Don River Watershed Plan

Air Quality – Memo on Current Conditions

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Toronto and Region Conservation for The Living City

Member of Conservation Ontario Natural Champions

theDon

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1.0 Introduction

The Toronto and Region Conservation Authority (TRCA), in consultation with the multi-stakeholder Don Watershed Regeneration Council and watershed municipalities, is developing a watershed plan for the Don River. This watershed planning process has been initiated in response to a number of recent policy and planning developments, including the need to fulfill York Region's watershed planning requirements under the Oak Ridges Moraine Conservation Plan (ORMCP, Ontario Regulation 140/02) and to update the original management strategy outlined in *Forty Steps to a New Don* (Metropolitan Toronto and Region Conservation Authority (MTRCA), 1994).

The goal of the watershed planning study is to recommend updated management strategies that will guide land and water use decisions, such that the overall ecological health of the Don River watershed is protected and improved. The aim is to build on the *Forty Steps'* principles to protect what is healthy, regenerate what is degraded, and take responsibility for the Don. Recognizing the significant watershed planning work that has already been completed, and given that there are limited undeveloped lands remaining on the Oak Ridges Moraine within the watershed boundary, this study will focus mainly on filling information gaps, guiding land use planning and approval decisions, and providing direction to advance implementation of regeneration priorities.

This memo has been prepared as part of the scoping and characterization phase of the watershed planning process, in which current watershed conditions are presented in the form of technical reports covering a range of subject areas, including groundwater quality and quantity, surface water quantity, low flows and water use, fluvial geomorphology, surface water quality, aquatic systems, terrestrial systems, nature-based experiences, cultural heritage, and land and resource use.

This technical memo summarizes data on air quality drawn from monitoring stations in and near the Don River watershed. Management considerations relating to air quality and land and resource use are presented.

2.0 Air Quality and Climate Change

Air is usually invisible and is easily overlooked in assessing the impacts of human activity. Yet, as an essential ingredient of life, air is a critical component in watershed protection. Air can also become a threat to life, as a medium for the spread of airborne contaminants. Contaminants arise from both human and natural activities, and from the interactions of these chemicals. They can be derived from local, regional and even global sources, thereby complicating management efforts.

Air quality is measured on the basis of emissions of contaminants into the atmosphere from both human and natural activity, and from their atmospheric interactions. Although both natural and human sources contribute to air pollution, the main contribution comes from everyday human activity (City of Toronto, 2000). Pollutants are released through volcanic eruptions, dust storms, emissions from oceans and vegetation, forest fires, factories, power plants, smelters, planes, trains, and other vehicles. Air pollution can affect the health of humans and vegetation and the appearance and integrity of buildings and structures. Poor air quality may also contribute to climate change, through elevated levels of greenhouse gases in the atmosphere.

Air pollution affects living organisms and inanimate objects through direct contact with air, chemical loading via dry or wet deposition (i.e., precipitation), and through condensation and absorption processes. Many of the chemicals that are emitted to air settle on surfaces, such as soils or built features, and ultimately enter surface waters and groundwater. Water bodies adjacent to urban areas are impacted by air pollution due to atmospheric deposition. As water moves through the hydrological cycle, it falls as rain or snow and then evaporates to the atmosphere from the land and surface waters. Other substances, including toxic pollutants, follow this same path. Pollutants may evaporate to the atmosphere, where wind currents can carry them for long distances before depositing them.

Since the industrial revolution, significantly greater volumes and concentrations of carbon dioxide, methane, nitrous oxide, sulphur dioxide and chlorofluorocarbons (CFCs) have entered the Earth's atmosphere. These gases not only impact air quality, but also they trap outgoing radiation and raise the temperature of the Earth's lower atmosphere by creating a "greenhouse effect", resulting in changes to the Earth's climate. In fact, there is some evidence to suggest that climate change is already occurring, resulting in shorter winters, warmer annual average temperatures, shorter lake ice cover, and more frequent heavy rainstorms in the Great Lakes basin (Kling *et al.*, 2003).

