

Performance Audit of Salt Management Processes

Presented To: Audit Committee

Meeting Date: June 21, 2022

Type: Routine Management Reports

Prepared by: Ron Foster
Auditor General

Recommended by: Auditor General

Report Summary

This report provides a recommendation regarding the City's salt management processes.

Resolution

THAT the City of Greater Sudbury approves the recommendations as outlined in the report entitled "Performance Audit of Salt Management Processes", from the Auditor General, presented at the Audit Committee meeting on June 21, 2022.

Relationship to the Strategic Plan, Health Impact Assessment and Community Energy & Emissions Plan (CEEP)

This report supports the strategic goals of demonstrating innovation and cost-effective service delivery and creating a healthy community.

Financial Implications

There are no immediate financial implications.

Resources Cited

Salt Management Plan <https://pub-greatersudbury.escribemeetings.com/filestream.ashx?documentid=5882>

Performance Audit of
Salt Management
Processes

June 7, 2022

Final Report



OBJECTIVE

To assess the effectiveness of the salt management processes which support the City's salt management plan.

BACKGROUND

The City's Salt Management Plan (SMP) sets out a policy and procedural framework to ensure the City's Linear Infrastructure Services (LIS) Division continuously improves the effective delivery of winter maintenance services and the management of road salt used in winter maintenance operations. By following the objectives stated in Environment Canada's "Code of Practice for the Environmental Management of Road Salts", LIS works to ensure environmental protection while maintaining public safety during adverse road conditions. With proper monitoring and reporting, the recommendations made within the Code of Practice will result in improved safety and benefits to the environment, as well as potential efficiencies and material usage savings.

The City's SMP also follows the Transportation Association of Canada's, Syntheses of Best Practices for Road Salt Management. Additional recommendations follow the Ministry of Transportation's (MTO's) Maintenance Manual for highway maintenance operations. The SMP is meant to be dynamic, allowing the City to evaluate and phase-in changes, new approaches, and technological improvements in winter maintenance activities in a fiscally sound manner. At the same time, any modifications to municipal winter maintenance activities must ensure that roadway safety is not compromised.

METHODOLOGY & SCOPE

This audit included road patrols, site visits, staff interviews, process reviews, report analyses and control tests for the period January 1, 2018 to May 31, 2022.

EXECUTIVE SUMMARY

The City's Linear Infrastructure Services (LIS) Division has adopted a number of better practices which support the continuous improvement of winter maintenance processes and management of road salt. As a result, the City was able to deliver winter maintenance processes at lower costs than our municipal peers between 2017 and 2020. Opportunities for improvement remain, however, so we have recommended that staff identify progress toward the medium and longer term objectives and recommendations outlined in the City's salt management and salt optimization plans within the annual reports on winter maintenance.

AUDIT STANDARDS

We conducted our audit in accordance with Generally Accepted Government Auditing Standards which require that we adequately plan audits; properly supervise staff; obtain sufficient, appropriate evidence to provide a reasonable basis for audit findings and conclusions; and document audits. For further information regarding this report, please contact Ron Foster at the City of Greater Sudbury at 705-674-4455 extension 4402 or via email at ron.foster@greatersudbury.ca

OBSERVATIONS AND ACTION PLANS

A. Salt Management Plan and Objectives

GHD, which is a professional engineering and architectural services company, was engaged in 2019 to update the City's salt management plan which sets out a policy and procedural framework to ensure the City's Linear Infrastructure Services (LIS) Division continuously improves the effective delivery of winter maintenance services and the management of road salt used in winter maintenance operations. The 2019 Salt Management Plan identifies the following objective: "LIS is committed to continuously improving winter maintenance operations in a cost effective manner while ensuring public safety. This dynamic approach will allow LIS to optimize the use of chloride-containing winter maintenance materials on municipal roads while striving to minimize negative impacts to the environment."

This audit indicated that detailed monthly reports and high-level annual reports on winter maintenance operations are provided to Operations Committee. However, these reports do not fully support continuous improvement as they do not measure progress against the objectives and recommendations within the City's salt management plan.

Recommendation

Progress against the salt management plan objectives and recommendations shown at Table 1 and Table 2 of this report should be provided to Operations Committee in the annual report on winter maintenance operations.

Management Response and Action Plan

We agree. An update on progress will be provided to Operations Committee annually beginning in 2023.

