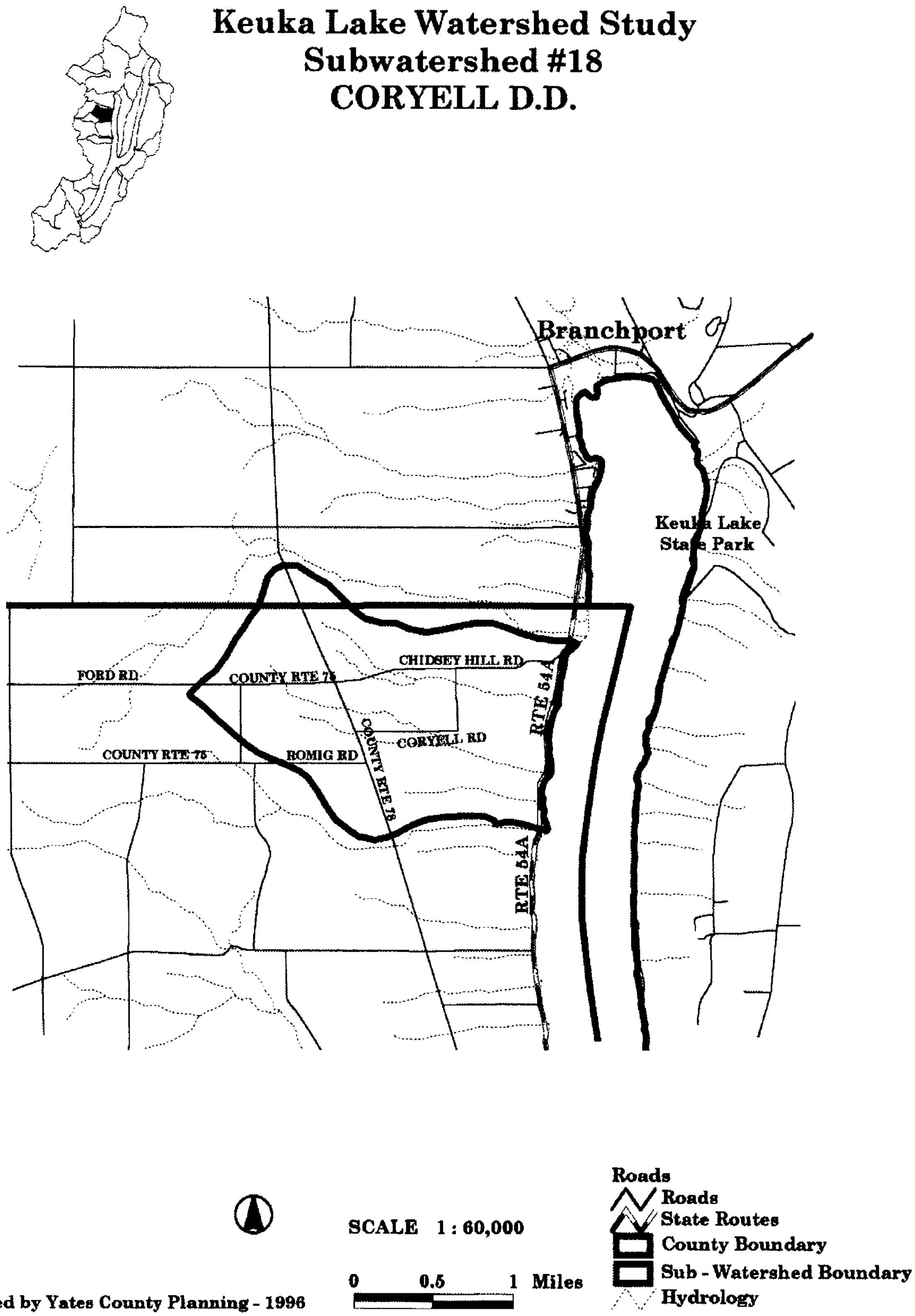

Figure 8-18. Keuka Lake Watershed Study, Subwatershed #18 Coryell D. D..

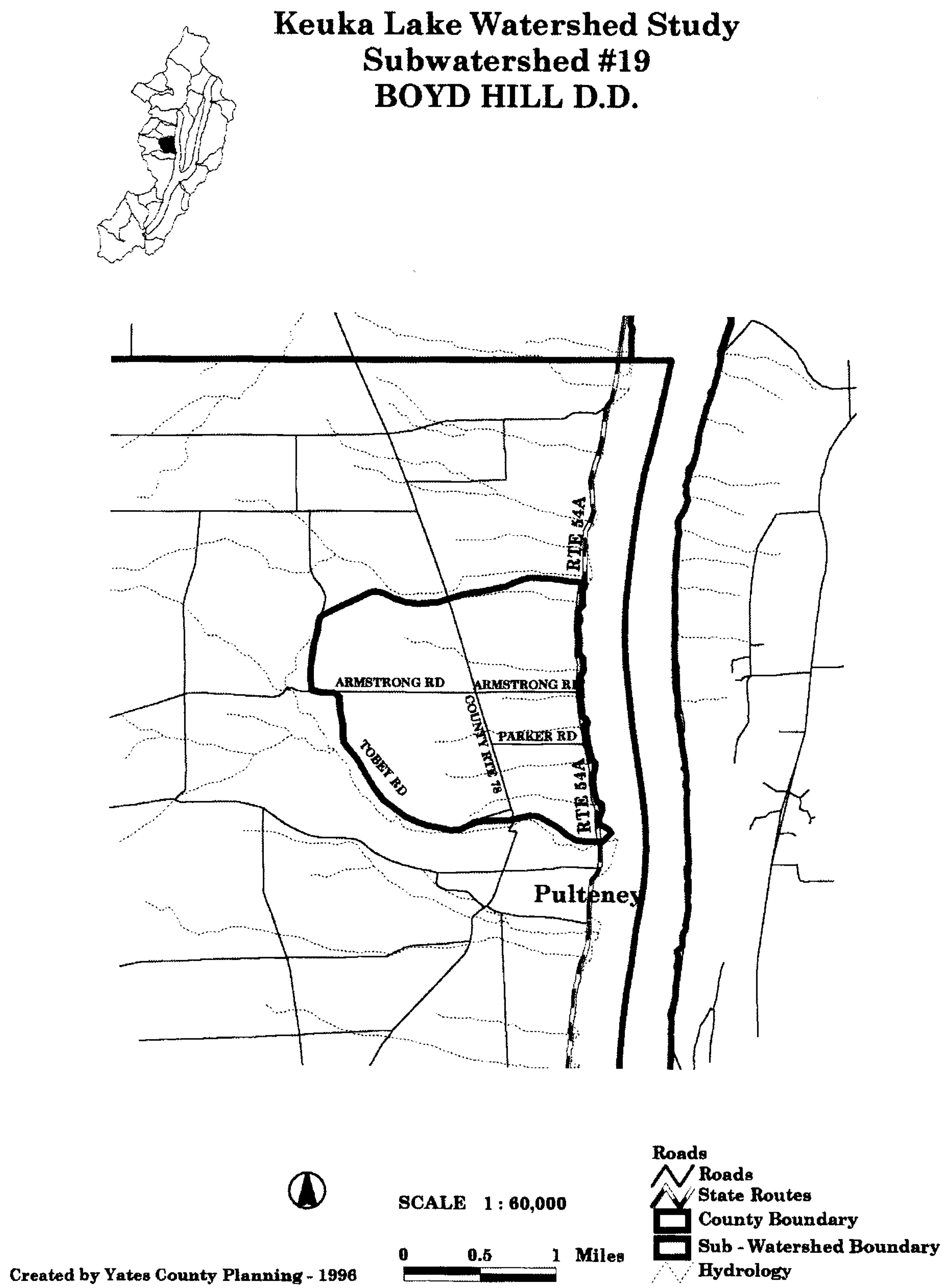

Figure 8-19. Keuka Lake Watershed Study, Subwatershed #19 Boyd Hill D. D..

Keuka Lake Watershed Study
Subwatershed #20
ARMSTRONG ROAD D.D.

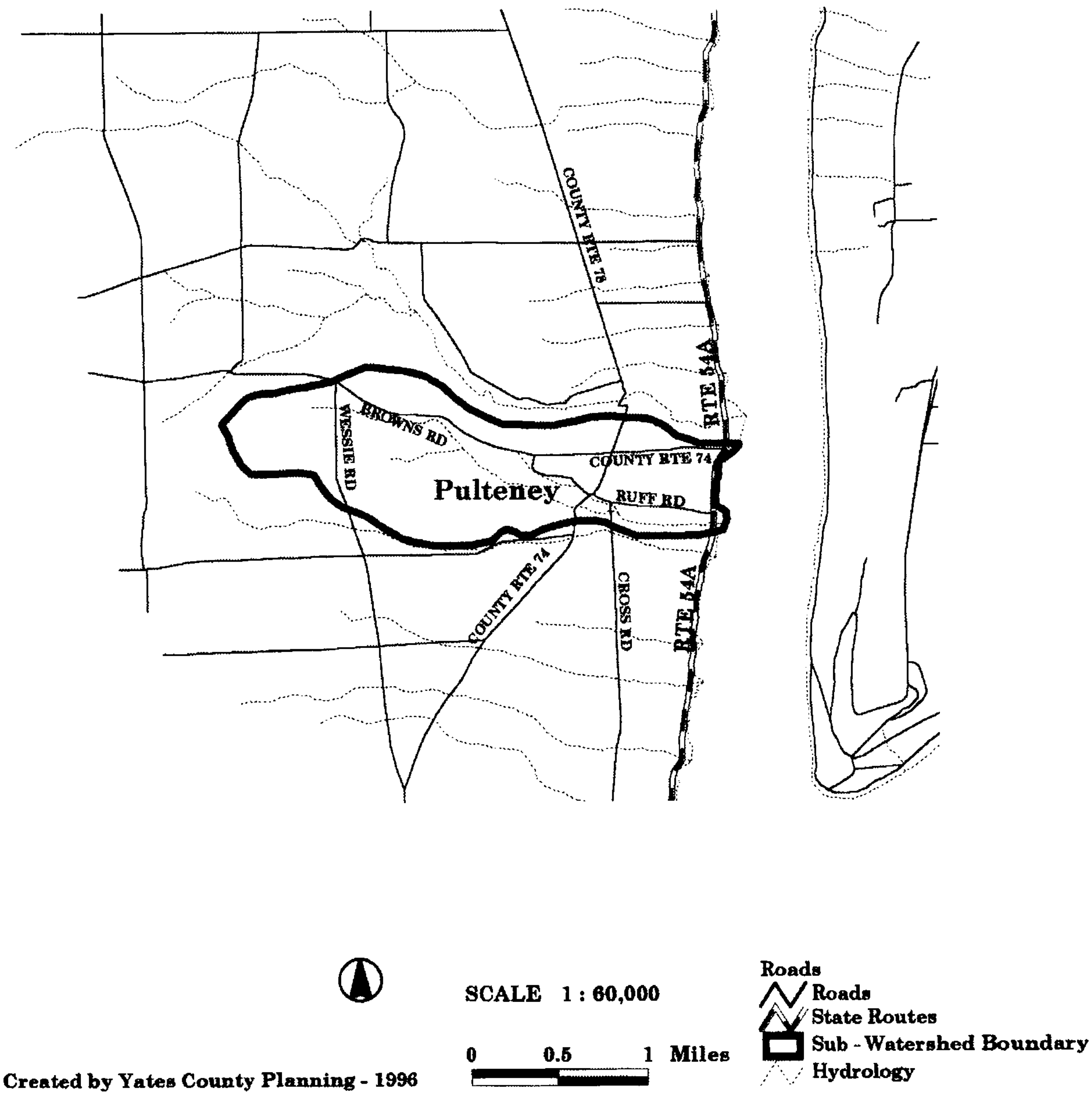

Figure 8-20. Keuka Lake Watershed Study, Subwatershed #20 Armstrong Road D. D..

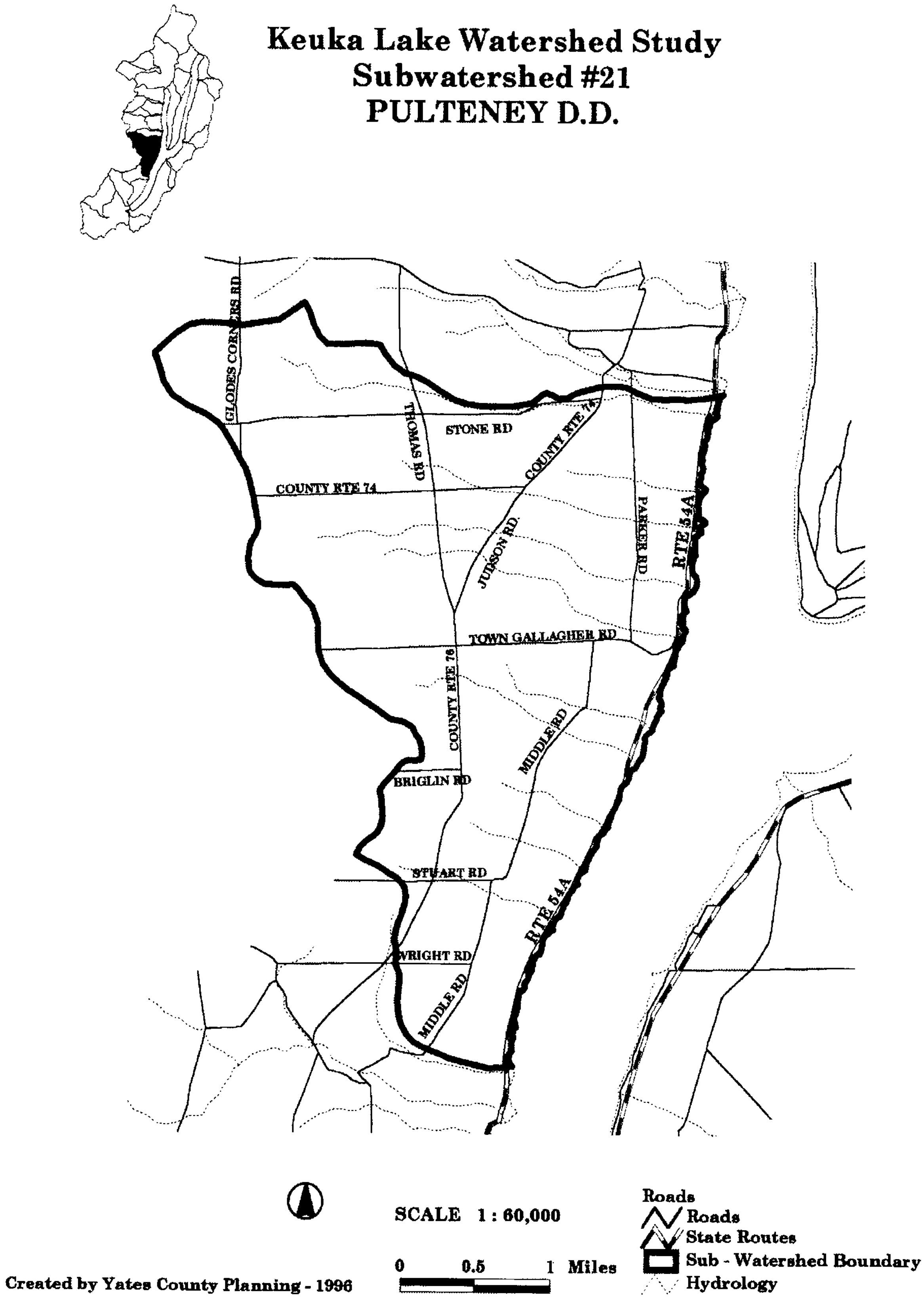

Figure 8-21. Keuka Lake Watershed Study, Subwatershed #21 Pulteney D. D..

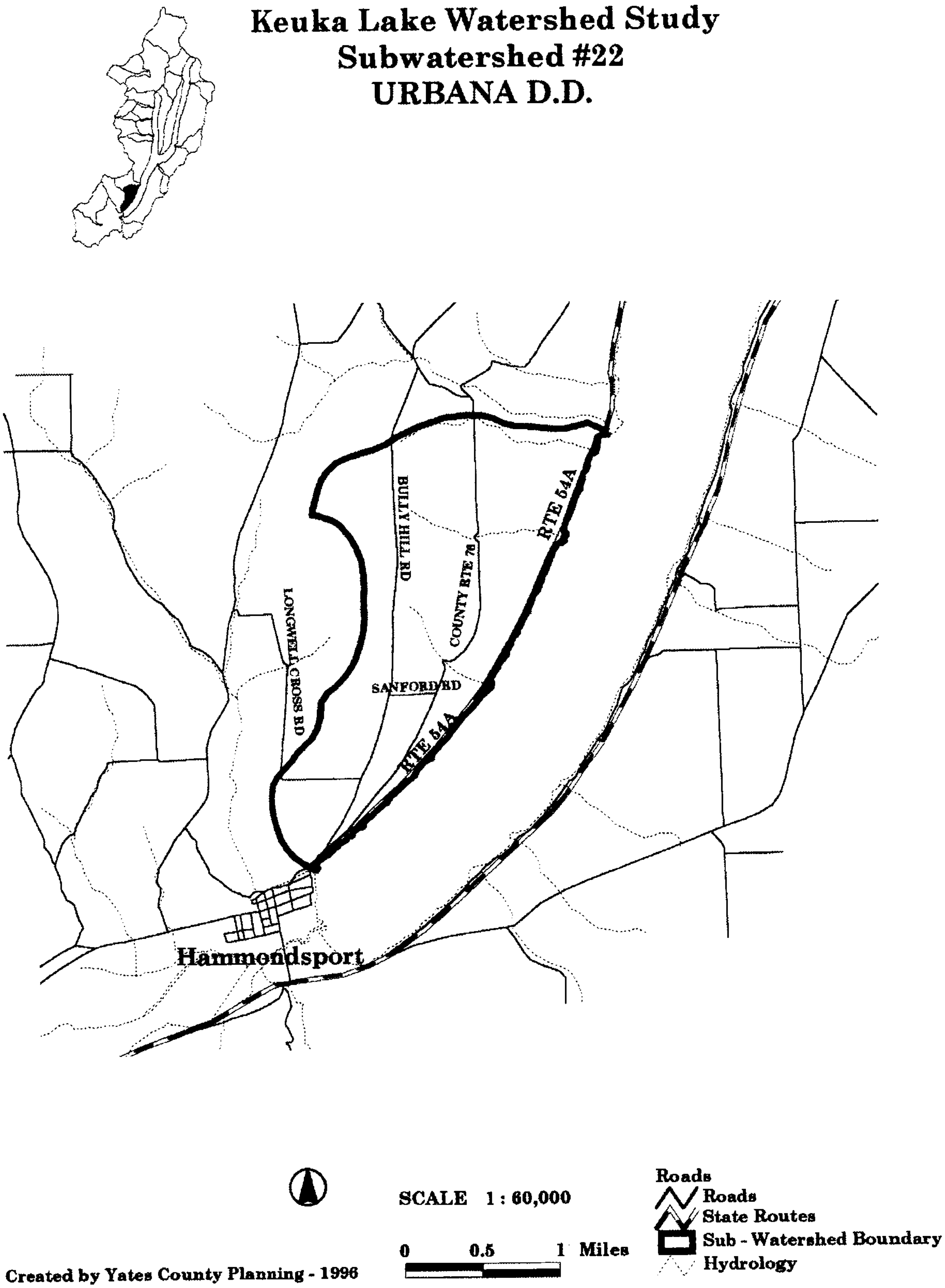

Figure 8-22. Keuka Lake Watershed Study, Subwatershed #22 Urbana D. D..