Climate change has the potential to cause significant changes to the hydrological cycle in the Rouge River watershed, with associated impacts on land and water resources and human communities. Climate change studies for the Great Lakes region predict changes in the mean and seasonal distribution of precipitation and streamflows, and changes in the frequency and intensity of extreme weather events (e.g., droughts, floods, ice storms, heat waves) (Duncan *et al.*, 2001; Kling *et al.*, 2003).

Climate change may also intensify air pollution. Higher air temperatures combined with air pollutants may increase the concentration of ground-level ozone, thereby reducing air quality and exacerbating human respiratory, cardiovascular disorders and allergy problems (Intergovernmental Panel on Climate Change, 1996).

3.0 Current Conditions in the Don River Watershed

3.1 Air Quality Index

Ontario's air quality is monitored by a network of monitoring stations operated by the Ontario Ministry of the Environment. The Air Quality Index (AQI) measures hourly ambient concentrations of six key contaminants known to have adverse effects on human health and the environment: sulphur dioxide (SO2), ozone (O3), nitrogen dioxide (NO2), total reduced sulphur (TRS) compounds, carbon monoxide (CO) and suspended particles (SP).

AQI values are divided into five levels of severity: very good (AQI 1-15), good (AQI 16-31), moderate (AQI 32-49), poor (AQI 50-99), and very poor (AQI > 100). Each level has an associated effect on human and ecological health. At the time that the air quality index was established, values of 0 to 31 were believed to have few or no known health effects. Those of 32 to 49 can damage vegetation and cause respiratory irritation in sensitive people when active. Values of 50 to 99 can cause decreased visibility, irritation for people with sensitive respiratory systems at rest, and damage to some plants. Those above 200 may cause severe

odour, serious respiratory effects and disorientation, and extensive damage to vegetation. The Ontario Medical Association (2001) has supported the Toronto Public Health's call for a revised air quality index and recognized that all levels of air pollution are harmful.

In order to minimize the impacts on human and environmental health, the target AQI for the Don River Watershed should be "very good" (i.e., an AQI of 0 to 15 for 100 % of the annual sampled hours).

There are 11 monitoring stations across the GTA. One is located within the Don watershed at the intersection of Yonge and Finch. The data summarized in this report are derived from this site and two local sites in Scarborough and Downtown Toronto, although the atmospheric region of influence, or "airshed", for the area extends far beyond the watershed boundary. Situated in the densely populated Great Lakes Basin, the Toronto Region is affected by long range transport of pollutants from beyond the city as far away as the Ohio Valley in the USA (Health Canada, 1997).

Table 1 shows the AQI ratings for 2003, as a percentage of hours measured, for the three monitoring stations that are closest to the Don River watershed. On average, 93 per cent of the time the AQI was good or very good (Figure 1). The AQI was poor for less than one per cent of the time on average. This occurred for at least one hour on 6 days for the Toronto Downtown monitoring station, eight days for the Toronto East station and 10 days for the Toronto North station. Ozone and particulate matter were the pollutants responsible for the poor AQI ratings.

Table 1: AQI distribution for the three monitoring stations closest to the Don River watershed.

Station ID	Station Name	Percentage of valid hours in AQI range					Valid hours	# of days AQI >49 for at least one hour
		Very Good (0-15)	Good (16-31)	Moderate (32-49)	Poor (50-99)	Very Poor (100+)		
31103	Toronto Downtown	47.9	44.2	7.6	0.3	0	8770	6
33003	Toronto East	53.3	39.3	7.1	0.4	0	8730	8
34020	Toronto North	42.7	49.0	7.7	0.6	0	8774	10
	Average	48.0	44.2	7.5	0.4	0		

