



# Rouge River State of the Watershed Report

Prepared by:

Toronto and Region Conservation Authority  
5 Shoreham Drive  
Downsview, ON  
M3N 1S4

FINAL 2007



## Acknowledgements

The *Rouge River State of the Watershed Report* represents the combined effort of many participants. The report was prepared by technical staff of the Toronto and Region Conservation Authority (listed in Appendix A) with input from Rouge Park staff, consultants, government partners and the Rouge Watershed Task Force. Appreciation and thanks are extended to all those who contributed.



Disclaimer: The views and ideas in this report are those of the authors and do not necessarily reflect the views and policies of Environment Canada. Any mention of trade names, commercial products, or supplier names does not constitute endorsement or recommendation of use.



This product has received funding support from the Ontario Ministry of Natural Resources. Such support does not indicate endorsement by the Ministry of the contents of the material.



ISBN 978-0-9732764-8-0

[www.trca.on.ca](http://www.trca.on.ca)

5 Shoreham Drive,  
Toronto, ON M3N 1S4

Phone: 416-661-6600  
Fax: 416-661-6898

# TABLE OF CONTENTS

<b>1.0</b>	<b>INTRODUCTION</b>	<b>1-1</b>
1.1	Global Watershed Context	1-2
1.2	Rouge River Watershed Planning Process	1-3
1.3	Guiding Documents	1-5
1.4	Rouge River Watershed Management Goals	1-5
1.5	Organization of the State of the Watershed Report	1-7
1.6	References	1-9
<b>2.0</b>	<b>STUDY AREA AND PHYSICAL SETTING</b>	<b>2-1</b>
2.1	Location	2-1
2.2	Climate	2-3
2.3	Physiography, Topography and Soils	2-4
2.4	Geology, Surficial Geology and Hydrogeology	2-7
2.5	References	2-14
<b>3.0</b>	<b>REGIONAL MONITORING PROGRAMS</b>	<b>3-1</b>
3.1	Introduction	3-1
3.2	Regional Watershed Monitoring Network	3-1
3.3	Other Monitoring Initiatives	3-6
3.4	References	3-7
<b>4.0</b>	<b>GROUNDWATER QUANTITY AND QUALITY</b>	<b>4-1</b>
4.1	Introduction	4-1
4.2	Understanding the Factors that Affect Groundwater	4-2
4.3	Measuring and Evaluating Groundwater Quantity and Quality	4-4
4.3.1	Data Sources	4-4
4.3.2	Groundwater Modelling for the Rouge River Watershed	4-5
4.3.3	Monitoring	4-6
4.3.4	Groundwater Use	4-7
4.4	Existing Conditions	4-7
4.4.1	Hydrogeologic Setting	4-7
4.4.2	Water Budget	4-10
4.4.3	Groundwater Recharge	4-12
4.4.4	Groundwater Levels	4-12
4.4.5	Groundwater Discharge	4-19
4.4.6	Groundwater Quality	4-22
4.4.7	Groundwater Use	4-22
4.5	Objectives for Groundwater	4-25
4.5.1	Groundwater Quality	4-26
4.5.2	Groundwater Use	4-26
4.6	Summary and Management Considerations	4-27
4.6.1	Water Quantity (Availability)	4-27
4.6.2	Water Quality	4-27
4.6.3	Water Use	4-27
4.7	References	4-28