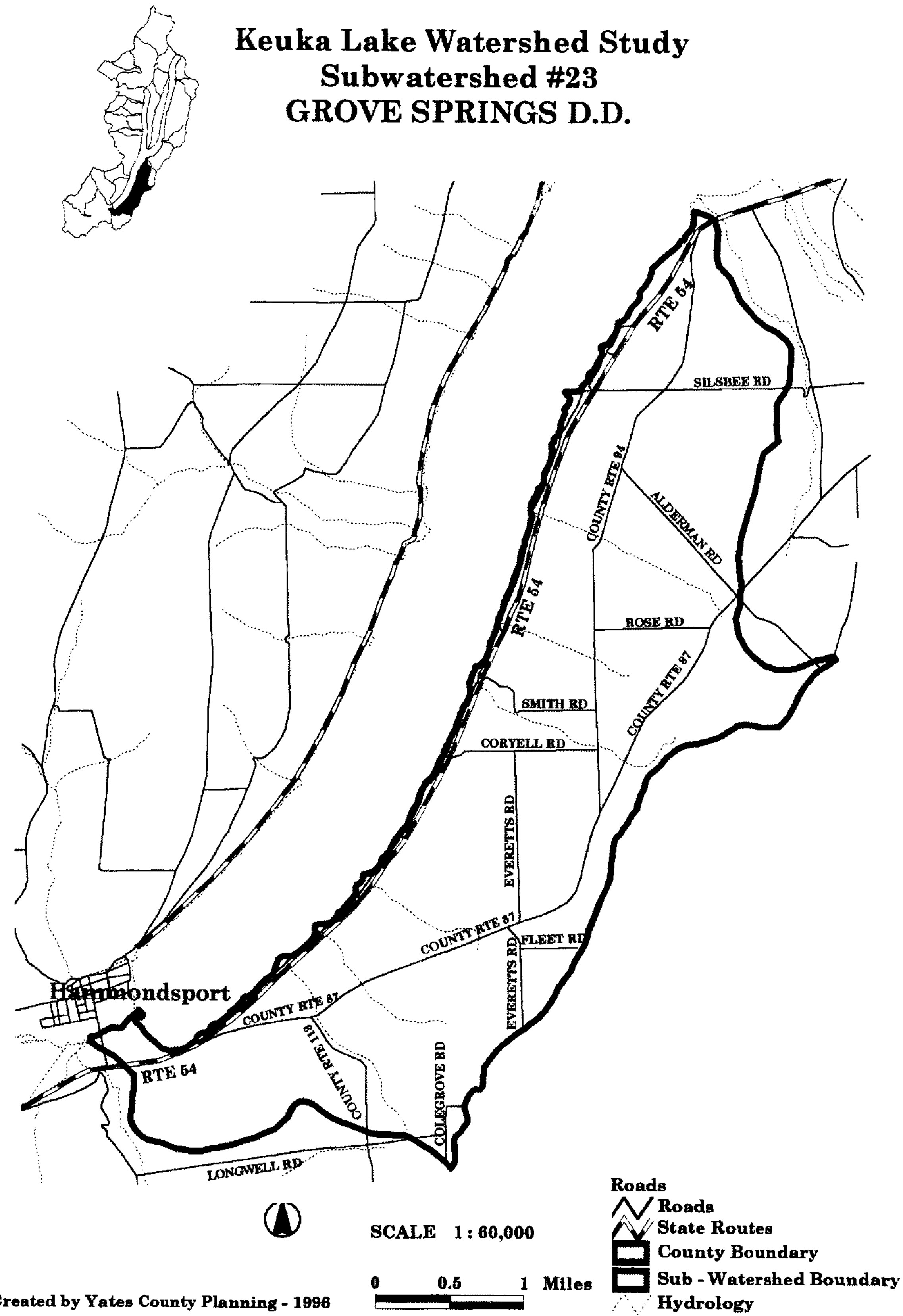

Figure 8-23. Keuka Lake Watershed Study, Subwatershed #23 Grove Springs D. D..

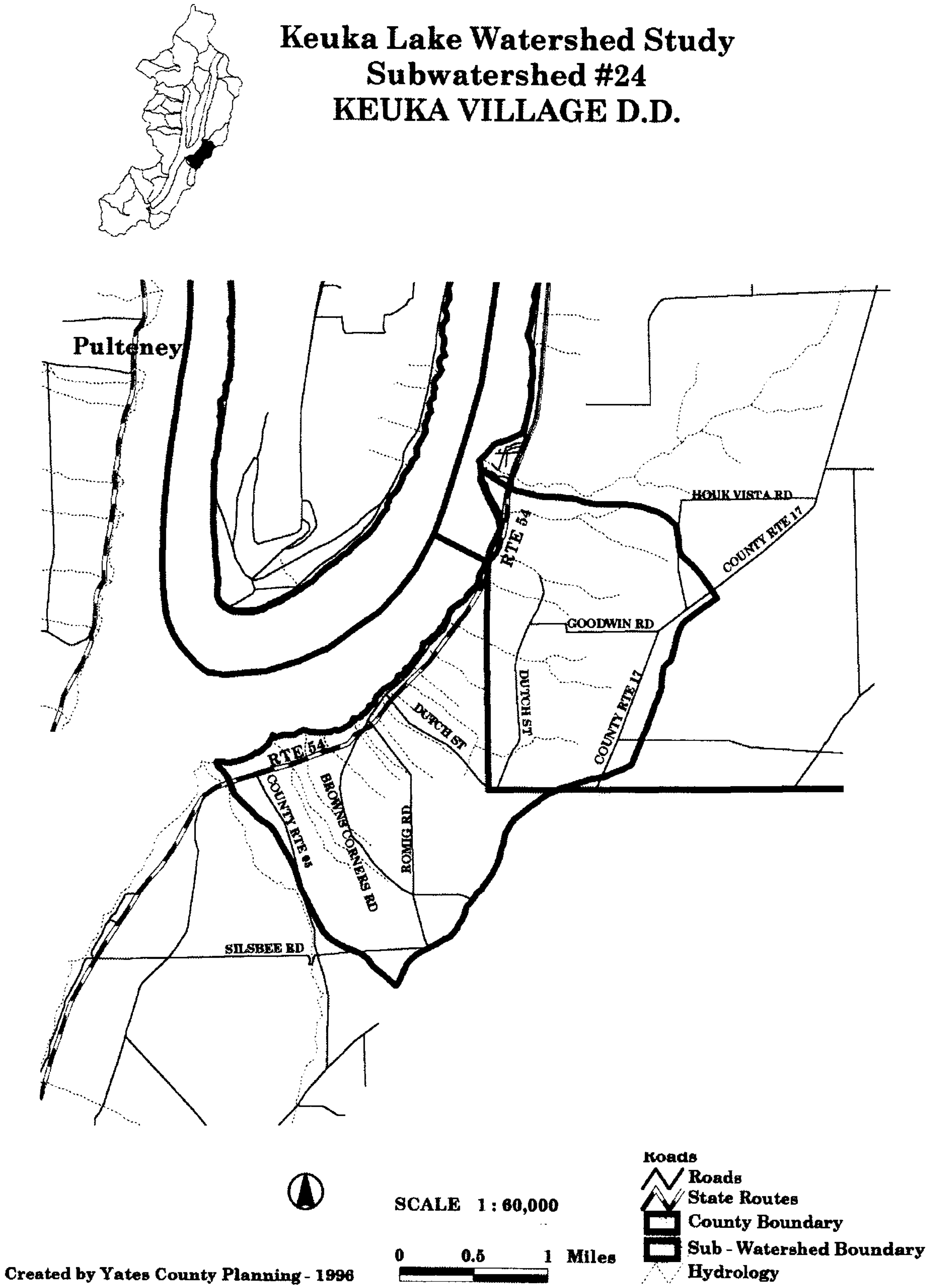

Figure 8-24. Keuka Lake Watershed Study, Subwatershed #24 Keuka Village D. D..

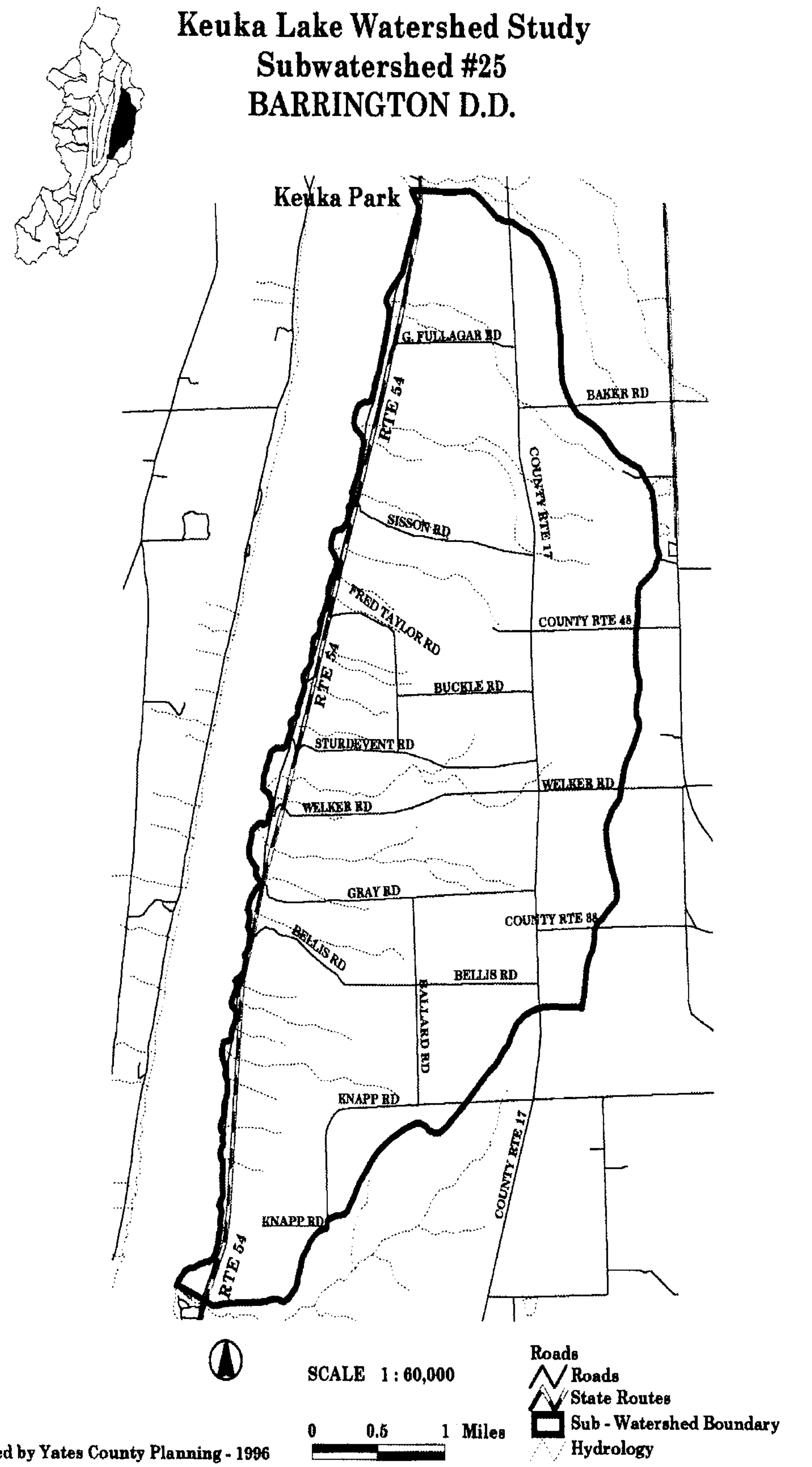

Figure 8-25. Keuka Lake Watershed Study, Subwatershed #25 Barrington D. D..

Figure 8-26. Keuka Lake Watershed Study, Subwatershed #26 Milo D. D..

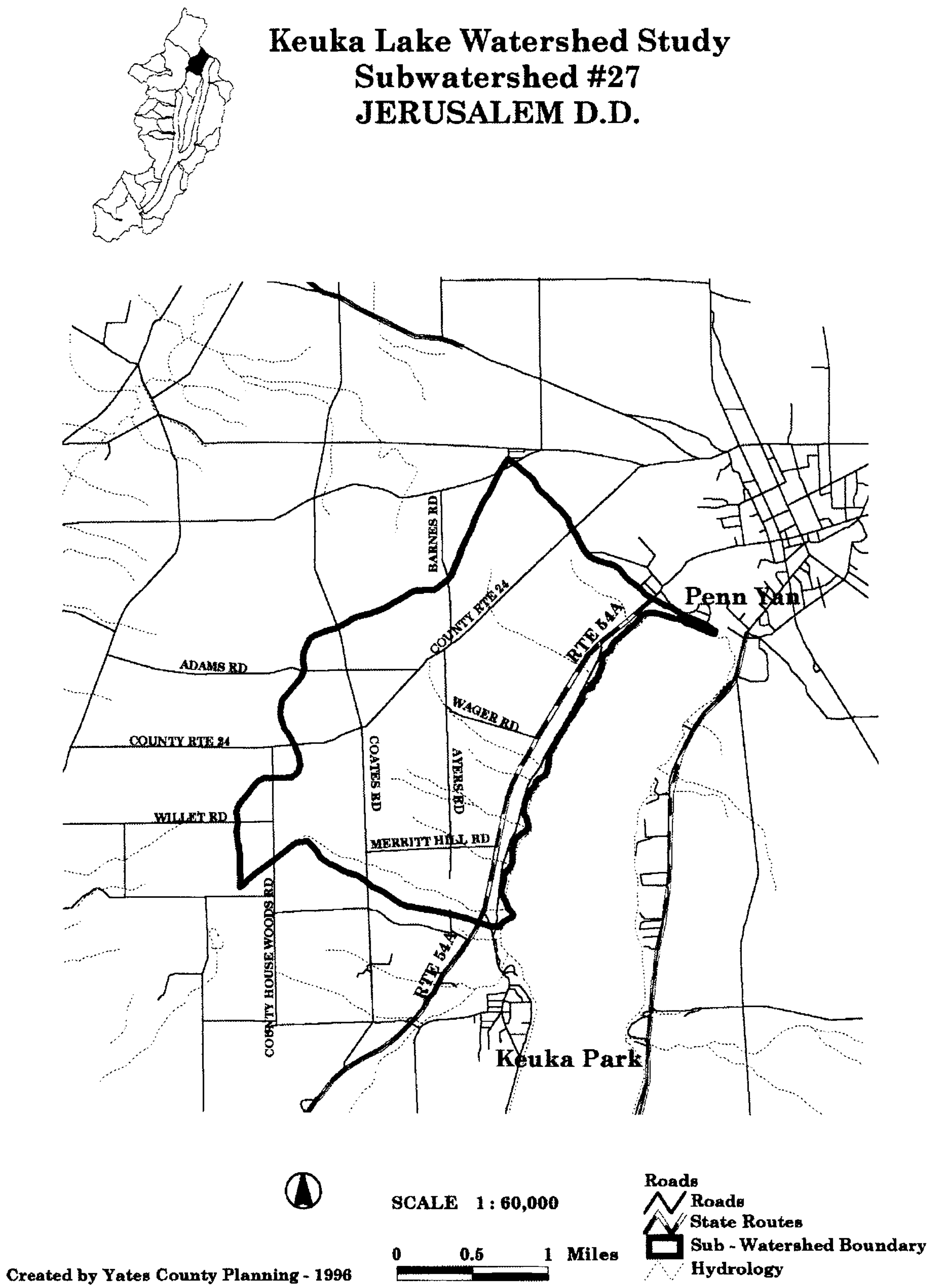

Figure 8-27. Keuka Lake Watershed Study, Subwatershed #27 Jerusalem D. D..