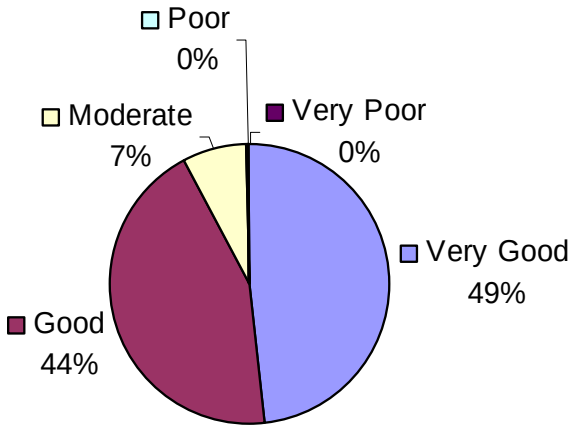

Figure 1: AQI distribution for the three monitoring stations closest to the Don River watershed.

3.2 Smog Advisories

Smog is the most visible form of air pollution. It is a brownish-yellow hazy cloud caused when heat and sunlight react with various pollutants emitted from industry, cars, pesticides and oil-based home products. Smog Alerts are issued for a specific area when the AQI in that area is predicted to reach or exceed 50. Table 2 presents a summary of smog advisories issued for the City of Toronto and York-Durham. While smog conditions are greatly affected by weather conditions, the data show a general increasing trend in the number and duration of smog advisories.

Table 2: Summary of smog advisories (1996-2006).

Region	1996		1997		1998		1999		2000		2001		2002		2003		2004		2005		2006	
	Adv.	Days	Adv.	Days	Adv.	Days	Adv.	Days	Adv.	Days	Adv.	Days	Adv.	Days	Adv.	Days	Adv.	Days	Adv.	Days	Adv.	Days
City of Toronto	2	3	2	5	3	7	5	9	3	3	7	20	9	18	5	12	6	14	14	48	5	11
York-Durham	2	3	2	4	3	7	5	9	3	3	7	20	9	18	5	12	6	14	14	48	5	11
Ontario	3	5	3	6	3	8	5	9	3	4	7	23	10	27	7	19	8	20	15	53	6	17

Note: An example of how this table should be interpreted is as follows:

In 2006, the ministry issued 5 smog advisories covering 11 days for York-Durham.

Please note that the Smog Alert Program was enhanced on August 23, 2002 when PM2.5 was incorporated into the provincial Air Quality Index. Prior to August 23, 2002, smog advisories were issued for ground-level ozone only.

3.3 Summary of Conditions

In evaluating current conditions in the Don River watershed, a rating system was adopted based on standard letter grades. Each of these categories corresponds with "poor", "fair", "good" and "excellent" levels of condition as shown in the table below. Where the measures and targets were quantitative and data permitted, ratings were assigned, in part, to reflect the percent satisfaction of the target. Comparisons to conditions in other watersheds under TRCA jurisdiction were made and informed evaluations where data were available, to reflect relative conditions. Where measures and targets were qualitative, or data were lacking, evaluations were based on professional judgment.

Grade	**Rank**	**Percent of Target Achieved**
A	Excellent	Better than 80
B	Good	Between 70 and 79
C	Fair	Between 60 and 69
D	Poor	Between 50 and 59
F	Fail	Below 50
TBD	To be determined	Further study required; baseline data not available

The management objectives, indicators, measures, targets, and current conditions ratings for the air quality indicators are presented below. Overall, air quality conditions in the Don Watershed are rated as "C" or "fair". However, "fair" should not be interpreted to mean "acceptable". High levels of ozone and fine particulate matter are linked to a number of serious health consequences, including heart and respiratory conditions such as asthma and bronchitis, and increased mortality.

Objective:

1. Reduce air pollution to levels that protect human health and natural ecosystems, and do not exacerbate global climate change.

