



Muskoka
WATERSHED COUNCIL

***INDICATORS OF
WATERSHED HEALTH***

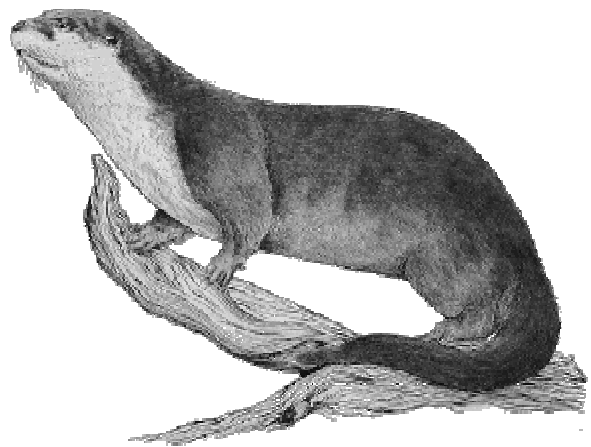


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INDICATORS OF WATERSHED HEALTH

INTRODUCTION

The goal of the Muskoka Watershed Council is to preserve and enhance the air, water and terrestrial ecosystems of the watersheds in Muskoka for the environmental, health, economic, spiritual and intrinsic values they provide. This is to be done through several activities including:

- Education and public information programs
- Encouraging environmentally responsible lifestyles
- Promoting sound land and water use planning
- Promoting Best Management Practices for a variety of activities; and
- Developing implementation and reporting programs to assess and monitor the watersheds.

Early in 2002, the Watershed Council began to develop a set of indicators of watershed health that will form the base of a watershed report card. A report card is a useful tool for providing the public with a concise evaluation of the state of the watersheds of Muskoka. By establishing benchmarks and targets for key programs and environmental values, change in the watersheds can be monitored and evaluated, and proactive programs or remedial action can be taken to ensure the long-term health of the area.

Many governments and other organizations have developed indicators of environmental health and the Muskoka Watershed Council has borrowed heavily from these experiences. In particular, the framework set out in the International Joint Commission's (IJC) report entitled *Indicators to Evaluate Progress under the Great Lakes Water Quality Agreement* was used as a model for this exercise. Muskoka's watersheds form a significant part of the Georgian Bay portion of the Great Lakes watershed, and therefore, there is a benefit to being able to compare types of data with that of the IJC. In addition, the process followed by the IJC is clear and easily understood by the lay reader and can be easily modified for use as a public reporting tool.

All the watersheds of Muskoka flow into Georgian Bay of Lake Huron. The primary watersheds include The Muskoka River, the Black River, the Severn River and several smaller watersheds that flow directly into Georgian Bay. The inland water tends to be low in alkalinity (soft) and relatively high in Dissolved Organic Carbon (DOC) which makes the water dark or tea coloured. The water in Georgian Bay tends to be higher in alkalinity (hard) and low in DOC or very clear. Although the indicators for both the inland lakes and Georgian Bay are the same, and therefore, the general trends for each area can be compared, the actual data may not be comparable due to the different chemistry of these waters.

In today's society, we are overloaded with data and information, but the question remains, what does it all mean? How do we respond to the question: Are the watersheds of Muskoka getting better? This report provides a context within which data and information can be used, so that these fundamental questions can be answered.

PROGRAM METHODOLOGY

Environmental indicators communicate information about the environment and about the human activities that affect it. When communicated effectively, the indicator highlights problems and draws attention to the effectiveness of policies. An indicator can be defined as:

“An indicator provides a clue to a matter of larger significance or makes perceptible a trend or phenomenon that is not immediately detectable. It is a sign or symptom that makes something known with a reasonable degree of certainty. An indicator reveals, gives evidence. Its significance extends beyond what is actually measured to a larger phenomenon of interest.”¹

Indicators are used in the medical and economic field on a regular basis with common indicators being, blood pressure and temperature or the TSX and the Dow Jones. Indicators give us “feed-back” to help us change behaviour and provide a measure of success or effectiveness in relation to stated goals and objectives. It has been said that societies measure what is important to them and can only manage what they measure. A meaningful and concise set of indicators for the watersheds of Muskoka will form the basis upon which the Muskoka Watershed Council will evaluate its goals and objectives, develop an action plan and provide a report to the public detailing the health of the watersheds.

The process used by the Muskoka Watershed Council to develop a set of indicators of watershed health involved a series of technical and non-technical workshops. The process began in May 2002 with a series of public consultation sessions held in a variety of locations across the watersheds. Those sessions resulted in the development of a set of public values, identified stresses in the watershed, set a “top 10” action list and ultimately resulted in the Draft Goals and Objectives for the Watershed Council. In November 2002, a group of 29 technical experts came together to provide advice on indicators that would assist the Muskoka Watershed Council and the general public in assessing the health of the watersheds of Muskoka from a technical perspective. In February 2003, the members of the Muskoka Watershed Council came together in a similar workshop and developed a list of indicators that reflected the concerns of the public with respect to the health of the watersheds. These two lists of indicators form the basis upon which the suite of indicators, detailed in this report, is based.

QUALITIES OF A GOOD INDICATOR

For an indicator to be useful it must be easy to understand and the data must be available. The following set of criteria for a good indicator was provided to both the technical committee and the Watershed Council for use in developing their respective lists of indicators.

A good indicator must be:

1. Relevant – It is driven by policy and tells you something about the system that you need to know.
2. Easy to Understand – It simplifies the information so that even people who are not experts can understand it.

¹ International Joint Commission, Indicators to Evaluate Progress under the Great Lakes Water Quality Agreement, April 1996

3. Reliable – you can trust the information that the indicator is providing.
4. Integrated – It can integrate information in a way to serve as a barometer of the ‘health’ of the system.
5. Flexible – It can be reconsidered as conditions change, new issues arise, and responses to some problems begin to work.
6. Comprehensive – It can reflect a spectrum of conditions ranging from living systems back through the chemical and physical environments to the sources of stress.
7. Accessible – The information is available or can be easily gathered without great time or cost.
8. Measurable – It can be measured in an effective and meaningful manner.

