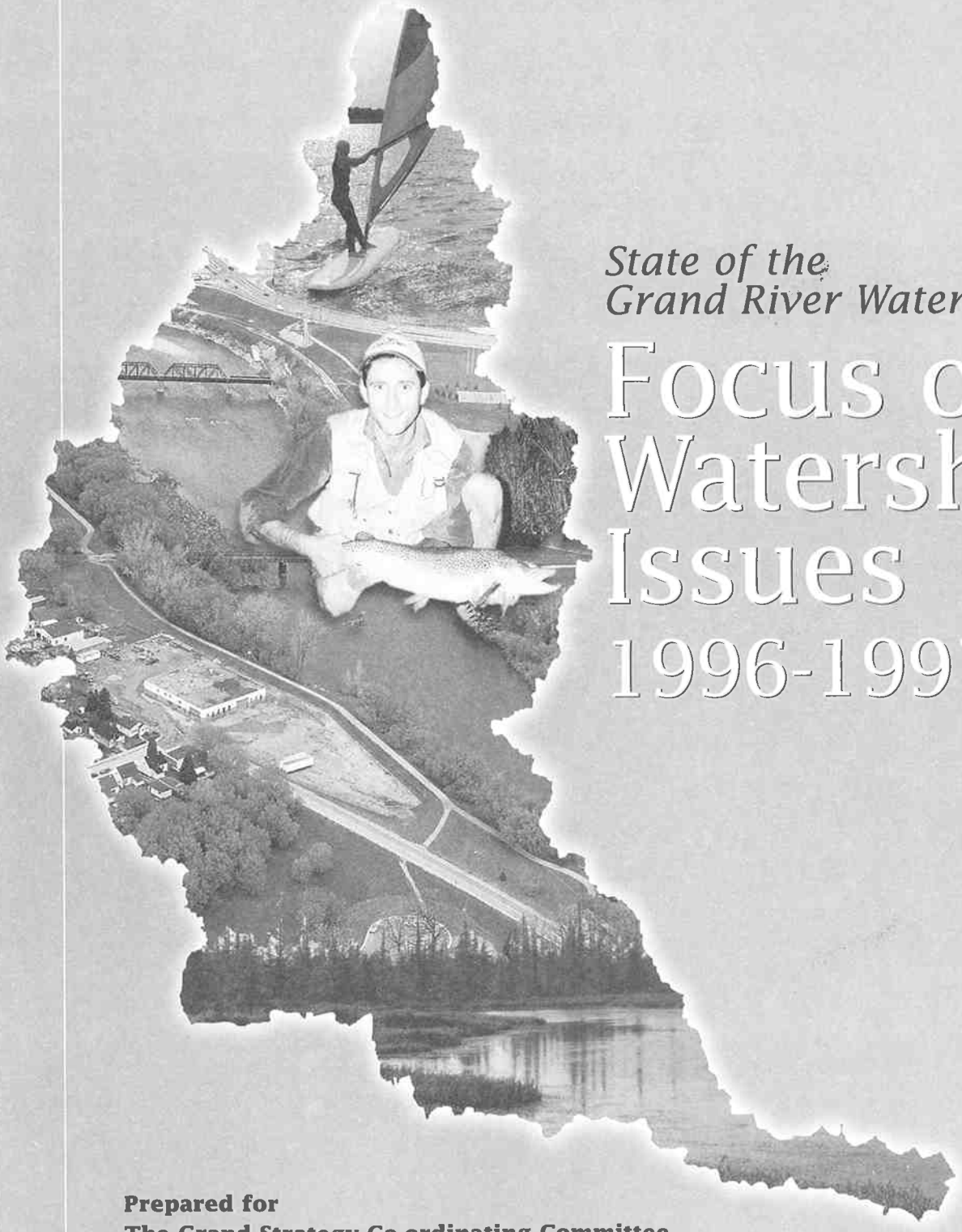


State of the Grand River Watershed

Focus on Watershed Issues 1996-1997

Prepared for
The Grand Strategy Co-ordinating Committee
by The Grand River Conservation Authority

November, 1997
Reprinted with minor revisions: September, 1998

Table of Contents

Preface

The State of the Grand River Watershed

The purpose of *The Grand Strategy* is to tackle the most pressing cross-boundary watershed management issues facing communities in the Grand River watershed by setting priorities, building partnerships, linking programmes and pooling resources.

THE GRAND RIVER WATERSHED holds a growing population, a large industrial base and a productive agricultural community. All have prominence within the Great Lakes Basin and Canada as a whole; all are dependent on inland surface and groundwater sources for water supply.

The targets, allocations and long term strategy for this heavily-managed river system must be carefully balanced to ensure that our present and future needs can be met.

Millions of municipal dollars are tied to water supply and management decisions. Water managers and others in 58 watershed municipalities are committed to deal jointly with current and future water issues on a watershed basis, and we have a well established process to do this.

Cross-boundary growth and sustainability issues include:

- the capacity of the Grand River to receive the additional wastewater generated by future growth;
- the ability of the river and groundwater system to meet the growing demand for water;
- maintaining river water quality and health so that the river system can be the focus for developing a viable tourism and outdoor recreation industry;
- maintaining the high quality groundwater resources and sensitive wildlife habitats in the central basin under the increasing stresses of urbanization.

These issues are being addressed by the partnership of municipalities and watershed residents through a shared work plan called *The Grand Strategy.* Current partners include municipalities, non-government organizations, universities, businesses, Six Nations, and federal and provincial agencies. The Coordinating Committee and numerous Working Groups have jointly identified issues and present this *Focus on Watershed Issues* as part of an ongoing series on the state of the watershed.


Grand River Watershed
N
Dundalk
GRAND RIVER
LUTHER LAKE
Grand Valley
Arthur
Irvine Creek
BELWOOD LAKE
Drayton
CONESTOGO LAKE
Fergus
Elora
Canagagigue Creek
CONESTOGO RIVER
WOOLWICH RESERVOIR
GUELPH LAKE
Rockwood
Elmira
Milverton
Guelph
Maryhill
St. Jacobs
Wellesley
Bridgeport
SPEED RIVER
Waterloo
Mill Creek
NITH RIVER
Baden
Kitchener
New Hamburg
Cambridge
Homer Creek
Ayr
Bright
NITH RIVER
St. George
Fairchild Creek
Drumbo
Paris
Princeton
Brantford
Kenny Creek
Whitemans Creek
Caledonia
McKenzie Creek
Boston Creek
GRAND RIVER
Hagersville
Cayuga
Dunnville
0 5 10 20 30 40
KILOMETERS

Overview

THE GRAND RIVER, in southwestern Ontario, originates near the Village of Dundalk and picks up its major tributaries, the Conestogo, Nith and Speed Rivers, as it winds 300 kilometres southeast to Lake Erie. The Grand is the largest tributary to Lake Erie on the Canadian side, and its 7,000 square kilometre watershed contributes 10 percent of the drainage to Lake Erie. The watershed's contribution to Canada's gross domestic product is comparable to that of Nova Scotia.

Agricultural and rural land uses predominate, with urban land uses concentrated in the central portion. Although this is considered an urban watershed, 81 percent of the population lives on seven percent of the land. Ninety-three percent of the watershed is rural. It is anticipated that agriculture will remain the major land use.

Most of the basin's 787,000 residents live in the cities of Kitchener, Waterloo, Cambridge, Guelph and Brantford and place high demands and stresses on the surface and ground water resources of the central basin. These are Ontario's only major cities that mutually rely on an inland river system for water supply and treated wastewater disposal. Typically, large cities import water from one of the Great Lakes or another large water body.

Today, the Grand River is one of the healthiest river systems in North America in a heavily populated area. Recreational use of the river has increased significantly. The natural beauty, cultural diversity and recreational opportunities of the river system were formally recognized as nationally important through the designation of the Grand River as a Canadian Heritage River in 1994. Communities like Grand Valley, Fergus, Elora, New Hamburg, Guelph, Cambridge and Dunnville are looking to the river system as a focus for developing a viable tourism industry.

Our continued growth and prosperity depend on a healthy watershed.

The Grand River Success Story

FROM SEWER to salmonids in 50 years! This is the story of the recovery of the Grand River from years of degradation and industrialization. It is an epic story of challenge and change that is far from over.

Water power made the Grand River valley a focus for settlement and industrialization from the 1800s. Deforestation of the watershed and drainage of wetlands changed the way the Grand River and its tributaries dealt with heavy rainstorms and summer droughts. Surplus flows, previously restrained in woody swamps, rushed downriver, flooding banks and destroying property and livestock. The rivers became sluggish and shallow, filled with undiluted human waste from riverside communities. By the early 1900s, the river had become the enemy—at times a vengeful swollen entity in the spring and a smelly sewer in the summer.

