



2001 State of the Environment Report

**A Report of the
Saskatoon Environmental Advisory Committee**

**Prepared by:
Erika Ritchie, P.Eng.**

May 20, 2003



Printed on recycled paper

Saskatoon Environmental Advisory Committee Members, 2002 and 2003

The 2001 State of the Environment Report (SOER) was prepared under the direction of the members of the 2002 Saskatoon Environmental Advisory Committee (SEAC), and completed under the direction of the members of the 2003 Saskatoon Environmental Advisory Committee (SEAC), as listed below.

2003 Members:

Councillor T. Paulsen
Dr. M. Carroll Chubb
Dr. Judit E. Smits
Mr. Leo Monseler
Mr. Roger Peters
Mr. Harry VanEyck
Mr. Bill Wright
Ms. Lorna Shaw-Lennox
Dr. Tom Wolf
Mr. Jon A. Gillies
Mr. Lawrence Pinter

2002 Members were the same as above with the exception of the following members who were unable to complete their term:

Ms. Katherine Gerein replaced by Dr. Judit E. Smits
Ms. Amanda Plante replaced by Dr. Tom Wolf

Acknowledgements

The author would like to expressly thank those individuals and departments that provided data, information and technical input into the preparation of this document, including the City of Saskatoon, City of Regina, Sask Water Corporation, SaskEnergy, Environment Canada, Sustainable Communities Indicator Program, Saskatchewan Environment, and Meewassin Valley Authority.

Summary Overview

Urban sustainability is a process of conserving resources and promoting the health of the individual, the community and the ecosystem of which it is apart, while providing the infrastructure and means by which to sustain them. A sustainable city endeavours to improve its natural, built and cultural environments at neighbourhood and regional levels while working in ways which support the goal of global sustainable development. These principles are reflected in The City of Saskatoon Development Plan, which identifies 'Saskatoon as a sustainable community' as a *fundamental value*.

The *City of Saskatoon 2001 State of the Environment Report* is a platform document that contributes to assessing how well Saskatoon is achieving the goals of urban sustainability by evaluating sustainability indicators of environmental health.

In order to move towards urban sustainability, decision-makers need information about developing trends and pressure points, as well as the impacts or effects of policies that have been put into place. They need feedback on how implemented measures speed up or slow down the effects of their policies. They need information about successes that have been made or about failures that frustrate progress.

This report identifies that Saskatoon is endowed with plenty of fresh air and water, however, our consumption of natural resources is increasing on a per capita basis. With a population that is growing at a rate of 2% percent every year, our environmental impact, or ecological footprint, is increasing.

There are several environmentally positive initiatives underway within civic

departments, however, this report identifies that the City could take a more proactive and directed approach towards environmental stewardship. There are many local, national and international examples from which to draw inspiration and direction to meet the many challenges associated with implementing environment-related initiatives. Developing our collective ecological literacy will be a critical component in meeting these challenges.

Areas identified for immediate policy initiatives include:

1. Increasing public transit ridership
2. Treatment of stormwater run-off
3. Enhancing waste minimization strategies
4. Providing incentives for commercial and residential reductions in energy consumption
5. Increasing the percentage of our urban forest
6. Creating our collective ecological literacy through public education

Table of Contents	page
Saskatoon Environmental Advisory Committee Members, 2002 and 2003	i
Acknowledgements	ii
Summary Overview	iii
Table of Contents	iv
Nomenclature	iv
Introduction	1
Indicator #1: Urban air quality	4
Indicator #2: Water quality and water consumption	7
Indicator #3: Energy usage	14
Indicator #4: Transportation	17
Indicator #5: Resource recovery	21
Indicator #6: Urban form	27
Indicator #7: Contaminated sites	31
Indicator #8: Habitat	33
Indicator #9: Greenhouse gas emissions	38
Indicator #10: Noise	41
Environmental Legislation	42
Bibliography	44
Appendices: Data sources and related information	
Appendix A1: Urban air quality data	A1
Appendix A2: Water consumption and water quality data	A4
Appendix A3: Energy usage	A22
Appendix A4: Transportation	A24
Appendix A5: Resource recovery	A26
Appendix A6: Urban form	A28
Appendix A7: Contaminated sites	A31
Appendix A8: Habitat	A32
Appendix A9: Greenhouse gas emissions	A34
Appendix B: Summary of Recommendations	B1

Nomenclature

$\mu\text{g/L}$	micrograms per litre or ppb
API	Air pollution index
BOD	Biological oxygen demand
CBP	Chlorination disinfection by-products
CHEP	Child Hunger Education Program
Cl_2	Chlorine
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2/ca	Carbon dioxide emissions per capita
CSR	Corporations Supporting Recycling
dBA Ldn	Decibels: ambient sound level averaged over day and night, , with additional decibel weighting for night time sensitivity
DED	Dutch elm disease
GAP	Generally Accepted Principals
GHG	Greenhouse gases
GDP	Gross domestic product
ha	hectare
HPC	Heterotrophic plate count
IMAC	Interim Maximum Acceptable Concentration
kWh	kilowatt hour
L/day/ca	litres per day per capita
m^3/s	cubic metres per second
mg/L	milligrams per litre or ppm
MW	Megawatt
NO_2	Nitrogen dioxide
ppb	parts per billion
ppm	parts per million
PM-10	Particulate matter less than 10 microns
SE	Saskatchewan Environment
SCIP	Sustainable Communities Indicator Program
SEAC	Saskatoon Environmental Advisory Committee
SOER	State of the Environment Report
SO_2	Sulphur dioxide
SPM	Suspended particulate matter
SSR	South Saskatchewan River
SWQI	Saskatchewan Water Quality Index
THMs	Trihalomethanes
TSS	Total suspended solids
VOC	Volatile organic compounds
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

Introduction

Current issues

Sectors, individuals and all orders of government are corporately and personally responsible for minimizing the environmental impacts of their decisions and actions.

Saskatoon's municipal government has an integral role to play in the environmental health and well-being of its citizens and ecological resources through its municipal responsibilities over water and sewage treatment, solid waste management, land use, transit, parking and municipal roads. As a result, municipal government is necessarily at the forefront of efforts to achieve the economic efficiency, social well-being and environmental protection to sustain and improve our collective quality of life. Strong, responsible municipal government is key to building urban sustainability.

High environmental quality is best achieved by adopting policies and practices that facilitate the development of infrastructure such as transportation, waste management and building systems that use natural resources efficiently and minimize polluting emissions. Environmental decision-making must be inclusive and allow for full participation and representation from all its municipal stakeholders.

As Saskatchewan's largest urban centre, Saskatoon is a driving force for innovation and development. We also possess a wealth of intellectual resources within our economic,

educational and research institutions. The people of Saskatchewan are known for their resourcefulness, whether it's building infrastructure, health programs or donating to charity.

Saskatoon is also the hub for the City and the larger surrounding area, which in total services 250,000 people. While surrounding rural municipalities are experiencing depopulation, Saskatoon's population is increasing by over 2% every year, putting added pressure on infrastructure and services. These factors challenge the ability of the City to achieve the goals of urban sustainability.

The global context

North Americans comprise 6% of the world population, yet disproportionately consume 30% of its resources and produce 50% of the non-organic waste; an imbalance that will not be sustainable indefinitely. Urban sustainability necessitates that we acknowledge that we are only part of a larger whole, and that our health and prosperity are contingent on the health of the entire global system. It requires that we recognize that local municipal decisions affect global environmental health and have a global impact.

The vision for the community: sustainability goals and objectives

As part of the City of Saskatoon's Core Values, the following principles apply to our sustainability goals and objectives:

- We will leave our environment in better shape for the next generation than we received it.
- We will continue to protect and enhance the beauty of our natural environment, parks and the urban forest.
- We will continue to promote responsible use of natural resources.
- We will protect and enhance the river valley as one of our primary resources

The Indicator program

The *City of Saskatoon 2001 State of the Environment Report* (SOER) identifies environmental issues of relevance to the people of Saskatoon. The SOER is a public document that provides the most current statistical information relevant to decision making for City Council, the City of Saskatoon Environmental Advisory Committee, and other City Advisory Committees and Boards.

The last SOER was prepared in 1998 and considered data available for the years 1996 and 1997. This edition of the SOER was prepared according to a new format, utilizing the Sustainable Community Indicators Program (SCIP), a joint project of Environment Canada and Canada Mortgage and Housing

Corporation. The 2001 SOER considers data from the period 1996-2001, where available. Historical data was compared with benchmark information set out in the 1997 State of the Environment Report², and other national statistics where applicable to identify emerging trends.

The Indicators

Drawing on the goals and objectives set out as part of the City of Saskatoon's Core Values, indicators of environmental sustainability were selected. These indicators can be tracked over time to represent or summarize selected key statistics that focus primarily on environmental conditions, while also considering related social and economic parameters. The indicators shown below in Table 1 are organized into relevant areas of government using a framework geared towards a municipal policy-maker audience.

**Table 1: City of Saskatoon, 2001 State of the Environment Report
List of Indicators**

<i>Indicator</i>	<i>Data Set</i>
<i>1. Urban air quality</i>	Air Pollution Index (API) Particulate matter (PM-10) Nuisance odours
<i>2. Water quality and consumption</i>	Water consumption Domestic water quality Water quality along the South Saskatchewan River South Saskatchewan River water supply Wastewater and Stormwater Effluent
<i>3. Energy usage</i>	Residential electricity consumption Commercial electricity consumption Residential natural gas consumption Commercial natural gas consumption
<i>4. Transportation</i>	Mode Share (bikes, cars, transit, walking) Public Transit Use Motor vehicle ownership per capita Length of bikeways as a percentage of total length of major vehicle lanes
<i>5. Resource recovery</i>	Residential waste composition Residential waste diversion Waste received at the City Landfill
<i>6. Urban form</i>	Population density Total area of rural land converted to urban uses New housing starts by type Housing density Number of community gardens
<i>7. Contaminated sites</i>	Remediated industrial contaminated sites
<i>8. Habitat</i>	Greenspace as a percentage of total land area Park Management Environmentally sensitive habitat Species at risk Urban forest Dutch Elm Disease
<i>9. Greenhouse gas emissions</i>	CO ₂ equivalent emissions per capita CO ₂ equivalent emissions per sector Historical weather trends
<i>10. Noise</i>	Noise levels along traffic corridors

Indicator #1: Urban Air Quality

Issue context

Urban air quality is an important indicator of environmental health that assesses the quality of the outdoor ambient air. Air quality is influenced by both natural factors; such as dust or smoke, weather patterns, as well as human-induced factors; such as the combustion of fossil fuels, the intensity of industrial and agricultural development, traffic intensity and other human activity. Vehicles, residential furnaces and industrial boilers are the most significant contributors of air emissions from fossil fuel combustion.

Without good quality air, environmental health and human health are affected, particularly for those individuals suffering from lung ailments or other environment related sensitivities. Saskatchewan Environment (SE) reports air quality according to a composite air pollution index (API), that is based on sub-indices for suspended particulate matter (SPM), ozone (O₃), carbon monoxide (CO), sulphur dioxide (SO₂), and nitrogen dioxide (NO₂). Although agricultural activity in the area surrounding Saskatoon relies on various agricultural insecticides, fungicides and herbicides, pesticide residue is not included in the calculation of the API.

Comparing annual air quality data for Saskatoon with other Canadian cities allows for trends and relative assessments in air quality to be established.

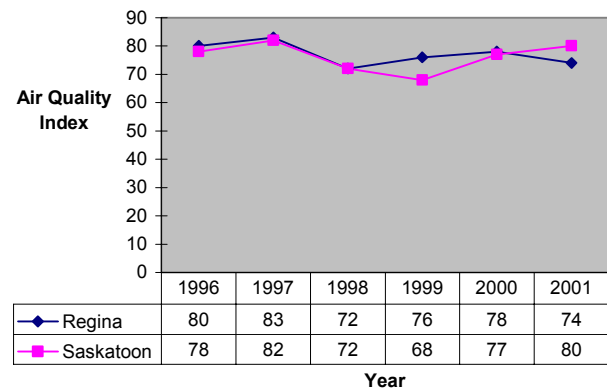
Nuisance odors affect our quality of life and can be the result of a single odor source, a single odor event, or the combination of several sources and events. Industry, wastewater treatment and agricultural practices can contribute to nuisance odors. Reviewing the number of odour complaints received by the City identifies whether odour issues are perceived by City residents as a nuisance.

Trends and prospects

Air Pollution Index

The APIs for Saskatoon and Regina are compared for the years 1996 to 2001. Figure 1.1 indicates that over this period air quality in Saskatoon and Regina were similar; typically classified as Good (API between 70 and 84).

Figure 1.1: Air Quality Indices for Regina and Saskatoon



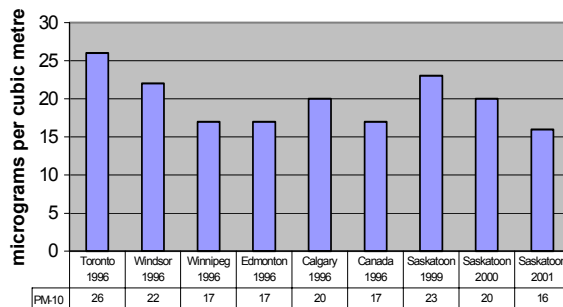
In Saskatoon, the API was higher than 70, 98% of the time for all years, except 1999. In 1999, Moderate (55-69) air quality was experienced due to higher levels of SPM. (Table A1.2 provides data for each sub-index.)

During the summer and fall, SPM from agriculturally induced dust and northern forest fires are major contributors to Saskatoon's overall annual API rating. Occurrences of elevated levels of ground level ozone or nitrogen dioxide are rare, and occurrences of elevated levels of carbon monoxide and sulfur dioxide are very rare. Due to typically strong winds, air quality in Saskatoon generally receives a positive impact from dilution. Based on the above considerations, Saskatoon achieves the objective of Good air quality.

PM-10

In Saskatoon, suspended particulate matter is the major contributor to the overall API. SE has been measuring concentrations of particulate matter less than 10 microns in diameter (PM-10) since 1999. Figure 1.2 compares the average annual PM-10 in Saskatoon for the years 1999, 2000, and 2001 with the most currently available data for other Canadian cities. The data provide both a temporal comparison, as well as a national perspective on Saskatoon's air quality. PM-10 concentrations for Saskatoon during these years were within the range measured in the other major cities considered (between 17 and 26 $\mu\text{g}/\text{m}^3$). Notably, there was a steady reduction in PM-10 levels over these years, declining from 23 $\mu\text{g}/\text{m}^3$ in 1999; 20 $\mu\text{g}/\text{m}^3$ in 2000; and falling below the national average (17 $\mu\text{g}/\text{m}^3$) to 16 $\mu\text{g}/\text{m}^3$ in 2001.

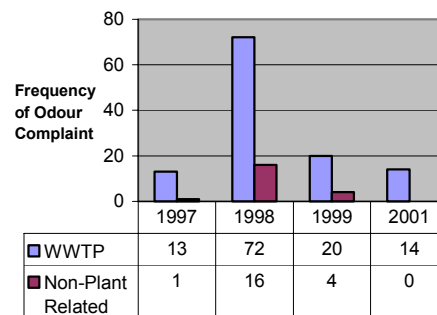
Figure 1.2: Average PM-10 Levels in Selected Canadian Cities



Odour

Figure 1.3 provides odour complaint data logged between 1997 and 2001 at the City Wastewater Treatment Plant. The majority of these complaints were identified as related to the WWTP. Although the WWTP typically received less than 20 complaints per year, a high volume of WWTP-related complaints (72) were received in 1998.

Figure 1.3: Frequency of Odour Complaints Received at the Wastewater Treatment Plant



Odours may be generated from open sources such as aeration basins, weirs, and effluent channels. Several measures were introduced subsequent to 1998 to reduce odours emanating from the WWTP, these included: reducing the fall

distance at weirs, the addition of potassium permanganate at the headworks, covering open odour sources, and limiting degritting operations to coincide with favourable wind patterns.

Further detailed data and information regarding how the data were selected and measured are provided in Appendix A1.

Recommendations

Air Quality:

1. Through civic programs and policies, it is recommended that the City continue to encourage residents to reduce their vehicle usage in order to mitigate air quality, noise and global warming effects related to the combustion of fossil fuels.
2. It is recommended that the City request continuous pesticide monitoring be performed in Saskatoon as part of Saskatchewan Environment's air quality monitoring program.

Odour:

3. That the City evaluate further possible measures to minimize odours generated at the Wastewater Treatment Plant.

Indicator #2: Water Consumption and Water Quality

Issue context

Water quality is maintained by protecting water quality at source and reducing consumption. While we require only 80 litres of water per day to sustain a minimum quality of life, Canadians average 343 litres per person per day.¹

This indicator is concerned with the quality and consumption of water used and returned to the South Saskatchewan River (SSR). Water quality and consumption is important for assessing several factors related to the availability of high quality, fresh water:

- Domestic water quality is important for ensuring a safe water supply for residents.
- Residential water consumption impacts on urban sustainability in terms of the infrastructure necessary to treat and supply urban demand without disturbing river flow and water quality, as well as ensuring that an adequate fresh supply remains for aquatic life.
- Wastewater treatment and the quality of the water entering the SSR is important for ensuring high quality water for human populations downstream, as well as protecting the aquatic ecosystems that receive our water after we have used it.

Since 1967, the South Saskatchewan River flowrates have been regulated via the Gardiner Dam on the Lake Diefenbaker reservoir.

Saskatoon's domestic water is treated and distributed by the Water Treatment Plant, (WTP). Municipal water is returned to the South Saskatchewan River following treatment at the Wastewater Treatment Plant (WWTP). Stormwater runoff in older neighbourhoods is connected to the sewage system; in newer areas stormwater is directly discharged to the SSR. As an alternative to chemical treatment, naturalized species of aquatic plants are used to filter stormwater from local neighbourhoods at the Lakewood Stormwater Retention Pond prior to discharging into the South Saskatchewan River.

Following the North Battleford Water Inquiry, the provincial government set up a Long-term Safe-Drinking Water Strategy. One of the key objectives of the newly formed *Saskatchewan Watershed Authority*, is to protect source water supplies by developing and implementing best management practice guidelines to reduce impacts of urban runoff. During rain events, stormwater drains across open areas, picking up oil, gasoline, soot, yard and garden chemicals (fertilizers and pesticides), pet waste and other contaminants that may be directly discharged into the SSR. To protect source water supplies downstream, Saskatoon will need to address untreated stormwater that discharges into the SSR.

¹ Environment Canada at:
http://www.ec.gc.ca/water/en/manage/use/e_data.htm

There is concern regarding leachate from the City landfill which is located south-west of the water treatment plant, and is upstream of a water treatment plant intake. Groundwater monitoring along the perimeter of the City's landfill indicates that leachate migration is towards the north, south and the River. The Environmental Compliance Branch has contracted an engineering consultant to design a leachate collection system that will transfer leachate from the landfill to the sanitary main. Construction is expected to be completed in the summer of 2003.

Trends and prospects

Water Consumption

Residential water consumption in Saskatoon is expressed as an average daily per capita consumption rate. The data shown in Figure 2.1 represents the *total* water pumped from the water treatment plant to allow for comparisons with nationally compiled data. Per capita consumption is thus made up of residential, industrial/commercial, and unaccounted volumes. In Saskatoon it is notable that residential and commercial consumption are approximately equal. Additionally, unaccounted losses due to leakages along the distribution system comprise 16% of total water pumped, which is slightly higher than the national average of 14%.