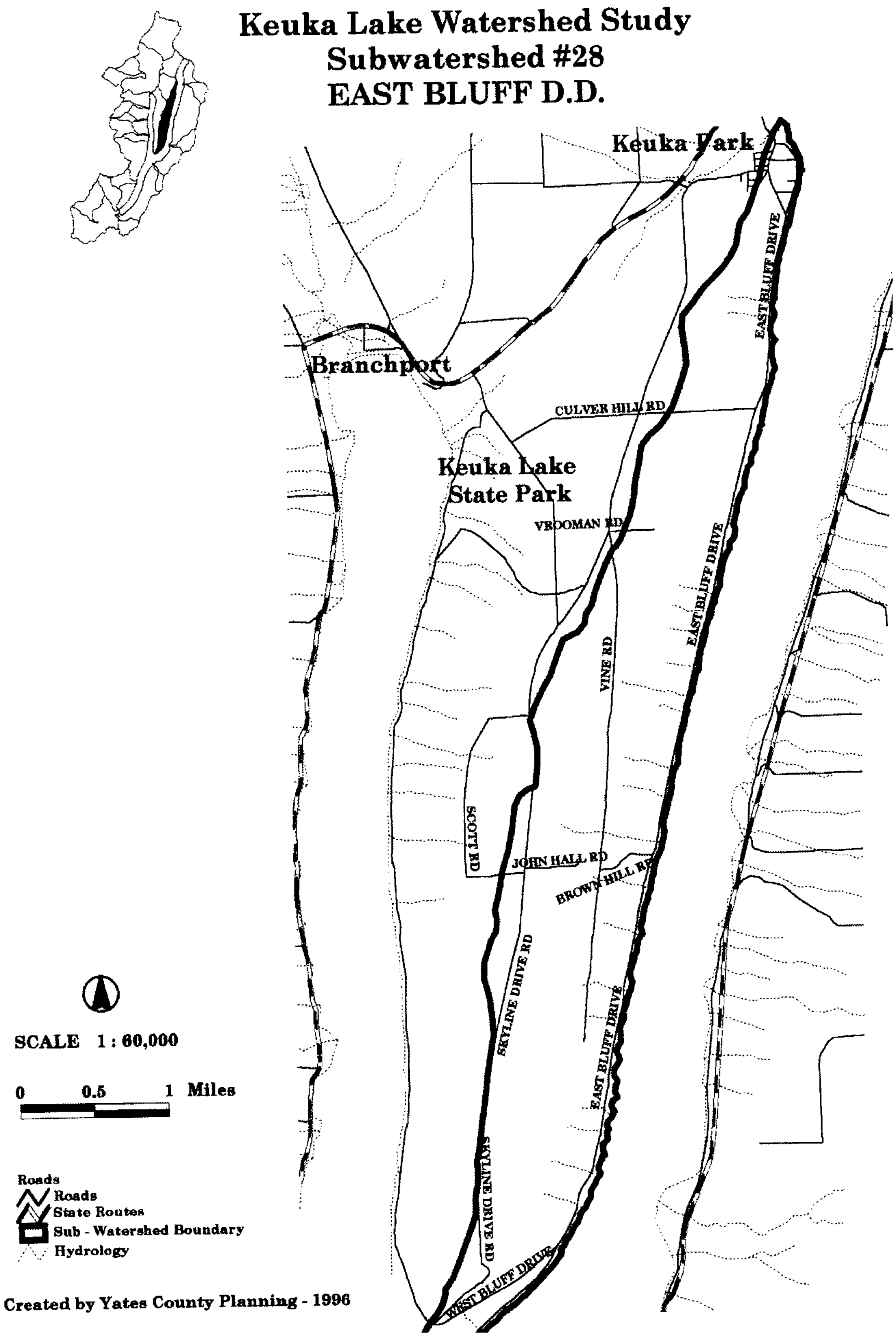

Figure 8-28. Keuka Lake Watershed Study, Subwatershed #28 East Bluff D. D..

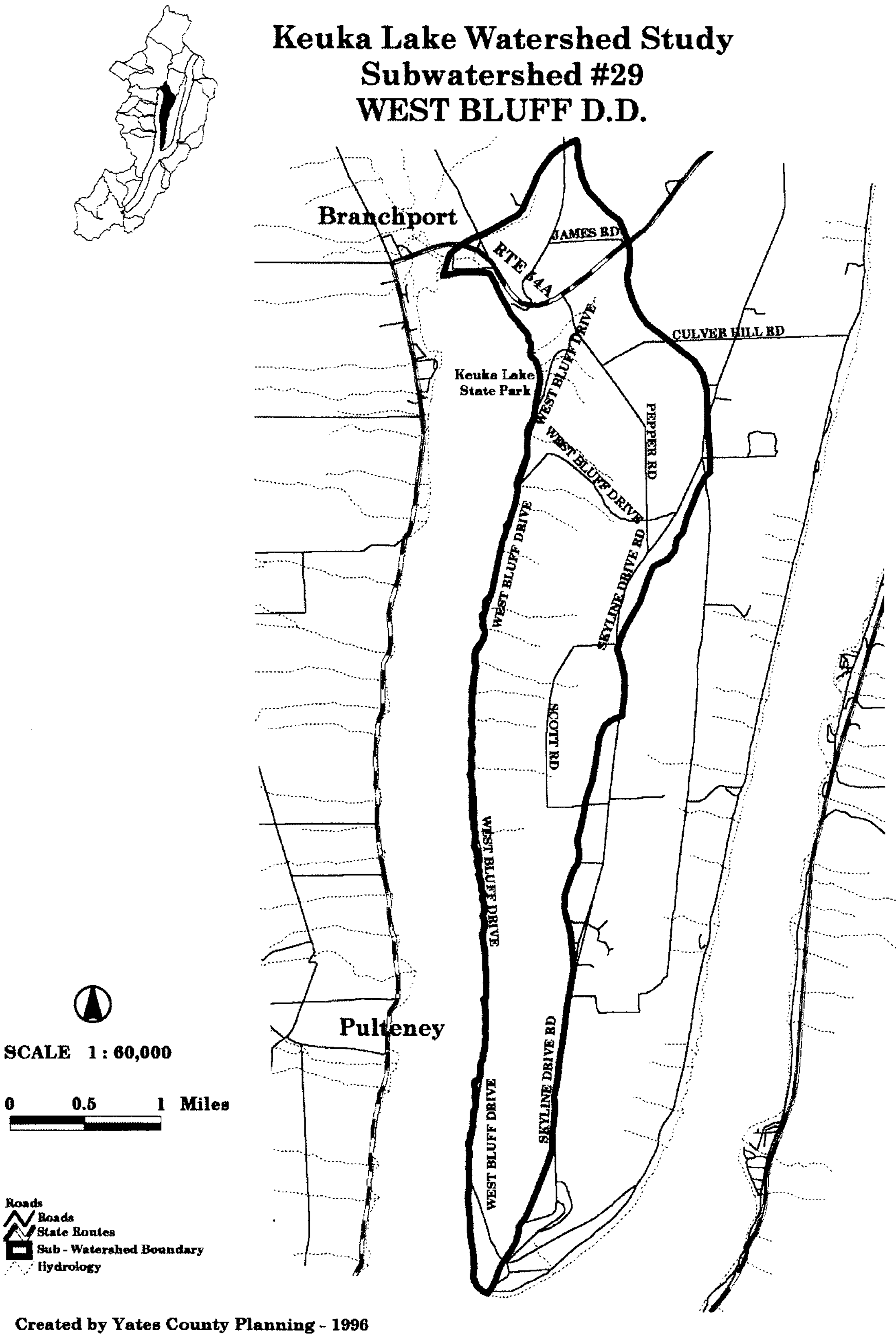

Figure 8-29. Keuka Lake Watershed Study, Subwatershed #29 West Bluff D. D.

PROBLEM DEFINITION

INTRODUCTION

A major step in nonpoint source planning is to verify and describe the level of waterbody impairment. The level of impairment can be determined by examining a variety of information sources including the waterbody classification system of New York State, county nonpoint source assessment reports, stressed stream segments, documented water supply impacts (drinking water), fisheries impacts, beach closures, and water quality monitoring data.

PROBLEM SUMMARY

Best Use Classifications and Containment Standards

The New York Water Quality Standards are the foundation for the state's water pollution control and water quality protection efforts. The standards provide the specific criteria for the management and protection of New York's waters. Both surface and groundwater standards are developed in accordance with state administrative practices, including public hearing. They are approved by the State Environmental Board prior to filing as regulation with the Secretary of State. Adoption of surface water standards must also conform with Federal Regulations, 40 CFR Part 131.

Surface water quality standards are embodied in 6 NYCRR Parts 700, 701, 702 and 704 and include general and numerical values which correspond to several classes of use. The values are considered surrogates, presuming if the standards are met for a waterbody of a class, the use associated with that class can be served. The eight major classes and their significant use are as follows:

Fresh Water Classification

Class N - Natural [1]
Class AA - Drinking (culinary or food processing, coliform < 50/100ml)
Class A - Drinking (culinary or food processing, coliform < 5,000/100ml)
Class B - Bathing
Class C - Fish Propagation
Class D - Fishing

[1] Outside of the Adirondack Park, no tributary in the State is so classified.

Salt Water Classifications

Class SA - Shellfishing
Class SB - Bathing
Class SC - Shell Fish and Fin Fish Propagation
Class SD - Finfishing

Standards for the classes are remarkably similar. Differences occur due to differing uses and differing waters, fresh versus saline.

Concern	Classification
Public Health - Drinking	Class A, AA
Public Health - Bathing	Class B, SB
Public Health - Fish Consumption	Class A, B, C, D, SA, SB, SC, SD
Public Health - Shell Fish Consumption	Class SA
Aquatic Life - Propagation	Class A, B, C, SA, SB, SC
Aquatic Life - Fishing	Class C, D, SC, SD

Standards exist for those classes both for conventional, toxic, and non-conventional pollutants. Conventional pollutant indicators and criteria (e.g. dissolved oxygen and pathogenic organisms) are generally well established and accepted from historic development periods. These standards are revised over time as our knowledge evolves.

Toxic and certain non-conventional pollutants are a more complex issue. Hundreds of thousands of organic and inorganic potentially toxic chemicals exist today. To evaluate candidates for regulation through standards setting, the NYSDEC has established an interagency ambient water quality standards program.

The NYSDEC Division of Water first develops candidate substances for toxicity review by evaluating any discharge permit data and other information sources. Human health and aquatic toxicity scientists in state agencies review the literature to determine availability of toxic effect data.

Protocol for the development of numerical values have been developed through the standards setting process. The literature on a compound is reviewed against the protocol to determine whether enough information is available to propose a value for the compound under scrutiny.

Several issues are reviewed pertaining to public health when studying a toxic chemical including carcinogen potential, acute poisoning effects, and palatability. For aquatic life, poisons, bioaccumulation and tainting are considered.

Once a preliminary determination has been made that a high confidence value can be proposed, it is placed onto the agenda of a scientific review group representing lay experts in the human health and aquatic toxicity field. After their review, the substance is placed onto the agenda for inclusion as a standard with the next update of the water quality regulations.

The Federal Clean Air Act, Section 303(c) requires regular review and revision of water quality standards and classifications. Surface water classifications (6 NYCRR Parts 800-941) must "serve the purpose of the Act". This means that water quality standards should, whenever attainable, provide water quality for the protection and propagation of fish, shellfish and wildlife and for recreation in and on the water and take into consideration their use and value for public water supplies. These requirements and goals are embodied in 40 CFR Part 131. If the state does not believe that a waterbody can attain these uses, a use attainability analysis must be conducted. This is a structured scientific assessment as the factors affecting the attainment of the uses which may include physical, chemical, biological, and economic factors.

Section 17-0301 of the Environmental Conservation Law (ECL) provides the legal basis for classification of the state's waters. The Law requires that all classifications "be made in accordance with consideration of best usage in the interest of the public" based on the following:

a. The size, depth, surface area covered, volume, direction and rate of flow, stream gradient and temperature of the water.

b. The character of the district bordering said waters and its peculiar suitability for the particular uses and with a view to conserving the value of the same encouraging the most appropriate use of the bordering said waters, for residential, agricultural, industrial or recreational purposes.

c. The uses which have been made, are being made, or may be made of said waters for transportation, domestic and industrial consumption, bathing, fishing and fish culture, fire prevention, the disposal of sewage, industrial waste and other wastes, or other uses within the state, and at the discretion of the department, any such uses in another state or interstate waters flowing through or originating in this state.

d. The extent of present defilement of fouling of said waters which has already occurred or resulted from past discharges therein.

These requirements are set forth in detail in 6 NYCRR Part 609. This part also requies public hearings to be held on any reclassification. Reclassification can be proposed by the public or the Department.

Although closely related, there is a distinct difference between classifications and standards. The classification refers to the intended best usage of water as represented by alphabetic designations, whereas standards refer to specific pollutant criteria or indicators in a waterbody. Standards are established for each classification but all classifications which require quality at least equal to that particular classification (e.g. Class A, intended as drinking water, is also usable for bathing and fishing). Water quality standards are adopted and assigned to all classified waters of the State (ECL Section 17-0301(4)) The official classifications are contained in 6 NYCRR Parts 800-941.

The classification program was initially completed in 1965 after field surveys initiated in 1950 culminated in the production of some 60 reports and public hearings covering all 17 major drainage basins in the State. From 1966 to 1981, reclassification of specific waterbodies was routinely carried on through public hearings. During this time, some one thousand waterbody segments of more than 10,000 statewide were reclassified. The largest group involved upgrading waters from fishing to trout propagation and spawning as recommended by the Department's Fish and Wildlife Division. There were no downgrading of classifications during this period.

The reclassification program has been re-instituted to consider requests for additional changes. It is anticipated that requests will continue to relate primarily to fisheries concerns with some proposals for bathing waters and other uses.

Groundwater standards and classifications (6 NYCRR Part 703) provide enforceable targets for management of quality for the best usage of the groundwater in any particular locality and the maximum allowable concentrations of various pollutants in the groundwater according to the intended best usage. These standards and classifications are adopted pursuant to the Environmental Conservation Law, Sections 17-0301 and 17-0809. There are currently no federal requirements for the development of groundwater standards and classifications.

Effective September 1, 1978, the Department revised its regulations entitled Groundwater Classifications, Quality Standards and Effluent Standards and/or Limitations for the purpose of preventing pollution of groundwater and protection of the groundwater for use as potable water. There are three classes of groundwater within the system:

> Class "GA" - The best usage of Class "GA" waters is as a source of potable water supply. Class "GA" waters are fresh groundwater found in the saturated zone of unconsolidated deposits and consolidated rock or bedrock.
>
> Class "GSA" - The best usage of Class "GSA" waters is as a source of potable mineral waters, or as raw material for the manufacture of sodium chloride or its derivatives or similar products. Such waters are saline waters found in the saturated zone.
>
> Class "GSB" - The best usage of Class "GSB" waters is as a receiving water for the disposal of wastes. Such waters on those saline waters found in the saturated zone which have a chloride concentration in excess of 1,000 milligrams per liter or total dissolved solids concentration in excess of 2,000 milligrams per liter.

All fresh groundwater in the state are classified as "GA" reflecting the policy that the best usage of fresh groundwater in the state is for sources of drinking water.

Numerical standards for Class "GA" groundwater are identified for over 75 pollutants, including various metals, chloride, foaming agents, nitrate, Ph, numerous pesticides and some organic solvents. As in the case of Surface Water Standards, The Department's ambient water quality standards program proposes revised and new values for inclusion in updating of these standards.

Effluent limitations are also identified for a similar list of substances and are applicable to all point sources of pollution. In addition, no discharge is allowed which would preclude the best use of Class "GA" waters.

Narrative statements for Class GSA and GSB, without specific ambient or effluent standards, require that no discharge be allowed which would affect the use of that class or other state classified waters.

There are many documented contravention's of best use classifications and contaminant standards for Keuka Lake and tributaries within the Keuka Lake watershed as described in the limnology chapter 6. Bacterial levels often exceed the 50 colonies/100 ml standard, sediment levels are often elevated "beyond natural conditions" after storm events or as a result of a particular land disturbance activity (i.e., roadbank project). For the most part, however, these disturbances are temporary do not seem to have lasting impacts, but may pose risks during the actual event. The NYSDEC has recently upgraded all streams within the watershed from class D to Class C. Sugar Creek and Cold Brook are the only classified streams in the watershed they are class A and C respectively.

County Nonpoint Source Assessment Report and Priority Water Problem List

In 1989 the NYSDEC began a program to increase knowledge of nonpoint source pollution in New York State. This effort was to provide a better indication of the number of waterbodies affected by nonpoint sources and to obtain more information about source subcategories of concern. The Water Quality Act of 1987 focused increased attention and priority on the development and implementation of nonpoint source control programs. Section 319 of the Act required states to prepare as Assessment Report identifying waterbodies affected by nonpoint source pollution, determining categories of nonpoint sources that are significant problems in the state and listing state programs available for the control of nonpoint source pollution. There are three primary NYSDEC publications relating to nonpoint source management:

a. Nonpoint Source Management Program, NYSDEC, January 1990

b. New York Nonpoint Assessment Statewide Summary, NYSDEC, June 1990

c. NY Nonpoint Assessment Report for Yates County, NYSDEC, June 1990

The Assessment Report identifies numerous waterbodies in the state that are affected by nonpoint source pollution. The Assessment Report was assembled based upon some hard data, but more often based on local, non-scientific observation and local knowledge. The Report should be viewed as a listing in many cases of suspected problems, most of which need more site verification. The Assessment Report cannot be viewed as a complete and final list of impaired waterbodies. The Assessment Report recommended that water quality problems be updated and enhanced on a regular basis by utilizing the following six methods:

1. Use additional sources of information to identify possible nonpoint source impacts.

2. Provide an opportunity for everyone with knowledge of nonpoint source problems and sources to present this information.

3. Refine the information provided with more details on specific nonpoint sources.

4. Expand the database to include waterbodies that are stressed or threatened by nonpoint source pollution.

5. Develop a statewide organized data management system for groundwater quality.

6. Maintain a real time assessment of water quality problems in the state.

The Priority Water Problem List (PWP) is a list of surface waterbodies whose use is impaired. The list is used as a base for water program management, both generally and for specific issues. It can demonstrate broad shifts in program issues over time, and generate baseline information for specific program elements. Further, it is used in the priority scoring for the State Revolving Fund, and in meeting Federal mandates including the Biennial Water Quality Report CWA Section 305(b), and the listing of use impaired waters required by CWA Section 304 (i). There are two NYSDEC documents relating to the PWP list:

a. 1995 Priority Water Problem List, NYSDEC

b. 1995 Priority Water Problem List, Region 8, NYSDEC

The PWP is issued every two years and has been in existence since 1982. Information for each waterbody includes the problem, casual agent, and source. Each waterbody data report represents a consensus finding of a panel consisting of the Regional Water Engineer, Regional Fisheries Manager, and a senior member of the Bureau of Monitoring and Assessment.