B. Salt Storage and Facility Management

The salt management plan provided a number of recommendations to better manage environmental risks associated with the current depots that have not been addressed yet as many require capital investments. There are also a number of operational deficiencies and inefficiencies associated with the storage of salt, sand and brine at the current depots which the 2018 depot master plan recommends rationalizing. Table 1 in this report summarizes these recommendations.

Recommendation

The City needs to move forward with Phase 1 of the depot master plan to address inefficiencies and environmental risks associated with the storage of salt, sand and brine at the depots.

Management Response and Action Plan

We agree. The professional services contract for the design and contract administration services for the depot master plan is currently being finalized. Work will begin on the design by Q4 of 2022.

C. Salt Optimization Plan

In 2018, the City developed a salt optimization plan to remain proactive with its Salt Management Plan initiatives and as a requirement of the Ministry of Environment and Climate Change. Developing this plan demonstrated to the community that safe and environmentally conscious road salt management and winter maintenance practices are a priority.

The recommendations below in Table 3 were developed to achieve the project's vision of minimizing the environmental impact of using road salt to maintain safe pedestrian and vehicular traffic and to improve the efficiency of winter maintenance practices. As a result of budget constraints and the pandemic, some of the high and medium priority recommendations have not been addressed yet.

Recommendation

Progress against the salt optimization plan objectives and recommendations shown at Table 3 of this report should be provided to Operations Committee in the annual report on winter maintenance operations.

Management Response and Action Plan

We agree. An update on progress will be provided to Operations Committee annually beginning in 2023.

D. Salt Purchases

During the last three years, on average, the City purchased \$2.2 million annually of rock salt for winter maintenance operations. Opportunities for potential cost savings from bulk purchasing were not realized because the City does not participate in a bulk purchasing program for rock salt with other northern municipalities.

Recommendation

The City should explore the potential for a bulk purchasing program for rock salt with other northern municipalities.

Management Response and Action Plan

We agree. The operating departments, with the assistance of Purchasing, will explore the merits of a shared bulk purchasing program for rock salt with other northern municipalities.

E. Accomplishments

According to the annual BMA Benchmarking Reports, the City's costs per lane km for winter maintenance for 2017 to 2020 were lower than those of our peers in Ottawa, North Bay, Timmins and Sault Ste. Marie. A portion of these economies stems from the City's adoption of best practices such as the use of Road Weather Information Systems data in deployment decisions and pre-wetting of rock salt that is applied to the roads during winter maintenance operations. The table below indicates, however, that the City's cost advantage has been diminishing over time.

Peer Group	Cost/Lane Km 2017	Cost/Lane Km 2018	Cost/Lane Km 2019	Cost/Lane Km 2020	Cost/Lane Km 4-Year Average
CGS	\$5205	\$5058	\$6603	\$5540	\$5601
Ottawa	5716	5300	6509	5183	5677
North Bay	5475	6188	6795	5486	5986
SS. Marie	6409	6679	7884	7086	7014
Timmins	7784	7280	8204	5483	7188
Peer Avg	6346	6362	7348	5809	6466
CGS vs Peers	18.0%	20.5%	10.1%	4.6%	13.4%

We also noted that the LIS Division recently created a Technical Support Services Manager position which will be responsible for recommending and implementing improvements in business processes, operational activities and procedures to align activities with industry best practices and to achieve the objectives of safe and efficient operation and maintenance. This new position will be helpful in monitoring progress toward the objectives and recommendations in the City's salt management and salt optimization plans.