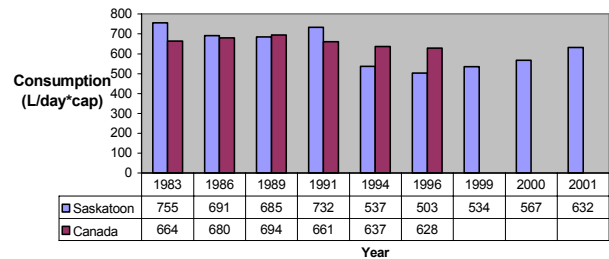


Figure 2.1: Daily Per Capita Water Consumption

Over the period 1983-2001, water consumption fluctuated greatly. While the combined residential and industrial/commercial water consumption during the 80's hovered around 700 L/day/ca, lower consumption rates seen in the early 90's have been slowly creeping back up over the last few years. Water consumption was reduced to its lowest levels in 1996, when the average consumption rate was 503 L/day/ca. Per capita water consumption steadily increased from 534 L/day/ca in 1999 to 632 L/day/ca in 2001. This may be a result of increased industrial/commercial activity, higher irrigation requirements and relaxed efforts by residential consumers to conserve water usage.

Continued education and other measures are necessary to encourage and remind all consumers (both residential and commercial/industrial) to use water more efficiently to: preserve water quality; lower water infrastructure costs; and extend the life of existing municipal facilities for water supply and sewage treatment.

Domestic Water Quality

The quality of Saskatoon's domestic water supply was considered good in 2001, as all measured constituents were within the limits set by Saskatchewan Environment. Tables A2.4 and A2.5 provide detailed water quality data for receiving and domestic water and compare it to the limits set by SE. *Saskatchewan's Drinking Water Quality Standards and Objectives (summarized)* are also provided in Appendix A2.

A discussion of some of the significant parameters is provided below.

Aluminum

With the modification in the coagulation treatment process implemented in 2001, aluminum levels in drinking water have fallen below the detectable limits (0.1 mg/L), compared to 0.7 mg/L in 1997. The limit for aluminum is 0.2 mg/L.

Fluoride

Fluoride levels in 2001 were slightly lower at 0.68 mg/L compared to 0.92 mg/L in 1997. There is a growing body of literature re-examining the efficacy of fluoridated drinking water towards reducing tooth decay.² Significant health concerns attributed to fluoridated drinking water include lowered bone density and increased bone fractures.

Chlorine

Saskatoon uses chlorine gas as a disinfectant to kill microbes that may be harbouring in the distribution system and can cause disease in humans. Although the City reports the chlorine residual (both free and combined chlorine) levels at 1.6 mg Cl₂/L, free chlorine levels range from 0.05 to 0.1 mg Cl₂/L when leaving the plant. SE recommends a minimum level of 0.1 mg/L free chlorine for secondary disinfection in the distribution system.

Trihalomethanes

Related to the level of chlorine residuals in drinking water, trihalomethanes (THMs) are chlorinated organic compounds that are formed as chlorination disinfection by-products (CBPs) in water treatment and distribution systems. Epidemiological evidence suggests a causal role between THM in drinking water and potentially mutagenic and carcinogenic effects. For example, the risk of bladder cancer increases with both duration and concentration of exposure to CBP. SE's interim maximum acceptable concentration (IMAC) for total THMs in drinking water is 100 µg/L. At 32 µg/L, the concentration of THMs in drinking water, were within these limits.

To reduce the level of chlorine used as a disinfectant in water treatment, combining treatment with ozone or ultraviolet light would substantially reduce residual chlorine in drinking water, and the formation of THMs.

² *Fluoride Water Treatment*, Dr. Hardy Limeback, University of Toronto, at: <http://www.slweb.org/limeback.html>

Metals

Average inorganic metal constituent concentrations were reported as below Canadian Water Quality Guidelines. Mercury and lead concentrations are reported below detection limits.

Microbiological Agents

Reported concentrations of cryptosporidium, fecal streptococcus, Giardia, Heterotrophic plate count (HPC), and total coliform were all below detectable limits. Total coliforms are a group of harmless bacteria tested to detect the possible presence of fecal coliform, an indicator of possible water contamination.

Pesticides

The City tests for several known pesticides on a quarterly basis. Data retained for August, 2001 indicates that all pesticides tested for were below Saskatchewan's Drinking Water Quality Standards and the analytical detection limits.

Wastewater and Stormwater Effluent

Table 2.1 indicates that the average annual effluent parameters as part of the WWTP's *Permit to Operate* are within the required limits. For example, total suspended solids (TSS) and biological oxygen demand (BOD) were 8 mg/L and 9 mg/L, respectively, compared to the operating limits of 25 mg/L, each.

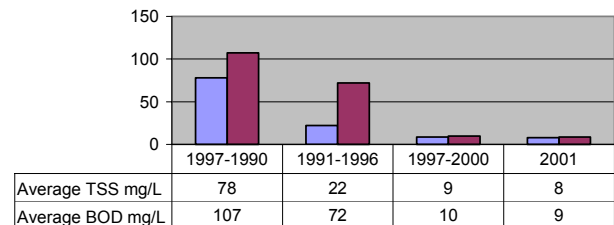
In 1996, activated sludge and biological nutrient removal processes were implemented to provide full secondary treatment at the WWTP. Since that time, TSS and BOD have decreased dramatically. As shown

in Figure 2.2 biological nutrient removal has reduced average TSS and BOD concentrations by 90%.

Table 2.1: Wastewater Treatment Plant Permitting Results

Parameter	Permit to Operate	2001 - Annual Averages
Total Suspended Solids	25 mg/L (weekly average)	8 mg/L
Biochemical Oxygen Demand	25 mg/L (weekly average)	9 mg/L
Phosphorous	1.0 mg/L (annual average)	0.40 mg/L
Bacti (monthly average of geometric means)	200 count/100 ml	No exceedances
Flow	--	28.02 million cubic meters

Figure 2.2: Reductions in Total Suspended Solids and Biochemical Oxygen Demand in the Saskatoon Effluents



To prevent pathogens from entering the SSR, wastewater effluent is chlorinated prior to discharge from the WWTP. However, due to the toxicity of chlorinated compounds and their impact on the SSR, ultraviolet (UV) treatment is budgeted to replace chlorination as part of the City's 2007 capital works projects.

The improvements made in the quality of wastewater entering the SSR from the WWTP has redirected

focus on the relative quality and impact of intermittent urban stormwater discharge. Based on preliminary findings of a study on storm water quality undertaken in 2001 and 2002, mass loading from the storm sewer system is significant in comparison to point source loading from the WWTP³. However, further analysis is necessary to determine its full impact.

Water Quality along the South Saskatchewan River

A study published in 2001 by Environment Canada concluded that “the City of Saskatoon does not appear to be having a significant ecological impact on the South Saskatchewan River”⁴. Benthic invertebrates (aquatic species indicative of watershed health) were found to be diverse and abundant throughout the river below the sewage outfall. The study reported that nutrient concentrations (phosphate and ammonia) were significantly reduced since secondary treatment was introduced in 1996.

Figure 2.3 provides an indication of water quality along the South Saskatchewan River, with Leader (near the Alberta border) being the most upstream sampling station and Muskoday (near the confluence with the North Saskatchewan River), the farthest downstream site. The data reflect the Saskatchewan Water

Figure 2.2: South Saskatchewan River Protection of Aquatic Life SWQI 10 Year Average

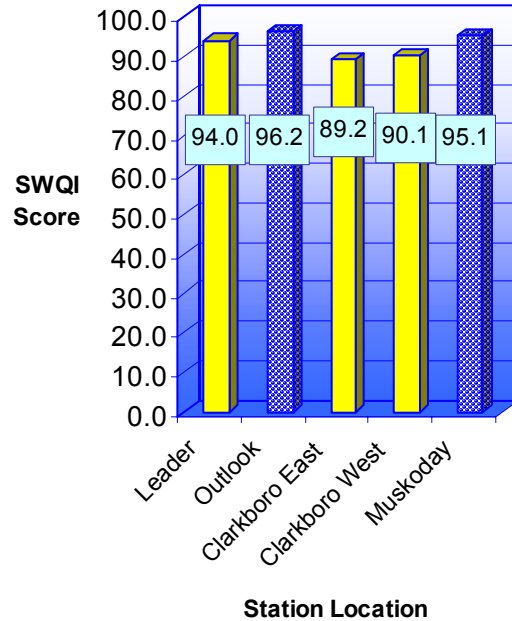
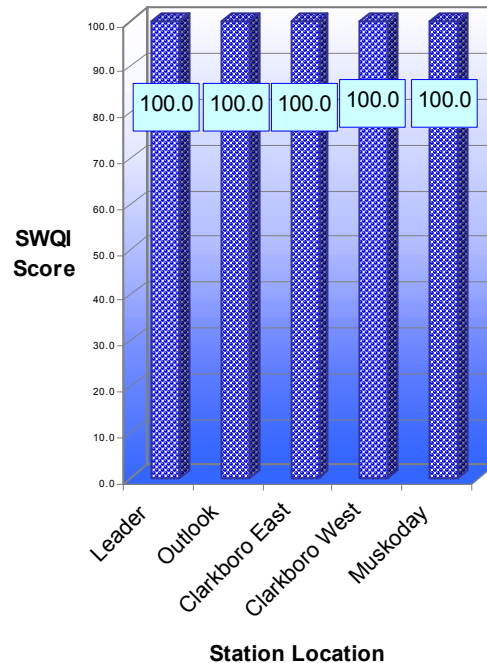


Figure 2.3: South Saskatchewan River Livestock Watering SWQI 10 Year Average



³ *Characterization of Stormwater Input To The South Saskatchewan River Within Saskatoon*, S.M. McLeod, G.J. Putz and J.A. Kells, 2002.

⁴ *Ecological Survey of the South Saskatchewan River Downstream of the City of Saskatoon Wastewater Treatment Plant*, EPS 5/AT/2, Environment Protection Branch, Prairie and Northern Region, Environment Canada, 2001, Page v.

Quality Index (SWQI) numerical ratings for the protection of aquatic life and are based on the mean annual average for the period 1990-2000. For the nearest stations downstream of Saskatoon located at Clarkboro East and West, the SWQI are 89.2 and 90.1, respectively, which correlates to 'Good' (80-94) conditions for the protection of fish and other aquatic life. There was very little variation in the ratings over the study period. The SWQI could not be applied to the years 1997 to 1999 because insufficient water quality data were available.

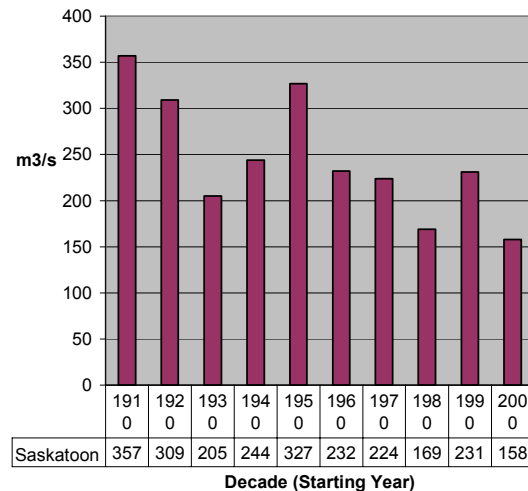
The average SWQI (Livestock Watering) ratings for five specific locations on the South Saskatchewan River are shown in Figure 2.4. Again, water quality data collected during the period 1990 to 2000 were used to determine these ratings. There was very little variation from one station to another in a downstream direction, with all sites experiencing 'Excellent' (95-100) condition for livestock watering.

South Saskatchewan River Water Supply

The 10 year average annual flowrate per decade since 1910 for the South Saskatchewan River at Saskatoon is shown in Figure 2.5. Since the 1960's when the Diefenbaker Dam was constructed, flowrates have been regulated and consistently remained below 250 m³/s. Although there was some variability in average annual flowrates per decade since 1960, the 1980's experienced the lowest rate for any given decade at 169 m³/s. By comparison, the 1-year average annual flowrate in 2000 was

158 m³/s (Figure 2.5), which was lower than the rate for the 10 year average annual periods considered.

Figure 2.5: 10 Year Average Annual South Saskatchewan River Flows at Saskatoon



Further detailed data and information regarding how the data were selected and measured are provided in Appendix A2, including National Pollution Release Inventory data on releases to air, surface water and land for facilities within a 25 km radius of Saskatoon.

Recommendations

Water Consumption

4. That the City develop policies and incentive programs that encourage residential and business consumers to reduce water consumption. For example, these policies could encourage consumers to incorporate water saving devices such as low flow shower nozzles and toilets; and reduce water usage for non-essential activities such as lawn maintenance.

Domestic Water Treatment

5. In light of recent studies that discount the efficacy of water fluoridation on dental carries, evaluate continuing fluoride additions to the water treatment process.
6. Evaluate ultra-violet and ozonation treatment methods of disinfection for minimizing chlorination as a means of reducing the formation of chlorination by-products in domestic water.
7. Develop a disposal method for ferric sulphate sludge produced from the coagulation process at the water treatment plant, in accordance with Provincial requirements.
8. That the City cover the treatment basins at the water treatment plant to prevent organic debris and other matter from entering the domestic supply. This may also be considered to avoid terrorist or nuisance activity.
9. That the Water Treatment Branch prepare fact sheets for public distribution and website access

that provide information on water quality parameters important to domestic water quality.

Wastewater Treatment

10. That the City undertake regular monitoring of storm water quality for general water quality parameters.
11. Due to the expected future regulation of stormwater run-off, that the City evaluate sustainable methods for treating run-off, such as engineered wetland systems.
12. That a public education program be developed to inform individuals that deleterious substances not be dumped down storm drains. That storm drains be stenciled with messages explaining that deleterious substances are not to be dumped into them.
13. That the City maintain its plans to include the replacement of chlorination with ultraviolet treatment of wastewater effluent at the WWTP, in the 2007 capital works budget.

Indicator #3: Energy Usage

Issue context

Energy consumption represents a fundamental component of resource use, and a key aspect of sustainability. A sustainable community conserves non-renewable resources for future generations and expends the minimum in energy resources to meet its needs. Energy consumption is linked to resource depletion, air pollution, habitat fragmentation (through resource extraction, power line and road corridors, etc.), ground water pollution and climate change.

In Canada, space heating accounts for one half of emissions of "greenhouse gases" (GHG) - the products of combustion of fossil fuels that are responsible for accelerated changes in the world's climate. Natural gas is the primary resource that Saskatoon's residential and commercial occupants use for heating. The average detached home produces 50 percent more emissions than an average apartment or condominium.⁵ Trends in natural gas consumption are affected by both price and weather conditions.

Saskatoon's electricity is provided by SaskPower. 70% of SaskPower's electricity is produced by fossil fuels, the remainder comes from hydroelectric power and a small fraction (currently 5.9 MW) from wind power. Electricity consumption for

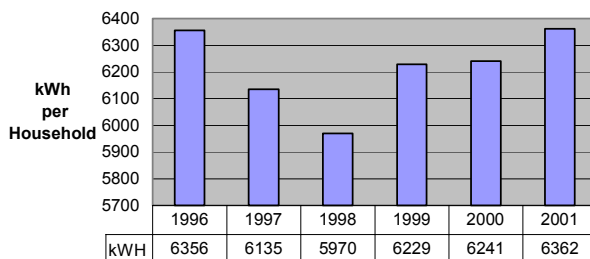
residential and commercial customers within the 1958 city boundary that the city services is compared for the years 1996-2001. While there will be a wide range of electricity requirements by Saskatoon's commercial clients, average annual commercial consumption is a meaningful indicator when cross-tabulated with Saskatoon's gross domestic product over the same period.

Trends and prospects

Residential Electricity Consumption

The average Saskatchewan home uses 7100 kWh of electricity per year. By comparison, Saskatoon residents use approximately 1000 kWh less per year, averaging 6362 kWh/household in 2001. As shown in Figure 3.1, household consumption decreased between the years 1996-1998 and then reversed in trend with marked increases in 1999 and 2001. The end result is that average annual electrical

Figure 3.1: Residential Average Annual Electricity Consumption



household consumption remained unchanged from the start of the period in 1996 to the end of the period in 2001.

⁵ *Kyoto and Beyond* at: www.climatenetwork.org

According to SaskPower estimates, air conditioning units, hot tub pumps, space heaters, furnace fans, vehicle interior warmers, and vehicle block heaters account for the largest electricity requirements⁶.

SaskPower and SaskEnergy have developed a web site that allows electricity and natural gas customers to complete an on-line survey to determine their total energy consumption, associated utility costs and identify potential areas to reduce consumption and save money through replacing dated appliances, home renovations and reduced usage.

Commercial Electricity Consumption

As shown in Figure 3.2, average annual commercial electricity consumption increased steadily over the period 1996 to 2001, experiencing a 12% increase overall. While gross domestic product grew at roughly the same rate for the years 1998, 1999 and 2000, in 2001 there was a marked increase in electricity consumption while GDP declined slightly.

Residential Natural Gas Consumption

For the years 1996-2000, natural gas consumption varied inversely to changes in average winter temperatures, as expected. However, as indicated in Figure 3.3, although the winter of 2001 was almost 4 degrees *cooler* than 2000, Saskatoon residents consumed 5%

less natural gas than the previous year. Evidently, with energy costs 30% higher in 2001 than the previous year, Saskatoon residents were motivated to find ways to reduce their consumption in order to keep their heating costs down, even though they experienced colder weather conditions.

Figure 3.2: Commercial Average Annual Electricity Consumption

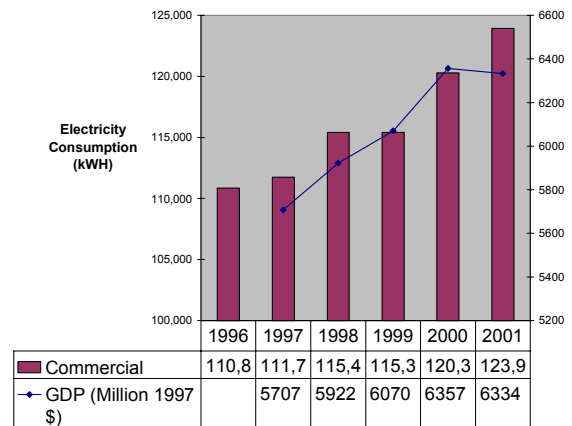
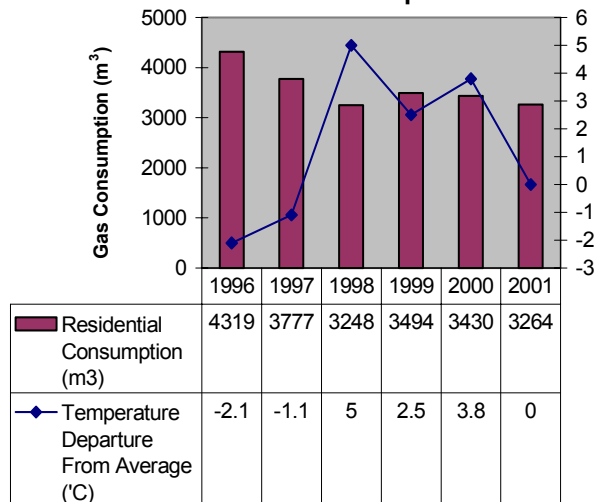


Figure 3.3: Residential Average Annual Natural Gas Consumption

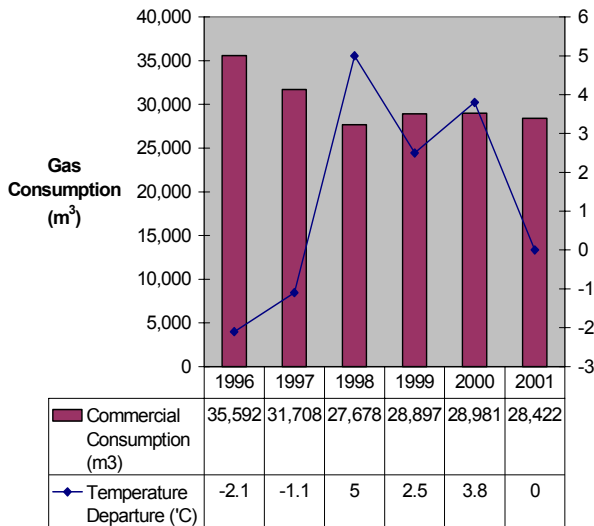


⁶ 1998 Operating Costs, SaskPower, Customer Services Business Unit.