Indicators require a framework within which information can be collected, assessed and reported. The ‘pressure – state – response’ (PSR) model, developed by the Canadian component of the IJC, has been used because of its simplicity and wide acceptance. The main categories in the PSR framework are:

1. Indirect and underlying direct **pressure**, including human activities that cause environmental change.
2. The physical, chemical and biological condition, or **state** of the natural world, plus human health and welfare.
3. **Response** or changes in policy or behaviour by governments, private sector, households and individuals, including efforts to ameliorate environmental conditions.
4. **Effect** on the ecosystem, human health and human welfare.

Through this framework, four relevant questions can be asked:

1. What is happening in the environment? (state)
2. Why is it significant? (effects)
3. Why is it happening? (pressure)
4. What are we going to do about it? (societal response)

INDICATORS

The following suite of indicators reflects the advice of the Technical Advisory Committee and the recommended areas of interest identified by the Muskoka Watershed Council with respect to key aspects of watershed health. For each desired outcome, there are multiple stresses, and therefore, there are several possible indicators with each stress. The recommended indicators have been selected because they meet the qualities of a good indicator as detailed above and have specific relevance to the watersheds of Muskoka.

The framework incorporates the Pressure – State – Response (PSR) model. It consists of four components: a statement of the desired outcome; relevant background data and information; stresses; and indicators. Where the indicator identifies that a desired outcome is not achieved, the feedback loop urges that program and policies are revisited and revised accordingly to ameliorate the stress. Muskoka Watershed Council will work with its partners to achieve these identified revisions. To achieve desired outcomes and ecosystem integrity, the process must be

iterative and so the Muskoka Watershed Council will report progress to the public through a report card on a regular basis.

The Following suite of indicators will be used to provide a measure of the health of the watersheds of Muskoka.

Swimability

Desired Outcome:

This desired outcome focuses on human recreational use of water. The intent is safe, full-body water contact activities at public beaches and elsewhere. The desired outcome for Swimability is:

- *No public bathing beaches closed or recreational swimming areas displaying bacteria counts in excess of provincial standards for body contact recreation as a result of human activities.*
- *No nuisance algae blooms*

Background Data:

Swimming can be impaired in one of three ways:

- Beach closings – “When waters, which are commonly used for total-body contact ... recreation, exceed standards, objectives, or guidelines for such use”
- Eutrophication – “Where there are persistent water quality problems ... attributed to cultural eutrophication.”
- Degradation of aesthetics – “Where the waters have substance which produce a persistent objectionable deposit, unnatural colour or turbidity, or unnatural odor.”

Stresses:

The primary stresses affecting the swimability desired outcome are associated with human activities such as shoreline development, alteration of natural shorelines, agriculture and urbanization.

Indicators:

The Muskoka Watershed Council proposes the following indicators to evaluate progress toward the desired outcome of swimability:

- Beach closings, measured in number of occurrences and total number of days closed.
- Bacteria counts, measured as the number of occurrences and total number of days that a lake association measures bacteria levels above provincial guidelines.
- Phosphorus concentrations, measured as the number of occurrences of spring turnover phosphorus measurements that exceed established benchmark levels.
- Periphyton communities, measured by the concentration and the species present
- Changes in water clarity (i.e. secchi disc) measured as the incidence of the annual average water clarity measurement less than long-term average measurement for a given lake.

Drinkability

Desired Outcome:

This desired outcome focuses on human consumption of the water resources in Muskoka. As a large number of watershed residents are not serviced by municipal water systems, this section will focus on both the quality of municipal treated water and the quality of raw water drawn by individuals.

The desired outcome for Drinkability is:

- *Municipal treated water is safe for human consumption; and*
- *Surface water and groundwater are safe for human consumption with only standard disinfectant procedures available to private systems.*

Background Data:

Treated drinking water can be defined as safe for human consumption when

- Densities of disease-causing organisms or concentrations of hazardous or toxic chemicals or radioactive substances do not exceed human health objectives, standards or guidelines;
- Taste and odour problems are absent; and
- Treatment needed to make raw water suitable for drinking does not exceed the standard treatment used in similar undegraded portions of the watershed.

Stresses:

Three stresses impact this desired outcome:

- Microorganisms (e.g. bacteria) directly impact health of consumers;
- Nutrients contribute to plant growth which, in turn, increases algal biomass. Excess algae results in taste and odour problems; and
- Man-made chemicals, especially toxic and persistent toxic substances, can impact the health of consumers or contribute to taste and odour problems.

Indicators:

The Muskoka Watershed Council proposes the following indicators to evaluate progress toward the desired outcome of drinkability:

- Incidence of unacceptable bacteria counts in treated drinking water (private and public supplies)
- Incidence of malfunctioning or inadequate septic systems
- Reports of human illness or infectious disease due to consumption of treated water
- Number of boil water advisories
- Incidence of taste and odour problems in treated water based on public surveys and complaints

- Report of spills, process upsets and other incidents that release chemicals into the raw water supply and which could threaten drinking water treatment plants (including grey and black water spills from boats)
- Concentration of chemicals as a result of human activity in raw water (e.g. well driller's records, municipal drinking water reports)

Fishability

Desired Outcome:

The desired outcome for fishability focuses on the human consumption of fish from the lakes in Muskoka. The desired outcome for Fishability is:

There shall be no restrictions on the human consumption of fish in the waters of the inland lakes and rivers of Muskoka or Georgian Bay as a result of human inputs of persistent toxic substances.

Background Data:

There have been fish advisories for fish caught in several Muskoka waterbodies since the early 1980's to inform anglers that consumption of certain preferred fish species may increase health risks. The resulting health problems may be small or could lead to birth defects and cancers. The advice varies from not eating certain kinds of fish in any amount to limited consumption over extended periods of time. The advice can differ for different groups of individuals, being more restrictive for women of childbearing age and for children.

Persistent toxic substances produced, discharged or deposited in aquatic ecosystems become more concentrated in higher levels of the food web. Fish with high concentrations of fat (e.g. trout) tend to become relatively more contaminated than those with lower fat level. Older fish are also generally more contaminated. The public tends to equate healthy, uncontaminated fish with healthy ecosystems. Accordingly, the Watershed Council adopted fish health as a key indicator of watershed health.

Stresses:

Inputs of persistent toxic substances continue to impact this desired outcome. There are four major sources or pathways for contaminant entry into, or availability in the Muskoka environment.