Table 1 – Status of Salt Management Plan Recommendations for Depots

Recommendation	St. Clair Depot	Frobisher Depot	Whitefish Depot	Black Lake Depot	Suez Depot
Store salt so that it does not contact the salt dome's foundation walls	Done	NA	NA	NA	NA
Consider placing sand under cover to prevent salt from washing out	Part of depot study	Part of depot study	NA	Part of depot study	Part of depot study
Consider discontinuing use of site for salt and sand storage	Part of depot study	NA	NA	NA	NA
Install/maintain sediment control	Done but will reinstall In 2022	Done but will reinstall In 2022	NA	NA	Done but will reinstall In 2022
Redirect uncontrolled drainage	Not done	NA	NA	NA	NA
Confirm the discharge location of floor drains	Not done	NA	NA	NA	NA
Inspect and test brine tank for leaks prior to the beginning of the winter maintenance season	Done	Done	NA	NA	Done
Monitor wetland for signs of vegetative stress	NA	Not done	NA	NA	NA
Review Storm Water Management Plan requirements	NA	Scheduled for 2022	NA	NA	NA
Maintain housekeeping	NA	Done	NA	NA	Done
Remove stored salt from site when the dome is demolished. Cover dome entrance to prevent precipitation mixing with stored salt.	NA	NA	Done	NA	NA
Repair erosion damage	NA	NA	NA	Scheduled for 2022	NA
Move salt into storage sheds as soon as possible after delivery	NA	NA	NA	NA	Done
Consider replacing salt storage sheds with a new salt storage structure	NA	NA	NA	NA	Part of depot study

Table 2 – Status of Significant Salt Management Plan Recommendations

Recommendation	Extent of Completion
Level of Service Policy	
Review and update level of service policy	Done
Equipment Upgrading	
GPS – review periodically	Done
Calibration	
Stipulate application rates for all materials used	Done
Mid-Winter Calibration	Done
Calibration after installation or repair work done on spreading equipment	Done
Benchmark routes for theoretical amount of required materials prior to winter	Partial
Record calibration data for comparison and development of application rates	Done
Equipment Washing	
Wash all vehicles indoors	Not Done
Salt water retention/treatment area installed at all yards	Not Done
Oil/water separators installed at all patrol yards	Not Done
Material Delivery and Handling	
Reduce salt used in salt/sand mix to minimum amount to prevent sand from freezing	Done
Salt/sand piles covered to prevent leaching	Not Done
Clean loading pads following transfer of material indoors	Done
Brine transfer from tank to truck conducted on solid impermeable flooring	Done
Records kept on the timing of transfer of material indoors	Not Done
Discontinue summer storage of pickled sand	Partial
Records of Material Usage	
Record material usage for each route/each truck/each storm event	Done
Compare material usage to benchmarked usage	Done
Use material tracking system to rationalize amount of materials used with the amount ordered and the residual amount at the end of the season	Partial
Compare material usage from spreader controls to material tracking system	Done
Storm Response	
Note frost penetration into pavement base and effects on pavement temp	Done
Winter Patrol	
Ensure patrollers are trained and under the supervision of a seasoned supervisor	Done
Emergency Response Procedures	
Review procedures periodically	Done
Training	
Sufficient training for equipment operators on controls and operating procedures	Done
Refresher training on basic weather forecasting to determine pavement temperature	Done
Operators trained in the application of de-icing/anti-icing materials to obtain maximum effect	Done
Supervisors/patrollers trained on basic weather and pavement temperature forecasting, RWIS	Done
Health and safety requirements for use of equipment and materials	Done
Environmentally Sensitive/Vulnerable Areas	
Identify vulnerable areas and areas of natural and scientific interest	Done
Locate stockpiles and snow disposal sites outside of vulnerable areas	Not Done
Communication Strategy	
Distribute guideline to public to ensure awareness of the winter maintenance program	Done
Prepare an employee handbook that communicates the approved winter maintenance policies and procedures and other important information such as, contact lists, shift assignments, etc.	Done
Provide winter maintenance information on the municipal website	Done

Table 3 – Status of Significant Salt Optimization Plan Recommendations for LIS Division

