

**Corporate Air Quality & Climate Change
Strategic Plan
Phase II**

Corporate Air Quality & Climate Change Strategic Plan Report

Table of Contents

	Page
Executive Summary.....	4
Introduction.....	5

Part I – Background

A) Climate Change	6
B) Air Quality	9
C) Municipal Greenhouse Gas Emissions – An Overview.....	10
D) A Corporate Air Quality & Climate Change Strategic Plan	11

Part II – Corporate Actions

A) Adaptation & Reduction of Greenhouse Gases.....	11
a) Adaptation & Risk Management	12
b) Emergency & Health Response	13
c) Water Quality & Supply.....	14
d) Tree Planting & Preservation.....	16
e) Land-Use Planning.....	18
i) Growth Management	18
ii) Intensification.....	19
iii) Protection of the Natural Heritage System	19
iv) Community Design	20
v) Urban Design	20
vi) Community Improvement Plans	20
f) Built Environment.....	21
i) LEED – Leadership in Energy & Environmental Design.....	23
ii) Green Development Standards.....	23
g) Transportation & Transportation Planning	24
i) Personal Transportation Options - Biking	27
ii) Transportation Demand Management.....	28
iii) Greening the Corporate Fleet	30
iv) Transit.....	31

v) Idling Control	33
h) Energy Conservation & Demand Management.....	34
i) Waste Management and Reduction.....	38

Part III – Implementation & Delivery

A) Delivery of Corporate Actions on Air Quality & Climate Change	45
a) Corporate Air Quality & Climate Change Working Group.....	46
i) Senior Management Team & City Council.....	47
ii) Clean Air Hamilton.....	47
iii) Climate Change Roundtable.....	48
b) Corporate Emissions Inventory.....	48
c) Research on New Policies & Strategies.....	49
d) Response, Engagement & Communications.....	50
B) Implementation of Corporate Actions on Air Quality & Climate Change	50
Recommendations.....	51
Conclusions.....	54
References & Sources of Information.....	55

Appendices

- A – Vision 2020 Goals in the Corporate Air Quality and Climate Change Strategic Plan**
- B – Government Actions on Climate Change**
- C – Corporate Air Quality and Climate Change Actions**

EXECUTIVE SUMMARY

Increasing greenhouse gases leading to climate change and poor air quality will continue to have impacts on community health, the environment and the economy of Hamilton.

Transportation, energy use, industry, land-use planning, and the built environment are areas that contribute to significant air and climate change emissions within Hamilton and that the City can influence or address in its own corporate operations, services and policies. However, the time needed and significance of each area's contribution to the goals of improving air quality and reducing greenhouse gases will vary significantly.

The Kyoto Protocol on Climate Change establishes Canada's commitment to reducing greenhouse gases to 6% below 1990 levels from 2008 to 2012. The Kyoto Protocol entered into force internationally in 2005.

The City of Hamilton supports the objectives of the Kyoto Protocol. The Corporate Air Quality and Climate Change Strategic Plan recognizes the need to reduce greenhouse gases while improving air quality. The Corporation will strive to reduce greenhouse gas emissions in its operations starting with a 10% reduction of 2005 levels by 2012, followed by a 20% reduction by 2020.

The Corporation has already begun to address air and greenhouse gas emissions in the areas of responding to smog days, greening the fleet, waste, water, energy conservation and demand management, land-use and transportation planning, and idling. The City supports programs and partnerships with community groups to address air quality and the impacts of climate change through local initiatives such as Trees Across Hamilton, the Commuter Challenge, the Idling Stinks education program, and Wise Water Use.

Partnerships with community stakeholders outside of the Corporation and co-ordination of efforts with the broader Hamilton community are essential. The City of Hamilton will work with local community groups, academic and industry partners and other levels of government to ensure that action on air quality and climate change is taken - locally, provincially and globally.

To build upon the action already undertaken by the Corporation, and to continuously improve local air quality and address climate change, areas of increased focus in the short and medium term should include:

- Transportation:
 - Increased support of Transit within the City
 - Increased Transportation Demand Management and encouragement of alternative modes of transportation (walking, cycling, carpooling, teleworking) and discouragement of single occupancy in vehicles
- Investing in the "Green Infrastructure" to adapt and mitigate impacts.
 - Focus on forestry in urban areas – encourage more sustainable tree canopy
 - Encouragement and Development of green buildings and standards
- Undertake Adaptive planning to reduce the risks of climate change impacts in policies and actions

In the short term, a comprehensive greenhouse gas emissions inventory to quantify actions and results will be undertaken by the Corporate Air Quality and Climate Change Working Group to provide necessary information for further corporate strategic action and to measure results and targets.

INTRODUCTION

Increasing awareness and scientific support of climate change and associated impacts such as extreme weather events and influences on local environments including poor air quality have resulted in municipalities starting to reduce the amounts of greenhouse gas emissions from their operations and services, and educate their citizens. Municipalities have also begun to understand the need to adapt to the risks of a changing climate.

Municipalities have an important role to play in improving local air quality and addressing climate change given the types and levels of services they provide their citizens through public works, health services and planning.

The Corporate Air Quality and Climate Change Strategic Plan recognizes the City of Hamilton as a corporate entity including its municipal operations and as an implementer of programs and policies that address air quality and climate change within its operations. The role of the City of Hamilton as the “governor of the community” or the geographical district know as Hamilton is not the focus of this report.

Canada signed the Framework Convention on Climate Change in 1992, among other international legal obligations, it committed to adopting policies and measures to reduce greenhouse gas emissions and promote adaptation to climate change. In 1998 Canada adopted, then ratified in 2002, the Kyoto Protocol and pledged to reduce Canada's greenhouse gas emissions to six percent below 1990 levels during the commitment period of 2008 to 2012. The Corporate Air Quality and Climate Change Strategic Plan captures the intent of the Kyoto Protocol by recognising the need to take action on climate change in corporate operations and policies.

Through the Federation of Canadian Municipalities (FCM), the City of Hamilton urged Canada to support and ratify the Kyoto Protocol. The City of Hamilton continues to support actions on addressing climate change through Hamilton's Vision 2020 Strategy.

Hamilton's Vision 2020 Strategy has the following air quality and climate change goals:

- *To ensure the City has the best air quality of any major urban centre in Ontario;*
- *To have effective plans that identify, reduce and manage risks; and,*
- *To reduce greenhouse gas emissions*

The goals of the Vision 2020 Strategy have been incorporated into the Corporate Air Quality and Climate Change Strategic Plan through the recognition of the air and climate change goals and other areas of the Vision 2020 Strategy including transportation, land-use, water, waste, and energy. A full listing of the Vision 2020 Strategy goals endorsed by the Corporate Plan can be found in **Appendix A**.

This report highlights the environmental initiatives that the Corporation has undertaken, or is beginning to undertake, and brings them together in a strategic manner to address improvements in air and address climate change. The report also highlights the areas that need to be addressed by the Corporation to combat climate change in the short and medium term.

PART I -BACKGROUND

This section provides a brief overview on the issues of climate change and poor air quality, as well as the sources of municipal emissions.

It is important to recognize the complexity of climate change and air quality, the risks associated with climate change, and the municipal sources of emissions in the development of strategic corporate actions and priorities in Hamilton.

A) Climate Change

Climate Change refers to the long term change in average weather patterns resulting from the release of substantial amounts of greenhouse gases (GHGs), such as carbon dioxide, methane, nitrous oxide, etc. into the planet's atmosphere. These emissions alter the chemical composition of the atmosphere, resulting in intensification of the earth's natural greenhouse effect.

Climate change can be caused by natural processes, such as a change in the sun's strength, and by human activities. Scientific consensus has been reached that increased fossil fuel use and permanent forest loss since pre-industrial times has resulted in atmospheric concentrations of greenhouse gases growing significantly, leading to accelerated changes in our climate.

Table 1: Key Greenhouse Gases and Sources

Symbol	Name	Sources
CO₂	Carbon Dioxide	Fossil fuel combustion, forest clearing, cement production, etc.
CH₄	Methane	Landfills, production and distribution of natural gas & petroleum, livestock manure, sewage waste treatment, fossil fuel combustion, etc.
N₂O	Nitrous Oxide	Fossil fuel combustion, fertilizers, etc.
HFC's	Hydrofluorocarbons	Refrigeration gases, aluminium smelting, semiconductor manufacturing, etc.
PFC's	Perfluorocarbons	Aluminium production, semiconductor industry, etc.
SF₆	Sulfur Hexafluoride	Electrical transmission and distribution systems, circuit breakers, magnesium production, etc

Climate change is predicted to have several impacts. These include:

- Humans and societal infrastructure will be vulnerable to several types of extreme weather events, including droughts, intense precipitation, extreme temperature episodes, high winds, and severe storms from which they are currently unprepared.
- Changes in the frequency of severe storms and associated safety risks.
- The overcharging from urban sewage systems is likely to increase.

- Increased temperature, especially extreme heat, which contributes to heat stress in the elderly and ill.
- Accelerated changes to natural ecosystems, stress on wild animal populations and erosion of arctic/northern climate ecosystems.
- Increased favourable conditions for a number of pests (insects, rodents, disease vectors)
- Increase in weeds and pollen resulting in an increase in allergy attacks in individuals.
- Average water levels in the Great Lakes are expected to decrease and become variable resulting in impacts on water supply and quality (groundwater and surface water) and concerns in commercial and recreational transportation.
- Reduced water levels in lakes which may concentrate pollutants and toxins requiring changes to water purification practices.
- Altered precipitation and temperature regimes will affect seasonal patterns in water levels in waterways and wetlands, thereby affecting their functioning in flood protection, water cleansing, and waterfowl/wildlife habit and their use in recreational pursuits (fishing, camping, and boating).
- Increased maintenance costs for transportation, with variable freeze-thaw cycles, increased pavement buckling due to longer periods of intense heat and shifts from less snow to more freezing rain.
- Increased demand for building cooling through increased use of air conditioning resulting in higher energy consumption and associated greenhouse gas and air pollutants.
- Changes (extreme droughts, floods, shifting produce, weeds and insects) in agriculture may affect the supply of foods.
- Insurance and reinsurance industries that may already be burdened may increase liability costs or remove coverage as the risk associated with investment in property, infrastructure and resource-base industries increases.¹

Overall, climate change, combined with poor air quality, will place major stresses on built infrastructure (buildings, roadways, sewer systems), “green” infrastructure (watersheds, trees and parks), the health infrastructure (combating respiratory and cardiovascular, stress, and disease), social support systems (emergency response), and the economy. Many negative impacts of climate change can be reduced through preventative measures (mitigation); others must be adapted to, while the remaining impacts may have to be borne.

In 2006, Canada's total greenhouse gas emissions reached an estimated 747 Megatonnes of carbon dioxide (equivalent), up 25% from 1990. In terms of individual greenhouse gases, 78% of the 2006 emissions were attributed to carbon dioxide, 15% to methane and 6% to nitrous oxide. Sulphur hexafluoride, PFCs and HFCs accounted for the remaining 1%.

What is one tonne of Greenhouse Gases (GHGs)?

- Greenhouse Gases are measured in tonnes of carbon dioxide
- 1 Mt (mega tonne) is 1 million tonnes of carbon. 1 Mt of carbon is equivalent to 3.67 million tonnes of carbon dioxide. Carbon dioxide, the most abundant greenhouse gas produced, is used as the standard to which greenhouse gases are measured against and is referred to as eCO₂
- The volume of one tonne of GHGs would fill a two-storey, three-bedroom house
- The average Canadian produces approximately 5 tonnes of greenhouse gas emissions each year so one tonne is a reduction of about 20%
- An automobile produces approximately 5 tonnes/year of CO₂ equivalents

¹ Weather related insurance losses multiplied more than 13 times between 1960 and 1999.

It is important to note that Canada's greenhouse gas emissions vary from region to region and are linked to the distribution of natural resources and heavy industry within the country. Particular provinces tend to produce more greenhouse gas emissions because of their economic and industrial structure and their relative dependence on fossil fuels for producing energy. Ontario is recognized as one of the highest emitters of greenhouse gases at 200 million tonnes of CO₂ equivalents.²

In 2007, the United Nations Commission on Sustainable Development convened an international panel of scientific experts to prepare a report outlining the best measures for mitigating and adapting to climate change. The panel's conclusion is that a two-pronged strategy is needed: avoid the unmanageable (mitigation) and manage the unavoidable (adaptation).

The key United Nations recommendation is the creation and rebuilding of cities to be climate resilient (adaptation) and GHG-friendly (mitigation). Action items to take advantage of the most advanced technologies and approaches for using land, fresh water, terrestrial, and energy resources include the following elements:

- Modernize cities and plan land-use and transportation systems, to support greater use of public transit, to reduce energy use and greenhouse gases and increase the quality of life and economic success of citizens.
- Improve the design and efficiency of commercial and residential buildings through building codes, incentives for property developers and landlords to build and manage properties efficiently, and financing for energy-efficiency investments; Construct all new buildings using designs appropriate to the local climate, and upgrade existing buildings to reduce energy demand and slow the need for additional power generation.
- Promote reforestation and improved land-use practices in ways that enhance productivity and delivery of ecological services while reducing emissions.
- Expand the use of biofuels, especially in the transportation sector, through energy portfolio standards and incentives, with careful attention to environmental impacts, biodiversity concerns, and energy and water inputs.
- Undertake performance measures that monitor the progress of energy and greenhouse gas reductions.
- Promote lifestyles, adaptations, and choices that require less energy and demand for non-renewable resources.

B) Air Quality

Sources of air pollutants are varied but primarily stem from the industrial and transportation sectors. The key air pollutants are released when fossil fuels such as coal, oil, gasoline, diesel and natural gas are burned for the purposes of transportation or energy in both

² Environment Canada -Canada's 2005 Greenhouse Gas Inventory

industrial and personal uses. These same sources also generate greenhouse gases that contribute to climate change.

Hamilton's Six Key Air Pollutants:

Nitrogen dioxide (NO ₂)	Ground level ozone (O ₃)
Inhalable particulate matter (PM ₁₀)	Respirable particulate matter (PM _{2.5})
Sulphur dioxide (SO ₂)	Carbon Monoxide (CO)

Poor air quality has significant direct and indirect impacts on the health, environment and economy of Hamilton. Strong scientific evidence supports the linkages between air pollutants (ozone, nitrogen oxides, carbon monoxide, and airborne particulates) and significant respiratory and cardiovascular ailments. The impacts of air pollutants on health and the environment can be exacerbated by higher temperatures and humidity brought about by changes in the local climate.

Health estimates demonstrate that poor air quality continues to present a substantial risk to the health of residents in Hamilton.

Clean Air Hamilton was established in 1998 under the former Hamilton-Wentworth Air Quality Initiative and serves as an independent multi-stakeholder research and advisory committee to the City on issues of air quality in Hamilton.

In 1997 and 2003, *Clean Air Hamilton* undertook research regarding air pollution and health on Hamiltonians. It has been estimated that five key air pollutants – nitrogen dioxide, ground level ozone, fine particulate matter, sulphur dioxide and carbon monoxide - contribute to approximately 100 premature deaths and 620 hospital admissions in Hamilton each year.

In 1998, the Ontario Medical Association (OMA) declared air-pollution “a public health crisis.”³ According to a 2005 report from the OMA, air pollution was responsible for an estimated 5,800 premature deaths, almost 17,000 hospital admissions and close to 60,000 emergency room visits in Ontario in 2005.⁴

According to *Clean Air Hamilton*:

- The transportation sector is the leading source of Nitrogen Oxide (NO_x) emissions within the city, followed closely by the industrial sector.
- The industrial sector is the leading source of directly-emitted particulate matter followed by road dust and area sources such as fireplaces, home heating and businesses.
- Industry is by far the leading source of Volatile Organic Compounds, Sulphur Dioxide, and Carbon Monoxide.

Clean air strategies help in the fight against climate change, as measures that promote efficient land use, efficient use of fossil fuels and/or a switch to cleaner sources of energy will reduce emissions of both smog pollutants, greenhouse gases, and increase health.

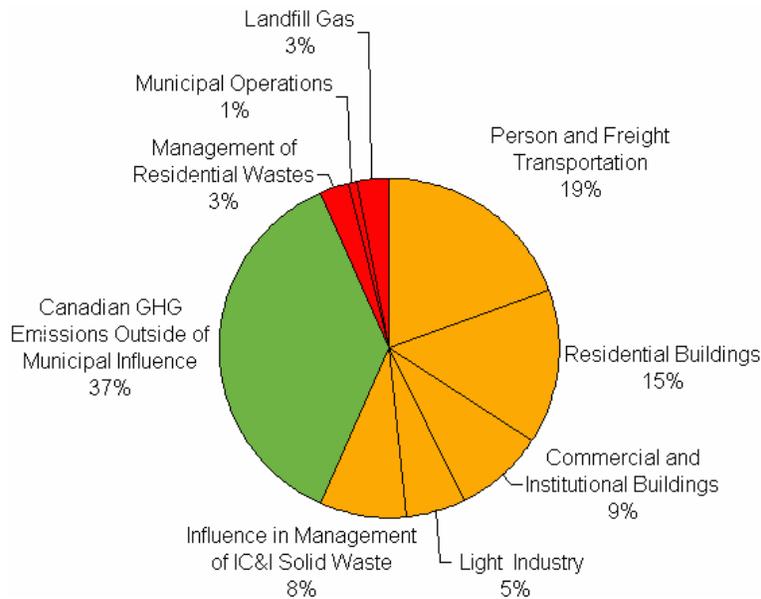
C) Municipal Greenhouse Gas Emissions – An Overview

³ Ontario Medical Association: News release May 12, 1998, “*Beware the Air You Breathe: Ontario’s Doctors Call for Cleaner Air*”

⁴ Clean Air Hamilton: 2004-2005 Progress Report

According to the Federation of Canadian Municipalities (FCM), up to half of Canada's greenhouse gas emissions (360 Megatonnes (Mt)) are under the direct or indirect control or influence of municipal governments. Municipalities directly control decisions that produce some 38 Mt of greenhouse gas emissions from municipal operations, residential waste, and landfill sites. Greenhouse gas emissions under the indirect (regulatory, public policy, and community awareness) control of municipal governments total 322 Mt.