Public outcry after the devastation of several severe floods resulted in a provincial government investigation into the recurring river problems. The Finlayson Report in 1932 recognized low flow as a health hazard, and considered problems of water supply and sewage disposal as well as flood control. Several concerned municipalities recognized that they could not each deal with the problems alone. In 1938, they formed a partnership, the Grand River Conservation Commission, to deal with the issues. This was the first organization of its kind in Canada and third in the world. The Shand Dam was built by these partners in 1942 to prevent flooding and provide flow for dry seasons.

> This is the story of the recovery of the Grand River from years of degradation and industrialization.

With public and political recognition that land and water resources needed permanent management and protection, the Conservation Authorities Act was passed in 1946. Municipalities were empowered to initiate joint conservation measures, with technical and financial help from the province of Ontario. Since 1938, the Grand River Conservation Commission and its successor, the Grand River Conservation Authority, have worked in partnership with watershed municipalities and other government agencies to solve

Grand River Success Story

flood, low flow and water quality problems.

Seven reservoirs now provide storage for flood water and steady year-round flow. Flood control includes not only structural changes to river banks but a recognition of the value of woodlots, wetlands and natural stream channels in natural flood protection and water quality improvement.

Since 1966, the Ontario Water Resources Commission and its successor, the Ministry of Environment, have regulated municipal sewage treatment and industrial discharge into waterways. Summer flows are maintained by steady release from the major dams on the Grand River and its tributaries, and raw sewage no longer contaminates the river.

Aquatic life in the Grand River and its tributaries is thriving under the gradually improving conditions.

The 1982 Grand River Basin Water Management Study, completed by the Ministries of Environment, Natural Resources, Agriculture and Food, Municipal Affairs and Housing, and the Grand River Conservation Authority, set out an updated plan to deal with water quality, water supply and flooding issues. The recommendations of the plan included flood protection schemes, revised reservoir operating targets, wastewater treatment plant upgrades, and municipal surface water taking schemes for Waterloo Region, Guelph, and Brantford. Recommended projects were systematically designed to provide for flood control, water supply and wastewater discharge while improving water quality in the river system. Most of the recommendations of the plan have been implemented.

Municipal planning requirements now ensure that new developments retain and filter stormwater drainage before it is discharged to creeks or rivers. Programs such as the Environmental Farm Plan assist farmers with improvements that protect the water quality of local streams. Community stewardship plays a large part in tree planting and stream assessment and rehabilitation.

The Ministry of Natural Resources has developed successful programs and creative regulations with the goal of moving from fish stocking to protection and enhancement of river habitat. Aquatic life in the Grand River

Grand River Success Story

and its tributaries is thriving under the gradually improving conditions. Fish are returning from the Great Lakes, moving upstream into accessible tributaries to spawn.

The diverse fishery in the Grand and its tributaries is a measure of an enormous improvement in water quality and quantity. Anglers from all over North America enjoy the splendid recreational fishing opportunities of the Grand River watershed. Canoeists now enjoy a leisurely paddle in August, where once pedestrians walked on the riverbed—if they did not care about the state of their shoes!

The diverse fishery in the Grand and its tributaries is a measure of an enormous improvement in water quality and quantity.

The Grand Strategy and this Report

IN 1994, the Grand River and its major tributaries, the Nith, Conestogo, Speed and Eramosa Rivers, were officially proclaimed a Canadian Heritage River. A management plan called *The Grand Strategy for Managing the Grand River as a Canadian Heritage River* was produced. Participants in the process emphasized that now is the time to address pressing watershed resource issues. They suggested that the next step was an integrated watershed management plan, developed, supported and implemented by a wide range of watershed partners. A continuous and integrated watershed approach has evolved. Now called *The Grand Strategy for Shared Management of the Grand River Watershed*, this approach is being coordinated by the Grand River Conservation Authority.

The following sections outline the current state of the watershed with respect to population growth, business development, water supply, water capacity for waste water discharge, flooding, water quality, fisheries, natural areas and biodiversity, outdoor recreation, and human heritage. For each of these topics, the report summarizes the visions, goals and management principles set out by the participants to date, as well as the major resource and management issues and what needs to be done to deal with them.

Our challenge now is to partner and take action. Success depends on action by all partners, including agencies, municipalities, private enterprise, residents and users of watershed resources.

The reward will be improved health of the watershed ecosystem and the quality of human life in the watershed.

The major watershed management issues include:

- Keeping the watershed healthy (economically, socially and environmentally) while accommodating growth;
- Developing a viable tourism industry while protecting the resources on which it is based;
- Improving water quality using a cost-effective balance between wastewater polishing and non-point source control;
- Ensuring adequate water supply and dealing with water allocation issues;
- Reducing flood and erosion damages using a mix of structural and non-structural approaches;
- Conserving the natural environment and biodiversity;
- Conserving heritage and a sense of place.

About the GRCA

TODAY'S GRAND River Conservation Authority is a partnership of 48 municipalities and 10 counties and regions in the Grand River watershed that manages water and natural resources on a watershed basis. Its 26 member Board is composed of representatives appointed by the municipal councils in the watershed. It is financially supported by municipal levies (30 percent), government grants (12 percent) and its own user fees and rentals (58 percent). Its staff includes experienced practitioners – water resources and environmental engineers, terrestrial and aquatic biologists, foresters and environmental planners – who work as an integrated team. Its core business includes watershed planning, improving water quality, reducing flood damages, providing water supply, protecting natural heritage and biodiversity, and information management.

The Grand River Conservation Authority is committed to act as a catalyst for *The Grand Strategy*, and to:

- actively pursue partnerships and cooperative efforts by all levels of government, institutions, businesses, community organizations and landowners in solving watershed problems;
- coordinate the preparation of an annual state of the watershed report on the health of watershed resources, the effectiveness of the year's activities, and priorities for action;
- provide administrative and technical support to ensure continuing participation;
- organize and maintain, with other partners, an accessible information base; and
- carry out priority actions for which the Grand River Conservation Authority is deemed responsible.

The reward will be improved health of the watershed ecosystem and our quality of life.

Is there river capacity to receive additional wastewater at reasonable cost as the population grows?

Population Growth

The watershed population will grow by 37 percent over the next 25 years —an additional 300,000 people.

THE 1996 POPULATION in the watershed is estimated to be 787,000. The population is projected to grow by 24 percent by 2011 and 37 percent by 2021. Most of the growth will take place in the centre of the watershed, in and around the five major cities and along the Highway 401 and 403 corridors. Ninety percent of the population growth will occur in these five cities, and each of the cities projects that this growth can be accommodated within the current city boundaries. The remainder will be clustered around serviced towns and villages, since many municipalities in the higher growth areas have policies directing development to serviced settlement areas.

Vision for the Future

- The quality of life and sense of place will be maintained.
- Growth will be managed so that it benefits future generations by integrating economic growth, social development and environmental protection.

Water and Wastewater Capacity to Support Growth

The "inland" location of the cities has created opportunities and unique challenges related to water supply and wastewater treatment. The most serious questions about water supply capacity to support projected growth have arisen in Waterloo Region. While water supplies and allocations for the cities of Kitchener, Waterloo and Cambridge are sufficient for the next 15 to 20 years, Waterloo Region is working to identify

Downstream communities are concerned about the impact of upstream population growth on river water quality.

What to Do?

- Determine the capacity of the Grand River system to receive wastewater discharge from this growing population. Determine how this capacity can be improved.
- Determine the capacity of the Grand River system (surface and groundwater) to meet the long-term water supply needs of this growing population.
- Determine how development should take place to ensure that the water capacity and watershed health are sustained.

a secure long-term water supply. At the same time, the cities and towns in the Grand River watershed discharge treated wastewater (sewage) into the river. Wastewater treatment standards exceed those normally seen across Ontario because of the heavy demand on the receiving river system. There is a serious question of river capacity to receive additional wastewater at reasonable cost in response to population growth, particularly in Guelph and Waterloo Region. Downstream municipalities are also concerned about the impact of upstream population growth on river water quality from both water supply and community resource perspectives.

Shifting Demographics

The population is ageing. By 2021, people aged 55 and older will shift from 17 percent to 31 percent of the population. The labour force will age but will remain at about 65 percent of the population. By 2021, the labour force is expected to grow by 229,000 people. Employment growth must keep pace with the potential growth of the labour force to avoid creating the bedroom community situation with its imbalance in service expectations and tax base. Population ageing also implies shifts in leisure activities (toward outdoor recreation) and interests (toward participation, environmental activism, appreciation of natural and human heritage).

Population Growth

Population Growth Issues

- The capacity of the river system to accommodate increasing wastewater discharge at reasonable cost.
- The capacity of the ground and surface water systems to meet growing municipal/domestic water demands at reasonable quality/cost.
- Adapting to an ageing population.
- Developing industry along with population growth—avoiding the bedroom community syndrome.
- The cost of building and maintaining infrastructure.

Management Issues

- Water supply, wastewater disposal, and municipal growth strategies have not been integrated over most of the watershed.
- There is no guidance on a watershed basis for sustainable capacity and how growth should be managed.