<b>5.0</b>	<b>SURFACE WATER QUANTITY</b>	<b>5-1</b>
5.1	Introduction	5-1
5.2	Understanding Surface Water Quantity in the Rouge Watershed	5-2
5.3	Measuring Surface Water Quantity	5-4
5.4	Existing Conditions	5-7
5.4.1	Surface Flow Regime	5-7
5.4.2	Baseflow	5-15
5.5	Objectives for Surface Water Quantity	5-30
5.6	Summary and Management Considerations	5-30
5.7	References	5-32
<b>6.0</b>	<b>SURFACE WATER QUALITY</b>	<b>6-1</b>
6.1	Introduction	6-1
6.2	Understanding the Factors Affecting Surface Water Quality	6-1
6.3	Measuring Surface Water Quality	6-5
6.4	Existing Conditions	6-9
6.4.1	Bacteria: The Swimming and Body Contact Recreation Indicator	6-9
6.4.2	Conventional Contaminants: the Aquatic Health Indicator	6-10
6.4.3	Organic and Metal Contaminants: The Chronic Effects Indicator	6-15
6.4.4	Water Quality Trends in the Rouge River Watershed	6-20
6.4.5	Other Issues: Spills, Landfills, Sanitary Servicing, Golf Courses	6-23
6.5	Objectives for Surface Water Quality	6-24
6.6	Summary and Management Considerations	6-24
6.7	References	6-26
<b>7.0</b>	<b>FLUVIAL GEOMORPHOLOGY</b>	<b>7-2</b>
7.1	Introduction	7-2
7.2	Understanding Geomorphic Processes	7-3
7.3	Measuring Fluvial Geomorphology	7-5
7.4	Existing Conditions in the Rouge River Watershed	7-8
7.5	Objectives for Fluvial Geomorphology	7-19
7.6	Summary and Management Considerations	7-20
7.7	References	7-23
<b>8.0</b>	<b>AQUATIC SYSTEM</b>	<b>8-1</b>
8.1	Introduction	8-1
8.2	Understanding the Aquatic System in the Rouge River Watershed	8-2
8.3	Measuring and Evaluating the Aquatic System	8-3
8.3.1	Reporting Aquatic Data: Appropriate Scale and Metrics	8-6
8.3.2	Methodology: Field Data Collection and Indices Calculations	8-8
8.4	Existing Conditions	8-13
8.4.1	Watershed Scale	8-13
8.4.2	Fisheries Management Zone Conditions	8-27
8.5	Objectives for the Aquatic System	8-62
8.6	Summary and Management Considerations	8-70
8.7	References	8-72

<b>9.0</b>	<b>TERRESTRIAL SYSTEM</b>	<b>9-1</b>
9.1	Introduction	9-1
9.2	Understanding the Terrestrial System in the Rouge River Watershed	9-1
9.3	Measuring and Evaluating the Terrestrial System	9-2
9.3.1	Data collection	9-3
9.3.2	Evaluation	9-3
9.4	Existing Conditions	9-5
9.4.1	Quantity of Natural Cover	9-5
9.4.2	Quality and Distribution of Natural Cover	9-7
9.4.3	Threats	9-12
9.4.4	Vegetation Community and Species	9-14
9.5	Objectives for the Terrestrial System	9-21
9.6	Summary and Management Considerations	9-24
9.7	References	9-27
<b>10.0</b>	<b>AIR QUALITY</b>	<b>10-2</b>
10.1	Introduction	10-2
10.2	Understanding the sources and impacts of air pollution	10-2
10.2.1	Human health	10-5
10.2.2	Terrestrial and aquatic health	10-5
10.2.3	The built environment	10-7
10.2.4	Climate change	10-7
10.3	Measuring air quality	10-8
10.3.1	Federal and provincial criteria	10-9
10.4	Existing conditions in the Rouge River watershed	10-9
10.4.1	Ozone	10-10
10.4.2	Particulate matter	10-11
10.4.3	Sulphur dioxide	10-11
10.4.4	Nitrogen dioxide	10-14
10.4.5	Carbon monoxide	10-15
10.4.6	Smog Advisories	10-16
10.5	Objectives for Air Quality	10-16
10.6	Summary and Management Considerations	10-17
10.7	References	10-18
<b>11.0</b>	<b>CULTURAL HERITAGE</b>	<b>11-1</b>
11.1	Introduction	11-1
11.2	Understanding Cultural Heritage in the Rouge River Watershed	11-1
11.2.1	Aboriginal Heritage	11-4
11.2.2	Euro-Canadian History	11-9
11.2.3	20th and 21st Century Culture	11-12
11.3	Measuring Cultural Heritage	11-13
11.4	Existing Inventory	11-16
11.4.1	Archaeological Sites	11-16
11.4.2	Built Heritage Structures	11-18
11.5	Objective for Cultural Heritage	11-19

