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The City of St. John's

Review of Winter Maintenance Services

Final Report

February 26, 2014

Notice to Reader

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Information and Limitations

KPMG's procedures consisted solely of inquiry, document review, comparison and analysis of City of St. John's ("City") provided information, and information provided by comparable jurisdictions.

KPMG relied on information provided by project participants. Information in this report pertaining to the City has been provided by and/or validated by City staff.

The information contained in this report does not constitute an audit of the City's services, presented data, organization, or governance structure. Any future oriented financial information is unaudited and is highly dependent on future events while noting that the impact of such events may be material.

Accordingly, KPMG does not express an opinion on such matters.

The Review

KPMG conducted a review of the winter maintenance activities carried out by the Roads Division and the Parks and Open Spaces Division of the City of St. John's. The process undertaken included a review of documentation, interviews with staff, consultation with stakeholders within and external to the City (including two public workshops), and a jurisdictional review identifying comparable practices in Halifax, Fredericton, Quebec City, Saguenay and Mount Pearl.

An Interim Report was provided to the City identifying some actions it could initiate for implementation in the winter of 2014-2015. Those items are addressed in this report as well. Some chapters of the Final Report were drafted in November, 2014 and may reflect "now" as being in November, 2014.

This is the Final Report.

ST. JOHN'S

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Mandate - Scope

This Winter Maintenance Operations Review covers:

- Roads Division Winter Maintenance services, which include:
  - Snow and ice control on roads and sidewalks; and
  - Pre-treatment, salting/sanding, plowing, snow removal, and snow disposal/storage.
- Parks and Open Spaces Division Winter Maintenance services, which include:
  - Snow clearing at parks, civic buildings, pedestrian crosswalks, pedestrian stairways, and other publicly accessible areas.
- Fleet Services Division support to the above operations.
- The goals of this project were to:
  - Review levels of service;
  - Identify low cost approach to achieve the levels of service reliably; and
  - Identify potential mid- to long-term changes given growth, changing regulations, etc.
- This report outlines how these services are currently provided to provide a basis for discussion on ways to improve winter maintenance.

Mandate - Project Schedule

Kick-off Meeting	June 4, 2014
Early Consultation Process	June 23 to July 31, 2014
■ Release the “As Is” Report	
■ Launch consultation process	
■ Launch benchmarking of other cities	
Analysis Phase	August to October, 2014
■ Interim Report identifying list of options to examine, and Quick Hits (QH) for implementation this winter	
■ Steering Committee confirmation of options and Quick Hits	
■ Analysis of options to identify implications	
Draft Final Report Review	November, 2014
Final Report Issued	February, 2014

Mandate - Stakeholder Consultation Process

The process involved gathering comments, suggestions and information from a wide range of stakeholders:

External Stakeholders

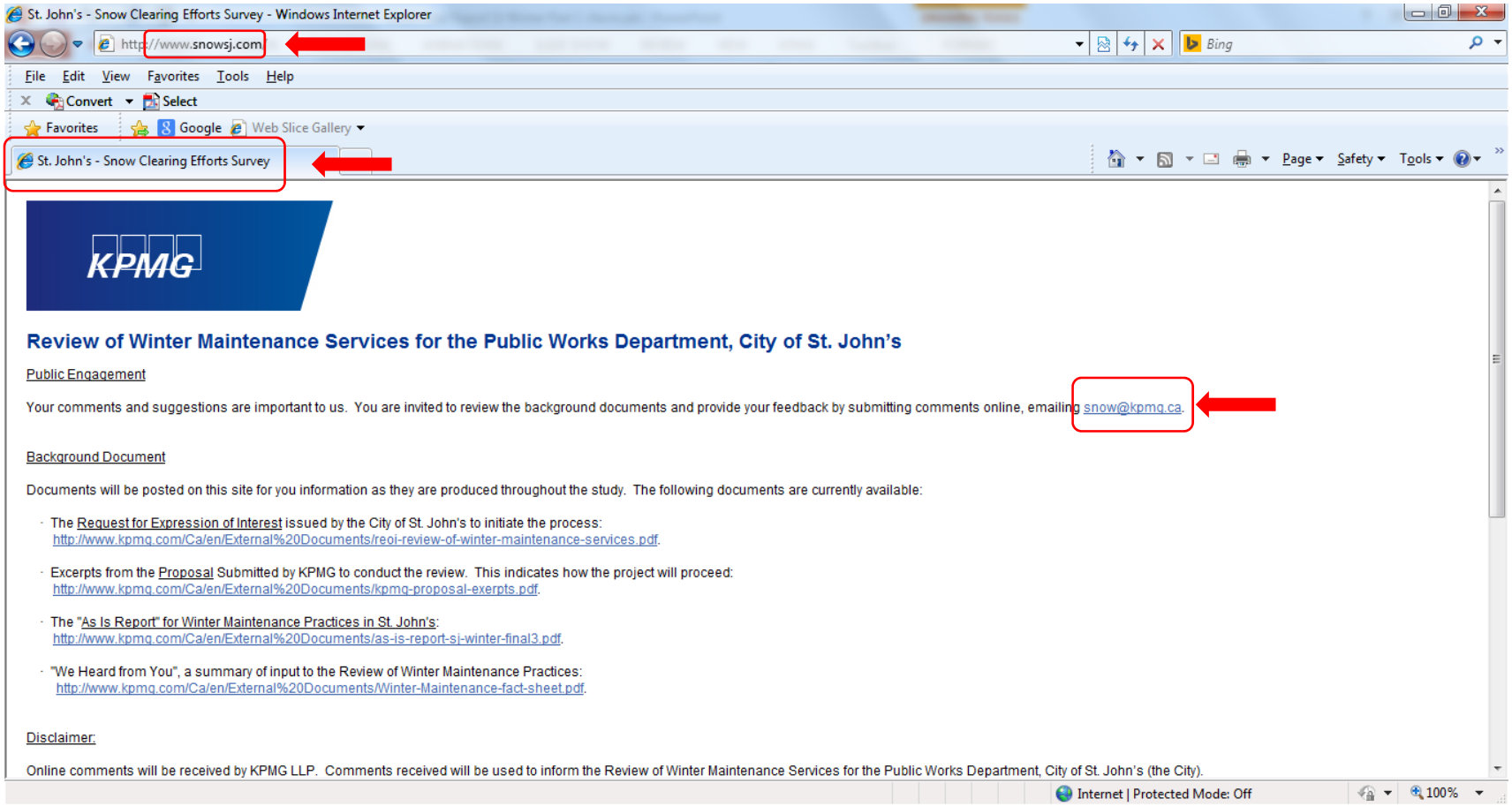
1. Downtown St. John's
2. George Street Association
3. Happy City
4. Metrobus
5. Canada Post
6. NL English School District (City Reps)
7. Memorial University (MUN Traffic Study)
8. Coalition of Persons with Disabilities

Internal Stakeholders

1. Winter Maintenance Staff - group and individual sessions
2. Forepersons
3. Union Executive
4. Council
5. Steering Committee
6. Management in Public Works, Roads, Fleet Services, Supply, Communications, etc.

In addition to these targeted consultations, two public meetings were held that were open to both residents and staff. Reports have been published on-line, an opportunity to provide comments online or by email has been provided, and everything has been promoted on the website and by social media.

Mandate - Online Comments



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Context

St. John’s

St. John’s has:

- A 2011 census population of 106,172, with the addition of about 20,000 students during the winter. The population of the Census Metropolitan Area (including St. John’s) was 196,966.
- St. John’s reports an area of 483 sq. kms with:
  - 1,400 lane kms of roadways to maintain; and
  - 700 kms of concrete sidewalk, of which 134 kms receive winter maintenance.
- The population has grown by 3.3% over last decade (census data), while the road network has grown by 21% from 547 to 662 kms (City of St. John’s). The largest growth area is residential roads (340 to 438 kms), with 14% fewer residents per km of road on average.
- Continued population growth is expected, and growth continues to be in lower density, suburban style developments.