Commercial Natural Gas Consumption

The commercial sector was not as responsive to increased natural gas prices. As shown in Figure 3.4, gas consumption was 2% below 2000 consumption levels at 28,422 m³ natural gas/customer in 2001.

Figure 3.4: Commercial Average Annual Natural Gas Consumption



Further detailed data and information regarding how the data were selected and measured are provided in Appendix A3.

Recommendations

14. That the City develop an education program to promote the more efficient use of non-renewable fuels and encourage the utilization of alternative, renewable energy sources.

15. That the City review its building codes, standards, bylaws and fee structures to identify how the City can encourage residents and businesses to improve energy efficiency, utilize renewable energy sources and reduce their energy usage. As part of this initiative, the following modifications to the City's Building Bylaw 7306 are recommended:
 - a) Adoption of R2000 standards for new home construction by 2007.
 - b) Adoption of the Commercial Building Incentive Program (CBIP) by 2005.

Indicator #4: Transportation

Issue context

Conventional fuel-powered vehicles contribute significant amounts of primary pollutants that affect urban ambient air quality, as well as the development of ground level ozone and acid rain. Additionally, fuel emissions are a major contributor of greenhouse gases that contribute to global warming.

By considering the transportation choices of city residents, comparing these to other Canadian cities and identifying the capacity for commuters to access alternative modes, we can assess the degree to which the City is facilitating sustainable transportation choices. In support of this, Saskatoon's Development Plan⁷ has set out the following as part of its policy regarding transportation needs:

"The proximity of new residential development to the Downtown and other major areas of employment shall be a goal in determining the overall form of the City. Mixed-use focal points, significant employment opportunities, and other major community facilities shall be situated to minimize the need for new transportation infrastructure, and to encourage greater use of the public transit system."

Mode Share assesses the means by which commuters travel to and from

⁷ Development Plan Bylaw No. 7799. Page 4, City of Saskatoon.

the downtown and compares it to other Canadian cities. Motor vehicle ownership per capita relates the trend in our reliance on motor vehicles. Public transit use provides an indication of how well we are utilizing this public service for our transportation needs. By providing baseline data on the percentage of dedicated pedestrian and bike trails in Saskatoon versus the total length of surfaced streets, we will be able to gauge the relative change in this indicator in future reports.

Trends and prospects

Mode Share

Figure 4.1 provides a breakdown of the Mode Share during peak morning and afternoon periods into the downtown core. 83% of commuters travel by private automobile, compared to 12% that travel by public transit, 3% are pedestrians and 2% travel by bicycle.

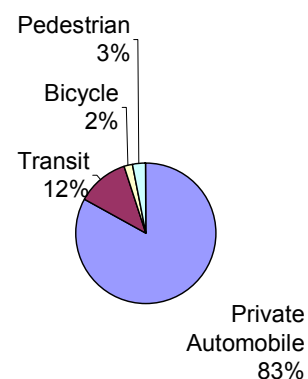
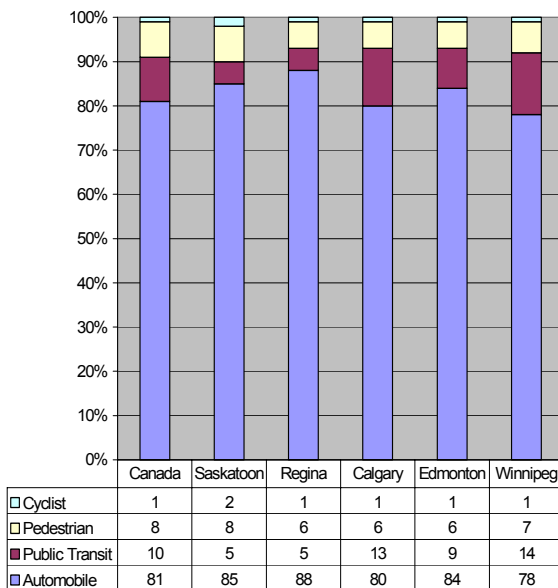


Figure 4.1: Mode Share for Saskatoon's Central Business District (2001)

Travel to work data compiled during the 1996 Canadian Census for major western-Canadian cities is shown in

Figure 4.2. The Census found that 85% of Saskatoon commuters travel by automobile, which is higher than the National average of 81%. This discrepancy may be primarily attributed to significantly lower public transit usage (5%), compared to the national average (10%).

Figure 4.2: Mode Share Comparison (1996)



Both Calgary and Winnipeg have heavily invested in their public transit infrastructure and consequently, their public transit usage exceeds the national average at 13% and 14%, respectively. The data suggest that reducing private automobile usage within Saskatoon could be achieved by promoting greater transit usage through expanded public transit services and other transit policy initiatives.

Motor Vehicle Ownership Per Capita

Motor vehicle ownership per capita in Saskatoon increased dramatically through the 1980's and then leveled

off during the 1990's⁸. Vehicle ownership in 2001 was 0.66 vehicles per capita. Comparing this trend to public transit ridership indicates that more people are driving instead of using public transit.

Public Transit Use

Between 1982 and 1997, transit ridership in Saskatoon declined by 51%⁹. At least 60% of transit riders were women. The highest ridership occurred in the 15-24 age group. Major factors identified as contributing to ridership declines included:

- Decentralization of Employment
- Residential Development and Decentralization of Population
- Auto-ownership
- Fare increases
- Service cuts

Transit usage is sensitive to fare increases. Studies on fare elasticity have shown that on the average, a ten percent increase in bus fares results in a four percent decrease in ridership¹⁰.

High auto ownership and use (0.97 cars per working resident for personal use), especially in outlying suburban areas, contributes significantly to decreased transit ridership. Suburban growth leads to the movement of workers from established urban and suburban

⁸ *Traffic Characteristics Report 2001*, City of Saskatoon, Infrastructure Services Department, Municipal Engineering Branch.

⁹ *City of Saskatoon 1997 Transit Planning Study – Summary Report*, Reid Crowther and Partners Inc., 1998.

¹⁰ *Fare Elasticity*, American Public Transportation Association at: <http://www.apta.com/info/online/elastic.htm>

neighborhoods to the new suburban neighbourhoods. This decentralization results in changes in travel patterns and increases commuter's dependence on private transportation. When combined with the movement of employment away from the central business district, decentralization is a significant factor responsible for declined transit ridership.

In a report produced for the City of Winnipeg several items were identified that may be applicable to improving public transit in Saskatoon. The report recommends that public transit be focused on:

- Financial accessibility;
- Fare structure;
- Speed;
- Reliability;
- Comfort;
- Convenience;
- Physical accessibility; and Productivity¹¹

Length of Dedicated Pedestrian and Bike Trails as a Percentage of Total Length of Surfaced Streets

In 2000, there were 957 kilometres of surfaced streets in Saskatoon¹². There are 25.5 kilometres of dedicated pedestrian and bike trails which have been developed by the Meewassin Valley Authority within the City limits¹³. Based on these

figures, dedicated pedestrian and bike trails account for less than 3% of the total kilometers of surfaced streets. Although these figures are low, it is recognized that cyclists share roadways and pedestrian walkways with their counterparts.

In an effort to reduce automobile usage within the city, SEAC recommended in November 1999 that the five-year Bicycle Network Plan proposed by the Traffic Management Branch of Infrastructure Services be supported by City Council¹⁴. Recently, the City published a Plan¹⁵ detailing several goals for promoting and facilitating cycling as a mode of travel. The Plan is based on the guiding principles that:

- Every street is a cycling street.
- Every bicycle trip improves the quality of life for all.
- Bicycles can be used safely and without fear of injury.

In addressing these principles, the Plan recommends that the City provide adequate facilities for cyclists, enact appropriate legislation for cycling, and establish an education program.

Further detailed data and information regarding how the data were selected and measured are provided in Appendix A4.

¹¹ *Direction To the Future: The Guide to Better Transit For Winnipeg Final Report*, January 2000, City of Winnipeg Working Group on Public Transportation Policy at: <http://www.winnipegtransit.com/OtherPages/transitReport.pdf>

¹² *City of Saskatoon Municipal Manual 2001*, Compiled By The Office of The City Clerk

¹³ *State of the Valley*, Meewassin Valley Association, 1998.

¹⁴ *Bicycle Network Plan, File No. CK 175-9*, Saskatoon Environmental Advisory Committee Report, Nov. 1999, Subject:

¹⁵ *Comprehensive Bike Plan*, City of Saskatoon, Infrastructure Services Department, November, 2002.

Recommendations

16. That municipal policies be revised to encourage individuals' primary transportation choices to shift away from private vehicles and instead to public transit. Actions for consideration to encourage and promote public transit include:
- Educational awareness programs;
 - Improving access to public transit by re-directing financial resources from budgets for new road construction towards public transit initiatives;
 - Discouraging private vehicle use by redesigning transportation corridors within the City to favour public transit; and
 - Limiting the size of parkades at shopping malls, and providing incentives for grocery and other delivery services to reduce the need to use personal vehicles for shopping trips.
17. That the City develop programs and infrastructure to realize the immediate target of doubling transit usage from 5% to 10%, to reflect the national average.
18. That strategies directed at facilitating ridership from outlying, new residential developments be considered at the neighbourhood development stage.
19. That improvements to Saskatoon's public transit system be focused on:
- Financial accessibility
 - Speed
 - Reliability
 - Comfort
 - Convenience (For example, by providing readily accessible route

and schedule information at all bus stops and kiosks.)

- Physical accessibility
- Productivity

Indicator #5: Resource Recovery

Issue context

In today's society, solid waste generation is an unavoidable part of living. Garbage collection and disposal are considered a core service of municipal government that is funded through the municipal property tax base and tipping fees at the landfill. "Waste... is the result of over-consumption, poor product design, inefficiencies in manufacturing processes, use and recovery of materials, and ineffective market signals to correct these deficiencies"¹⁶. So, while municipal governments do not have control over regulating the production of products and packaging that are collected by municipal solid waste collection departments, ultimately they are the ones left "holding the bag".

The principle of *environmental stewardship* is concerned with the long-term health of the land and its resources, while recognizing the responsibility incumbent upon all of us to preserve it for future generations. Environmental stewardship governs the decision making process and actions within The City of Saskatoon's waste management program¹⁷. The program is committed to: reducing, reusing, recycling and recovery of resources; informed decision

making; working cooperatively with the community; and a comprehensive /integrated approach. The City recognizes a responsibility for education and communication, and cost effectiveness.

Waste represents not only a loss of resources, both financial and material, but a potential danger to human and environment health. The migration of toxic leachate into surface and groundwater and emissions of toxic chemicals into the air can be dangerous to human health and the environment. Methane gas produced from the decomposition of organic matter in landfills contributes 3% to Canada's greenhouse gas emissions. As it is currently being utilized, the City's landfill is expected to reach its maximum rated capacity (5.5 million cubic metres) in about 10 years, thus adding further incentive for the City to reduce waste disposal.

Waste diversion in Saskatoon is limited by the availability of adequate financial resources to fund an integrated waste management program. Currently, other than the property tax base, the largest source of revenue for cost recovery is tipping fees. While deposit revenues represent a great potential for offsetting the cost of recycling and waste diversion programs, these funds are not available to municipal governments. In response to this situation, Saskatoon relies on partnerships and the efforts of non-civic collection and recycling programs to provide waste diversion services.

¹⁶ ENVIRONMENTAL ISSUES, Adopted May 2001, FCM Annual Conference, at: <http://www.fcm.ca/english/national/enviro1.htm>

¹⁷ Waste Management Program, Strategic Plan 2002, Environmental Services Department, City of Saskatoon, 1997.

Trends and prospects

Cities initiatives taken in 2001 to address waste diversion included:

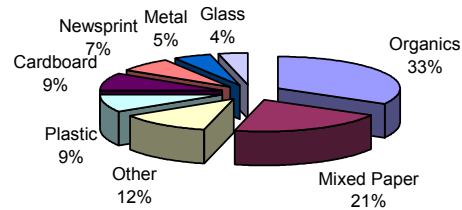
- The sale of residential composting bins: this event was well received, all bins were sold. A recent survey indicates that 9 out of 10 respondents reported that they are utilizing these composting bins¹⁸.
- A new partnership with SARCAN for the collection of milk cartons and jugs.
- A test site for cardboard collection with Cosmopolitan Industries.

Residential Waste Composition

The approximate composition of Saskatoon's residential waste stream is shown in Figure 5.1. Organics and mixed paper at 33% and 21%, respectively, represent the major components of residential waste collected and disposed of at the City landfill. Newsprint accounts for only 7% of the total residential waste stream, as most newsprint is diverted to recycling collection depots in partnership with Cosmopolitan Industries. Organic waste, including yard and food waste has been targeted for increased diversion through the promotion of composting and yard waste collection depots. SARCAN provides diversion through the collection of beverage containers including glass, aluminum cans, tetra-paks, milk cartons and jugs at its depot locations throughout the City.

¹⁸ CITY OF SASKATOON COMPOSTING SURVEY, Pulse Research Limited, October 2002.

Figure 5.1: Residential Waste Stream Composition



Residential Waste Diversion

For comparison purposes with other municipalities, the City applies the *Corporations Supporting Recycling (CSR) Generally Accepted Principals (GAP)* methodology to assess waste diversion. Using this methodology, the City considers the total residential and non-residential waste collected by City trucks along with waste diverted to all civic and non-civic repositories. Based on this approach, Saskatoon's residential flow diversion rate is 24%¹⁹. The collection of newsprint and other paper products accounts for 57% of the total flow diversion rate. Using this methodology to compare Saskatoon's waste reduction and diversion rate to other Canadian cities indicates that these efforts are similar to other municipal jurisdictions. However there are limitations to this method (as discussed further on).

The proportion of waste diverted from each waste stream is shown in Figure 5.2, based on weight

¹⁹ Environmental Compliance Branch Annual Report, 2001, Utility Services Department, City of Saskatoon, 2002.

percentages. Newspaper, glass and cardboard demonstrate the highest rates of diversion at greater than 20% each. Facilities for some waste diversion exist for each of these categories via Cosmopolitan Industries and SARCAN. However, less than 20% of disposed organics, plastic, mixed paper and metals are diverted. These waste streams also represent those categories for which access to recycling facilities is limited. In this case, a lack of adequate provisions for recycling as well as access to recycling facilities, contributes to low diversion rates. Low diversion rates for organics, plastic, mixed paper and metal identifies a high potential for improving recycling rates within these waste streams.

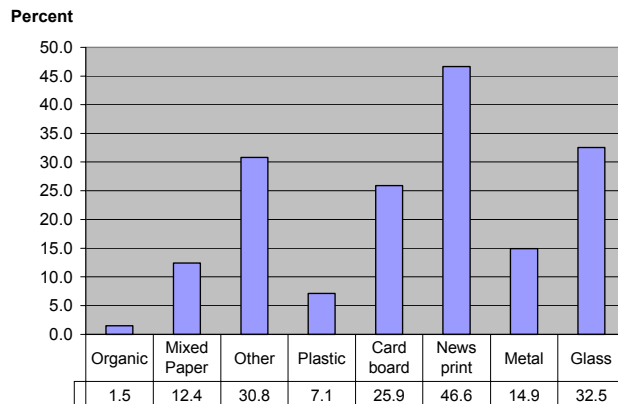
- Organics produce toxins such as NO₂, NH₄, CH₄ that may leach from the landfill

Although the City has undertaken several initiatives in recent years to reduce the disposal of organics at the landfill, such as yard-waste only collections, these efforts have met with marginal success. Continued efforts are necessary to enlist the participation of City residents in reducing the amount of organics disposed at the City landfill through diversion incentives and opportunities supported by educational programs that promote awareness of the importance of waste reduction.

Waste Received At the City Landfill

In terms of overall waste received by the City landfill, total waste to landfill decreased by 30%, from 139,491 tonnes in 1996 to 96,611 tonnes in 2001. While this trend is important for prolonging the life of the landfill, it does not translate into a drop in overall waste generation by either the residential or the non-residential sectors. As shown in Figure 5.3, the decrease was due to a reduction in non-residential waste to landfill by more than 50%, which was twice the targeted decrease of 25% reduction²⁰. The reduction in non-residential waste was in part due to the shift in disposal from the City landfill to private landfills outside of the City. Because private landfills are not required to report their waste tonnage, it is therefore not possible to assess the non-residential trends

Figure 5.2: Percent of Residential Waste Stream Diverted



At 1.5 %, the diversion rate for organics accounts for City landfarming programs but does not account for organics diverted through home composting efforts. However, organics represent a crucial component of the waste stream to target for immediate reductions for the following reasons:

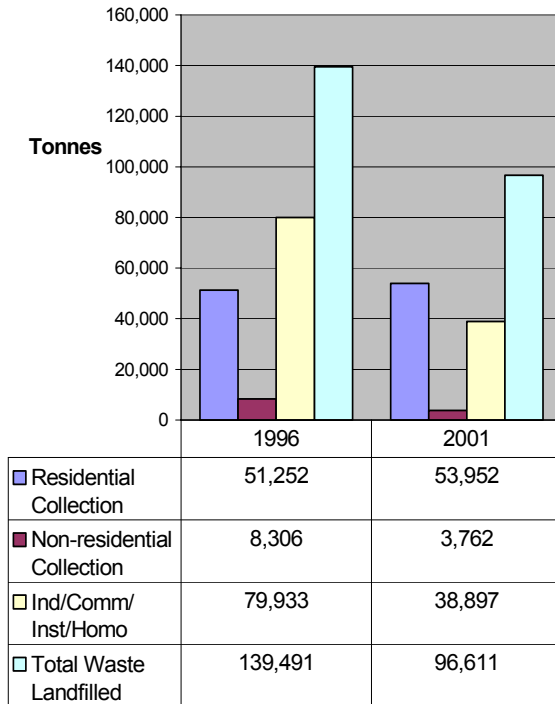
- 33% of the residential waste stream is organic

²⁰ Waste Minimization Program: Strategic Plan 2002, 1998, Environmental Services Department, City of Saskatoon.

in waste generation or diversion.

Between 1996 and 2001, residential waste to the landfill did not change significantly on a per capita basis.

Figure 5.3: Comparison of Landfill Tonnage By Sector



The Waste Minimization Program targeted a 25% reduction in residential waste generation by 2002. As discussed earlier, while Saskatoon residents are diverting greater amounts of waste to recycling programs, in terms of total residential waste generation and diversion, per capita waste disposal rates have remained steady. As a result, total waste *generation* per capita has *increased* by almost 20%. This reflects a global trend where growth in gross domestic product (GDP) is in step with waste

generation growth²¹.

In keeping with the City's philosophy of developing partnerships with non-civic organizations, non-profit and private businesses are providing the bulk of diversion services to Saskatoon's residents. In 2001, city waste diversion programs were responsible for diverting 6% of the total solid waste received at the City Landfill. City-run programs increased their diversion rates by 60% from 4292 tonnes in 1997 to 6825 tonnes in 2001. The bulk of the diversion is attributed to old newspapers that were collected by the City and recycled by Cosmopolitan Industries. Other programs not managed by the City, such as SARCAN and SARRC diverted 14,008 tonnes of waste, or 12%. The discrepancy in figures between those calculated according to the CSR's GAP method is because the GAP method considers only waste collected by civic trucks, instead of total waste landfilled.