Figure 1: Canadian Greenhouse Gas Emissions Directly & Indirectly Controlled by Municipalities Compared to Total National Emissions (1990).



By 2012, the Federation of Canadian Municipalities estimates that communities could cut greenhouse gas emissions by 20 to 50 Mt from municipal operations and community-wide initiatives with investments in environmental infrastructure and sustainable transportation infrastructure. Municipal governments can reduce emissions through:

- land-use, energy, and transportation planning and management;
- infrastructure design and adaptation planning;
- green procurement;
- green fleets (hybrid, alternative fuels, right-sizing);
- building retrofits;
- energy conservation and efficiency;
- green development standards;
- water conservation and efficiency;
- solid waste diversion and reduction; and
- using renewable energy.

Efforts to reduce air pollutants and greenhouse gas emissions from municipal operations could produce economic benefits for the Corporation and improve the quality of life in the City. They could produce energy and operating costs savings, encourage renewal of physical assets, and improve the delivery of municipal services.

D) A Corporate Air Quality & Climate Change Strategic Plan

Departments run a variety of policies and programs that address air quality and climate change. Some have been expressly created for that purpose, while many others make a direct contribution to air quality and climate change issues as they pursue other goals. A clear, coherent strategy is needed to bring the current policies and programs together and translate corporate effort to more effectively address both air quality and climate change by a strategic action plan.

In August, 2006, City Council recognized the need to begin developing a comprehensive strategy to address climate change and air quality in Corporate policies and operations⁵.

The approved Corporate Air Quality and Climate Change Strategy outlined 5 action categories to be addressed by the actions of City Departments:

- I. Research that Informs Policies and Strategies;**
- II. Response, Engagement & Communication;**
- III. Adaptation to Smog & Climate Change;**
- IV. Reducing Emissions, Key Pollutants & Greenhouse Gases; and;**
- V. Delivering Air Quality and Climate Change Programs.**

This report outlines the initial elements and actions of the Corporation of the City of Hamilton under a comprehensive strategic plan to address climate change and air quality.

PART II – CORPORATE ACTIONS

This section provides information on specific areas (smog response, water quality & supply, transportation, land use planning, energy, and waste) and the related climate change and air quality issues therein.

Current actions of the corporation in addressing these areas are highlighted and future actions that can address air quality and climate change are recommended. These corporate activities serve as the baseline and respective future actions under the Corporate Air Quality and Climate Change Strategic Plan.

A) Adaptation & Reduction of Greenhouse Gases

Addressing climate change requires two types of actions: adaptation and mitigation (i.e. reduction). Adaptation involves actions or planning to minimize citizens or infrastructure's vulnerabilities to the impacts of climate change. Mitigation involves actions aimed at reducing greenhouse gases. Adaptation and mitigative actions are complimentary.

Adaptation includes technical adaptation (e.g. new technology or resources that reduce dependency on non-renewable natural resources and energy constraints); environmental adaptation (e.g. responding to the changes in natural systems such as water, air, and forests); and social adaptation (e.g. changes in personal behaviour and social/community support services).

Adaptation does not need to be dramatic or disruptive. It can include minor changes to established activities and practices within an organization. Preparing for events reduces the risk of an organization's vulnerabilities to the impacts of climate and/or poor air quality.

⁵ The 2006 Phase I Report (PED06336)

Reduction, or mitigation, is directed at reducing atmospheric concentrations of air pollutants and greenhouse gases resulting from municipal operations and services (i.e. areas of direct control or influence by the Corporation). Mitigation involves actions meant to avoid or delay the occurrence of climate change.

Reduction strategies should:

- Define actions to reduce greenhouse gases and improve air quality in corporate operations, and
- Encourage actions by staff to reduce their personal emissions to improve air quality and retard climate change.

A. a) Adaptation & Risk Management

Municipalities run the risk of suffering from the impacts of climate change from more frequent storms, droughts, floods, heat waves, poor air quality days, invasive species and diseases. Corporate actions need to include an element of preparation and risk protection that the Corporation cannot directly control but can still prepare for.

In 2004, the City of Hamilton undertook a vulnerability scan of climate change impacts through the GRIDS (Growth Related Integrated Development Strategy) process to identify risks and the City's adaptive capacity to climate change. The report concluded that climate change should be addressed by the City and considered in the planning of City development and infrastructure (ECO5 Inc., 2004).

The City of Toronto has identified the need to begin addressing adaptation and examining the vulnerabilities of their operations to climate change. The Toronto Clean Air Partnership has been undertaking projects looking at Adapting to Climate Change in Toronto. The Alliance for Resilient Cities (ARC) is a recent collaborative network of decision-makers that supports the efforts of local governments to identify the impacts of climate change, analyze adaptation options and develop action strategies to protect their communities. The City has been engaging with the Alliance to learn more on adapting to climate change.

Action:

- **Undertake vulnerability scans of climate change impacts on municipal operations.**
- **City Council should direct all departments to take appropriate action to incorporate responses to potential risks of climate change into corporate operations.**
- **Develop a Corporate Climate Change Adaptation Strategy**

A. b) Emergency & Health Response - Adaptation

Natural hazards pose a threat to cities, measured in physical disruption of infrastructure, human health effects and economic losses from damage and lost productivity. Weather hazards include tornadoes, hailstorms, winter storms, heat waves, drought, storm surges, and floods. Climate change is expected to alter the frequency and/or severity of hazards that surround cities, demanding adaptation to reduce catastrophic loss (Institute for Catastrophic Loss Reduction, 2003).

Hamilton is not exempt from the effects of climate change. The City's 2004 Environmental Scan points out that "research indicates that future weather patterns in Southern Ontario will

fluctuate to an increasing degree. Adverse weather conditions will become more intense and less predictable.”

Winter storms cause more than 100 deaths in Canada every year.⁶ Similarly heat waves can have a substantial impact on human health by exasperating the risk of heart attack or worsen medical conditions such as diabetes. Extreme heat can result in dehydration, heatstroke, heat cramps, and heat exhaustion in healthy populations. The very young and elderly are the most vulnerable to extreme weather events because they have a more limited capacity to regulate their body temperatures through prolonged extreme temperatures. At greater risk are those who lack access to proper heating, air conditioners or cool recreational facilities needed for relief from excessive heat. Heat waves are expected to increase in Southern Ontario with climate change.⁷

Extreme Cold or Heat Alerts, conducted by a local health unit, could identify potential shelters, both public and private, (community centres, libraries) and areas where there are large numbers of seniors. These alerts would also include: the use of a temperature index, declaration of cold or heat emergency and response plans, requesting hostels/shelters to stay open, and having city nursing staff visit people at risk. (Health Canada, 2003)

Hamilton Public Health Services issues media advisories for extreme cold or heat events and works with community agencies on actions to protect the vulnerable from extreme weather conditions. The actions for extreme cold alerts include transporting and sheltering of people who are at particular risk.

In 2007, Hamilton introduced a hot weather protocol, in which includes a three stage classification of the heat event. In the event of a Heat Alert (the third and most severe heat event), the City Emergency Control Group will be convened, a cooling center will be provided downtown, and outdoor City swimming pools will have extended hours⁸. It has been suggested that heat alert programs be strengthened through coordination with public air quality advisories.⁹

Studies have suggested that climate change and extreme weather affects the breeding and range of disease vectors. Warm, wet weather encourages insects and bacteria proliferate. Increased flooding and precipitation may increase the transmission of pathogens and parasites from other animals to humans through the water system.

To reduce the health risks of climate change, emergency and health planning responses should consider scenarios of extreme weather such as flooding, drought, wind storms, extreme cold and heat on citizens in their emergency preparedness protocols.

The Ontario Emergency Management and Civil Protection Act (EMA), amended in 2006, outlines the responsibilities of local/municipal and provincial government in the mitigation and management of emergency situations. It requires all Ontario municipalities to develop comprehensive, risk-based emergency management programs based on planned emergency prevention, preparedness, response and recovery.

⁶ Institute for Catastrophic Loss Reduction: *Climate Change, Natural Hazards and Cities*, 2003

⁷ McGeehin, and Mirabelli, *The Potential of Climate Impacts of Climate Variability and Change on Temperature-Related Morbidity and Mortality in the United States*. Vol. 109, Supp 2, Environ Health Perspect. May 2001

⁸ City of Hamilton Public Health Services, *Heat Alerts and Response* (BOH07024), May 2007.

⁹ Pollution Probe, *Towards an Adaptation Action Plan: Climate Change and Health in the Toronto-Niagara Region*, 2002

The City of Hamilton Emergency Management Program has been in effect since the 1990's. The Program presents an opportunity to address the risks of extreme weather events resulting from climate change.

Action:

- **Enhance disaster preparedness and emergency response plans. Strengthen emergency communications, emergency preparation, public education, and emergency response coordination (e.g. planning for the combat of infectious diseases, illness, temperature and poor air quality induced health impacts)**
- **Develop and maintain a comprehensive risk based analysis procedure, in conjunction with the vulnerabilities scan, to determine climate change based high risk events in order to support co-ordinated inter-departmental mitigation programs to reduce risks and vulnerabilities.**

A. c) Water Quality & Supply – Adaptation

Climate change is forecasted to have impacts on water supply and quality, in combination with increased demand. Impacts are predicted to range from lowered lake and river levels, increased moisture deficits and local droughts, to increased extreme precipitation with increased flooding.

The City's Integrated Water and Waste Water Master Plan for the Lake Based Systems (2006) provides Hamilton with a water and wastewater servicing strategy for the lake based systems to support GRIDS. The plan identified upgrades required to service existing residents, address water quality issues in Hamilton Harbour, and support growth of Hamilton over the next 30 years. One of its policies is for the City to maintain sufficient reserve capacity in its water and wastewater infrastructure and facilities to provide operational flexibility and meet potential changes in servicing conditions (such as power failures, growth rates and fluctuating demands).

The City of Hamilton accepted an invitation to participate in the Great Lakes and St Lawrence Cities Initiative (GLSLCI) Water Conservation Framework. This is a voluntary program by which Cities commit to reductions in water use. The target reduction by year 2015 is 15% below a year 2000 baseline. The Public Works Department has undertaken various initiatives to conserve water and educate the public. The City has already achieved considerable water savings since 2000 and will be meeting this objective prior to 2015.

A large contributor has been the City's Water Metering Program. In 2002, the City moved from a partial flat rated water charge to implement a fully metered system. Since that time, the number of metered unit users has risen from 60,000 to more than 132,000. On the municipal water system, 99.8% of homes have had water meters installed.

Studies have shown that when water meters are initially installed, as much as a 20% reduction in water use can be realized as water consumers pay for what they use. Within 2 to 3 years, water consumers tend to return to old water use habits and consumption stabilizes with an approximate 10% reduction. In partnership with Green Venture, the Wise Water Use program is designed to educate citizens on the importance of local water sources and methods of water conservation. The Wise Water Use program has reached approximately 150,000 people and Green Venture has directly engaged approximately 50,000 water users.

The City's water use reduction from full metering has consistently maintained reductions of more than 10%. With daily residential household use in 2003-2004 averaging 800 litres (approximately 350 litres per capita day [lcd]), daily household average use fell to 760 litres

(330 lcd) in 2005 and fell again in 2006 to 710 litres (309 lcd). The current average for 2007 is 620 litres (270 lcd), representing an overall reduction from 2003 of 11.3 to 22.5%.

In 2008, a Water Efficiency Master Plan is to be proposed. The Master Plan is proposed to apply to residential, institutional, commercial and industrial users and is proposed to consider measures such as public education, new codes and standards, consumption based metering, municipal retrofits of household water efficiency devices (i.e. low flow showerheads, low flush toilets), system leakage detection and low water use landscaping.

The City is collaborating with members of the Canadian Water and Wastewater Association's Network Efficiency Committee. Water culled from efficiency programs is available, with approval from the Ministry of the Environment, as reserve capacity; it can defer the need for new supply infrastructure and thus is the least cost option for any new supply requirements. Water efficiency contributes to reductions in chemical and pumping energy usage, and a commensurate reduction in the amount of wastewater requiring treatment.

Water efficiency programs have little environmental footprint, and contribute to an overall reduction in greenhouse gas emissions. An updated corporate greenhouse gas inventory will identify how water usage and greenhouse gas emissions are linked for future corporate efficiency improvements. Through efficiency programs, achievable reductions are typically at 15 to 25%. This represents more than 40,000 cubic metres of treated water a day based upon current City flow rates.

Hamilton's storm water management programs are pivotal to improving source water quality. Unpredictable and extreme precipitation events will challenge the design capacity of water collection and conveyance systems, and multiply the probability of flooding. Excess runoff from overwhelmed storm and sewer systems permit the release of contaminants into local water bodies.

During the summers of 2004 to 2006 the City experienced heavy rainstorms causing sewer back ups and resulting in property damage and financial losses of totalling hundreds of thousands of dollars (Independent Community Panel (SERG), 2006). Hamilton also experienced flooding in parks and recreational areas, underpasses and erosion in streams and in areas outside the combined sewer network of the older City.

In response, the City formed an independent community panel called SERG (Storm Event Response Group) to explore the causes and effects of extreme weather on Hamilton's storm management/drainage systems and review the stormwater and wastewater master plans.

The panel concluded that the majority of Hamilton's stormwater management infrastructure works well but some areas could benefit from improvements. SERG also indicated opportunities for stream remediation in natural water courses as well as opportunities to improve existing stormwater retention through the use of natural processes and functions such as absorbent soils, additional trees, and increasing the canopy cover to intercept rainfall and enhance transpiration of runoff.

Although the mandate of the group did not include climate change, the SERG report (2006) did indicate that climate change would be a continuing factor and that the City undertake a proactive approach to designing for severe storm events in stormwater infrastructure planning.

Changes in temperature and precipitation patterns accordant with climate change may lead to earlier spring runoff and lower summer water levels, while intense rain events may result in more flooding. Wetlands will typically deliver steady baseflow, but in isolation do not necessarily perform well as flood prevention structures. Wetlands are most effective as

components of larger designs which account for both storm and inter-storm water conditions rather than for a handful of individual events. The City has integrated its design models into the Stormwater Master Plan component of GRIDS.

The City undertook the City-wide Stormwater Master Plan to provide strategies for the City's stormwater system (including storm trunk sewers) for the next 30 years. It is also a strategy to protect, enhance and restore the environmental resources within Hamilton's 15 watersheds. The Stormwater Master Plan recommends several types of measures to ensure that development practices for stormwater management in the City are sustainable. These measures include source control through measures such as green roofs, downspout disconnection and rain barrels, etc. the incorporation of infiltration into stormwater conveyance measures, enhanced use of vegetated buffer strips, the retrofitting of 29 stormwater pond facilities, stream restoration measures, and increase tree coverage.

Action:

- **Consider impacts on local air quality and reduction of greenhouse gases in City water & wastewater operations on a continual basis**
- **Incorporate climate change factors in Environmental Assessments used in the planning of water, wastewater and stormwater infrastructure and policies to ensure adaptive response to a changing climate.**
- **Promote greater water conservation in Hamilton to ensure adequate supplies of water under extreme weather scenarios (flooding, drought, lower lake levels, brownouts)**

A. d) Tree-Planting & Preservation – Adaptation & Mitigation

Trees absorb carbon to off-set the release of greenhouse gases by other sources; they offer shade that can protect from the damaging effects of the sun's ultra-violet light. They can provide cool retreats against heat waves; and they help remove many pollutants from the atmosphere.

Studies in Oakville and New York have estimated the benefits of trees financially and environmentally. New York's City street trees provide an annual benefit of about \$122 million and the City receives \$5.60 in benefits for every dollar spent on trees, including costs associated with planting and upkeep.

An effort to improve air quality through the commitment to establish an Urban Forestry Management Plan found Oakville's urban forest of 29.1% forest canopy coverage was responsible for filtering 172 tonnes of pollutants - all of the local industrial and commercial emissions of particulate matter (PM₁₀) and 7% of PM_{2.5} and over two times the amount of sulphur dioxide plus other criteria pollutants. A total of 22,000 tonnes of carbon dioxide were filtered and 6,000 tonnes of carbon were sequestered. While local air pollution is reduced, Oakville's urban forest does not filter a significant volume of the trans-boundary pollutants coming into Halton Region's airshed.