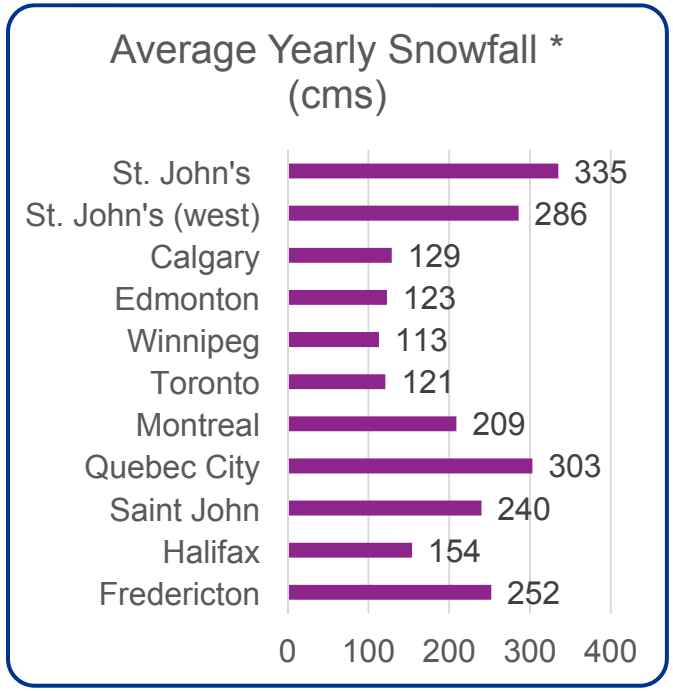
St. John’s

St. John’s receives more snow than any other major Canadian city.

St. John’s averages 335 cms of snow per year*. (*This reading is at the St. John’s airport while a second station, at a lower elevation, south of Mount Pearl records 286 cms/year on average.)*

The record winter of 2000-2001 had 648 cms of snow. Although snowfall over 500 cms only occurs every 20 years or so, it does occur*.

The hills and very narrow road right-of-ways in the older areas of town create unique challenges. The snow is also relatively high in water content, making it heavier and harder to push and/or haul.

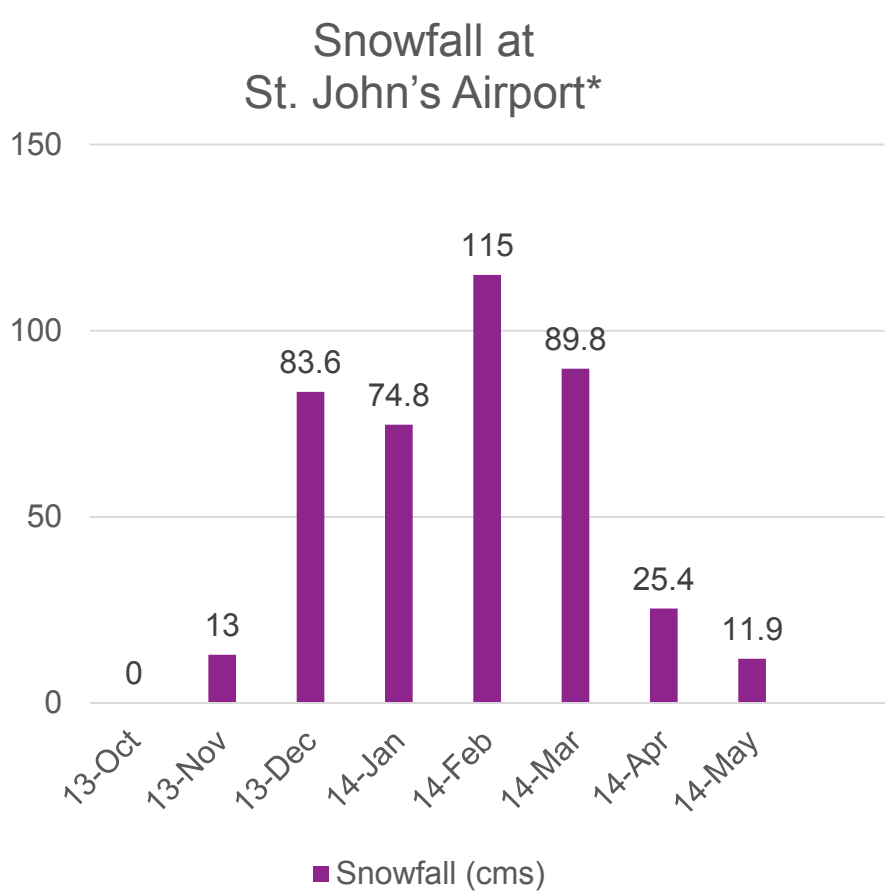


* http://www.currentresults.com/Weather/Canada/Cities/snowfall-annual-average.php

Snowfall and Accumulation at St. John's Airport

2013-2014 was particularly severe in St. John's with 413* cms of snow at the airport and 440 cms at some locations.

- December snowfall was particularly heavy, and the late snowfalls experienced in April and May were after the normal winter season.



- http://www.currentresults.com/Weather/Canada/Cities/snowfall-annual-average.php
- 440 cm estimate by City staff

Costs of Snow Clearing

The table below shows the costs of Roads division snow clearing activities in 2013 and 2014 (to the end of May). The overall cost is $15.2 Million per year. The largest items are the cost of labour ($5.4 Million), vehicles ($6.1 Million) and salt ($3.2 Million). Note: the biggest fluctuation created by the unusually severe winter last year is overtime costs which were almost twice the budget in 2013 and were well over twice the budget in the first half of 2014. Salt usage is also above budget. Note: St. John's does not record its costs by activity (e.g. plowing, removal) or track costs for roads versus sidewalks.

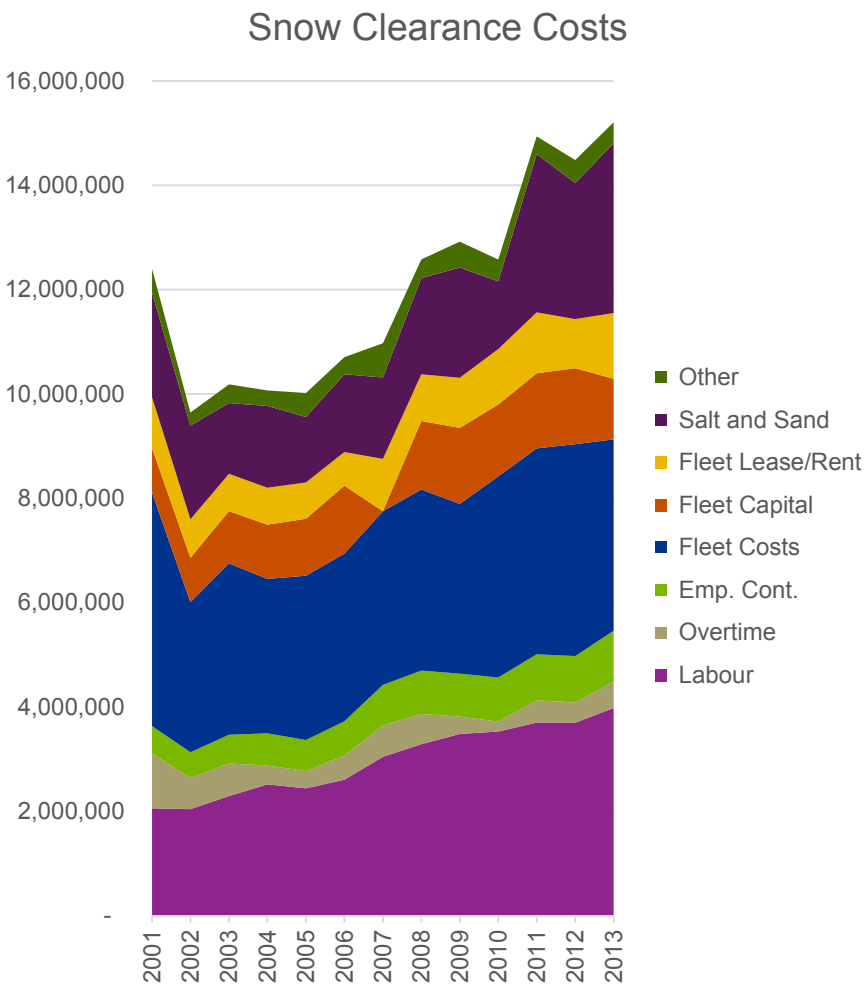
Costs	2013 YTD Actual	Percent of Total Costs	2013 Budget	(Over) Under Budget	2014 Actual to June
Salaries and Wages	3,977,978	26%	3,857,632	(120,346)	2,772,379
Labour Overtime	511,017	3%	275,000	(236,017)	653,709
Employer Contributions	972,087	6%	919,750	(52,337)	780,936
Contractual Services	56,061	0.4%	155,304	99,243	19,379
Weather Reports	149,632	1%	140,000	(9,632)	41,993
Fleet Costs	3,669,413	24%	4,495,320	825,907	69,355
Fleet Capital Costs	1,160,592	8%	1,160,592	-	960,500
Lease of Heavy Equipment	1,257,390	8%	1,168,876	(88,514)	691,228
Salt	3,245,494	21%	2,942,352	(303,142)	2,371,314
Other	211,545	1%	297,768	86,223	239,854
Total Costs	15,211,209		15,412,594	201,385	8,600,646

* All figures from City of St. John's reports

Historical Costs

The actual cost of snow clearing has increased over time and varies based on snowfall.