The watershed is one of Canada's richest agricultural regions. Agricultural growth and intensification have implications for sustainable water supply, water quality and environmental management.

Business Development

Employment growth and business development must keep pace with growing labour force.

THE WATERSHED, which contains Canada's Technology Triangle, has a vibrant diversified economy and supplies a significant portion of Canada's gross domestic product. As of 1991, the service sector was the most dominant sector of the watershed economy (32 percent), followed by manufacturing (25 percent) and trade (17 percent). The proportion of the labour force working in manufacturing is significantly higher in this watershed than in the rest of Ontario and Canada.

Employment growth and business development must keep pace with the growing labour force to realize growth expectations, to maintain current living standards and to avoid the "bedroom community" situation. Industry needs an abundant, qualified workforce, ready transportation of goods, and predictable development costs and regulatory framework. On the other side of the equation, the abundant well-trained workforce is attracted by the quality of life and the promising standard of living in the area.

The watershed is also one of Canada's richest agricultural

Vision for the Future

- The watershed will remain a preferred area in which to invest and entice prospective employees.
- A vital rural economy will support and sustain rural communities.
- Tourism, based on heritage and recreational resources, will provide significant economic benefits for rural and urban communities.
- Business development that benefits communities will be encouraged in all sectors.
- Business development will reflect the values we uphold in the watershed.

The watershed's great potential for a strong cultural, recreational and eco-tourism industry has not yet been realized.

What to Do?

- Get the business and manufacturing sectors actively involved in *The Grand Strategy.*
- Demonstrate proactive, streamlined planning and approval processes that result in predictable business development costs.
- Develop adaptive strategies to strengthen the rural economy and revitalize rural communities.
- Link urban and rural heritage and outdoor recreational opportunities to create Grand River experiences. Market as a world-class recreational, cultural and ecotourism destination.

regions, referred to by Statistics Canada as an "agricultural nirvana." The average value of capital per farm is one of the highest in the nation. In 1990, the area had Canada's second highest average gross farm receipts. The area is experiencing a great deal of agricultural growth and intensification (with implications for sustainable water management, water quality and environmental management).

Rural towns and villages, once the rural centres of business and commerce, are now attempting to refocus their economies and to adapt to the changes that are taking place.

There is a basis for a strong cultural and eco-tourism industry within the Grand River watershed. The watershed is underutilized as a cultural, recreational and educational asset. The designation of the Grand River as a Canadian Heritage River has enhanced public awareness and destination recognition. A number of profit and non-profit interest groups have already taken initiatives to increase the profile of the Grand in their own promotional efforts.

Business Development

Business Development Issues

- Maintaining the quality of life, standard of living, and municipal infrastructure that support industrial and business growth.
- Economic revitalization of rural towns and villages.

Management Issues

- Business development is rarely connected to environmental and social planning.
- Poorly organized information and just-in-time land use and infrastructure planning can make business development costs very unpredictable.
- The potential for tourism based on natural and human heritage resources of the watershed has not been realized.

While Waterloo Region's current drinking water supplies will meet its needs for the next 15 to 20 years, options are being considered to secure "long term" water supply.

Water Supply

Most of the watershed is blessed with abundant, good quality groundwater. Protecting its quality is critical.

GROUNDWATER IS the major source of municipal and domestic water supply in the watershed. High quality groundwater resources are relatively plentiful in the upper and middle portions of the watershed. Brantford and areas downstream (Cayuga and Dunnville) have historically taken their water supply from the river. In response to recent growth, Waterloo Region is relying more heavily on water taken or recharged from the river system. Brantford and Six Nations (Ohsweken) rely exclusively on the river for water supply. Caledonia and Cayuga obtain water from Hamilton, and Dunnville pipes water from Lake Erie. The remainder of the serviced towns and villages continue to use groundwater.

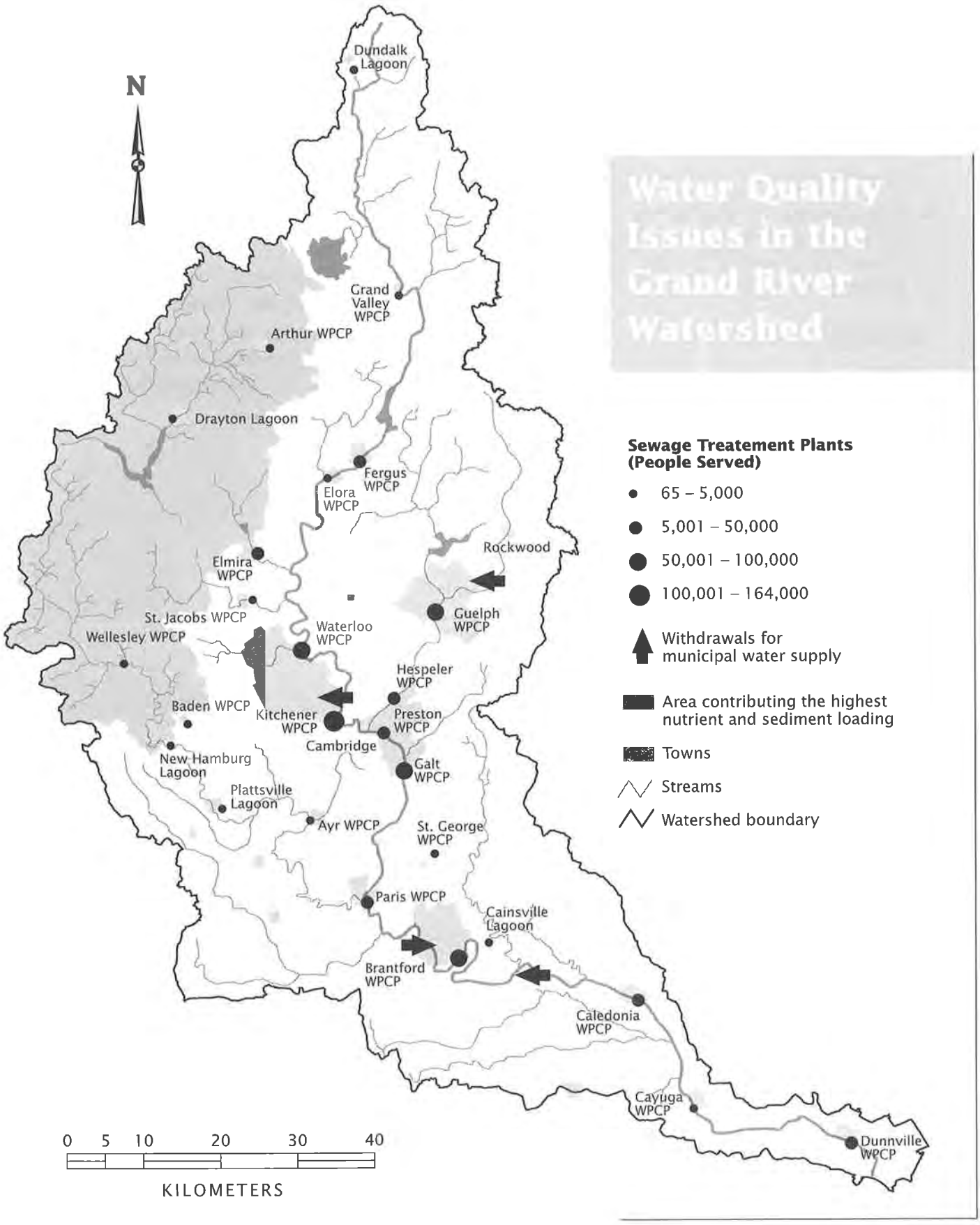
Most of the watershed is blessed with abundant, good quality groundwater. However, issues have arisen over water taking across municipal boundaries, water taking in rural areas for urban use and our ability to protect the quality of groundwater.

While Waterloo Region's current drinking water supplies will meet its needs for the next 15 to 20 years, options are being considered to secure "long-term" water supply. These include recharging treated river water to groundwater aquifers for use in dry seasons (currently being tested); drilling more wells; or building a pipeline to one of the Great Lakes (which

Vision for the Future

- Surface and groundwater will be used wisely to ensure that there is sufficient water to meet future needs (domestic, industrial, agricultural, recreational, and natural environment).
- Watershed residents will value water and protect the quality of water.

Brantford's water supply from the river, while abundant, is affected by the quality of the water flowing from upstream.