11.6	Summary and Management Considerations	11-23
11.7	References	11-26
<b>12.0</b>	<b>NATURE-BASED RECREATION</b>	<b>12-1</b>
12.1	Introduction	12-1
12.2	Understanding Recreational Use in the Rouge River Watershed	12-2
12.3	Measuring Nature-based Recreation	12-3
12.4	Existing Conditions in the Rouge River Watershed	12-4
12.4.1	Recreational Use Areas and Experiences	12-4
12.4.2	Trails	12-11
12.5	Objectives for Nature-based Recreation	12-14
12.5.1	Ecological Compatibility	12-14
12.5.2	Opportunities – Variety and Access	12-16
12.5.3	Trails	12-17
12.6	Summary and Management Considerations	12-18
12.7	References	12-20
<b>13.0</b>	<b>LAND AND RESOURCE USE</b>	<b>13-1</b>
13.1	Introduction	13-1
13.2	Watershed Location and Demographics	13-1
13.3	Planning Policy Context	13-5
13.3.1	Flood Vulnerable Areas and Special Policy Areas	13-5
13.3.2	Rouge Park Management Plan and Rouge North Management Plan	13-11
13.4	Current Conditions, Emerging Trends, and Key Issues	13-12
13.4.1	Land Use	13-12
13.4.2	Transportation	13-21
13.4.3	Water	13-24
13.4.4	Solid Waste	13-27
13.4.5	Energy	13-29
13.5	Moving Toward Sustainable Land and Resource Use	13-30
13.5.1	Development Limits	13-31
13.5.2	Development Design	13-31
13.5.3	Infrastructure	13-33
13.5.4	Stormwater Management	13-34
13.6	Summary and Management Considerations	13-37
13.7	Objectives for Sustainable Land and Resource Use	13-41
13.8	References	13-46
<b>14.0</b>	<b>SUMMARY</b>	<b>14-1</b>
<b>APPENDIX A</b>	<b>Technical Support and List of Supporting Documents to the Rouge River Watershed Planning Study</b>	<b>A-1</b>

## LIST OF FIGURES

Figure 1-1	TRCA Jurisdiction	1-1
Figure 1-2	Rouge River Watershed Planning Process	1-4
Figure 2-1	Rouge River Watershed Study Area	2-2
Figure 2-2	Physiographic Regions	2-5
Figure 2-3	Stratigraphic Schematic	2-7
Figure 2-4	Formation of the Oak Ridges Moraine (from Eyles, 2002)	2-9
Figure 2-5	Surficial Geology	2-12
Figure 2 6	Conceptual Model of Geology and Groundwater Flow	2-13
Figure 4-1	Cross-Section along the Main Rouge	4-9
Figure 4-2	Cross-Section through the Middle Rouge Tributaries	4-9
Figure 4-3	Cross-Section along the Little Rouge River	4-10
Figure 4-4	Overall Rouge River Watershed Water Balance	4-11
Figure 4-5	WABAS Calculated Recharge (EarthFx, 2006)	4-13
Figure 4-6	Modelled Groundwater Levels, Oak Ridges Aquifer (EarthFx, 2006)	4-14
Figure 4-7	Modelled Groundwater Levels, Thorncliffe Aquifer (EarthFx, 2006)	4-15
Figure 4-8	Modelled Groundwater Levels, Scarborough Aquifer (EarthFx, 2006)	4-16
Figure 4-9	Reference Well Hydrographs, Oak Ridges (Upper) Aquifer	4-18
Figure 4-10	Reference Well Hydrographs, Thorncliffe (Middle) Aquifer	4-18
Figure 4-11	Reference Well Hydrograph, Scarborough (Lower) Aquifer	4-19
Figure 4-12	Modelled Groundwater Discharge (EarthFx, 2006)	4-20
Figure 4-13	Separated Baseflow from Long Term Flow Gauges	4-21
Figure 5-1	Active Stream Gauging Locations	5-5
Figure 5-2	Streamflow Data from 1962 to Present for Rouge River, Little Rouge River and Highland Creek Gauges	5-8
Figure 5-3	Seasonal Flow Patterns: Rouge and Little Rouge Rivers and Highland Creek	5-10
Figure 5-4	Summer Flow Volume Trends, Rouge and Little Rouge Rivers and Highland Creek	5-11
Figure 5-5	Area-Weighted Rainfall Event Response: Rouge and Little Rouge Rivers Compared with Highland Creek	5-12
Figure 5-6	Area-weighted daily flows for summer 1965 and summer 1997	5-14
Figure 5-7	Location of Baseflow Sampling	5-16
Figure 5-8	Summer Mean Monthly Baseflow from Hydrograph Separation	5-17
Figure 5-9	Baseflow Normalized to Stream Length	5-19
Figure 5-10	Flood Vulnerable Sites and Special Policy Areas	5-27