The chart at right shows the City's cost by major line item from 2001 to 2013. 2001 costs were higher than normal because of the record breaking 2000-2001 winter. The table below shows how much costs have increased compared to 2001 and the more normal 2002. Labour costs have grown the most, salt next, and vehicle costs less.



Growth in Actual Costs Over Time			
	2013	% over 2001	% over 2002
Labour	3,977,978	94%	95%
Overtime	511,017	-52%	-15%
Emp. Cont.	972,087	86%	96%
Fleet Costs	3,669,413	-18%	27%
Fleet Capital	1,160,592	36%	37%
Fleet Lease/Rent	1,263,056	30%	70%
Salt and Sand	3,252,910	62%	81%
To (from)Reserve	-		
Other	404,156	-12%	61%
Total	15,211,209	46%	58%

* All figures from City of St. John's reports

Changes in Budgeted Costs

The actual snow clearing costs are impacted by the weather, but budgeted costs are prepared on a reasonably consistent basis assuming an “average” winter. Adjustments are made based on cost increases (including wage increases) and changes in the expected level of service (including more roads and sidewalks).

The table below shows that the budget has increased by 83% since 2001, but only 68% since 2002. The purchase of weather reporting services is a significant part of the increase in the “Other” category. Employment contributions are the fastest growing category, with fleet costs second.

Growth in Budgeted Costs Over Time

	2001	2002	2014	% over 2001	% over 2002
Labour	1,996,680	2,272,130	3,941,541	97%	73%
Overtime	243,000	243,000	300,000	23%	23%
Emp. Cont.	413,500	500,620	1,040,162	152%	108%
Fleet Costs	2,279,100	2,669,490	4,874,703	114%	83%
Fleet Capital	855,050	847,520	960,500	12%	13%
Fleet Lease/Rent	822,000	735,670	1,186,612	44%	61%
Salt and Sand	2,010,000	2,155,000	3,158,277	57%	47%
To (from)Reserve	-	-	-		
Other	141,000	96,000	565,336	301%	489%
Total	8,760,330	9,519,430	16,027,130	83%	68%

* All figures from City of St. John’s reports

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Jurisdictional Review

Jurisdictional Review

The Jurisdictional Review considered how snow clearing is handled in 5 other cities to help identify what St. John's is doing well and what can be improved upon. The review also provided an opportunity to consider different approaches or concepts.

There are no other cities exactly like St. John's. However, the following 5 cities were selected for further review based on having some level/characteristics of comparability:

- Halifax – often mentioned and compared, even though the snow load is much less;
- Fredericton – a provincial capital, with snow levels reasonably comparable;
- Mount Pearl – similar snow levels and often compared in conversations;
- Saguenay – highest comparable snow volume and similar size; and
- Quebec City – high snow volumes and some big hills, and a large city that may have different approaches worth considering.

The high level results are provided in this section, with more detailed information included in each of the sections that follow.

Costs of Winter Maintenance

The table below compares characteristics of the selected cities examined as part of this review.

	Population	Ave. Snowfall	Lane kms. of Roads	Lane kms/ capita	Notes
St. John's	106,172	335	1,400	0.013	Narrow streets, steep hills, large rural area
Fredericton	56,000	252	719	0.013	Provincial capital, lowest density
Halifax	390,096	154	3,860	0.010	Provincial capital, hills, rural area
Mount Pearl	24,284	335	240	0.010	Similar snow load
Quebec City	530,163	303	6,569	0.012	Provincial capital, some old, narrow, steep areas
Saguenay	144,746	321	1,200	0.008	Closest snow load and similar size

All data provided by or confirmed by the city concerned

The chart above identifies some important characteristics to be considered when comparing results:

- Halifax has much lower snowfall totals than the other cities. Thus, one would expect Halifax's costs to be lower and their approach different in many respects. We have compensated for this in certain tables by adjusting costs to reflect the different snowfall (i.e. adjustments are pro-rata);
- The different cities have different "lane kms" of roads. This measure is used as it takes approximately twice the effort to clear a four lane road compared to a two lane road. While the larger cities have the most roads, Fredericton has more roads per capita than the other cities, with St. John's second. One would expect more roads would cost more to clear, so we show costs in per "lane km" to account for this; and
- While the adjustments stated above help normalize, they do not remove all the differences between cities (e.g. the impact of frequent freezing and thawing, the extent of hills and narrow streets, etc.). Thus, the comparisons can help suggest areas to look at but do not provide a perfect analysis of relative efficiency.

Comparing the Costs of Winter Maintenance

The table below compares the costs in the different cities examined.

				Adjusted for Snowfall	
	Snow Budget	Cost/capita	Cost/lane km	Cost/capita	Cost/lane km
St. John's	$ 9,123,814	$ 85.93	$ 6,517.01	$ 0.26	$ 19.45
Fredericton	$ 2,273,000	$ 40.59	$ 3,161.34	$ 0.16	$ 12.53
Halifax	$ 19,995,000	$ 51.26	$ 5,180.05	$ 0.33	$ 33.59
Mount Pearl	$ 1,972,647	$ 81.23	$ 8,219.36	$ 0.24	$ 24.54
Quebec City	$ 38,200,000	$ 72.05	$ 5,814.91	$ 0.24	$ 19.17
Saguenay	$ 11,000,000	$ 75.15	$ 9,166.67	$ 0.23	$ 28.56

Note: All data provided by or confirmed by the respective city. Costs reported exclude most fleet costs where possible as the cities do not report in a similar manner.

- Total expenditures vary widely, even when adjusted for population, length of roads maintained, and amount of snow received. St. John's costs are the highest per capita, but it also has a large rural area so the costs per lane km are lower than Saguenay and Mount Pearl.
- When adjusted pro-rata for the amount of snowfall, Halifax figures become the highest, as it faces similar fixed costs to the cities with higher snowfall. The low cost provider is clearly Fredericton, which is considerably lower in all categories. If Halifax is excluded given the difference in snowfall, St. John's remains the most expensive per capita, while Saguenay is the most expensive per lane km.
- Saguenay costs per lane km reflect only 1,200 kms of roadway which is less than St. John's at 1,400 kms of roadway even though it has a larger population. Saguenay indicates its costs reflect a very cold environment which requires frequent application of abrasives, the use of calcium chloride and other expensive alternatives to salt, and a very extensive snow removal program.

Comparing the Costs of Winter Maintenance (cont.)

- Unfortunately, all cities did not report on their fleet costs for snow clearing. Therefore, those costs were excluded from the analysis (where possible).
- Halifax, Saguenay and Quebec City contract a material amount of service provision. The costs of the vehicles used by contractors are included in their contract price and are therefore included in the costs reported. This means their costs are somewhat over-stated.
- Similarly, the analysis above does not consider the length of sidewalks cleared. St. John's clears the fewest sidewalks.

Some Cost Factors

The table below compares some of the key factors that influence snow clearing costs in each city.

	Costs Adjusted for Snowfall			
	Cost/capita	Cost/lane km	Service Level	Delivery Approach
St. John's	$ 0.26	$ 19.45	Mixed – few sidewalks, but bare pavement	In-House
Fredericton	$ 0.16	$ 12.53	Medium	In-House
Halifax	$ 0.33	$ 33.59	Medium	In-house, Hired Eqmt, Area Contracts
Mount Pearl	$ 0.24	$ 24.54	High	In-House
Quebec City	$ 0.24	$ 19.17	Medium	In-house, Area Contracts (47%)
Saguenay	$ 0.23	$ 28.56	Medium	In-house, Area Contracts (40%)

All data provided by or confirmed by the respective city.

- Service levels vary considerably. Mount Pearl has the highest service levels in terms of completing operations the most quickly after a storm and conducting considerable snow removal.
- Fredericton, Quebec and Halifax have fairly similar service levels (although timeframes vary by city) that often include plowing all major sidewalks and achieving bare pavement on arterials (but not on residential streets). St. John's has the highest level of service on residential streets (bare pavement), but the lowest level of service on sidewalks (where few are maintained and only after the roads are completed).
- Mount Pearl and St. John's have somewhat similar in-house operations, with virtually all activities carried out by city employees using city vehicles. St John's uses three crews to provide two shifts on duty seven days a week, while Mount Pearl uses two crews to staff during the week with standby coverage for weekends. Fredericton functions with one crew of employees who respond as required by weather, resulting in much lower costs. Quebec and Halifax both use performance-based contracts for some of their work and use "hired" equipment (comes with equipment and operator) to carry out some work. Saguenay also contracts about 40% of its work using performance-based contracts.

