
CITY OF SASKATOON Street Cleaning and Sweeping

The Program is responsible for removing sand and debris from Saskatoon's 3,200 lane kilometers of roadway. In 2008, a fleet of 17 street sweepers removed approximately 35,000 tonnes of debris from Saskatoon's roadways.

April 2009

Report Highlights

City of Saskatoon Street Cleaning and Sweeping Program

Purpose of the Audit

The objective of this audit was to determine whether adequate systems, practices and controls are in place to effectively manage significant business risks inherent in the Street Cleaning and Sweeping Program.

What Internal Audit Recommends

- Improve the reliability of the street sweeping fleet.
- Evaluate the cost effectiveness of street sand recycling.
- Include bicycle lanes in Pre-Sweep priorities.
- Evaluate the cost-effectiveness of a fall sweep program in select areas.
- Implement maintenance zones in certain areas.

What Internal Audit Found

There are adequate systems, practices and controls in place to manage several of the significant business risks inherent in the Program.

However, we do believe additional steps should be taken to further minimize the likelihood or impact of risks in the following areas:

- Fleet reliability,
- Data integrity,
- Environmental stewardship,
- Performance management,
- Service prioritization,
- Inter-departmental coordination and inter-dependencies,
- Public awareness, and
- Chronic problem areas.

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Chapter 1 – Introduction and Background

Introduction

The corporate audit plan included provision to conduct an operational audit of the Street Cleaning and Sweeping Program.

Background

The Street Cleaning and Sweeping Program is responsible for removing sand and debris from Saskatoon's 3,200 lane kilometers of roadway. The overall mandate of the Program is to keep streets safe for all kinds of vehicle and pedestrian traffic by removing material that can negatively affect traction, visibility and air quality. In 2008, a fleet of 17 street sweepers removed approximately 35,000 tonnes of debris from Saskatoon's roadways.

The Program is divided into three phases:

- Pre- Sweep: focuses on major roadways and bridges and commences after the snow and ice have melted from city streets, generally the middle of April, and continues until the beginning of May when the Spring Sweep begins.
- Spring Sweep: commences at the beginning of May for about four to five weeks and includes the annual sweeping of all residential areas. There are two components – the Lettered Area Sweep (i.e., residential areas around non-resident parking generators such as hospitals, the University of Saskatchewan, SIAST, Broadway, etc.) and the Area Sweep (i.e., all other residential areas).
- Summer Sweep: ongoing sweeping activities including construction areas, priority streets, industrial areas and business districts.

Table 1: Operating Funding 2005 – 2008

	2005 (actual)	2006 (actual)	2007 (actual)	2008 (actual)
Staff Compensation	\$ 702,000	\$ 764,500	\$ 849,900	\$ 957,900
Operating Costs	692,400	680,800	825,400	895,600
Cost Recovery	(6,900)	(6,700)	(6,000)	(7,200)
Net Operating Funding Requirements	\$ 1,387,500	\$ 1,438,600	\$ 1,669,300	\$ 1,,846,300
Full Time Equivalents	13.46	13.61	13.60	13.50

Audit Objective

The objective of the audit was to determine whether adequate systems, practices and controls are in place to effectively manage significant business risks inherent in the Street Cleaning and Sweeping Program. Areas of risk included the following:

- Financial (e.g., operating financial resources do not keep pace with growth),
- Human (e.g., inability to recruit and/or retain qualified staff, inappropriate staff levels),
- Infrastructure (e.g., vehicle breakdown),
- Technology (e.g., failure to identify and/or implement advances in technology),
- Administrative (e.g., inappropriate prioritization of efforts, failure to coordinate with other civic programs),
- Strategic (e.g., inappropriate service delivery strategy),
- Service Delivery (e.g., inefficient scheduling of staff and equipment, inclement weather, parked vehicles, poor quality),
- Accidents and Incidents (e.g., staff injury, vehicle accident, property damage), and
- Secondary Impacts (e.g., air pollution, water pollution).

Acknowledgements

Robert Prosser & Associates Inc. wishes to extend special thanks to the General Manager of Infrastructure Services, Public Works Branch Manager, Roadways Section Manager and their staff for accommodating our requests for interviews, information and documents, and reviewing our audit findings.

Chapter 2 – Business Risk Management

The objective of the audit was to determine whether adequate systems, practices and controls are in place to effectively manage significant business risks inherent in the Street Cleaning and Sweeping Program.

There are adequate systems, practices and controls in place to manage several of these risks (see Appendix A). However, we believe additional steps should be taken to further minimize the risks that appear in the upper and middle quadrants in the chart below, the most significant of which are discussed further on the pages that follow.

Likelihood	Impact		
	Minor	Moderate	Significant
High		<ul style="list-style-type: none"> ▪ Inappropriate staff levels ▪ Vehicle breakdown ▪ Inefficient scheduling of staff and equipment 	<ul style="list-style-type: none"> ▪ Air pollution ▪ Water pollution
Medium	<ul style="list-style-type: none"> ▪ Operating financial resources do not keep pace with growth ▪ Inclement weather 	<ul style="list-style-type: none"> ▪ Failure to identify and/or implement advances in technology ▪ Inappropriate prioritization of efforts ▪ Failure to coordinate with other civic programs ▪ Parked vehicles ▪ Poor quality 	
Low	<ul style="list-style-type: none"> ▪ Inability to recruit and/or retain qualified staff ▪ Inappropriate service delivery strategy 	<ul style="list-style-type: none"> ▪ Staff injury ▪ Vehicle accident ▪ Property damage 	

The majority of the Program's fleet is not reliable

The Program currently has a fleet of seventeen sweeping machines, ranging from only 2 years in service to 29 years in service. The expected useful life of a sweeping machine is 20 years or 12,000 hours of service and can cost between \$150,000 and \$250,000.