Every waterbody in the state has been classified according to its "best use". Each use has a set of standards associated with it that limit the concentrations of various contaminants that can be present in the water. These classifications and their standards are the basis for assessing water quality. A water quality problem exists only where a classified use is affected. The effects can range from precluding a classified use to threatening the ecosystem. The table that follows identifies the categories of impacts.

Table 9-1. Categories of impacts.

CATEGORIES OF IMPACTS
Precluded: Water quality and/or associated habitat degradation precludes, eliminates or does not support a classified use; natural ecosystem functions may be significantly disrupted. This category is used for the most severe impacts.
Impaired: Water quality and/or habitat characteristics frequently impair a classified use. Also applied when the designated use is supported, but at a level significantly less than would otherwise be expected. Natural ecosystem functions may be disrupted. These waters have severe impacts.
Stressed: Reduced water quality is occasionally evident and designated uses are intermittently or marginally restricted; natural ecosystem may be disrupted. These waters have moderate impacts.
Threatened: Water quality presently supporting designated use and ecosystem experiencing no obvious signs of stress; however, existing or changing land use patterns may result in restricted usage or ecosystem disruption. These waters have the least impacts.

For Keuka Lake, the 1995 DEC PWP lists the following information:

Table 9-2. NYSDEC priority water problem list, Keuka Lake.

Use Impairment	**Severity**	**Documentation**
Water Supply	Threatened	Some
Bathing	Stressed	Some
Fish Consumption	Impaired	Good
Fishing	Impaired	Good
Aesthetics	Stressed	Some
Boating	Stressed	Some
Type of Pollutants		
Pesticides	Nutrients	Silt
Oxygen Demand	Salts	Pathogens
Aesthetics		
Sources of Pollutants		
Contaminated Sediments	Agriculture	Construction
Land Disposal	Onsite Wastewater	Streambank Erosion
Roadbank Erosion		
Resolvability	Needs study and management plan	
TMDL	Technical Limitations	

Further details in the PWP describes the following:

"Use impairment: The fish consumption advisory on lake trout over 25 inches (eat no more than one meal per month) impairs the fishing use on the lake. The advisory is due to DDT in fish flesh. DDT in Lake sediment is a result of nonpoint sources. Every three years the Finger Lakes Trends Program studies lake trout for continued contamination; data collected in 1991 and reported in 1993 showed an apparent decline since 1988, particularly in older fish. Suspected source may be abandoned DDT buried underground in the area adjacent to the tributaries north of the Waneta Lake diversion.

Erosion from a variety of sources leads to areas of localized sedimentation and contributes to excessive aquatic macrophyte growth. There is also localized near shore degradation due to failing septic systems in Hammondsport, Branchport and lake shore cottages. This stresses swimming, boating and aesthetics in certain areas of the lake. The shoreline is ringed with development; many camps are on small lots with poor soils. This is a concern with development in areas with steep slopes and poor soils as some towns have no zoning or site review requirements. The Town of Pulteney in particular has a problem with septic systems. A septic survey done by Yates County Planning Office indicated that a substantial number of systems may be failing. The Keuka Lake Association Water Quality Monitoring Program found historically high fecal coliform levels during the 1994 sampling season (KLA, 1995). Steuben County has initiated a weed harvesting program at Champlain Beach in Hammondsport to permit swimming. Weed harvesting seems to be a viable solution for now. The Lakes Section did a study which indicated the 60% of the available phosphorus in this lake can be attributed to on-site systems.

Roadbank erosion in watershed is very high. There are steep slopes and many dirt roads. Very little is done to protect roads and ditches from erosion after maintenance. Road ditch erosion is especially a problem in the Town of Jerusalem. SWCD is starting a hydrseeding program to address this issue. There is also a high concentration of salt used on the roads. It is used for deicing in the winter and for dust control in the summer. Chloride testing is needed for the lake water.

The primary agricultural contribution is from vineyard erosion. This is considered a minor source comparatively. Waneta Lake Diversion is a possible source of nutrients to this lake. Cold Brook, Glen Brook and Wagener Glen are streams feeding into the lake which carry heavy sediment loads."

Source of Information: NYSDEC Regional Water and Fisheries Unit and Central Office

Many of the above issue are reviewed in Chapters 6 and 7 of this report. The issue of DDT contamination in fish is reviewed in Chapter 7. Fortunately, the DDT trend in fish flesh is downward and field surveys are being conducted by DEC to ascertain land sources at the time of this publication.

As for septic systems, the current KWIC program requiring uniform standards, maintenance and enforcement is a step in the right direction. In addition, areas along the Bluff in Jerusalem and on the east side in Milo are in the process of studying or designing water/sewer projects.

While nuisance aquatic weed levels do pose some problems during the summer in some areas, they are generally considered limited and the benefits for the fishery probably outweigh the negative impacts. In addition, the recent introduction of aquatic moths and weevils into the Finger Lakes may help alleviate most the problems associated with Eurasian milfoil. These exotic species have been discovered and studied in Keuka Lake by Dr. Bob Johnson at Cornell University and may in the future help reduce the problem. As a result of these issues, Yates County has stopped the weed harvesting program on Keuka Lake and Stueben and cut their program back considerably.

Roadbank erosion was studied extensively and is reported in Chapter 7 and there are many areas of "very severe" erosion which are not limited to the Town of Jerusalem. As a result of this study, Clean Water Bond Act funding was obtained for roadbank protection.

In terms of deicing salt storage and usage, this was also studied and presented in chapter 7. The results indicate that salt application in the watershed is modest overall and all of the towns have or are in the process of building storage facilities. Chloride testing has been conducted in the lake and no elevated levels have been observed. Stream testing has found higher levels in some streams during some storm events.

Erosion from agriculture was studied extensively in Chapter 7 and the conclusion was that while the impacts on the lake itself are not severe, the vast majority of sediment and nutrients are coming from agricultural operations (85%).

Several studies over the years have been conducted to determine the possible contributions of pollutants from the Waneta Lake hydropower diversion canal. The studies indicate that while the levels of nutrients, sediments and bacteria are somewhat higher, they are not significantly higher. Perhaps more importantly, NYSEG has decided (1998) to close the plant and dismantle the canal, rendering this point mute.

IMPLEMENTATION OPTIONS

This final chapter provides two major elements: a listing of best management practices (BMP) for each potential pollution source and implementation options by pollution source presented in the form of Pollution Prevention Worksheets (PPW). BMPs are any type of management practice that minimizes or eliminates pollution, has been tested in the field, and is economically feasible for most applications.

The listings of BMPs and the options listed in the PPWs are the result of the analysis of sources of pollution in Chapter 7 and a review of nonpoint source pollution prevention literature by the authors. These are not a prescription for what has to be implemented in the Keuka Lake watershed, rather, they are options for the watershed community to consider and serve as a basis for developing an implementation plan.

AGRICULTURAL BEST MANAGEMENT PRACTICES

The Keuka Lake watershed encompasses 100,800 acres of land. Agriculture is an estimated 34,300 acres representing 34% of the land within the watershed. Of the estimated 365 farm operations in the Keuka Lake watershed, approximately 37% of these report having livestock. The amount of agricultural land devoted to various crops was reported as follows: 40% hay, 20% corn, 24% vineyard/orchard, 13% small grains and the remaining 3% in vegetables and other fruit.

Suitable agricultural best management practices BMPs are identified in the *Management practices catalogue for nonpoint source pollution prevention and water quality protection in New York State* (NYSDEC, 1993). Selected BMPs were chosen based on the following concerns:

1) Practices that are applicable and consistent with the level of detailed information collected to date;

2) Practices that are applicable with a minimum of technical assistance; and

3) Practices that are generally accepted and used within the Keuka Lake watershed.

Table 10-1. Agricultural best management practice recommendations for the Keuka Lake Watershed.

Ref #	Agricultural BMPs	Ref #	Animal Concentration BMPs
1	Crop Rotation	1	Barnyard Runoff Management
2	Minimum-Till	2	Manure Storage Systems
3	No-till	3	Manure Nutrient Analysis
4	Contour Farming	4	Land Application of Manure
5	Stripcropping	5	Rotational Grazing
6	Filter Strips		
7	Nutrient Management		
8	Soil Testing		
9	Vineyard Mulching		
10	Permanent Vegetative Cover		
11	Construction Practices		
	Diversions, Waterways, Terraces		
	Integrated Pest Management		
12			

PETROLEUM AND CHEMICAL BULK STORAGE BEST MANAGEMENT PRACTICES

1. New York State Permit System

Petroleum And Chemical Bulk Storage are non-point sources that are already being monitored by New York State Department of Environmental Conservation. The information in this report was obtained from DEC records.

Communication could be improved and municipal planning officials should be made aware of the status of bulk storage facilities within its municipalities. Location, type and quantity of bulk storage information could be used for additional comprehensive land use management decisions. The status of closed bulk storage facilities and the status of tank removal or other means of closing the tanks should be closely monitored by local municipal planning officials for potential surface and/or groundwater contamination sites.

A local watershed agency should be in communication with DEC to receive regular activity reports of the New York State Permit System.

Possible Agency(s):
1. Keuka Watershed Improvement Cooperative (Watershed Manager)
2. Keuka Lake Association (KLA)
3. Yates County Planning Department (YCPD)
4. Cornell Cooperative Extension- Yates County (CCE)

INACTIVE HAZARDOUS WASTE DISPOSAL SITES BEST MANAGEMENT PRACTICES

1. New York State Permit System

Hazardous Waste Disposal Sites are a non-point source that is already being monitored by New York State Department of Environmental Conservation. The information in this report was obtained from DEC records. The two sites within the Keuka Lake watershed are known by DEC and remediation projects are underway.

However, new sites will be identified over time, and appropriate remediation projects will be designed and implemented. A local watershed agency should be in communication with DEC to receive regular activity reports of the New York State Permit System. The status of the inactive hazardous waste disposal sites should be monitored by local municipal officials until the site contamination has been remediated. This would not be a duplication of reporting but simply establish an effective liaison for communication between New York State, local governments, and agencies with water quality responsibilities in the watershed (SWCD, YCPD, CCE)

Possible Agency(s):

1. Keuka Watershed Improvement Cooperative (Watershed Manager)
2. Keuka Lake Association (KLA)
3. Yates County Planning Department (YCPD)
4. Cornell Cooperative Extension- Yates County (CCE

2. Identifying Unreported Inactive Hazardous Waste Disposal Site.

While DEC does an effective job in monitoring and encouraging remediation of identified hazardous waste sites, there is the suspicion that there may be unreported sites in the watershed. (see "Landfill" section).

A study should be conducted of all known landfills and dumps (permitted and unpermitted) in the watershed. This analysis would include researching historic records for physical design, operation, and period of activity, with site evaluation if possible to determine material disposed in each site. This research may lead to having historic landfills classified as Inactive Hazardous Waste Disposal Sites.

Possible Agency(s):

1. Keuka Watershed Improvement Cooperative (Watershed Manager)
2. Keuka Lake Association (KLA)
3. Yates County Planning Department (YCPD)
4. Cornell Cooperative Extension- Yates County (CCE)

HAZARDOUS WASTE SPILLS
BEST MANAGEMENT PRACTICES

1. New York State Permit System

Hazardous Waste Spills are a non-point source that is already being monitored by New York State Department of Environmental Conservation. The information in this report was obtained from DEC records. However, the status of hazardous waste spills reported, the type of chemical and the status of the clean up should be monitored by local municipal planning officials for potential sources of surface and/or groundwater contamination

A local watershed agency should be in communication with DEC to receive regular activity reports of the New York State Permit System. Again. this would increase communication between New York State, local governments, and agencies with water quality responsibilities in the watershed (SWCD, YCPD, CCE)

Possible Agency(s):

1. Keuka Watershed Improvement Cooperative (Watershed Manager)
2. Keuka Lake Association (KLA)
3. Yates County Planning Department (YCPD)
4. Cornell Cooperative Extension- Yates County (CCE)

2. Education

114 hazardous waste spills were reported in the watershed in a 20 year period of DEC record-keeping. The majority of these spills were petroleum products in relatively minor quantities (less than 50 gallons). Perhaps, many of these spills could have been avoided with better handing practices. Therefore, the key to "remediating" the impact of hazardous waste spills in the watershed is to decrease the likelihood of their occurrence. Educational programs for boaters and lakefront home-owners may significantly reduce the number of spills that occur.

Possible Agency(s):

1. Keuka Lake Association
2. Cornell Cooperative Extension- Yates County

INACTIVE LANDFILL BEST MANAGEMENT PRACTICES

Inactive landfills have been closed and should be properly covered with dirt and vegetation. In some cases, dumping may still be going on of which some is non-polluting and known, and other polluting and not known.

BMP's for Town officials:

1. Check closure and complete it properly.
2. Check for additional dumping and post "No Dumping" signs.
3. Check periodically with the KLA water quality monitoring to see if a nearby tributary or lake has tested positive for organic toxics or heavy metals.
4. Remove the rubbish and waste that might be toxic.
5. Include in the previous educational program a portion for inactive landfills that emphasizes toxics and how to protect oneself from clandestine dumping and inactive landfills.

BMP's for private citizens:

1. Monitor dumps for signs of pollution such as oil stains or drums and report to KLA/DEC.
2. Use recycling facilities, county dumps and garbage collection.
3. Become aware of informal (hidden) sites on private land, especially the sides of tributaries and in gullies and act either formally or informally about the problem as described above.

REFERENCES

1. Colgan, John W. et al. "Diet for a Small Lake", Federation of Lake Associations, Inc., Rochester, NY. Draft, Spring 1989.
2. Land Use Committee, KLA, Research

AUTOMOTIVE JUNKYARD BEST MANAGEMENT PRACTICES

"A management practice is any procedure that prevents or reduces the availability, detachment or transport of pollutants. Control of any one of these phases can reduce pollutant yield to waterbodies. Pollutants that can be controlled through the use of management practices include sediment, nutrients, pesticides and pathogens". (Reference 1, Chapter 7, page 5).

From a list of approved practices, the Best Management Practices, or BMP's, can be selected to address specific pollutant problems, site variables, management, operation and budget.

AUTOMOTIVE JUNKYARDS
A State law (Section 136) applies to management of automotive junkyards. This law is called out by local towns or the town introduces its own set of regulations, or, as in the case of one town in the watershed, uses the special permit process. The regulations refer to aesthetic control (eight foot high fencing) and not being sited too close to a church (500 feet or greater) for sound and odor pollution control.

BMP's recommended for pollution control of the toxics in the automotive junk entourage, remaining and being removed have to be voluntary on the part of the junkyard operator at this time, since there are no regulations in the State law.

BMP's FOR ESTABLISHED JUNKYARDS:

1. Remove or drain all fluids from the incoming vehicle for proper disposal at the county sanitary landfill.

2. Arrange the operation such that roads do not drain down a slope to a creek or tributary.

3. Keep the roads pervious such as using gravel where possible.

4. Install a greenbelt at the lowest side(s) of the property to retain the soil (toxics attach to the soil).

5. Maintain vegetation when large numbers of vehicles are removed for crushing.

6. Control storm water drainage by earth moving, if at all possible (the local municipality might wish to aid in this management practice).

LOCAL GOVERNMENT PRACTICES

Approval and Siting of New Commercial Automotive Junkyards:

1. Contact DEC and/or Cornell Cooperative Extension to discuss the site location and obtain other advice with respect to water pollution.

2. Limit the number of retained vehicles at the site.

SOME OTHER AUTOMOTIVE JUNK PROBLEMS

Existing non-commercial storage of automotive (and other large mechanical junk) is quite prevalent in the watershed. Whereas the large commercial automotive junkyards will more likely have their toxic contaminants reach the lake, the local citizens that collect their junk for all to see will probably locate it where it will foul their groundwater or a neighbor's groundwater downhill.
Some citizens put their junk in other people's yards or woods, or in the gullies on the side of the road or, worse yet, in creeks and tributaries.

There are some Best Management Practices that safely remove this unwanted junk which affects health, safety and aesthetic senses of all of us as well as the groundwater and surface waterbodies. Some of these have been successful in the past:

1. Town governments may consider "windshield-survey" of residences, businesses and farms for improper collection of vehicles which exceed two or more in number. The Town can, with the aid of the State, issue orders to remove the vehicles and other junk.

2. The Town Highway Department can remove the junk from the roadside gullies.

3. Volunteers can walk the creeks and tributaries and remove the junk in the dry season.

4. Neighbors, as a group, can try to persuade the offenders to clean up their yard.

5. Each town can develop a program of public awareness and present it at a Town meeting. (Bulletins 1, 2, 3 by Lyle S. Raymond of the Center for Environmental Research, Cornell University. These discuss groundwater, aquifers and their contamination). A resource such as this may be useful for the education program.

MINED LAND BEST MANAGEMENT PRACTICES

Mined lands in the watershed are sand and/or gravel. They primarily pollute water through large quantities of sediment fouling streams. They can be, however, an important safety hazard if the rim collapses on the top of the pit. Finally, the many abandoned gravel pits have not been covered with dirt and closed. This leaves them vulnerable to citizens that want to get rid of waste improperly, and not pay for collection and proper disposal.

Some mined lands BMP's:

1. Volunteers survey the abandoned and permitted mines to flag safety hazards, dumping and evidence of extreme erosion down entry roads.

2. Notification be given to town officials.

3. When the permitted mine is unsafe or there has been improper dumping, town officials make a contract to have it corrected.

4. Owners of the mines can post warning signs for the hazard, remove the waste and be vigilant to prevent any future dumping.