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Levels of Service

Levels of Service

Policy Framework

The Levels of Service for Winter Maintenance are outlined in a series of policy documents established by City staff, but generally have not been formally approved by Council. They are summarized in this section, along with other public commitments the Public Works Department has made.

The policies indicate the City will perform winter maintenance on:

- All public roads;
- Sidewalks - on one side of arterial roads, on collector roads within 1.6 km of schools, and on those adjacent to hospitals, seniors complexes and City facilities;
- Private lanes - some are maintained if possible with standard equipment and the request is approved by Council; and
- Private parking lots - a few are plowed when made available for residents during the parking ban.

Salt boxes are provided where slopes and narrow right-of-ways prevent heavy equipment from providing adequate service.

Levels of Service on Roadways

The Levels of Service for roadways used by the comparison cities are shown in the table below.

	Complete Plow on Arterials	Complete Plow on Residentials	Conditions (Arterials / Residentials)
St. John's	Generally 12 hours	Generally 24 hours	Bare / Bare
Fredericton	12 - 24 hours (all roads)		Bare / Snow packed
Halifax	• Plow / salt every three hours • Clear of snow 12 hours after end of snow	• Cut through at 10 cm • Passable 24 hours after snow ends	Bare / Snow packed
Mount Pearl	Pre-treat and plow from start of snow, add loaders when required	All roads cleared and pushed back to curb, 4-6 hours after storm	Bare / Bare

Quebec City	• During snow, plow from beginning and salt or sand/salt intersections, bus stops, school zones, hills, and slippery areas
	• Plow every 5 or 10 cm
	  • If <15 cm complete 4 hours after snow
	  • If <22 cm complete 6 hours after snow
	  • If >22 cm complete 8 hours after snow
		• During storm salt intersections, pedestrian crossing areas, and slippery areas
		• Plow after 10 cm
			Bare / Snow packed

Saguenay	8-14 hours (based on snowfall)	24 hours	Bare / Snow packed

Mount Pearl has the fastest response, completing plowing even on residential streets within 4 - 6 hours. St. John's is similar to the completion times elsewhere. Both St. John's and Mount Pearl stand out in their efforts to achieve bare pavement on all residential streets. Most of the others apply salt or sand on hills and intersections but do not plow residential streets until there is 10 cm of snow down. St. John's plows with salt trucks at about 5 cm and switches to loaders at about 10 cm. Mount Pearl also plows smaller snowfalls to achieve bare pavement conditions.

Levels of Service on Roadways (cont.)

During the consultation process, many residents indicated that their streets are often plowed too frequently. Some residents indicated that plowing can occur seven or eight times after a storm, although that is likely considering more than one snow event. In any case, they expressed a preference to have their driveways filled in less often even if that means the roadway is not plowed to its full width. The Roads division expresses concern that if it does not push back the snow far enough (e.g. to the curb) for early snowfalls, it will not be able to keep the road open after further snowfalls throughout the winter.

These issues are related to the significant difference in residential street service levels generally provided in St. John's (and Mount Pearl) compared to other cities – bare pavement versus snow packed. The other cities tend to salt or sand intersections, hills and school zones on residential streets while leaving the remaining residential streets snow packed and do not start plowing until 10 cm of snow has fallen (or accumulated). They plow to get the bulk of the snow to the side but do not salt and then scrape the road until they achieve bare pavement, as St. John's does.

This "snow packed" approach could reduce the level of effort required:

- For smaller events;
- Early in larger events; and
- During the "push back" period after the storm.

The process of salting and then scraping the streets to achieve bare pavement creates the frequent windrows across driveways.

Levels of Service on Roadways (cont.)

The Roads division is concerned that this snow-packed approach could result in the accumulation of ice, the development of ruts, and considerable unevenness as a result of the frequent temperature swings in St. John's.

A possible variation to reduce driveway shoveling while recognizing this concern could be to handle P3 (3rd Priority) residential streets as follows:

- Plow all residential streets after or during any storm of 5 cm or more (as is currently done);
- Make the first plow run go both ways, opening up two lanes;
- Perform a "push back" after the snow stops once to widen beyond two lanes;
- If temperatures are appropriate, salt each street once after push back; and
- Plow and salt again if the road becomes rutted.

Levels of Service on Roadways (cont.)

Cul-de-sacs

Cul-de-sacs is one area of residential streets that St. John's has a lower level of service than some other municipalities.

Mount Pearl (like many cities with lower snowfall levels) piles the snow in the middle of cul-de-sacs, thus limiting the amount of driveway clearing required. The snow is removed or melted when the piles are large enough to limit access to cul-de-sac properties by emergency or service vehicles.

St. John's makes every effort to avoid conducting snow removal in cul-de-sacs and generally achieves that by pushing the snow onto front lawns. Some residents complained that this dramatically increases the amount of work required to clear their driveways.

Halifax does not remove snow from cul-de-sacs due to the lower total snowfall and the more frequent thaw cycles.

Fredericton used to remove snow like Mount Pearl, but reduced costs by switching to a system like St. John's (but without the salt) - plowing to the side and blowing onto lawns if roads become too narrow. However, the new approach is not popular.

Saguenay removes snow from some cul-de-sacs depending upon the design of the road and level of development, which is one of the reasons their cost per lane km are high.

Levels of Service on Roadways (cont.)

Cul-de-sacs (cont.)

Cul-de-sac snow removal is a significant cost to Mount Pearl. Snow is removed as piles grow and potential safety concerns arise. It is usually removed within a week of each major snowfall. The average cul-de-sac runs approximately 500-600 cubic yards (25 truck loads) depending upon snowfall(s).

In St. John's there are approximately 600 cul-de-sacs. Removing snow from 600 cul-de-sacs just twice per year (frequency would vary with winter conditions) would require a snow removal team of approximately 15 individuals for approximately one hour per cul-de-sac, or 1,200 hours. Assuming 10 trucks (costs could be much higher if a local snow dump was not available), the total cost would be at least $1.8 Million plus the additional cost of acquiring and operating snow dumps in suburban locations. Five additional snow dumps or snow melters would likely be required at costs that may range from $1-5 Million, depending upon the location.

An alternative is to instruct and train operators to spread the snow more evenly between properties on cul-de-sacs so the residents at the end of the cul-de-sacs do not receive an inappropriate share of the load.

Levels of Service on Roadways (cont.)

With respect to the level of service on roadways, we suggest that the City consider the following:

- No change in the approach to snow removal from cul-de-sacs.
- The approach to plowing residential streets should focus on minimizing the frequency that driveways need to be shoveled by residents by:
  - Plowing all residential streets after any storm of 5 cm or more, as is presently done;
  - Designing the routes to ensure the first plow run will go both ways in a reasonable period of time, opening two lanes;
  - Providing each street with a single “push back” run in each direction (if needed), widening the street to a plowed area that is greater than two lanes;
  - Salting each street once after “push back” (if temperatures are appropriate); and
  - Plowing and salting again if the road becomes rutted.

Levels of Service on Sidewalks

The Levels of Service for sidewalks used by the comparison cities are shown in the table below.

	Sidewalks Maintained	Commercial Core	Timing
St. John's	• One-side of arterial roads • Collector roads within 1.6 km of schools and those adjacent to hospitals, seniors complexes and City facilities, others as designated (totalling 19% of all sidewalks)	• Responsibility of business owners • City pays 50% of contract	Start second shift 18 to 24 hours after snow stops
Fredericton	All	By City	Complete 48 hours after snow stops
Halifax	All (recent expansion)	• By City • P1 sidewalk routes, plow at 5 cm	P1s 12 hours after, P2s 18 hours (if 10 cms or more), P3 start after P1 and P2, complete at 36 hours
Mount Pearl	All	By City	Main streets followed by school zones (4-6 hours) and the remaining within 5 to 7 days
Quebec City	• Most where there is any indication of need (see details on following slide) • New areas where there is not enough snow storage area are generally not done	• By City • P1 (high usage), salt before and after, plow after 5 cm	• P1 salt before and after, plow at 5 cm • P2 sand for freezing rain, after storm, plow after 5 cm • P3 sand during freezing rain, and icy areas after snow - plow after 10 cm Complete 4 hours after snow if <15 cm, 6 hours after snow <22 cm, 8 hours after snow >22 cm
Saguenay	291 of 468 kms (62%)	By 7:30 am (unless still snowing heavily after 4 am)	School zones/core by 7:30 am, all sidewalks within 48 hours

All cities maintain far more sidewalks than St. John's, including the downtown core. All start sidewalk clearing earlier than St. John's (e.g. during an event). The larger cities use a priority system on sidewalks similar to that used on roads, giving some sidewalks priority over others (priority definitions on next page).