Currently, annual collection costs are approximately \$23 per capita. This translates to less than \$100 per year per Saskatoon household for collection services, which is far lower than many major Canadian cities. Waste Minimization services accounted for 9% of the Solid Waste Management Budget of over \$5 million.

According to a recent survey²², the majority of City residents (69.4%) are

²¹ ENVIRONMENTAL ISSUES, Adopted May 2001, FCM Annual Conference, at: <http://www.fcm.ca/english/national/enviro1.htm>

²² "Appendix 1: Survey Results, Solid Waste Management Survey, May 1998", Solid Waste Management Master Plan 2000-2020, City of Saskatoon, 2000.

in favour of a City-run household waste management program that involves recycling, landfarming or composting organics, and landfilling. 50.9% of respondents indicated they would be in favour of a system where users pay directly for the management of household waste through surcharges on recyclables and a direct user-pay for recycling services. Over two-thirds of respondents were in favour of the City collecting recyclables by using depots where residents must bring their recyclables. It is unclear whether other options for collection were presented for consideration.

In 2001, the City provided a pamphlet listing recycling programs that are available throughout Saskatoon. However, convenience of the current system is limited by the accessibility to these recycling services. Although there are efforts to increase the number of collection stations, currently these are sparsely located, and not all materials can be returned at any one location because different organizations collect different materials. More cooperation between these organizations is required to improve the effectiveness of these programs.

Further detailed data and information regarding how the data were selected and measured are provided in Appendix A5.

Conclusions and Recommendations

Waste *reduction* continues to be the most environmentally effective and cost-effective measure of a waste management strategy. Better incentives are required to achieve the goal stated in the *Waste Minimization Program, Strategic Plan-2002* of a 25% reduction in residential waste collected by the City. Continuing efforts to implement the recommendations of the Strategic Plan, such as educating residents on the importance of reducing waste and packaging, are necessary to counter the trend in increased residential waste generation.

Organics, plastics, glass, metal and mixed paper were identified as under-diverted waste streams, that require an enhanced waste diversion strategy. At 21% of the post-diversion waste stream, mixed paper is a primary target. While metal represents only 5% of the total residential waste, it is also a worthy target because of the access to a local market at IPSCO in Regina. In this instance, education and opportunity may all that is necessary to stimulate increased diversion of metal.

Based on the above evaluation, the following recommendations have been identified.

20. That the City undertake discussions with the Government of Saskatchewan to encourage provincial legislation and product stewardship programs that provide regulations and market incentives for local solid waste reduction and resource recovery programs.
21. That the City explore ways of encouraging waste reduction and diversion within all its municipal operations and future development plans. For example, the City's *Development Plan* should be reviewed and revised to include provisions for an integrated waste management strategy.
22. That the City consider ways to develop viable partnerships and programs with other established organizations, such as manufacturers, retailers and service organizations.
23. That the City create a product stewardship program to divert targeted waste streams from the municipal landfill. For example, a stewardship program for disposed computer hardware will be required in the coming years as this waste stream burgeons.
24. That changes to existing bylaws be considered to discourage or prohibit yard waste from entering the regular waste collection system. As is the case in Nova Scotia, consideration should be given to banning yard waste from the City landfill.
25. Lacking a curb-side recycling program, that the City increase accessibility to recycling facilities by accelerating the rate at which it establishes *full-service*, community based collection depots for recyclable items. Items that have been identified for enhanced waste recovery via a full-service depot include:
 - Yard and garden waste
 - Mixed Paper
 - Metal Cans
 - Clear and colored glass
 - Plastics
 - Batteries
 - Ink cartridges
 - Household hazardous wastes
 - Used oil
26. That the City re-assess whether support exists for curb-side versus community-based depot facilities and other waste reduction initiatives.
27. That greater awareness of the City's Waste Minimization Program be developed through an enhanced website, featuring information on the City's waste minimization efforts and access to applicable documents, such as *Strategic Plan 2002*.
28. That future direction for the City's strategy for resource recovery and waste minimization be addressed in a Strategic Plan for Waste Minimization for the next five-year period (2003-2007). That progress made on implementing action items identified in *Strategic Plan 2002* and future plans be included in the Environmental Compliance Branch's annual reports.

Indicator #6: Urban Form

Issue context

Growth in Canada's urban areas is attributed to changes in population and an urban form shaped by car-oriented planning. The use of automobiles and the development of related infrastructure has caused employment to shift away from central core areas in many Canadian cities, including Saskatoon.

Over the last fifty years, preferences in location and type of home also changed and accelerated the expansion of urban areas. Single-family homes, which consume more land than other dwelling types, as well as occupying relatively larger lots away from the central core, dominate the urban form.

Industrial parks, recreational facilities, shopping malls with their adjacent parking lots are all commonly found in suburbs. These spaces all contribute to a need for more space to house a given population, and result in a decline in urban population density.

Related to this issue, urban sprawl contributes to higher infrastructure demands on municipal and other services including electricity, natural gas, water, sewer and transportation services that consume energy, and other natural resources to install and maintain.

The City of Saskatoon²³ identifies as

²³ City of Saskatoon Development Plan, Schedule 'A' to Bylaw No. 7799, page 3.

its objectives for urban form and structure:

"To build a fiscally, socially and environmentally sustainable community by:

- i. Ensuring the efficient use of land and civic infrastructure;*
- ii. Maintaining a rational and effective system to manage urban growth; and*
- iii. Providing an appropriate distribution of important community facilities and services throughout the City."*

To achieve these objectives, The City of Saskatoon's *Development Plan* outlines policies directed at:

- Compact City Form
- Role of the Downtown
- Community Focal Points
- Concentrate Activities
- Transportation Needs
- Suburban Development Areas
- Suburban Centres
- District Commercial
- Residential Land Use and Neighbourhoods
- Infill Development
- Parks and Open Spaces
- Industrial Development

As one of its major objectives for future growth²⁴, the City identifies promoting the retention of prime agricultural land, significant natural areas, and wildlife habitat.

Comparing Saskatoon's population density with that of other Canadian cities provides a relative assessment of urban sprawl. Reviewing the historical growth in land annexations

²⁴ Future Growth of Saskatoon, "A Tradition of Planning", Final Report and Recommendations. City of Saskatoon, June, 2000.

provides an indication of how our footprint (in terms of land area occupied) has grown over the last sixty years, displacing agricultural land and natural areas. Considering the distribution of the type of new housing starts relates the trend in population density for new neighborhoods and the resources necessary to build and service them. Single-unit dwellings use more land than two-unit or multiple-unit dwellings, consequently requiring proportionately more resources and being greater contributors to urban sprawl. The impact of the type of unit dwelling on urban sprawl is also reflected in the housing density of a neighbourhood.

Considering the number of community gardens provides an indication of the extent to which civic policies and programs attain the *fundamental value* of Saskatoon as a sustainable community within the context of its urban form. A community garden may be uniquely structured to meet the needs of its community. Typically, land is utilized to produce food and flowers for its members. Land for community gardens may be provided on City-owned land, land controlled by other government agencies, or privately owned land. A community education program, which encourages the involvement of schools, youth groups and citizens, is typically integral to its activities.

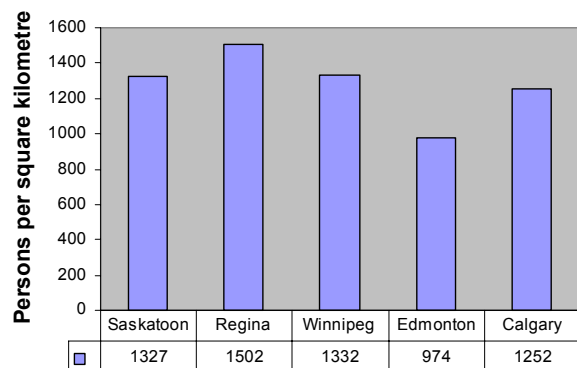
Trends and prospects

Population Density

Saskatoon is not considered a sprawling city when compared

against other Canadian cities. The average population density in Canadian cities was at 799 persons per square kilometre in 1996. Saskatoon’s population density is significantly higher, at 1327 persons, based on a land area of 148 km² in 2001, and the 2001 census population for Saskatoon. As shown in Figure 6.1, Saskatoon’s population density is comparable to that of Winnipeg’s.

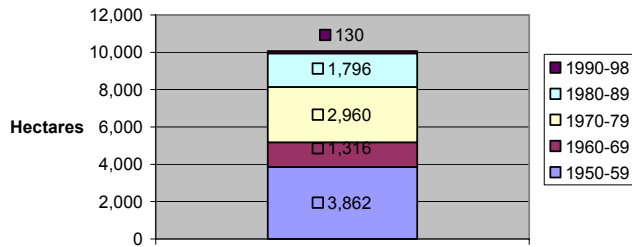
Figure 6.1: Population Density Comparison for Major Prairie Cities



Rural Land Converted to Urban Uses

Table 6.2 shows how the City of Saskatoon has grown over the period 1950 to 1998. The largest growth occurred during the 1970’s to accommodate the housing demands of the “baby boomers”. Saskatoon’s current boundary and land inventory is expected to accommodate a population of 270,000 using current land development practices and will reach the expected capacity in 25 years, based on current rates of population growth.

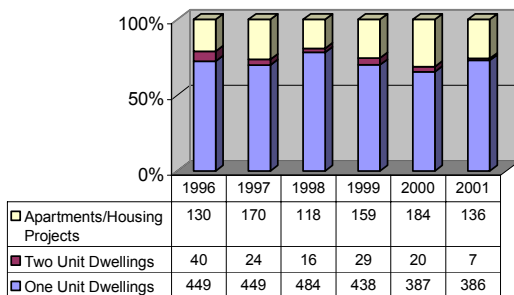
Figure 6.2: Land Annexations Made By the City of Saskatoon per Decade (1950-1998)



New Housing Starts By Type

As shown in Figure 6.3, single unit dwellings consistently made up the bulk of new housing starts over the period 1996-2001. Averaging 70% of annual new home construction, single unit dwellings remain the type of new homes Saskatoon residents

Figure 6.3: New Housing Starts By Type Comparison



prefer, with no discernible change in this trend over the period. Two unit dwellings accounted for only a small fraction of all new homes (less than 5%). Apartments and other housing projects account for one quarter of all new housing starts.

Housing Density

Table 6.2 provides housing density data for core, suburban and future neighbourhoods. While core neighbourhoods built prior to the Second World War had relatively high housing densities, following this period housing densities decreased dramatically.

Currently, housing densities in new neighbourhoods are reverting back to a higher housing density. For example, the plan for the new Willowgrove neighbourhood in the North East sector of Saskatoon will have a population density of 13.8 housing units per hectare. This is higher than suburban neighbourhoods that average 9 units per hectare. However, older neighbourhoods such as City Park average 21 units per acre²⁵. Based on the proposed Suburban Development Areas Plan, the expected lot size of a single unit dwelling in new neighbourhoods will average 13m x 35m.

Table 6.1: Housing Density

Neighbourhood	units per hectare
Core neighbourhoods:	
City Park	21.0
Nutana	20.5
Suburban:	
Hudson Bay Park	8.4
Nutana Park	9.1
Lakeridge	9.1
Silverwood Hts.	9.4
New 2003 and beyond:	
Willowgrove	13.8
Hampton Village	15.1
Stonebridge (preliminary)	14.8

²⁵ City of Saskatoon, *Urban Planning, email communication, 2003.*

Number of Community Gardens

Child Hunger and Education Program (CHEP), a non-profit organization, currently operates the only community garden in Saskatoon on a vacant, privately owned lot at 19th St. and Avenue F.

A report recommending that the City endorse community gardening on City-owned land was accepted in September, 1999²⁶. The recommendation also contained policy guidelines for the establishment of community gardens on City-owned land. This recommendation has facilitated the first park-based community gardening initiative in Saskatoon. The City Park Community Association in partnership with CHEP is currently in the process of developing a memorandum of agreement with the City to undertake a community garden at Wilson Park. There are also 96 garden plots rented out on an individual basis on vacant City land at Richardson Road and 37th St. The cost of renting a plot are subsidized to a small extent by the City.

Recommendations

29. That the City develop policies that encourage developers and residents to shift away from building single unit dwellings and instead towards multiple unit dwellings for new home construction.
30. That the City continue to evolve their plans for new residential developments to reflect sustainable neighbourhood designs that minimize resource use.
31. That the City implement a standardized process for promoting and facilitating the development of community gardens within public parks and spaces.

²⁶ *Community Gardening in Parks*, General Manager, Infrastructure Services, September 15, 1999.

Indicator #7: Contaminated Sites

Issue Context

A contaminated site is "one at which substances occur at concentrations (1) above (normally occurring) background levels and pose or are likely to pose an immediate or long term hazard to human health or the environment, or (2) exceeding levels specified in policies and regulations"²⁷. Surface and ground water quality, as well as habitat and ecological systems can be impacted.

Based on the premise of "polluter pays", in 1998²⁸ Saskatchewan implemented a strategy for addressing contaminated sites that aids in determining appropriate remedial measures, identifying responsible persons, and provides a process for apportioning responsibility for the remediation of contaminated sites. Contaminated sites, where responsible parties cannot be located or owners are unable to finance the remediation of the properties, are known as "orphan" sites.

Saskatchewan Environment and the City of Saskatoon have been involved in the identification and clean up of contaminated sites in Saskatoon for a number of years. While many contaminated sites within Saskatoon have been

identified, work continues in the identification, assessment and clean up of contaminated sites. Through the provincially funded Centenary Fund, the cleanup program has provided an opportunity for formerly contaminated properties to become productive again.

Trends and prospects

Saskatchewan Environment does not retain a readily accessible database listing identified contaminated sites within Saskatoon. While the City of Saskatoon Fire and Protective Services Department does retain records, they are not readily retrievable. Table 7.1 identifies contaminated sites within or on the perimeter of Saskatoon that have undergone remediation in recent years.

Table 7.1: Remediated Contaminated Sites

IPCO Herbicide Formulating Plant	Located north of Silverwood Heights in Saskatoon, the site has long been identified as an abandoned site, contaminated with heavy metals and hydrocarbons. In 2000-2001, the Site was identified as a high-risk site and selected for remediation by SE, through funds received from the province's Centenary Fund.
NWR Salvage on 11th Street West	NWR was a salvage yard for batteries, wire insulation and tires. Contamination was cleaned up during 2001-2002.
Inland Steel	The former Inland Steel site, located at 22 nd Street and Avenue F is identified as contaminated with organic and inorganic contaminants. Clean-up of the Site to Residential/Parkland conditions is expected to be undertaken soon. Following remediation, a park is proposed for development on the site.
John G Diefenbaker International Airport	The Federal Contaminated Sites and Solid Waste Landfills Inventory identifies two contaminated sites at the airport. Petroleum hydrocarbons and PAH's were identified. Action not likely required. Current status 4: Under risk management.

²⁷ *The Federal Contaminated Sites and Solid Waste Landfills Inventory*, Treasury Board of Canada Secretariat, at: <http://www.tbs-sct.gc.ca/dfrp-rbif/cs-sc/home-accueil.asp?Language=EN>

²⁸ *Environmental Liability and Contaminated Site Management; A Strategic Approach for Saskatchewan*, Saskatchewan Environment at: http://www.se.gov.sk.ca/environment/protection/land/hazardous/CSL_Strategic_Approach.pdf

In addition, a number of lower-risk contaminated sites involving underground storage tanks containing fuel or other substances related to agricultural or industrial chemicals, may be in the clean up process.

Further detailed data and information regarding how the data were selected and measured are provided in Appendix A7.

Recommendations

32. That a registry and classification system for contaminated sites located within Saskatoon be developed in order to allow for identification and monitoring of contaminated sites. The Federal Contaminated Sites and Solid Waste Landfills Inventory program could be referenced as a guide for its development.

Indicator # 8: Habitat

Issue Context

Saskatoon is located within Saskatchewan's Prairie Ecozone, an area comprising the northern extension of open grasslands in the Great Plains of North America. The area surrounding Saskatoon is predominantly used for agricultural purposes, consequently, there are few remnants of the natural grassland ecosystem remaining, and loss of wildlife habitat is considered at a high level of risk.

Urban development has necessarily impacted wildlife habitat due to settlement along the South Saskatchewan River valley (an important wildlife corridor) and displaced native prairie habitat with residential, commercial and industrial land uses.

The document "*Future Growth of Saskatoon, A Tradition of Planning*"²⁹ identifies retaining significant natural areas and wildlife habitat as integral to preserving the environmental health of Saskatoon and the neighbouring region. Preserving endangered habitats and minimizing the impacts of urban settlement on surrounding habitats is fundamental to urban sustainability.

Canadians are also becoming increasingly aware, and concerned, about the relationship between the presence of toxic substances, and

human health. The City has prepared a brochure that outlines alternatives to chemical pesticides for lawn and garden maintenance, and also provides information on recommended methods of application and other safeguards.

Monitoring the trend in the ratio of greenspace to total land area will in future reports allow for assessing whether this ratio is increasing or decreasing over time. A discussion of parks management practises provides a general description of the methods employed within City parks to maintain open spaces.

Environmentally sensitive habitat and species-at-risk are identified within Saskatoon and the Moist Mixed Grassland Ecoregion. Urban forest and Dutch elm disease (DED), assess the extent and relative proportion of trees in Saskatoon on City-owned land and discusses the threat posed by DED.

Trends and prospects

Greenspace as a percentage of total land area

According to the data compiled in the City's municipal manuals for 1997 and 2001, total greenspace as a percentage of total land area in Saskatoon decreased slightly between 1996 and 2000 from 18% to 16%³⁰. While 40 hectares of park space were added, 2500 hectares of agricultural land annexed over this period reduced the proportionate amount of green space. As a result,

²⁹ *Future Growth of Saskatoon, "A Tradition of Planning", Final Report and Recommendations.* City of Saskatoon, June, 2000.

³⁰ *City of Saskatoon Municipal Manual, 1997 and 2001, Compiled By The Office of The City Clerk.*

these figures under-represent the percent of green space since annexed, non-developed land was not classified as greenspace but added to the total land inventory.

Table 8.1: Greenspace as a percentage of total land area

	1996	2000
	hectare	hectare
City Parks within City Limits	904	944
Parks outside City Limits	372	372
Afforested Areas	205	205
Buffer Strips	102	102
Environmentally Sensitive Habitat	954	954
Total Greenspace	2537	2577
Total Land Inventory	14,133	16,595
% Greenspace	18 %	16 %

The City³¹ considers a ratio of four hectares of public open space for every one thousand persons as adequate and reasonable. Such open spaces may include Municipal Reserves and other publicly owned land areas as are dedicated or assigned to fulfilling the needs of public enjoyment and recreation. In 2001, the City provided 12 hectares of public open space per 1000 persons, which tripled this target.

³¹ *City of Saskatoon Development Plan, Bylaw No. 7799, Section 9.2.2.*

Parks Management

Park management practices focus on low impact methods such as aerating turf beds, irrigation during low evaporation loss periods, usage of drought resistant plants, and twice per month mowing on turfed areas. Along arterial roads and Circle Drive, grass is mowed once per month to the ditch. Reducing mowing frequency has decreased operating costs, energy consumption and production of greenhouse gases, as well as the production of broad leaf weeds, which was an unexpected outcome. Licensed city employees remove established perennial weeds in shrub beds with glyphosate.

Saskatoon Parks Department plays an important role in reducing the use of pesticides within the City by limiting their use on public lands such as parks, nature-ways and roads. The City also provides information to citizens and the business community on alternatives to pesticide and herbicide use on private property.

Rodent populations serve as an indicator of the ecological quality as well as the imbalance in the predator/prey relationship within urban parks. Expansive, well-irrigated grassy areas free from predatory risk, have promoted the proliferation of Richardson ground squirrels (gophers) in some urban parks. These rodents are perceived as a nuisance because of the holes they leave in the ground and their potential to carry disease. Due to safety concerns, there is a zero tolerance for ground squirrels on

sports fields maintained by park management. Smoke bombs containing sulphuric gas are used to fumigate gopher holes to kill the rodents. Other pest nuisances are handled on a per complaint basis.