The value of the ecological services provided annually by trees within the Town of Oakville is \$2.1 million. In addition, trees save the local industry \$1.1 million each year by avoiding the expenditure on mechanical abatement measures to remove 172 tonnes of pollutants emitted at source. Trees save Oakville residents \$812,000 annually in reduced energy bills. This annual revenue potential through emissions trading arising from Oakville's qualifying carbon credits was \$5,191.

The Trees Across Hamilton program was initiated to undertake community based naturalized tree plantings in each Ward. In 2005 the program was carried out over six weekends with volunteers, Ward Councilors, and staff participating in the tree planting events. In total, 3,000 tree whips and 2,000 seedlings were planted in thirteen locations. In 2006, the program saw the planting of 2,300 trees in 12 areas across the City.

The City of Hamilton has undertaken steps to improve the service trees provide to the airshed and adapting to climate change. These include street tree trimming and planting programs, an Urban Forest Health Program to monitor and respond to forest health issues, and a consolidated Tree by-law to protect and guide management of public tree infrastructure. In 2007, a total of 7,144 street trees were planted in Hamilton through the Street Tree Planting program.

Rural Official Plan - Targets for Natural Cover

The City's objective is to expand and reinforce the existing Natural Heritage System in the long term by encouraging and undertaking ecological reparation towards locally established targets.

*Forest cover (Rural & Urban) was estimated at 17.7%, the target is 30%**

Wetland coverage was estimated at 8.3%, the target is 10%

*Based on Environment Canada's (2004) report, "A Framework for Guiding Habitat Restoration in Great Lakes Areas of Concern".

Although the Rural Official Plan established targets for natural cover, support is needed for a comprehensive forestry action plan by establishing an inventory of urban trees, determining a sustainable urban tree coverage, and allocating new resources to increase urban tree coverage in the City.

Action:

- **Undertake a tree inventory with community support to provide information for an Urban Forest Master Plan.**
- **Develop a comprehensive Urban Forest Management Plan with sustainable targets for the urban tree coverage in Hamilton.**
- **Create a Fund to preserve and enhance tree coverage in parks, open spaces, and forests in Hamilton.**

A. e) Land-Use Planning – Adaptation & Mitigation

Where different land uses, buildings and their amenities are located, and how they are laid out on the urban landscape is perhaps the most significant component to consider the influences on and impacts from climate change.

In the post World War II era, Canadian cities have been characterized by urban sprawl. Sprawl is associated with the expanding uptake of greenfield lands with each increment of a City's population growth developed. Home, work, shopping and recreation facilities are separated in this design leading to dependence on automobile transportation. The result is increased vehicle emissions that contribute to air pollution and negative impacts on human health. Low-density and segregated development patterns discourage alternative forms of transportation such as public transit, walking and bicycling. Public transit generally requires medium to high-

density diversity in land uses to foster travel for many purposes along the same route and more compact serviced districts to be cost-effective

Single-use, dispersed neighbourhoods, located far from downtowns, produce nearly 3 times more annual emissions per household than mixed-use, compact neighbourhoods near the downtown.

Within the same location, developing more compact neighborhoods with mixed-use and pedestrian oriented designs decreases greenhouse gas emissions by 24-50%.

Canadian Mortgage and Housing Corporation

According to the Ontario College of Family Physicians (2005), the best available evidence indicates that greenspace is an essential part of human health. People cannot continue to lead healthy lives without sufficient farmland to produce local food, forests to help purify the air, and protected watersheds to provide safe drinking water. Neither of these complementary goals - protecting environmental systems and protecting human health - can be accomplished, however, without curbing urban sprawl.

In Hamilton, the municipal planning is being altered to combat sprawl. The planning framework from growth management via the Growth Related Integrated Development Strategy (GRIDS), the Official Plan, secondary plans, site plan and design guidelines are being updated to prevent sprawl, change land use patterns and increase density. These initiatives will support and provide transit options and should contribute to a reduction of greenhouse gas emissions.

A. e. i) Growth Management

The Growth Plan for the Greater Golden Horseshoe (Places to Grow) forecasts the City of Hamilton increasing by 150,000 people, 80,000 households and 90,000 jobs between 2001 - 2031.

GRIDS identified a broad land use structure, associated servicing infrastructure and economic development strategy to accommodate Hamilton's growth forecast.

The GRIDS growth priority is a nodes and corridors urban structure. Corridors are mixed uses areas that serve a main street 'spine' for higher density residential buildings, the retailing of goods and services, higher transit services, community and recreational uses. The nodes reflect existing higher density concentrations of live, work and play activities.

Of the 80,000 new dwelling units to be required by 2031, 58,400 units will be accommodated within the existing approved urban area providing a compact urban form with complete communities of modestly increased density and mixed uses that are more transit supportive. Employment areas are located in proximity to residential areas to reduce home/work trip distances. The need for additional greenfield land is significantly decreased over current trends. This limits the impact on natural heritage system (environmental lands) and agriculture and rural lands in the future expansion of the City.

A. e. ii) Intensification

In order to achieve this growth scenario, increased residential intensification and greater levels of land use diversity within the existing urban boundary is required. Intensification includes:

- Redevelopment including the reuse of brownfield sites,
- Redevelopment of underutilized lots within previously developed areas,
- Infill development of vacant land, and
- The expansion or conversion of existing buildings

(Provincial Policy Statement, 2005)

Intensification will be strategically focused throughout the urban area in nodes, corridors and key sites. Increased density will provide the critical mass of people required to provide for higher order inter-regional transit system connections to Hamilton and facilitate the provision of an efficient local transit system.

A. e. iii) Protection of the Natural Heritage System

In addition to minimizing the amount of land required through urban boundary expansion, the City is focusing on the protection and enhancement of the Natural Heritage System (Environmental lands). With the revised Provincial Policy Statement (2005) and the Greenbelt Plan (2005), the City is required and has the authority to protect more natural heritage features and functions in both the urban and rural areas of the City. As a result, significantly more environmental lands should be protected from development and protected from the impact of development on surrounding land. Protecting and enhancing natural areas serves to buffer and moderate extreme air and water related impacts associated with climate change.

A. e. iv) Community Design

Future development and redevelopment of the City's neighbourhoods will be based on the concept of "complete communities". Most existing areas segregate land uses requiring people to drive to each destination. Complete communities mix residential land use, shopping, recreation, education and workplaces in a higher density that provides better support for people and the environment. Community design must ensure they are more convenient and liveable, pedestrian friendly and walkable. Residents and businesses who are less dependent on the automobile are more likely to participate in active transportation (e.g., walking, cycling).

Increased densities in combination with complete communities will provide alternatives to the automobile and result in a decrease of greenhouse gas emissions.

Ontario Provincial Policy Statement (2005):

The Ontario Provincial Policy Statement provides policy direction on matters of provincial interest related to land use planning and development. Air quality & climate change effects of planning decisions are two of the many factors that need to be evaluated in the decision-making planning process. Section 1.1.3.2 (a) (3) of the Statement makes specific mention of the importance of minimizing impacts to air quality, climate change and promoting energy efficiency.

A. e. v) Urban Design

Recent changes to the Ontario Planning Act provide a City with the authority to regulate exterior design and require sustainable building forms. Promotion of development that is designed to be sustainable, supportive of public transit and oriented to pedestrians is deemed to be a provincial interest. The adherence to site plan guidelines will be a critical component of achieving sustainable design and contributing to the development of complete communities. The location, design and materials used in the construction of buildings are components of planning that can contribute to air issues and adaptation to climate change.

A. e. vi) Community Improvement Plans

Community Improvement Plans are a vehicle by which government funding programs can be established for specific areas of the City. However, these plans and associated funding and programs are limited to specific scopes (e.g., heritage or architectural significance, infrastructure issues, parking, business improvements areas) by the Ontario Planning Act. Recent amendments to the Ontario Planning Act permit grants and loans for energy efficiency in Community Improvement Plans.

The changes to the Building Code and the more energy efficient urban forms that will result from the Places to Grow initiative have large impacts on emissions over the long term, but they affect only new buildings and new neighbourhoods, and their greenhouse gas emission impacts will only begin to build by 2020.

Ontario Government, 2007

The City's Official Plan provides the background policy framework for land use, transportation and infrastructure planning across Hamilton. Since all three of these areas impact or are impacted by poor air quality and climate change, it is important to have air quality and climate change issues considered and inform policy direction of the new Official Plan.

Action:

Throughout the development of the urban component of the new Official Plan:

- **Implement the approved land use planning related growth strategy (GRIDS and the recommendations of the associated Master Plans).**
- **Provide for complete communities and mixed use and related urban design guidelines.**
- **Target areas for residential intensification.**
- **Develop policies for the protection and enhancement of the Natural Heritage System.**
- **Examine and incorporate air quality and climate change policies in the City's Official Plan.**
- **Examine the ability to prepare Community Improvement Plans for energy efficiency.**

A. f) Built Environment - Adaptation & Mitigation

The built environment (buildings and city infrastructures) influence, and are influenced by, the local climate and can be impacted by climate change. Buildings and construction generate air pollutants and greenhouse gas emissions through the energy use of fossil fuels. Buildings and associated infrastructure reflect heat thereby warming the local climate and inducing smog. Buildings are also impacted by changes in climate such as extreme weathering.

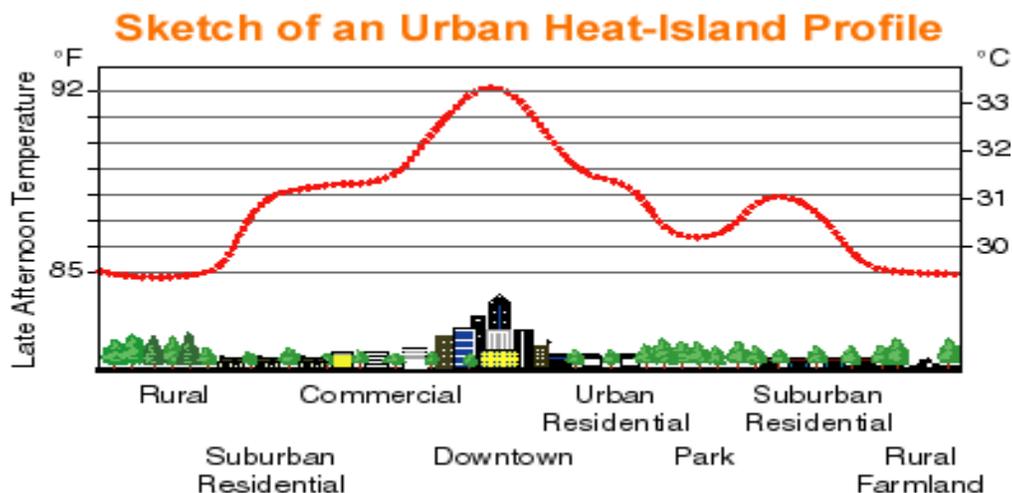
Buildings and their construction account for 25% of Canada's overall greenhouse gases emitted through new construction, combustion of fossil fuels to meet building utility requirements and electrical consumption in lighting and air conditioning. Most emissions come from the combustion of fossil fuels to provide heating, cooling, and lighting and to run electrical equipment and appliances after the building is constructed. The manufacture of building materials and products, and emissions from transportation sources generated by urban sprawl, also contribute significant greenhouse gas emissions every year.

Greenhouse gas emissions from new buildings can be reduced through improved energy efficiency in building design and construction that reduce the use of fossil fuels. Existing buildings can be retrofitted to increase energy and water efficiency, although retrofitting may be more costly when compared to a more proactive approach to the design and development phase of buildings, existing buildings still need to be addressed to reduce their energy demand and greenhouse gas emissions. Many energy-efficiency investments in new buildings have a pay-back period of as little as 3-5 years.¹⁰

Cities can be up to 4 to 7 degrees Celsius hotter than their suburban or rural surroundings on hot summer days. This is referred to as "the heat island effect" and occurs because urban development replaces trees and natural surfaces with large amounts of paved and dark asphalt coloured surfaces like roofs, walls, roads, and parking lots that absorb, rather than reflect, the sun's heat. The vertical surfaces of larger buildings, with concrete walls and glass absorb great amounts of incoming radiation and store heat. Tall buildings within many urban areas also provide multiple surfaces for the reflection and absorption of sunlight, increasing the heat levels in urban streets and neighbourhoods (called the "canyon effect").

The absorption of heat by urban developments and buildings causes air temperatures to rise. Hotter air in cities increases both the frequency and intensity of ground-level ozone, smog and intensifies heat waves in cities, making citizens at increased risk for heat exhaustion and heat stroke (ICLEI, 2005). Waste heat from cars, factories and air conditioning used to cool buildings can add more heat through the use of energy so the elevated temperatures build up over an entire city (**Figure 2**).

Figure 2: The Urban Heat Island



¹⁰ Natural Resources Canada, Office of Energy Efficiency <http://oe.nrcan.gc.ca/>

Heat Island Reduction strategies (i.e. shade trees, reflective or white roofs, greenroofs, less reflective pavements and urban reforestation) can reduce cooling energy use in buildings, lower the ambient air temperature and improve local air quality. For example, green rooftops can reduce the impacts of the heat island effect in cities: a study conducted at Ryerson University in 2005 demonstrated that using green roof technology for 8% of Toronto buildings reduced the city's heat island effect by up to two degrees Celsius. White roofs are an affordable interim measure, but green roofs would provide long term benefits such as reducing air pollutants through absorption by plants, provide further shade and insulation to lower energy costs, and reduce urban water runoff. The Ryerson study found that green roofs could slow runoff of rainfall at peak times, reducing the risk of sewer overflows¹¹.

Climate change may lead to potential increases in the amounts of precipitation as well as the frequency of extreme weather events, including storms. Thus it is also likely that there will be an increased rate of weathering on the built environment. Damage to buildings from weather can be caused by: storm damage; rain penetration; poor durability of construction materials; flood damage; coastal erosion and foundation movement. To respond to these anticipated changes, new buildings should compensate for changing weather in their design, materials and construction processes.

Building service retrofits such as solar panel and roof garden installations increase energy efficiency, improve thermal comfort, and saves peak demand electricity which generates savings on heating and electricity bills. They also contribute to reduced stormwater runoff and improved air and water quality. Strategically placed trees, shading windows and walls of a building, reduce the amount of direct heat gain. Trees act as filters, trapping dust particles and absorbing gaseous pollutants.

A number of green building standards¹² have emerged that address the energy use and greenhouse gas emissions from the development, construction and use of buildings. The Leadership in Energy & Environmental Design (LEEDS) is one of these standards.

A. f. i) LEED – Leadership in Energy & Environmental Design

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ is a voluntary standard created by the US Green Buildings Council. It is a US and Canadian accepted benchmark for the design, construction, and operation of high performance buildings. LEED gives building owners and operators the incentive they need to have an immediate and measurable impact on their buildings' performance. In Canada, the Canadian Green Building Council introduced Canadian standards for LEEDs.

The LEED system is a rating system that provides points for building features that fall into six categories: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Air Quality, and Innovation and Design Process.

LEED has certain prerequisites that must be met for certification, along with numerous optional credits for each category, which earn the building additional points. The number of points a building earns determines its LEED rating: LEED Certification, LEED Silver, LEED Gold, and LEED Platinum.

¹¹ Geoff Wilson. *Urban Design Forum*, 76

¹² LEED (Leadership in Energy and Environment Design), Green Globes, R – 2000, Energy Star, and EnerGuide for Houses are some of the standards in Ontario.

The Corporation's first LEED building is the Hamilton Water & Wastewater Division's Woodward Environmental Laboratory and Operations Control Centre.

In, 2006 East Gwillimbury adopted a Municipal policy directing all new Town facilities and new industrial, commercial, institutional and high-rise residential buildings within the municipality to be built to LEED "Silver". This same policy also requires all major renovation projects for industrial, commercial, institutional and high rise residential buildings to meet LEED "Silver" after January, 2010.

Under the Corporate Energy Policy (PW Report 07-014), the Corporation will be undertaking a LEED Pilot program over a 3 year period.

A. f. ii) Green Development Standards

The City of Toronto adopted the level of LEED Silver as an interim standard for its new buildings. However, Toronto has examined the creation of locally driven, green development standards. In 2006, the City of Toronto adopted green development standards through the enhanced targets for site and building design that address matters of sustainability. The City of Toronto proposed an integrated set of principles and practices to guide the development of City-owned facilities and to encourage green development amongst the private sector.

Toronto sees the development of more sustainable buildings and sites could use less electricity and water, more use of modes of transportation that do not burn fossil fuels, improve management of stormwater for better water quality, less waste production, and create green spaces that are aesthetic and provide habitat for local fauna. Green development standards identify the criteria for development that fulfill these objectives.

Massachusetts will soon require private developers to estimate the greenhouse gases that large-scale projects will produce and reduce them with measures such as energy-efficient lighting, alternative fuels, or commuter shuttles. Planning projects (public, large private and environmentally sensitive) that warrant a state environmental review will have to assess how the projects contribute to global warming. Large housing developments, office projects, and mixed-use developments that combine retail, industrial, and residential uses will be affected. This makes Massachusetts one of the first states to consider greenhouse gases as part of developers' environmental impact reviews (Boston Globe, 2007).