Levels of Service on Sidewalks (cont.)

- The Halifax priority system for sidewalks is as follows:
  - P1* includes sidewalks on arterials and in the capital district with plowing starting at 5 cms of snow and completed 12 hours after the end of the snowfall;
  - P2* includes school drop off areas and transit routes (not on arterials) with plowing starting at 10 cm and completed at 18 hours;
  - P3* includes residential areas and plowing starts when P1 and P2 are completed and is finished 36 hours after a snowfall ends; and
  - Halifax clears 3,600 bus stops within 48 hours (previously 72 hours).
- Saguenay is planning changes to its current priority system:
  - School zones and the commercial core will be targeted for completion by 7:30 am (unless heavy snowfall continues after 4 am); and
  - All other sidewalks will be completed within 24 hours of the end of a snowfall.

* P1, P2, and P3 refer to 1st Priority, 2nd Priority, 3rd Priority, etc. throughout this report.

Levels of Service on Sidewalks (cont.)

- The Quebec priority systems for sidewalks is as follows:
  - Both sides on primary and secondary arterials and one side on all collector roads are maintained, as well as sidewalks in front of any schools, medical facilities, senior citizen homes, medium or high density housing, commercial sectors including the downtown, bus routes, areas with plenty of parking on the street, and roads less than 6.5 m wide (sidewalks that are rarely used may be dropped from list);
  - Daycare centres (with >6 children) and mobility reduced residents are considered;
  - New areas without sufficient snow storage are generally not cleared;
  - P1 sidewalks including all high use walks and those with over an 8% grade are salted during freezing rain, and salted for hills and stairs during the beginning of any snowfall, with plowing commencing after 5 cm and then salt after snowfall ends;
  - P2 sidewalks including those serving schools, those with a grade >5%, or with a particular issue (seniors, limited mobility resident) are plowed at 5 cm but generally receive sand for freezing rain, or after snowfall ends; and
  - P3s (others that are maintained) are not plowed until 10 cm of snow and get sand or salt only at intersections, pedestrian crossings, and slippery areas.

Levels of Service on Sidewalks (cont.)

A consistent message from the public, from staff, from businesses and from other stakeholders was that the City does not do enough for pedestrians during the winter.

While sidewalks were a major focus, crosswalks, signal activation buttons, bus stops and general pedestrian safety also received attention. Everyone is a pedestrian for some part of their trip, but school children; university students; downtown workers, shoppers, residents and patrons; and people with disabilities or low incomes are more frequently pedestrians.

The other cities provide an indication of the level of service that is “becoming standard”. We say “becoming standard” because Halifax, for example, has expanded its sidewalk maintenance over the past 8 years to the point that it currently includes all sidewalks. The movement towards more livable, walkable cities is increasing the emphasis on pedestrian facilities everywhere.

None of the comparison municipalities require property owners to maintain the sidewalks in front of their properties, even in commercial areas, and all provide the highest levels of service they provide for the sidewalks in main street shopping locations. Although there was general acceptance among stakeholders in St. John’s that downtown businesses should be responsible for clearing their own sidewalks, we have only seen extra charges on downtown businesses in other cities in the context of businesses paying for extra services (generally decorative items like plantings, special street lighting, sidewalk paving materials, etc.) but not for basic road or sidewalk maintenance.

The current sidewalk runs cover all major arterials, often just on one side, with many sidewalks maintained likely having limited volumes of pedestrians. However, the City does not have any data on the volumes of pedestrians on the various sidewalks.

Levels of Service on sidewalks (cont.)

The analysis suggests that the main issue with sidewalks is that the sidewalks maintained are not maintained well (rather than too few sidewalks being designated for winter maintenance). Therefore, the highest priority should be improving the maintenance activities. Some of those requirements are discussed in the Service Delivery Approach section, but changes in approved service levels are also appropriate.

We suggest that the City consider the following:

- Establish sidewalk routes on a priority basis, based on proximity to schools (including post-secondary), commercial, and employment areas with significant pedestrian volume (see Routes section).
- Salt P1 sidewalks (and P2 sidewalks on hills), including Duckworth Street and Water Street, before or early in a freezing rain or snow event.
- Commence plowing of P1 sidewalks after 5 cm of snow and continue until completed, targeting completion within 12 hours after a storm.
- Begin plowing of P2 sidewalks after 10 cm of snow and complete within 36 hours after the end of a storm.
- Have sidewalk plows provide a small opening (e.g. 6 feet) in any windrow between the sidewalk and the road at any bus stop along their route (one opening at expected front door location).
- Have Parks develop a list of problematic pedestrian button locations and clear them as a P5 activity.
- Base decisions to add or delete sidewalks from the list of maintained sidewalks primarily on the level of usage, and collect sidewalk usage data in the spring to facilitate this process:
  - Set threshold usage levels once data is collected and ranges of actual usage levels can be identified;
  - Set required usage levels lowest for arterial roads where walking on the street is most dangerous; and
  - Consider the location of schools, hospitals and seniors complexes.

Levels of Service - Snow Removal

Snow removal standards and approaches vary widely.

St. John's does not have a specific policy on when snow removal must be undertaken or when it must be completed. The policy is to begin snow removal once the "push back" has been completed sufficiently that trucks and loaders are available, so generally a day or two after a storm ends. This is because the same equipment is used for the plowing/push back operation and snow removal. Snow removal was further restricted last winter by equipment breakdowns that left the department with no snow blowers in some periods (see Vehicles and Equipment section), thus making snow removal take longer than planned.

The decision on where to conduct snow removal is currently made based on road conditions and the ability to maintain service on the roads without the windrows encroaching to much onto the travelled surface. The preference is to push or blow the snow onto lawns or properties away from the roadway and behind any sidewalks where available. Where there is insufficient storage space to accommodate a blow back, snow removal is carried out.

The lack of snow removal in St. John's was a major source of the frustration with the sidewalks last winter. The sidewalk plows were generally starting after the snow from the roads had been plowed and pushed back onto the sidewalks, making it very difficult for the sidewalk plows to run their routes and generally requiring them to use blowers rather than plows, making things go even slower. Commencing plowing earlier and using the plows as much as possible will allow improved, early coverage as the plows can cover sidewalks 4 to 5 times faster than blowers. Enhanced snow removal is a key component of improving sidewalk services (ensuring they do not always need to be snow plowed).

Levels of Service - Snow Removal (cont.)

Quebec City provided a very specific policy on snow removal priorities:

- Snow will be removed where there is no space to put it, street furniture to protect, issues of vision, or electric wires impacts.
- Snow removal begins after 10 cm and if there is no second snow then arterials, commercial streets and collectors are to be completed within:
  - 1 day (if <15 cm);
  - 2 days (if <22 cm);
  - 3 days (if <30 cm);
  - 4 days (if >30 cm) for streets that have sidewalks or med/high density, seniors, narrower than 8 m, or have significant on-street parking; and
  - Those without sidewalks will take 5-7 days depending on volume.
- 39% of streets meet the snow removal criteria and are scheduled for snow removal as a regular event.
- The existence of sidewalks is a major factor in setting priorities for snow removal.

Saguenay reported that it conducts snow removal in all downtown commercial areas within one day of a snowfall.

Levels of Service - Snow Removal (cont.)

It is suggested that the City consider the following:

- Designate streets for snow removal when it is required to keep the sidewalk open.
- Designate Duckworth, Water and George Streets for snow removal generally after 10 cm of snowfall or as necessary to minimize impact to pedestrians, parking, and access to business and entertainment areas.
- Among streets identified as requiring snow removal, prioritize in the order of:
  - Commercial core (Water, George and Duckworth Streets);
  - Streets with maintained sidewalks and are impassable to vehicles;
  - Streets without maintained sidewalks and are impassable to vehicles;
  - Streets with maintained sidewalks where all lanes cannot be kept open;
  - Streets without maintained sidewalks where all lanes cannot be kept open; and
  - Other streets where maintained sidewalks cannot be kept open.
- Perform snow removal earlier in the event cycle, beginning after the snowfall ends.
- Continue snow removal activities underway when a snowfall begins to the end of the shift, provided there are sufficient operators available to cover the high service routes.

KPMG

cutting through complexity

Service Delivery Approach

Comparing High Level Service Delivery Approaches

The high level elements within the service delivery approaches of the comparison cities are shown below.