As of 2008, six sweeping machines (i.e., 35% of the fleet) have exceeded their expected useful life and are due for replacement. There are also several sweeping machines that are experiencing significant down time but are less than ten years old. Available funding will not support replacement of all of these machines.

As replacements are deferred, increasing amounts are spent on repairs and maintenance, and there is increased risk of vehicle breakdown. This risk is already being experienced by the Program – in 2008, only 30% of the fleet was available for service at least 80% of the time.

Controls should be strengthened to ensure data entered into the MMS system is complete and accurate

Management gathers information regarding Program resources and workload on a daily basis and enters it into a Maintenance Management System (MMS). However, the information contained in the MMS appears to be incomplete and inaccurate. This limits management's ability to measure, monitor and report on trends in financial resources, human resources and workload.

Management should consider PM₁₀ efficiency when making sweeping machine replacement decisions

Fine road dust, which is generated as asphalt, rubber tires and brake pads wear down, is a significant health risk and fine particles known as PM₁₀ (particulate matter smaller than 10 microns) are considered to be a toxic substance according to the Canadian Environmental Protection Act.

It is becoming increasingly common for street sweeping programs to base sweeping equipment replacement decisions, in part, on the ability of the equipment to remove PM₁₀ from the road surface. Such an approach would be consistent with the City's Strategic Plan and City Council's Environmental Policy.

There may be an opportunity to reduce costs and improve environmental stewardship by recycling street sand

The Snow and Ice Program deposits approximately 35,000 tonnes of sand on city streets each winter in order to provide adequate traction for vehicular traffic. In the spring, this material is swept up by the Program and either used as cover at the landfill or put to other uses (e.g., infill, sound attenuation berms).

The City of Edmonton has developed an award winning process whereby street sand is recycled. The capital cost of the process was funded in part through a grant from the FCM's Green Municipal Fund. The process results in the diversion of approximately 150,000 tonnes of material from Edmonton's landfill each year, extending its life by at least half, and significantly reduces the amount Edmonton spends on sand each winter (pre-2005: \$2-3 million/year).

The GPS system could be used to monitor and report on performance

Each sweeping machine is equipped with a GPS transponder. The GPS system (Grey Island) can present information in real time or on a historical basis. Various management reports can be generated showing fleet activities and accomplishments.

At the present time, the GPS system is being used mainly to acknowledge or dispute claims for damages through the City Solicitor's Office. Management and staff indicate they have not had the time or training necessary to allow them to use the system's capabilities to monitor and report on Program performance.

Pre-Sweep priorities should be documented and include bicycle lanes

The Pre-Sweep begins as soon as possible in the spring and focuses on removing the greatest quantity of material from high speed/high volume roadways – generally freeways/expressways, arterials and collectors.

Management agrees that bicycle lanes should be prioritized for sweeping due to the risk that a loss of traction could pose to the cyclists who use them. We also note that Pre-Sweep priorities are not documented which increases the risk of inefficiency (e.g., some streets might be swept more than once while others might not be swept at all).

The Spring Sweep should be better coordinated with Parks Branch

Throughout the winter months, sand applied as a traction aid is thrown up onto boulevards and medians by snow plows and traffic flows. If the sand is not removed from grass boulevards within a few weeks of spring growth, the grass may be damaged.

Although attempts have been made to coordinate efforts in the past, per management coordination should be improved.

Management should determine whether a Fall Sweep would be cost effective

The Roadways Section budgeted \$427,000 in 2008 to clear catch basin blockage throughout the city; however, the locations cleared are not tracked so the neighborhoods that are experiencing the most problems can not be identified.

Management estimates that it would cost approximately \$240,000 to perform a fall leaf sweep in certain areas of the city over the course of four weeks. If management were to determine whether the areas in which a fall leaf sweep would be undertaken are the same as those experiencing catch basin blockages, the cost effectiveness of the initiative could be determined.

Certain neighborhoods may benefit from the use of notification signage at entry points

When a vehicle is parked on the street, approximately two car lengths of gutter line can not be swept. Despite door-to-door delivery of pamphlets/flyers, advertisements, public service announcements and information on the Program's website, parked vehicles continue to be a problem in some areas.

When a neighborhood has a limited number of entrypoints (e.g., Lakeview, Wildwood, Erindale, Willowgrove, College Park, Hampton Village, Silverwood Heights, etc.), signage may be an effective way in which to notify residents and visitors about sweeping activities.

Maintenance zones could improve the effectiveness of several civic programs

The Program posts parking restrictions in residential areas with significant non-resident on-street parking generators (e.g., the University, City Hospital, Broadway/Five Corners). Signage must be in place for at least 36 hours in order to be enforceable. In the event of unauthorized removal of the signage, it may not be legal to tow vehicles and therefore the area must be rescheduled and the posting process repeated, at additional cost.

Management believes that the implementation of “maintenance zones” in these areas could help ensure a more effective and efficient sweep. These zones would have a set day of week and time of day during which parking would be prohibited. This would allow for more effective scheduling of sweeping activities and other civic services (e.g., tree pruning, pothole patching, snow clearing etc.).

Industrial areas and new developments are chronic problem areas

Industrial properties and new developments are often unpaved and frequented by large vehicles and equipment. In the spring and after a rainfall, significant amounts of mud are often tracked onto the roadway. In addition, the proximity of these properties to undeveloped land often allows topsoil, debris and vegetation to blow in and collect in and around the gutters.

This is a common problem that is faced by many street sweeping programs. There are various tools that could be evaluated to help address the issue (e.g., enact and enforce a bylaw prohibiting the tracking of debris onto the roadway, add an additional fee on each building permit for extra sweeping services, fund a higher level of service).