- Direct point source discharge from municipal and industrial sources.
- Diffuse discharge resulting, for example, from surface runoff of pesticides, nutrient loading from septic systems or hazardous leachates.
- Long and short-range airborne transport and deposition of contaminants from inside and outside the watershed.
- Sediment resuspension, facilitating contaminant re-entry into the food web.

Indicators:

The Muskoka Watershed Council proposes the following indicator to evaluate progress toward the desired outcome of fishability:

- Fish consumption advisories

Breathe-ability

Desired Outcome:

The desired outcome for breathe-ability focuses on the human health need for clean air. Many health problems can be traced back to the rise in air-borne contaminants and smog.

The desired outcome for Breathe-ability is:

No incidence of respiratory ailments as a result of human inputs to the air.

Background Data:

Health research has recently shown that there is no threshold below which smog will have no negative effect on human health. Breathe-ability can be impacted either by smog levels or acid precipitation. Smog is composed of ground-level ozone and fine particulate matter. Ground level ozone is comprised of nitrogen oxide (NO_x) and volatile organic compounds (VOC). Smog can make breathing more difficult -- even for healthy people -- and it can make us more susceptible to cardio-respiratory diseases. Even healthy young adults breathe less efficiently on days when the air is heavily polluted, especially if exercising outdoors. Particularly vulnerable to smog are people with heart or lung disease, the elderly and small children.

Human activities are responsible for the increases in ground-level ozone in recent years. About 95 per cent of nitrogen oxides from human activity come from the burning of coal, gas and oil in motor vehicles, homes, industries and power plants. VOC come mainly from gasoline combustion and from the evaporation of liquid fuels and solvents.

Acid rain is comprised of sulfur dioxide which reacts with other chemicals in the air to form tiny sulphate particles which can lodge deep within the lungs and cause respiratory problems.

Stresses:

Two stresses impact this desired outcome:

- Increase in motor vehicle size, efficiency and use
- Long range pollutant transport from more industrial areas south of Muskoka

Indicators:

The Muskoka Watershed Council proposes the following indicators to evaluate progress toward the desired outcome of breathe-ability:

- Lichen diversity and abundance
- Incidence and length of smog alerts issued
- Number of lakes with a pH less than 5

Healthy Natural Areas

Desired Outcome:

The desired outcome focuses on the ability of natural areas to function and handle stress. Healthy natural areas must be able to continue to function and maintain diverse of plant and animal communities. This will require consideration of chemical water quality, habitat, energy dynamics, biotic factors and processes, and hydrology. The more diverse the biological community, the more they are robust to withstand present and future stresses.

The desired outcome for Healthy Natural Areas is:

Maintenance of the ability of natural areas to function normally in the absence of severe environmental stress (ecosystem health) and to cope with changes in environmental conditions which impose stress, i.e. to be able to maintain their process of self –organization on an ongoing basis (ecosystem integrity).

Maintenance of the diversity of biological communities, species and genetic variation within species.

Background Data:

A healthy ecosystem is always in balance, although its specific make-up may be constantly changing. Benchmarks for individual aspects of the biological community, such as the health the lake trout population or the number of interior bird species, must be developed in order to understand change in a particular ecosystem. These benchmarks must be based both on the ecology of the area and the level of change acceptable to people. Nevertheless, the basic objective is to maintain the watersheds in a condition that preserves their natural ability to function recognizing that this may produce some constraints on the range of human choices.

Stresses:

The following stresses are believed to be the principal ones of concern with respect to this desired outcome:

- Destruction of habitat important to desirable species or their supporting food web
- Introduction of exotic species, particularly those liable to displace desirable native species from the available habitat and thereby decrease diversity
- Overharvesting to the point of reducing populations below minimum viable levels
- Introduction of toxic contaminants
- Introduction of excessive nutrients (e.g. phosphorus).

Indicators:

The Muskoka Watershed Council proposes the following indicators to evaluate progress toward the desired outcome of biological community integrity and diversity:

- Presence and abundance of selected key species within the food web, including top predators, mid-trophic level species, and species at the food base. (e.g. loon counts, frogs, benthic analysis)
- Quantity and quality of particular habitat types (e.g. changes in land cover or habitat such as forest, wetlands, lake trout habitat, agriculture, urban areas)
- Quality of shoreline and buffer area
- Number and abundance of endangered native species, including fish, waterfowl, plants and invertebrates
- Cumulative number and abundance of exotic species introduced
- Specific stresses on habitat (e.g. phosphorus concentrations, pH levels)

Sustainable Physical Environment

Desired Outcome:

The physical environment is a critical component of ecosystem health, for instance, to provide sufficient appropriate habitat to meet the requirements of plants and animals comprising the food web, and to minimize adverse impacts arising from land use activities. The physical environment encompasses a broad spectrum, including wetlands, shoreline use, stream flow alteration and new road activity.

The desired outcome for Sustainable Physical Environment integrity is:

Land development and land use that is compatible with maintaining aquatic and terrestrial habitat of a quantity and quality necessary and sufficient to sustain a widespread collection of fish and wildlife populations.

Background Data:

The Muskoka Watershed Council identified the following guidelines relevant to physical environmental integrity:

- The amount and quality of physical, chemical and biological habitat required to meet fish and wildlife management goals have been achieved and protected.

Stresses:

Three stresses impact this desired outcome:

- Actions that alter habitat e.g. dredging, infilling, changing drainage patterns, changing water levels, air pollution and siltation. Actions may affect biota directly, or cause indirect impacts by changing relationships in the food web.

- Land use change, e.g. due to conversion of land to industrial, commercial, transportation or residential purposes. Such changes can directly remove habitat (e.g. wetlands), or indirectly impact habitat by secondary causes.
- Alterations in shorelines and tributaries. Such changes can affect habitat of resident or migratory species.