	Staff	Contracts	Average route length
St. John's	• **Three shifts** provide 18 hours coverage, 7 days per week • Use overtime to fill 24 hours during events	• No contracting except in exceptional circumstances (some hired trucks last winter)	• Salting 51.9 km • Plowing 40.0 km • Sidewalk 33.5 km
Fredericton	• **One shift**, year round workers • Each assigned to particular routes and equipment who work when it snows	• No contracting except in exceptional circumstances	• Salting 94.2 km • Plowing 40.9 km • Sidewalk 16.5 km
Halifax	• **Two shifts** year round workers, standby on weekends	• **35% of streets, 85% of sidewalks** maintained by contractors • Also, use hired equipment to supplement in-house operation (sanders, graders, and loaders)	• "Routes" are designed but do not relate to the amount of equipment assigned
Mount Pearl	• **Two shifts** year round workers, standby on weekends	• **No** contracting	• Salting 48.09 km • Plowing 18.5 km • Sidewalk n/a
Quebec City	• Permanent, year round staff	• 47% of areas contracted (streets, sidewalks, removals)	• N/A
Saguenay	• Two large 8 hour shifts per weekday plus 4 staff on third shift and weekends	• 40% of operations contracted – performance based area contracts	• N/A

St. John's and Mount Pearl are both relatively high cost providers with operations based almost exclusively on in-house resources. Likewise, Fredericton's operations are almost exclusively in-house yet they have the lowest cost operation. The other three cities contract out considerable work using both comprehensive contracts (i.e. contractor is responsible for winter maintenance on designated facilities) and hired equipment with operator (i.e. hired by the hour following City direction when working). The plow routes in St. John's are very close in length to those in Fredericton, but the salting routes are much shorter and the sidewalk routes are much longer. The routes in Mount Pearl are much shorter, which corresponds to the quicker completion periods. Quebec, Saguenay and Halifax did not report the number of routes related to the contracting approaches.

Current Approach Based on In-House Staff, Three Shift System

The vast majority of snow clearing in St. John's is carried out by City staff.

- There are three staff groups within Roads Division (A/B/C shifts), with two working 8 hour shifts and one working 10 hour shifts. There are two shifts on duty any given day with one in the day and one at night.
- Each shift has 72 staff members:
  - 5 Forepersons;
  - 59 Operators;
  - 6 Laborers;
  - 1 Welder; and
  - 1 Salt Loader Operator.
- During snow events, the 8 or 10 hour shifts are extended to provide around the clock snow clearing capability (hence the increased overtime costs when more storms happen).
- The Parks and Open Spaces Division has 32 staff on 3 shifts:
  - Monday – Friday: 8am – 4pm (1 crew + 2 FCOs);
  - Monday – Friday: 4am – Noon (2 crews + 2 FCOs); and
  - Thursday – Monday: 4am – Noon (2 crews + 1 FCO).

Staffing

Other cities perform their staffing differently.

- As per the table below, St. John's and Mount Pearl are similar in terms of number of staff relative to population, although Mount Pearl has more per lane km of road.
- Fredericton has far less staff, even though most of its winter maintenance is completed with in-house staff, and Halifax is very low due to its extensive use of contractors.
- All cities compared use year round staff that are transferred between positions applicable to the season. St. John's also lays off and rehires each summer and fall and hires extra seasonal employees in the winter. Both Halifax and Fredericton have small enough winter staffing that they conduct seasonal hiring in the summer, whereas St. John's has the larger workforce in the winter. While numbers were not made available by Quebec City, its staff is small given its extensive use of contracting. Quebec City staff are full-time and switch to water, sewer and road maintenance in the summer.

	St. John's**	Fredericton	Halifax	Mount Pearl	Saguenay
Management	2	2	4	1	3
Supervisor	15	7	19	4	10
Operators	177	51	102	40	170
Labourers	18		58	6	20
Other	6				
Total	218	60	183	51	203
Staff/Supervisor	13.4	7.3	8.4	11.5	19.0
Staff/1000 Pop	2.1	1.1	0.5	2.1	1.4
Staff/100 Lane Kms	15.6	8.3	4.7	21.3	16.9

** 32 St. John's Parks division staff excluded

Cost Reduction Options, In-House

One major cost of winter maintenance is the cost of "stand-by" capacity, or the cost of having resources available to respond when the weather is bad.

The highest cost approach is to have staff on standby 24 hours a day, 7 days a week, with sufficient staff to handle all weather conditions. This approach ensures a quick response in the event of weather changes, but results in extra staff when the weather is good. None of the comparison cities do this, but it is not uncommon in some other cities (e.g. Toronto, London, Ottawa), at least with respect to high priority staff such as operators for salt trucks on major roads.

St. John's has two shifts on-hand 16-18 hours a day, seven days a week, and extends the shifts with overtime to cover 24 hours during weather events. It has sufficient staff to handle any event, and has full staffing on-hand for 16-18 hours a day when there is no weather event.

Mount Pearl has more staff than St. John's because it chooses to pay for a higher service level, but it has a less expensive shift plan with two shifts covering 16 hours a day, five days a week. The remaining 8 hours and any weekend requirements are handled with staff overtime. A limited group of staff are paid 9 hours standby pay each weekend to ensure they are available if required.

Cost Reduction Options, In-House (cont.)

Fredericton has taken the process a step further. It only has one shift of workers that generally works days, five days a week, but works overtime when there are snow events that occur outside their normal work day or on weekends. They do not receive standby pay, but the City reports that workers generally understand the nature of the job and work when required. Their overtime rate is 1.5 times regular pay, with 2 times pay on Sundays.

Fredericton notes that salt truck drivers receive a lot of overtime as salt or light plow runs are the most frequent winter maintenance activities. For large snow events, they generally run the salt trucks (equipped with plows) into the evening and bring the full shift back at midnight for a full plow run to open up streets before the morning rush hour. The staff come back in the evening for more plowing or snow removal, depending upon when the storm ended. Note: there are also 2 staff on each night, 7 days a week, to handle immediate response requirements.

Fredericton's model has some additional advantages. Each operator has a specific route for which they are personally responsible throughout the winter. Accountability is very clear. Similarly, each operator has a specific vehicle that is their vehicle. Spares are available if a vehicle goes down, but the operator will generally attempt to keep their own vehicle up and operating as much as possible. Again, there is full accountability. The routes are designed to be cleared in a single shift which does result in quicker completion – although a more limited ability to continue operations throughout a long event (safety requirements limit the hours operators can work without resting).

Cost Reduction Options, In-House (cont.)

St. John's had a system similar to Fredericton until about 20 years ago. It shifted to the current system for a number of reasons:

- Snow removal is major requirement in St. John's, and most of this is best done overnight;
- The St. John's labour contract requires standby time and overtime paid at double time after the first four hours
- Concerns that plowing must be suspended during major events each time operators reached their maximum work hours before resting. Maximum work hours are now closely regulated by the province; and
- An expected savings on equipment, with the same vehicle being used by three operators over the course of a week.

That said, these reasons do not remove all advantages of having fewer shifts.

Cost Reduction Options, Contracting

The other major approach to reducing the cost of standby time is to contract some work, particularly the work that is required less frequently.

London, Ontario has 24X7 in-house staffing sufficient to operate enough salt trucks that do the equivalent of the High Service Routes in St. John's. When more resources are required, for instance to conduct a plowing operation, they bring in hired equipment. The salt trucks might be out 50 or 60 times during a winter and the consequence of slow response is significant (e.g. accidents, traffic tie ups) so they feel 24X7 staffing and immediate response is worthwhile. They only need to conduct a full plow perhaps 10 times a year, so hiring resources when needed limits cost.

Quebec, Halifax and Saguenay have gone a step further by contracting responsibility for maintenance of specific facilities to a specific service level (generally termed "area contracts"). Quebec and Halifax both have a similar arrangement for certain roads.

In Halifax, certain groups of sidewalks are included in each contract and the contractor is responsible to salt or plow them within a certain time period. It is up to the contractor to determine how to get it done. Halifax is now considering putting the roads and sidewalks in a certain area together in the same contract next time around to improve accountability. For those area contracts, Halifax pays a fixed amount per year for the facilities involved, making the contractors bear the risk of the weather. Quebec pays an amount per cm of snowfall and uses Environment Canada records to determine how much to pay its contractors.

In both cases, effective contract management and supervision is essential. Halifax has had to penalize some contractors when performance was inadequate. Halifax was also able to quantify its savings: sidewalks cost $12,000 per km when performed in-house, and only $5,200 when contracted. That difference is much less on roads at $3,800 per lane km contracted versus $4,400 in-house.