Recommendations

1. That management, in cooperation with Vehicle and Equipment Services, identify and evaluate ways to increase the reliability of the street sweeping fleet.
2. That management strengthen controls to ensure data entered into the Maintenance Management System is complete and accurate.
3. That management consider PM₁₀ efficiency when making equipment purchase decisions.
4. That management evaluate the cost effectiveness of street sand recycling.
5. That management research and develop the reporting features of the GPS system.
6. That management develop a listing of Pre-Sweep priorities and maintain this listing as sweeping is carried out.
7. That Pre-Sweep priorities include bicycle lanes.
8. That management improve coordination with Parks Branch's boulevard sweeping activities.
9. That management evaluate the cost effectiveness of a fall sweep program in select areas of the city.
10. That management review each neighborhood and determine whether the use of signboards at key entry-points would be an effective way to notify residents and visitors of Spring sweeping activities.
11. That management discuss with City Solicitor's Office the potential for maintenance zones in certain areas with significant non-resident on-street parking generators.
12. That management evaluate options regarding how to deal with excessive on-street debris in industrial areas and new developments.

Management Response

1. *Agree.*
Implementation of this recommendation will be dependent upon implementation of Vehicle and Equipment Services' new fleet management system.
2. *Agree.*
3. *Agree.*
We will have to ensure an appropriate balance is achieved between heavy material pickup capabilities versus fine material pickup capabilities.
4. *Agree.*
A pilot project is currently underway – 2,000 tonnes of material will be recycled this year, with a final decision regarding the feasibility of full-scale recycling expected in time for the 2010 season.
5. *Agree.*
6. *Agree.*
7. *Agree.*
The 2009 pre-sweep included some bicycle lanes and will be formalized for the 2010 season and beyond.
8. *Agree.*
We met with Parks Branch this spring to coordinate our activities. However, full implementation of this recommendation will have staffing implications.
9. *Agree.*
The preliminary 2009 operating budget included provision for a fall sweep but the initiative was not approved. We will include a fall sweep in our 2010 operating budget submission.
10. *Agree.*
A pilot project is currently underway. After the 2009 season we will evaluate the potential for a more wide-spread roll-out to other neighborhoods for the 2010 season.

11. *Agree.*

We have started discussions with the City Solicitor's Office. We will need to amend the bylaw and install signage.

12. *Agree.*

We have had discussions with Land Branch regarding the funding for an additional sweep in City of Saskatoon residential developments and will further evaluate options for industrial areas and non-civic developments.

Chapter 3 – Implementation Plan

	Recommendations	Implementation Date
1.	That management, in cooperation with Vehicle and Equipment Services, identify and evaluate ways to increase the reliability of the street sweeping fleet.	December 31, 2010
2.	That management strengthen controls to ensure data entered into the Maintenance Management System is complete and accurate.	March 31, 2011
3.	That management consider PM ₁₀ efficiency when making equipment purchase decisions.	March 31, 2010
4.	That management evaluate the cost effectiveness of street sand recycling.	March 31, 2010
5.	That management research and develop the reporting features of the GPS system.	April 30, 2010
6.	That management develop a listing of Pre-Sweep priorities and maintain this listing as sweeping is carried out.	February 28, 2010
7.	That Pre-Sweep priorities include bicycle lanes.	Implemented
8.	That management improve coordination with Parks Branch's boulevard sweeping activities.	March 31, 2010
9.	That management evaluate the cost effectiveness of a fall sweep program in select areas of the city.	November 30, 2009
10.	That management review each neighborhood and determine whether the use of signboards at key entry-points would be an effective way to notify residents and visitors of Spring sweeping activities.	March 31, 2010
11.	That management discuss with City Solicitor's Office the potential for maintenance zones in certain areas with significant non-resident on-street parking generators.	May 31, 2010
12.	That management evaluate options regarding how to deal with excessive on-street debris in industrial areas and new developments.	December 31, 2010

Appendix A – Risk Matrix

Appendix A, cont'd

RISK EVENT	SYSTEMS, PRACTICES AND CONTROLS	RESIDUAL RISK		CONCLUSION
		LIKELIHOOD	IMPACT	
FINANCIAL				
Operating financial resources do not keep pace with growth	<ul style="list-style-type: none"> ○ Inadequate operating financial resources could result in an increased overall lapse time for the Spring Sweep and/or failure to achieve service level objectives. ○ Management gathers information regarding Program resources and workload on a daily basis and enters it into a Maintenance Management System (MMS). <ul style="list-style-type: none"> ○ However, we have concerns regarding the completeness and accuracy of the information in the MMS and therefore could not use the data for analysis. ○ Although global indicators such as number of complaints received, and staff increases from 2004-2008 (i.e. 1.8%) relative to the increase in total street pavement area (i.e. 4.5%), might suggest pressure is being placed on Program resources, other key indicators such as pass kilometers swept, tonnes of material collected and lapse time for the Spring Sweep are not available and therefore a definitive conclusion can not be made. 	Medium. Complete and accurate information regarding accomplishments, workload and staff resources is not available.	Minor. The overall lapse time for the Spring Sweep may increase; service level objectives may not be achieved.	Additional actions are required. Management should strengthen controls to ensure data entered into the MMS is complete and accurate.
HUMAN				
Inability to recruit and/or retain qualified staff	<ul style="list-style-type: none"> ○ Streets can not be swept if qualified staff can not be hired or retained to perform the work, resulting in an increased overall lapse time for the Spring Sweep and/or failure to achieve service level objectives. ○ Management has the following controls in place to minimize this risk: <ul style="list-style-type: none"> ○ Job postings are advertised as “General Postings’ which allow for a high degree of variety and flexibility (i.e., staff are hired to perform a variety of duties for both the Roadways Section and Water and Sewer Section). ○ Shifts are 10-hours long, 4 days a week, allowing staff to have more consecutive days off. ○ Annual pre-season training programs ensure staff skills are current. ○ Management has found that most staff return year-after-year to these seasonal positions and that openings are most often as a result of retirements. ○ Management recognizes that staff are under a lot of public pressure to complete sweeping as soon as possible and that some people do not like to work in the evenings and on weekends. <ul style="list-style-type: none"> ○ Management indicates there have been problems with having full staff complements available each shift and that in some cases, sweeping has had to be postponed due to a lack of resources. ○ In response, management is considering the implementation of Districts whereby staff would be dedicated to one area of the city and the scheduling, prioritization and performance of sweeping in that District would be a team accomplishment. 	Low. Existing and planned controls appear to be adequate to reduce the likelihood of this risk to an acceptable level.	Minor. The overall lapse time for the Spring Sweep may increase; service level objectives may not be achieved.	Additional actions are not required.