Water Quality Issues in the Grand River Watershed
N
Dundalk Lagoon
Grand Valley WPCP
Arthur WPCP
Drayton Lagoon
Fergus WPCP
Elora WPCP
Elmira WPCP
Rockwood
St. Jacobs WPCP
Wellesley WPCP
Waterloo WPCP
Guelph WPCP
Hespeler WPCP
Baden WPCP
Kitchener WPCP
Preston WPCP
Cambridge
New Hamburg Lagoon
Galt WPCP
Plattsville Lagoon
Ayr WPCP
St. George WPCP
Paris WPCP
Cainsville Lagoon
Brantford WPCP
Caledonia WPCP
Cayuga WPCP
Dunnville WPCP
Sewage Treatement Plants (People Served)
65 – 5,000
5,001 – 50,000
50,001 – 100,000
100,001 – 164,000
Withdrawals for municipal water supply
Area contributing the highest nutrient and sediment loading
Towns
Streams
Watershed boundary
0 5 10 20 30 40
KILOMETERS

Water Supply Issues

- Enough water to meet both current and future water supply needs.
- Balance between consumptive water use and maintaining aquatic and wetland resources.

Management Issues

- No one knows whether total water use by all users is sustainable over the long term.
- Rural water taking for urban use, cross-boundary water taking, commercial export of water.
- Urban residential water use is seen to be excessive.
- Water is considered a "free good" or has inconsistent value among users.

has implications for the amount of wastewater to be handled). Guelph is currently investigating the state of its long-term water supply. Brantford's water supply from the river, while abundant, is affected by the quality of the water flowing from upstream. While the city has the means and experience to deal with river water quality problems and deliver high quality drinking water, the cost of water treatment is affected by spills (including sewage spills from upstream treatment plants), soil washed off the land during rain storms, algae, and disease-causing organisms such as bacteria, *Giardia* and *Cryptosporidium*. Six Nations experiences similar challenges.

A key element of any long-term water strategy will be continued emphasis on water efficiency and water conservation. Several communities have implemented water efficiency programs. The status and potential for water conservation should be investigated on a watershed basis.

What to Do?

- Slow the increase in water use through municipal and industrial water efficiency programs and through residential water conservation programs.
- Investigate the sustainability of current water taking, and the capacity of surface and groundwater systems to meet future requirements. Investigate means of improving the capacity.
- Establish a process (and tools) to assess and allocate water taking with a clear understanding of impacts on both sustainable water supply and terrestrial and aquatic resources.
- Protect groundwater quality and groundwater recharge areas.
- Consider adaptive strategies to deal with drought periods and climate change.

600,000 people discharge treated wastewater into the river system. This will grow to 900,000 by 2021.

Guelph's future growth depends on finding additional capacity in the Speed River to receive the City's treated wastewater.

Water Capacity for Waste Water Discharge

WHILE ADEQUATE WATER SUPPLY is a long term question facing watershed residents, a more immediate question is the capacity of the river system to receive treated wastewater. Water taking limits for municipal water supply are directly linked to water quality. Dissolved oxygen, in particular, is affected by the amount of wastewater the river is asked to handle.

Treated wastewater from 600,000 people is currently discharged into the Grand River and its major tributaries. Guelph's future growth depends on finding additional capacity in the Speed River to receive the City's treated wastewater. Waterloo Region has estimated that over $100 million will be needed for wastewater treatment plant upgrades and expansions to accommodate the expected growth over the next 25 years. The capacity of the Grand River system to receive treated wastewater from Waterloo Region beyond that time frame is questionable and will affect the Region's long term growth potential.

Vision for the Future

- The river system will have adequate capacity to receive treated wastewater, while also meeting water quality and water supply goals.

Wastewater treatment standards exceed those normally seen across Ontario because of the heavy demand on the receiving river system.

Water Capacity for Waste Water Discharge

Resource Issues

- Withdrawal limits for water supply are linked to water quality.
- Water quality is affected by the amount of wastewater the river is asked to handle. 600,000 people discharge treated wastewater into the river system. This will grow to 900,000 by 2021.
- The capacity of the river system to receive additional wastewater into the future is questionable.

Management Issues

- The limiting factor for treated wastewater quality is cost. It is technically possible for wastewater treatment plants to discharge distilled water.
- Most wastewater treatment plants already incorporate advanced treatment and meet higher standards than are required across the province. It is becoming increasingly more costly to achieve improvements in water quality through treatment plant upgrades alone.

Water quality and water supply are improved by operating the multi-purpose reservoirs to put more water into the river. Four multi-purpose reservoirs are maintained and operated by the Grand River Conservation Authority as a system for low flow augmentation and flood control. They are filled with snowmelt and rain in February and March, and then drawn down in the summer to maintain river flows. The reservoirs are very important to the system. Eighty-five percent of the summer flow through Kitchener in dry summer periods, and 50 percent through Brantford and the lower Grand River, comes from the reservoirs. The reservoir flow targets at Kitchener, Guelph and Brantford are established to support wastewater capacity and allow for abstraction for water supply. They are operated very carefully on a day-to-day basis and have a 96 percent reliability of meeting flow requirements based on the last 35 years of record.

The recommendations of the 1982 Grand River Basin Water Management Study included revised reservoir operating targets, wastewater treatment plant upgrades, and municipal surface water taking schemes for Waterloo Region, Guelph, and Brantford. These are systematically designed to provide for water supply and wastewater discharge while improving water quality in the river system. Most of the recommendations of the plan have been implemented.

What to Do?

- Assess the combined impacts of long-term municipal wastewater strategies and rural water quality clean-up strategies. Optimize long-term wastewater strategies and plant discharges, considering river system capacity, water quality benefit and cost. Examine alternative technologies.
- Determine the capacity of tributary streams to receive wastewater from the smaller serviced communities, relative to growth projections. Where limitations are found, investigate means to improve capacity.

Water quality conditions have improved tremendously over the last 30 years, but there is evidence that this trend may have slowed or stopped.

WATER QUALITY CONDITIONS throughout the Grand River are greatly improved over those of the late 1960s and early 1970s. However, there is evidence that the improving trend may have slowed or even stopped. Declining water quality from upstream to downstream reflects the inputs from sewage treatment plants, industrial activity, urban development and agriculture throughout the basin.

The biggest water quality problems are low dissolved oxygen (affects aquatic life), excessive phosphorus (encourages nuisance plant growth and affects dissolved oxygen levels), bacteria and *Cryptosporidium* (public health concerns for surface water supplies and recreational use of the river) and suspended solids (also affect recreational use and increase the cost of water treatment). Toxins and contaminants (heavy metals, pesticides and industrial organic chemicals) are rarely found above guideline levels but are problems in localized areas (e.g. Elmira).

Fish caught in the river are suitable for human consumption, although pollutant concentrations in some predatory fish (walleye, pike, bass, salmon) are high enough that larger fish should only be eaten a few times per week. Microorganisms

Cryptosporidium, an organism thought to originate in areas where poor animal waste management occurs, is a concern for those who take their water supply from the river.

The biggest water quality problem is low dissolved oxygen, which affects aquatic life. Excessive phosphorus encourages weed and algae growth, which in turn affects dissolved oxygen levels.

Water Quality

Vision for the Future

- There will be a good quality water supply for both urban and rural residents at reasonable cost.
- We will be able to boat and swim in the river throughout the entire system without health concerns.
- We will be able to safely eat the fish.
- Water quality will support a healthy natural aquatic and terrestrial resource.

Water Quality

Water Quality Issues

- Water quality has improved over the last 30 years; however, progress has slowed or stopped.
- Phosphorus and suspended solids (mostly soil washed off the land) exceed provincial water quality objectives almost everywhere.

Management Issues

- Most water quality control efforts focus on municipal wastewater on a plant by plant basis. Processes and tools are needed to consider combined impacts and optimize upgrades.
- Municipal wastewater treatment plants and agricultural runoff both contribute significantly to the water quality problems.
- Technical support and financial assistance to farmers for water quality improvements has been greatly reduced.
- Funding support for water quality monitoring has been cut by at least one-half.

appear to be a serious problem only in localized areas. *Crytosporidium*, which may originate in areas where poor animal waste management practices occur, is a concern for those who take their water supply from the river.

Excessive phosphorus and nitrogen from wastewater treatment plants, urban storm sewers and agricultural runoff encourage nuisance plant growth, which leads to low dissolved oxygen levels at night, limiting fish and other aquatic organisms. Most municipal wastewater treatment plants now have phosphorus removal, and phosphorus loads from this source have been greatly reduced in recent years. However, phosphorus levels still exceed provincial guidelines almost everywhere. Dissolved oxygen conditions are still problematic in the Conestogo River, in the Speed River downstream of Guelph, in the Nith River, and in the middle Grand River between the Grand/Conestogo confluence and Glen Morris.

It is estimated that an additional 20,000 kilograms of phosphorus must be removed from the system each year to satisfactorily improve the current dissolved oxygen conditions. Removal of phosphorus solely by upgrading sewage treatment plants will not solve the problem. Control of phosphorus in agricultural runoff is also necessary. This can be achieved by managing nutrient application, by using soil erosion control practices such as conservation tillage and stream buffer strips, by managing livestock waste and milkhouse washwater and by maintaining septic systems. Wider use of these practices will also reduce nitrogen, bacteria, *Cryptosporidium* and suspended solids problems.

What to Do?