5. For abandoned mines, the towns should remove the waste and/or put up warning signs.

6. Since any toxics in the waste will go fairly rapidly into the groundwater through the highly permeable gravel, public education about dumping in gravel pits can be added to the clandestine dumping of junk education programs.

RESIDENTIAL SOURCES OF PESTICIDES & FERTILIZERS BEST MANAGEMENT PRACTICES

USDA and EPA officials estimate that approximately 25% of the assessed annual pesticide usage in the Great Lakes, US, watershed is applied to lawns and golf courses.[1] Given the significant amounts of pesticides used, homeowners cannot divorce themselves from their responsibility to recognize the potential impacts of lawn care practices. An EPA national survey of pesticides in drinking water wells was completed in 1990.[2] Extrapolating from this survey, EPA estimates that 10.4% of community water systems and 7.1% of rural water wells nationwide contain one or more pesticides. The most commonly detected pesticides were DCPA acid metabolites and atrazine. DCPA acid metabolites are breakdown products of DCPA used for weed control on turfgrass areas and selected fruits and vegetables.[2]

Current research on pesticide application to turf and associated water quality effects is sparse. What has been accomplished indicates little pesticide movement beyond the root zone[3] and the rapid breakdown of particular applied products.[4] However, the interaction between an applied pesticide and potential off-site movement is dependent upon factors inherent to the product used; the physical and chemical properties of the soil and plant growth characteristics; weather conditions such as temperature and moisture; cultural management techniques used to maintain a growing environment; and applicator knowledge of procedures for applying, storage and disposal.[5] Research is being undertaken to understand these factors in relation to runoff and leaching of pesticides.

In light of the above-mentioned research, the EPA survey, ongoing studies, and limited knowledge of some pesticide interactions, it appears judicious to restrict pesticide use to those situations when other control techniques have been exhausted. Fortunately for the homeowner, a neat appearing lawn can be obtained with little or no pesticide use. Homeowners should avail themselves to the services of Cornell Cooperative Extension, a recognized institution for information dissemination about horticultural and lawn care concerns. A county extension agent is available for consultation and can offer his or her county residents pamphlets and publications with invaluable information for lawn, tree, and shrub care.

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[1]United States General Accounting Office, Pesticides Issues Concerning Pesticides Used in the Great Lakes Watershed, June 1993, p. 4.

[2]United States Environmental Protection Agency, National Survey of Pesticides in Drinking Water Wells: Phase I Report, November 1990.

[3]Studies on isofenphos, chlorpyrifos, diazinon.

[4]Studies on dicamba, 2,4-D.

[5]James D. Willmott, The Risk of Turf Management Chemicals to Surface and Ground Water, Monroe County Cornell Cooperative Extension.

A well maintained, thick lawn is a desirable trait from an aesthetic viewpoint and its ability to withstand weed encroachment, disease, and insect attacks. To achieve this, Cornell Cooperative Extension stresses "cultural management."

- Choose turf grass areas with care. Don't expect to grow grass in heavily shaded sites or on steep slopes. There are other suitable ground covers for these critical areas. A pamphlet distributed by the Alliance for the Chesapeake Bay, Inc. recommends replacing expansive grass areas with perennial plants and shrubs that require less inputs of fertilizer, pesticides, and water.

- Prepare the growing environment (soil) for newly seeded lawns or renovated areas by spading to break up compaction, adding organic matter to sand and clay soils, incorporating lime and fertilizer per soil test recommendations, and grading for drainage control.

- Choose a grass seed variety/mixture suitable to climatic conditions, usage and site requirements. Consider soil type, drainage, disease resistance, light conditions, and outdoor recreation activities. There are new varieties that require less fertilizer and water and don't have to be mowed as frequently.

- Fertilize two to three times a year (per Extension recommendations) according to soil testing results and turf grass species requirements. Established lawns require different fertilization rates than younger ones. Maintain a pH of 6.0 to 7.0. Use of a slow release nitrogen fertilizer will provide a nitrogen source for grass that will be used as needed, avoiding nitrogen leaching to groundwaters.

- Mow a lawn at regular intervals and at a height that avoids scalping. Grass cut too short produces an environment favorable to weeds. Return clippings to the lawn. Keep lawn mower blades sharp. A dull blade will leave grass blades with a "ragged" cut providing a pathway for disease.

- To keep grass vigorously growing and less susceptible to pests, water to a 1" depth in spring if signs of wilting appear. In the summer months, water light and frequently. Proper selection of grass species can reduce irrigation requirements.

- Monitor for weed intrusion; hand pull for control.

Despite an individual's best efforts to follow these management practices, problems can result that may call for the use of a pesticide. Before using any chemical, accomplish the following:

- Identify the pest (weed, insect, disease), learn as much as possible about the problem, and monitor population levels. Do not be hesitant to consult professionals.

- Establish a threshold level of physical damage or population levels that warrants use of the product.

- Have all physical or biological control methods been explored?
- Use a pesticide that will affect a target pest but with minimal off-site impacts.

- Choose an appropriate application time. Generally, there are certain vulnerable times in the life cycle of pests when reduced amounts of pesticides will offer effective control.

When applying a pesticide, follow these guidelines.

- Spot-treat instead of blanketing the entire property.

- Apply according to label directions. There are restricted-use pesticides that can only be used by certified applicators.

- Buy only enough of a product to treat the problem or an amount to be used in one growing season.

- Store any unused product properly.

- Dispose of used containers properly.

These are only brief summaries of recommendations by Cornell Cooperative Extension. The following publications explore homeowner management options for controlling pests and coupled with consultation with extension agents or professional lawn care companies will offer a suburban/rural landowner an environmentally sensible way to maintain one's landscape.

- Selecting A Lawn Care Company by Cornell Cooperative Extension.

- Guide to Pest Management Around the Home, Miscellaneous Bulletin 74, a Cornell Cooperative Extension Publication, 1993-1994.

- Lawn Care and Groundwater Protection by Cornell Cooperative Extension.

- Home and Grounds, Lawn Care Without Pesticides by Norman W. Hummel, Jr., Department of Floriculture and Ornamental Horticulture, Cornell University, A Cornell Cooperative Extension Fact Sheet.

- Great Lakes: Great Gardening by New York Sea Grant, Cornell Cooperative Extension.

What is the best way to dispose of potentially hazardous household products. Cornell Cooperative Extension's best advice is **DON'T**. If you have a product you no longer require, give it to someone who can use it. Careless disposal has the potential for polluting ground and surface waters. Discarding our multitude of home products (nail polish to pesticides) in landfills is still not the answer because the hazardous chemicals can still escape into the environment. The options open to homeowners are limited to recycling or holding on to a product until an acceptable way of disposal is found.

A household hazardous waste collection facility or household hazardous waste collection days should be established to safely dispose of unwanted, banned, unused, or expired household chemicals. A Cornell Cooperative Extension bulletin Disposal of Household Hazardous Waste offers suggestions for proper disposal based on best available technology.

STATE POLLUTANT DISCHARGE ELIMINATION SYSTEM (SPDES) PERMITS BEST MANAGEMENT PRACTICES

1. New York State Permit System

SPDES permitting is a function of by New York State Department of Environmental Conservation. The information in this report was obtained from DEC records. However, further communication would benefit the local watershed governments.

A local watershed agency should be in communication with DEC to receive regular activity reports of the New York State Permit System. This agency could assist in the following elements of the SPDES process.

a. When the NYSDEC receives an application to renew a SPDES permit a notice appears in the NYSDEC publication, "Environmental Notice Bulletin." Under the State Environmental Quality Review Act, renewal of a SPDES permit is classified as a Type II activity, and therefore not subject to the specific environmental impact analysis requirements of that law, however, additional information (e.g., current permit, fact sheet, renewal application and supporting documentation may be obtained from or inspected at the regional office of the NYSDEC. A public comment period is available for substantive comments and/or request for a public hearing. The appointed agency could work on behalf of the concerned community to obtain such data or make appropriate comments.

b. Non-significant SPDES permit facility owners are not required to report effluent monitoring to the NYSDEC. They are required to maintain this information on site. Access to this information should be made available to municipal planning officials.

Possible Agency(s):

1. Keuka Watershed Improvement Cooperative (Watershed Manager)
2. Keuka Lake Association (KLA)
3. Yates County Planning Department (YCPD)
4. Cornell Cooperative Extension- Yates County (CCE)

2. Educational

Many local municipal planning officials are not aware of the SPDES process. They should know when a SPDES permit is required, the reporting and renewals that are required with a permit, as well as the potential negative impacts of SPDES activities (even when approved) on environmentally sensitive areas. For example certain locations within a community (based upon soils information) may be more susceptible to having non-conventional on-site septic systems installed, including systems that require SPDES permits.

Possible Agency(s):

1. Keuka Lake Association
2. Cornell Cooperative Extension- Yates County

3. Yates County Planning Department (YCPD)

AGRICULTURAL POLLUTION PREVENTION WORKSHEET

Goal: Reduce the impact of agricultural sources of sediment and nutrients on the water resources of the Keuka Lake watershed.

Problem Description: Potential agricultural sources of pollution include nutrients, pesticides and pathogens. These can contaminate both surface and groundwater resources. Transport of these pollutants can occur by being dissolved in rainwater or through the movement of eroded soil particles with pollutants attached.

Thirty-four percent (34,300 ac.) of the Keuka Lake watershed is in agriculture. Computer modeling suggests that eight subwatersheds, containing 19,993 acres of agricultural land, have the potential to contribute relatively high amounts of sediment and nutrients to the water resources of the Keuka Lake watershed.

Impaired Uses Being Addressed:

Current PWP Impairments (From 1991 Priority Water Problem List, NYS DEC Region 8)

A) Water Supply: *Threatened* at times due to turbidity and sediment.

B) Boating: *Stressed* due to erosion and failing septic systems contributing to excessive localized aquatic macrophyte growth.

C) Bathing: *Stressed*. Occasional impacts to swimming due to turbidity (sediment) and algal blooms (nutrients) making swimming undesirable mainly for aesthetic reasons.

D) Fish Consumption: *Impaired*. The fish consumption advisory on lake trout over 25 inches impairs fishing use on the lake. The advisory is due to DDT in fish flesh. DDT in lake sediment is a result of nonpoint sources.

E) Aesthetics: *Stressed* due to localized sedimentation and failing septic systems.

Other Use Impacts and Concerns: Nonpoint source pollution from agriculture has the potential to contaminate public and private groundwater drinking water supplies. The primary contaminants of concern include nitrates from manure and fertilizers, pesticides and herbicides and pathogens from animal sources.

Existing Measures:

1) Highly Erodible Lands (HEL): To receive United States Department of Agriculture (USDA) benefits, farmers must comply with conservation plans on highly erodible land (HEL) and not convert wetlands. HEL fields and wetlands have been identified on most farms within the watershed by the Natural Resources Conservation Service (NRCS). Farmers applying for USDA assistance must keep the FSA informed of all land use practices, obtain needed conservation plans from NRCS and certify that they will follow the required conservation plans.

Management of highly erodible lands aims to reduce erosion to 3 to 5 tons per acre per year (a level that ensures long-term productivity of the land) or to the lowest amount practically feasible.

2) Environmental Quality Incentives Program: USDA program administered by FSA office. The intention is to provide a financial incentive to landowners in local priority watersheds to accomplish soil and water quality conservation practices that are beyond farmer's economic means. Technical assistance is provided by the Natural Resources Conservation Service (NRCS), Soil and Water Conservation Districts, and the Division of Lands and Forest, NYS Department of Environmental Conservation.

Conservation practices offered are:

- Sediment and Erosion Control Systems
  - Access Road Improvement
  - Contour Farming
  - Critical Area Permanent Vegetative Cover
  - Cropland Protective Cover
  - Crop Rotation
  - Diversions
  - Field Windbreak Restoration or Establishment
  - Filter Strips
  - Permanent Vegetation Cover Establishment
  - Permanent Vegetation Cover Improvement
  - Reduced Tillage Systems
  - Sod Waterways
  - Stream Protection
  - Stripcropping Systems
  - Terrace Systems

- Agricultural Waste Management Systems
  - Barnyard Runoff Management

- Nutrient and Pest Management Systems
  - Integrated Pest Management
  - Nutrient Management
  - Pesticide Management

- Grazing Management Systems
  - Fencing
  - Rotational Grazing
  - Water Impoundment Reservoirs

- Forestry Management Systems
  - Riparian Forest Buffer

3) Conservation Reserve Program: CRP is a program that removes most highly erodible cropland from active agriculture production and returns it to conservation status for at least a 10 year period. The program participant receives a payment each year of the contract period for complying with the terms of a contract. The program protects the nation's cropland resource base while preserving water quality and enhancing wildlife habitat.

4) Riparian Buffer Strips: The USDA FSA has authorized a new cost-sharing practice for eligible agricultural lands. The practice, Riparian Buffer Strips (or WP7), removes nutrients, sediment, organic matter, and pesticides from surface and subsurface flow with vegetation planted adjacent to permanent and intermittent streams or waterbodies.

Pollution Prevention Actions:

1) Encourage agricultural producers to implement "Agricultural Environmental Management" (AEM). AEM supports the watershed planning process and is an agricultural initiative that includes on-farm planning and implementation. AEM provides a plan, documentation that is followed and professional technical assistance to help the farmer maintain and carry out enviromental protection. Through a series of environmental assessment worksheets the following potential pollution actions are reviewed:

- Pathogens
- Fertilizer management.
- Pesticide management.
- Manure management.
- Stream Management.
- Forest management.
- Pasture management.
- Barnyard management.
- Soil management.
- Waste Disposal.
- Water Source Evaluation.
- Milking Center Wash Water
- Silage Storage
- Petroleum Product Storage

The farm plans are built on a nine-step process:

1) Identify Problems-Identification of the resource problems and may include the recognition of resource enhancement opportunities.
2) Determine Objectives-Used to identify and agree on the client(s) goals and objectives.
3) Inventory resources-Current resource conditions are established.
4) Analyze Resource Data-Information gathered is analyzed to clearly define the resource conditions.

5) Formulate Alternatives-Options to achieve the client(s) objectives, solve resources problems, and take advantage of opportunities to improve or protect resource conditions.
6) Evaluate Alternatives.
7) Make Decisions-Select alternatives to implement.
8) Implement Plan.
9) Evaluate and update plan as needed.

2) Review and analysis of the eight subwatersheds identified by computer modeling and the agricultural survey as having relatively "high" potentials to contribute excessive sediment and nutrients from agricultural sources will include:

- update agriculture land use data as Tier I surveys are completed.
- determine agricultural conservation best management practices.
- determine areas contributing excessive amounts of sediment and nutrients.
- develop and evaluate conservation and management alternatives.
- develop implementation plan to reduce sediment and nutrients to acceptable levels.

Approach:
Agricultural Environmental Management will be targeted in the top eight priority subwatersheds-1, 2, 11, 15, 21, 25, 27, and 28. This will be a voluntary program with agricultural producers. Through various education efforts farmers will be informed of the program goals and objectives. Volunteer farmers will review the tiered environmental assessment worksheets with staff. The tiered approach utilizes worksheets to document what farm operators are doing well on their land and what areas need improvement. This approach is strictly voluntary and relies upon strong involvement from the farm operator and a careful evaluation of alternatives.

Lead: Yates & Steuben County SWCD and CCE.
Support: KLLA Agriculture Advisory Committee, Keuka Lake Project Committee, NRCS, DEC, Private Consultants
Time Line: 18 months
Equipment & Supply Needs: Computers, aerial photography, soils maps, topographical maps, etc.
Personnel Needs: Hire 1 FTE staff to coordinate Agricultural Environmental Management Program, Tiers I, II and III, with prospective volunteer farmers and the appropriate cooperating agency staff. Agency expertise will be needed in the following areas:

- Pathogens-CCE, DOH.
- Fertilizer management-CCE, NRCS.
- Pesticide management-CCE,DEC.
- Manure management-CCE, SWCD, NRCS, DEC.
- Stream Management-SWCD, NRCS.
- Forest management-SWCD, NRCS, DEC.
- Pasture management-CCE, NRCS.
- Barnyard management-SWCD, NRCS.

- Soil management-CCE, SWCD, NRCS.
- Waste Disposal-CCE, NRCS, DEC.
- Water Source Evaluation-CCE, DOH.
- Milking Center Wash Water-CCE, SWCD, NRCS.
- Silage Storage-CCE, SWCD, NRCS.
- Petroleum Product Storage-SWCD, NRCS, DEC.

Possible Sources of Funding:

- NYS Environmental Protection Fund.
- NYS Clean Water/Clean Air Bond Act.
- USDA Environmental Quality Incentives Program (EQIP).
- EPA to DEC to local agencies (319 and 604B funds).

DEICING SALT
POLLUTION PREVENTION WORKSHEET

Goal: To minimize the impact of deicing salt on Keuka Lake and its tributaries.

Problem Description: Deicing salt, primarily sodium chloride, is used to help deice road surfaces during the colder months of the year. There are several environmental concerns regarding the use of deicing salts. After application, deicing salts are highly soluble in water and easily wash off pavement into surface waters and leach into soil and eventually groundwater. High concentrations of salt can damage and kill vegetation, disrupt fish spawning in streams, reduce oxygen solubility in surface water, interfere with the chemical and physical characteristics of a lake, pollute groundwater making well water undrinkable, disintegrate concrete, and cause the corrosion of bridges, cars and plumbing. In the Keuka Lake Watershed, deicing salt sources include road surfaces spreading and uncovered salt/mix piles.

Impaired Uses Being Addressed:

Current PWP Impairments: None listed on current PWP list.

Other Use Impacts and Concerns: Uncovered salt storage areas in Pulteney and Wayne contaminated private wells in 1997. These are in the process of being covered in 1998.

Pollution Prevention Actions:

1) Store salt and salt/mixes in permanently roofed structures, on an impermeable surface, a safe distance from waterbodies, to avoid problems with runoff. Cornell Local Roads Program has information available on constructing such a facility. A containment area where mixing occurs and loading takes place should also be developed to prevent runoff.