Appendix A, cont'd

RISK EVENT	SYSTEMS, PRACTICES AND CONTROLS	RESIDUAL RISK		CONCLUSION
		LIKELIHOOD	IMPACT	
Inappropriate staff levels	<ul style="list-style-type: none"> ○ Staff levels that are too high result in excessive Program costs; staff levels that are too low may result in increasing pressure on existing staff (which may create morale issues). ○ Management gathers information regarding staff hours and workload on a daily basis and enters it into a Maintenance Management System (MMS). <ul style="list-style-type: none"> ○ However, we have concerns regarding the completeness and accuracy of the information in the MMS and therefore could not use the data for analysis. ○ Although global indicators such as number of complaints received, and staff increases from 2004-2008 (i.e. 1.8%) relative to the increase in total street pavement area (i.e. 4.5%), might suggest pressure is being placed on Program resources, other key indicators such as pass kilometers swept, tonnes of material collected and lapse time for the Spring Sweep are not available and therefore a definitive conclusion can not be made. 	High. Complete and accurate information regarding accomplishments, workload and staff resources is not available.	Moderate. Staff turnover may increase.	Additional actions are required. See conclusion re: financial risk.
INFRASTRUCTURE				
Vehicle breakdown	<ul style="list-style-type: none"> ○ If sweeping machines break down, staff are idle, streets can not be swept, the overall lapse time for the Spring Sweep increases and/or service level objectives can not be achieved. ○ Management has the following controls in place to minimize this risk: <ul style="list-style-type: none"> ○ Vehicle preventive maintenance program: vehicles are subject to preventive maintenance activities every 175 hours (minor maintenance) and every 500 hours (major maintenance). <ul style="list-style-type: none"> ▪ Per management, due to staffing shortages, Vehicle & Equipment Services Section (V&E) has had difficulties performing all scheduled preventive maintenance routines. ○ Turn in check: at the end of each season, when the sweeping machines are returned to V&E, a comprehensive “turn in check” is performed to identify and repair all deficiencies. ○ Pre-season check: prior to the beginning of each season, a comprehensive “pre-season check” is to be performed to ensure the sweeping machine is ready for service. ○ Circle checks: Sweeper Operators perform an extensive circle check to ensure the sweeper is in good working condition each day. ○ Spare machines: between 3 and 4 sweeping machines are maintained as spares for use in the event that an active sweeping machine is taken out of service for repairs. ○ Despite these controls, management indicates that vehicle breakdowns are occurring often and are hampering the Program’s ability to sweep streets in a timely manner. <ul style="list-style-type: none"> ○ Of the fleet of 17 sweeping machines, 6 (i.e., 35%) have exceeded 	High. In 2008, only 30% of the fleet was available for at least 80% of the time.	Moderate. Although spare sweeping machines are available, putting them into service is very disruptive for staff and inefficient.	Additional actions are required. Management should work with V&E to identify ways in which to increase the reliability of the fleet.

Appendix A, cont'd

RISK EVENT	SYSTEMS, PRACTICES AND CONTROLS	RESIDUAL RISK		CONCLUSION
		LIKELIHOOD	IMPACT	
	<p>their expected useful life of 20 years or 12,000 hours of service, in two cases by a large margin (45%).</p> <ul style="list-style-type: none"> ○ In 2008, only 30% of the fleet was available for service at least 80% of the time; 2 sweeping machines were undergoing repairs for more hours than they were available for service. 			
TECHNOLOGY				
<p>Failure to identify and/or implement advances in technology</p>	<ul style="list-style-type: none"> ○ Failure to identify and/or implement advances in technology could result in unrecognized and/or unrealized opportunities for improvements in efficiency. ○ Management has the following controls in place to minimize this risk: <ul style="list-style-type: none"> ○ Management networks with peers individually and in group settings (e.g., trade shows, conferences). ○ Management subscribes to industry publications. ○ Management has participated in equipment trials (i.e., staff “test drive” a vendor’s new equipment for a certain time period to determine if it would be effective in Saskatoon). ○ One recent technological advancement that could be suitable for the Program was developed by Edmonton in 2005 and involves the recycling of street sand used for traction control in the winter. <ul style="list-style-type: none"> ○ In response to shrinking sand deposits, rising costs and increasingly stringent environmental regulations, the Edmonton Waste Management Centre of Excellence and Sand Recycling Ltd. entered into a long term agreement to recycle used street sand. ○ Edmonton’s award winning process involves accepting street sweepings for processing, separating the litter and debris from the sand, washing the material (and reusing the water) and stockpiling the recycled sand for use during the following winter. ○ This process diverts 150,000 tonnes of street sweepings from Edmonton’s landfill each year, extending its useful life significantly. ○ This project qualified for the Federation of Canadian Municipalities Green Municipal Fund – a grant of almost \$619,000 was received towards the project which was valued at almost \$2 million (2002-2003 information). ○ Street sweeper technology has expended over the past several years to include vacuum-assist sweepers and regenerative-air sweepers. <ul style="list-style-type: none"> ○ Management has found that the vacuum-assist sweeping technology is not very effective and has only purchased one of these machines. Regenerative-air sweepers have not been tested. These machines blast the street surface with air and vacuum up the sand/dirt. ○ Management indicates that there are features of the GPS system (Grey Island) that are available but not being utilized due to lack of time to commit to developing these features (e.g., performance monitoring and reporting capabilities). 	<p>Medium.</p> <p>There are some advances that could be applicable to the Program’s activities.</p> <p>There are features of the GPS system that are not being utilized to their full potential.</p>	<p>Moderate.</p> <p>In addition to improving the City’s environmental stewardship, there is a potential for cost savings if street sand was recycled.</p> <p>Performance monitoring and reporting could be streamlined through better use of the GPS system.</p>	<p>Additional actions are required.</p> <p>Management should prepare a business case to determine if street sand recycling would be cost effective.</p> <p>Management should research and develop the reporting features of the GPS system.</p>