Action:

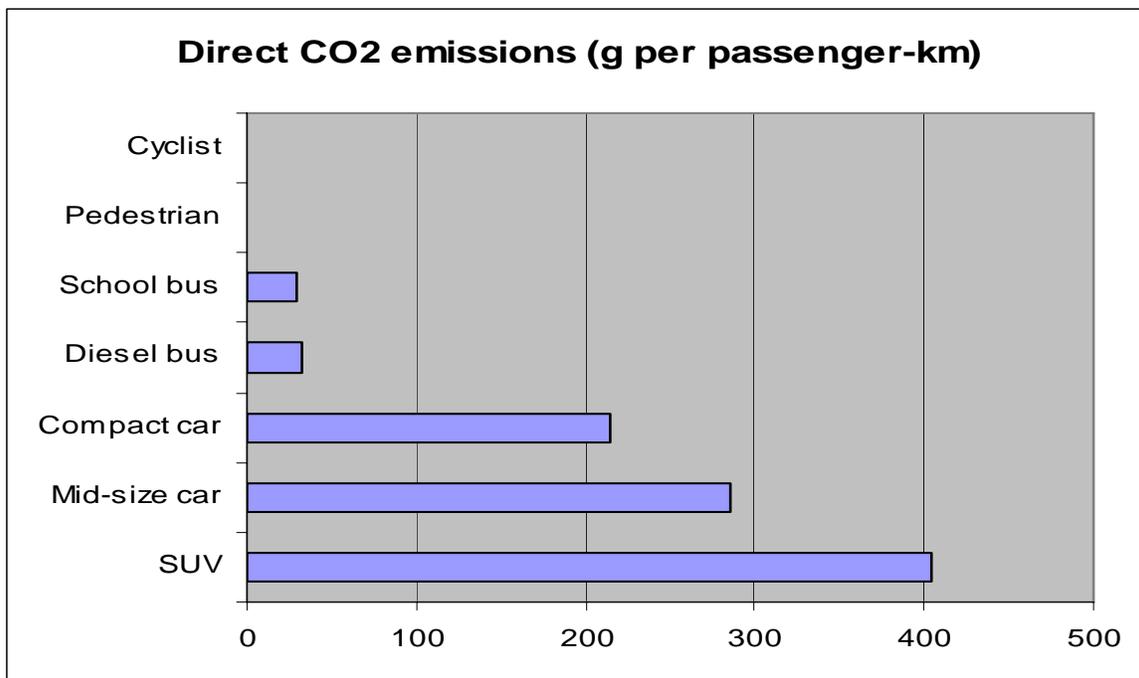
- **Encourage energy retrofits, especially in low income neighbourhoods and housing.**
- **Show leadership for green retrofits through the incorporation of energy efficiency, waste management, water efficiency and low greenhouse gas emissions in the retrofitting of Hamilton City Hall.**
- **Study the feasibility of green and white roofs in the downtown of Hamilton (combat urban heat island).**
- **Explore green development standards (LEED, Energy STAR) for public and private developments and have City staff become LEED Accredited professionals.**
- **Research climate adaptation strategies for buildings and city infrastructure.**

A. g) Transportation and Transportation Planning - Mitigation

Transportation (i.e. automobiles, trucks, buses, commercial vehicles) is the largest source of greenhouse gas emissions in Canada, and is the leading source of NO_x emissions within the City of Hamilton. Transportation emissions have a major impact on local air quality and creating greenhouse gases associated with climate change. A more inclusive approach to thinking about emissions from the transportation sector would include support activities such as oil refining, industries used in the manufacturing of vehicles and the production of steel and concrete required in the construction of roads and bridges. Including these indirect emissions to transportation's direct tail pipe emissions plus the vehicle's air condition units (which may leak HFC's) increases the amount of energy-related greenhouse gas emissions for transportation to about 50%.

This is why providing and linking transportation corridors that encourage citizens to use alternative and multiple modes of transportation outside of the personal automobile supports liveable sustainable communities.

Figure 3: Greenhouse Gas emissions by Vehicle type



Over the past two decades, the City of Hamilton has seen a significant increase in the use of automobiles with corresponding decreases in the percentage share of transit usage. Between 1986 and 2001, local transit went from a 12% morning peak period trips down to 6%. Increases in the use of automobiles now accounts for 85% of daily trips. Encouraging numbers show that over 10% of citizens walk or cycle in the morning peak period (Transportation Master Plan, 2007).

Figure 4: Trends in Mode Shares of Trips in Hamilton

AM Peak Period						
Year	Auto Driver	Auto Passenger	Local Transit	GO Rail	Walk and Cycle	Other
1986	63%	11%	12%	0%	11%	4%
1996	63%	13%	7%	1%	12%	5%
2001	64%	12%	6%	1%	11%	6%
24 hours						
Year	Auto Driver	Auto Passenger	Local Transit	GO Rail	Walk and Cycle	Other
1986	63%	18%	10%	0%	7%	2%
1996	66%	18%	6%	0%	7%	3%
2001	68%	17%	5%	1%	6%	3%

Source: Transportation Tomorrow Survey, 2001, 1996 and 1986 Travel Survey Summaries for the Greater Toronto Area, prepared by the Data Management Group, University of Toronto Joint Program in Transportation, February 2003.

A common situation among mid-sized cities like Hamilton that are not challenged by road congestion or constrained parking is that little progress is made towards promoting viable alternative modes of transportation (transit, pedestrian, cycling). Encouraging compact mixed land-use, presents an opportunity for cities to promote transportation demand management, increase transit, and alternative active transportation (walking and biking) means to reduce future congestion problems and reduce climate change impacts while controlling air pollutants.

In 2007, the City completed the Transportation Master Plan which includes operational policies for Hamilton's transportation network over the next 30 years in line with the preferred growth management option of GRIDS.

Figure 5: Transportation targets under the Transportation Master Plan

	Current Situation (based on 2001 data)	Potential Near Term Scenario (based on a goal of reducing auto vehicle-kilometres by 10% compared to 2001)	Potential Long Term Scenario (based on a goal of reducing auto vehicle-kilometres by 20% compared to 2001)
Estimated daily vehicle kilometres of travel by Hamilton residents	4.8 million km	4.3 million km	3.8 million km
Share of daily trips made by single-occupant drivers	68%	58%	52%
Share of daily trips made by using municipal transit	5%	9%	12%
Share of daily trips made by walking or cycling	6%	10%	15%
Annual transit rides per capita (City-wide) ⁽¹⁾	40	60	80-100

⁽¹⁾ Based on total residents within City boundaries, including residents outside primary service areas. Excludes GO Transit ridership.

The objectives of the Transportation Master Plan included offering a choice of travel modes, emphasizing walking and cycling, public transit and carpooling, encourage a more compact urban form, intensification and transit-supportive node and corridor development, minimizing

impacts on air, water, land and natural resources, enhance the liveability of neighbourhoods and rural areas, and operate transit and road systems efficiently, and be affordable to the City.

The preferred strategy in Hamilton is increased public transit with emphasis on options for cycling and walking, the reduction of single occupant vehicles through travel demand management, and optimizing current road capacity before major road expansion.

Key elements of the plan include:

- Establishment of a Rapid Transit system with three primary spines and interconnecting routes.
- Construction of 120 km of new on-street bike lanes and over 140km of multi-use paths.
- Supporting integrated travel through bike racks on buses, construction of new bicycle facilities, and encouraging “walkable” streetscapes.
- Potential incline railway near Wentworth Street to reduce the effect of the escarpment for cyclists and pedestrians.
- Encouraging alternative modes of transportation through Transportation Demand Management.

In June 2007, the Province of Ontario announced their MoveOntario 2020 plan which is aimed at improving public transit in the Greater Toronto and Hamilton Area (GTHA) through the funding of 52 projects, including two projects in Hamilton:

- Rapid transit along the King/Main Corridor, between Eastgate Square and McMaster University; and
- Rapid transit along the James/Upper James Corridor between King Street and Rymal Road.

Following the announcement, Metrolinx was charged with implementing a number of “Quick Win” projects that would have an immediate impact on providing sustainable transportation options within the municipalities of the GTHA, including three specific transit projects in Hamilton as well as a general GTHA bicycle promotion initiatives project. These projects include:

- 6 articulated hybrid buses for the James/Upper James corridor. This project will increase service levels on the Downtown-GO terminal - Mohawk College - Airport route by 2009, as a precursor to future rapid transit improvements on Upper James Street.
- 12 new hybrid articulated buses, and for customer waiting areas for the BLine between McMaster University and Eastgate Square. This project will result in more frequent service, more capacity, and more comfort provided by a dedicated fleet of high-tech, hybrid articulated buses.
- A GO/VIA platform at James Street North. Works would include a new platform, passenger amenities and park-and-ride lot. This would offer Hamiltonians more choice in travel modes and more convenient access to GO and VIA inter-regional train networks, and would enable two-way rail commuting potential.
- Metrolinx also approved the establishment of a GTHA-wide program for the implementation of Bicycle Promotion Initiatives for the provision of safe and secure bike storage and the expansion of the bike/bus rack program called BikeLinX. The goal of BikeLinX is to enhance the links between active transportation and public transit. In

March 2008, the City of Hamilton was presented with funds to be used to purchase and install bicycle racks on buses and provide secure and safe bicycle parking.

A. g. i) Personal Transportation Options - Biking

The Transportation Master Plan recognizes the importance of non-motorized forms of transportation (cycling and walking) as viable alternatives to personal vehicles. The existing bicycle lanes are fragmented and that the basic network needs construction of 120 km of new on-street bike lanes. Networking should be enhanced with supportive infrastructure such as secure bike parking, linking cycling with transit through use of bike racks on buses, and zoning and site plan provisions to ensure land uses encourage transit, bicycling and pedestrian linkages.

Shifting Gears- A New Cycling Plan for Hamilton- Wentworth was adopted by Regional Council in 1999. It provided guidance to installing new or updating existing cycling facilities. The Plan focused mainly on the urban centres within the City with less emphasis on outlying regions. An Alternative Transportation Coordinator position has been created to assist the cycling, pedestrian, and “walkability” programs of the City, and to update Shifting Gears¹³.

A. g. ii) Transportation Demand Management - Mitigation

Transportation Demand Management (TDM) aims to optimise the capacity of current transportation systems. It encourages individuals to:

- Choose more sustainable forms of transportation and reduce single occupant vehicle trips
- Using alternative travel modes (e.g., walking, cycling, taking public transit or carpooling) that consume fewer resources and create fewer undesirable impacts.
- Travel outside peak hours to avoid congestion.
- Choosing closer destinations or combine several stops into one trip.
- Use telework or other communication options where practical.

TDM can help reduce congestion, defer the need for new infrastructure, and improve air quality. The City of Hamilton has been active in the Smart Commute Association which implemented a number of TDM measures. The Smart Commute Association is a partnership between municipal governments and interested business and other organizations that support these initiatives for implementing TDM measures.

The Smart Commute Association (SCA) has been responsible for creating a Transportation Management Association (TMA) Toolkit which can help municipalities develop and maintain sustainable transportation initiatives through Transportation Demand Management. The Carpool Zone Website (www.carpoolzone.ca). The website offers a Map-based trip editor, Match ratings and new match indicator, Multi-trip match mapping, Route-based matching, and carpool names. The website has recruited 16 new employers throughout the GTA and Hamilton, with over 3500 users forming 230 carpools. The Carpool Zone Website alone has resulted in 78 tonnes of verified greenhouse gas emission reductions, and over 300 tonnes of estimated emission reductions.

Since January 1, 2008, The Smart Commute program, known for its online carpooling website and other Transportation Demand Management commuter services, has been recruited by

¹³ City of Hamilton Public Works Department, *On-Street Cycling Program* (PW07078), May 2007.

Metrolinx of the provincial government. The Smart Commute Association will compliment the Metrolinx by continuing to work with local employers to improve commuter options like carpooling and transit as well many more Transportation Demand Management Initiatives. Metrolinx and Greater Toronto and Hamilton Area (GTHA) municipalities will work together to make the region's transportation system greener and more sustainable.

Since 2000, the City has participated in the Commuter Challenge. The Commuter Challenge is a week-long, friendly competition between Canadian cities to reduce emissions by encouraging citizens to use sustainable modes of transportation. The goal of the program is to reduce the number of single occupancy vehicles (SOVs) traveling on roads. **Figures 6&7** below show the reduction in distance traveled by single occupancy vehicles and corresponding reductions in greenhouse gases over the week long event.

Figure 6: Reduction in travel distance by single occupancy vehicles

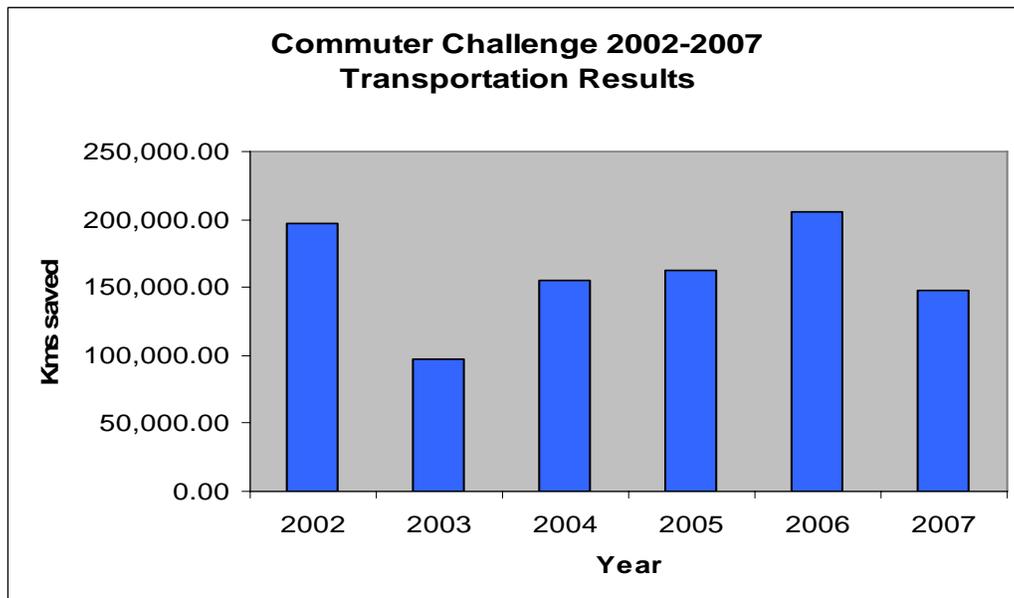
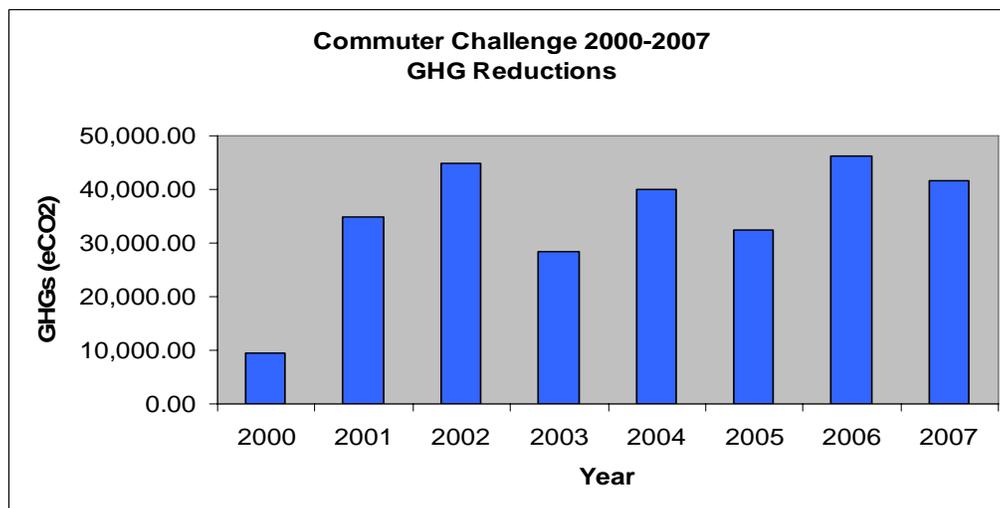


Figure 7: Reduction in Greenhouse Gas Emissions due to the Commuter Challenge



The Public Health Department has supported of the Active & Safe Routes to School program. A national program that promotes the use of efficient transportation for daily trips to school,

addressing health and traffic safety issues while taking action on air pollution and climate change.

The Corporation offers eligible employees a discounted bus pass. The Employee Commuter Pass program is available to full time employees who do not have an employer paid parking and operates through a flexible payroll deduction. The program is consistent with the objectives of the Downtown Transportation Plan and encourages the use of transit. In addition, an employee car pool sharing website is available to City employees via the Enet which encourages employees to ride share.

Action:

- **Demonstrate commitment to Transportation Demand Management through leadership by expanding the number of employees using alternative travel services (car pooling, car sharing, secure bike parking, and change facilities at office, use of transit, flexible work time, and teleworking).**
- **Maintain a Transportation Demand Management position to promote alternative modes of transportation (pedestrian, cycling, transit) to City residents.**
- **Continue supporting the annual Commuter Challenge and other programs to promote alternative modes of transportation.**

A. g. iii) Greening the Corporate Fleet - Mitigation

Hamilton's Green Fleet Implementation Plan was approved in 2005 to reinforce its commitment to improving air quality and preventing climate change. The objective is to have one of the country's leading low-emission fleets.