Cost Reduction Options, Contracting (cont.)

Saguenay uses area contracts for 40% of its roads, generally in rural and suburban areas, while keeping the more complex downtown areas to be managed by city staff. They indicate two main reasons for letting the contracts: 1) contracting some work helps maintain a better balance between winter and summer staffing requirements and allows it to work more with permanent staff and rely less on seasonal staff, and 2) it provides more assurance of continuous service in the event of a labour disruption or a contractor failure. In either case, it has some remaining capacity to provide service. Saguenay reports its costs are between 9% and 11% less expensive for contracted services, but attribute that in part to maintaining some 24/7 in-house staffing capacity to respond to emergencies.

Quebec and Halifax both have in-house operations responsible for some areas, and both augment direct staff with hired equipment during peak periods. This “hired equipment” is generally engaged under a standing offer and contracted complete with an operator. The hired equipment is supervised by the in-house forepersons and deployed the same as city vehicles.

Many municipalities complement in-house resources with hired equipment. It provides a means to add resources quickly when needed for major snow operations, usually for a plow run or for snow removal, without having to pay an operator during periods they are not required for operations.

Cost Reduction Options, Contracting (cont.)

St. John's has used hired trucks for snow removal in the past, and has decided to expand this process going forward for future winters (including the current 2014-2015 winter). It has occasionally hired equipment in the past, but not on a regular basis.

To test the viability of contracting additional services, some other local municipalities were contacted to determine their experience as well as some local businesses with the types of equipment the City may be interested in (generally loaders and/or graders) and that is potentially underutilized during the winter. The findings are as follows:

- Portugal Cove-St. Phillips and Mount Pearl do not use contract equipment on a regular basis.
- Conception Bay South hires loaders on a regular basis. Its contracts have a stand-by fee plus an hourly rate when the loaders are called out. There is some concern with the age and/or condition of the equipment and some concern with the cost, although the standby fees are modest. There is some discussion of phasing out hired equipment, but not before running another three year contract.
- Five potential contractors were contacted. One currently contracts to a local municipality (Petty Harbour/Maddox Cove), two currently contract summer work for the City of St. John's, and three perform winter services for private clients (e.g. condominiums, shopping centres and/or industrial sites).
- Some potential contractors had available capacity with their current equipment consisting of a very small numbers of loaders (2-7) and larger numbers of trucks. A number of contractors indicated a willingness to add equipment if regular work was available.

Cost Reduction Options, Contracting (cont.)

- The two contractors that do not currently provide winter services indicated a need to add snow accessories (e.g. blades and wings), and indicated a willingness to do so if work was available.
- The potential contractors generally favored area contracts over hiring equipment – i.e. having responsibility for doing all work in a particular area. This reflected their concerns regarding consistency in their services and revenues.
- One potential contractor expressed a concern that the current contract requires a $25,000 deposit or bond (which used to be $5,000). This makes it difficult for smaller contractors to participate.
- All expressed an interest in bidding on winter maintenance, assuming the terms are acceptable.

Cost Reduction Options, Contracting (cont.)

Other municipalities have found similar constraints. Contractors require revenue commitments or they will not invest in the vehicle and labour required.

For the area contracts, this is relatively straight forward:

- Halifax and Saguenay offer a fixed price whether it snows or not. The contractor may incur higher expenses during a harsh winter but will have a predictable cash flow, and the amounts tend to balance out over a multi-year contract; and
- In Quebec City there are years with heavy snowfall and years with light snowfall, but there is always some snow and the amounts tend to balance out over a multi-year contract.

For hired equipment, there are generally two approaches taken:

- The contractor may be given a “standby” payment to guarantee the equipment will be available plus an hourly rate when the equipment is used. This guarantees a minimum payment to contractor, and helps cover fixed costs for things such as the additional snow equipment. The variable costs of labour and equipment operations are covered by the hourly rate;
- The contractor may be guaranteed a minimum number of hours over a winter, ensuring there is some payment to cover the basic costs of making the equipment available, even if it is not used.

Cost Reduction Options, Contracting (cont.)

Capacity Building in Industry

Our interviews with potential contractors identified some existing industry capacity as well as a willingness to expand that capacity if the market warrants. There are likely other potential contractors with capacity and a willingness to expand that were not identified and contacted.

To achieve a reasonable price and stable and competent performance, the City must design its procurement strategy to recognize contractor circumstances:

- Financing new equipment requires the ability demonstrate an expected cash flow for multiple years;
- Most contractors will have access to competent heavy equipment operators, but most will have limited capacity to train operators on winter operations; and
- Accommodating smaller contractors will take more effort from City supervisors, but often produce lower prices and a stable workforce over time.

The Halifax experience is a good example. There were few privately owned sidewalk plows when it first decided to expand its sidewalk plowing and contract some of the associated work. Halifax started with small contracts offering a sufficient term for bidders to finance new equipment if awarded a contract. Over time it has expanded the size of the contracts and is planning to merge road and sidewalk contracts as the industry capacity has sufficiently evolved.

Cost Reduction Options, New Service Levels

Capacity Building

The new service levels adopted by St. John's for the current winter and the additional improvements recommended in this report require additional winter control capacity in two key areas:

- Sidewalk plowing is to commence earlier than in the past, starting while the snow is still falling rather than after the snow has stopped, the roads are plowed, and "push back" is well underway; and
- Snow removal is to start earlier (when the snow stops rather than when the plowing is completed and the push back well underway) and be completed more quickly.

Both of those changes increase the peak resource requirements as they will now begin when required to serve the public rather than when the manpower is available. Council has already approved two steps to add resources:

- An 8 person sidewalk plowing crew has been added as a day shift, and
- Staff has been directed to use hired trucks as part of the snow removal operations.

However, this will not address all requirements, particularly the requirement for snow removal crews to load the hired trucks and the requirement for additional loader/plow operators for the new routes that will accommodate growth areas, including those already built.

Operator Requirements Last Year (2013-2014)

Peak Requirement

Between Events	Freezing rain, light snow (30 -50 times per year)	Plow Run (8 – 12 times per year)	After Pushback
Crews conduct road and depot maintenance as available. Can use 25 to 50 staff for overlapping snow cleanup, potholes, and asphalt work	28 salt routes	9 high service 34 loader routes 2 on 44 A/B 2-4 extra machines on hilly downtown routes	15 first removal crew 11 second removal crew 20 trucks to support removal 4 sidewalk plows
	5 spares	9 spares	9 spares
As available	33 operators	56 – 58 operators	With 2 removal crews: 59 operators

The actual staffing level was 59 operators per shift, which has proven sufficient to carry out the “After Pushback” activities, requiring 50 active operators, so there are 9 spares to cover for absences and other duties that may be required.

Operator Requirement Next Year – (2015-16)

New Service Levels and Increased Peak Operator Requirements

Peak Requirement

No Event	Freezing rain, light snow (30 -50 times per year)	Plow Run (8 – 12 times per year)	After Pushback
Crews conduct road and depot maintenance as available. Can use 25 to 50 staff for overlapping snow cleanup, potholes, and asphalt work	28 salt routes	9 high service 34 loader routes 2 on 44 A/B 2 - 4 extra machines on hilly downtown routes	15 first removal crew 11 second removal crew 0 - 20 trucks to support removal
	2 new routes 5 sidewalk routes	4 new routes 10 sidewalk routes	4 sidewalk plows (day) 6 new sidewalk routes (day)
	(snow removal could continue during salting if in process, requiring up to 15 operators for a crew using hired trucks)	1 removal crew 15 operators (+ hired trucks)	11 third removal crew 0 – 10 trucks
	6-9 spares	13 spares	6 spares
As available	41 operators (up to 59 with snow removal)	89 - 91 operators	43 operators (plus 8 day time sidewalk Plus 0 to 30 trucks)