- Upgrade sewage treatment plants which are currently not meeting their discharge targets. Optimize operations at sewage treatment plants, focusing efforts on those plants nearing capacity or bypassing frequently.
- Focus work with the farm community on reducing phosphorus, bacteria, and soil entering streams in the Nith River watershed upstream of New Hamburg, in the Conestogo River watershed above Hawkesville, and in the Canagagigue Creek watershed above Elmira. Set up sustainable cost sharing arrangements between municipalities and farmers for water quality improvements.
- Focus urban stream quality monitoring in the major cities (Guelph, Waterloo, Kitchener, Cambridge, Brantford). Determine which urban streams are contributing the biggest phosphorus and sediment loads and which types of stormwater control are most effective for removing nutrients, bacteria, and sediment.
- Establish a watershed-based water quality management process (and tools) which will allow combined impacts of wastewater treatment plants and agricultural activities to be considered and efforts to be directed for maximum effectiveness.
- Improve consistency of spills warning for water users; i.e. municipal/industrial supplies, domestic/agricultural supplies, and recreation.

Half of the water quality problem comes from municipal wastewater treatment plants. Half of the problem comes from urban storm runoff and from rural/agricultural sources.

Many communities are still very vulnerable to flood damage. These include Grand Valley, Drayton, Kitchener, Waterloo, Guelph, New Hamburg, Paris and Dunnville.

Flooding

Flood damage potential has been greatly reduced by a combination of means: reservoirs, dyking and channel works, floodplain regulations, flood warning, reforestation and wetland protection.

THE GRAND RIVER and its major tributaries have a long history of flooding. The river system has been amazingly quiet for almost 20 years, and large scale flooding, such as that experienced in 1974 and 1975, seems a distant memory. The weather has been in our favour.

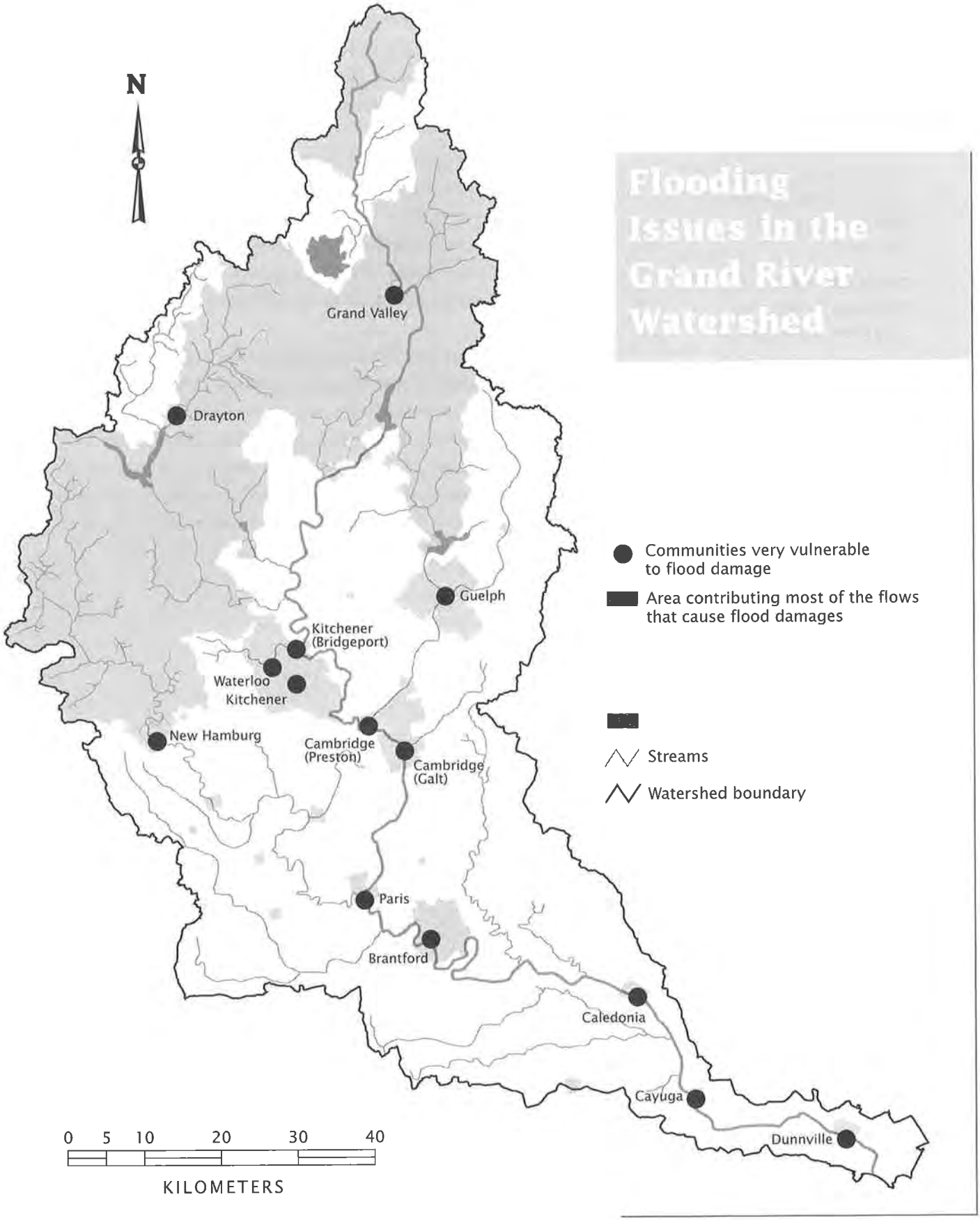
After 50 years of sustained effort, the flooding issue is relatively under control. Notwithstanding the favourable weather conditions, flood damage potential in the Grand River watershed has been greatly reduced by a combination of means. These include operation of the major reservoirs, dyking and channel works, floodplain regulations, flood warning, and non-structural means such as reforestation and wetland protection.

Since 1974, flood protection works have been completed in Kitchener (Bridgeport), Cambridge (Galt), and Brantford. A very effective flood forecasting and warning system has been developed, along with annual testing and maintenance routines. The communities with completed flood protection works must still maintain their preparedness for flood emergencies. Flood protection works reduce the risk and frequency

Vision for the Future

- Flood damages will be reduced.
- Flood prone communities will be prepared for flood emergencies.

The growing numbers of riverside campgrounds and recreational users are increasing the risk to life in what might have historically been called "nuisance floods."


Flooding Issues in the Grand River Watershed
N
Grand Valley
Drayton
Guelph
Kitchener (Bridgeport)
Waterloo
Kitchener
New Hamburg
Cambridge (Preston)
Cambridge (Galt)
Paris
Brantford
Caledonia
Cayuga
Dunnville
Communities very vulnerable to flood damage
Area contributing most of the flows that cause flood damages
Streams
Watershed boundary
0 5 10 20 30 40
KILOMETERS

Flooding Issues

- Potential for significant flood damages still exists in Grand Valley, Drayton, New Hamburg, Kitchener, Waterloo, Paris and Dunnville.
- Dam safety studies are indicating priority work that needs to be done.
- The growing numbers of riverside campgrounds and recreational users are increasing the risk to life in what might have historically been called "nuisance floods."

Management Issues

- Operating constraints on the multi-purpose reservoirs are increasing because of growing demands to control nuisance floods, growing demands for water supply, wastewater capacity and water quality improvements, and increasing pressure to operate for other uses.
- Efforts to maintain the flood warning system and emergency preparedness must continue.
- Provincial funding assistance for capital works and major maintenance of flood control structures is no longer available. New funding arrangements are needed for priority works.

of flooding but do not eliminate the hazard.

A dam safety program has been put in place. Dam safety studies have been carried out for Shand and Conestogo Dams. The undersized spillway at Shand Dam is currently being reconstructed. Other recommended work is underway or has been scheduled.

Floodplain mapping has been updated for most of the communities that experience flooding. Floodplain policies have been refined and are reflected in municipal planning documents. Two zone and special policy areas have been developed for most areas of existing development to minimize the increase in flood potential as development and redevelopment occur.

There are a number of communities that are still vulnerable to flood damage. Flood damage potential in each of Grand Valley, Drayton, Kitchener, Waterloo, Guelph, New Hamburg, Paris, and Dunnville still averages more than $50,000 per year. In addition, there are hundreds of rural homes and businesses that are vulnerable to flooding. The growing numbers of riverside campgrounds and recreational users are increasing the risk to life in what might have historically been called "nuisance floods."

What to Do?

Maintain preparedness for flood emergencies.

Keep inappropriate development and uses out of the floodplain.

Establish new funding arrangements to maintain and renew flood and erosion protection works.

Implement Dam Safety Study recommendations.

Undertake works to reduce flood damages.

Investigate the effectiveness of at-source measures.

Fisheries Resources

Health of the fishery is most limited by water quality, including low dissolved oxygen levels and sedimentation (soil washed off the land).

A very successful trout fishery, internationally recognized as one of the best in North America, has been created on the Grand River downstream of Belwood Lake.