In 2007, the City of Hamilton received a silver rating for fleet excellence under the E3 Fleet Program. The E3 "Environment, Energy and Excellence" Fleet Program is a Canadian wide program that assists fleets in meeting green standards. Fleets are rated and audited by a third party in the areas of fleet action plan, training and awareness, idling reduction, vehicle purchasing, fuel management, operations and maintenance, trip and route planning, fuel efficiency and greenhouse gas performance. Ratings range from Bronze, Silver, Gold and Platinum.

The Corporation's Central Fleet consists of approximately 825 licensed vehicles and almost 400 units of specialized equipment. Vehicles operated by the Transit Division, Hamilton Police Services, and Emergency Services have separate management. As part of the Green Fleet Implementation Plan, Hamilton has replaced 60 older sedans and pickups with hybrid electric vehicles (HEVs) and introduced renewable fuels, for the City's diesel fleet in 2007. This is projected to reduce carbon dioxide output by 2,300 to 3,300 tonnes over three years and reduce air pollutants by over 50 per cent. In fact, from 2005 to 2006 Hamilton increased fuel efficiency by 5% for every kilometre travelled and decreased GHG emissions by 2% by kilometre (Fraser Basin Council, 2007).

Reduced fuel consumption

- Hybrids overall average 25 per cent lower fuel consumption
- Hybrid cars and utility vehicles are 50 per cent more fuel efficient
- Hybrid pickup trucks are about 10 per cent more fuel efficient

Table 2: Summary of Green Fleet Implementation Plan eCO₂ Projected Reductions 2006 – 2008

HEVs	395,600 kg
Biodiesel (Soy)	1,942,500 kg
Biodiesel (Animal Fat)	2,971,500 kg
Total (depending on the feedstock of biodiesel)	2,338,100 – 3,367,100 kg

Note – eCO₂ reductions from biodiesel are based on a life-cycle analysis and not tailpipe emissions.

Fugitive dusts, including road dusts, are a significant local source of particulate in Hamilton’s airshed. Road dusts can also contain elevated levels of toxic substances such as chromium, manganese and polycyclic aromatic hydrocarbons (PAHs).

Regular street sweeping of roadways and streets can reduce the impacts of dust along and near roadways. The effectiveness of the sweeping equipment, the technology used in the sweeper and the frequency of sweeping have a direct influence on the dust collected. The more efficient the collection of material, particularly the finer fractions, the less will be available for dispersion into the air due to traffic.

To deal more effectively with fine particulate pollution, Hamilton has replaced all 17 street sweepers with new regenerative-air sweepers. This is based on a major change in sweeper design in North America as the City sweepers obtained the highest performance in removing particulate matter.

Action:

- **Continue to green the corporate fleet through the investigation and incorporation of hybrid and new vehicle technologies, right sizing and alternative fuels.**
- **Demonstrate new and proven transportation technologies in fleets that lower GHG emissions and improve local air quality.**
- **Examine site plan approval standards for heavy industrial uses to reduce the formation and track-out of road dust from unpaved sites.**

A. g. iv) Transit - Mitigation

Public transit includes services to the general public in multi-occupant vehicles ranging from shared taxis and vans to buses. Public transit solves a number of transportation management issues including: road and parking costs, congestion, energy consumption and pollution emissions, mobility for non-drivers, and costs to consumers.

- One full bus takes 40 vehicles off the road. Over the course of a year, that full bus will prevent 9 tonnes of pollutants from getting into the atmosphere.
- Using public transit for one year instead of your car will save nearly a tonne of pollutants from being released into the atmosphere.

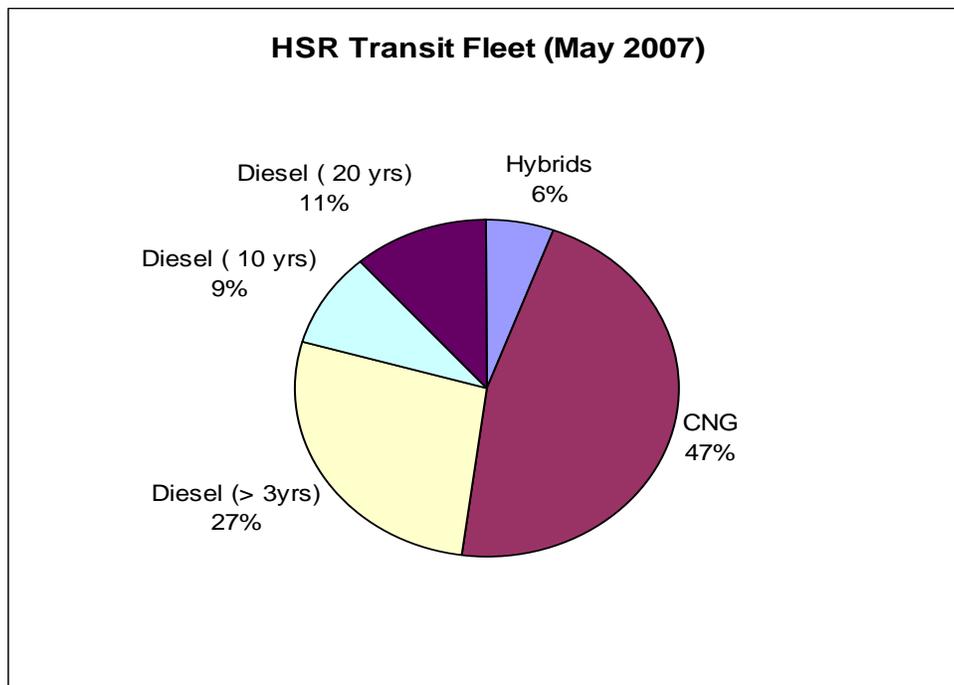
Transit becomes more important as cities grow. In smaller cities, transit primarily serves disadvantaged riders (people cannot use an automobile), representing 5-10% of the population. As cities grow in size and density transit serves more riders (people who have the option of driving), and provides more benefits by reducing traffic and supporting efficient land use (Victoria Transit Policy Institute, 2006).

The Hamilton Street Railway Company (HSR) provides transit service in Hamilton’s urban area. Transit services outside of downtown Hamilton are currently limited. HSR provides about 1.55 annual vehicle hours per capita, generating about 47 annual rides per capita. The HSR has approximately 200 buses in their fleet and, in addition operates para-transit services (DARTS) for seniors and disabled persons using vans and contracted taxi service where appropriate.

The Transportation Master Plan (2007) commits to the establishment of a Bus Rapid Transit (BRT) Network. The BRT will be supported by land use policies that encourage more compact and mixed-use development around transit nodes and corridors. A BRT system can be phased in over time using existing east-west and north-south corridors, with a longer term vision of dedicated bus lanes, extended hours of operation, low to zero emission fleets and enhanced passenger information systems.

The MoveOntario 2020 announcement permits Hamilton to accelerate rapid transit planning beyond the considerations in the Transportation Master Plan, and to consider the use of Light Rail Transit in the short term, instead of starting with Bus Rapid Transit and moving to Light Rail Transit in the longer term. Public consultation is being held with regards to the Rapid Transit feasibility Study to receive comments on the options for Bus Rapid Transit and/or Light Rail Transit.

HSR has implemented a number of initiatives to “green” public transit operations. HSR was one of the first transit authorities to introduce natural gas buses into their fleet. It has also purchased 12 new diesel-electric hybrid buses which contribute to improving Hamilton’s air quality and reducing greenhouse gases. HSR will also explore the use of biodiesel in buses in the future.



Hybrid diesel-electric buses consume less fuel than the conventional diesel bus. In urban applications, fuel savings can vary between 25 and 40%. For example, New York City Transit found a hybrid diesel-electric bus traveled 3.27 miles per gallon, compared to 2.31 miles per

gallon experienced by the conventional diesel buses (a savings of 41%) (Canadian Urban Transit Association, 2007).

According to the Canadian Urban Transit Association, emissions savings by Hybrid diesel-electric buses include:

- 50% reduction in nitrogen oxide
- 90% reduction in particulate matter
- 90% reduction in carbon monoxide
- 90% reduction in hydrocarbons, and
- Carbon dioxide is reduced in direct proportion to the amount of fuel used

Natural gas is a clean burning alternative to traditional diesel in buses. Exhaust from natural gas powered vehicles (NGV) and compact natural gas (CNGs) are lower - per unit of energy, natural gas contains less carbon than other fossil fuels, and thus produces lower CO₂ emissions per kilometre. Methane emissions (compact natural gas is approximately 90% methane) is also a significant factor for CNG in that methane remains in the atmosphere for 9-15 years and traps over 20 times more heat than an equivalent amount of carbon dioxide. In Ontario, transit agencies have not renewed their CNG programs mainly due to poor performance and high costs. Most are opting for low diesel emission buses.

HSR is also connecting transportation modes and trip planning for users through the on-line HSR trip planning website, the use of shared-ride taxi services in portions of Glanbrook and Stoney Creek, and bicycle racks on the buses to encourage cycling and transit within the City.

Provincial program announcements such as the MoveOntario2020 promise, a multi-year \$17.5 billion rapid transit action plan for the Greater Toronto Area and Hamilton, and a new transit fare card system will support and increase transit ridership.

Action:

- **Increase the use of public transit as a viable transportation mode within the City by increasing transit services in the future and setting a goal of increasing transit funding each year.**
- **Continue greening the transit fleet through the purchasing of low to zero emission vehicles to replace older vehicles coming out of service.**

A. g. v) Idling Control - Mitigation

Unnecessary idling results in Canadians wasting over 3.2 million litres of fuel a day. This costs about \$1.9 million and produces over 7.6 million kilograms of greenhouse gases, based on 10 minutes of idling per day. A freight-hauling truck averages 6 hours of idling a day for 43 weeks of the year. This means that a single truck emits about 21, 000 pounds of carbon dioxide, 390 pounds of carbon monoxide and 225 pounds of nitrogen oxides per year.

Natural Resources Canada, 2006

As part of the Green Fleet Implementation Plan, the Corporation established a policy on the idling of corporate vehicles that limits idling to no more than 3 minutes consecutively.

In 2006, Green Venture launched the Idling Stinks Hamilton campaign to promote awareness on vehicle idling in the community, at schools and in private fleets. Since the education campaign began, approximately 90 Idling Posters have been distributed to libraries, community centres, community policing centres, City of Hamilton municipal service centres, and Hamilton's Emergency Medical Services (EMS) stations, 204 idling signs are up at schools, Day cares, City Hall, driving centers, retirement and nursing homes and small auto businesses, and 500 idling stickers on 500 City of Hamilton Fleet vehicles.

In 2007, the City passed an Idling Control By-law and will continue to work with partners to educate citizens to stop idling their vehicles, protect public health, improve local air quality and reduce greenhouse gas emissions.

Action:

- **Continue to educate individuals on idling and associated impacts on health, air quality, climate change and vehicle operation costs.**

A. h) Energy Conservation & Demand Management - Mitigation

Energy production and use of non-renewable fuels – oil, natural gas, coal, is the largest significant source of greenhouse gas, smog forming pollutants, and acid rain. Gasoline and diesel burnt in cars and trucks; natural gas and other fuels used to heat and cool buildings; oil and gas that industry burns to drive production; boiler plants; and electricity generation all produce significant air pollutants and greenhouse gas emissions.

Emissions can be reduced simply from the promotion of energy conservation and demand management initiatives.

Conservation behaviour – Conservation occurs when customers change their behaviour to reduce the amount of energy consumed over time using technology already in place (e.g., by manually raising the temperature of their air conditioner by a few degrees).

Energy efficiency – Energy efficiency occurs when customers reduce their energy consumption but retain at least the same level of end-use service. Energy efficiency is the gain from investing in better appliances, equipment and buildings (e.g., replacing household electric appliances such as a refrigerator or air conditioner with higher efficiency models).

Demand management - Demand management occurs when customers reduce their electricity demand during peak-use hours (peak clipping) or shift some of their demand to off-peak hours (load shifting). Demand management can occur in a number of ways. For example, when residential customers shift the use of their dishwasher and laundry appliances to off-peak hours, when certain industrial customers contractually agree to shut down an assembly line in response to an automatic signal, and when customers allow the temperature on their thermostat to be increased in the summer by a previously installed device are all examples of demand management.

Ontario Power Authority, 2007

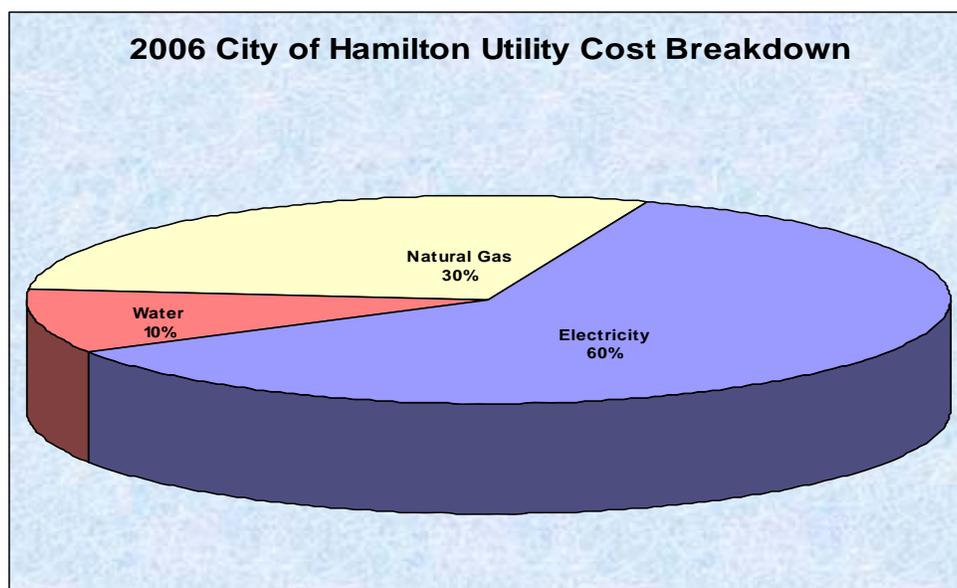
Increasing the use of alternative energy (i.e. wind, hydro, solar) in the supply mix will lower the demand for non-renewable sources and improve air quality and reduce greenhouse gases. A number of cities such as Toronto, Hamilton, Chicago, Seattle, Calgary, Ottawa, and Vancouver have implemented renewable energy sources or are exploring options. The Province has begun to provide incentives to promote alternative energy sources.

City buildings and the corporate fleet are the largest users of corporate energy. Other sources include office equipment (computer and photocopiers/faxes usage), street lighting, and operational equipment used in maintenance of green spaces and infrastructure (water & wastewater, lighting of roads).

The Corporation has already begun to address the corporate fleet energy usage through Hamilton's Green Fleet Implementation Plan.

To reduce the amount of energy that City buildings require (cooling, heating, and lighting), the Corporation has had an energy management program since 2006. The focus is on providing energy efficient upgrades to facilities while reducing operating costs, improving indoor air quality, addressing building code compliance, reducing energy consumption and reducing environmental emissions.

An energy management feasibility study of 20 City facilities (Arenas, Recreation Centres, Libraries, Fire stations, Public Works Operation Centers Social Housing, and Municipal centres) was undertaken and improvements were put into place by an energy retrofiting project.¹⁴ This reduces carbon dioxide emissions by approx. 1,000 tonnes per year, which is the equivalent to removing 157 mid sized cars from the road.



In 2006, the Corporation created an Office of Energy Initiatives (OEI) to formalize and centralize responsibility for energy management in the City by focusing on how and where the

¹⁴ City of Hamilton (2006) *Energy Retrofit Pilot Program: Implementation Phase (PW06078/FCS06067)*. Public Works, Infrastructure & Environment Committee- June 2006.

City of Hamilton is spending money on energy and to look for ways to save and reduce energy consumption. The role of the Office includes:

- Develop and implement billing verification strategies;
- Develop purchasing strategies and practices for commodities (natural gas, electricity and eventually fuel (diesel, unleaded, and biodiesel));
- Develop and project manage energy retrofit projects; and
- Raise awareness in the Corporation with respect to energy use.

The City of Hamilton has already seen nearly \$5 million in energy cost savings and avoided costs since implementing the Office of Energy Initiatives.

The City of Hamilton held an Energy Conservation Day in October 2006, to promote energy awareness. The Office of Energy Initiatives in the Public Works Department handed out approx. 2200 energy savings kits to residences and city employees. The kits, supplied by Union Gas and Horizon Utilities, included two low-flow shower heads, bathroom and kitchen aerators, an LED nightlight, two 13-Watt CFL Bulbs and conservation tips handbooks.

The City of Hamilton through the Voluntary Blackout Day in August 2007 reduced energy consumption by 2.2 per cent (104,737 kWh) and peak demand by 3.2 percent between the hours of 12:00 p.m. and 8:00 p.m. That is the equivalent of 6,000 homes turning off their air conditioners for 8 hours and taking 4,000 homes off the grid.

In March 2008, the City participated in its first Earth Hour, an initiative to raise awareness of climate change by switching lights off for an hour.

Corporate Energy Reduction Targets

Reduce energy intensity by 3% by 2009, 7.5% by 2012 and 20% by 2020, using 2005 as the base year.