Indicators:

The Muskoka Watershed Council proposes the following indicators to evaluate progress toward the desired outcome of physical environmental integrity:

- Long term protection for habitat (e.g. ownership by a conservation organization, zoning, conservation easements)
- Changes in large scale land use (e.g. wetlands, forest cover, urban areas)
- Quantity and quality of stream base flow
- Incidence of water levels above or below the chart datum of 176.5 on Georgian Bay, or establish rule curves for inland systems
- Quantity of groundwater consumption
- Number of man-made shoreline structures and extent of shoreline alteration
- Quality of stormwater management plans to protect groundwater, surface water and significant habitat.
- Land use and land use practices including, for example, amount of land zoned to protect environmentally significant areas (EP, NR), lot creation, building size, waterfront density.

Sustainable Community Values

Desired Outcome:

The desired outcome focuses on the behaviour of people living in the watershed. Sustainability is related to the quality of life in a community – whether the economic, social and environmental systems that make up the community are providing a healthy, productive, and meaningful life for all community residents, present and future.

The human component of the watersheds of Muskoka depends for its sustenance on both the natural attributes of the system and the continued, healthy functioning of its economy. The economy of Muskoka has always been closely tied to the natural attributes of the region, from logging to the grand resorts to cottaging and recreation based tourism. Growth and development that ensures the long-term health of the watersheds of Muskoka must also ensure a sound and viable economic system that provides people jobs.

The desired outcome for Sustainable community values is:

- *An economy that is viable and sustainable and provides jobs for people living in the watersheds.*
- *An environmental ethic that supports the desired outcomes of clean water, and healthy natural areas.*

Background Data:

Every sector of society has a role to play in achieving sustainability. Business must provide products and services that improve the quality of life and have benign or positive impacts on the environment. Government must establish a culture of sustainability by steering society and creating a favourable environment, often leading by example. Community organizations have the role of educating, informing, advising, encouraging and mobilizing public action. Often they articulate the public interest. Individuals are key to sustainability and they must be informed, be prepared to modify their behaviour and support sustainability-oriented companies or products.²

Public awareness and education programs are crucial components in encouraging people to live sustainably and there are many programs and information packages available for homes, schools and businesses that encourage environmentally sustainable behaviour.

Stresses:

The following stresses impact this desired outcome:

- Overall regional productivity and economic activity
- Demand for regional products
- Health of the resource base
- World commodity issues
- Population growth
- Access to fulfilling and supportive employment
- The consumer based attitude of western society
- Lack of knowledge with respect to the impact of behaviour and reasonable alternatives

Indicators:

- Employment levels in key resource based activities
- Total employment in the watershed
- The number of schools that have been recognized as Muskoka Green Schools
- The number of businesses that are recognized as practicing good environmental behaviour.
- The number of lake associations actively involved in a lake stewardship program measured as more than 75% of lake residents actively involved in stewardship activity.
- Number of households recognized as being Muskoka Watershed Friendly

Employment was chosen as an indicator because it links to a number of basic social concerns, including health. This approach may seem simplistic. It does not, for instance engage fundamental questions about the nature of work and the ultimate sustainability of an economic policy based on the ever-present need for jobs. The use of employment as a measure does, however, reflect a current reality, and capture a range of socio-economic and political imperatives.

² modified from: Indicators and Sustainability, David V.J. Bell, Director, York Centre for Applied Sustainability, York University, from a presentation to Muskoka watershed Council Technical Advisory Committee, November 18, 2002

CONCLUSIONS

This report provides a set of indicators for use by the Muskoka Watershed Council to review and evaluate the state of the health of the watersheds of Muskoka. The indicators will also form the basis for a Watershed report card that will provide the public with an evaluation of that state of the watersheds. The report focuses on a relatively small number of pertinent indicators that reflect key aspects of watershed health. By keeping the indicators simple, it is hoped that a broader number of people will use them to evaluate actions and promote sustainable development.

Appendix 1

Results of the Public Consultations Held Summer 2002

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March 25, 2003

Dear Friend of Muskoka's Watersheds:

Thank you for your participation in the Public Consultations on Watershed Health held in the spring and summer of 2002. The valuable input received through this exercise allowed us to develop a set of goals, objectives and actions for maintaining or enhancing the health of the watersheds in Muskoka.

Based on these goals and objectives, we are in the process of developing a suite of indicators that will allow us to work with several partners to monitor the health of Muskoka's watersheds. The findings of these monitoring programs will be published on a regular basis and distributed to Muskoka residents in a Watershed Report Card. This report card will keep residents of Muskoka up to date on the health of their watershed and issues affecting that health.

As a starting point to this whole process, the information gathered at the public consultations was reviewed by a group of volunteers over several days. A concentrated effort was made to keep participants' comments in their own words, so as to avoid personal bias or misinterpretation by the volunteer group. Comments were grouped together based on a common theme and then given a heading determined by those comments.

Most participants, no matter where they lived in Muskoka, voiced the same values and concerns regarding Muskoka and the health of its watersheds. In many cases, the same actions were suggested to deal with the increasing pressures placed on these watersheds. The actions were ranked based on the number of votes it received at the public consultations, and a "top 10" list of actions that the people of Muskoka would like to see happen was developed. This list of actions will help guide the efforts of the Muskoka Watershed Council in the coming years.

Your participation in this process was, and continues to be, vital to the efforts of the Muskoka Watershed Council in developing a plan that reflects the values and needs of Muskoka residents. We hope that you will continue to participate in the process of assessing the health of Muskoka's watersheds by reviewing and commenting on the selection of indicators, participating in monitoring programs through your cottage or lake association, or just by reducing the negative impacts your everyday actions have on your watershed.

Thank you again for your participation and valuable input.

~ Watershed Values ~

The people of Muskoka value:

1. CLEAN WATER

Fresh, clean water that you can drink and swim in was identified as being fundamental to the essence of Muskoka.

2. THE DIVERSE OUTDOOR RECREATIONAL OPPORTUNITIES OF MUSKOKA

Outdoor recreational activities were seen as being an important component of the lifestyle of people living in Muskoka. Fishing and other active outdoor activities along with the general understanding of the value of nature-based tourism were identified.

3. THE DIVERSITY AND HEALTH OF THE LANDSCAPE, HABITAT AND SPECIES

The natural setting of Muskoka is important to people who live here. In particular, people identified the importance of the biodiversity of the area, the clean and fresh air, and the enjoyment of the wildlife. In addition, specific natural settings such as wetlands, forests and natural shorelines were seen as core values.