Ground squirrels are an example of the link between the indicators and ecological integrity. The presence of these ground squirrels is important because they are prey for endangered species, such as ferruginous hawks. Their burrows are also important in developing habitat for swift foxes and burrowing owls.

Environmentally Sensitive Habitat

Figure 8.1 indicates the natural areas that are a priority for protection within the City of Saskatoon planning district boundary. Priority for protection areas are primarily located in the North East and South East ends of the City.

Species-at-risk

Plants and animals designated as species-at risk by Saskatchewan Environment are protected from being disturbed, collected, harvested, captured, killed and exported. Table 8.2 provides a list of species-at-risk within the Moist Mixed Grassland Ecoregion, in which Saskatoon is located. Future recovery planning initiatives for animals and plants undertaken by Sask Env will use an ecosystem-based approach.

Also of concern to maintaining habitat health is the encroachment of foreign species on native habitat. Purple loosestrife is a foreign plant

threatening species in Saskatchewan by supplanting native vegetation. This threatens wetlands by reducing their ability to provide habitat for wildlife. SWAP is a program operating in the City to allow residents to trade purple loosestrife plants for another perennial.

Table 8.2: Species at Risk

Extirpated (A species no longer existing in the region, but occurring elsewhere.)

<i>Birds</i>	<i>Mammals</i>
Eskimo Curlew	Plains Grizzly Bear
Greater Prairie Chicken	

Endangered (A species facing imminent extirpation or extinction.)

<i>Birds</i>	<i>Plant</i>
Burrowing Owl	Hairy Prairie Clover
Piping Plover	Western Spiderwort
Whooping Crane	

Threatened (A species likely to become endangered if limiting factors are not reversed.)

<i>Plant</i>
Slender Mouse-ear-cress

Urban Forest

The City of Saskatoon maintains approximately 195,000 trees in its parks, boulevards, shelter belts, golf courses and cemetery, covering approximately 2% of the total urban area, excluding water bodies³².

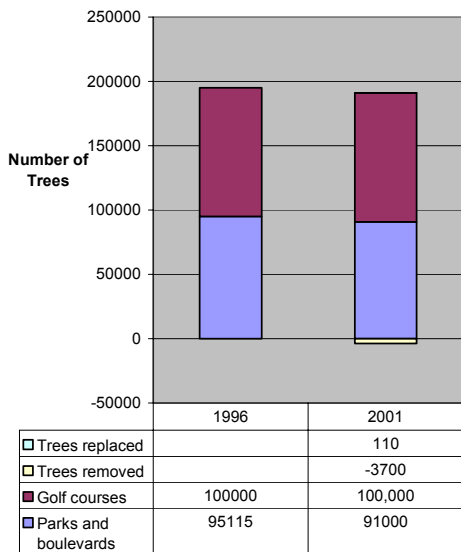
³² "Figure 2: Greenspace in selected urban centres in Canada", *The Status of Wildlife Habitats in Canada's Urban Landscapes*, Wildlife Habitat Canada, 2001.

Saskatoon’s urban forest has *decreased* by roughly 3600 trees since 1996 due to tree removals of old and diseased trees. A total of 110 trees were replaced over this period.

When compared with other Canadian cities that average roughly 25% forest coverage, the size of Saskatoon’s urban forest is significantly smaller. However, because we are situated within the moist mixed grassland ecoregion, the extent of our urban forest should not be expected to be as large as other cities not located in a

The causes and effects of DED were discussed in detail in the 1996/97 SOER. DED is classified under the *Pest Control Act*. It is caused by a fungus known as *Ceratocystis ulmi*. The fungi block the water conducting systems of the American and Siberian/Manchurian elms, causing them to eventually die. DED is spread by two species of bark beetle, namely the European and the American bark beetle. Saskatoon continues to apply a preventative approach to DED with an aggressive program of tree pruning and tree removals. Due to these efforts, the City has avoided the introduction of the disease, although it still remains a significant threat. The loss the American and Manchurian elms in Saskatoon would dramatically affect our landscape, diminish air quality, reduce wind shelter and shade, and destroy habitat for migratory and resident bird populations.

Figure 8.2: Saskatoon’s Urban Forest



Further detailed data and information regarding how the data were selected and measured are provided in Appendix A8.

grassland ecoregion.
Dutch Elm Disease

Until recently, Saskatchewan was one of the last regions in the world unaffected by Dutch elm disease (DED). However, in recent years hundreds of diseased elms have been identified in the Qu’Appelle Valley, Souris River, Cumberland House region, and most recently, Regina.

Recommendations

The following summarizes recommendations for promoting habitat conservation:

33. That the design of future or renovated public parks include criteria consistent with urban sustainability goals. Best practices should include:
 - percentage of tree coverage;
 - incorporation of drought resistant native plant species; and
 - habitat for native plants and animals.
34. That a program to increase the size of Saskatoon's urban forest be implemented to ensure the replacement of removed trees, as well as increase CO₂ absorption.
35. That guidelines be developed to allow municipal governments to report on and improve habitat conservation, as well as incorporating economic analysis of habitat benefits.
36. That the City develop and implement strategies to ensure conservation of species at risk.
37. That a coordinated approach to further manage remaining natural and modified habitats, and establish green corridors for wildlife, be built on the policies set out in the Development Plan.

Indicator #9: Greenhouse Gas Emissions

Issue context

Increasing atmospheric temperatures and other major changes in the world's climate are attributed to the gradual accumulation of "greenhouse gases" (GHG) in the atmosphere as a result of human activity. These greenhouse gases include carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (NO), which are normally reported in terms of equivalent carbon dioxide emissions. GHG emissions include direct emissions from fossil fuel combustion in households, institutions, businesses, transport, electric power generation, industry and agriculture. GHG emissions also include indirect emissions associated with the production of goods and services which Canadian households and businesses purchase, and also from agricultural operations.

While the extent and range of the possible effects of global warming are difficult to quantify, scientists predict they will include: flooding of coastlines from rising ocean waters; increased occurrences of severe weather events such as storms, droughts and heat waves; and rapid changes in plant and animal habitat due to changes in weather patterns.

Drought-related impacts could have a dramatic effect on Saskatoon's economy, because of the links to Saskatchewan's agricultural sector. It is incumbent upon all global residents, but especially those in

developed countries who are the major contributors to global warming, to reduce their impact.

Saskatchewan residents are one of the largest per capita contributors to greenhouse gas emissions due to the following factors: our agriculture and fossil fuel sectors are energy intensive; our population is distributed over a vast area and hence travel occurs over long distances; and we live in a cold climate requiring a great deal of energy to maintain our homes and places of work at a level of comfort that we have collectively become accustomed to.

In an effort to mitigate the impacts of greenhouse gas emissions, the Government of Canada ratified the Kyoto Protocol in December of 2002. The Kyoto Protocol commits 38 industrialized countries to cut their emissions of greenhouse gases between 2008 to 2012 below 1990 levels. Canada's commitment is a 6% reduction in greenhouse gas emissions below 1990 levels. This commitment will necessitate that all sectors of government, including municipalities, as well as businesses and individuals, monitor and reduce their emissions of greenhouse gases.

Rainfall and temperature data is included to identify possible trends in historical weather data for the Prairie Region.

Trends and prospects

CO₂ Equivalent Emissions Per Capita

Figure 9.1: Saskatchewan's Per Capita Carbon Dioxide Equivalent Emissions

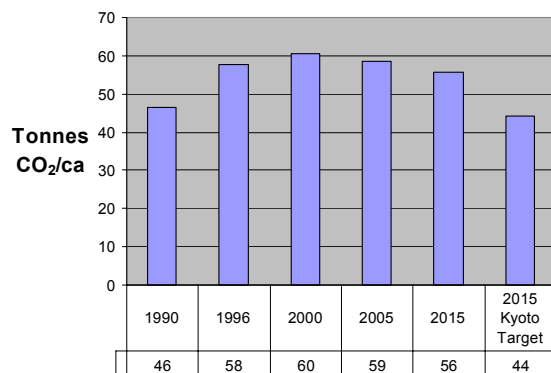


Figure 9.1 projects the expected trend in total direct and indirect GHG emissions in Saskatchewan divided by the Province's expected population between 1990 and 2015. In 1996, the Province's emissions per capita were estimated to be 58 tonnes CO₂ per capita, compared to 60 tonnes CO₂ in 2000. By 2015, per capita emissions are predicted to level off at 56 tonnes CO₂. If all Canadian provinces are expected to meet Canada's commitments in the Kyoto Protocol, Saskatchewan will need to reduce its emissions to 20% below the 2015 predictions, from 56 to 44 tonnes CO₂ per capita.

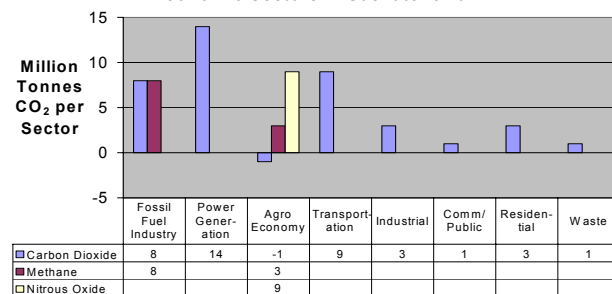
In the residential sector, space heating (half) and water heating (28%) account for the majority of GHG emissions. Based on average residential consumption rates of electricity and natural gas, the average household emitted 12 tonnes of greenhouse gases. The average detached house produces

50 per cent more emissions than the average apartment or condominium.

CO₂ Equivalent Emissions Per Sector

As shown in Figure 9.2, the fossil fuel, power generation and transportation sectors are the three major contributors to GHG emissions in Saskatchewan. Continued efforts in energy conservation and developing alternative energy sources such as co-generation facilities, wind power, fuel cell technologies and renewable sources, will be necessary to reduce overall GHG emissions. In the fossil fuel sector, operational modifications such as converting flare gases to energy sources contributes to reducing GHG emissions.

Figure 9.2: Green House Gas Emissions By Economic Sectors in Saskatchewan



Historical Weather Trends

Over the last century, the global average surface temperature has increased by approximately 0.6°C. Precipitation increased by 0.5 to 1% per decade in the 20th Century and snow cover and ice extent have decreased by about 10% since the late 1960's. Tables 9.3 and 9.4 provided temperature and rainfall data for the Prairie Region in the form of departures from normal values.

Temperature and rainfall data demonstrate a high degree of variability for this region.

Figure 9.3: Summer Temperature Departures For the Prairie Region, 1948 - 2002

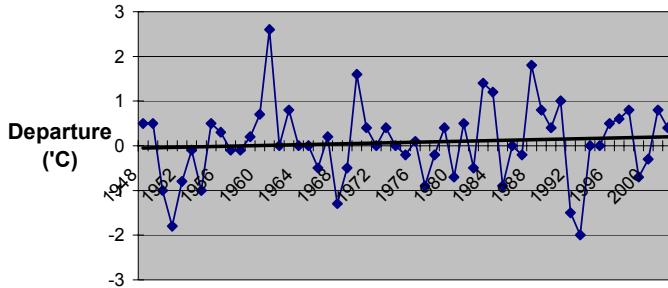
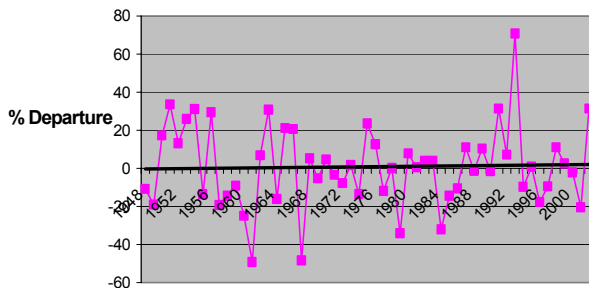


Figure 9.4: Summer Precipitation Departures For The Prairie Region, 1948-2002



Environment Canada reported that the summer of 2001 was the 3rd warmest on record in Canada, with temperatures 0.9°C above normal. It was the 17th season in a row with above-normal temperatures nationally. Saskatoon had its driest 12 months on record in 2001 (200 mm of precipitation), which is only 57% of its normally expected rainfall. Environment Canada stresses that the dry conditions experienced in much of southern Canada in 2001, while unusual, can be expected to occur from time to time as part of long-term natural weather variability. There is no clear evidence at this time to suggest that these conditions were

caused by human induced climate change.

Environment Canada also suggested that future climates for southern Canada will experience more frequent severe droughts and related impacts on agriculture and water resources with greater severity, in the coming decades. Hence, while the current drought conditions may not be unprecedented, these provide an example of what may become more prevalent under warmer climates.

Further detailed data and information regarding how the data were selected and measured are provided in Appendix A9.

Recommendations

38. As recommended by the Saskatoon Environmental Advisory Committee in its report to City Council in January 2000, that the City develop a local action plan for the reduction of greenhouse gases from City facilities, as well as from homes, businesses and transportation services throughout the City.
39. That the City move forward on plans to capture methane emissions from the municipal landfill for heat and electricity generation (the Wastewater Treatment Plant is already largely heated with methane recovered from the digesters).

Indicator #10: Noise

Issue Context

Noise issues within Saskatoon are related to industrial and traffic sources. Traffic noise is a major component of the noise experienced in residential areas. As the City expands, citizen concern over traffic generated noise will grow if traffic volumes increase. Noise impacts on residential neighbourhoods include annoyance, sleep interference, speech interference and lower property values. Related to this issue is increased vehicular traffic and how it contributes to sustainable transportation and the production of greenhouse gases.

In 2000, SEAC recommended that funding for retrofit projects for noise attenuation in existing heavy traffic areas backing residential neighbourhoods be referred to the City Administration for inclusion in future budget provisions³³.

The City has established a noise level policy of less than 65 decibels (dBA Ldn). By assessing noise levels along traffic corridors, where high noise levels are known to occur, we may determine the contribution that noise makes to quality of life in adjacent neighbourhoods.

Trends and Prospects

Noise level data measured along major traffic corridors between 1987

and 2002 are shown in Figure 10.1. Areas shown in green represent proposed locations for sound attenuation work identified in a 1991 study. The locations shown in red on the plan do not currently meet the 65 dBA policy levels, but are locations that have been brought to the attention of the Administration as having a traffic noise problem.

In December, 2002, City Council adopted a recommendation that sound attenuation walls be constructed at the following locations:

- Idylwyld Freeway – Ruth Street to Glasgow Street (east side)
- Warman Road – 7th Avenue to Circle Drive (east side)
- Idylwyld Freeway – Taylor Street to Ruth Street (west side)
- Warman Road – Assiniboine Drive to Primrose Drive (east side)

Further detailed data and information regarding how the data were selected and measured are provided in Appendix A10.

Recommendations

40. That the City consider environmentally sustainable methods of noise attenuation that exhibit other positive benefits.

³³ *Noise Attenuation for Heavy Traffic Near Residential Neighbourhoods*, File No. CK.175-9, Saskatoon Environmental Advisory Committee, November 16, 2000.

Environmental Legislation Applicable To Urban Sustainability Indicators in Saskatoon

Indicator	Regulations/Guidelines/Objectives /Bylaws
1. <u>General</u>	
Federal Legislation	
<i>National Round Table on the Environment and the Economy Act</i>	
2. <u>Air</u>	
Federal Legislation	
<i>The Canadian Environmental Protection Act</i>	
<i>The Vehicle Safety Act</i>	
Provincial Legislation	
<i>The Clean Air Act</i> <i>Environmental Management and Protection Act</i>	<i>The Clean Air Regulations</i> <i>Ozone Depleting Substances Regulations</i>
3. <u>Water</u>	
Federal Legislation	
<i>The Canada Water Act</i>	
<i>The Canadian Environmental Protection Act</i>	
Provincial Legislation	
<i>Drainage Control Act</i> <i>Environmental Management and Protection Act</i>	<i>Drainage Control Regulations</i> <i>The Water Pollution Control and Waterworks Regulations</i> <i>The Saskatchewan Surface Water Quality Objectives</i>
<i>The Ground Water Conservation Act</i>	<i>The Ground Water Conservation Regulations</i>
<i>Public Works Act</i>	
<i>Saskatchewan Watershed Authority Act</i>	
City of Saskatoon Bylaws	<i>Sewage Works Control Bylaw 5115</i>
4. <u>Energy Usage</u>	
Provincial Legislation	
<i>Home Energy Loan Act</i>	
<i>Uniform Building and Accessibility Standards Act</i>	<i>Uniform Building and Accessibility Standards Regulations</i>
City of Saskatoon Bylaws	<i>The Building Bylaw 7306</i>
5. <u>Transportation</u>	
Federal Legislation	
<i>Alternative Fuels Act</i>	
City of Saskatoon Bylaws	<i>Alternative Fuels Regulations</i> <i>Traffic Bylaw 7200</i>

Indicator	Regulations/Guidelines/Objectives /Bylaws
6. <u>Resource Recovery</u>	
Provincial Legislation <i>Environmental Management and Protection Act</i>	<i>Municipal Refuse Management Regulations</i> <i>Scrap Tire Management Regulations</i> <i>PCB Waste Storage Regulations</i> <i>Used Oil Collection Regulations</i>
City of Saskatoon Bylaws	<i>Waste Bylaw 5203</i>
7. <u>Urban Form</u>	
Provincial Legislation <i>Planning and Development Act</i> <i>Subdivisions Act</i>	<i>Subdivision Regulations</i> <i>Dedicated Lands Regulations</i>
City of Saskatoon Bylaws	<i>Subdivisions Bylaw 6537</i> <i>Development Plan Bylaw 7799</i> <i>Zoning Bylaw 7800</i>
8. <u>Contaminated Sites</u>	
Provincial Legislation <i>Environmental Management and Protection Act</i>	<i>The Environmental Spill Control Regulations</i> <i>The Hazardous Substances and Waste Dangerous Goods Risk Based Corrective Actions for Petroleum Contaminated Sites Guidelines</i>
City of Saskatoon Bylaws	<i>Fire and Protective Services Bylaw 7990</i>
9. <u>Habitat</u>	
Federal Legislation <i>Canada Wildlife Act</i> <i>Pest Control Products Act (Canada)</i>	<i>Wildlife Area Regulations</i> <i>Pest Control Products Regulations</i>
Provincial Legislation <i>Noxious Weeds Act</i>	<i>Noxious Weeds Regulations</i> <i>Noxious Weeds Designation Regulations</i>
<i>Pest Control Act</i>	<i>Dutch Elm Disease Control Regulations</i>
<i>Pest Control Products Act</i> <i>Wildlife Act</i>	<i>Pest Control Products Regulations</i> <i>Wild Species At Risk Regulations</i>
10. <u>Noise</u>	
City of Saskatoon Bylaws	<i>Noise Bylaw 6052</i>

Bibliography

1. *1997 State of The Environment Report Fact Sheet- The Prairie Ecozone: Our Agricultural Heartland* at: <http://www.serm.gov.sk.ca/ecosystem/fact-97/FACT-97.HTM>
2. *Characterization of Stormwater Input To The South Saskatchewan River Within Saskatoon*, S.M. McLeod, G.J. Putz and J.A. Kells, Department of Civil and Geological Engineering, University of Saskatchewan, 2002.
3. *City of Regina State of the Environment Report 2000*, Regina Urban Environment Advisory Council, May 2002.
4. *City of Saskatoon 1997 Transit Planning Study - Summary Report*, Reid Crowther and Partners Inc., 1998.
5. *City of Saskatoon Municipal Manual 1997*, Compiled By The Office of The City Clerk.
6. *City of Saskatoon Municipal Manual 2001*, Compiled By The Office of The City Clerk at:
http://www.city.saskatoon.sk.ca/org/clerks_office/municipal_manual.pdf.
7. *City of Saskatoon Development Plan*, Schedule 'A' to Bylaw No. 7799.
8. *Clean Green and Healthy: A Plan For An Environmentally Sustainable Toronto, Final Report*, Environmental Task Force, February, 2000, at:
<http://www.city.toronto.on.ca/council/etfepfin.pdf>
9. *Climate Change Plan for Canada, Achieving Our Commitments Together*, Government of Canada at: <http://www.climatechange.gc.ca>
10. *Climate Trends and Variations Bulletin for Canada Summer 2001 Temperature and Precipitation in Historical Perspective* at:
http://www.smc.ec.gc.ca/ccrm/bulletin/summer01/index_e.html
11. *Communities, development, and sustainability across Canada*, edited by John T. Pierce and Ann Dale, 1998.
12. *Comprehensive Bike Plan*, City of Saskatoon, Infrastructure Services Department, November, 2002.