Corporate Energy Policy (2007)

In 2007, the City approved the Corporate Energy Policy for City facilities and operations. Under the policy, the Corporation is addressing a number of initiatives to address energy conservation, efficiency and energy demand management in City buildings including:

- Establishing minimum or maximum temperature settings during business hours for the heating and cooling season for all City owned office space. That during the cooling season office space temperature shall not be set below 24 degrees Celsius (or 76°F). That during heating season that office space temperature shall not be set above 21 degrees Celsius (or 70°F).
- During summer smog days or emergency supply days, that cooling season temperatures be increased by up to 2 degrees Celsius to help reduce electricity requirements, air pollutants, and relieving electricity system supply constraints.
- Phase in lighting control upgrades to ensure that City facilities have the capability of turning off lighting in City owned facilities after hours when the buildings are unoccupied
- The replacement and elimination of incandescent lighting by 2010.
- City Purchasing Policies be adapted to designate supply of energy efficient equipment as the preferred option such as Energy Star rated appliances, photo copiers and computers. That all motor replacements be with high efficiency motors, which the minimum standards will be recommended by the Office of Energy Initiatives.

- All new back-up generation equipment be reviewed for conversion to cleaner fuels such as natural gas or dual fuel generation units verse diesel powered units.

The Corporation has a Computer Equipment Shutdown Policy for the daily shutting down of computers and related devices such as printers. The guidelines promote best practices to reduce energy consumption, reduce equipment wear and, time loss on corporate computer systems.

The City approved the conversion of traffic lights from incandescent bulbs to light-emitting diodes (LEDS). Intersections equipped with LED signals use approximately 30% of the energy used by intersections with traditional incandescent traffic signals. In Hamilton's case, the savings in electrical energy would amount to about \$350,000 per year in 2006. The energy savings equate to the amount used by about 500 average homes. In total, over 13,000 individual signal sections at 441 intersections have been retrofitted or replaced. The City received an \$85,000 rebate cheque from Horizon Utilities in 2008 for this program as part of Horizon Utilities' Energy Conservation Fund grant program.

The Corporation has begun to generate energy and reduce emissions through the use of wasted methane gas emissions. A 1.6 MW Cogeneration Facility, located at the Woodward Avenue Wastewater Treatment Plant, takes methane gas created from the wastewater treatment process to produce electricity and heat. The Cogeneration Facility converts 32 per cent of the available energy in the digester gas to electrical energy (electricity) and 48 per cent to thermal energy (heat). The power and heat will be used to operate the Woodward Wastewater Treatment Plant. It is anticipated that the facility will produce 13.6 million kilowatt hours of electricity per year. This is equivalent to the electrical needs of approximately 1,600 households.

This venture is forecasted to provide the City of Hamilton with a net benefit of up to \$1 million through the energy sales to the province while the heat that is harvested from the engine heats wastewater facilities and saves in natural gas costs.

The City is also undertaking a pilot project of vertical small wind turbines with Cleanfield Energy Corporation to examine the feasibility of these units in Hamilton.

In addition to the air and greenhouse gas impacts of fossil fuel use, is the risk of reduced energy sources and availability in the future. The risk of Peak Oil – where future world oil production reaches a peak and then rapidly declines resulting in higher energy costs – is also a driver towards cities seeking alternative means of generating and producing energy to create “energy security”. The City began to explore the future impacts of energy availability in Hamilton and should consider continued research and action to incorporate peak oil scenarios into energy management.

Action:

- **Continue to pursue energy conservation and demand management within all City operations (as outlined in the Corporate Energy Policy).**

- **Consider the energy usage and associated air and greenhouse gas emissions in City equipment operations and purchase.**
- **Examine the use of renewable technologies in supplying energy to new and existing City Facilities (as outlined in the Corporate Energy Policy).**

A. i) Waste Management & Reduction - Mitigation

Landfilling is the most common waste disposal method and produces the most greenhouse gas emissions when there is no landfill gas capture system in place. Anaerobic decomposition of waste in landfills produces methane, a greenhouse gas 21 times more potent than carbon dioxide.¹⁵ Incineration of waste results in emissions of both carbon dioxide and nitrous oxide, however, combusted waste can displace the burning of fossil fuels by producing electricity or heat for nearby buildings or industry. The transportation of waste to disposal sites produces greenhouse gases from the fuel used in the equipment.

Hamilton's Solid Waste Management Master Plan (SWMMP), was approved by City Council in December 2001. The waste reduction target is established for 65% diversion from landfill by 2010, based on 2000 waste generation rates. Amongst the recommendations of the Plan are a three-stream waste collection system (recyclables, organics and residuals), and centralized waste composting facility and community recycling and reuse centres.

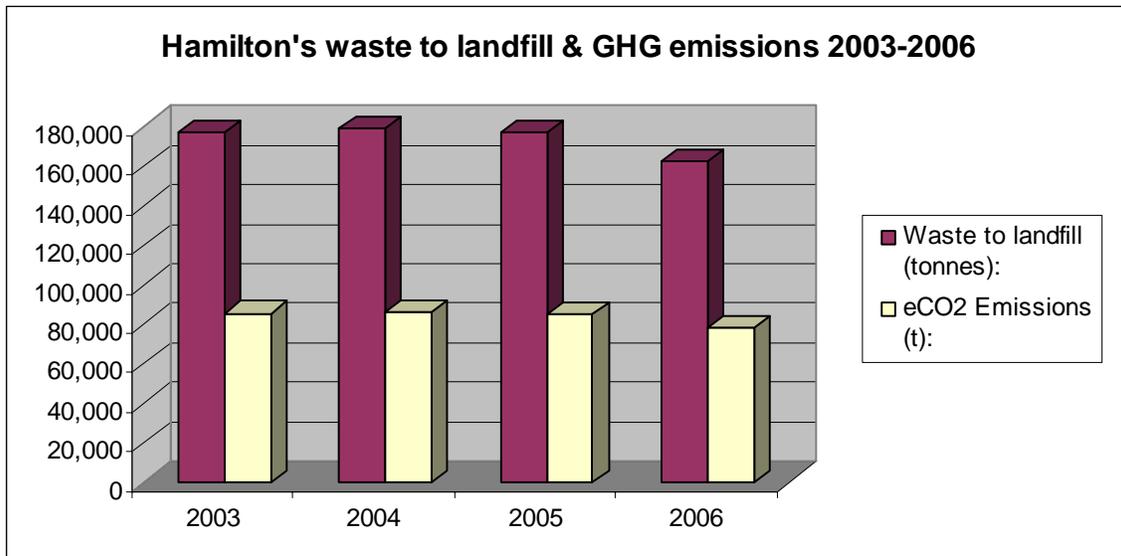
Recycling can have a large impact on reducing greenhouse gases, because it replaces some of the raw materials and energy used in the manufacturing process. Using recycled material not only reduces emissions used to produce these products, but also the energy required for manufacturing. For materials that require intensive processing, such as steel, plastic and aluminium, recycling can reduce emissions by about two tonnes of carbon dioxide equivalent per tonne of product. Paper recycling also increases carbon storage because it leaves more trees growing in the forest.

Composting is an option available for organic materials including food scraps and yard waste. Because it involves aerobic decomposition, composting does not generate methane emissions.

The City has undertaken a number of waste management initiatives in the SWMMP to divert and reduce the amount of waste to landfills, thereby reducing the amount of greenhouse gases. These programs include the organic waste Green Cart program, the Blue Box recycling program, community recycling centres and household special waste. Hamilton has also built a central composting facility, located on former industrial land, to process the organic materials diverted through the green cart program.

Since 2003, the annual waste generated by the City of Hamilton has increased 10% (23,427 tonnes); however, the amount of waste sent to landfill has decreased 8.5% (14,848 tonnes). Improved waste diversion has resulted in a reduction in eCO₂ emissions of 7,153 tonnes per year. eCO₂ reductions are anticipated to increase considerably with the full operation of the green cart program. The figure below indicates the annual waste generated and estimated greenhouse gas emissions per year.

¹⁵ United States Environmental Protection Agency (2006) *Global Warming*



The Waste Management Division is currently constructing a landfill gas collection system at the Glanbrook Landfill, which will capture 80% of the methane produced at the site through collection of gas produced from waste disposed in the landfill over several years. It will be operational in April 2008 and will result in eCO₂ reductions of 96,330 tonnes per year thereafter.

The City is undertaking a review of options to address the remaining solid waste after 65% diversion is achieved. The Niagara-Hamilton WastePlan is a joint initiative of the Regional Municipality of Niagara and City of Hamilton to work together to manage solid waste.

The process recognizes that diversion programs help reduce the amounts of waste going into each community's landfills in the short term, but for the long term, the option of disposal may greatly reduce the amount of waste that is sent to landfill and needs to be considered (e.g. thermal technologies, mechanical and biological processes, etc.).

The WastePlan is being carried out under the Provincial Environmental Assessment Process and is a multi-year study that involves extensive community consultation. Each preferred option undergoes an extensive assessment of impacts to the economy, community and the environment in categories such as air quality and climate change.

Action:

- **Continue the reduction and diversion of waste through recycling, green carts and composting and reduce environmental impacts associated with landfills.**
- **Determine actions to address the 35% of remaining waste, recognizing potential air pollutants, toxins and greenhouse gas emissions in actions.**
- **Consider air quality impacts and greenhouse gas emissions in the operations of city waste facilities and fleets.**

PART III – IMPLEMENTATION & DELIVERY

A Corporate Air Quality and Climate Change Strategic Plan must recognize the complexities of climate change and linkages with issues (poor air, water and land, health, economic) and strive to take action, where appropriate, to address the impacts and sources of climate change and poor air quality through Corporate operations and policies.

In the development of actions under the Corporate Air Quality & Climate Change Strategic Plan, comparable municipal plans from North America, Canada and Ontario were studied to compare Corporate activities to address climate change and air quality to identify “gaps” that need to be addressed and supported by the Corporation (**see Table 3**).

Table 3: Summary of Climate Change actions compared to other Municipalities- Adaptation

	Hamilton	Ontario			Canada		North America	
		London	Toronto	Ottawa	Calgary	Vancouver	Minneapolis	Seattle
Corporate GHG Reduction Targets	10% below 2005 levels by 2012, 20% below 2005 levels by 2020	Track emissions, no target at this time	Reduced by 20% between 1990-2005	20% by 2012	50% by 2012	20% by 2010	12% by 2012, 20% by 2020	Emissions reduced by more than 60% (2006)
Air Quality (Smog Response)	Yes	Anticipated	Yes	Developing	Developing	Yes	Yes	Yes
Adaptation Plan	GRIDS Vulnerability Scan		Conducting vulnerability scans	To be developed				
Heat/Cold Alerts	Yes	Yes	Yes	Yes				Heat alerts
Water Quality & Design	Water & Wastewater Master Plan, Stormwater Master Plan	Monitor programs	Master Plan-Wet Flow Management	Water Efficiency Strategy	Water Efficiency Plan	Yes	Management Plan	Under discussion
Tree Planting & Preservation	Currently – 17%, Goal 30%, Street Tree Planting, Tree By-Law	Community Tree Planting, 2002 Inventory, carbon sequestration project	Currently 20%, Goal 35%	Tree restoration and Environmental Enhancement (TREE) program, Street tree maintenance		Tree trust, Tree By-law	Urban Forest Policy, Tree Conservation By-law, Tree preservation standard for new developments	Plan increase of urban forest by 2/3 over 30 years, All new developments require open space and trees

Table 3: Summary of Climate Change actions compared to other Municipalities- Planning

	Hamilton	Ontario			Canada		North America	
		London	Toronto	Ottawa	Calgary	Vancouver	Minneapolis	Seattle
Land Use Planning – Compact Urban Form	GRIDS	Smart Growth & Placemaking	Focus Development along centres and corridors	Growth Management	Sustainable Suburbs Study		Encourage reduction in auto reliance	City Centre Strategy, zoning changes
Land use Planning – Green Space	Amendments to OP & Zoning By-laws			Greenspace Master Plan	Open Space Plan	Open Space Plan	Open Space Plan	Open Space Plan
Built Environment & Green Design	3 year LEED pilot program	LEED, Energy retrofits	Green Building standards, Green Roofs, Energy retrofits	LEED, Energy retrofits	Sustainable Building Policy (LEED), Environmental Construction Operations (ECO) Plan, Contractor Environmental Responsibilities Package (CERP)	LEED, Energy retrofits	Energy efficiency standards, Green Roofs, Energy retrofits	LEED, Residential Energy Code, Energy retrofits
Transportation Plan	Transportation Master Plan – bike, transit, pedestrian, Shifting Gears	Yes, Bike Plan	Yes, Transit City Plan, Bikeway network	Transportation Master Plan, O-Train, cycling & walking paths, Rack & Roll service, Bike Plan	GOPlan, Transit Orientated Development Guidelines, Pathway & Bikeway Plan	Yes, Intelligent Transport System, Central Valley Greenway	Yes, Reinvigorate transit with Light Rail & bus	Street car, light rail, Bike Station transportation Pedestrian Master Plan
Transportation Demand Management	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3: Summary of Climate Change actions compared to other Municipalities- Operations

	Hamilton	Ontario			Canada		North America	
		London	Toronto	Ottawa	Calgary	Vancouver	Minneapolis	Seattle
Green Fleets	Green Fleet Implementation Plan, hybrid vehicles (including buses), natural gas, biodiesel, vehicle right-sizing. First E3 green rated fleet	Intelligent vehicle tracking & Monitoring, hybrids, ethanol and biodiesel	Green Fleet Plan, hybrid vehicles (including buses), biodiesel, vehicle right sizing	Green Fleet Plan, hybrid buses and biodiesel, ethanol-blended fuel	Green Fleet Plan, hybrid vehicles, hybrid taxis, Ride the Wind bus program, integrating hybrid and biodiesel into fleet, C Trains, vehicle right-sizing, transit hydrogen study	E3 fleet program, hybrid vehicles, hybrid taxis, exploring biodiesel, electric trolleys	Initiating a program, hybrid and ethanol vehicles.	Green Fleet Plan, hybrid vehicles, segways, vehicle right-sizing, exploring biodiesel.
Energy Conservation & Demand Management	Corporate Energy Policy	Corporate Energy Management Plan, Energy Matters Technical & steering Committee, wind study	Energy Conservation goals, exploring generating and purchasing green energy	Employee Energy Efficiency Program, energy audits, exploring geothermal, solar & wind, exploring purchasing green energy	Energy Management Office & Performance Contract, solar, exploring purchasing green energy	Air Quality Management Plan, energy purchasing policy, district energy system, purchasing Green power certificates	Energy reduction goals, solar panels, district heating & cooling	Created Dept. incentives, Green Up program
Lighting – CFLs or LED Conversions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Operations – Traffic Signal Control and/or lighting conversion	Yes	Yes	Yes	Yes	Yes			Yes

Table 3: Summary of Climate Change actions compared to other Municipalities- Operations

	Hamilton	Ontario			Canada		North America	
		London	Toronto	Ottawa	Calgary	Vancouver	Minneapolis	Seattle
Operations – Small engines retrofit	Exploring		50% by 2020	Exploring				Yes
Operations – Street sweeping fleet	Purchased PM compliant street sweepers	Purchased PM compliant street sweepers	Purchased PM compliant street sweepers					
Operations – Idling Control	Idling by-law	Idling by-law	Idling by-law	Idling by-law	Vehicle idling reduction policy	Idling by-law	Idling Ordinance	Employee education campaign
Operations – Procurement		Yes	Yes		Yes	Yes	Yes	Yes
Waste Management & Reduction	Solid Waste Management Plan	Waste Management By-law	Waste Mgmt Plan	Waste Mgmt Plan	Waste Mgmt Plan	Waste Mgmt Plan	Waste Mgmt Plan	Waste Mgmt Plan
Waste Diversion (Recycling, Composting)	65% reduction by 2010, Green cart, curbside recycling, composting,	Curbside recycling,	100% diversion by 2010, Green bin	60% diversion by 2008, curbside recycling, composting, yellow bag program	80% recycle by 2020, curbside recycling in 2009,	Target being decided	Promoting solid waste reduction, recycling credit, curbside collection of electronics	
Energy from Waste/Methane Capture	Gas collection by 2008	Proposing landfill power plant, gas collection	Methane collection by 2009	Yes (Trail Road), gas collection	Yes, Methane Optimization Policy for energy		Yes	Flaring methane

When Hamilton is compared to these seven cities, a number of mutual actions the Corporation have undertaken that address climate change and air quality are apparent. These include;

- A Greening the Corporate Fleet Plan
- The introduction of hybrid vehicles and alternative fuels
- A Corporate Smog Response Plan
- A City Idling Control By-law
- A Corporate Energy Policy
- Use of renewable energy
- Replacement of traffic signals with energy efficient LEDs
- Waste diversion (organic and source separation)
- Water conservation
- Encouraging compact urban form in policy
- Particulate Matter (PM) compliant street sweepers.

Although many of these actions are comparable to other municipalities, some are still unique to Hamilton such as particulate compliant street sweepers and diesel-electric buses that address local issues of air quality.

“Gaps” in addressing air quality and climate change were also identified. These “gaps” need to be improved upon or require actions to be undertaken by Council and staff in order for the Corporation to have a more complete strategic action plan.

These “gaps” include:

- Transportation:
 - Support of Transit within the City
 - Increased Transportation Demand Management and encouragement of alternative modes of transportation (walking, cycling, carpooling) and discouragement of single occupancy in vehicles
- Investing in the “Green Infrastructure” to adapt and mitigate impacts.
 - Focus on forestry in urban areas – encourage more sustainable tree canopy
 - Encouragement and Development of green buildings and standards
- Undertake Adaptive planning to reduce the risks of climate change impacts in policies and actions.