4. THE WARM, CARING & OPEN COMMUNITIES OF MUSKOKA

Muskoka is known and loved for its small town atmosphere. Communities where people can interact on a casual basis, artisans can be supported and encouraged, there is not a sense of being over crowded and people can enjoy a lifestyle that is intertwined with a natural setting were highly valued.

5. THE HISTORY & HERITAGE OF MUSKOKA

Development in Muskoka began at the turn of the last century and people value the unique natural and man-made features that have been identified with life in Muskoka since that period.

6. THE NATURAL ENVIRONMENT'S CALMING EFFECT ON THE SENSES

Of all the values identified through the public consultation process, the physical and spiritual rejuvenation people experience in Muskoka was identified most often. Specifically, people valued the tranquility of the area and the scenic beauty. There is an intimacy with nature. People value the sounds of nature they hear on a lake or in the forest. The scenic beauty and appearance of waterways as they change throughout the seasons are also special to many people.

~ Stresses on the Watershed ~

1. HUMAN ACTIONS DEGRADE AND STRESS THE NATURAL ENVIRONMENT

The majority of comments indicated that people feel that human action is degrading the natural environment. In particular, there is a perception that shoreline development is impacting water quality; natural areas are being threatened through development and over use and human activities are polluting both the land and the water. It was indicated that the following activities were seen as resulting in pollution: the use of 2 stroke motors, untreated stormwater, farm run-off, old septic systems, and sewage treatment and sludge disposal.

2. *There is a need to develop a greater understanding and accountability for the impact of actions on a healthy natural environment*

Many stresses on the watersheds of Muskoka are a result of the lack of understanding of the effect of people's actions on the environment. There was strong agreement that an aggressive public education program is required to address issues such as appropriate shoreline development, human impact on natural systems, and balancing fun, consideration for others and responsibility for their actions. In particular, boating and lighting practices and the generation of excessive noise were areas of concern.

3. *There is inadequate research and resources to evaluate, regulate and enforce necessary development controls to maintain a sustainable natural environment*

Development is having a significant impact on the natural values of Muskoka. Concern was expressed with respect to the impact development has on wetlands, shoreline vegetation, erosion, wildlife habitat and the scenic values of the area. There was strong concern expressed about the lack of understanding of the impact of development on the natural environment in Muskoka. Without an understanding of the impact of development, it is difficult to develop appropriate regulations or enforce existing standards.

4. **Lack of political will inhibits the development and enactment of coordinated public policy that incorporates full consideration of environmental issues**

People were generally of the opinion that more political leadership is required to achieve sustainable development. There is a strong feeling that there are inadequate resources put to enforcing existing regulations, for example, there is only one MOE representative to

enforce regulations throughout Muskoka. Also, people felt that stronger environmental controls are required for such things as septic system re-inspections, managing shoreline development and monitoring hazardous waste and dumping on private property.

5. THERE IS A NEED TO BUILD A BALANCED ECONOMY THAT IS COMPATIBLE WITH A SUSTAINABLE ENVIRONMENT

There is a concern that although the economy and the environment have to be balanced, this is not occurring today. People felt that Muskoka is importing 'city values' with the development of strip malls and monster homes. Due to the popularity of Muskoka as being a great place to live and retire, too many changes are occurring that are threatening the 'small town' character that was identified as a core value.

6. Shift in demographics has lead to a change in demands on Muskoka (societal trends)

People recognized the ongoing shift in demographics which is resulting in more conversions of seasonal properties to year round use. Coming with this shift are larger dwellings, more motorized 'toys', and heavier demands on septic systems.

7. THE INTRUSION OF FOREIGN SPECIES INTO THE MUSKOKA ENVIRONMENT IS HAVING A SIGNIFICANT IMPACT ON THE NATURAL ENVIRONMENT.

The intrusion of exotic species into the ecosystems of Muskoka is resulting in change and environmental stress over which we have little control.

~ Actions to Ensure a Healthy Watershed ~

The Muskoka Watershed Council is a volunteer-based organization whose mandate is to encourage stewardship and advocate for the health and sustainability of those watersheds lying partially or totally within the District of Muskoka. Based on the actions identified through the public consultations, the Council has recognized ten program areas on which to concentrate its efforts. The role of the Muskoka Watershed Council is to work with a variety of partners to encourage and support activities that enhance the health of Muskoka's watersheds.

Top ten program areas:

1. To support Muskoka and the Area Municipalities in developing and implementing strong developmental control policy, regulations, and implementation tools to guide new development and redevelopment along shorelines (10.5% of votes).
2. To develop new and enhance existing educational programs for schools, community groups, and lake associations (10% of votes).
3. To encourage the expansion of existing septic system re-inspection programs to include more residences and businesses etc (8.5% of votes).
4. To encourage the protection of private lands through such tools as eco-gifts and conservation easements and public lands through such tools as conservation areas and reserves. In addition, to allow for the development of environmentally sensitive recreational activities in some areas i.e. hiking, bird-watching, biking, skiing (8% of votes).
5. To advocate for a ban on the cosmetic use of pesticides and regulate their non-cosmetic use (7% of votes).
6. To support having existing environmental laws and bylaws enforced (7% of votes).
7. To aid in the expansion of existing water quality testing and monitoring programs, both through lake associations and municipal bodies (6.5% of votes).
8. To aid in identifying and protecting Muskoka's remaining wetlands (5% of votes).
9. To advocate for the development of boating regulations to control factors such as noise, speed, engine and boat size, etc (3.5% of votes).
10. To encourage participation in stewardship organizations and the development of lake plans and other stewardship programs (2% of votes).

Appendix 2

Muskoka Watershed Council Goals and Objectives

Muskoka Watershed Council Draft Goals and Objectives

Goal: To preserve and enhance the air, water and terrestrial ecosystems of the watersheds in Muskoka for the environmental, health, economic, spiritual and intrinsic values they provide.

Objectives:

1. Develop and implement education and public information programs that promote an understanding of the impact of human actions on the environment and encourage lifestyles that are compatible with healthy and functioning watersheds.

Actions:

- a. Encourage and support environmental curriculum and extra curricular activities in schools.
 - b. Develop and distribute information related to watershed health.
 - c. Develop and maintain an up to date resource library on environmental issues.
 - d. Develop and implement recognition programs for businesses and industries that operate in an environmentally sensitive manner.
2. Encourage environmentally responsible lifestyles.