Recommendation	Priority	Status Comments
Establish a salt vulnerability index based on existing surface and groundwater vulnerabilities including WHPAs, SGRAs, HVAs and ESGRAs. Create a salt vulnerability index map with the results to better understand salt sensitive areas to help in better decision-making.	High	Complete
Review transportation infrastructure that receives winter maintenance services to better identify system users and incorporate user data and winter maintenance considerations into the Transportation Master Plan.	Medium	Ongoing
Annually review transportation infrastructure that receives winter maintenance services specifically priority plow and salt/sand routes to identify opportunities for improvement. Proposed changes in services will consider all roads segment's planning classification, OMMS class, gradient, zoning and proximity to points of interest. Environmental vulnerability to the surrounding area must also be considered.	High	Ongoing
Establish or look for areas to expand direct liquid application routes with the use of additives.	High	Ongoing
Track the volume of anti-icing/de-icing materials used by CGS Fleet.	High	Ongoing
Develop a snow removal contract template for future Traffic and Transportation Services snow removal contractors.	High	Ongoing
Update Global Positioning System devices used by City plows, sanders and contractor vehicles to incorporate salt vulnerable area maps and track salt application and track salt application within these areas.	High	Not Done
Obtain additional Road Weather Information System within the City of Sudbury to better understand and respond to weather events.	Medium	Ongoing – An additional RWIS was added in the SW Region
Obtain anti-icing/de-icing material application equipment for City fleet that is capable of being calibrated.	Medium	Existing equipment utilized as needed
Obtain multi-purpose types of equipment that can be utilized to better perform winter maintenance services	Medium	Existing equipment utilized as needed
Develop storm water maintenance plans at maintenance yards and snow disposal facilities that would also help to capture salt laden runoff.	High	In Progress- some plans implemented
Require Smart About Salt training for all City contractor hires.	Medium	Not Done
Continue encouraging and offering learning opportunities for City staff involved in winter maintenance activities through professional development opportunities and knowledge sharing sessions.	High	Ongoing
Hold a professional campaign to begin at the start of every winter maintenance season (and continue throughout the season) that will help educate the general public about salt application best management practices and the City's winter maintenance program.	Medium	Ongoing via website updates
Remove and assess permissible truck routes though the City for potential changes to optimize the winter maintenance strategy.	High	Ongoing
Have future updates to the Transportation Master Plan consider ways to optimize winter maintenance activities of proposed road network changes.	Medium	Needs discussion
Employ plowing as the primary technique to reduce amount of material applied to the surface.	Hi/Med	Ongoing
Review material application rates to identify successes and areas for improvement.	High	Ongoing
Provide recommendations and guidance to Planning & Engineering Policy and Standards on how winter maintenance can be better considered in site designs.	High	Ongoing
Continue as an active member of Ontario Roads Salt Management Group which has municipal and Environment Canada membership and investigates/pilots state of the art salt management practices and explores new technologies to further enhance road salt management.	Medium	Group dissolved – Participating in new group

Table 4 – Summary of Significant Risks

Risk	Total Risks	Risks (Before Controls)			Residual Risks (After Controls)		
		High (15 to 25)	Med (9 to 14.99)	Low (1 to 8.99)	High (15 to 25)	Med (9 to 14.99)	Low (1 to 8.99)
Reputation (R)	1	1	0	0	0	1	0
Operational (O)	4	4	0	0	0	2	2
Financial (F)	4	4	0	0	0	2	2
Legal (L)	1	1	0	0	0	1	0
TOTAL	10	10	0	0	0	6	4

Table 5 – Significant Risks

Type of Risk	Description of Risk	Risk Rating Before Controls	Residual Risk* Rating
L1/R1	Legal and regulatory obligations may not be managed effectively.	20	12
O1/F1	Maintenance processes may not be delivered with due regard for efficiency.	20	11
F2	Maintenance processes may not be delivered with due regard for economy.	20	11
O2	Maintenance processes may not be delivered with due regard for effectiveness.	20	8
O3/F3	The performance of contractors may not be managed effectively.	20	8
O4/F4	Staff performance may not be managed effectively.	20	8