By addressing these areas by 2012, the Corporation can build on actions to date, raise its profile and lead on environmental issues, reduce corporate costs of energy, address its commitments to Vision 2020, and begin a path towards becoming climate resilient.

A) Delivery of Corporate Actions on Air Quality & Climate Change

Delivery of the Corporate Air Quality & Climate Change Strategic Plan will be undertaken through a proposed Corporate management and reporting system including:

- A Corporate Air Quality & Climate Change Group
- Senior Management Team & Council
- Climate Change Roundtable

A. a) Corporate Air Quality and Climate Change Working Group

An Inter-Departmental Air Quality and Climate Change Work Group would co-ordinate and have responsibility for the actions of the corporation to address air quality and climate change and serve as a clearing house to disseminate information on corporate actions and priorities regarding air quality and climate change.

Phase 1 Report (PED06336)

A Corporate Air Quality & Climate Change Working group has been formed with respective Corporate Departments to co-ordinate air quality and climate change actions between Departments so as to maximize the outcome of each initiative and generate efficiencies within the Corporation. Representation in the group currently contains members from Planning & Economic Development - Strategic Planning (Air Quality, Sustainability and Policy), Public Health – Health Protection, Public Works - Capital Planning & Implementation (Transportation), Energy, Fleets & Facilities (Office of Energy Initiatives and Central Fleet) Waste Management, Water & Wastewater Management, Forestry, and Emergency Services. The objective of the group is to improve air quality in Hamilton and address climate change throughout corporate operations.

Moving forward on corporate actions to address climate change and air quality, the group will require additional members representing Community Services, Transit, Traffic Operations & Engineering, and Purchasing

In 2007, the Working Group has been examining air quality and climate change with respect to their own Departmental operations and corporately. The group has assessed and compared actions with other municipalities, communicated actions to the public and Council through various venues (staff reports, conferences, trade shows, community events, staff requests), identified areas that need to be supported to address air quality and climate change impacts, and have proposed short and medium term recommendations, identified in this report, to move the Corporate Air Quality and Climate Change Plan forward.

In future, the group will:

- Identify which City business units should have Air Quality & Climate Change initiatives planned or underway. These include energy conservation initiatives.
- Convene a group in these business units to share information and develop opportunities to work together.
- Communicate the Corporation's actions on air quality and climate change to Council and the public.
- Provide information to the Senior Management Team and program directors on Corporate Air Quality and Climate Change actions and results.
- Participate in federal, provincial, and municipal forums addressing Air Quality & Climate Change issues.
- Research actions undertaken by other cities.
- Hold an annual public event to showcase Hamilton's progress on Air Quality & Climate Change initiatives to its citizens.

The Corporate Air Quality & Climate Change Working Group will continue to provide a venue for Departments to communicate with each other on their respective activities and develop opportunities to work together and implement the Corporate Air Quality & Climate Change Strategy.

A. a. i) Senior Management Team & City Council

Council in its role in providing overall leadership for the City will be presented with an annual report by Staff on the Corporation's actions to improve air quality and reduce greenhouse gases starting in 2009. Council also has the ability in enacting laws or allocate City resources for programs, services, and activities that address climate change and air quality that promote community support and understanding.

Figure 8 below outlines the proposed reporting structure for the delivery of Corporate actions on air quality & climate change.

Figure 8: Reporting structure of the Corporate AQ&CC Plan

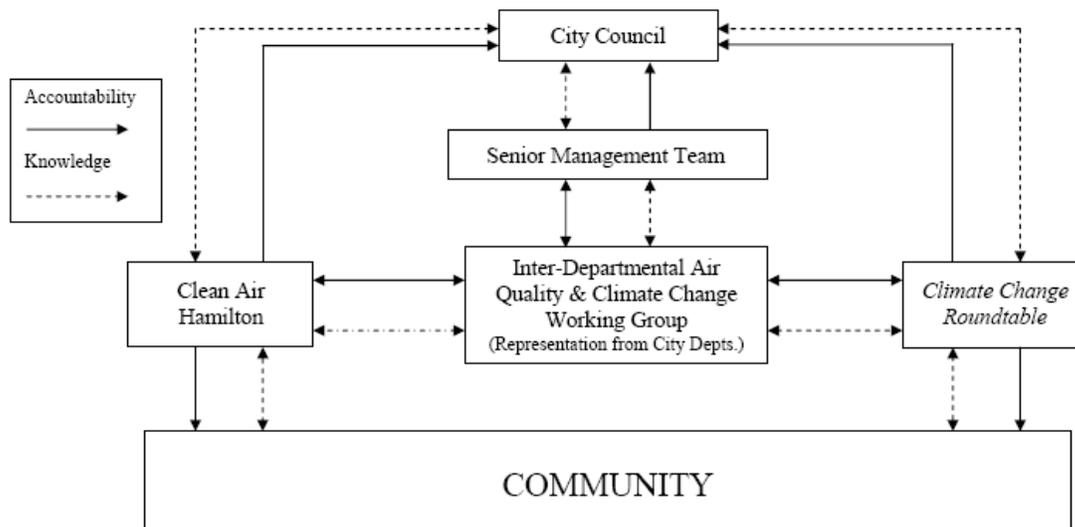


Figure 8 also identifies two bodies that would serve in the provision of policy and research advice on air quality and climate change to the Corporation and encouraging actions in the wider Hamilton community. These two bodies are *Clean Air Hamilton* and a proposed future *Climate Change Roundtable*.

A. a. ii) Clean Air Hamilton

Clean Air Hamilton is a multi-stakeholder group of academia, government, industry, environmental and local citizen groups dedicated to improving air quality through the promotion of realistic, science-based decision-making and sustainable practices. *Clean Air Hamilton* is supported by Council, provides policy advice to all levels of government, and reports annually to Council on actions to improve air quality in Hamilton. *Clean Air Hamilton* would continue to advise the City on matters of air quality and work with government partners, community stakeholders and the private sector in developing strategies to improve air quality in Hamilton.

A. a. iii) Climate Change Roundtable

A future *Climate Change Roundtable* would advise the City on matters of climate change and work with government partners, community stakeholders and the private sector in developing strategies to address climate change in Hamilton.

Representatives of the group would be from the City, industry, community/citizens, government, academic, health professionals and similar partners who can engage and promote actions to reduce greenhouse gases and adapt to climate change within the City of Hamilton. This group would have links to the community on climate change actions for the City, and build partnerships to undertake joint programs/actions on air quality and climate change.

A. b) Corporate Emissions Inventory

The former Region of Hamilton-Wentworth conducted a partial greenhouse gas emissions inventory in 1999. The greenhouse gas emissions for regional operations were calculated in the areas of landfills, Regional buildings and fleets, HSR and police services. The Region committed to corporate reductions of 20% of greenhouse gas emissions (14,802 tonnes) and a reduction of 6% community-wide (5,884,050 tonnes) from 1994 levels by 2005. The 1999 analysis of Corporate greenhouse gas emissions between 1994 and 1998 showed a reduction of 3.8% in municipal operations that was negated by an increase of 5.4% of City-wide emissions.

Table 4: Corporate Greenhouse Gas Emissions (1999)

	1994 eCO ₂ (Tonnes)	1998 eCO ₂ (Tonnes)	Trend to 2005	Goal
Municipal Operations	18,503	17,800 (3.8% reduction)	16,569 (10.45% reduction)	14,802 (20% reduction)
City-wide Emissions	6,259,628	6,599,162 (5.4% increase)	7,697,280 (22.9% increase)	5,884,050 (6% reduction)

Note: eCO₂ is a measure of all Green House Gases, such as nitrous oxide and methane, adjusted to equivalent CO₂ units)

Due to amalgamation and the changes in Corporate structure and operations, the results of the 1999 inventory are impossible to assess and compare to current City operations. Determining a baseline municipal operations emissions figure for 1990 would be costly, highly extensive, and require a historical analysis of all the operations of all former municipalities. Since amalgamation, no resources have been available to update and track the greenhouse gas emissions of the City through an emissions inventory.

The Corporate Air Quality and Climate Change Working Group will examine a number of greenhouse gas and related environmental inventories to determine the best inventory for City Operations. Departmental representatives on the Corporate Air Quality and Climate Change Working Group will collect the data required for an inventory. Staff will partner with external stakeholders to develop a community climate plan and inventory. Staff will report to Council on the Inventory and results in 2009.

The Corporation is still committed to the 20% reduction below 1990 levels, but it is proposed to extend the deadline to ensure sufficient time to properly inventory Corporate emissions and implement abatement actions. The 6% emissions reduction target of 2005 levels by 2012 is an interim target for the Corporation. Undertaking a current and proper emissions inventory using 2005 data for Corporate operations will determine if the interim target has been achieved and permit the refinement of the target to ensure continuous improvement.

Action:

- **Undertake an emissions inventory for the Corporation (2005 base year) and the City of Hamilton (2006 base year)**

- **City Council to review and adjust emissions target accordingly to emissions inventory results.**

A. c) Research on New Policies & Strategies

Research helps an organization identify its role on air quality and climate change issues, assess what actions it can undertake, and influence others to take action. The Corporation does not often undertake original research due to resources and mandate limitations.

Partnerships with other governments, academics and organizations assist the Corporation to obtain knowledge on air quality and climate change. The transfer of knowledge to Departments through the Corporate Air Quality and Climate Change Working Group will keep corporate activities relevant and current.

Original local research on air quality in Hamilton is undertaken through *Clean Air Hamilton* and the City's membership with the Greater Toronto Area (GTA) Clean Air Council. *Clean Air Hamilton* initiates research on health and air quality in Hamilton, provides policy advice, and encourages actions to improve local air quality by individuals, industries and other sources. *Clean Air Hamilton* recognizes that measures to reduce greenhouse gases will translate directly into local air quality improvements. (Clean Air Hamilton, 2007).

Upwind Downwind Conference

Since 1992, *Clean Air Hamilton* and the City of Hamilton have hosted a biennial conference on issues of air quality, health and planning. This provides a local and provincial forum for improved understanding of air quality and human health of cities. The conference highlights the roles that industry, community groups and governments can play in achieving air quality improvements. The conference generates many ideas and is an excellent opportunity for Hamilton and other communities to share practical solutions to air quality problems. In 2008, the theme of the conference address climate change in recognition of the linkages between improving air quality and reducing greenhouse gases.

Research on climate change is now primarily a partnership activity with other levels of government, organizations, municipalities, local industries, academics and community groups.

The GTA Clean Air Council is an intergovernmental working group that promotes the reduction of air pollution and increased awareness of Regional air quality issues. The GTA Clean Air Council has also begun to recognize the need to undertake research on climate change impacts in southern Ontario. It has begun work on adaptation to climate change through the Clean Air Partnership's Climate in Focus program (http://www.cleanairpartnership.org/climate_change.php).

The Alliance for Resilient Cities (ARC) is a recent collaborative network of decision-makers that supports the efforts of local governments to identify the impacts of climate change, analyze adaptation options and develop action strategies to protect their communities. (<http://www.cleanairpartnership.org/arc.php>)

A. d) Response, Engagement & Communication

The Corporate Air Quality and Climate Change Strategic Plan needs to respond to enquiries and proposals from the public, internal Departments, different levels of government, international activities, industry, stakeholders, etc. These differing interests influence how, when, and to what degree actions undertaken by the Corporation address air quality and climate change.

Departments within the Corporation are responsible for responding to enquiries and/or proposals on specific issues concerning their programs that may impact on air quality or climate change. They will also be responsible for the promotion and marketing of their individual actions.

The Corporate Air Quality and Climate Change Working Group will:

- Communicate the Corporation's actions on air quality and climate change internally and to the public and other jurisdictions.
- Provide information to the Senior Management Team and program directors on Corporate Air Quality and Climate Change actions and results.
- Participate in forums addressing Air Quality & Climate Change issues (e.g. Environment Week, Shared Air conference, Energy Matters conference, Sustainable Transforum, Globe Conference).
- Hold an annual public event to showcase Hamilton's progress on Air Quality & Climate Change initiatives.

Reporting of the actions undertaken through the Corporate Air Quality & Climate Change Strategic Plan will be presented to City Council on an annual basis starting in 2009 and is proposed to be (in-line with or incorporated into) the annual reporting on corporate actions addressing energy, waste and water.

B) Implementation of Corporate Actions on Air Quality & Climate Change

A Corporate Air Quality and Climate Change Strategic Plan is a long term strategy. Implementation will be phased and actions will cut across many Departments and programs.

Appendix C of this report provides a listing of some of the programs that the Corporation has undertaken to address air quality and climate change that combined form the baseline of programs for the Corporate Air Quality & Climate Change Strategic Plan. The short to medium timelines within each program is also outlined.

An analysis of Air Quality & Climate Change Plans and actions from six cities across North America compared with the activities by Hamilton that address air quality and climate change and identification of Corporate "gaps" also helped established recommendations that the Corporation should address under a Corporate Strategic Air Quality & Climate Change Plan.

Recommendations:

Immediate next steps to be taken under the Corporate Air Quality and Climate Change Strategic Plan include:

- **Establish the Corporate Air Quality and Climate Change Working Group.**

- **Undertake an assessment and inventory Corporation greenhouse gas emissions (2005 base year) and City emissions inventory (2006 base year) and report to Council the results of analysis in 2009**

To support actions under the Corporate Air Quality and Climate Change Strategic Plan, Council should:

- **Direct the inclusion of air quality and climate change objectives in all Corporate and Department Strategic Plans.**
- **Direct all Departments to take appropriate action and incorporate responses to potential climate change risks into corporate operations.**

In the short term to medium term (2007-2011), actions by Departments under the Corporate Air Quality and Climate Change Strategic Plan to improve air quality, reduce greenhouse gases and adapt to a changing climate include:

Adaptive Planning

- **Undertake vulnerability scans of climate change impacts on municipal operations.**
- **Develop and maintain a comprehensive risk based analysis procedure, in conjunction with the vulnerabilities scan, to determine climate change based high risk events in order to support co-ordinated inter-departmental mitigation programs to reduce risks and vulnerabilities.**
- **Research climate adaptation strategies for buildings and city infrastructure**
- **Enhance disaster preparedness and emergency response plans. Strengthen emergency communications, emergency preparation, public education, and emergency response coordination (e.g. planning for the combat of infectious diseases, illness, temperature and poor air quality induced health impacts)**

Transportation

- **Support public transit as a viable transportation mode within the City through a Transit Master Plan.**
- **Commit to Transportation Demand Management by encouraging and expanding the number of employees using Transportation Demand Management services (car pooling, car sharing, use of transit, flexible work time, telework, and cycling).**
- **Continue to green the corporate and transit fleet through the investigation and incorporation of hybrid and new vehicle technologies, right sizing and alternative fuels to replace to replace older vehicles coming out of service.**

Energy Management & Conservation

- **Encourage energy conservation and demand management within City operations (as outlined in the Corporate Energy Policy).**
- **Examine the use of renewable technologies in supplying energy to new and existing City Facilities (as outlined in the Corporate Energy Policy).**
- **Consider the energy usage and associated air and greenhouse gas emissions in City equipment operations and purchase.**

- **Encourage energy retro-fits, especially in low income neighbourhoods and housing.**

Land-Use Planning

- **Implement the approved land use planning related growth strategy (GRIDS and the recommendations of the associated Master Plans).**
- **Examine and incorporate air quality and climate change policies into the City's Official Plan.**

Green Infrastructure

- **Undertake a tree inventory with community support to provide information for a Forestry Management Plan**
- **Develop a comprehensive Forestry Management Plan with sustainable canopy targets**
- **Create a Fund to preserve and enhance parks, open spaces, and forests in the Hamilton community.**
- **Incorporation of energy efficiency, waste management, water efficiency and low air and greenhouse gas emissions in the retrofitting of Hamilton City Hall**
- **Study the feasibility of green and white roofs in the downtown of Hamilton**
- **Adopt green development standards (LEED, Energy STAR) for public and private developments and have City staff become LEED Accredited professionals.**

Water & Wastewater Management

- **Encourage water conservation in Hamilton to ensure adequate supplies of water under extreme weather scenarios (flooding, drought, lower lake levels, brownouts)**
- **Incorporate air quality and climate change in the planning of water, wastewater and stormwater infrastructure and policies to ensure adaptive response to a changing climate.**
- **Consider impacts on local air quality and reduction of greenhouse gases in City water & wastewater operations**

Waste Management

- **Continue the reduction and diversion of waste through the use of recycling, green carts and composting which reduces environmental impacts associated with landfills.**
- **Determine actions to address the 35% of remaining waste, recognizing potential air pollutants, toxins and greenhouse gas emissions in actions.**

By undertaking these actions and creating the supporting initiatives (e.g. the Corporate Working Group and tracking emissions), the Corporation can build on existing programs and address air quality and climate change in a more comprehensive manner. Moreover, the Corporation will be striving to get its own operations in order to reduce the corporate

costs of energy, encourage renewal of physical assets, and address its sustainability commitments to Vision 2020.

Ultimately, the Corporate Air Quality and Climate Change Strategic Plan helps guide the Corporation's future policies and operations in such a way to ensure that Corporate actions are consistent with the goals of improving air quality, mitigating greenhouse gases, and adapting to the effects of climate change.