Figure 6-1	Stream Water Quality Monitoring Stations and Fish Tissue Monitoring Stations	6-3
Figure 6-2	Percent of Samples that Meet Guidelines at Regional Monitoring Stations	6-8
Figure 6-3	Median chloride concentrations in the Rouge River from 1973 to 2003	6-22
Figure 6-4	Median phosphorus concentrations in the Rouge River from 1973 to 2003	6-22
Figure 7-1	Rouge River Watershed – Stream Order and Geomorphic Monitoring Stations	7-7
Figure 7-2	Rouge River Watershed – Topography	7-10
Figure 7-3	Bruce Creek at Stouffville Road (RMN Site GR-14)	7-11
Figure 7-4	Upper Rouge River Near Highway 404 (RMN Site GR-7)	7-11
Figure 7-5	Bruce Creek at Major Mackenzie Drive (RMN Site GR-17)	7-12
Figure 7-6	Rouge River West of McCowan Road (RMN Site GR-21)	7-12
Figure 7-7	Little Rouge River at Major Mackenzie Drive (RMN Site GR-38)	7-13
Figure 7-8	Rouge River Upstream of Sheppard Avenue (RMN Site GR-27)	7-13
Figure 7-9	Little Rouge River Upstream of Sheppard Avenue (RMN Site GR-52)	7-14
Figure 7-10	Rouge Marsh	7-14
Figure 8-1	High Groundwater Discharge Areas in the Rouge River (pink)	8-4
Figure 8-2	Predicted Groundwater Flow Patterns Showing Regional Sources (longer track lines) and Local Sources (short track lines)	8-5
Figure 8-3	Target Species within Fisheries Management Zones	8-7
Figure 8-4	2003/2005 Fisheries Sampling Sites (RWMP and FMP sites)	8-9
Figure 8-5	Index of Biotic Integrity (IBI) Scores for all RWMP Sites	8-14
Figure 8-6	Fish Canonical Correlation Analysis (CCA) Scores Analyzed for 2002 Landcover Types	8-15
Figure 8-7	Measured Thermal Regime	8-17
Figure 8-8	Thermal Stability	8-18
Figure 8-9	Priority Instream Barriers	8-25
Figure 8-10	Existing Conditions and Issues in Upper Main Rouge River (FMZ 1)	8-28
Figure 8-11	Existing Conditions and Issues in Middle Reaches of Main Rouge River (FMZ 10)	8-32
Figure 8-12	Existing Conditions and Issues in Berczy Creek (FMZ 2)	8-36
Figure 8-13	Existing Conditions and Issues in Bruce Creek (FMZ 3)	8-39
Figure 8-14	Existing Conditions and Issues in the Headwaters of the Little Rouge River (FMZ 4)	8-42
Figure 8-15	Existing Conditions and Issues in Central Main Rouge River (Toogood Pond & Milne Reservoir) FMZ 5	8-46
Figure 8-16	Existing Conditions and Issues in Robinson Creek and Mt. Joy Creek (FMZ 6)	8-49
Figure 8-17	Existing Conditions & Issues in Mid to Lower Reaches of the Little Rouge (FMZ 7)	8-52
Figure 8-18	Existing Conditions & Issues in Lower Main Rouge & Morningside	