Appendix A, cont'd

RISK EVENT	SYSTEMS, PRACTICES AND CONTROLS	RESIDUAL RISK		CONCLUSION
		LIKELIHOOD	IMPACT	
ADMINISTRATIVE				
Inappropriate prioritization of efforts	<ul style="list-style-type: none"> ○ When efforts are prioritized inappropriately, debris may remain on high speed/high volume streets longer than low speed/low volume streets, resulting in higher risk of accident (i.e., poor traction) and/or property damage (i.e., flying debris). ○ Management has the following controls in place to minimize this risk: <ul style="list-style-type: none"> ○ The Pre-Sweep commences as soon as roadway surfaces are free of snow/ice and sweeping machines are available for use. <ul style="list-style-type: none"> ▪ The roadways swept during this phase are typically Priority 1 and Priority 2 roadways since they dry earlier – snow is generally plowed and/or removed from these streets as part of the Snow and Ice Program. ▪ Priority 1 and Priority 2 roadways are the highest traffic volume roads in the city and therefore are sanded the most in the winter months. A large quantity of material is collected from these roads. ○ The Business Improvement Districts are included in the Pre-Sweep and on a regular basis during the Summer Sweep. <ul style="list-style-type: none"> ▪ This is due, in part, to the high level of pedestrian traffic in these areas – removing street debris reduces the level of dust in the air. ○ The order in which neighborhoods are swept during the Spring Sweep is rotated, with some exceptions (e.g., Montgomery). ○ In addition to the Business Improvement Districts, the Summer Sweep focuses on Priority 1 and Priority 2 roadways (higher speed/higher volume), and construction and industrial areas (unsightly; recurring issues). ○ Management agrees that bicycle lanes should be prioritized for sweeping due to the risk that a loss of traction could pose to the cyclists who use them. ○ We do note that staff are not provided with a listing of the streets that should be swept during the Pre-Sweep. This increases the risk of inefficiency (e.g., some streets might be swept more than once while others might not be swept at all). 	<p>Medium. Bicycle lanes are not considered when sweeping activities are being prioritized.</p> <p>There is little documentation regarding which roadways have been assigned a higher sweeping priority.</p>	<p>Moderate. Cyclists could be involved in an accident.</p> <p>Pre-Sweep activities may be carried out inefficiently.</p>	<p>Additional actions are required. Management should include bicycle lanes in the Pre-Sweep.</p> <p>A listing of Pre-Sweep priorities should be developed and maintained as sweeping is carried out.</p>
Failure to coordinate with other civic programs	<ul style="list-style-type: none"> ○ Coordination of the Program’s activities with other civic programs minimizes traffic disruptions, duplication of efforts and inefficiencies. ○ The Program’s major cooperators include Parks (boulevard sweeping), Environmental Services (garbage collection) and Roadways Section (clearing catch basin blockages) <ul style="list-style-type: none"> ○ Parks Branch has a very short time window during which it can 	<p>Medium. Activities are not being effectively coordinated with Parks at the present time.</p>	<p>Moderate. The public’s perception of the City could be negatively affected; resources are wasted if the same area has to be</p>	<p>Additional actions are required. Management should improve coordination with</p>

Appendix A, cont'd

RISK EVENT	SYSTEMS, PRACTICES AND CONTROLS	RESIDUAL RISK		CONCLUSION
		LIKELIHOOD	IMPACT	
	<p>conduct boulevard sweeping. Although attempts have been made to coordinate efforts in the past, management has indicated that coordination should be improved.</p> <ul style="list-style-type: none"> ○ Garbage collection schedules for those areas where individual roll-out containers are used are considered when the overall Spring Sweep plan is being developed. ○ Certain areas of the city experience problems with catch basin blockages in the spring because of leaf build up in the gutters in the fall. The catch basin clearing program is not complaint driven and a listing/map of problem locations is not maintained for analysis and evaluation. Management estimates that it would cost approximately \$240,000 to perform a fall leaf sweep in certain areas of the city for a total of 4 weeks. The cost of a fall sweep could be partially offset by cost savings in the Roadways Section (2008 budget for catch basin clearing \$427,000). 	The locations of catch basin blockages are not monitored to determine if there is a correlation to heavily treed/mature neighborhoods.	<p>swept twice.</p> <p>The cost of a fall sweep could be partially offset through savings in having fewer catch basin blockages.</p>	<p>Parks Branch boulevard sweeping activities.</p> <p>Management should evaluate the cost effectiveness of a fall sweep program in select areas of the city.</p>
STRATEGIC				
Inappropriate service delivery strategy	<ul style="list-style-type: none"> ○ Failure to adopt an appropriate service delivery strategy for the Program could result in excessive costs. Because the Program is funded almost exclusively by general revenues, this could lead to undue pressure on the mill rate. ○ Management has considered the following alternative service delivery strategies for the Program. <ul style="list-style-type: none"> ○ Private sector service delivery: in June 2008, management undertook a study that examined, in part, the extent to which major Western Canadian cities contract out their street sweeping activities. Edmonton, Calgary and Winnipeg contract out a portion of their sweeping activities; Regina and Saskatoon do not contract out sweeping at all. This study also found that there are no contractors in Saskatoon that can perform street sweeping on a large scale, so out-of-town contractors would most likely be required. Because demand for services is extremely high for a limited period of time each year, availability could be limited and/or premium rates charged. ○ Leased sweepers vs. purchased sweepers: leasing sweepers is very expensive due again, in part, to the fact that demand for the equipment is extremely high for a limited period of time. Management's June 2008 study indicates it can cost from \$6,900 - \$8,500 per month per sweeper (three month minimum). Vehicle & Equipment Services currently charges the Program \$6,315 per month for 3-wheel sweepers and \$8,310 per month for 4-wheel sweepers. ○ Tax supported vs. utility funded: many municipalities, mainly in the United States, have transformed the mission of their street sweeping 	<p>Low.</p> <p>Controls appear to be adequate to reduce the likelihood of this risk to an acceptable level.</p>	<p>Minor.</p> <p>Controls appear to be adequate to reduce the impact of this risk to an acceptable level.</p>	<p>Additional actions are not required.</p>