Conclusion

Climate Change and poor air quality are issues being examined and addressed by a number of municipalities. Poor air quality and the potential impacts of climate change have effects on public health, municipal operations, City infrastructure, the local economy, and supporting ecosystems.

The Corporation has already begun to address air and greenhouse gas emissions in areas of smog day response, greening the corporate fleet, waste management, water management, land-use and transportation planning, and vehicle idling.

The Corporation will strive to reduce greenhouse gas emissions in its operations starting with a 10% reduction of 2005 levels by 2012, followed by a 20% reduction by 2020. This report outlines the actions the Corporation will undertake under a Corporate Air Quality and Climate Change Strategic Plan in the short and medium term (2007 – 2011). The Corporate Air Quality and Climate Change Strategic Plan is a long term strategy with phased implementation and actions that cut across many Departments and programs.

Actions include:

- Undertaking adaptive planning to reduce risks in policies and actions.
- Undertaking a Corporate and City emissions inventory to calculate the levels of emissions in Hamilton.
- Transportation:
 - Increased support of Transit within the City.
 - Increased Transportation Demand Management and encourage alternative modes of transportation (walking, cycling, carpooling) and discourage the use of single occupancy vehicles.
 - Continuation of greening the corporate fleet.
- Investing in the “Green Infrastructure” to adapt and mitigate impacts.
 - Focus on forestry and encourage more sustainable tree canopy in urban areas.
 - Encouragement and Development of green buildings and standards.
- Energy Conservation and Demand Management
 - Examination of renewable energy technologies and encouraging energy retro-fits.
- Waste Management
 - Continue reduction and diversion of wastes from landfills through recycling and composting.

Ultimately, the Corporate Air Quality and Climate Change Strategic Plan helps guide the Corporation’s future policies and operations in such a way to ensure that Corporate actions are consistent with the goals of improving air quality, mitigating greenhouse gases, and adapting to the effects of climate change.

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Appendices

A – Vision 2020 Strategy Goals in the Corporate Air Quality and Climate Change Strategic Plan.

B- Government Action on Climate Change

C- Corporate Air Quality & Climate Change Actions

Appendix A – Vision 2020 Strategy Goals in the Corporate Air Quality and Climate Change Strategic Plan.

Air Quality & Climate Change

- *To ensure the City has the best air quality of any major urban centre in Ontario;*
- *To have effective plans that identify, reduce and manage risks; and,*
- *To reduce greenhouse gas emissions.*

Water Quality & Supply

- *To ensure the water quality in streams, Cootes Paradise, Hamilton Harbour, Lake Ontario and other surface bodies is generally good, that the water is clean and clear.*
- *To ensure the quality of groundwater throughout the City is suitable for drinking and is a source of pure recharge for surface waters.*
- *To reduce the municipal water use of households and businesses*
- *To ensure that water quality is not affected by run-off and sedimentation due to changes in the landscape.*

Tree-Planting & Preservation

- *To develop and protect a system of interconnected natural areas which provides for the growth and development of native plants and wildlife and, where appropriate provides access for all citizens of the City of Hamilton.*

Land-Use Planning

- *To curb urban sprawl and suburban encroachment onto rural and agricultural lands*
- *To encourage development which makes efficient and economical use of infrastructure and services.*
- *To minimize the environmental, social, and financial costs of new development to the residents of The City of Hamilton.*

Energy Conservation & Demand Management

- *To reduce the consumption of non-renewable energy and eliminate the excessive and wasteful use of energy.*

Appendix A – Vision 2020 Strategy Goals in the Corporate Air Quality and Climate Change Strategic Plan.

Transportation and Transportation Planning

- *To develop an integrated sustainable transportation system for people, goods and services which is environmentally friendly, affordable, efficient, convenient, safe and accessible.*
- *To encourage a shift in personal lifestyle and behaviour towards transportation choices that enhance personal health and fitness, save money, and have the lowest environmental cost*
- *To use alternative modes of movement, such as, walking, bicycling, and public transit everyday .*

Waste Management & Reduction

- *To reduce the amount of waste generated by residents, businesses and government in the City.*
- *To safely and responsibly manage waste.*

Nine Directions to Guide Development. The Nine Directions stem from the Vision2020 Strategy and the Building A Strong Foundation process and established nine directions to guide the development of GRIDS and Hamilton’s Official Plan. Below are two of the directions that are embraced by the Corporate Air Quality and Climate Change Strategic Plan.

Direction #6 Expand transportation options that encourage travel by foot, bike and transit and enhance efficient inter-regional transportation connections

Direction # 8 Protect ecological systems and improve air, land and water quality.

Appendix B – Government Actions on Climate Change

a) Provincial

The Provincial Government has introduced a number of initiatives for “**A Greener, Healthier Ontario**”. These include the introduction of 5% ethanol in gasoline, offering new agreements for wind and solar power energy generation, rebates for hybrid vehicles, improvements in the Building Code, the banning of incandescent light bulbs by 2012, a proposed rapid transit action plan for the Greater Toronto Area and Hamilton, and a proposed Municipal Eco Challenge Fund to help municipalities reduce greenhouse gas emissions.

Ontario has set out a plan of action to address climate change in a number of areas and has established the following targets:

- A reduction of greenhouse gases to 6 per cent below 1990 levels by 2014, or 61 Megatonnes.
- A reduction of greenhouse gases to 15 per cent below 1990 levels by 2020, or 99 Megatonnes.
- A reduction of greenhouse gases to 80 per cent below 1990 levels by 2050.

The province has decided to create an Ontario Climate Change Secretariat in the provincial Cabinet Office to make sure the government's numerous environmental plans – from banning conventional light bulbs to phasing out coal-fired power plants – are carried out and to lead Ontario's fight against climate change.

b) Federal

In 2007, the Federal Government unveiled ***Turning the Corner: An Action Plan to Reduce Greenhouse Gases and Air Pollution***. The main focus of the plan is targeting industrial sectors to comply with mandated air and greenhouse gas emissions targets.

Under the federal plan, existing industry facilities will undertake a 6% reduction each year from 2007 to 2010, giving an enforceable 18% reduction from 2006 emission intensity, starting in 2010.

New facilities will have a three year grace period, before a 2% reduction annually is undertaken. National and sector specific caps on NO_x, SO_x, PM and VOCs will be underway from 2010 to 2015. The overall target of the federal government is a 20% reduction in emissions by 2020.

In addition, the Federal Government proposes to take action to reduce emissions from the transportation sector through fuel standards and the ecoENERGY for Personal Vehicles and ecoAUTO Rebate Programs, reduce energy usage in consumer and commercial products such as dishwashers, refrigerators, air conditioners, and commercial boilers and take action to improve indoor air quality.

c) International

At the international level, the United Nations 1994 Convention on Climate Change sets the overall framework for intergovernmental efforts to tackle climate change. The Convention recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. 191 countries have signed and ratified the Convention.

Under the Convention, governments:

- Gather and share information on greenhouse gas emissions, national policies and best practices;
- Launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries; and,
- Cooperate in preparing for adaptation to the impacts of climate change.

The adoption of the Convention and its commitments are not sufficient to tackle climate change. At the 1995 Conference of Parties (COP1) in Berlin, governments launched a round of talks to decide on stronger and more detailed commitments for industrialized countries. After two and a half years, the Kyoto Protocol was adopted at COP 3 in Kyoto, Japan.

The Kyoto Protocol shares the Convention's objective, principles and institutions, but strengthens the Convention by committing industrialized countries (such as Canada) to individual, legally-binding targets to limit or reduce their greenhouse gas emissions. In 1998, Canada adopted the Kyoto Protocol and pledged to reduce Canada's greenhouse gas emissions to six percent below 1990 levels during the commitment period of 2008 to 2012. Canada did not ratify Kyoto until 2002 and the Kyoto Protocol entered into force internationally in 2005.

Between December 3 to 15, 2007, the United Nations held a Climate Change Conference in Bali, Indonesia to set out the framework for negotiations of the "second phase" of the Kyoto Protocol, commencing in 2012, and attempted to lay the groundwork for strengthening global efforts to tackle climate change. Representatives from over 180 countries attended, together with observers from intergovernmental and nongovernmental organizations.

A meeting of environment ministers and experts held in June of 2007 called on the conference to agree on a road-map, timetable and 'concrete steps for the negotiations' with a view to reaching an agreement by 2009.

The agreement reached at Bali launches a two-year negotiation process for the post-2012 "Kyoto Phase 2". In addition to setting a range of emission reduction targets for industrialized countries, "the Bali roadmap" contains commitments to negotiate actions to control emissions in developing countries; financial agreements for adaptation and the transfer of climate-friendly technology; and an agreement to tackle the problem of deforestation in developing countries.

Appendix C: Corporate Air Quality & Climate Change Actions - Policy Actions

Department/Division	AQ & CC Category	Item	Description	Short	Medium	Long	On-going
				3months - 1 year	1 year - 2 years	3 years +	
PED - Strategic Services/Special Projects	Land Use & Transportation Planning	Official Plan	Inclusion of air quality and climate change considerations in Hamilton's Official Plan				
PED - Strategic Services/Special Projects	Land Use & Transportation Planning	Official Plan & Secondary Plans	Promotion of Compact Form, efficient use of infrastructure & transit, improved "walkability"				
PED - Strategic Services/Special Projects	Air Quality Research	<i>Clean Air Hamilton</i>	Support and administration of <i>Clean Air Hamilton</i> to support research and policy analysis of air quality needs in Hamilton				
PED - Strategic Services/Special Projects	Smog Response	Corporate Smog Plan	Review and update the 2000 Corporate Smog Response Plan				
PED - Strategic Services/Special Projects	Air Quality Research	Air Quality Co-ordinator	Co-ordinate, educate and respond to efforts by the Corporation and the City to engage actions on air quality.				
PED - Strategic Services/Special Projects	Vision 2020	Vision 2020 Co-ordinator	Educate and manage Hamilton's Vision 2020 Strategy for the City				
PW - Waste Management	Waste Management & Reduction	Solid Waste Management Master Plan	Implementation of the City's Integrated Waste Management System, specifically 65% waste diversion by 2010				

PW - Water-Wastewater - Plant Capital & Planning	Water Quality & Supply	Water & Wastewater Master Plan	The master plans are consistent with and reflect the servicing needs for the preferred growth pattern which will form the basis of the City's new official plan, thereby ensuring efficient servicing and compact growth.				
PW - Water- Wastewater - Plant Capital & Planning	Waste Management & Reduction	Biosolids Master Plan	Long range plan addressing the management of wastewater treatment residuals (biosolids) with current production at 50,000 T/yr rising over the planning period (to 2035) to 90,000 T/yr.				
PED - Strategic Services/Special Projects	Land Use & Transportation Planning	GRIDS Implementation	30 year growth strategy for the City which will form the basis of the City's new official plan, ensuring compact growth.				
PED - Economic Development	Land Use & Transportation Planning	ERASE	Promotion of the rehabilitation and redevelopment of brownfield properties within 3,400 acres of old industrial area				
PED - Strategic Services/Special Projects	Land Use & Transportation Planning	Residential Intensification Program	Compact Form				
EMS- Emergency Planning	Climate Change Research	Climate Change Awareness - IPCC Reports	Production and distribution of summary reports based on the Intergovernmental Panel on Climate Change Working Group papers				

EMS- Emergency Planning	Climate Change Research	Climate Change 'Best Practices'	Possible creation of action panel on climate change best practices for emergency managers and business continuity practitioners (external to the city, with the Ontario Association of Emergency Managers & the Canadian Centre for Emergency Preparedness)				
EMS- Emergency Planning	Emergency Management	Hazard Identification & Risk Assessment	Evaluate Climate Change against 'greatest risks' facing the city				
EMS- Emergency Planning	Emergency Management	Hazard Identification & Risk Assessment	Evaluate Risk Management Guidelines recently produced for Canadian Municipalities				
PW - Capital Planning & Implementation	Land Use & Transportation Planning	Transportation Master Plan	Implementation of Transportation Master Plan recommendations				
PW - Capital Planning & Implementation	Land Use & Transportation Planning	Transportation Master Plan	Transportation Master Plan recommends one permanent FTE for TDM (currently temporary), starting in 2008				
PW - Capital Planning & Implementation	Land Use & Transportation Planning	Transportation Master Plan/Travel Demand Management	Transportation Master Plan recommends one permanent FTE for TDM (currently temporary), starting in 2008				
PW – Energy, Fleet & Facilities	Corporate Energy Plan	Energy Conservation and Demand Management	Implementation of energy conservation and demand management in Corporate buildings and operations to meet Corporate energy targets				
PW - Capital Planning & Implementation	Extreme Weather Events	Storm Event Response Group (SERG) - related studies	PM, Watershed Management undertakes studies to address findings of the Independent Community Panel and for areas which experienced flooding during the storms of 2005 and 2006				

PW - Capital Planning & Implementation	Water Quality & Supply	Stormwater Master Plan	Provide strategies for servicing and management guidance for the City's stormwater system (including storm trunk sewers) for the next 30 years, and a strategy to protect , enhance and restore the environmental resources within Hamilton's 15 watersheds				
PW - Energy, Fleet & Facilities	Fleet Greening	Green Fleets Implementation Plan	Plan to implement new vehicle and fuel technology in an affordable and sustainable way to reduce engine exhaust emissions from fleet vehicles				
PW - Energy, Fleet & Facilities	Fleet Greening	Idling Control Policy	Idling control policy for city vehicles				
HSR Transit	Fleet Greening	End of the Line idling Policy	Policy to reduce idling of vehicles at the end-of-the line of transit routes				

Appendix C: Corporate Air Quality & Climate Change Actions – Operational Actions

Department/Division	AQ & CC Category	Item	Description	Short	Medium	Long	On-going
				3months - 1 year	1 year - 2 years	3 years +	
PW - Waste Management	Waste Management & Reduction	Green Cart Program	Organics diversion program for all single-family homes in the City				
PW - Waste Management	Waste Management & Reduction	Multi-Residential Green Cart Program	Organics diversion program for all multi-family dwellings in the City				
Public Works - Waste Management	Energy Management	Landfill Gas to Energy Collection System	On-site collection of landfill gas and production of energy				
PW - Water-Wastewater Customer Service & Community Outreach	Water Quality & Supply	Water Use Reduction	Initiatives to support and implement water conservation measures such as water metering and the Wise Water Use programs.				
PW - Water-Wastewater - Compliance & Regulations	Waste Management & Reduction	Sewer Use Bylaw	Regulation and Inspection to control and reduce metal and contaminant input to sewer and mitigating WWTP treatment load.				
PW - Water-Wastewater - Water Distribution & Wastewater Collection	Waste Management & Reduction	Combined Sewer Overflow (CSO) Management	Compliance with Procedure F-5-5 to reduce incidence of untreated release and mitigate WWTP treatment load.				
PW - Water-Wastewater - Plant Operations	Energy Management	Hamilton Renewable Power	WWTP sludge digester methane fuelling 1.6MW generator for production of 'green' energy.				

PW - Water-Wastewater - Compliance & Regulations	Waste Management & Reduction	Biosolids EMS	The Biosolids Environmental Management System (EMS) provides the City with a systematic approach and the necessary tools to ensure biosolids quality and application programs consistently comply with regulations and guidelines, maintains a pro-active community involvement program, and fosters continuous improvement in corporate mission / value statements.				
PW - Water - Wastewater - Plant Capital & Planning	Water Quality & Supply	Wastewater Investment Needs and Strategies (WINS)	WINS addresses Future Growth, water quality and wet weather treatment to protect and enrich environmental and public health; that Water and Wastewater Treatment Plants meet water quality objectives (e.g. RAP targets), and development (dry weather) capacity requirements, and to address wet weather flow issues in the collection system due to the high proportion of combined sewers				
PW- Traffic Engineering & Operations	Energy Management & Conservation	Traffic Lights Conversion	Conversion of traffic signal lights from incandescent to light emitting diodes (LEDs)				
PW- Traffic Engineering & Operations	City Operations	Traffic Signal Control	Timing of traffic signals to encourage transportation flow				
PW - Energy, Fleet & Facilities	Fleet Greening	Introduction of Hybrid Vehicles in Fleet	Introduction of hybrid vehicles into Corporate Fleet as available and affordable				

HSR Transit	Fleet Greening	Introduction of Hybrid buses in Fleet	Introduction of hybrid buses into the HSR fleet. 12 diesel/electric buses. - 5 40 foot & 7 articulated 60 foot buses.				
PW – Energy, Fleet & Facilities	Fleet Greening	Street Sweepers	Purchase of regenerative street sweepers that reduce fine particulate matter. 17 street sweepers purchased.				
HSR Transit	Transportation Demand Management	Employee Commuter Pass					
IT	Energy Management & Conservation	Corporate Computer Equipment Shutdown	Best practices for routine end of day shutdown of desktop computers result in a reduction of power consumption, reduce wear and time loss on systems, reduce security risks and will allow administrative updates, such as virus protection updates, to be loaded automatically at system start up.				
PW - Energy, Fleet & Facilities	Fleet Greening	Vehicle Idling Reduction					
PW - Operations & Maintenance	City Operations	Low emission equipment	Exploring the use of low emissions equipment in City operations				