Indicator	Measure	Target	Overall Rating
Air Chemistry	Air Quality Index (AQI)	AQI of "Very Good" (AQI does not exceed 15)	Fair
Smog	# of Smog Days	0 smog days and smog advisories issued per year	

4.0 Management Considerations

Air quality will continue to be an issue in the GTA. Population growth in the 905 region may result in a greater reliance on the automobile and trip lengths in the GTA will continue to rise as

residents relocate to suburban areas (see *Sustainable Land and Resource Use – Report on Current Conditions*). As automobile exhaust is a major source of air pollutants, increased automobile use is likely to exacerbate local and regional air quality problems. Furthermore, climate change and the urban heat island effect are likely to warm the temperature in the region, which could aggravate air quality concerns and increase risks to human health. On a positive note, air quality in the GTA may improve in response to the 2005 closing of the coal-burning Lakeview plant.

Poor air quality does not have to be accepted as an inevitable consequence of progress and urban living. A benefit of taking on the challenge of improving air quality is that by tackling air pollution we will also tackle a number of other connected problems. Everyday choices and actions impact energy use, climate change, transportation and land use patterns, acid rain, electricity generation, urban heat island, pesticide use and ozone. All of which have an impact on the quality of the air.

4.1 Reduce Automobile Usage

As urban population growth increases, so does urbanization. Since suburban development is still the most popular form of urbanization in the GTA, it means that this low-density land use keeps people farther away from where they work, shop and play. This means car use increases as more people commute. More cars, means more air pollution and greenhouse gases. Emissions from private vehicles are the largest source of air pollutants in the Don River watershed. Even at the current level of use, public transportation is a major contributor to air quality. Public transit produces only half as much of the greenhouse gas carbon dioxide for every kilometre travelled per person, compared to the same trip by car. Promoting the use of public transit instead of taking the car also reduces air pollutants percent that have associated negative health impacts - such as volatile organic carbons (Voss) and nitrogen oxides (Knox) - by over 90. Opportunities also exist to improve energy efficiency and reduce air pollutants associated with public transit vehicles such as using more energy efficient buses.

Making the streets welcoming for bikes and pedestrians is a vital component of a clean air strategy. While municipalities across the watershed are working on trails plans, they are lacking still in some areas. For example, Richmond Hill has a trails plan (Town of Richmond Hill, 2004), the City of Vaughan has a pedestrian and cycling plan (City of Vaughan, 2004), and the Town of Markham is currently working on a “Markham Pathways and Trails Master Plan Study”. The City of Toronto lacks a city-wide trails plan, but has created trail management strategies for individual properties, such as Crothers’ Woods (The Planning Partnership *et al.*, 2007). Toronto also has a Bike Plan (City of Toronto, 2001) and a number of initiatives to encourage cycling. For example, as part of the Rack It and Rocket program, cyclists can bring their bikes on city buses on special racks.

4.2 Implement Heat Island Mitigation Strategies

As a highly developed urbanized watershed, the Don is a significant contributor to the Heat Island Effect. Heat islands develop in cities as naturally vegetated surfaces are replaced with asphalt, concrete, rooftops and other manufactured materials. Waste heat from vehicles, industry, and air conditioners may add warmth to their surroundings, further exacerbating the heat island effect. Mitigation strategies that should be implemented in the watershed include trees & vegetation, green roofs, cool roofs and alternative pavement technologies. These efforts tie in with other programs and policies to improve stormwater management, energy

efficiency, public health, and quality of life. A temperature model of the GTA or watershed would identify the areas that most significantly contribute to increased temperatures.

4.3 Expand and Better Maintain the Urban Forest

A healthier urban forest will better cool the city, control stormwater run-off and help clean pollution from the air. Trees growing in an urban environment contribute a cooling effect in the summer. Recent research has produced statistics for the forests within the City of Toronto (Kenney and Associates, 2001). Toronto's estimated 7.5 million trees store about 900,000 tonnes of carbon and sequester a net 28,000 tonnes of carbon each year. Through this research, it was also found that the treed areas of Toronto absorb:

- 614 tonnes of ozone per year,
- 117 tonnes of sulphur dioxide per year,
- 306 tonnes of nitrogen oxide per year, and
- 452 tonnes of particulate matter (of less than 10 microns) per year.

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