Appendix A, cont'd

RISK EVENT	SYSTEMS, PRACTICES AND CONTROLS	RESIDUAL RISK		CONCLUSION
		LIKELIHOOD	IMPACT	
	<p>programs from safety and aesthetics to environmental stewardship. Several municipalities fund all or a portion of their street sweeping activities through their storm water utility because of the role street sweeping can play in minimizing the amount of potentially toxic material that is washed into the storm sewer system and released into the environment. Such a shift in mindset would have to be strongly supported and endorsed by City Council since the Storm Water Utility gross budget would increase by 45% if this were to occur (i.e. the source of funds for the Street Sweeping Program would shift from the property tax base over to utility charges).</p> <ul style="list-style-type: none"> ▪ The gross operating budget for the Street Sweeping Program was just over \$1.5 million in 2008; the gross operating budget for the Storm Water Utility was almost \$3.3 million in 2008. 			
SERVICE DELIVERY				
<p>Inefficient scheduling of staff and equipment</p>	<ul style="list-style-type: none"> ○ If Program resources are not scheduled efficiently, the Program could incur excessive costs as a result of inefficiencies. ○ Management has the following controls in place to minimize this risk: <ul style="list-style-type: none"> ○ For the Spring Sweep, the city is divided into districts, and then further divided into neighborhoods. Each neighborhood is intended to represent one day's work for one crew. ○ For the Summer Sweep, priorities and frequencies have been determined (e.g., priority streets, industrial areas, Business Improvement Districts). ○ Routing principles are practiced (i.e., maximize right hand turns, minimize conflicts with traffic (e.g., u-turns in intersections) and minimize backtracking). ○ Ten-hour shifts are being utilized in order to maximize the amount of time each sweeper operator can sweep and minimize unproductive time that results from shift-changes. ○ Management gathers information regarding Program resources and workload on a daily basis and enters it into a Maintenance Management System (MMS). <ul style="list-style-type: none"> ○ However, we have concerns regarding the completeness and accuracy of the information in the MMS and therefore could not use the data for analysis. ○ Management also indicates that vehicle breakdowns are occurring often and are hampering the Program's ability to sweep streets in a timely manner. <ul style="list-style-type: none"> ○ In 2008, only 30% of the fleet was available for service at least 80% of the time. 	<p>High.</p> <p>Complete and accurate information regarding accomplishments, workload and staff resources is not available.</p> <p>In 2008, only 30% of the fleet was available for at least 80% of the time.</p>	<p>Moderate.</p> <p>Program costs may be excessive.</p>	<p>Additional actions are required.</p> <p>See conclusions re: financial risk & infrastructure risk.</p>

Appendix A, cont'd

RISK EVENT	SYSTEMS, PRACTICES AND CONTROLS	RESIDUAL RISK		CONCLUSION
		LIKELIHOOD	IMPACT	
Inclement weather	<ul style="list-style-type: none"> ○ Inclement weather can put a halt to all sweeping activities, resulting in idle staff and equipment, and a longer overall lapse time for the Spring Sweep. ○ Management has the following controls in place to minimize this risk: <ul style="list-style-type: none"> ○ Management has the ability to send staff home after a minimum of three hours. ○ Staff can be reassigned to other duties (e.g., sign washing, back lane litter pickup, catch basin cleaning, equipment maintenance, hauling sweeping stockpiles, etc.). ○ Thresholds for determining when to halt sweeping activities have not been documented, but rather, are based on field observations (e.g., when there is too much moisture accumulated on the street, sweeper operators will see that sand/dirt becomes like a paste and smears on the roadway surface; when it is freezing and snow stays intact on the roadway). ○ During the Spring Sweep, areas that were not swept due to inclement weather will be reassigned to the end of the schedule. 	Medium. Inclement weather occurs and is unpredictable.	Minor. Controls appear to be adequate to reduce the impact of this risk to an acceptable level.	Additional actions are not required.
Parked vehicles	<ul style="list-style-type: none"> ○ When a vehicle is parked on the street, approximately two car lengths of gutter line can not be swept. This decreases the effectiveness of the Program (especially in areas that are only swept once per year), increases the risk of damage to vehicles as the sweeper has to maneuver around the vehicle, and results in a poor perception of the Program by residents. ○ Management has the following controls in place to minimize this risk during the Spring Sweep: <ul style="list-style-type: none"> ○ Pamphlets/flyers are delivered to each house, school and apartment building in most residential areas at least one day in advance of sweeping activities. Pamphlets/flyers specify the time period during which sweeping will be done and the boundaries of the neighborhood that will be swept. Residents are encouraged to remove their vehicles from the street. However, if vehicles are not moved, the sweeper operator will sweep around it – vehicles are not towed. ○ Parking restrictions are posted in residential areas with significant non-resident on-street parking generators (e.g., the University, City Hospital, Broadway/Five Corners) at least 36 hours in advance of sweeping activities. These are called “Lettered Areas.” If vehicles are parked on the street after the time at which the parking restriction goes into effect, the vehicle is ticketed and towed by a private towing company “around the corner” at the City’s expense. ○ Advertisements and public service announcements are published on a weekly basis, describing the neighborhoods that are scheduled for sweeping for the following week. 	Medium. Despite existing controls, parked vehicles continue to be a problem.	Moderate. Public perception of the Program may be negatively affected. Operators may damage vehicles as they have to maneuver around them.	Additional actions are required. Management should review each neighborhood and determine whether signboards at key entry-points would be an effective way to notify residents and visitors of Spring sweeping. Management should discuss with City Solicitor’s Office the potential for maintenance zones in certain areas with significant non-resident on-street parking generators.