13. *Conservation Strategy for Sustainable Development in Saskatchewan*, Saskatchewan's Round Table on Environment and Economy, 1992.
14. *Direction To the Future: The Guide to Better Transit For Winnipeg Final Report*, January 2000, City of Winnipeg Working Group on Public Transportation Policy at:
<http://www.winnipegtransit.com/OtherPages/transitReport.pdf>
15. *Ecological Survey of the South Saskatchewan River Downstream of the City of Saskatoon Wastewater Treatment Plant*, EPS 5/AT/2, Environment Protection Branch, Prairie and Northern Region, Environment Canada, 2001.
16. *Econnections, Linking the Environment and the Economy. Indicators and Detailed Statistics*, 2000, Catalogue No. 16-200 XKE, Statistics Canada.
17. *ENVIRONMENTAL ISSUES*, Adopted May 2001, FCM Annual Conference, at: <http://www.fcm.ca/english/national/enviro1.htm>
18. *Environmental Liability and Contaminated Site Management; A Strategic Approach for Saskatchewan*, Saskatchewan Environment at:
http://www.se.gov.sk.ca/environment/protection/land/hazardous/CSL_Strategic_Approach.pdf
19. *Future Growth of Saskatoon, "A Tradition of Planning", Final Report and Recommendations*. City of Saskatoon, June, 2000 at:
http://www.city.saskatoon.sk.ca/org/city_planning/Land_Use_Policy/Future%20Growth-Final%20Report.pdf
20. Haughton and Hunter (1994) as cited in *Sustainable Community Indicators User Manual*, Computing Research Lab for the Environment, Environment Canada, and Canada Mortgage and Housing Corporation, 1999.
21. *Kyoto and Beyond: The Low Emission Path to Innovation and Efficiency*, prepared for The David Suzuki Foundation and CANet Canada by Torrie-Smith Consultants, 2002 at: <http://www.torriesmith.com>
22. *Office Consolidation, City of Saskatoon Development Plan, Bylaw No. 7799*. City Council Passed November, 2000.
23. *Saskatchewan's State of The Environment Report 1997 - The Prairie Ecozone: Our Agricultural Heartland*, Saskatchewan Environment and Resource Management at: <http://www.serm.gov.sk.ca/pdf/SOE-97.PDF>

24. *Saskatoon Regional Waste Management Association Integrated Waste Management Feasibility Study*, Stantec Consulting Ltd., 2000.
25. *Signposts on the Trail to Vision 2020*, City of Hamilton, 2001.
26. *Solid Waste Management Master Plan 2000-2020*, 1999. P. Kerc, Environmental Compliance Branch, Utility Services Department, City of Saskatoon.
27. *State of the Environment Report, 1996/1997 Annual Report*, Saskatoon Environmental Advisory Committee, 1998.
28. *State of the Valley*, Meewassin Valley Association, 1998.
29. *Summary for Policy Makers, A Report of Working Group 1 of the Intergovernmental Panel on Climate Change*, 2001 at:
<http://www.ipcc.ch/pub/spm22-01.pdf>
30. *Sustainable Calgary, State of Our City Report 2001*, Sustainable Calgary, 2001.
31. *Sustainable Community Indicators User Manual*, Computing Research Lab for the Environment, Environment Canada, and Canada Mortgage and Housing Corporation, 1999.
32. *Traffic Characteristics Report 2001*, City of Saskatoon, Infrastructure Services Department, Municipal Engineering Branch.
33. *Urban Policy Issues, Canadian Perspectives*, 2nd Ed. Edmund Fowler and David Siegel, Editors, Oxford University Press, 2002.
34. *Waste Minimization Program, Strategic Plan-2002*, 1998, Environmental Services Department, City of Saskatoon.

Appendix A1: Urban Air Quality

Air Pollution Index

The use of some form of air quality index (AQI) is common with most jurisdictions. The advantage of an AQI is that air quality conditions involving multiple pollutants, varying concentrations and differing degrees of impact can be expressed through a single easily understood value. To further simplify matters, a normalized scaling system is often used. The resulting values for the AQI are then grouped into broad descriptive categories (e.g., good, fair, poor).

The index uses air quality objectives or standards as the numerical basis for the index. It transforms the measured concentrations of certain air pollutants into a single number and descriptive term that represents both the measured and the publicly perceived quality of the ambient air for a given time period and location.

The annual air quality index accounts for the measured outdoor concentrations of the major pollutants: suspended particulate matter (SPM or PM-10), ground-level ozone (O₃), carbon monoxide (CO), sulphur dioxide (SO₂) and nitrogen dioxide (NO₂). Since 1999, PM-10 has replaced SPM to better reflect the size range of particulates that affect human health. Particulate matter and ground level ozone are also the major components of smog.

Table A1.1
Air Quality Indices for Regina and Saskatoon

Year	Regina	AQI Rating	Saskatoon	AQI Rating
1996	80	Good	78	Good
1997	83	Good	82	Good
1998	72	Good	72	Good
1999	76	Good	68	Moderate
2000	78	Good	77	Good
2001	74	Good	80	Good

Source: Saskatchewan Environment, Ecological Monitoring Branch, email communication, 2002.

Table A1.2 presents annual averages for each species, although poorer air quality usually occurs during the summer and fall seasons due to agricultural activity, forest fires and other seasonal events. Air quality parameters in Saskatoon are continuously measured at 511 1st Avenue North.

Table A1.2
ANNUAL AIR QUALITY SUB-INDICIES
SASKATOON 1996 – 2001

Species	1996	1997	1998	1999	2000	2001
SPM	26	22	53	61	41	29
O ₃ (1hr)	23	18	18	21	17	21
CO (8 hr)	7	7	7	6	5	6
CO (1 hr)	4	3	3	3	2	2
SO ₂ (1 hr)	1	0	0	0	0	0
SO ₂ (24 hr)	1	1	1	1	1	1
NO ₂ (24 hr)	16	14	13	14	12	10
NO ₂ (1 hr)	10	9	9	9	8	6
Overall Index	78 Good	82 Good	72 Good	68 Moderate	77 Good	80 Good

Source: Saskatchewan Environment, Ecological Monitoring Branch, email communication, 2002.

Particulate Matter (PM-10)

PM-10 is focused on primarily because it contributes more than the other parameters to the overall API. However, there are many sources that contribute to PM-10 concentrations, such as forest fires, agricultural activity, industrial activity, transportation, as well as weather conditions.

Table A1.3
Average Annual PM-10 Levels in Selected Canadian Cities

Year	City	PM-10 µg/m ³
1996 ¹ .	Toronto	26
1996 ¹ .	Windsor	22
1996 ¹ .	Winnipeg	17
1996 ¹ .	Edmonton	17
1996 ¹ .	Calgary	20
1996 ¹ .	Canada	17
1999 ² .	Saskatoon	23
2000 ² .	Saskatoon	20
2001 ² .	Saskatoon	16

Source:

1. Environment Canada as cited in Sustainable Communities Indicators Program, Version 1.1.
2. Saskatchewan Environment, Ecological Monitoring Branch, email communication, 2002.

Nuisance Odours

Odour issues impact on the quality of life for municipal residents, affecting both their ability to enjoy spending time outside in their neighbourhoods and property values.

The number of complaints does not correlate with odour emissions. Generally odour complaints occur when there is a drastic change in odour conditions. In some cases, residents are asked to phone whenever there are odours for purposes of data gathering - these phone calls then become complaints.

The City's wastewater treatment plant (WWTP) tracks the number of odour complaints that they receive and records whether the odour is attributed to the WWTP or some other source. The number of complaints may or may not be associated with any particular odour event. As well, complaints may be received more than once from the same individual. SE does not maintain a similar registry.

Table A1.4
Frequency of Odour Complaints Received at the Wastewater Treatment Plant

Year	Total # of Complaints	Plant Related Normal Operation	Plant Related Basin, Digester Cleaning	Not Related to Plant or Uncertain
1997	13	5	7	1 - chemical plant
1998	72	33	23	1 - farm 14 - uncertain 1 - chemical plant
1999	20	5	11	4 - uncertain
2001	14	4	10	

Source: City of Saskatoon, Wastewater Treatment Branch, email communication, 2002.

Appendix A2: Water Consumption and Water Quality

Water Consumption Data

Daily per capita consumption is calculated based on total water pumped, which is comprised of industrial usage, residential usage, and unaccounted losses.

Table A2.1
Daily Per Capita Water Consumption

Year	Saskatoon L/day/ca	Canada L/day/ca
1983 ¹	755	664
1986 ¹	691	680
1989 ¹	685	694
1991 ¹	732	661
1994 ¹	537	637
1996 ¹	503	628
1999 ²	534	na
2000 ²	567	na
2001 ²	632	na

Sources

1. Environment Canada as cited in *Sustainable Communities Indicators Program, Version 1.1*.
2. City of Saskatoon, *Utility Services Department, Water and Wastewater Treatment, Annual Report, 2001*.

Domestic Water Quality

The City's receiving water from the South Saskatchewan River is treated using a conventional treatment process train with cold lime softening. Ferric sulfate replaced aluminum sulfate for coagulation purposes in 2001 to address concerns of aluminum in treated water. Clarified and softened water is chlorinated and fluoridated prior to filtration. Ammonium hydroxide is added to the treated water to help maintain disinfection residuals throughout the system.

Table A2.2:
Water Treatment Plant Operating Statistics

		1999	2000	2001
Total Water Pumped (m ³)		40,991,000	44,131,970	49,798,800
Water Sold (m ³) *				
Domestic		17,343,761	18,672,739	21,070,439
Commercial and Industrial		17,088,679	18,305,121	20,655,616
Total		34,432,440	36,977,860	41,726,056
Unaccounted for Water (m ³)*		6,558,560	7,154,110	8,072,743
Percent unaccounted water*(%)		16	16	16
Maximum hourly pumpage (m ³ /h)		14,400	16,100	18,100
Maximum daily pumpage (m ³ /day)		202,600	232,200	271,200
Average daily pumpage (m ³ /day)		112,292	122,190	136,435
Chemical Usage (kg)	Aluminum	1,579,562	1,150,569	na
	Sulphate	2,356,030	2,588,669	2,955,874
	Lime	16,964	16,606	21,781
	Potassium	134,141	126,883	123,898
	Permanganate	47,002	44,686	47,933
	Chlorine	64,523	61,289	56,094
	Fluoride	0	966,203	3,003,229
	Ammonium-Hydroxide	na	na	na
	Ferric Sulphate	na	na	na

Source: City of Saskatoon, Water Treatment Branch, email communication, 2002.

Notes:

*Water Sold reflect Billing System Estimates. Actual numbers are not available..

na denotes "not available".

Table A2.3
2001 Average Water Quality Characteristics For Saskatoon Receiving and Domestic Water

Characteristic	Reported As	Domestic Water	Limits	Receiving Water
A. Physical Characteristics				
Color (apparent)	APHA	<2	15	NR*
Conductivity at 25°C	umhos/cm	370	none	472
pH		9.0	9.0	8.5
Temperature	C	14	none	14
Turbidity	NTU	<0.1	1	2.7
B. Inorganic Constituents				
Aluminum	mg Al/L	<0.1	0.20	0.06
Arsenic	mg As/L	<0.002	0.025	<0.002
Barium	mg Ba/L	0.028	1.0	NR*
Boron	mg B/L	0.027	5.0	NR*
Cadmium	mg Cd/L	<0.001	0.005	<0.001
Calcium	mg Ca/L	26	none	46
M-Alkalinity	mg CaCO ₃ /L	81	500	157
P-Alkalinity	mg CaCO ₃ /L	6	none	4
Carbonate	mg CaCO ₃ /L	12	none	10
Bicarbonate	mg CaCO ₃ /L	73	none	149
Total Hardness	mg CaCO ₃ /L	136	800	186
Chloride	mg Cl/L	9	250	7
Chlorine Residual	mg Cl ₂ /L	1.6	3.0 ^A	NR*
Chromium	mg Cr/L	<0.001	0.05	NR*
Copper	mg Cu/L	<0.002	1.0	NR*
Cyanide	mg CN/L	<0.001	0.2	NR*
Fluoride	mg F/L	0.68	1.5	0.17
Iron	mg Fe/L	<0.01	0.3	0.12
Lead	mg Pb/L	<0.002	0.01	0.009
Magnesium	mg Mg/L	17	200	18
Manganese	mg Mn/L	<0.002	0.05	0.012
Mercury	mg Hg/L	<0.00005	0.001	<0.00005
Potassium	mg K/L	3.2	none	3.0
Selenium	mg Se/L	<0.001	0.01	
Silver	mg Ag/L	0.003	None	NR*
Sodium	mg Na/L	24	300	23
Sulfate	mg SO ₄ /L	87	500	68
Uranium	mg U/L	<0.001	0.1	NR*
Zinc	mg Zn/L	0.006	5.0	NR*
C. Nutrient Constituents				
Ammonia	mg N/L	0.23	none	<0.1
Nitrate (& Nitrite)	mg N/L	<0.6	9 (1)	<0.1
Total Kjeldahl Nitrogen	mg N/L	NR*	none	<0.5
Soluble Ortho Phosphate	mg P/L	NR*	none	<0.05
Total Phosphate	mg P/L	NR*	none	<0.05
D. Organic Constituents				
BOD 5 day	mg /L	NR*	none	<2
Phenolics	mg Phenol/L	<0.001	--	0.002
Soluble Organic Carbon	mg C/L	2.4	none	3.1
Total Dissolved Solids	mg /L	231	500	278
Total Suspended Solids	mg /L	<2	none	9
Volatile Suspended Solids	mg /L	<2	none	<2
E. Microbiological				
Chlorophyll-a	mg /L	NR*	none	<0.005
Cryptosporidium	ct/10 L	<1	0	<1-1
Fecal Coliform	CFU/100mL	NR*	<1	181
Fecal Streptococcus	CFU/100mL	NR*	<1	539
Giardia	ct/10 L	<1	0	<1-24
HPC	CFU/mL	<1	500	3500
Total Coliform	CFU/100mL	<1	<1	377
F. Total Trihalomethanes				
	µg/L THM	32 ¹	100	29 ¹
G. Pesticide Scan, H. Organic Scan, I. Radiochemicals				

^A As Chloramine ¹ Tested in Distribution System ² Concentrations less than detection or within limits for all constituents tested as required by the Minister's Order.				

Source: City of Saskatoon, Water Treatment Branch Annual Report, 2001.



Acrobat Document

**Table A2.4
CITY OF SASKATOON**

Utility Services Department/ WTP-MO Laboratory Report --2001

Includes - Water Treatment Plant (WTP) Limits

Quarterly Analysis

Date: Month/Year

PARAMETERS MONITORED	Reported As	Aug/01		Aug/01	
		WTP Tap		WTP Raw	QE Raw

A) PHYSICAL CHARACTERISTICS

PARAMETERS MONITORED	Reported As	Aug/01 WTP Tap	Aug/01	Aug/01 WTP Raw	Aug/01 QE Raw
Colour (apparent)	APHA	1		-	-
Conductivity	umhos/cm	387		486	477
pH		8.86		8.55	8.56
Temperature	Celsius	23		-	21
Turbidity	NTU	0.08		6.10	5.40

B) INORGANIC CONSTITUENTS

PARAMETERS MONITORED	Reported As	Aug/01 WTP Tap	Aug/01	Aug/01 WTP Raw	Aug/01 QE Raw
Aluminum	mg Al/L	0.066		0.034	0.013
Arsenic	mg As/L	< 0.0005		0.0005	< 0.0005
Barium	mg Ba/L	0.03		0.09	0.09
Boron	mg B/L	0.029		0.030	0.029
Cadmium	mg Cd/L	< 0.001	<	0.001	< 0.001
Calcium	mg Ca/L	22		45	45
M-Alkalinity	mg CaCO3/L	76		158	152
P-Alkalinity	mg CaCO3/L	6		5	4
Carbonate	mg CaCO3/L	12		10	8
Bicarbonate	mg CaCO3/L	64		148	144
Total Hardness	mg CaCO3/L	136		186	182
Chloride	mg Cl/L	9.8		7.8	7.8
Chlorine Residual (Total)	mg Cl2/L	1.70		-	-
Chromium	mg Cr/L	< 0.001	<	0.001	< 0.001
Copper	mg Cu/L	0.001	<	0.001	< 0.001
Cyanide	mg CN/L	< 0.001		-	-
Fluoride	mg F/L	0.67		-	0.18
Iron	mg Fe/L	0.013		0.079	0.037
Lead	mg Pb/L	< 0.002	<	0.002	< 0.002
Magnesium	mg Mg/L	17.0		18.0	18.0
Manganese	mg Mn/L	< 0.001		0.013	0.009
Mercury	mg Hg/L	< 0.00005		-	-
Potassium	mg K/L	3.0		3.0	2.9
Selenium	mg Se/L	< 0.001		-	-
Silver	mg Ag/L	< 0.001	<	0.001	< 0.001
Sodium	mg Na/L	24		24	24
Sulfate	mg SO4/L	90		68	70
Uranium	mg U/L	0.0009		-	-
Zinc	mg Zn/L	< 0.005	<	0.005	< 0.005

C) NUTRIENT CONSTITUENTS

PARAMETERS MONITORED	Reported As	Aug/01 WTP Tap	Aug/01	Aug/01 WTP Raw	Aug/01 QE Raw
Ammonia	mg N/L	0.22		0.03	0.08
Nitrate (and Nitrite)	mg N/L	0.06		0.03	0.03
Total Kjeldahl Nitrogen	mg N/L	0.32		0.10	0.08

Table A2.4 (continued)
Utility Services Department/ WTP-MO Laboratory Report --2001

Includes - Water Treatment Plant Ministerial Order							
Quarterly Analysis							
Date: Month/Year			Aug/01		Aug/01		Aug/01
PARAMETERS MONITORED	Reported		WTP		WTP		QE
	As		Tap		Raw		Raw
Soluble Ortho Phosphate	mg P/L		-	<	0.01	<	0.01
Total Phosphate	mg P/L	<	0.01	<	0.01	<	0.01

D) GENERAL ORGANICS

BOD (5 day)	mg/L		-	<	2.0	<	2.0
Phenolics (Total)	mg Phenol/L		0.0007	<	0.0005	<	0.0005
Dissolved Organic Carbon	mg C/L		2.0		2.4		2.7
Total Dissolved Solids	mg/L		221		271		270
Total Suspended Solids	mg/L	<	1		8		4
Volatile Suspended Solids	mg/L	<	1		1		1

E) MICROBIAL

Chlorophyll-a	mg/L		-		0.0053		0.0076
Fecal Coliform	CFU/100mL		-		174		96
Fecal Streptococcus	CFU/100mL		-		54		870
HPC	CFU/mL		0		7700		12820
Total Coliform	CFU/100mL		0		440		240