THERE IS EXTRAORDINARY potential for a healthy, sustainable aquatic ecosystem throughout the Grand River watershed. Coldwater (brook trout) streams fed by groundwater from the moraines and gravel terraces occur throughout the watershed and are plentiful in the eastern and central portions. In agricultural areas, new approaches that optimize stream health and drainage improvement are needed. In urbanizing areas, efforts are being made to upgrade wastewater treatment, to control stormwater runoff, and to maintain groundwater flow to these streams.

The Grand, Conestogo, Speed and Nith Rivers, and their larger tributaries, support warmwater aquatic life (bass, walleye, pike, panfish). These larger tributaries are recovering from their degraded state from the 1950s to 70s and can yet realize a much greater potential. Health is most limited by water quality issues, including low dissolved oxygen levels, sedimentation, and localized ammonia/chlorine toxicity barriers.

Seasonal migration of lake species (rainbow trout, walleye, channel cats, mooneye) from Lake Erie up the Grand River has

There is extraordinary potential for a healthy, sustainable, world-class fishery throughout the Grand River watershed.

Vision for the Future

- The entire Grand River system will support a healthy, self-sustaining world-class fishery.
- Aquatic resource health and diversity will be indicators of overall watershed health.
- Fisheries management will be based on the aquatic ecosystem approach to managing fisheries.

Fisheries Resources

Resource Issues

- Poor water quality, including low dissolved oxygen levels, sedimentation, increasing water temperatures and localized ammonia/chlorine toxicity.
- Sensitive habitats are being lost due to urbanization and municipal drain clean-out.
- Barriers to fish movement (e.g. dams) limit access to the range of habitat conditions needed seasonally or through the life cycle.
- Invasive exotics (e.g. zebra mussels, gobie, sea lamprey) threaten to displace native species.

Management Issues

- Growing popularity of sport fishing versus overfishing.
- Expanding migratory sport fish range while protecting resident fish populations.

improved with the construction of the Dunnville Fishway. Brantford's Lorne Dam removal has opened access all the way to New Hamburg. The colonization of Nith River tributary streams by migratory rainbow trout is being monitored.

The large reservoirs (Belwood, Conestogo, Guelph) support warmwater sport fish, although the operation of these multi-purpose reservoirs is not always ideal for fish production. The cold water discharge from the large dams creates potential for tail-water fisheries development. A very successful brown trout fishery, internationally recognized as one of the best in North America, has been created on the Grand River downstream of Belwood Lake.

The Grand River Watershed Fisheries Management Plan was recently completed by MNR with DFO, Six Nations, angling clubs and GRCA, and with extensive public consultation. The Plan outlines priorities which include water quality improvement, local habitat improvements, promotion of local resources, innovative regulatory changes, improved availability of information, protecting native stocks, and removing barriers to fish movement.

What to Do?

- Improve water quality with emphasis on dissolved oxygen levels, reducing sediment and reducing summer water temperatures. Focus water quality improvements on the Nith and Conestogo Rivers and the Lower Grand River.
- Develop a "win-win" stream and drain management strategy that optimizes land drainage improvement, water management, and stream health. Focus demonstrations and applications in the Nith, Conestogo and Upper Grand River watersheds.
- Carry out tributary subwatershed plans to define opportunities, cause/effect and restoration needs.
- Improve stream habitat through cooperative efforts of various partners. Follow up on subwatershed plan recommendations for stream rehabilitation in Strasburg, Laurel, Hanlon, Blair, Bechtel, and Mill Creeks, and the Eramosa River. Expand community action opportunities.

Natural Areas & Biodiversity

Landowners hold the key to protection and management.

Wetlands and brooks supported by mixed forest uplands provide habitat for diverse flora and fauna.

FEW ARE AWARE of the outstanding natural heritage resources in the 29 different eco-regions that make up the watershed.

Expansive wetlands in the headwaters of the Grand provide nationally important stopover and nesting areas for migratory birds and waterfowl.

The complex groundwater systems and rugged terrain in the watershed's central portion set the stage for wild areas that have been set aside from agriculture over the history of human settlement. Wetlands and brooks supported by mixed forest uplands provide habitat for diverse flora and fauna. The deeply incised river valleys of the Grand, Nith, Conestogo, Speed and Eramosa Rivers provide extensive natural corridors.

Within the Carolinian Zone in the watershed's southern half, prominent features include the Brant prairie habitat, the extensive forests of the Six Nations Reserve, the slough forests and the Dunnville Marshes.

The intensively farmed till plains on the west side of the

Most of the population growth will continue to occur in areas of sensitive habitat in the central and east side of the watershed.

Vision for the Future

- Habitats will support viable self-sustaining populations of naturally-occurring species. We will not lose any more native species.
- Landowners will value natural areas and understand the management needs of resources on their land.

Natural Areas & Biodiversity

Resource Issues

- Expansive upland forest, grassland and wetland habitats are being fragmented and lost, threatening gene pools, specialized species, and species vulnerable to predation.
- Invasive exotics (garlic mustard, Norway maple, buckthorn, purple loosestrife) threaten to displace native species.

Management Issues

- Technical help for landowners in understanding the role and management needs of resources on their land.
- Low dollar value of forest products limits management activity. Forestry programs are not linked to natural heritage conservation.

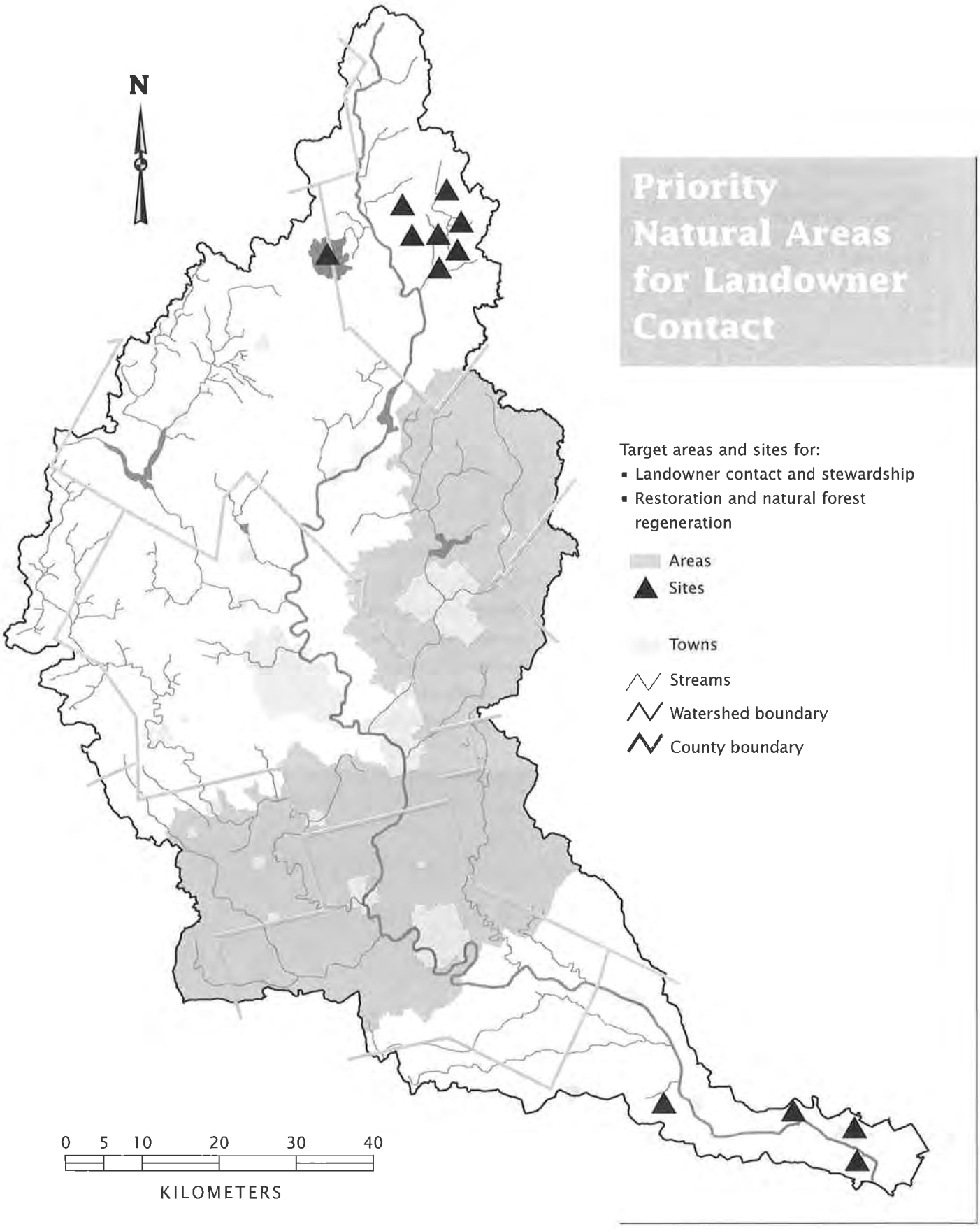
watershed have the least forest cover. To a large degree the woodlots along the backs of farms comprise the remaining natural area, creating a patchwork parallel to rural concession roads. Overall, the watershed is 17 percent forested, although forest cover is close to 30 percent on the east side. Thirty percent forest cover is considered healthy.