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RISK EVENT	SYSTEMS, PRACTICES AND CONTROLS	RESIDUAL RISK		CONCLUSION
		LIKELIHOOD	IMPACT	
	<ul style="list-style-type: none"> ○ The Program’s website includes a listing of all neighborhoods and when they are scheduled for sweeping. Maps for each neighborhood are also available for residents to determine where they may have to move their vehicle in order to avoid the sweeping activities. ○ Despite these measures, parked vehicles continue to be a problem in some areas during the Spring Sweep. For the most part, problem areas are in residential areas, not freeway/expressway, arterial and collector roadways. <ul style="list-style-type: none"> ○ In some neighborhoods, signboards have been used on a pilot basis but with poor results. Management agrees that the success of this notification technique depends greatly on the configuration of the neighborhood (e.g., limited access points) and should be considered for newer neighborhoods. ○ In the Lettered Areas, there is a concern regarding unauthorized removal of the parking restriction signage. This creates difficulties because if the signage has not been displayed for the entire 36 hour period before the restriction goes into effect, it is unenforceable – tickets can not be issued and vehicles can not be towed. This requires that the area be rescheduled for sweeping or sweeping be conducted around the parked vehicles. <ul style="list-style-type: none"> ▪ Management believes that the establishment of maintenance zones in these Lettered Areas would help alleviate the problem of parked vehicles and would be more economical than administering temporary signage. Each maintenance zone would have a specified time and day of week during which parking would be prohibited and would ensure a more effective sweeping program. In addition, this parking ban would allow for more effective scheduling of other civic services throughout the year (e.g., tree pruning, pothole patching, snow clearing etc.). ○ During the Summer Sweep, parked vehicles are less of a problem given that there are permanent parking restrictions in the Business Improvement Districts that allow access to the curb line, and construction and industrial areas are generally free of parked cars at night when sweeping usually takes place. 			
Poor quality	<ul style="list-style-type: none"> ○ When streets are not swept properly, debris remains on the road surface. This can result in a poor perception of the city by residents and visitors, and reduce traction for motorists and cyclists. ○ Management has the following controls in place to minimize this risk: <ul style="list-style-type: none"> ○ Standard operating procedures have been developed. These procedures ensure staff understand what is expected of them in terms of quality. ○ Staff receive training prior to the commencement of the sweeping 	Medium. Chronic problem areas include industrial areas and new developments.	Moderate. Public perception of the city may be negatively affected. Motorist and cyclist safety may be at risk.	Additional actions are required. Management should evaluate options regarding how to deal with excessive on-street

Appendix A, cont'd

RISK EVENT	SYSTEMS, PRACTICES AND CONTROLS	RESIDUAL RISK		CONCLUSION
		LIKELIHOOD	IMPACT	
	<p>season. This training program includes a field portion where varying levels of quality can be evaluated.</p> <ul style="list-style-type: none"> ○ Supervisors inspect the work performed by the crews to ensure quality expectations are being achieved. ○ Industrial areas and new residential or commercial developments are two areas where there are chronic issues of poor quality, but not due to staff performance. <ul style="list-style-type: none"> ○ In these areas properties are typically unpaved. Therefore, before the properties dry in the spring, and after a rainfall, vehicles track a significant amount of mud onto paved streets. In addition, topsoil and debris blow onto the street from undeveloped lots and collect in and around the gutters. These streets quickly become dirty and unsightly. ○ This is a common problem in the sweeping industry and there are various ways in which it could be addressed (e.g., enact and enforce a bylaw prohibiting tracking debris on the roadway, add an additional fee on each building permit for extra sweeping services, fund a higher level of service). 			debris in industrial areas and new developments.
ACCIDENTS AND INCIDENTS				
Staff injury	<ul style="list-style-type: none"> ○ If staff are injured, replacement staff must be scheduled, often at overtime rates. If replacement staff can not be scheduled, the overall lapse time of the Spring Sweep can increase and/or service level objectives may not be achieved. ○ Management has the following controls in place to minimize this risk: <ul style="list-style-type: none"> ○ One Program staff person is a member of the OH&S Committee. ○ Staff receive OH&S training prior to the commencement of the sweeping season. This training program changed effective October 2008 and now requires that competent operators assess the skills demonstrated by operators. ○ Each crew of sweeper operators has at least one radio that has access to emergency services (911). ○ Management receives reports on a monthly basis regarding workplace injuries and lost time incidents. <ul style="list-style-type: none"> ▪ Information is not tracked in a way that easily allows for the isolation of street sweeping incidents and accidents. However, over the past three years, injuries and lost time incidents in Public Works (of which Street Sweeping is a part) has decreased by 43% and 5% respectively. ○ The Department recognizes staff who have been accident free over the past year through annual safety awards. 	Low. Controls appear to be adequate to reduce the likelihood of this risk to an acceptable level.	Moderate. Replacement staff at overtime rates would be required to keep the Spring Sweep on schedule.	Additional actions are not required.