F) TRIHALOMETHANES

(Distribution Locations: #5 1025 Boychuk Dr. and 122 Wakooma St. for Columns WTP Raw and QE Raw, respectively.)

chloroform	µg/L		42		24		26
bromodichloromethane	µg/L		5		7		7
dibromochloromethane	µg/L	<	1	<	1	<	1
bromoform	µg/L		ND		ND		ND
total:	µg/L		47		31		33

Remarks: ND: not detectable

G) PESTICIDES / INSECTICIDES

			WTP Tap Water		Drinking Water Quality Standards		
atrazine	µg/L	<	0.05		5		-
bromoxynil (Buctril)	µg/L	<	0.50		5		-
dicamba (Banvel)	µg/L	<	0.50		120		-
diclofop-methyl (Hoe Grass)	µg/L	<	1.00		9		-
carbofuran	µg/L	<	0.05		90		-
2,4-dichlorophenoxyacetic acid (2,4-D)	µg/L	<	0.50		100		-
lindane	µg/L	<	0.01		-		-
2-methyl-4-chlorophenoxyacetic acid (MCPA)	µg/L	<	0.50		-		-
pentachlorophenol (PCP)	µg/L	<	0.50		60-		-
picloram (Tordon)	µg/L	<	1.00		190		-
propanil (Stampede)	µg/L	<	0.05		-		-
triallate (Avedex BW)	µg/L	<	0.05		-		-
trifluralin (Treflan)	µg/L	<	0.05		45		-
chlorpyrifos (Lorsban)	µg/L	<	0.05		90		-
dimethoate (cygon)	µg/L	<	0.05		20		-
malathion	µg/L	<	0.05		190		-

Table A2.4 (continued)
Utility Services Department/ WTP-MO Laboratory Report --2001

Includes - Water Treatment Plant Ministerial Order

Quarterly Analysis

Date: Month/Year

PARAMETERS MONITORED

**Reported
As**

**August
2001
WTP
Tap Water**

**Saskatchewan
Drinking Water
Quality
Standards
And Objectives**

H) SPECIFIC ORGANICS + phenols

carbon tetrachloride (CCl4)	µg /L	<	0.50	5
dichloromethane (DCM)	µg /L	<	0.50	50
1,1-dichloroethylene	µg /L	<	0.50	14
1,2-dichlorobenzene (DCB)	µg /L	<	0.50	200
1,4-dichlorobenzene (DCB)	µg /L	<	0.50	5
1,2-dichloroethane (DCA)	µg /L	<	0.50	5
2,4-dichlorophenol (DCP)	µg /L	<	0.20	900
monochlorobenzene (chlorobenzene)	µg /L	<	0.50	80
nitrilotriacetic acid (NTA)	µg /L	<	0.10	-
2,3,4,6-tetrachlorophenol (TET,CR)	µg /L	<	0.50	100
1,1,1-trichloroethylene (TCE)	µg /L	<	0.50	50
1,1,1-trichloroethane (Methyl chloroform)	µg /L	<	0.50	-
2,4,6-trichlorophenol (TCP)	µg /L	<	0.20	5
benzene	µg /L	<	0.20	5
toluene	µg /L	<	0.20	24
ethylbenzene	µg /L	<	0.20	2.4
xylenes	µg /L	<	0.20	300
benzo(a)pyrene (resample)	µg /L	<	0.01	-

I) RADIOCHEMICALS (Not requested)

Cesium-137	Bq/L	<	0.3	-
Iodine-131	Bq/L	<	0.2	-
Radium-226	Bq/L	<	0.005	-
Strontium-90	Bq/L	<	0.1	-
Tritium	Bq/L	<	15	-
gross-alpha	Bq/L	<	0.08	0.1
gross-beta	Bq/L		0.12	0.11
Radon 222	Bq/L	<	1.0	-

Remarks: Bq/L= Becquerels per Litre

Data was questionable for a benzo(a)pyrene value (0.03 ug/L). Resamples done of source water, WTP, distribution system & reservoirs were all non-detectable for this component.

*Source: Email communication from the City of Saskatoon Water Treatment Plant
 Saskatchewan's Drinking Water Quality Standards and Objectives (summarized), 2002.*

Water Quality Along The South Saskatchewan River

“The Canadian Water Quality Index (CWQI) was developed by a federal/provincial taskforce to provide a convenient means of summarizing complex water quality data and facilitating communications to a wide audience – from technical managers to the general public. The Index incorporates three elements: scope – the number of variables not meeting Saskatchewan’s Surface Water Quality Objectives (SWQO); frequency – the number of times these objectives are not met; and amplitude – the amount by which the objectives are not met. The Index produces a number between 0 (worst water quality) and 100 (best water quality). In this way, the Index can be used to assess water quality relative to its desirable state (as defined by the SWQO) and to provide insight into the degree to which water quality is affected by human activity.

“The Index has the flexibility to allow different users to select parameters, sites and time periods that are meaningful to their issues. Saskatchewan’s application of the Index – hereafter referred to as the SWQI - allows the user to evaluate water quality parameters against the SWQO in four categories or uses: Protection of Aquatic Life – this category uses a wide range of parameters necessary to support fish, insect, and plant life; Irrigation – parameters that can adversely affect irrigated crops; Livestock Watering – as the name implies, includes parameters that can affect livestock growth and well being; and Recreation – this category evaluates the bacterial and aesthetic quality parameters of the water....”

“Once the Index value has been determined for a particular watershed use, water quality is ranked by relating it to one of the following categories:

“Excellent: (Index value 95-100) – water quality is protected with a virtual absence of threat or impairment; conditions are very close to natural or pristine levels;

“Good: (Index value 80-94) – water quality is protected with only a minor degree of threat or impairment; conditions rarely depart from natural or desirable levels;

“Fair: (Index value 65-79) – water quality is usually protected but occasionally threatened or impaired: conditions sometimes depart from natural or desirable levels;

“Marginal: (Index value 45-64) – water quality is frequently threatened or impaired; conditions often depart from natural or desirable levels; and

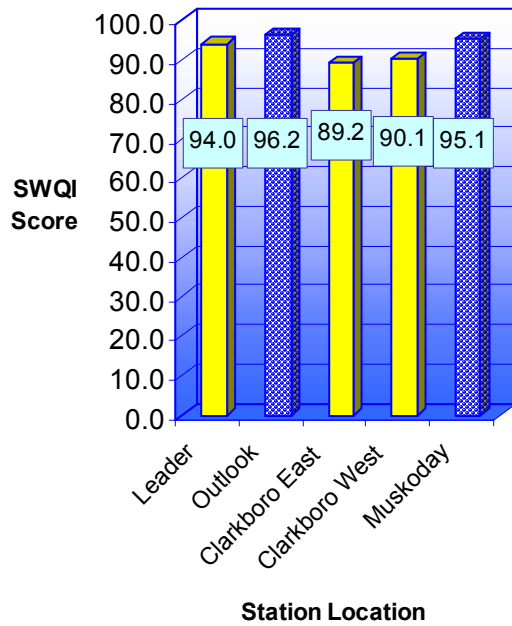
“Poor: (Index value 0-44) – water quality is almost always threatened or impaired; conditions usually depart from natural or desirable levels.”

**Table A2.5
Objectives of the Saskatchewan Water Quality Index for Aquatic Life**

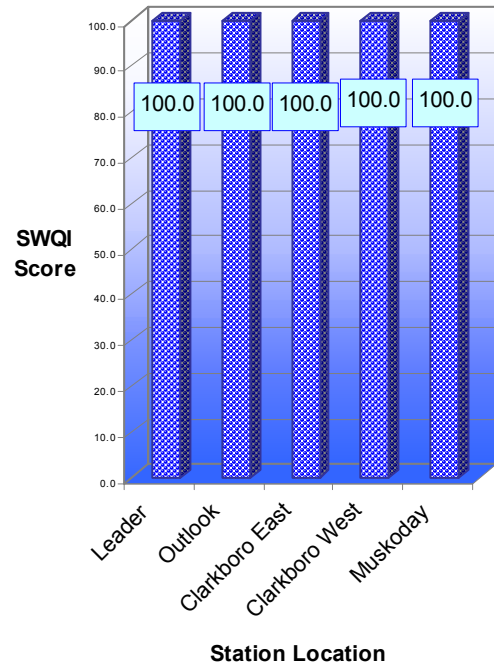
Water Quality Parameter:	Objective:
Chloride - Dissolved	100 mg/L
Arsenic - Total	50 mg/L
Chromium - Total	0.02 mg/L
Nitrogen - Total Ammonia	Based on pH and Temperature
Mercury	0.1 mg/L
Sodium - Dissolved	100 mg/L
pH	6.5 – 8.5
Oxygen - Dissolved	5 mg/L
2' 4-D	4 ug/L
MCPA	0.025 ug/L

Source: Saskatchewan Environment

**Figure 2.2: South Saskatchewan River
Protection of Aquatic Life
SWQI 10 Year Average**



**Figure 2.3: South Saskatchewan River
Livestock Watering
SWQI 10 Year Average**



South Saskatchewan River Water Supply

Table A2.6
South Saskatchewan River Average Annual Flowrate per Decade at Saskatoon

Decade	Average Annual Flowrate
	m ³ /s
1910	357
1920	309
1930	205
1940	244
1950	327
1960	232
1970	224
1980	169
1990	231
2000 ¹	158

1. One year average annual flowrate

Source: Compiled from average annual flowrate data received from SaskWater Corporation, email communication, 2002.

Wastewater and Stormwater Effluent

Wastewater treatment provides initial treatment of the raw sewage for primary solids removal and full secondary treatment with additional nutrient reduction using a biological nutrient removal process. Biosolids are further treated at a remote handling facility 12 km north of Saskatoon. The wastewater is treated with chlorine prior to release into the South Saskatchewan River. Treatment ensures that biochemical oxygen demand, total suspended solids (TSS), and phosphorous (P) concentrations are within the permit to operate limits set by Saskatchewan Environment.

Table A2.7
Wastewater Treatment Plant Operating Results

	1999	2000	2001
Flow Received (Million cubic metres)	* 23.1	* 27.4	28.0
Total Pollutant Loads Removed			
Biochemical Oxygen Demand (tonnes)	* 5365	* 7297	7705 97
Process Efficiency (%)	95	96	5351
Suspended Solids (tonnes)	* 4213	* 4992	97 164
Process Efficiency (%)	96	96	94
Phosphorous (tonnes)	* 135	*174	
Process Efficiency (%)	95	94	
Chemical Usage (Kg)			
Chlorine	77,58	93,03	95,6
Ferric Chloride (as Fe)	5	6	93
Polymer	35,75	35,90	8188
Potassium Permanganate (as KM _N O ₄)	6	8	2719
	0	815	12,7
	14,56	12,33	09
	1	5	

Source: City of Saskatoon, Wastewater Treatment Branch

Notes:

* A correction to the plant's flow meter occurred in September 2000. Corrected flows readings for 1999 and 2000 are reported herein.

Table A2.8
Wastewater Treatment Plant Permitting Results

	Permit to Operate	2001 – Annual Averages
Total Suspended Solids	25 mg/L (weekly average)	8 mg/L
Biochemical Oxygen Demand	25 mg/L (weekly average)	9 mg/L
Phosphorous	1.0 mg/L (annual average)	0.40 mg/L
Bacteri	200 count/100 ml (monthly average of geometric means)	No exceedances
Flow	--	28.02 million cubic meters

Source: City of Saskatoon, Wastewater Treatment Branch

Table A2.9
Nutrient Concentrations from 1994-1995 and 2000

Summer Mean Concentration (mg/L)								
	Upstream		140 m downstream		10-12 km downstream		26 km downstream	
	1994-1995	2000	1994-1995	2000	1994-1995	2000	1994-1995	2000
NH ₃ as N	0.03	<0.02	0.06	<0.02	0.27	<0.02	0.18	<0.02
NO ₂ -NO ₃ as N	0.03	<0.03	0.04	<0.03	0.46	0.05	0.24	0.06
TP	0.023	0.01	0.02	0.01	0.126	0.017	0.113	0.017

Source: Ecological Survey of the South Saskatchewan River Downstream of the City of Saskatoon Wastewater Treatment Plant, EPS 5/AT/2, Environment Protection Branch, Prairie and Northern Region, Environment Canada, 2001.

Table A2.10
Reductions in Total Suspended Solids (TSS) and Biochemical Oxygen Demand (BOD₅) in the Saskatoon Effluents

Years	Average TSS (mg/L)	Average BOD ₅ (mg/L)
1997-2000	9	10
1991-1996	22	72
1977-1990	78	107

Source: Ecological Survey of the South Saskatchewan River Downstream of the City of Saskatoon Wastewater Treatment Plant, EPS 5/AT/2, Environment Protection Branch, Prairie and Northern Region, Environment Canada, 2001.

Table A2.11 Example composite sample standard parameter and herbicide analysis results - Sturgeon Drive Site, June 17, 2001.

Parameters	Value	Units
Total Dissolved Solids (Calc)	199	mg/L
Suspended Solids (fixed)	97	mg/L
Suspended Solids(volatile)	24	mg/L
Suspended Solids (total)	121	mg/L
Conductivity	312	ms/cm
Sulphate	62	mg/L
pH	6.9	pH units
Total Alkalinity	58	mg/L as CaCO ₃
Bicarbonate	71	mg/L
Sodium (ICP)	16	mg/L
Magnesium (ICP)	8	NTU
Calcium (ICP)	27	mg/L
Total Hardness	100	mg/L
Chloride	13	mg/L
Potassium (ICP)	2	mg/L
Turbidity	48.40	mg/L
Biochemical Oxygen Demand	7.1	mg/L
Dissolved Organic Carbon	18	mg/L
Preserved Ammonia – N		mg/L
Nitrate – N	0.68	mg/L
Total Kjeldhal Nitrogen	1.1	mg/L
Phosphorous (Total)	0.32	mg/L
Phosphorous (Ortho)	0.04	mg/L
Chemical Oxygen Demand	66	mg/L
Herbicide Scan Analysis		
Trifluralin	<0.01	mg/L
Triallate	<0.04	mg/L
Diclofop	<0.04	mg/L
Mecoprop (MCP)	<0.04	mg/L
24-D	1.40	mg/L
24-DB	<0.02	mg/L
Dichlorprop	<0.10	mg/L
MCPA	<0.04	mg/L
Dicamba	Interference	mg/L
Bromoxynil	0.30	mg/L
Biological		
Total Coliform (MPN)	150,000	orgs/100 mL
Fecal Coliform (MPN)	210	orgs/100 mL

Source: *Characterization of Stormwater Input To The South Saskatchewan River Within Saskatoon*, S.M. McLeod, G.J. Putz and J.A. Kells, 2002.

Table A2.12:
2001 National Pollution Release Inventory Data For Reporting Facilities in
Saskatoon

Agrium Inc. - Vanscoy Potash Operations					
NPRI ID - 1177 General Delivery Vanscoy, SK S0L 3J0					
CAS Nr.	Substance Name	On-Site Releases	Transfers for Disposal	Transfers for Recycling	Units
<u>107-21-1</u>	<u>Ethylene glycol</u>	1.50	0.00	0.00	<u>tonnes</u>
<u>7647-01-0</u>	<u>Hydrochloric acid</u>	0.00	0.00	0.00	<u>tonnes</u>
Akzo Nobel Chemicals Ltd.					
NPRI ID - 3977 Wanuskewin Road P.O. Box 4090 Saskatoon, SK S7K 4E3					
CAS Nr.	Substance Name	On-Site Releases	Transfers for Disposal	Transfers for Recycling	Units
<u>107-13-1</u>	<u>Acrylonitrile</u>	0.05	0.00	0.00	<u>tonnes</u>
<u>NA - 16</u>	<u>Ammonia (Total)</u>	53.51	0.00	0.00	<u>tonnes</u>
<u>NA - 11</u>	<u>Nickel (and its compounds)</u>	0.03	0.00	23.03	<u>tonnes</u>
<u>7664-93-9</u>	<u>Sulphuric acid</u>	0.10	0.00	0.00	<u>tonnes</u>
Cargill Limited - Clavet Oilseeds					
NPRI ID - 5274 P.O Box 190 Clavet, SK S0K 0Y0					
CAS Nr.	Substance Name	On-Site Releases	Transfers for Disposal	Transfers for Recycling	Units
<u>7783-06-4</u>	<u>Hydrogen sulphide</u>	27.75	0.00	0.00	<u>tonnes</u>
<u>110-54-3</u>	<u>n-Hexane</u>	105.02	0.00	0.00	<u>tonnes</u>
<u>7664-93-9</u>	<u>Sulphuric acid</u>	0.00	0.00	0.00	<u>tonnes</u>

Table A2.12 (continued):

City of Saskatoon - Biosolids Dewatering Facility					
NPRI ID - 5348 470 Whiteswan Dr. Saskatoon, SK S7K 6Z7					
CAS Nr.	Substance Name	On-Site Releases	Transfers for Disposal	Transfers for Recycling	Units
NA - 16	<u>Ammonia (Total)</u>	0.00	11.50	0.00	tonnes
NA - 10	<u>Mercury (and its compounds)</u>	0.00	6.14	0.00	kg
City of Saskatoon - Wastewater Treatment Plant					
NPRI ID - 5347 470 Whiteswan Dr. Saskatoon, SK S7K 6Z7					
CAS Nr.	Substance Name	On-Site Releases	Transfers for Disposal	Transfers for Recycling	Units
NA - 16	<u>Ammonia (Total)</u>	64.00	11.50	0.00	tonnes
7782-50-5	<u>Chlorine</u>	19.00	0.00	0.00	tonnes
NA - 10	<u>Mercury (and its compounds)</u>	0.00	6.14	0.00	kg
NA - 17	<u>Nitrate ion in solution at pH >= 6.0</u>	795.00	0.00	0.00	tonnes
City of Saskatoon - Water Treatment Plant					
NPRI ID - 5349 1030 Ave H S Saskatoon, SK S7M 1X5					
CAS Nr.	Substance Name	On-Site Releases	Transfers for Disposal	Transfers for Recycling	Units
NA - 16	<u>Ammonia (Total)</u>	0.00	0.00	0.00	tonnes
7782-50-5	<u>Chlorine</u>	0.00	0.00	0.00	tonnes

Table A2.12 (continued):					
Dairyland Fluid Division Limited - Saskatoon Plant					
NPRI ID - 5292 122 Wakooma Street Saskatoon, SK S7K 3J4					
CAS Nr.	Substance Name	On-Site Releases	Transfers for Disposal	Transfers for Recycling	Units
NA - 17	<u>Nitrate ion in solution at pH >= 6.0</u>	0.00	47.60	0.00	<u>tonnes</u>
<u>7697-37-2</u>	<u>Nitric acid</u>	0.00	0.01	0.00	<u>tonnes</u>
Flexi-Coil - Saskatoon Plant					
NPRI ID - 5276 1000 71st. Street E. Saskatoon, SK S7K 3S5					
CAS Nr.	Substance Name	On-Site Releases	Transfers for Disposal	Transfers for Recycling	Units
NA - 09	<u>Manganese (and its compounds)</u>	0.12	0.12	18.30	<u>tonnes</u>
IMC Global Inc. - IMC Potash Colonsay					
NPRI ID - 1742 P.O. Box 1500 Colonsay, SK S0K 0Z0					
CAS Nr.	Substance Name	On-Site Releases	Transfers for Disposal	Transfers for Recycling	Units
<u>7647-01-0</u>	<u>Hydrochloric acid</u>	0.00	0.00	0.00	<u>tonnes</u>
POS Pilot Plant Corporation					
NPRI ID - 5217 118 Veterinary Road Saskatoon, SK S7N 2R4					
CAS Nr.	Substance Name	On-Site Releases	Transfers for Disposal	Transfers for Recycling	Units
107-21-1	<u>Ethylene glycol</u>	0.40	0.00	0.00	<u>tonnes</u>
<u>7647-01-0</u>	<u>Hydrochloric acid</u>	0.00	0.00	0.00	<u>tonnes</u>