**Note that it is not cost-effective to eliminate all residual risks.*

Impact	Services	Technology	People	Strategic	Legal/Reputational	Financial
Very Minor (1)	<ul style="list-style-type: none"> • Less than 90% of service objectives achieved. 	<ul style="list-style-type: none"> • Minor disruptions of secondary systems or data loss or corruption. 	<ul style="list-style-type: none"> • Minor reportable employee injury. • Increase in number of union grievances. 	<ul style="list-style-type: none"> • Minor instances of actions that are at odds with strategic priorities. 	<ul style="list-style-type: none"> • Small amount of negative media coverage or complaints to City. • Non-lasting damage or no reputational damage • Theft or Fraud under \$1,000. 	<ul style="list-style-type: none"> • Uninsured loss, cost overruns or fines < \$10K • Insured loss < \$100K • Loss of replaceable asset.
Minor (2)	<ul style="list-style-type: none"> • Less than 75% of service objectives achieved. • Unable to perform non-essential service. 	<ul style="list-style-type: none"> • Disruptions of systems or data loss or corruption • Disclosure of non-confidential but embarrassing information. 	<ul style="list-style-type: none"> • Reportable employee injury. • Loss of key staff but able to recruit competent replacements • Significant increase (>10%) in number of union grievances. 	<ul style="list-style-type: none"> • Instances of actions at odds with strategic priorities. 	<ul style="list-style-type: none"> • Complaints elevated to the Director level. • Short-term repairable damage to City's reputation • Public outcry for discipline of employee. • Moderate amount of negative media coverage • Theft or Fraud of \$1,000 to \$10,000. 	<ul style="list-style-type: none"> • Uninsured loss, cost overruns or fines of \$10K to \$100K • Insured loss < \$100K - \$1M • Inefficient processes • City's actions result in reduced economic development.
Moderate (3)	<ul style="list-style-type: none"> • Less than 60% of service objectives achieved. • Unable to perform essential service but alternatives exist. 	<ul style="list-style-type: none"> • Disruptions of significant systems or data loss or corruption • Recoverable loss from important system. 	<ul style="list-style-type: none"> • Multiple employee injuries or long-term disability from one incident. • Inability to retain or attract competent staff. • Increase in stress leave, sick leave or WCB claims. • Work-to-rule union disagreement or short-term strike. 	<ul style="list-style-type: none"> • Numerous actions are at odds with strategic priorities. 	<ul style="list-style-type: none"> • Public/media outcry for removal of management • Long-term damage to City's reputation • Citizen satisfaction survey indicates unacceptable performance. • Complaints elevated to Council level. • Results inconsistent with commitments made to citizens • Theft or Fraud under \$100,000. 	<ul style="list-style-type: none"> • Uninsured loss, cost overruns or fines of >\$100K to \$1M • Insured loss >\$1M to \$10M • Having to delay payments to contractors/suppliers. • City's actions results in lost revenue for significant number of City businesses.

Impact	Services	Technology	People	Strategic	Legal/Reputational	Financial
Major (4)	<ul style="list-style-type: none"> • Less than 45% of service objectives achieved. • Unable to perform an essential service where no alternative exists. 	<ul style="list-style-type: none"> • Unrecoverable loss or corruption of data from important system • External exposure of important information • Unavailability of significant systems 	<ul style="list-style-type: none"> • Serious injury of one or more employees • Legal judgment against the City in workplace matter. • Turnover of key employees • Sustained strike of staff. 	<ul style="list-style-type: none"> • Numerous actions are significantly at odds with the strategic priorities. 	<ul style="list-style-type: none"> • Public/media outcry for change in CAO or Council • Public or senior officials charged or convicted • Legal judgment against the City in a workplace matter • Integrity breach resulting in decreased trust in City Council or Administration. • Theft or Fraud >\$100,000 	<ul style="list-style-type: none"> • Uninsured loss, cost overruns or fines of >\$1M - \$10M • Insured loss of >\$10M - \$100M • Unable to pay employees and contractors on time. • City's actions impair local economic conditions.
Extreme (5)	<ul style="list-style-type: none"> • Less than 30% of service objectives achieved. • Unable to perform several essential services where no alternatives exist. 	<ul style="list-style-type: none"> • Unrecoverable loss or corruption of data from critical system • External exposure of confidential information • Unavailability of critical systems 	<ul style="list-style-type: none"> • Death of an employee • Major legal judgment against the City in workplace matter. • Significant turnover of key employees with ELT • Sustained strike of staff supporting key services 	<ul style="list-style-type: none"> • Many actions are significantly at odds with the strategic priorities. 	<ul style="list-style-type: none"> • Public/media outcry for change in CAO or Council • Senior officials criminally charged or convicted • Severe legal judgment against the City in a workplace matter • Major integrity breach resulting in complete loss of trust in City Council or Administration. • Theft/Fraud >\$1,000,000 	<ul style="list-style-type: none"> • Uninsured loss, cost overruns or fines >\$10M • Insured loss > \$100M • File for bankruptcy • Failure to maintain financial capacity to support current demands. • City's actions significantly impair local economic conditions.

Likelihood	Unlikely (1)	Possible (2)	Probable (3)	Likely (4)	Very Likely (5)
	Less than 20%	>20% but < 40%	>40% but < 60%	>60% but < 80%	80% or more
	Less frequent than every 10 years	May occur in the next 2 years	Will occur this year or next year at least once	May occur regularly this year	Will occur within months may reoccur often