2) Municipalities should practice sensible salting to use only as much salt as is necessary for public safety. The Town of Farmington and Gorham implemented such a policy in the 1980's which involved increasing the percentage of sand in their mix from 1:1 to 3:1, doing more plowing and less salting, salting mainly intersections, and posting signs at town entrances to inform travelers of the reduced salting policy. They achieved an approximate salt reduction of 12-15%.

   Additionally, salting equipment should be maintained in good condition to insure proper delivery and spreading rate. Highway departments should practice careful procedures during mixing and loading of deicing salt to prevent spills. Highway Departments should keep abreast of studies, research and new technologies concerning deicing salt. Such training and information could be part of an educational program targeting highway department personnel. A regular forum could be sponsored by the Cornell Local Roads Program and the Yates/Steuben County Highway Superintendent's Association.

3) Promote public awareness and education on safe winter driving. As the saying goes "Sensible salting requires sensible driving". Information distributed in Monroe County during the 1970's and in Farmington during the 1980's could be updated and printed at a minimal cost. Newspaper articles and/or ads and town and country newsletters to residents could also be used to disseminate the information.

4) Continue a regular salt survey of highway departments deicing salt usage. This is a reasonable way of quantifying the amount of salt being applied to the watershed as part of the ongoing effort to monitor the health of the lake. Since the groundwork has been done as part of the first survey (winter 1996) future efforts will be minimal.

5) Monitor salt concentrations, through tributary sampling of chloride, during winter runoff events for tributaries of concern. Although this is being treated as an independent option for the purposes of this report, it should be part of a comprehensive annual sampling and monitoring program.

Estimated Effectiveness of Proposed New Measures:

1) Covering salt storage piles would be a very effective means of preventing potential salt runoff from this point source.

2) Based on the 1996 salt usage survey most municipalities are already practicing sensible salting shown by their low application rates.

3) Public awareness about sensible winter driving is an integral part to reduced salting and has the potential to be effective.

4) The salt usage survey is an effective means of estimating the amount of salt being applied to the watershed.

5) Tributary monitoring of salt concentrations can be an effective "spot check" to identify and verify areas of concern. It can be used to determine impacts of uncovered salt/mix storage piles and areas of high salt application rates.

Technical Feasibility:

All options are technically feasible.

Political/Behavioral Feasibility:

The goal of minimizing salt usage would be very easy to promote to the public. Municipal officials may resist the covering of salt/mix storage piles because of the cost involved. Some municipalities may object to interference in highway department policies and procedures.

Possible Sources of Funding:

Costs for some options would be minimal and could be picked up by the KLA or CCE. Water Quality Monitoring costs should be part of a comprehensive plan with a dedicated source of funding such as from County government. Costs for construction of salt storage buildings is partly available from the Bond Act.

References/Sources of Information:

Canandaigua Lake Watershed Management Plan

FORESTRY POLLUTION PREVENTION WORKSHEET

Goal: To reduce the potential impacts of forest harvesting activities on water quality in the Keuka Lake watershed.

Problem Description: Forest harvesting operations can have a negative impact on forest soil resources, surface water quality and local roads. Heavy equipment used to harvest trees can disturb the protective leaf litter and forest soils which increases vulnerability to erosion. Stream water quality (and ultimately Keuka Lake) can be negatively impacted from increased erosion and sedimentation from poorly planned harvesting activities. Local roads can be damaged by heavy equipment traffic during certain critical times of the year.

Impaired Uses Being Addressed:

Current PWP Impairments: None.

Other Uses and Impacts: Forest harvesting activities may lead to increased sediment delivery, nutrients and temperatures in adjacent surface waters. Sediments can affect stream capacity, aquatic habitats and transport attached pollutants. Nutrients can promote unwanted vegetative growth and affect dissolved oxygen level, macroinvertebrate populations and fish habitat.

Existing and Past Measures: Section 480-A Real Property Tax Law provides preferential assessment to forest landowners following an approved forest management plan. Forest Stewardship Program through NYS DEC and USDA provides cost sharing payments for various forest improvement practices.

Pollution Prevention Actions:

1) Encourage that all forest landowners in the watershed contact the following for initial timber harvesting advice:

Yates and Steuben County forest landowners contact:

Billy Morris, Sr. Forester
NYS DEC
7291 Coon Road
Bath, NY 14810 (607) 776-2165

Steuben County forest landowners contact:

Jim Pitt, Sr. Forester
NYS DEC
7291 Coon Road
Bath, NY 14810 (607) 776-2165

Yates County forest landowners contact:

Jim Balyszak, District Foresters
Yates County Soil and Water Conservation District
110 Court Street
Penn Yan, NY 14527 (315) 536-5188

2) Provide the following resource information in the Yates and Steuben Soil and Water Conservation
District offices:

- DEC list of Cooperating Consulting Foresters
- Silvicultural Best Management Practices Catalog
- Master Forest Owners Program referral list
- NY Forest Owners Association information and list

The Yates and Steuben Soil and Water Conservation Districts should promote the availability of these resources through such means as district newsletters.

3) Forest owners workshop: a periodic workshop should be held where the target audience is forest landowners. These workshops could be sponsored through the CCE, DEC, SWCD's and NY Forest Owners Association.

HAZARDOUS WASTE SITES
POLLUTION PREVENTION WORKSHEET

Goal: To improve the remediation process of hazardous waste disposal sites within the Keuka Lake watershed.

Problem Description: The NYSDEC Division of Hazardous Waste Remediation maintains a record of all hazardous waste disposal sites reported to it and conducts investigations as to the cause and extent of contamination of each disposal site. This record was last reported in the NYSDEC publication entitled, Inactive Hazardous Waste Disposal Sites in New York State, Site List by Counties, Volume 8, NYSDEC and NYSDOH, April 1992.

This publication indicates that there are 2 inactive hazardous waste sites located within the Keuka Lake watershed: 1) Urbana Landfill and 2) Penn Yan Aero Services, Inc. Both site have been studied and have remediation plans. The remediation of Penn Yan Aero has been completed.

It is essential that a state and local partnership for pollution remediation be established. Local involvement would enhance the State's Hazardous Waste Remediation Program.

Impaired Uses Being Addressed:

Current PWP Impairments: There are no documented impairments caused by hazardous waste sites identified on the PWP list.

Other Use Impacts and Concerns: The need to address the potential contamination from hazardous waste sites stems from the pollution prevention approach to water quality protection.

Existing or Past Measures:

1) Federal and State
   - A) CERCLA (Comprehensive Environmental Response, Compensation and Liability Act of 1980).
   - B) Article 27, Title 13, Sate Environmental Conservation Law.

Pollution Prevention Actions:

Planning

1) Study of landfill site to identify potential inactive hazardous waste sites

Direct Government Action:

2) Upon reporting of a hazardous waste site to the NYSDEC the KWIC should also be notified.

3) A local data base of hazardous waste sites should be kept by the KWIC. The NYSDEC should provide a copy of all future hazardous waste site records at the time they are processed.
4) A memorandum of understanding should be implemented between the NYSDEC and the KWIC regarding the above referenced items.

Estimated Effectiveness of Proposed Measures:

1) A study could be very effective in identifying unknown but potentially serious pollution sources

2) The notification of the KWIC would be very effective. It is important to have local involvement on pollution remediation.

3) The local data base would be very effective for quantifying and mapping sources of nonpoint source pollution.

4) A memorandum of understanding would be very effective for formalizing the state and local partnership.

Technical Feasibility:

1) It may be difficult to identify all unpermitted sites
2) Requires a local/state partnership.
3) The local data base would need to be transferred to the KWIC. This may require computer hardware, software, and training.
4) The MOU would not be difficult to prepare.

Political/Behavioral Feasibility:

1) Difficult
2) Difficult
3) Acceptable
4) Difficult

Hazardous Waste Sites

Control Options	Planning	Education	Research	Technology Transfer	Financial Incentives	Regulatory Programs	Direct Government Action
Measures	1) Study						2) Notification procedure 3) Database 4) Memorandum of Understanding
Lead and Support	YCPD						2) KWIC 3) KWIC 4) KWIC
Time-line							
Capital Equipment and Personnel	40 hours 200 intern hours						2) Inspection time 3) Computer time 4) 20 hrs for MOU preparation and adoption
Costs	40 @ $25/hr 200@ $10/hr = $3000						2) Part of existing program 3) $300/software and training 4) 20 hrs @ $25/hr = $500

HAZARDOUS WASTE SPILLS
POLLUTION PREVENTION WORKSHEET

<u>**Goal:**</u> To reduce the number of hazardous waste spills within the Keuka Lake watershed. To improve the effectiveness of the spill response and reporting system.

<u>**Problem Description:**</u> There were 114 hazardous waste spills within the Keuka Lake watershed reported to the NYSDEC since 1974. While the NYSDEC, through its Spill Prevention and Response Section, responds to reported spills for pollution remediation, the number of spills reported within the watershed indicates that pollution prevention measures need to be improved.

<u>**Impaired Uses Being Addressed:**</u>

<u>**Current PWP Impairments:**</u> There are no documented impairments caused by hazardous waste spills identified on the PWP list.

<u>**Other Use Impacts and Concerns:**</u> The need to address the potential contamination from hazardous waste spills stems from the pollution prevention approach to water quality protection.

<u>**Existing or Past Measures:**</u>

1) Federal and State
    - A) SARA Title 3
    - B) Article 12, State Navigation Law
    - C) Article 17, Title 10 of the Environmental Conservation Law (Petroleum Bulk Storage law; Cross referenced with spill occurring from bulk storage facilities)

<u>**Pollution Prevention Actions:**</u>

<u>Planning:</u>

1) The hazardous waste spills database and the Task IV Report should be used to determine the typical typé of spills by location and the contributing factors of hazardous waste spills. This study would be used to identify pollution prevention measures.

<u>Education:</u>

2) The results of the study could be used to educate the people or businesses that are causing the spills about appropriate pollution prevention measures and how to prevent future hazardous waste spills.

<u>Direct Government Action:</u>

3) Upon reporting of a hazardous waste spill the KWIC should also be notified.

4) A local data base of hazardous waste spills should be kept by the KWIC. The NYSDEC should provide a copy of all future spill records to the KWIC at the time they are processed.
5) A memorandum of understanding should be implemented between the NYSDEC and the KWIC regarding the above referenced items.

Estimated Effectiveness of Proposed Measures:

1) A study of the hazardous waste spills data base would be very effective in revealing the nature of the problem.

2) The study of the hazardous waste spills data base would be very effective at educating the "spillers" about the problem and how to institute appropriate preventative measures.

3) The notification of the KWIC would be very effective. It is important to have local involvement on pollution remediation.

4) The local data base would be very effective at determining patterns of spills.

5) A memorandum of understanding would be very effective for formalizing the state and local partnership.

Technical Feasibility:

1) The study would not be technically difficult and could be handled by agency staff.
2) The study as an educational tool would be very feasible.
3) Requires a local/state partnership.
4) The local data base would need to be transferred to the watershed inspector. This requires computer hardware, software, and training.
5) The MOU would not be difficult to prepare.

Political/Behavioral Feasibility:

1) Acceptable
2) Difficult
3) Difficult
4) Acceptable
5) Difficult

Hazardous Waste Spills

Control Options	Planning	Education	Research	Technology Transfer	Financial Incentives	Regulatory Programs	Direct Government Action
Measures	1) Study	2) Brochures & On-site meetings					3 Notification procedure 4) Database 5) Memorandum of Understanding
Lead and Support	YCPD	CCE					3) KWIC 4) KWIC 5) KWIC
Time-line							
Capital Equipment and Personnel	40 hours	20 hrs for brochures and 60 hrs for onsite meetings					3) Inspection time 4) Computer time 5) 20 hrs for MOU preparation and adoption
Costs	40 @ $32/hr = $1280	80 @ $25/hr = $2,000					3) Part of existing program 4) $300/software and training 5) 20 hrs @ $25/hr = $500

AUTOMOBILE JUNKYARDS
POLLUTION PREVENTION WORKSHEET

1) **Goal:** Generally, to minimize water pollution and the potential impact of toxic heavy metals and organic compounds upon water quality.

Problem Description: One automobile junkyard has been operating in the Keuka Lake watershed in the Town of Urbana with an estimated 300-500 vehicles present at any one time. The junkyard is on a slope above Mitchellsville Creek which in turn flows into Cold Brook and then to the lake. The problem results from the large number of junk vehicles and their associated liquid wastes located on a gradual slope to a tributary to Keuka Lake.

There are two other small automotive junkyards that have less than 30 vehicles. They do not appear to have pollution potential. They should be fenced.

There is the casual collection of automobile and other old vehicles and other types of junk throughout the watershed. If the owner has two or more used vehicles which are unregistered and old and no longer intended or in condition for legal use on the public highways or for the resale of parts, then a license must be obtained, the vehicles registered or removed down to one vehicle.

Part of the problem is that the NYS law doesn't discuss protection of water quality. The requirements are that the owner be a citizen in good standing, the yard be located properly (not within 500 feet of a church), be aesthetically acceptable and be surrounded with 8 foot high wooden fencing. However, if the Town wishes to pass a regulation that requires consideration of water pollution, it may do so without conflict with the State law.

Impaired Uses Being Addressed:

Current PWP Impairments: none

Other Use Impacts and Concerns:

1) Heavy metal and plastic pollutants in the groundwater and surface water as well as gas and oil
 wastes from the large automotive junkyard.
2) Unpermitted private use junkyards and casual junk distributed throughout the watershed in roadside gullies, streams and tributaries to the lake which will pollute the lake.

Existing or Past Measures:
General Municipal Law 96 Paragraph 136
The role of local governments is to regulate by licensing junkyards using the State General Municipal Law or their own rules and regulations within their own ordinances.

Pollution Prevention Actions:
1) Inventory - junkyards (two or more vehicles) and yards full of junk which require a license for
the former and removal of the latter.
2) Perform a preliminary study of Hadley's junkyard as to number of vehicles, site location, fencing and potential for water pollution.
3) If the study recommends water quality testing, determine the most cost effective way and collect data.
4) If contamination is present, contact the appropriate government agency.
5) Develop and implement an educational program for town officials and the public as to the potential pollution of leaving junk on one'' own property or dumping it on somebody else'' property or into a roadside gully or stream.

Estimated Effectiveness of Proposed New Measures:
1) Needed first step
2) Needed first step
3) Needed to see if toxic contamination is present in surface water
4) Placed in the hands of the regulating government

Technical Feasibility:
1) Feasible
2) Feasible
3) May not be feasible technically without a high cost
4) Feasible
5) Feasible

Political/Behavioral Feasibility:
1) Feasible with volunteers - in some Towns not feasible politically with Town officials
2) Feasible
3) Feasible
4) Feasible
5) Feasible

Possible Need & Sources of Funding:
1) Little cost
2) Little cost
3) Possible high cost for ground water tests
4) No cost for contact - might need to write grants
5) Presentation costs are reasonable

Table 10-2. Summary Table or Pollution Prevention Actions (Measures) with Stage of Action and Program Management (Implementation

Control Options	Planning	Surveys, Literature Review	Engineering Study	Data Collection	Referral to Government Action	Institution of Regulatory Programs	Education	Financial Incentives	Enforce Regulatory Programs
Measures 1,2,3,4,5	1,2,5	1	2	3	4	1	1, 5		1
Lead and Support	SCPD YCPD CCE*	SCPD YCPD	CCE SCPD	CCE, KLA Surface water consultant ground water	SCPD	Towns Support SCPD YCPD	CCE KLA	KLF CCE	Local Towns & State
Time-line	January 1998	Surveys-April-June 1998	April 1998	June-Oct** 1998 Surface Ground TBD	November 1998-January 1999	1999	April-July	July-Oct** 1998 Ground Water	July-Sept 1998
Capital Equipment Personnel Volunteers Others	Personnel & Volunteers	Personnel & Volunteers	Personnel	Capital Equipment Personnel	Personnel	Town Officials	Personnel Volunteers	Grant writer or Personnel	Town Officials
Costs	$2,500	$500	$500-$1,000	$1,000 surface water $25,000 grant ground water	–	–	$500-$1,000	3 - Grant especially for ground water	Town Officials

*CCE Cornell Cooperative Extension ** Mitchellsville Creek after heavy rains. Grant writing started if surface water data toxic.

REMEDIAL ACTIONS ABBREVIATED

1) Unlicensed automobile junkyards and yards with older vehicles and junk.
2) 300-500 car junkyard - Hadley's
3) 300-500 car junkyard - Hadley's
4) 300-500 car junkyard - Hadley's
5) Overall problem of junkyards ands junk

INACTIVE LANDFILLS
POLLUTION PREVENTION WORKSHEET

Goal: To minimize the impact of abandoned landfills or dumps on the water quality of the watershed and to alleviate and remove the threat to human health.

Problem Description: There are no active, permitted landfills in the Keuka Lake Watershed. There are ten well-identified inactive dumps and landfills and one major automotive junkyard, discussed in a previous part of Sections 7 and 10. Tables 7-23 and 7-24 provide summary detail required in a preliminary watershed survey. The hazardous waste landfill under DEC Class 2 remediation is the Urbana Landfill (ID4 on Table 7-23) represents a potential threat to public health. The two other landfills that might have received the same types of industrial waste by chronology are ID5 (Urbana) and ID9 (Hammondsport). As described in Chapter 7, these seem to merit further investigation for toxic water quality impact. A fourth landfill that might be further investigated is landfill ID3 (Pulteney) which may be the cause or a contributor to the detection of DDT in the Wagener's Glen tributary at route 54A. The other six, ID's 1,2,7,9,10,11 do not appear to pose a pollution threat. Enough of a health risk exists in the presence of DDT in landfill ID4 and with the possibility of toxic pollution in landfills ID5 and ID8 to support continued concern.

Impaired Uses Being Addressed:

Current PWP Impairment: Fisheries impaired.

Other Use Impacts and Concerns: There are not other use impacts or concerns.