Most of the population growth will continue to occur in areas of sensitive habitat in the centre and east side of the watershed, placing significant pressure on these resources. While fewer large features are being lost to development, fragmentation continues to threaten gene pools, specialized species and species vulnerable to predation. In addition, the natural environment, highly dependent on water conditions, is rarely taken into consideration in water management and use decisions.

In the urban and urbanizing areas, the municipal land use planning process will be instrumental in natural heritage conservation. In the 93 percent of the watershed that is rural, landowners hold the key to protection and management.

What to Do?

- Develop a natural heritage framework to provide context for municipal/local planning, and to focus restoration and management activities.
- Focus landowner contact on the broad band of wetland complexes stretching from Erin Twp. to Blandford Blenheim Twp., and on sites of great importance: Luther Marsh, Amaranth Township wetlands, Grand River Forests, Brant County prairie sites, North Cayuga slough forests, Oriskany Sandstone, Dunnville Marshes.
- Provide positive incentives to landowners for good management of natural heritage resources. Work with landowners to develop stewardship plans for their forests.


N
Priority Natural Areas for Landowner Contact
Target areas and sites for:
▪ Landowner contact and stewardship
▪ Restoration and natural forest regeneration
Areas
Sites
Towns
Streams
Watershed boundary
County boundary
0 5 10 20 30 40
KILOMETERS

With the improvement in water quality and a growing interest in outdoor recreation, many people have discovered the Grand.

Outdoor Recreation

The growing recreational use of the river system brings pride and recognition, opportunities for small business development and increased tourism dollars

WITH THE IMPROVEMENT in water quality and a growing interest in outdoor recreation, many people have discovered (or rediscovered) the Grand. Recreational use of the river has increased in recent years, particularly for boating, canoeing, camping, hiking and fishing.

Camping and outdoor recreation facilities are provided by both private and public sectors. The GRCA plays a major role in watershed recreation by providing over 2,700 campsites and 100 kilometres of hiking trails.

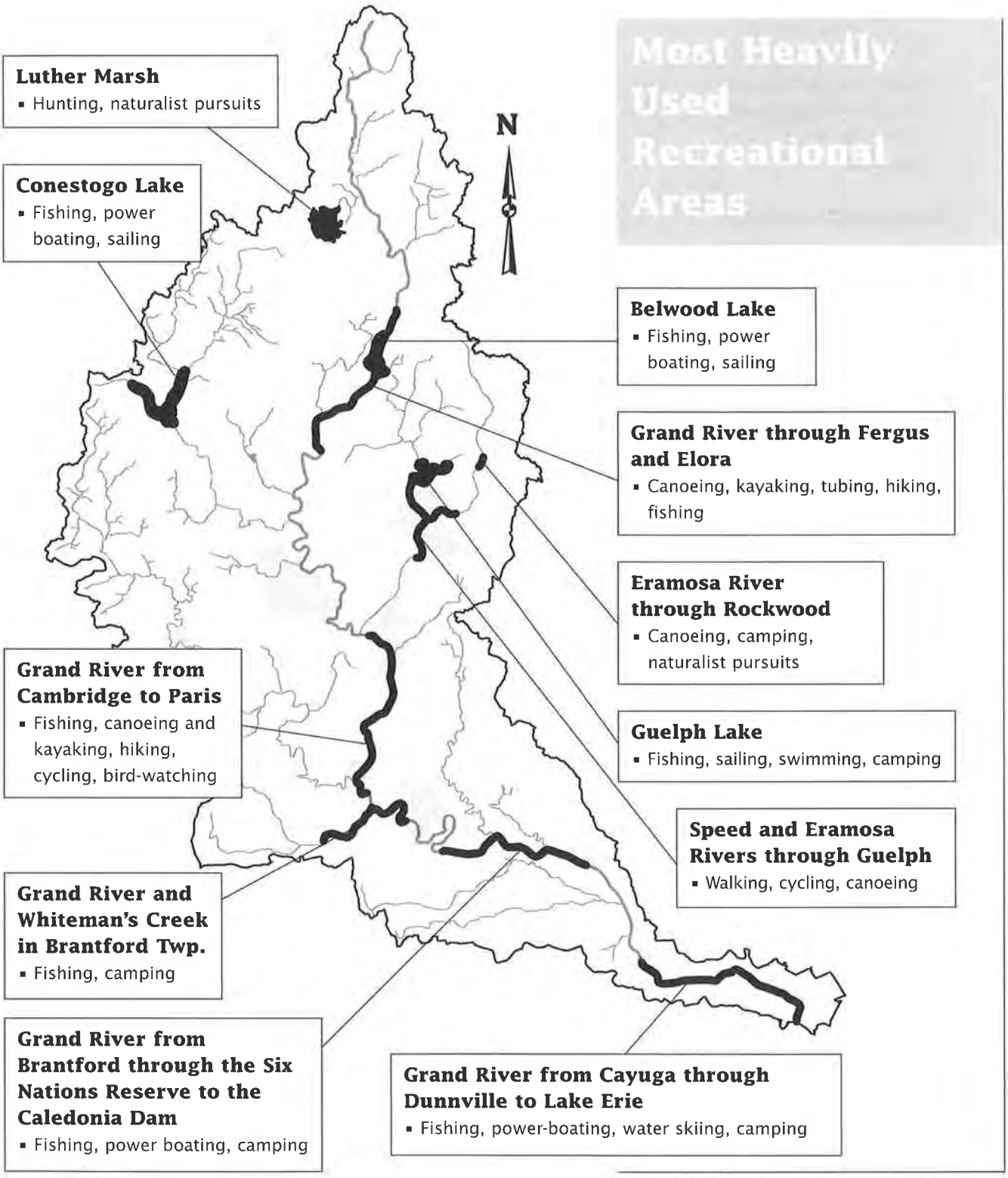
There is vast potential beyond the current use: for extending fishing opportunities, for expanding and interconnecting trail networks and for naturalist pursuits (e.g. Luther Marsh).

The growing recreational use of the river system brings pride and recognition, opportunities for small business development and increased tourism. It also brings pressure to improve water quality, conflicts with adjacent land uses and between recreational uses, and potential for overuse of the resource.

Our Vision for the Future

- Outdoor recreational opportunities, essential to our health and well-being, will be managed jointly on a watershed basis.
- The entire Grand River watershed system will be recognized as a world class fishery.
- An extensive network of interconnected trails will be used for hiking, cycling, horseback riding and nature appreciation.
- Recreationalists will follow a code of ethics that respects resources.
- Watershed visitors will be attracted by the diversity and quality of experiences.

The growing recreational use of the river also brings pressure to improve water quality, conflicts with adjacent land uses, conflicts between recreational uses, and potential for overuse of the resource.


Most Heavily Used Recreational Areas
N
Luther Marsh
▪ Hunting, naturalist pursuits
Conestogo Lake
▪ Fishing, power boating, sailing
Belwood Lake
▪ Fishing, power boating, sailing
Grand River through Fergus and Elora
▪ Canoeing, kayaking, tubing, hiking, fishing
Eramosa River through Rockwood
▪ Canoeing, camping, naturalist pursuits
Grand River from Cambridge to Paris
▪ Fishing, canoeing and kayaking, hiking, cycling, bird-watching
Guelph Lake
▪ Fishing, sailing, swimming, camping
Speed and Eramosa Rivers through Guelph
▪ Walking, cycling, canoeing
Grand River and Whiteman's Creek in Brantford Twp.
▪ Fishing, camping
Grand River from Brantford through the Six Nations Reserve to the Caledonia Dam
▪ Fishing, power boating, camping
Grand River from Cayuga through Dunnville to Lake Erie
▪ Fishing, power-boating, water skiing, camping

Outdoor Recreation

Resource Issues

- Water quality problems limit some recreational opportunities.
- Some resources are under pressure from overuse or adjacent land use changes.

Management Issues

- Infrastructure (e.g. hotels, parking lots) to accommodate increasing interest.
- Public access versus property rights.
- Increased use has led to conflicts between adjacent land uses and between competing recreational uses.
- Urban development has affected scenic vistas, cut off access to the river corridor, and reduced the quality of the experience.

Outdoor recreation has typically been managed on a municipal basis or by individual business operators. On the other hand, recreation based on natural resources is essentially cross boundary in nature. The ageing population, with more leisure time to be spent locally, will increase the pressure on municipalities, recreation providers and resources. Complex issues of riverfront development, access, and protection of landowner rights indicate that a process is needed to deal with resource-related recreation issues on a watershed basis.