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RISK EVENT	SYSTEMS, PRACTICES AND CONTROLS	RESIDUAL RISK		CONCLUSION
		LIKELIHOOD	IMPACT	
	<ul style="list-style-type: none"> ○ Management considers how to avoid potential staff injuries when making equipment purchase decisions. Dust control and ergonomic seating are key factors in the purchasing decision. ○ Periodic maintenance activities are also carried out to try and maintain an acceptable breathing environment in the sweepers (i.e., sweeping generates a lot of dust that can make its way into the cab of the sweeper if seals, filters and air pressure are not maintained properly). <ul style="list-style-type: none"> ○ Despite these activities, older pieces of equipment do not keep dust out of the cab and pose a concern for staff. 			
Vehicle accident	<ul style="list-style-type: none"> ○ A vehicle accident can result in injuries to staff, other motorists or pedestrians; legal action could ensue. ○ Management has the following controls in place to minimize this risk: <ul style="list-style-type: none"> ○ All sweepers are equipped with lights and flashers to warn motorists about the slow moving equipment. ○ Sidewalk sweeping machines are paired with an arrow truck due to the significant amount of dust generated. ○ Each crew of sweeper operators has at least one radio that has access to emergency services (911). ○ Due to the nature of the work, the equipment is not traveling very fast, which allows for enough time to effectively respond to changing driving conditions. ○ Sweeper operators are required to submit a driver's abstract upon hire and periodically thereafter. ○ All vehicle accidents are reported to management. An Accident Adjudication Committee reviews the circumstances surrounding each accident and determines if corrective action is required (e.g., coaching, disciplinary action, training). ○ In the past five years, the Program has experienced an average of three vehicle accidents per year, with only one accident in each in the past two years. 	<p>Low. Controls appear to be adequate to reduce the likelihood of this risk to an acceptable level.</p>	<p>Moderate. Personal injuries and property damage can result.</p>	<p>Additional actions are not required.</p>
Property damage	<ul style="list-style-type: none"> ○ Legal action can ensue if private property is damaged as a result of Program activities. ○ Management has the following controls in place to minimize this risk: <ul style="list-style-type: none"> ○ Sweeper operators receive training on the proper and safe operation of the equipment prior to the commencement of the season. This training includes operation of the equipment in the field under controlled conditions. ○ Each sweeper machine is equipped with engineering controls to minimize the chance of debris being discharged at a high speed (e.g., moving parts are covered by guards/shrouds and the brooms direct debris into the path of the sweeper, not outward). ○ Each sweeper machine is equipped with GPS technology. 	<p>Low. Controls appear to be adequate to reduce the likelihood of this risk to an acceptable level.</p>	<p>Moderate. Legal action could be brought against the City.</p>	<p>Additional actions are not required.</p>

Appendix A, cont'd

RISK EVENT	SYSTEMS, PRACTICES AND CONTROLS	RESIDUAL RISK		CONCLUSION
		LIKELIHOOD	IMPACT	
	<p>Information regarding equipment location can be used to acknowledge or dispute a claim for damages.</p> <ul style="list-style-type: none"> ○ In some cases, management will meet with the complainant and visually inspect the property. ○ In the past three years (2006-2008), there have been very few claims of property damage submitted to the City Solicitor's Office. 			
SECONDARY IMPACTS				
Air pollution	<ul style="list-style-type: none"> ○ Fine road dust, which is generated as asphalt, rubber tires and brake pads wear down, is a significant health risk and fine particles known as PM₁₀ (particulate matter smaller than 10 microns) are considered to be a toxic substance according to the Canadian Environmental Protection Act. ○ For the most part, mechanical broom sweepers are very good at collecting larger material and debris, but they are not very effective at removing fine particles from the road surface. Vacuum-assist sweepers are better at collecting the fine particles, but the used air is constantly exhausted into the environment. The street sweeper that is most effective at removing fine particles is the regenerative-air sweeper which is much like the vacuum-assist sweeper but the used air is re-circulated. <ul style="list-style-type: none"> ○ The Program's fleet currently consists of 16 mechanical broom sweepers and 1 vacuum-assist sweeper. ○ It is becoming increasingly common for street sweeping programs to base sweeping equipment replacement decisions, in part, on the ability of the equipment to remove particulate matter from the road surface. <ul style="list-style-type: none"> ○ For example, the City of Toronto has adopted a standard, as part of its Clean Roads to Clean Air initiative, that replacement street sweepers must be PM₁₀ and PM_{2.5} efficient. Their current plans call for 60% of their fleet to satisfy this standard. ○ Such an approach would also be consistent with the City's Strategic Plan and City Council's Environmental Policy. 	<p>High.</p> <p>94% of the Program's fleet is mechanical broom sweepers which are the least effective at removing PM₁₀ particles from the road surface.</p>	<p>Significant.</p> <p>PM₁₀ particles have been designated a toxic substance.</p> <p>Studies show that these fine particles can contribute to several health risks, including respiratory hospitalizations, emergency room visits, bronchitis in children and even premature death.</p>	<p>Additional actions are required.</p> <p>Management should consider PM₁₀ efficiency when making equipment purchase decisions.</p>
Water pollution	<ul style="list-style-type: none"> ○ If fine road dust is not removed from the road surface through sweeping activities, it can be washed untreated into the storm water system, and ultimately into the South Saskatchewan River. The fine particles can cause environmental damage (affecting fish, birds and wildlife) and, for those who live downstream, can result in higher water treatment costs in order to make the water suitable for drinking. ○ The importance of street sweeping as a pollution control practice is becoming more popular as governments recognize that it is more economical to sweep streets than construct storm water treatment facilities, and it is more effective to remove pollutants before they enter the storm water system in the first place. 	<p>High.</p> <p>94% of the Program's fleet is mechanical broom sweepers which are the least effective at removing PM₁₀ particles from the road surface.</p>	<p>Significant.</p> <p>Stormwater runoff is released, untreated, into the South Saskatchewan River.</p>	<p>Additional actions are required.</p> <p>See above.</p>