Actions:

- a. Promote environmentally sensitive use of land and water.
 - b. Promote socially responsible use of light and sound.
 - c. Promote personal lifestyle choices that are both environmentally responsible and considerate of neighbours and community.
 - d. Create an appreciation-of-nature ethic by promoting the development and use of trails and parks and by preserving nature reserves.
3. Promote sound land and water use planning that protects Muskoka's watersheds.

Actions:

- a. Promote communication, dialogue and partnerships with all levels of government on watershed health, including air quality, water quality and quantity, and habitat protection.
- b. Participate in local and regional government decision-making on matters of watershed health.
- c. Provide informed opinions on environmental issues.
- d. Promote development that maintains the small town character of communities and encourages people to walk and cycle.

4. Promote activities and best practices that respect the natural environment, do not damage the resource base of Muskoka, and support a strong economy and healthy community structure.

Actions:

- a. Actively promote environmentally responsible behaviour by individuals, government, business and industry by encouraging lifestyle and best management practices that enhance watershed health.
 - b. Advocate for responsible use of our natural resources including soils, water, forests, aggregates, granite bedrock and air.
 - c. Advocate for the responsible and considerate use of motorized recreational vehicles.
 - d. Promote land and water use and other human activities that support healthy watersheds and develop plans and programs to rehabilitate existing degraded areas.
5. Develop and implement programs to assess and monitor the health of Muskoka's watersheds.

Actions:

- a. Develop partnerships and implement programs to monitor watershed health and identify areas of degradation or impairment.
- b. Regularly prepare a watershed report card on the health of the watersheds in Muskoka.

Appendix 3

Technical Advisory Committee

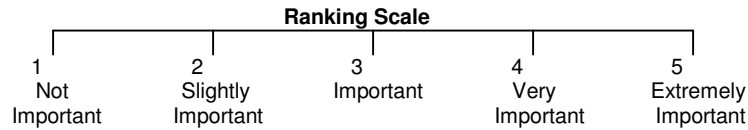
**MUSKOKA WATERSHED COUNCIL
INDICATORS PROGRAM
MEMBER OF THE TECHNICAL ADVISORY COMMITTEE**

Bob Bergmann	Fisheries Biologist, MNR
Jan McDonnell	Wildlife Biologist, MNR
Warren Dunlop	Fisheries Biologist MNR
Mike McMurtry	Landscape Ecologist, MNR
Keith Somers	Biostatistician
Norm Yan	Zooplankton Specialist
Peter Dillon	Water Quality Scientist
Neil Hutchinson	Limnologist
Debra Martin-Downs	Water Scientist
Darlene Upton	Georgian Bay Island National Park, Biologist
Brian Craig	Senior Science Advisor, Environmental Monitoring and Assessment Network
David Bell	Director for the York Centre for Applied Sustainability
Silvia Strobl	Ducks Unlimited
Karl Schiefer	Water Scientist
Keith Sherman	Water Scientist
Rob Keen	Forester
Robin Tapley	Naturalist
Sven Miglin	Small business operator
Ian Turnbull	Social concerns
Armin Gragaitis	Chair, Port Severn/Honey Harbour Chamber of Commerce
Tom Clark	Forester
Ron Reid	Executive Director, Couchiching Conservancy
Beth Cragg	Muldrew Lake Cottager
Jack Fenn	Muskoka Lakes Association
Michael Crunhorn	Muskoka Tourism
JP Varto	Air quality technologist
Evelyn Brown	Healthy Communities
Don Goodyear,	Hydrogeologist, Lake Simcoe Region Conservation Authority
Tom Irvine	Trout Unlimited

Appendix 4

Technical Advisory Committee Report from the November 18, 2002 Workshop

BRAINSTORMING INDICATORS



A. Hydrology

Indicator	Stressor	Impact	Ranking	# Responses	Average
1. Surface Water					
Number of days with no flow in small streams			17	5	3.4
Sewage Treatment Plant effluent quality	Excess nutrients	Increased algal growth	32	8	4
Total volume of water discharged at Bala			10	3	3.3
Water level at benchmark streams, incl. Lakes and wetlands			22	6	3.7
2. Groundwater					
Storm flow			8	3	2.7
Base flow			18	5	3.6
Temperature			13	4	3.3
Precipitation (average summer monthly rainfall)			19	6	3.2
Water level in shallow and deep aquifers			21-shallow 20-deep	6	3.5-s 3.3-d
Number of contaminated wells	Improper land use (septic cross contamination)	Contaminated drinking water	30	7	4.3
Groundwater consumption			26	7	3.7

B. Aquatic Habitat

Indicator	Stressor	Impact	Ranking	# Responses	Average
1. Benthic					
Benthic indices (there are about 10 good ones)			21	5	4.2
Vertebrate Organisms			12	4	3
2. Zooplankton					
Zooplankton richness			11	4	2.8
3. Fish					
# of fish species with consumption restrictions			30	8	3.8
Fish species composition			17	5	3.4
Cold water habitat size			28	7	4
Condition, reproduction, growth of lake trout populations	Over fishing development or management decisions	Loss of population, economic and recreational opportunities	20	5	4

4. Physical Structure					
Number of water crossings			16	5	3.2
5. Periphyton					
Changes in periphyton communities and volume (algae)			25	6	4.2
Algal richness			4	2	2
Algal bloom composition			8	3	2.7
% blue/green algae			8	3	2.7
6. Higher order animals					
Loon counts and the number that mature through the summer	Human Activity toxin levels	Loss of species/biodiversity	18	5	3.6