	Tributary (FMZ 8)	8-57
Figure 8-19	Existing Conditions and Issues in Mouth of the Rouge River and Estuary (FMZ 9)	8-60
Figure 9-1	Existing Natural Cover (2002)	9-6
Figure 9-2	Landscape Analysis – Quality of Natural Cover, 2002 Conditions	9-8
Figure 9-3	Forest Interior	9-11
Figure 9-4	Severe Disturbances to Ecological Land Classification (ELC) Communities (1995-2005)	9-13
Figure 9-5	Flora Species of Conservation Concern to TRCA within Different Physiographic Regions	9-15
Figure 9-6	Fauna Species of Conservation Concern to TRCA within Different Physiographic Regions	9-16
Figure 9-7	Provincially Significant Wetlands (PSWs)	9-17
Figure 9-8	Refined Rouge River Watershed Terrestrial Natural Heritage Target System	9-22
Figure 10-1	Air Quality Index Summary (2001 data) (OMOE, 2002)	10-10
Figure 10-2	VOC Emission Estimates in Ontario by Sector (OMOE, 2001)	10-10
Figure 10-3	Estimated Ontario PM10 Emissions by Sector (OMOE, 2002)	10-13
Figure 10-4	Estimated Sulphur Emissions in Ontario by Sector (OMOE, 2002)	10-13
Figure 10-5	Estimated Nitrogen Dioxide Emissions in Ontario by Sector (OMOE, 2002)	10-14
Figure 10-6	Estimated Carbon Monoxide Emissions in Ontario by Sector (OMOE, 2002)	10-15
Figure 11-1	Cultural Heritage Highlight Areas	11-25
Figure 12-1	Rouge River Watershed Nature-based Recreational Opportunities and Experiences.	12-5
Figure 12-2	Inter-Regional Trails in the Rouge River Watershed	12-12
Figure 13-1	General Land Use within the Rouge River Watershed	13-2
Figure 13-2	Municipal Share of the Rouge River Watershed	13-3
Figure 13-3	Special Land Use Policy Areas in the Rouge River Watershed	13-6
Figure 13-4	2002 Land Use/Land Cover and Approved Official Plan Land Use in the Rouge River watershed	13-13
Figure 13-5	Existing and Proposed High Order Transit Network in the Rouge River watershed	13-25
Figure 13-6	Stormwater Management Controlled Areas	13-35

## LIST OF TABLES

Table 4-1	Summary of Groundwater Quality	4-23
Table 4-2	Summary of Known Groundwater Extractions in the Rouge River Watershed	4-24
Table 4-3	Effect of Scale in Water Use Stress Assessment (Example)	4-24
Table 5-1	Known Water Abstractions by Sector-Rouge River, 2006	5-21
Table 5-2	Total Water Abstractions by Subwatersheds - Rouge River, 2006	5-23
Table 5-3	Number and Flood Frequency of Watershed Flood Vulnerable Areas and Roads	5-26
Table 6-1	The environmental effects and sources for key water quality variables	6-5
Table 6-2	Data Sources, locations and period of record	6-7
Table 6-3	Rouge River bacteria levels and Rouge Beach postings	6-9
Table 6-4	The median and percent of samples that meet guidelines for conventional pollutants (1999-2003)	6-11
Table 6-5	Wet weather concentrations (2003/04)	6-14
Table 6-6	Levels of Canada Ontario Agreement 'Tier 1' Contaminants in the Main Rouge Rivers (1991/92 survey)	6-16
Table 6-7	Water quality summary table for metals (2002-2005)	6-17
Table 6-8	Young-of-the-year fish sampling locations where fish tissue guideline exceedances occurred (as indicated by an x)	6-18
Table 6-9	Consumption restrictions for species tested (meals per month)	6-19
Table 6-10	Seasonal Kendall trend analysis results for selected water quality variables	6-21
Table 7-1	Rouge River Watershed Stream Length by Order	7-8
Table 7-2	Morphologic Characteristics of the Rouge River and Tributaries	7-15
Table 8-1	Indices and Conditions/Criteria used by TRCA's Benthic Aggregate Assessment (BAA, 2004)	8-10
Table 8-2	Riparian Vegetation in the Rouge River Watershed	8-19
Table 8-3	Management Recommendations for Priority Barriers in the Rouge River Watershed	8-21
Table 8-4	2007-2008 Sport Fish Consumption Guidelines	8-26
Table 8-5	Stream Health of Upper Main Rouge River - FMZ 1	8-29
Table 8-6	Historic and Existing Fish Species in FMZ - 1	8-31
Table 8-7	Stream Health of Middle Reaches of Main Rouge River - FMZ 10	8-33
Table 8-8	Historic and Existing Fish Species in FMZ 10 (Main and Beaver Creek)	8-34
Table 8-9	Stream Health of Berczy Creek - FMZ 2	8-35
Table 8-10	Historic and Existing Fish Species in FMZ 2	8-37
Table 8-11	Stream Health of Bruce Creek - FMZ 3	8-40
Table 8-12	Historic and Existing Fish Species in FMZ-3	8-40
Table 8-13	Stream Health of Little Rouge River - FMZ 4	8-43
Table 8-14	Historic and Existing Fish Species in FMZ 4	8-44