Existing or Past Measures:
1) The past measure has been the survey of landfills for this project.
2) Past and ongoing is the engineering study and remediation activity by DEC for the Class 2 hazardous waste Urbana landfill.

Remedial Actions:
1) A preliminary study should be conducted to determine a) the location; b) dates of operation of the landfills; c) the type of materials disposed at the sites; and d) vulnerability of water resources using mapped information (soils and topography maps).
2) An intensive groundwater leachate study should be conducted on targeted sites to characterize leachate quality and determine fate and transport pathways for the purposes of determining the risk to public health and water quality impairment.
3) An engineering study may need to be initiated to develop recommendations to properly close and secure sites.
4) Grant proposals may need to be written to secure funds from the Environmental Protection Fund to work on this project. Other options include municipal sponsorship of the costs.

5) Public educational materials should be developed to describe the landfill issues (old vs. new types of landfills; threats to public health and water quality; need to ensure that the sites are closed properly).
6) Conduct designated surface water quality tests as needed.

Estimated Effectiveness of Proposed New Measure:
1) A preliminary study would be very effective in revealing needed baseline information to describe the nature of the problem and predict the potential impact on water resources.
2) A groundwater study is the only effective means of quantitatively characterizing and measuring the impact of leachate on groundwater resources. Surface water is easier to measure.
3) If the leachate is determined to be hazardous or detrimental to groundwater, an engineering study would be required and effective in determining remedial measures.
4) Grant monies to support the projects would be very effective and would reduce the tax burden on local residents.
5) Public education programs would be very effective in informing the public about the issues and gathering support for actions which may be needed and costly. Also educating the public to BMP's and how to protect themselves would support selling the effort.

Technical Feasibility:
1) The preliminary study would be technically not that difficult and probably could be handled by agency staff.
2) The groundwater study would be technically difficult and would require a competent engineering consultant. Surface water measurement is technically easier and could be collected readily by KLA and/or DEC.
3) The engineering study would also be difficult and would require an experienced consultant engineer.
4) Grant applications would probably be fairly easy to complete and could be handled by one of the county agencies or even one of the respective towns.
5) Public educational programs would be easy to put together by one of the county agencies or the Keuka Lake Watershed Project Task Force.

Political/Behavioral Feasibility:
1) The preliminary study should not be that controversial, although some of the municipalities may resist efforts to investigate the sites with the concern of potential costs to taxpayers.
2) The same as above.
3) If problems are found, an engineering study would probably be demanded by the public and accepted by the decision-makers or enforced by the state.
4) Grant monies are always welcome.
5) Educational efforts would probably be supported by all groups.

Possible Sources of Funding:
1) Environmental Protection Fund (NYS Legislature)
2) Municipal budgets
3) Other DEC grants yet unidentified

Table 10-3. Inactive Landfills: Implementation Matrix *

Control Options	Planning	Education	Research	Technology Transfer	Financial Incentives	Regulatory Programs	Direct Government Action	Other
Measures 1 2 3 4 5 6	[1]Preliminary Study	[5]Brochure and articles for newspaper, newsletters, 1-2 public forums	[2] Leachate Study [6] Surface Water Data	[3]Engineering Study	[4]Grant Proposal			
Lead and Support	SWCD, SCPD, YCPD	YCPD, CCE , SWCD, SCPD	SWCD to contract with engineer	Municipality to contract with engineer	YCPD, SCPD, Task Force			
Time-Line **	Spring 1998	Summer, Fall 1998, 1999	Spring		Summer			
Capital Equipment and Personnel	40 hours per site	20 hrs per brochure + article 12 hrs forums	Administration-SWCD	Depends on scope of problem	10 - 20 hrs - depends on grant			
Costs	inkind or $2, 000 @ $50/hr	inkind or $500, $800 @ $25/hr	inkind plus $25,000 per site	Depends on scope of problem	Depends on grants			
Stage of Actual Landfills	C	A, B	B[2] C[6]		B, C		A (DEC)	D - check routine surface water data

LEGEND - Landfills sorted and entered by decreasing threat

ID 4: Urbana Landfill - Hazardous Waste Class 2	A
ID 5: Urbana Reservoir Hill, suspected Hazardous Waste	B
ID 9: Hammondsport Lakeshore - requires mediation if disturbed	B
ID 3: Pulteney - suspected source of DDT to Wageners Glen	C
ID 1,2,7,8,10,11: The other landfills	D

* See Page 10-5 for the measures corresponding to these numbers. Number 6 is added for surface water quality tests. The superscript numbers refer to the measure.

** Time-lines vary by category. "A" is directed by DEC. "B" is recommended for testing of surface and groundwater for remediation, and "C" is for surface water testing at this time.

*** Estimates of hours and costs are gross and intended only to give a "feel" of the effort and dollars of the task.

**** Categories A, B, C, D are discussed previously on page 10-34 .

References/Sources of Information:
1) NYSDEC Region 8
2) KLA water quality reports and tributary data
3) References in Chapter 7 on page 7-160

MINED LANDS
POLLUTION PREVENTION WORKSHEET

Goal: To minimize water pollution related to active or inactive mining sites in the Keuka Lake Watershed.

Problem Description: Nine sand and gravel mines in the Keuka Lake Watershed currently operate under permits from the New York State Department of Environmental Conservation. Numerous other mine sites are inactive or operate beneath or outside the level of activity (generally one thousand tons removed per year) requiring permits. Permitted mines are required to have reclamation plans and performance bonds. Operating permits include specifications for the protection of adjacent surface waters and groundwater. Inspection of mines by regulatory personnel is infrequent.

Inactive, non-permitted, and poorly regulated mines may pollute surface and groundwater. Unrestricted runoff from bare mine banks may carry significant sediment loadings. Once bare, mine banks are difficult to revegetate and can remain a problem for decades.

Soils at inactive mine sites tend to be very permeable. Spilled pollutants will readily enter groundwater through these sites. Unrestricted access to inactive mine sites has led to dumping of construction debris and household waste.

Impaired Uses Being Addressed:

Current PWP Impairments: none

Other Use Impacts and Concerns: Sediment loads from mine sites, though generally low in nutrients, can impair stream flows, diminish water clarity, and damage fish habitat. Pollutants carried into the groundwater through mine sites can pollute adjacent private and public wells.

Existing or Past Measures: The mined land reclamation law revised and enacted in June, 1991 may be found in Article 23, Title 27, Environmental Conservation Law Implementing Regulations - 6NYCRR Part 420-426. The role of local governments to review and/or regulate mining activity is specified in State law: to enforce laws of general applicability and zoning and to specify conditions relating to mine roads, haul roads, enforcement of listed special conditions and reclamation requirements, and enforcement of local laws or ordinances regulating mining or mine reclamation not regulated by the State.

Pollution Prevention Action:
1) Inventory unpermitted mines of the Keuka Lake Watershed - prioritize and rank mines for potential to pollute surface or groundwater
2) Share information on permitted mines with regulatory officials
3) Contact owners of mines regarding reclamation

4) Inform local governments of their rights to regulate mines
5) Close access to abandoned mines
6) Reclaim polluting, abandoned mines

Estimated Effectiveness of Proposed New Members:
1) Necessary first step
2) May be all that's needed
3) ?
4) Effective
5) Effective
6) Effective over long term

Technical Feasibility:
1) Feasible
2) Feasible
3) Feasible
4) Feasible
5) Feasible
6) Slow, costly but feasible

Political/Behavioral Feasibility:
1) Feasible
2) Feasible
3) ?
4) Feasible
5) Difficult because of costs, process involved
6) Nearly impossible

Possible Sources of Funding:
1) Special project grants, Watershed Commission, KWQCC
2) Little cost
3) Little cost
4) Little cost
5) Municipal governments, property owners
6) Municipal governments, property owners

Table 10-4. Remedial Action Worksheet-mined lands.

Control Options	Planning	Education	Research	Technology Transfer	Financial Incentives	Regulatory Programs	Direct Government Action
Measures	[1] Inventory and prioritize	[3] Educational contact [4]Contact with municipalities	[6] Reclamation			[2] Information sharing	[5]Close access
Lead and Support	KLA KWIC	SCPD, YCPD CCE, KLA	KLA, CCE			KWIC	KWIC
Time-line	1999, ongoing	1999 and ongoing	1999			ongoing	immediate
Capital Equipment and Personnel	Personnel could be shared w/ landfill inventory	mailings, telephone mailings, workshop	Heavy equipment, time			Information management	Heavy equipment, time
Costs	$6,000-$7,000	$350 - $600	$600 per site			inkind	$1200 per site

[1] Refers to measure listed on page 10-8
[2] Refers to measure listed on page 10-8
[3] Refers to measure listed on page 10-8
[4] Refers to measure listed on page 10-8
[5] Refers to measure listed on page 10-8
[6] Refers to measure listed on page 10-8

REFERENCES/SOURCES OF INFORMATION

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SEPTIC SYSTEMS
POLLUTION PREVENTION WORKSHEET

Goal: Reduce nutrient and pathogen impacts from septic systems on surface and groundwaters in the Keuka Lake Watershed.

Problem: On-going water quality monitoring confirms the potential for contamination of drinking water supplies by septic system discharges. Geometric means of fecal coliform bacteria counts in Keuka Lake have exceeded or nearly exceeded established maximum acceptable targets during certain times of the year, or in certain geographic locations. Other concerns regarding septic systems point out the difficulty with design and construction of suitable septic systems in certain locations, including the hamlets of Pulteney and Branchport, the southern perimeter of Keuka Lake and the village of Hammondsport.

Impaired Uses:

A) Water Supply. Private and public supplies threatened due to pathogens and nutrients (esp. groundwater supplies).

B) Bathing. Threatened due to potential exposure to pathogens and weed growth due to nutrients.

Other Use Impacts and Concerns: The difficulty and expense in developing replacement septic systems in the locales identified above constitutes a drag on development and improvement of properties within those areas. Improved wastewater treatment facilities would dramatically improve opportunities for growth and re-development.

Existing or past measures: Unlike other potential pollution sources in the watershed, a comprehensive study of overall on site wastewater treatment needs, and management measures, has been made. A lengthy public process developed the KWIC program, and resulted in the following important regulatory and technical expectations: construction of all new and replacement septic systems requires a permit based on current sanitary code standards, those septic systems along the lake perimeter are most critical in terms of impacts on the lake as a drinking water supply, and they must be routinely inspected, a common set of standards for inspection and design of septic systems must be followed throughout the watershed, and maintenance certain critical systems is required. Premises of the program are that current technologies and standards can capably protect water quality from contamination by inadequate septic system, if uniformly and vigorously applied.

Pollution Prevention Actions:

1. Promote appropriate maintenance practices in all phases of program implementation.
2. Hold educational forums for contractors and others associated with system design and construction on an annual basis.
3. Identify and secure resources necessary to meet annual goal for Zone One and holding tank inspection program.

4. Continue monthly and annual reporting of program progress, and follow status of water quality in Keuka Lake as documented in annual monitoring report.
5. Develop and maintain system to review and document interpretations of state sanitary codes and relationship with the uniform fire prevention and building code.
6. Encourage development of sanitary public and private water supplies.
7. Assist as appropriate in development of public wastewater collection and treatment projects.
8. Develop more complete assessment of wastewater treatment and water supply needs of problematic locales identified in Chapter 7.

Estimated Effectiveness of Proposed Measures:

1) Continued effective function of on-site septic systems is very dependent on appropriate maintenance and operation.
2) Educational forums will improve acceptance of newly introduced methods and technologies, and result in over all better construction of new septic systems.
3) Some septic systems that are real or potential sources of pollution will not be found and corrected without complete implementation of the Zone One program throughout all municipalities in the watershed.
4) Satisfaction of all responsibilities established in the model wastewater law will not be recognized or achieved without public reporting.
5) Better understanding of administrative and technical requirements in the state sanitary and building codes will result in more uniform activities from municipality to municipality.
6) Drinking water safety is as dependent on appropriate supply systems as it is on wastewater treatment systems.
7) Development of public wastewater collection and treatment will eliminate the need for on-site wastewater treatment on sites where current sanitary code standards cannot be practically met.
8) Complete factual information about these areas will lead to effective action where appropriate and practical.

Technical Feasibility: All of these actions are technically feasible.

Political/Behavioral Feasibility:

1. Very Feasible
2. Very Feasible
3. Feasible, will require assessment of staff needs.
4. Very Feasible
5. Feasible, will require improved communication between several different interest groups.
6. Feasible, some public water supply systems are expanding in the watershed, better installation of private water supplies must recognize lack of enforcement of current water supply standards.
7. Very difficult due to large share of project costs that must be borne at the local level.
8. Feasible

Possible Sources of Funding:
1) Part of current program.
2) KWIC, Private Industry, Water Quality Grants
3) KWIC, Towns
4) KWIC, KLF Inc. CCE
5) KWIC, DOH, CCE
6) Towns, KWIC, Clean Air Clean Water Bond Act
7) Towns, KWIC, Bond Act
8) KLF Inc., KWIC

BULK STORAGE FACILITIES (PETROLEUM AND CHEMICAL) POLLUTION PREVENTION WORKSHEET

Goal: To minimize the impact of contamination from bulk storage facilities due to spills, leaks or tank failure within the Keuka Lake watershed. To create a local bulk storage facilities data base and spill notification procedure.

Problem Description: Bulk storage facilities are regulated by the New York State Department of Environmental Conservation. While the bulk storage facility regulations may adequately control structural elements, such as tank design and registration, the regulations do not address the location of these facilities relative to water supply sources. The proximity of a storage facility to a tributary, public or private well, or the lakeshore, significantly increases the risk to public health from a failure of a storage facility. Records on the registration of the storage facilities are maintained by the NYSDEC and are not readily available for local land use decisions.

Impaired Uses Being Addressed:

Current PWP Impairments: There are no documented impairments caused from bulk storage facilities of petroleum and chemicals identified on the PWP list.

Other Use Impacts and Concerns: The need to address the potential contamination from bulk storage facilities stems from the pollution prevention approach to water quality protection.

Existing or Past Measures:

1) State:

In an effort to prevent petroleum leaks and spills, the New York State Legislature passed the Petroleum Bulk Storage (PBS) Law (Article 17, Title 10 of the Environmental Conservation Law) requiring the NYSDEC to develop and enforce a State code for the storage and handling of petroleum. The resulting regulations are Parts 612, 613, & 614 of Title 6 of the New York State Code of Rules and Regulations.

Under Part 612, owners must register petroleum storage facilities with NYSDEC, notify NYSDEC of substantial modifications to a facility, re-register when facility ownership changes, and renew registration every 5 years. Under Part 613, owners must periodically inspect aboveground storage systems and report test results to NYSDEC. Any equipment found leaking must be repaired or replaced in accordance with Part 614, the standards for new or substantially modified facilities, or closed in accordance with section 613.9. Under the law, owners of regulated facilities (not operators) are responsible for registration.

Only liquid non-waste petroleum-based oils suitable for use as a fuel to produce heat or energy or as a motor lubricant, such as gasoline, heating oil, heavy residual fuel oils, kerosene or reprocessed waste oil used as fuel or lubricant, are regulated.

In an effort to prevent improper storage and handling of hazardous substances, the New York State Legislature passed Article 40 of the Environmental Conservation Law, the Hazardous Substances Bulk Storage Act of 1986. This law requires NYSDEC to develop and enforce State regulations governing the sale, storage, and handling of hazardous substances, as needed to prevent leaks and spills in New York State.

Controls established by the laws include: registration and inspection of storage and handling facilities; design, construction and operation standards; requirements for reporting leaks and spills and corrective action to be taken; and requirements for proper facility closure. The laws apply to both underground and aboveground tanks and prohibit sales of hazardous substances to unregistered facilities.

Hazardous substances subject to regulation are listed in Part 597 of the Chemical Bulk Storage (CBS) regulations. Over 1000 solids, liquids, and gases which are toxic, known or suspected carcinogens, explosive or otherwise dangerous when improperly handled or stored are included on the list.

Pollution Prevention Actions:

Educational

1) In conjunction with the creation of a local bulk storage facilities data base, municipal planning officials should be made aware of the status of bulk storage facilities within its municipalities. Location, type and quantity of bulk storage information could be used for land use management decisions.

2) The local data base should also be made available to emergency services agencies (i.e. - fire and rescue) for increased awareness of appropriate response equipment and personnel.

Direct Government Action

3) Create a local bulk storage facilities data base.
4) Create a local spill notification procedure.

Estimated Effectiveness of Proposed Measures:

1) Somewhat effective
2) Somewhat effective
3) Very effective
4) Somewhat effective

Technical Feasibility:

1) Education would not be technically difficult and could be handled by agency staff.
2) Education would not be technically difficult and could be handled by agency staff
3) Data base may be used on currently available software, but may hardware, software, and training.
4) The local data base would need to be transferred to the watershed inspector. This requires computer

<u>Political/Behavioral Feasibility:</u>

1) Acceptable
2) Acceptable
3) Acceptable
4) Will be required for the implementation of a local spill notification procedure

Bulk Storage Facilities (Petroleum and Chemical)

Control Options	Planning	Education	Research and Demonstration	Technology Transfer	Financial Incentives	Regulatory Programs	Direct Government Action
Proposed Measures		1) Use of data base for local decision making 2) Data to Fire and Rescue Services					3) Create local database 4) Establishment of spill response procedures
Implementation Lead Support		1) KWIC, CCE, SWCD, YCPD 2) Yates Emergency Management					3) KWIC 4) Yates Emergency Management, KWIC
Time-line							
Capital Equipment and Personnel Needs		Materials preparation, meetings w/ planning boards					3) Software and training 4) In-Kind Agency
Cost		16 munic. x 3 hrs x $30/hr $1440 inkind					$300 cash, $500 inkind 4) minimal

RECREATION
POLLUTION PREVENTION WORKSHEET

Goal: To encourage recreational activity and tourism and minimize the environmental impact within the Keuka Lake watershed.