C. Terrestrial Landscape

Indicator	Stressor	Impact	Ranking	# Responses	Average
1. Landscape Level – Forest					
Land cover change - agricultural, urban (industrial, commercial, residential), forested, wetland etc. Changes in landscape patterns	Human activity	Biodiversity/Connectivity	32	7	4.6
Forest fragmentation (patch size, landscape matrix, roads, trails, transmission corridors)			33	7	4.7
% forest cover, by watershed			32	7	4.6
% interior forest cover (300 metres from the edge)			24	6	4
Interior bird species			15	5	3
Songbird species nesting in the Spring			9	4	2.3
Tree/shrub/ground vegetation change			10	4	2.5
Number and size of protected areas			19	5	3.8
2. Forest level					
Course woody debris			13	4	3.3
Species composition of the forest			19	5	3.8
Dbh (size or biomass) of selected sites			9.5	4	2.4
3. Natural Setting					
Amount of impervious areas relative to historical levels (total kilometers of roads)	Development	Impact on water quality/ loss of habitat/ impact on ecosystem function	26	6	4.3
Extent of roadless area			16	5	3.2
Upgrades to roads			11	4	2.8
4. Wetlands					
Number and size of wetlands - % wetland area	Development	Water quality/ ecosystem function	32	7	4.6
% wetlands in headwater areas of each watershed			21	6	3.5
Species richness in wetlands			14	5	2.8

(salamanders, Frogs)					
5. Acidification Indicators					
Cation Exchange Capacity in soil			13	4	3.3
Calcium in soil and foliage			3	2	1.5
Calcium content of tree wood			4	2	2
Soil decomposition			4	2	2

D. Biodiversity

Indicator	Stressor	Impact	Ranking	# Responses	Average
1. Richness					
Species richness			16	5	3.2
Integrity of plant and animal communities			16	4	4
Number and type of aquatic and terrestrial species (Changes in wildlife sitings)			14	4	3.5
Diversity of nearshore aquatic and terrestrial communities			9	3	3
# of introduced or foreign species (fish, phytoplankton, benthos, vascular plants, insects, mammals, etc.)			21	5	4.2
2. Habitat					
Changes in wildlife habitat			20	6	3.3
Impact of natural processes on habitat including insects, disease, wind, and fire			12	4	3
Change in forest type, quality and diversity			10	3	3.3
# square kilometers of available land or corridors for migratory species			12	4	3
3. Pollution Indicators					
Tumors and toxins in top predators			13	3	4.3
Counts of animals that take advantage of human presence (squirrel, blue Jays, cowbirds, raccoons)			9	6	1.5

E. Riparian Zone

Indicator	Stressor	Impact	Ranking	# Responses	Average
% developed shoreline			40	9	4.4
% of altered shoreline and naturally vegetated shorelines			36	8	4.5
Number of shoreline residents			36	9	4
Length of stream or lake shoreline with minimum 10 metre wide natural buffer			30	7	4.3

F. Air Quality

Indicator	Stressor	Impact	Ranking	# Responses	Average
Lichen diversity and abundance			24	7	3.4
Tree health - forest die back and other affects on plants			22	6	3.7
Number of inversions			10	4	2.5
Number of days that air quality standard is exceeded			16	6	2.7
Number of smog alerts issued			20	5	4
Amount of soot on snow			7	4	1.8
Health impacts (hospital admissions, doctors reports)			19	6	3.2
Number of complaints annually about air quality			12	5	2.4
Ground level ozone			8	3	2.7
SO ₂ Levels			8	3	2.7
NO _x levels			9	3	3
Change in CO ₂ emissions by source			11	4	2.8
Average SO ₄ deposition to land			13	4	3.3
Total Kwatts of electricity used/yr/capita			5	3	1.7
Visibility			6	3	2
UV flux			7	3	2.3

G. Water Quality

Indicator	Stressor	Impact	Ranking	# Responses	Average
1. Health					
Change in the average annual number of faulty septic systems			19	5	3.8
Number of Communities serviced by Sewage Treatment Plants			17	5	3.4
New septic system permits, annually			18	6	3
Bacteria counts (E-coli, coliform)			19	5	3.8
Indicator	Stressor	Impact	Ranking		
Parasites in surface water			13	4	3.3
Annual number of beach closures			24	6	4
Number of Ministry of Health 'boil water advisories'			22	5	4.4
Nuisance Canada Geese			8	4	2
2. Trophic Status					
Change in total phosphorus levels (by lake and region on the river systems)			25	6	4.2
Late summer Dissolved Oxygen concentrations			21	5	4.2
Water clarity (Secchi depth measurements)			19	5	3.8
Summer chlorophyll <u>a</u>			11	4	2.8

Changes Dissolved Organic Carbon			7	3	2.3
3. Pollution					
Other chemical analysis			6.5	3	2.2
Number of untreated stormwater outfalls to surface water			26	6	4.3
Number of dead fish reported			9	4	2.3
Suspended solids			11	4	2.8
Changes in SO ₄			10	3	3.3
Changes in Calcium			5	2	2.5
Quality of point source discharges			16	4	4
Number of lakes with pH greater than 6			21	6	3.5
4. Background Chemistry					
Alkalinity			16	6	2.7
Lake flushing rate			8	4	2
5. Climate Change					
Duration of ice cover (ice-on/ice-off)			29	7	4.1
Maximum water temperature, total heat content			4	2	2
Average summer temperatures			16	5	3.2
6. Question?					
Extinction coefficient of water in mid summer			2	1	2

H. Policy Framework

Indicator	Stressor	Impact	Ranking	# Responses	Average
1. Policy					
Municipal, District, Provincial policy that supports natural values			34	8	4.3
Policy/Regulation changes (zoning, official, provincial decision)			29	7	4.1
2. Programs					
Protected areas policy			27	7	3.9
Degree of protection for areas (policy, easement, ownership)			14	4	3.5
Public participation in planning exercises			17	5	3.4
Number of people collecting under various environmental property tax incentive programs.			14	5	2.8

I. Education

Indicator	Stressor	Impact	Ranking	# Responses	Average
Programs in schools			17	7	2.4
Public awareness programs			27	7	3.9
Number of lakes with Lake Plans			24	6	4
Recycle Volumes			19	5	3.8