Table 8-15	Stream Health of Central Main Rouge River (Toogood Pond & Milne Reservoir) FMZ 5	8-47
Table 8-16	Historic and Existing Fish Species in FMZ 5	8-47
Table 8-17	Stream Health of Robinson Creek and Mt. Joy Creek - FMZ 6	8-50
Table 8-18	Historic and Existing Fish Species in FMZ 6	8-51
Table 8-19	Stream Health of Mid to Lower Reaches of the Little Rouge River - FMZ 7	8-54
Table 8-20	Historic and Existing Fish Species in FMZ 7	8-55
Table 8-21	Stream Health of Lower Main Rouge River and Morningside Tributary - FMZ 8	8-58
Table 8-22	Historic and Existing Fish Species in FMZ 8	8-58
Table 8-23	Historic and Existing Fish Species in FMZ 9	8-61
Table 8-24	Index of Biotic Integrity (IBI) Scores and Grade Equivalents	8-63
Table 9-1	Existing Cover Conditions	9-7
Table 9-2	Average Total Patch Quality Scores	9-9
Table 9-3	Disturbances to Natural Areas based on data collected for ELC polygons (1995-2005 data).	9-12
Table 10-1	Linkages Among Air Pollutants and Air Quality Issues	10-3
Table 10-2	Pollutants that Frequently Exceeded the Ontario Ambient Air Quality Criteria in the Rouge River Watershed and Surrounding Area (2001 data)	10-4
Table 10-3	Potential Air Pollution Damages to Ontario's Crops	10-5
Table 10-4	Air Quality Index Categories	10-8
Table 10-5	Ambient Air Quality Criteria (AAQC) for Air Quality Index Pollutants	10-9
Table 10-6	Annual Mean Concentrations of Ozone (ppb) and Exceedance days (>80ppb)	10-12
Table 10-7	Annual Mean Concentrations of Inhalable Particles (PM10) and 24 hour Exceedances (>50ug/m3)	10-12
Table 10-8	Annual Nitrogen Dioxide Mean Concentrations (ppb)	10-15
Table 10-9	Number of Smog Alert Advisories and Smog Days	10-16
Table 11-1	Heritage Definitions	11-2
Table 11-2	Rouge River Watershed Heritage Study Database	11-14
Table 11-3	Definition of Terms used in the Cultural Heritage Database	11-15
Table 11-4	Rouge River Watershed Archaeological Sites: Cultural Affiliation	11-17
Table 11-5	Rouge River Watershed Built Heritage Structures: Original Use	11-18
Table 11-6	Rouge River Watershed Built Heritage Features by Municipality	11-19
Table 11-7	Rouge River Watershed Built Heritage Structures: Architectural Style	11-20
Table 11-8	Architectural Styles Found in the Rouge River Watershed	11-21
Table 12-1	Area of Greenspace and Other Public Use Areas by Municipality in the Rouge River Watershed	12-4
Table 12-2	Length of Trails in the Rouge River Watershed, by Municipality	12-11
Table 12-3	Rouge Park Trails Network	12-13

Table 13-1	Distribution of Population and Employment for Rouge River watershed Municipalities in the Greater Golden Horseshoe 2001-2031	13-4
Table 13-2	Policy Documents Affecting Land and Resource Use in the Rouge River Watershed	13-7
Table 13-3	Residential solid waste diversion rates 2001-2006	13-42
Table 13-4	Number of transit passenger trips per person 2001-2006.	13-44
Table 13-5	Mode of transportation to work based on Statistics Canada 2001 Census of Population data.	13-44
Table 14-1	Summary of Rouge River Watershed Report Card Ratings	14-3