Problem Description: The Keuka Lake watershed provides a diversity of outdoor recreation opportunities on land, in the water, and throughout the seasons. Water-based recreation produces tremendous economic benefits locally and depends on a clean and healthy lake. Motorized boating, while enjoyable and popular on Keuka Lake, does come with a cost. Concerns over fuel spillage, exhaust, noise, sediment pollution from wave action, conflicts with other recreational pursuits, safety, visual impacts and poor sanitation are some of the issues identified in the literature and by a Keuka Lake Association poll of its membership.

Impaired Uses Being Addressed:

Current PWP Impairment: Bathing (stressed), Aesthetics (stressed), and Boating (stressed)

Other Use Impairments and Concerns: The cumulative effects of the problems noted above may lead to damage of the high quality fishery, a loss of certain passive recreational uses incompatible with the more active uses, poor lake water quality, unwanted weed growth, increased turbidity, and a growing perception of a polluted lake.

Existing or Past Measures: Keuka Lake has special navigation laws established for boat speed and noise passed in the 1980's by the State Legislature. Day, night and nearshore speeds are also regulated. Dock and mooring enabling legislation was passed by the State Legislature in the late 1980's, however, the municipalities did not convene and agree on a uniform standard and the legislation authority expired after a specified period. The Yates and Steuben County Sheriffs operate a full-time boat patrol on the lake enforcing water safety regulations, speed and noisee limits, littering ordinances and the 1993 and 1996 Navigation Law amendments pertaining to sealed heads on boats and personal watercraft operation.

Pollution Prevention Actions:

1) Increased education for all boaters, young and old, on Keuka Lake.

2) Increased statewide enforcement for boating violations (i.e., licensing or other mechanisms that tie boating violations with vehicle licensing). Work with other lake associations (Federation of Lake Associations), law enforcement agencies, magistrate associations, and local legislators to develop a viable and effective strategy.

3) Increased enforcement of existing navigational laws.

4) More public restrooms and pumpout stations on the lake.

5) Reexamine boat speed regulations nearshore (200') and during high water levels.

6) Promote signage for all houses/docks on the lake.

7) Examine and recommend a strategy for dock and mooring issues on the lake.

8) Increase public review and communications on special boating events (i.e., regattas).

9) Examine and recommend a strategy for increasing setbacks from bathing areas for all boats (currently 500' for jetskis and 200 feet for other motorized craft).

10) Education on the importance and protection of the littoral zone.

11) Minimize impacts of sediments and nutrients on the lake to protect recreation uses and benefits.

12) Promote tourism and recreation with cooperating organizations consistent with protecting the health of the lake.

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RESIDENTIAL SOURCES OF PESTICIDES & NUTRIENTS POLLUTION PREVENTION WORKSHEET

Goal: Minimize off-site impacts of pesticide application. Advocate responsible pesticide use through integrated pest management.

Problem Description: Pesticide application can result in environmental contamination through diverse pathways. Off-site movement can occur by pesticide drift, chemical transport in surface water runoff to waterbodies or groundwater access through abandoned wells, leaching, attachment to eroding soil particles, negligent application practices, volatilization of applied chemicals, improper preparation or cleanup, careless disposal techniques, and ill-timed applications in relation to weather events.

Some pesticides are persistent for long periods of time and collect in the tissue of plants and animals. Predators feeding on smaller prey accumulate these persistent pesticides. Those organisms higher up the food chain bioaccumulate these toxins to a level that can alter reproductive success or cause other chronic toxicity problems. Consumption advisories for Keuka lake trout were issued because of unacceptably high concentrations of DDT and its metabolites in fish flesh.

Current PWP Impairment: The New York State Department of Health (DOH) has issued a health advisory which recommends that people over the age of 15 eat no more than one meal per month of lake trout over 25". Women of childbearing age, infants, and children under the age of 15 should not eat any fish species from Keuka Lake.

A review of chemical contaminants data shows that DDT (and metabolites) is a chemical of concern. There has been a clear trend of reduced levels in fish flesh, however, DOH looks for an established trend over several sampling periods before any advisory is lifted.

Existing or Past Measures:

1) All pesticides found in Keuka Lake fish tissue analysis (DDT) are banned in the United States but are highly persistent in the environment.

2) All pesticides sold in New York State are registered with NYSDEC. A registered pesticide is reviewed for its proposed claims, including directions for use. The permitted usage may be "subject to conditions or limitations that fully protect the public interest."

3) New York State law requires that pesticides which are highly toxic or persistent and accumulative be placed on a restricted use list.

4) Private applicators of restricted use pesticides are required to be certified by NYSDEC.

5) An individual who is applying general use and/or restricted use pesticides for commercial purposes is required to be certified unless under the direct supervision of a certified commercial applicator.
6) Certification requirements include a training program that addresses such topics as pesticide safety, application techniques and rates of application, and current laws governing the use of pesticides. To become certified, an applicant is required to pass two separate written examinations. All certifications must be renewed.

7) Commercial applicators are required to keep written records of the kind and quantity of pesticides used; dosage rates; methods of application; target organisms; and the use, date, and place of application for each pesticide used.

8) Private applicators must record on a form the restricted use pesticides purchased, the crop treated, their method of application, and the date of their application(s).

9) Registered pesticides are to be used in accordance with label directions only.

10) Commercial lawn care companies must provide their clients with a written contract stating the brand names and generic names of active ingredients applied and any warnings that appear on product labels pertaining to the protection of humans, animals, or the environment.[1] Markers must be placed on the perimeter of the area treated with pesticides, notifying people not to enter the property for at least twenty-four hours.

11) Cornell Cooperative Extension has numerous publications and resource materials concerning pest management around the home. A county extension agent is available for consultation and can offer recommendations for homeowner problems.

12) Cornell Cooperative Extension is a recognized institution for the dissemination of up-to-date pest management information for New York State.

Pollution Prevention Actions:

1) Promote pesticide awareness through pamphlet distribution, media publications, and workshops.

2) Establish a household hazardous waste and pesticide collection facility or periodically hold collection days for the agricultural community and homeowners.

3) Require stormwater controls in all new developments. Ensure that capture and treatment of the first flush (the initial runoff from a precipitation event that transports a majority of water quality contaminants) is provided.

[1]This is not an all-inclusive description of responsibilities under the law.

4) Work cooperatively with lawn and tree care companies to promote IPM programs for homeowners. Enact IPM standards to protect soil and water resources of the lake watershed.

5) Offer on-site lawn care consultative services through Cornell Cooperative Extension.

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ROADS
POLLUTION PREVENTION WORKSHEET

Goal: To reduce delivery of sediments, nutrients, salts, etc. originating from construction and maintenance activities associated with roads to watershed streams and Keuka lake.

Problem Description: There are 381.5 miles of public roads and several miles of private roads in the watershed. 24.2 miles of the public roads are associated with very severe erosion conditions, and 36.7 are associated with severe erosion problems.

By a conservative estimate, over 6300 tons of sediments per year originate in public road ditches and banks. Additionally, new private roads are constructed each year. The lack of site or construction standards causes these roads to yield increasingly large amounts of sediments to surface waters.

Road problem areas are commonly associated with highly sloping land. The collapse, slippage and scour of road banks and ditch bottoms can yield massive amounts of sediments. Such sediments clog ditches and culverts, diminish capacity and cause local flooding. Sediments can also damage stream life, especially by damaging fish habitat.

Differing approaches can be taken to erosion problems associated with roads depending on whether the problems arise from construction, maintenance, or siting activities.

Nutrients, especially phosphorus, often travel with sediments. Phosphorus is the limiting nutrient for Keuka Lake, and special attention should be given to sources and transports of phosphorus.

Impaired Uses Being Addressed:

Current PWP Impairments: none

Roadbank erosion is noted as a source of impairments in Keuka Lake in New York Nonpoint Assessment Report for Yates County, NYS DEC, 1990.

Existing or Past Measures: Cornell Local Roads Program offers technical training in road maintenance and construction. Local road projects require NYS DEC permits under Article 15, Title 5, 6NYCRR Part 608, Protection of Waters. Larger projects, however, are often covered by blanket permits, which lack measures to meet special conditions and problems.

The NYS DEC / NYS DOT Memorandum of Understanding Re. Stormwater Discharges, 12/17/93 establishes the responsibilities and exemptions of NYS DOT in relation to storm water discharges from road projects. Local laws may require permits for erosion and sediment control and stormwater management for highway projects.

Through a water quality education grant, Yates and Steuben County Water Quality Coordinating Committees developed a "Town Highway Superintendents Road and Water Quality Handbook".

This handbook is a collection of reference materials for highway superintendents to use when making road construction and maintenance decisions. A handbook was provided to every highway superintendent in the two counties. A day long training session was held to introduce the handbook.

Pollution Prevention Actions:

1) Increased use of training by highway officials, esp. for erosion control, offered by Cornell Local Roads Program.
2) Conduct local training programs organized by local SWCD in coordination with highway superintendents association.
3) Inclusion of erosion and sediment control standards in all highway construction and maintenance contracts.
4) Requirement of special re-vegetation measures, such as mulching, hydroseeding.
5) Requirement of structural measures for control of sediments and other pollutants of stormwater runoff.
6) Establish and enforce site and construction standards and erosion control measures for private roads.
7) Town laws for erosion and sediment control should include most highway practices.
8) When permits are required for the protection of waters, wetlands, etc., responsibility for application and enforcement should rest with highway superintendents, not contractors.
9) Local SWCDs can provide technical assistance for erosion and sediment control and stormwater management.

Possible sources of funding:

- NYS 1996 Clean Water/Clean Air Bond Act
- NYS Environmental Protection Fund for non-agricultural projects.
- Federal EPA 319 Water Quality funds.

References/Sources of Information:

Cornell Local Roads Program, 416 Riley-Robb Hall, Cornell University, Ithaca, NY 14853-5701.

"Developing Erosion Control Plans for Highway Construction", Brian C. Roberts, in Erosion Control, May-June 1994.

A Guide to Conservation Plantings on Critical Areas for New York, USDA Soil Conservation Service, Syracuse, 1991.

Reducing the Impacts of Stormwater Runoff from New Development, NYSDEC Division of Water, Albany, 1992.

Guidelines for Urban Erosion and Sediment Control- New York, USDA Soil Conservation Service, Syracuse, 1988.

"Town Highway Superintendents Roads and Water Quality Handbook", compiled by Yates and Steuben County Water Quality Coordinating Committees.

STATE POLLUTANT DISCHARGE ELIMINATION SYSTEM (SPDES) PERMITS
POLLUTION PREVENTION WORKSHEETS

Goal: To improve the management of SPDES permits classified as non-significant in the Keuka Lake watershed.

Problem Description: SPDES permits are divided into two categories: significant and non-significant. Significant discharges are those facilities with large amounts of wastewater discharge or wastewater which includes toxic substances.

The public may examine SPDES permits for significant and non-significant systems. However, actual sampling data is only available for significant permits. Non-significant sampling data is kept on-site by the facility owner and is not available to the public or are the data reviewed by the DEC on a regular basis.

SPDES permits are issued for five years, and the public can examine and comment on the permit's conditions and limits prior to issuance and/or during renewal. Non-significant SPDES permits are administratively extended/renewed without review by the NYSDEC. The actual condition and/or functioning of the non-significant systems are not physically inspected at the time of permit renewal.

The DEC is severely limited in manpower and dollars. When a non-significant system is reported as failing it is difficult to get the DEC to respond. The DEC has set a threshold of 10,000 gallons per day as the minimum discharge necessary for environmental concern and active inspection. Once the DEC permit is issued for a non-significant system, a failure may be considered a public health threat and as such the DEC passes the responsibility to the NYS Department of Health for correction. Coordination and participation between the two State agencies is considered efficient and effective.

SPDES permit information from the Region 8 Office of the DEC is difficult to obtain. Non-significant SPDES permit data is not entered on the State's computerized Permit Compliance System (PCS). A request for data must be made under the freedom of information law (FOIL) to obtain the SPDES permit data.

Impaired Uses Being Addressed:

Current PWP Impairments: There are no documented impairments caused from land use activities which contain a SPDES permit identified on the PWP list.

Other Use Impacts and Concerns: The need to address the potential contamination from land use activities which contain a SPDES permit stems from the pollution prevention approach to water quality protection.

There are 27 significant SPDES permits listed on the State's Permit Compliance System within the Keuka Lake watershed. SPDES facilities discharge to two types of receiving waters: groundwater and surface water. Of the 27 SPDES permits, 14 discharge to groundwater (i.e., to a leach field system) and 13 discharge to surface waters, 5 of which discharge directly into Keuka Lake.

Existing or Past Measures:
1) State
Article 17, Titles 7 and 8 address the State Pollution Discharge Elimination Systems Program.

Pollution Protection Actions:
Education:
1) Local officials should be made aware of the SPDES process, active permits in their municipality, and the impact on land uses decision making.

Direct Government Action
2) Sampling data from non-significant SPDES facilities should be provide by the facility owner on a regular basis to the KWIC.

3) An on-site inspection of all non-significant SPDES facilities at the time of permit renewal/extension should be conducted by the KWIC.

4) Upon failure of a non-significant SPDES facility the Keuka Lake watershed Association should coordinate the remediation of the violation between the DEC and DOH.

5) A local data base of SPDES permit data should be kept by the KWIC. The DEC Region 8 Office should provide a copy of all future SPDES permit records to the KWIC at the time they are processed.

6) A memorandum of understanding should be implemented between the Region 8 Office of the DEC and the KWIC regarding the above referenced items.

Estimated Effectiveness Of Proposed Measures: Very Effective

Technical Feasibility: feasible

Political/Behavioral Feasibility: Taking into account the manpower and budget constraints of the DEC concerning non-significant SPDES facilities it is feasible that a local/state partnership could be arranged between the DEC and the KWIC.

State Pollutant Discharge Elimination System (SPDES) Permits

Control Options	Planning	Education	Research	Technology Transfer	Financial Incentives	Regulatory Programs	Direct Government Action
Measures		1) Training for Local Officials					2) Sampling data of non-significant(NS) SPDES facilities transfered KWIC 3) On-site inspection of NS SPDES 4) Coordination of remediation 5) Establish local SPDES database 6) MOU between DEC and KWIC
Lead and Support		1) KLA, CCE, YCPD					2) KWIC and DEC 3) KWIC 4) KWIC and DEC 5) KWIC 6) KWIC and DEC
Time-line							
Capital Equipment and Personnel		1) Materials preparation, meetings w/ planning boards					2) [1]personnel time 3) [2]personnel time 4) [3]personnel time 5) [4]computer, software, personnel time 6) [5]personnel time
Costs		1) 16 munic. x 3 hrs x $30/hr $1440 inkind					2) 10 hours @ $25 = $250 3) 50 hours @ $25 = $1,250 4) 20 hours @ $25 = $500 5) 50 hours @ $25 = $1,250, software =$500, training = $250, computer $2,000 6) 10 hours @ $25 = $250

STREAMBANK EROSION
POLLUTION PREVENTION WORKSHEET

Goal: To diminish delivery of sediments and nutrients to Keuka Lake which originate in watershed streams.

Problem Description: Erosion of streambanks is one source of sediment loading into Keuka Lake. The purpose of this study was to estimate sediment yield from each subwatershed and direct drainage area and prioritize those having the highest pollution potential. The Keuka Lake watershed was divided into 16 subwatersheds and 13 direct drainage areas that comprise 132 tributaries that enter Keuka Lake. The 132 tributaries studied represent 308 miles of streams in the watershed.

The Erosion and Sediment Inventory (EASI) conducted in 1974 by the USDA Soil Conservation Service estimated 157 miles of actively eroding streambank in the watershed (USDA-SCS, 1974). The estimated sediment contribution from the 157 miles of streambank averaged 78 tons of sediment yield/mile/year. The total sediment yield from streambanks was estimated to be 3% of the total for the watershed (USDA-SCS, 1974). Streambank erosion was also named a high priority nonpoint source pollution in the Water Quality Management Plan for Yates County, 1981. Keuka Lake, Big Gully, Sugar Creek and many unnamed tributaries were listed as impacted water resources from streambank erosion in the 1981 study. The current (1997) county water quality strategies for Yates and Steuben County also name streambank erosion as a high priority nonpoint source.

Impaired Uses Being Addressed:

Current PWP Impairment: Fishing, (impaired), Bathing (stressed), Aesthetics (stressed), and Boating (stressed) All of these uses are affected by streambank erosion.

Other Use Impairments and Concerns: The cumulative effects of the problems noted above will lead to a damage of the high quality fishery, poor lake water quality, unwanted weed growth, increased turbidity, and a growing perception of a polluted lake.

Existing or Past Measures: A number of the town, county and state highway departments have implemented streambank protection practices at road and culvert intersections. Additional streambank work away from the highways have been concentrated on Cold Brook and Michellsville Creek. Private landowners have also protected numerous streambank problem areas in both counties.

Pollution Prevention Actions:
1) Encourage the use of vegetative filter strips to protect stream corridors (NYSDEC, 1986) .
2) Promote the installation of fencing to exclude livestock from streams (NYSDEC, 1986).

3) Diminish peak streamflows during storm events through land use regulations, stormwater and erosion control ordinances (NYSDEC, 1992).
4) Where feasible, implement bank stabilization practices on severely eroding banks (NYSDEC, 1986).
5) Educational programs on the protection of stream and shoreline areas.

Possible Sources of Funding

Environmental Quality Incentives Program-EQIP
NYS Environmental Protection Fund-EPF
New York State Clean Air/Water Bond Act
Clean Water Act-319
US Fish and Wildlife Partnership Program
Wildlife Habitat Incentives Program (WHIP)

References

NYSDEC. 1986. *Stream corridor management-a basis reference manual.* NYSDEC, Albany, New York.

NYSDEC. 1992. *Reducing the impacts of stormwater runoff.* NYSDEC, Albany, New York.

USDA-SCS. 1974. *Erosion and sediment inventory in New York.* USDA-SCS, Syracuse, New York.

USDA-SCS. 1954. *Handbook of channel design for soil and water conservation.* Technical Bulletin SCS-TP-61. USDA-SCS, Washington, DC.