J. Quality of Life

Indicator	Stressor	Impact	Ranking	# Responses	Average
1. Light/Noise					
Change in noise levels (average decibel level of noise on a summer weekend for lakes)			21	6	3.5
Number of homes, industry, commercial establishments and municipal facilities with dark sky compatible lighting			21	6	3.5
Number of complaints from people (smells, noise, dirt, garbage)			12	4	3
Complaint calls about jet skis			12	4	3
Change in use of motorize recreational vehicles			10	4	2.5
2. Recreational Opportunities					
Change in number of trails (walking, biking, skiing etc.)			22	6	3.7
Number of motor free lakes			17	5	3.4
Number of bike racks at town businesses			11	4	2.8
Number of healthy sustainable outdoor recreation opportunities (Number of angler hours/year)			17	6	2.8
Number of designated, historic buildings			6	3	2
Land base used for specific recreational opportunities			14	4	3.5
Number of tourists/year			21	6	3.5
3. Human Based Change					
Average square foot size of new homes			12	5	2.4
Change in overall average square foot size of home including additions			6	3	2
Measure of urban sprawl - % or number of new housing starts within urban limits vs rural areas			24.5	6	4.1
% land base developed			15	4	3.8
Changes in construction practices			7	3	2.3
4. Stewardship					
Number of lake associations doing water quality monitoring			24	7	3.4
Membership in stewardship associations (lake associations, heritage foundations, Watershed Council)			24	7	3.4
5. Community Composition					
Total population (permanent/seasonal breakdown)			24	6	4
Age distribution			16	5	3.2
Population density			12	4	3
Homelessness			7	2	3.5
Literacy Rate			2	1	2

Cancer rate			3	1	3
Number of Ontario Works recipients			2	1	2
Crime rate (number and type)			2	1	2
% of students who graduate from high school			2	1	2
Average level of education			2	1	2
Change in the average wage in Muskoka			6	2	3
Doctors/capita			4	2	2

K. Economic

Indicator	Stressor	Impact	Ranking	# Responses	Average
Number of businesses involved in sustainable economics (solar panel sales, photovoltaic cells, sale of 4-stroke motors)			16	5	3.2
Change in the number of businesses			7	2	3.5
Change in the businesses composition (types of businesses)			12	3	4
Volume of marine gas sold			8	3	2.7
Number of forest industry jobs			5	2	2.5
Number of new jobs that are self-sustaining			1	1	1
Average value of property sales			9	4	2.3

Updated January 30, 2003

Appendix 5

Muskoka Watershed Council Report for the February 2003 Workshop

Muskoka Watershed Council

~ Indicators Workshop ~

February 21, 2003

Land and Air

The Land and Air Group identified the following indicators:

- **Plant and animal biodiversity – as measured by**
 - γ Type and number of species

- **Air quality – as measured by**
 - γ Number of smog alerts
 - γ Ground-level ozone
 - γ Phosphorus in the air
 - γ Lichen diversity
 - γ Heavy metals in rainfall

- **Land use classification and changes**
 - By using satellite imagery the following changes can be tracked
 - γ Changes in forest cover
 - γ Changes in wetland cover
 - γ Changes in agricultural cover
 - γ Changes in urban and rural cover

- **Amount of non-point source pollution – as measured by**
 - γ Amount of pesticides sold in Muskoka
 - γ Quantities used by golf courses
 - γ Amount of road salt applied by District
 - γ Amount of fuel sold in Muskoka

- **Shoreline preservation**
 - γ By using shoreline mapping, determine the softening of shorelines in the future

- **Measure baseline chemistry of terrain conditions using**
 - γ Soil samples
 - γ Groundwater quality and quantity

Human

The Human Issues Group identified the following indicators:

1. Transportation

- Roads as measured by
 - Kilometres of roads
 - Traffic counts
 - Chemicals per kilometre
 - Loss of green space
- Boats as measured by
 - Size of boats
 - Number of 2-cycle versus 4-cycle engines
 - Horse power
- Other – ATVs and Snowmobiles as measured by
 - Sales
 - Snowmobile permits sold

2. Septics as measured by

- Re-inspection programs
 - Number of inadequate systems
 - Number of improved systems
 - Number of new septic systems
- Lake associations bacteria programs

3. Development as measured by

- Number of new lots created and building permits issued
- Number of new major developments (zoning)
- Change in development density
- Conversions

4. Waste management as measured by

- Recycling
 - Amount
 - Landfill diversion

5. Lighting

- Sale of dark sky compatible lighting fixtures

6. Economic Health as measured by

- Number of jobs → tourism, forestry, golf etc.
 - Income from → golf courses/recreation, aggregates, etc.
- Land area
 - Forestry → cut and planted
 - Aggregate → area
 - Major developments
- Income from commercial fisheries

- Number of outfitters, fish tournaments/derbies, family fishing weekend
- General employment levels (unemployment levels), education level, demographics → trends

7. Political will as measured by

- Budgets
- Enforcement – decisions
- Staffing levels
- Types of legislation
- Review of policies, bylaws and other legislation (heritage, crown)
- Involvement of elected officials in environmental committees
- Monitoring programs → habitat, reforestation, MNR
- Public involvement in political process
- Informed decision-making by elected officials
- Programs to educate the public

8. Brownfields

- Number of redeveloped brownfield sites

Water

The Water Group identified the following indicators:

- 1. Can we swim in it?**
- 2. Can we drink it (with reasonable treatment)?**

Specific, the following should be monitored

- Water quality
 - ∩ Test and monitoring of bacteria, phosphorus and algae
 - ∩ Contaminants/toxics
- Quality of water at beaches
- Ability to consume the water without inducing personal illness
- Monitoring point sources (sewage outlets)
- Construction/monitoring/maintenance of septic systems
- Greywater dumped from boats, especially in Georgian Bay area
- Nutrient loading and total phosphorus
- Water clarity – secchi testing

3. Biodiversity as measured by:

- Fish species/populations
 - ∩ Can our lakes support healthy aquatic populations of fish, bugs and frogs?
- Inventories of critical wildlife and fisheries habitat
- Number of Speckled trout found in creeks in Muskoka
- Benthic macroinvertebrate quantity and distribution

4. **Presence/absence of algae blooms in recreational water bodies (swimming)**
5. **Identification of significant wetlands and protection**
6. **Invasive species**
7. **Water quantity as measured by**
 - Water levels
 - ∩ Quantity
 - ∩ Control of flows
 - Stormwater runoff rate
 - Minimize erosion
 - Water quantity in Georgian Bay
 - Destructive damage to water-based infrastructure (i.e. docks, boathouses, etc.)

Low Priority

- Groundwater quality and quantity
- Water temperature → warm water versus cold water streams and lakes
- Accumulation of toxins in the food chain
- Can we eat the fish we catch?
- Oxygen levels