What to Do?

- Establish a process, formal or informal, to deal with natural resource and river related recreation planning and issues on a watershed basis.
- Investigate the potential and capacity for recreational use development.
- Make municipal policies/plans to guide riverfront development, designed to resolve conflicting resource issues, to maintain/improve the quality of the experience, and to provide for infrastructure to accommodate increasing interest. Priority areas include Dunnville, Haldimand, Brantford, New Hamburg, West Montrose, Fergus, Elora and Grand Valley. (Cambridge and Guelph have completed plans).
- Expand the extent and variety of a sustainable world-class recreational fishery in the Grand River and its tributaries.
- Expand and link the trail systems within and outside the watershed.
- Develop partnerships for development, maintenance and appropriate use of outdoor recreation opportunities.
- Establish mechanisms to resolve/neutralize conflicts among land uses and among users.

The early settlement of the Grand River watershed was directly influenced by the river system.

MANY HERITAGE FEATURES and values within the Grand River watershed are considered to be nationally significant and have been recognized as such by the designation of the Grand River as a Canadian Heritage River.

The early settlement of the Grand River watershed was directly influenced by the river system: the Six Nations land grant, the United Empire Loyalists, the Grand River Navigation Company and the Grand River canal, the Mennonite purchase in Waterloo County, the industrial mill towns (Brantford, Paris, Galt, Preston, Hespeler and Guelph), the Scots settlement in the Dumfries Townships and in central Wellington County (Fergus and Elora). The river and its tributaries provided power for mills, transportation, and productive valley lands.

Today, valley residents enjoy a rich legacy of history, reflected through well-preserved evidence of Aboriginal and European cultures that were drawn to the valley of the Grand. Many of the features and values such as mills, canals, factories, architecture, customs, festivals and other aspects of settlement reflect the attitudes and values of these groups.

Heritage conservation is still a relatively new concept for

The whole is greater than the sum of its parts. Heritage conservation efforts can be strengthened by recognizing upstream-downstream and cross-boundary links along the river system.

As populations grow, heritage and "sense of place" are essential to sustaining community association and quality of life.

Human Heritage

Vision for the Future

- We will value the watershed's cultural and human heritage resources, and conserve and interpret them on a watershed basis.
- Human and natural heritage resources will be inextricably linked, such that the natural and human components combine to give a sense of place and community.

Human Heritage

Resource Issues

- Significant features and landscapes are under threat due to development pressures, lack of maintenance and lack of interest.

Management Issues

- Lack of awareness about the value, significance, and interrelationships of the valley's heritage resources.
- No process to identify or monitor significant heritage resources. No established method to identify the cultural landscape.
- Current tax laws are a disincentive to heritage resources conservation. Current legislation does not protect the integrity of sites and features.

municipalities to consider in their municipal plans. Cultural landscapes are difficult to define and protect. On the other hand, as populations grow, heritage and "sense of place" are essential to sustaining community association and quality of life. Heritage conservation efforts can be strengthened by recognizing upstream-downstream and cross-boundary links along the river system.

Municipalities recognize the potential for economic benefits based on cultural tourism. Historically, both general tourism and specific heritage sites have been managed and promoted on a municipal basis. Given the quality, diversity, and significance of human heritage in the Grand River watershed, there is substantial opportunity to market and promote "Grand River Experiences" which showcase the heritage of the Grand River watershed.

What to Do?

- Establish a process, formal or informal, to deal with river-related human heritage planning and issues on a watershed basis.
- Build capacity for planning and managing heritage conservation, interpretation and tourism.
- Motivate community efforts to recognize, value, protect, and manage cultural/human heritage resources.
- Encourage taxation and legislative reforms that provide positive incentives for conservation of human heritage resources.

Next Steps 1997-98

1. Integrate the work to be done

Ask the Technical Working Groups to identify common needs, cross-linkages and potential conflicts among the various objectives and the work to be done. Encourage meetings among Technical Working Groups to discuss these common needs, cross-linkages and potential conflicts, and how these might be resolved.

2. Establish some priorities for work to be done

Hold a Joint Working Group conference to identify work items that address more than one issue and/or appear to be central to moving forward on the vision from several fronts. Recommend priorities for action by combining and integrating the input from the Technical Working Groups, municipalities and community groups.

3. Build municipal support

Focus the Joint Work Plan for each watershed municipal council by summarizing each municipality's critical role in reaching the watershed vision. Define the benefits for each municipality. Consult with municipal staff on the steps to be taken in requesting each Council's support.

4. Seek participation of community interest groups and organizations.

a) Distribute *Focus on Watershed Issues* paper through the Grand Actions newsletter. Ask for input on issues and options. Develop a display around the *Focus on Watershed Issues* paper for use at information/participation workshops.

b) Develop a "compendium of bite sized actions" based on the Joint Work Plan and input from the Technical Working Groups and community groups. Focus the Joint Work Plan for each community by summarizing that community's critical role in reaching the watershed vision. Consult with community groups about the issues and options, and about the roles and actions each group is interested in pursuing.

c) Invite submissions for the 1997 Actions Registry.

5. Pursue partnerships and cooperative efforts by government and institutions.

a) Hold a meeting with the provincial District Managers in the watershed to discuss how their programs and work plans can be linked with the identified work needs.

b) Hold a meeting with the federal Directors-General for Ontario to discuss how their programs and work plans can be linked with the identified work needs.

c) Establish a research network among the watershed universities and others for watershed science to support watershed management and the joint work plan.

Acknowledgments

THE GRAND STRATEGY Coordinating Committee would like to acknowledge the support and dedication of all of the participants in *The Grand Strategy*. This report was based on input from:

Blackport & Associates
Brantford Public Utilities Commission
Brantford Steelheaders
Canadian Department of Fisheries and Oceans
Caledonia Bait and Tackle
Caledonia Chamber of Commerce
Cambridge Engineering and Planning Consultants Ltd.
Cambridge Visitor and Convention Services
Canadian Forest Service
Christian Farmers Federation of Ontario
City of Brantford
City of Cambridge
City of Guelph
City of Kitchener
City of Waterloo
County of Brant
County of Wellington
County of Perth
CRC Communications
Department of Canadian Heritage
Dorfman Planning Inc.
Dunnville Bioregion Association
Ecological Services for Planning
Elmira District Secondary School
Environment Canada
Environmental Economics
Festival Country
Friend of the Grand River
Grand Erie Community Development Corporation
Grand River Canoe Company
Grand River Conservation Authority
Green Scheels Pidgeon Planning Consultants
Guelph Arts Council
Guelph Round Table on the Environment and Economy
Haldimand-Norfolk Field Naturalists
Haldimand-Norfolk Round Table
Headwaters Coalition
R.A. Harrington and Associates
Hallman Property Management
Headwaters Coalition
Headwater Country Tourism Association
Heritage Brantford
Heritage Canada
Heritage Consultants
Heritage Greenway Coalition
Heritage Resources Centre
Humber College
Isaac Walton Fly Fisherman's Club
Langdon Hall Country House Hotel
Lower Grand River Land Trust
MacKinnon Hensel & Associates
Ontario Farm Women's Network
Ontario Federation of Agriculture
Ontario Federation of Anglers and Hunters
Ontario Ministry of Agriculture, Food and Rural Affairs
Ontario Ministry of Citizenship, Culture and Recreation
Ontario Ministry of Environment and Energy
Ontario Ministry of Economic Development, Trade and Tourism
Ontario Ministry of Finance
Ontario Ministry of Municipal Affairs and Housing
Ontario Ministry of Natural Resources
Ontario Ministry of Transportation
Natural Sports Store
Ontario Out-of-Doors
Ontario Soil and Crop Improvement Association
Ontario Steelheaders
Ontario Streams
Peter Williams & Associates
Regional Municipality of Haldimand-Norfolk
Regional Municipality of Halton
Regional Municipality of Hamilton-Wentworth
Regional Municipality of Waterloo
St. Jacob's Country
Schroeter and Associates
Six Nations Ecosystem Centre
Speed River Land Trust
S.P.U.D.
Stewardship Councils
Terraqua Investigations Inc.
Tourism Brantford
Triton Engineering Services Limited
Trillium Estates Limited
Trout Unlimited
UMA Engineering Limited
University of Guelph
University of Guelph Arboretum
University of Toronto
University of Waterloo
Wellington-Dufferin-Guelph Health Unit
Waterloo Centre for Groundwater Research
Wilfrid Laurier University

DESIGN & LAYOUT: LIND DESIGN PHOTOS: GRCA PRINTED ON CANADIAN-MADE PAPER WITH 20% POST-CONSUMER RECYCLED CONTENT

Grand River Conservation Authority

400 Clyde Road, Box 729
Cambridge, Ontario N1R 5W6

Phone: 519-621-2761
Fax: 519-621-4844
Website: www.grandriver.on.ca

The Grand – A Canadian Heritage River