Table A2.12 (continued):

<u>67-63-0</u>	<u>Isopropyl alcohol</u>	1.30	2.70	0.00	<u>tonnes</u>
<u>67-56-1</u>	<u>Methanol</u>	7.40	1.60	0.00	<u>tonnes</u>
<u>71-36-3</u>	<u>n-Butyl alcohol</u>	1.80	1.80	0.00	<u>tonnes</u>
<u>110-54-3</u>	<u>n-Hexane</u>	25.60	17.70	0.00	<u>tonnes</u>
<u>7697-37-2</u>	<u>Nitric acid</u>	0.00	0.00	0.00	<u>tonnes</u>
<u>7664-93-9</u>	<u>Sulphuric acid</u>	0.00	0.00	0.00	<u>tonnes</u>
Pounder Emulsions, A division of Husky Oil Limited - Pounder					
NPRI ID - 6548					
806 - 50th Street East					
Saskatoon, SK					
S7K 0X6					
CAS Nr.	Substance Name	On-Site Releases	Transfers for Disposal	Transfers for Recycling	Units
<u>7647-01-0</u>	<u>Hydrochloric acid</u>	0.01	0.00	0.00	<u>tonnes</u>
<u>78-83-1</u>	<u>i-Butyl alcohol</u>	0.00	0.00	0.00	<u>tonnes</u>
<u>NA - P/H</u>	<u>PAHs, total Schedule 1, Part 3</u>	1.27	0.00	0.00	<u>kg</u>
Russel Metals Inc.					
NPRI ID - 5695					
922 51 st Street East					
Saskatoon, SK					
S7K 4E5					
CAS Nr.	Substance Name	On-Site Releases	Transfers for Disposal	Transfers for Recycling	Units
<u>NA - 09</u>	<u>Manganese (and its compounds)</u>	0.00	0.04	1.97	<u>tonnes</u>
Saskatoon - AIR CANADA - SASKATOON INTERNATIONAL AIRPORT					
NPRI ID - 3834					
AIRPORT					
SASKATOON, SK					
S7L 7L1					
CAS Nr.	Substance Name	On-Site Releases	Transfers for Disposal	Transfers for Recycling	Units
<u>107-21-1</u>	<u>Ethylene glycol</u>	6.25	0.00	0.00	<u>tonnes</u>

Table A2.12 (continued):

SaskPower - Queen Elizabeth Power Station					
NPRI ID - 2085 NE S 18, T 36, R 5 West of the 2nd Saskatoon, SK S7K 3S1					
CAS Nr.	Substance Name	On-Site Releases	Transfers for Disposal	Transfers for Recycling	Units
<u>118-74-1</u>	<u>Hexachlorobenzene</u>	0.00	0.00	0.00	<u>g</u>
<u>NA - D/F</u>	<u>Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans</u>	0.00	0.00	0.00	<u>g TEQ</u>
<u>7664-93-9</u>	<u>Sulphuric acid</u>	0.00	0.00	0.00	<u>tonnes</u>
Sterling Pulp Chemicals Ltd. - Sterling Pulp Chemicals (Sask)					
NPRI ID - 2074 71st and Wanuskewin Rd. Saskatoon, SK S7K 3R3					
CAS Nr.	Substance Name	On-Site Releases	Transfers for Disposal	Transfers for Recycling	Units
<u>7782-50-5</u>	<u>Chlorine</u>	0.51	0.00	0.00	<u>tonnes</u>
<u>7647-01-0</u>	<u>Hydrochloric acid</u>	0.00	0.00	0.00	<u>tonnes</u>
<u>7664-93-9</u>	<u>Sulphuric acid</u>	0.00	0.00	0.00	<u>tonnes</u>
West Coast Reduction Ltd. - Saskatoon Processing Company					
NPRI ID - 2367 3018 Miners Avenue Saskatoon, SK S7K 4Z8					
CAS Nr.	Substance Name	On-Site Releases	Transfers for Disposal	Transfers for Recycling	Units
<u>7664-93-9</u>	<u>Sulphuric acid</u>	0.00	0.00	0.00	<u>tonnes</u>

Source: Environment Canada, NPRI Data Search at:
<http://www.ec.gc.ca/pdb/querysite/html/>

Appendix A3: Energy Usage

Residential and Commercial Electricity Consumption

Consumption data for 1999-2001 are estimates. Accurate figures are not available because of the software conversion that the City undertook in 1999. Residential estimates were determined from the total estimated municipal consumption. Total residential consumption was determined by using ratios of residential to commercial and industrial usage from previous years.

Table A3.1
Annual Residential and Commercial Electricity Consumption for Saskatoon

Year	Residential Consumption ¹	Commercial Consumption ¹	GDP ²
	kWH	kWH	(1997 \$million)
1996	6356	110,837	na
1997	6135	111,747	5707
1998	5970	115,406	5922
1999	6229	115,399	6070
2000	6241	120,303	6357
2001	6362	123,936	6334

Sources:

1. City of Saskatoon, Electrical Services Branch. Electronic communication from Henry Hildebrandt, "Average Annual Consumption For Residential Customers", 11/07/02.
2. Conference Board of Canada data. Email communication,, Saskatoon Regional Economic Development Authority Inc., November 8, 2002.

Notes:

1999, 2000 and 2001 electricity consumption data are estimates based on total consumption and applied ratio of commercial to residential use.

The population estimates for 1999, 2000 and 2001 are from a Capital Development and Expansion report and do not include the population served outside the city.

"na" denotes not available.

Residential and Commercial Natural Gas Consumption

Table A3.2
Natural Gas Consumption in Saskatchewan¹.

Year	Residential Consumption ¹ (m ³)	Residential Gas Charges ² (cents/m ³)	Commercial Consumption ¹ (m ³)	Average Winter Temperature Departure ³ (°C)
1996	4319	13.11	35,592	-2.1
1997	3777	13.32	31,708	-1.1
1998	3248	14.47	27,678	5.0
1999	3494	16.03	28,897	2.5
2000	3430	18.20	28,981	3.8
2001	3264	23.79	28,422	0

Sources:

1. SaskEnergy. email communication with Bernie Ryma, November 8, 2002.
2. SASKENERGY HISTORICAL RATES 1992 TO 2001 at:
<http://www.saskenergy.com/rates/sehistoricalrates.htm>
3. Climate Trends and Variations Bulletin, Environment Canada at:
http://www.msc-smc.ec.gc.ca/ccrm/bulletin/winter01/ttabrgfu_e.html

Table A3.2
Average Electricity and Natural Gas Consumption in Saskatchewan

Average household electricity consumption for Saskatchewan residents:	7100 kWh/year.
Average household natural gas consumption for Saskatchewan residents:	3550 m ³ /year.
Production of greenhouse gases from electricity consumption:	0.83 kg GHG / kWh
Production of greenhouse gases from natural gas consumption:	1.86 kg GHG/ m ³ natural gas.

Source: SaskPower Energy Check website at:
<http://www.energycheck.ca/homecheck/comparison.asp>

Appendix A4: Transportation

Mode Share

Table A4.1:
Mode Share for Saskatoon's Central Business District

Transportation Mode	Percent (%)
Private Automobile	83
Transit	12
Bicycle	2
Pedestrian	3

Source: *Traffic Characteristics Report 2001*, City of Saskatoon, Infrastructure Services Department, Municipal Engineering Branch.

Table A4.2:
Mode Share Comparison (1996)

Mode	Canada	Saskatoon	Regina	Calgary	Edmonton	Winnipeg
Motor Vehicle Driver	73.4	77.9	79.3	72.9	77.0	68.2
Motor Vehicle Passenger	7.6	7.4	8.2	7.4	7.1	9.2
Public Transit	10.1	5.1	5.0	12.6	9.0	14.4
Pedestrian	7.0	6.4	5.8	5.4	5.0	6.2
Cyclist	1.1	2.0	1.1	1.1	1.1	1.4
Other	0.8	1.2	0.6	0.6	0.8	0.6
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: *Statistics Canada, 1996 Census as cited in Traffic Characteristics Report 2001*, City of Saskatoon, Infrastructure Services Department, Municipal Engineering Branch.

Notes for the accompanying Figure 4.2:

Data was rounded to the nearest digit.

Motor vehicle driver and motor vehicle passenger data were combined to reflect the number of individuals traveling to work by automobile.

Due to the low proportion of individuals in the "Other" category, the data for the Pedestrian and Other categories were combined.

Motor Vehicle Ownership Per Capita

Source: Traffic Characteristics Report 2001, City of Saskatoon, Infrastructure Services Department, Municipal Engineering Branch.

Appendix 5: Resource Recovery

Residential Waste Composition and Diversion

Data collected by the City of Saskatoon Environmental Compliance Branch conforms with the Corporations Supporting Recycling (CSR) Generally Accepted Principles (GAP) for measuring municipal waste flow to allow for comparisons with other municipalities. Saskatoon figures have not been verified by CSR.

Table A5.1
Waste Diversion From City Sponsored and Other Programs

	1996	2001
	Tonnes Diverted	Tonnes Diverted
City Programs		
Old Newspaper	5188	5910
CanMan/Appliances/Scrap Metal	614	398
Paint Exchange	11.9	16
Christmas Trees	34	39
Landfarming	52	434
Milk Container recycling-jugs	0	11
-cartons	0	6
SARRC Eco-centre at landfill		
-Oil filters, containers	0	0.65
-used oil	0	10
Other*	2052	
Sub-total-City Programs	4292	6825
Other Programs		
SARCAN – cans, PET plastic, glass, etc.	2148	3080
Cosmo.Industries-other paper products	3108	5872
SARRC Eco-centre at other city locations		
-Oil filters, containers	NA	305
-used oil	NA	2906
SSTC – tires	NA	1845
Sub-total Other Programs	5256	14,008
Total Waste Diverted	11,600	20,833
Residential Waste Landfilled	51,252	57,714
Industrial/Commercial Waste Landfilled	88,239	38,897
Total Waste Landfilled	139,490	96,611
Total Waste Diverted and Landfilled	151,090	117,444

Source:
City of Saskatoon Environmental Compliance Branch Annual Report, 2001.

**Table A5.1:
Residential Waste Stream Composition and Diversion Rates**

Residential Waste	Waste Stream Composition ¹	Waste To City Landfill	Waste Diverted ²	Total Waste	Diversion Rate
	%	Tonnes	Tonnes	Tonnes	%
Organics	33	31,881.63	473	32,354.63	1.5
Mixed Paper	21	20,288.31	2872	23,160.31	12
Other	12	11,593.32	5161	16,753.97	31
Plastic	9	8694.99	665	9359.99	7.1
Cardboard	9	8694.99	3043	11,737.99	26
Newsprint	7	6762.77	5910	12,672.77	47
Metal	5	4830.55	847	5677.55	15
Glass	4	3864.44	1864	5728.44	33

Sources:

1. *Saskatoon Regional Waste Management Association Integrated Waste Management Feasibility Study, Stantec Consulting, 2000.*
2. *City of Saskatoon Environmental Compliance Branch Annual Report 2001 with supplemental data from SARCAN, and Cosmopolitan Industries.*

Notes:

The Other category includes tires, used oil and containers, tetrapaks, milk containers, Christmas trees, and paint.

Waste Received At The City Landfill

**Table A5.3:
Comparison of Landfill Tonnage By Sector**

Sector	1996 (tonnes)	2001 (tonnes)	% change
Residential collection	51,252	53,952	5
Nonresidential collection	8306	3762	-55
Ind/Comm/Inst/Homo	79,933	38,897	-51
Total Landfilled	139,491	96,611	-31

Source: City of Saskatoon Environmental Compliance Branch Annual Report, 2001.

Appendix A6: Urban Form

Urban Land Use describes and measures the area of land used for urban purposes. Growth in urban areas can be attributed to changes in population and an urban form shaped by car-oriented planning. Due to the use of automobiles and the development of related infrastructure, employment has shifted away from the central core areas. By 1998, there were almost 18 million highway vehicles registered in Canada, an increase of 30% since 1980. Preferences in location and type of home also changed and accelerated the expansion of urban areas. Single-family homes, which consume more land than other dwelling types, as well as occupying relatively larger lots away from the central core, dominate the new urban form. Shopping malls and their attendant parking lots, industrial parks and recreational facilities, commonly found in suburbs also contribute to a need for more space to house a given population, resulting in a decline in urban population density.

The average population density in Canadian cities was 1030 persons per square kilometre in 1971; by 1996 this figure had fallen to 799 persons.

While other areas of the country have concerns with urban areas occupying dependable agricultural land, Saskatchewan still retains most of its Class 1 land.

The effect of urban areas extend beyond their physical boundaries, for instance golf courses, gravel pits, recreational areas, waste management facilities and other installations are often located on agricultural land abutting urban areas.

(Source: Econnections: Indicators and Detailed Statistics 2000, Statistics Canada - Catalogue no. 16-200-XKE)

Population Density

Population density data is based on 2001 Canada Census Data to allow for comparison with other Western Canadian cities. Population densities based on 2001 Census data may under-estimate Saskatoon's true population. The City normally uses Saskatchewan health card data which is normally higher and considered more accurate. Using the City's Planning Branch December 31st, 2001 population estimate of 212,654 and land area of 165.95 km² decreases Saskatoon's population density from 1327 people/km² to 1281 people/km².

Table A6.1: 2001 Population Density

City	Population	Land Area (km ²)	Population Density (Persons/km ²)
Saskatoon	196,811	148.34	1327
Regina	178,225	118.66	1502
Winnipeg	619,544	465.16	1332
Edmonton	666,104	683.88	974
Calgary	878,866	701.79	1252

Source: Statistics Canada at: http://www12.statcan.ca/english/census01/release/pop_dwell.cfm

Total Area of Rural Land Converted To Urban Uses

Table A6.2
Land Annexations made by The City of Saskatoon

Years	Hectares
1950-59	3862
1960-69	1316
1970-79	2960
1980-89	1796
1990-98	130

Source: City of Saskatoon, "Future Growth of Saskatoon", Final Report and Recommendations, 2000.

New Housing Starts By Type

Table A6.3
New Housing Starts by Type

Year	1996	1997	1998	1999	2000	2001
One Unit Dwellings (sud)	449	449	484	438	387	386
Two Unit Dwellings (dud)	40	24	16	29	20	7
Apartments/Housing Projects	130	170	118	159	184	136
sud %	73	70	78	70	65	73
dud%	6	4	3	5	3	1

Source: City of Saskatoon, City Planning Branch.

Note:

Two unit dwellings and apartment/housing projects account for each individual dwelling within each category.

Table A6.4
Housing Density

Core neighbourhoods:	units per acre	units per hectare
City Park	8.5	21.0
Nutana	8.3	20.5
Suburban:		
Hudson Bay Park	3.4	8.4
Nutana Park	3.7	9.1
Lakeridge	3.7	9.1
Silverwood Hts.	3.8	9.4
New 2003 and beyond:		
Willowgrove	5.6	13.8
Hampton Village	6.1	15.1
Stonebridge (preliminary)	6	14.8

Appendix A7: Contaminated Sites

Remediated Contaminated Sites

Table A7.1: Remediated Contaminated Sites

IPCO Herbicide Formulating Plant ¹ .	Located north of Silverwood Heights in Saskatoon, the site has long been identified as an abandoned site, contaminated with heavy metals and hydrocarbons. In 2000-2001, the Site was identified as a high-risk site and selected for remediation by SE, through funds received from the province's Centenary Fund.
NWR Salvage on 11th Street West ¹ .	NWR was a salvage yard for batteries, wire insulation and tires. Contamination was cleaned up during 2001-2002.
Inland Steel ¹ .	The former Inland Steel site, located at 22 nd Street and Avenue F is identified as contaminated with organic and inorganic contaminants. Clean-up of the Site to Residential/Parkland conditions is expected to be undertaken soon. Following remediation, a park is proposed for development on the site.
John G Diefenbaker International Airport ² .	The Federal Contaminated Sites and Solid Waste Landfills Inventory identifies two contaminated sites at the airport. Petroleum hydrocarbons and PAH's were identified. Action not likely required. Current status 4: Under risk management.

Sources:

STATE OF ENVIRONMENT REPORT – 2003, Environmental Protection Branch Draft Submission, Saskatchewan Environment, July 2002.

The Federal Contaminated Sites and Solid Waste Landfills Inventory at:

<http://www.tbs-sct.gc.ca/dfrp-rbif/cs-sc/numbers-numeros.asp?view=dat&Format=html&Referrer=Query&Qid=347&Language=EN>

Appendix A8: Habitat

Greenspace As A Percentage Of Total Land Area

Table A8.1
Greenspace As A Percentage Of Total Land Area

Area of Greenspace	1996 hectare	2000 hectare
City Parks within City Limits	904	944
Parks outside City Limits	372	372
Afforested Areas	205	205
Buffer Strips	102	102
Environmentally Sensitive Habitat	954	954
Total Greenspace	2537	2577
Total Land Inventory	14,133	16,595
% Greenspace	18%	16 %

Source: City of Saskatoon Municipal Manual 2002, compiled by the Office of the City Clerk.

Species At Risk

Table A8.2
Wild Species at Risk

<i>Extirpated</i>	
Birds Eskimo Curlew Greater Prairie Chicken	Mammals Plains Grizzly Bear
<i>Endangered</i>	
Birds Burrowing Owl Piping Plover Whooping Crane	Plant Hairy Prairie Clover Western Spiderwort
<i>Threatened</i>	
	Plant Slender Mouse-ear-cress

Source: Saskatchewan Environment at: www.serm.gov.sk.ca/ecosystem.speciesatrisk/

Urban Forest

Table A8.3
Saskatoon's Urban Forest

	Number of Trees	
	1997	2001
Boulevards and Parks	56,536	91,000
Woodlawn Cemetery	33,996	4,002
Shelter Belts and golf courses	100,000	100,000
Total	195,115	191,000

Source: *City of Saskatoon Municipal Manual 2002, compiled by the Office of the City Clerk.*

Appendix A9: Greenhouse Gas Emissions

CO₂ Equivalent Emissions Per Capita

Table A9.1:
Canada's Emission Outlook for Saskatchewan

Year	1990	1996	2000	2005	2015	2015 Kyoto Target	
Actual/Projected GHG (CO ₂ equivalent) ¹	47	59	64	65	67		million tonnes
SK Population	1.011	1.025	1.058	1.108	1.206		million
Per capita emissions	46	58	60	59	56	44	tonnes/ca

1. Source: Statistics Canada, Catalogue No 11-509-XPE at:
<http://www.Statcan.ca/english/Pgdb/Land/Environment/envir10.htm>

CO₂ Equivalent Emissions Per Sector

Table A9.2:
Greenhouse Gas Emissions By Economic Sectors In Saskatchewan

Sector Break Down	1996 (CO ₂ Equivalent)	Carbon Dioxide	Methane	Nitrates	
Fossil Fuel Industry	16	8	8		million tonnes
Power Generation	14	14			million tonnes
Agro Economies	11	-1	3	9	million tonnes
Transportation	9	9			million tonnes
Industrial	3	3			million tonnes
Comm/ Public	1	1			million tonnes
Residential	3	3			million tonnes
Waste	1	1			million tonnes
Total	58	38	11	9	million tonnes

Source: Statistics Canada, Catalogue No 11-509-XPE at:
<http://www.Statcan.ca/english/Pgdb/Land/Environment/envir10.htm>

Historical Weather Trends

Source:

Climate Trends and Variations Bulletin, Temperature and Precipitation in Historical Perspective, Summer 2002 at: http://www.smc-msc.ec.gc.ca/ccrm/bulletin/national_e.cfm