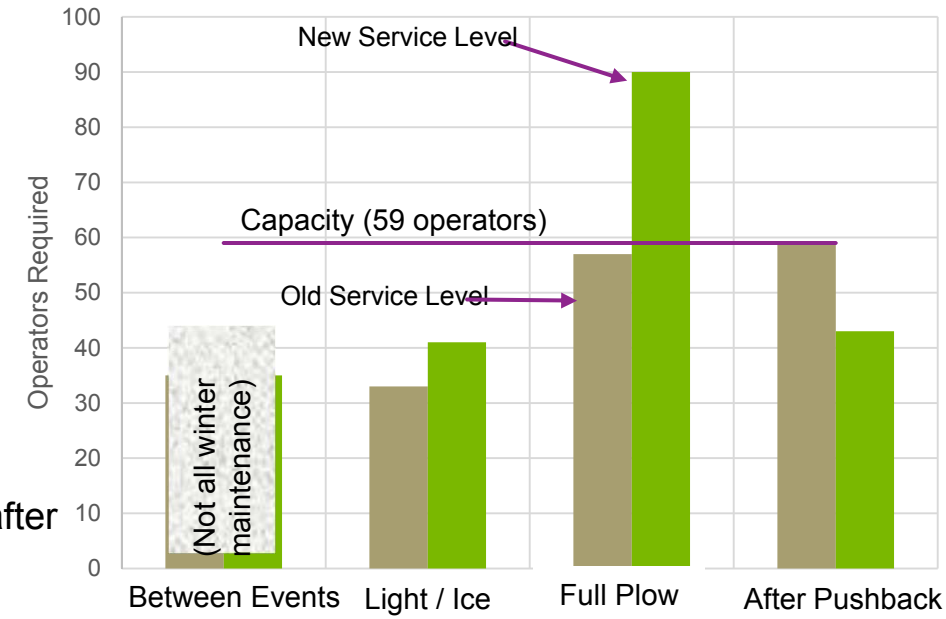
Spare requirements assumed to be proportional to current requirements, e.g. 9 for 50

Operator Requirements Summary

Higher Peak

As the graph shows, the old service levels were set based on how much the staff of 59 operators per shift could accomplish.

Sidewalk plowing and snow removal was deferred until the operators completed the plow runs and pushback, which generally took a day after the snow stopped.



The new service levels call for sidewalk plowing during the snowfall and snow removal immediately after the snowfall stops. The result, as shown on the graph, is a much higher peak requirement during and immediately after a snowfall. The requirements are lower once the plowing and pushback process is completed.

These requirements assume all snow removal trucks are leased, and more staff could be usefully employed after the pushback by using City trucks for snow removal in lieu of some leased trucks.

However, the new service levels will require many more resources during a full plow than at other times during the winter. Of 126 days in the new winter staffing period, a full plow will occur about 10 times per year, taking up approximately 20 days.

Options for Analysis

As demonstrated previously herein, the current staffing of 59 operators on each of three shifts is insufficient to provide the improved level of service outlined in this report and partially adopted in the Interim Report. Even with the use of leased trucks, 89-91 operators are required to carry out all activities required during a full plow run, including starting sidewalk plowing early in the event and deploying at least one snow removal crew while the plow run continues.

The following pages analyze different approaches to meeting these requirements using varying combinations of in-house and contracted resources. The assumption, which is based on the Environment Canada snow data shown in the table in the "Staffing Issues" section, is that a salting or light plow run will be required about 40 times during an average winter, and a full plow run will be required 10 times during an average winter.

Each of the options has been analyzed to identify increased or decreased costs. In each case, the increase or decrease is relative to the funds approved for 2014-15 including the funds for the leased trucks and daytime sidewalk crew approved considering the Interim Report. The options outlined are the extremes (i.e. all one way or the other) to facilitate analysis and identify preferred directions. Actual implementation may be less extreme as discussed following the options analysis.

The key assumptions used for these calculations are outlined in Appendix A. They have been reviewed by City staff, but the future oriented financial information is based upon a number of assumptions, is unaudited, and is highly dependent on future events while noting that the impact of such future events may be material.

How to Meet Requirements: Option One – Increase Staffing

Summary of crew size requirements

40 times a year, for salt/light plow, for 8 - 24 hours, need	41
10 times per year for full plow run, for 1 - 3 days, need	90
10 times a year to clean up after plow run, for 1 - 7 days, need	43

The rest of the winter (35 - 45 days) – requirements are flexible, for road repair and snow

There are currently only 59 operators on each shift, which is much less than the 90 (plus hired trucks) required to meet the new service levels. The Pilot Project provides 8 new sidewalk operators, but only in the daytime. Increasing staff levels to 90 on each shift would still result in some overtime during plow runs, with shifts extended to 12 hours as they are now.

Option One – Increase staffing

- Increasing the full-time staffing of each of three shifts to 90 operators would require 85 new operators at a cost of about $2.5 Million (see Appendix A).
- There would be some reduction in the cost of leased trucks for snow removal during the clean up period, perhaps as much as $500,000.
- There would be significant excess capacity whenever there is no plow run in progress.

How to Meet Requirements: Option Two – Use Overtime

Summary of crew size requirements

40 times a year, for salt/light plow, for 8 - 24 hours, need	41
10 times per year for full plow run, for 1 - 3 days, need	90
10 times a year to clean up after plow run, for 1 - 7 days, need	43

The rest of the winter (35 - 45 days) – requirements are flexible, for road repair and snow

There are currently only 59 operators on each shift, so meeting the expanded requirements for the plow runs would require 31 operators each shift to work overtime (62 total per day). That would be some combination of operators working a double shift and operators who are on their off days coming in to work.

Option Two – Use Overtime

- Assuming the average plow run requires 48 hours to complete (including push back), the 62 operators would each work two 12 hour overtime shifts for a total cost of approximately $880,000.
- The main challenge would be identifying enough staff available to work the overtime. During a plow run the two shifts on schedule would already be working 12 hour shifts. They could at most be extended another 4 hours. The third shift, the group currently on their days off, would have to be called in and most of the 59 would have to work through their days off. There would be additional planning issues to ensure nobody exceeded the maximum permissible hours operating. It is unlikely all requirements could be met and the planned snow removal, essential to improving both road and sidewalk conditions, would likely not happen

How to Meet Requirements: Option 3 – Contracted Loaders

Summary of crew size requirements

40 times a year, for salt/light plow, for 8 - 24 hours, need	41
10 times per year for full plow run, for 1 - 3 days, need	90
10 times a year to clean up after plow run, for 1 - 7 days, need	43
The rest of the winter (35 - 45 days) – requirements are flexible, for road repair and snow	

Staffing with 43 operators per shift would meet all requirements except a plow run. During a plow run, the 43 would still be sufficient to handle high service routes, sidewalks, and a snow removal operation (with leased trucks).

Leasing loaders to plow the P2, P3 and P4 roads would provide the additional resources required for plow runs.

Option Three – Lease Loaders

- Reduce the 3 shifts from 59 operators to 41, and contract for hired loaders for plow runs.
- Staffing could be reduced by 56, reducing costs by $1.7 Million. The cost of 26 leased loaders and 14 owned by the City ($1.6 Million) would also be eliminated. Leasing 40 loaders for 10 plow runs would cost around $2.9 Million during an average winter with a net saving of $460,000 (see Appendix A).
- Excess capacity is reduced when no large event is underway, but the City can still respond in very severe winters and maintain the response when there are repeated events. Current loader lease provisions will influence implementation timing.
- The loaders could be acquired either by area contract or as hired equipment.

How to Meet Requirements: Option Four – Two Shifts

Summary of crew size requirements

40 times a year, for salt/light plow, for 8 - 24 hours, need	41
10 times per year for full plow run, for 1 - 3 days, need	90
10 times a year to clean up after plow run, for 1 - 7 days, need	43

The rest of the winter (35 - 45 days) – requirements are flexible, for road repair and snow

Option Four - Two Shifts

- A night shift starting Sunday night would be on duty before each work day to salt and/or plow as required.
- The day shift would be on duty 3 weekdays and on weekends.
- If two shifts had 90 operators each to cover the plow runs with simultaneous snow removal, 5 positions could be removed with a savings of $150,000.
- The use of overtime for salt runs and plowing when no shift is scheduled (13 salt events and 13 plow shifts would cost about $750,000), resulting in a net cost of about $600,000 (see Appendix A).
- A large crew would be available to accomplish removals (with hired trucks) during and after large events, five nights a week.
- The day shift could perform substantial blowback and daytime removal where appropriate.
- The net impact is modest cost, with a risk that operators will not be available for rapid response to a second or third consecutive event given the number of hours on duty. There is also a risk operators will not respond to overtime requirements, especially around holidays or late in the year.

Analysis of Options

	Financial	Risks	Mitigation
1 – Increase Staff	Cost $2M	Low - Some risks around inexperienced seasonal staff and labour disruptions	Expand training program in fall further (also leads to higher costs)
2 – Increase Overtime	Cost $880K	Highest – High risk of staff unwilling to work all overtime and/or exceed permitted operating hours, leading to large risk of inadequate service during large/multiple events	Combine with option 1, providing some additional staff and less reliance on overtime
3 – Contracted Loaders	Save $460K	Medium - New approach, industry unprepared to meet needs, City faces learning curve	Phase in contracting to test best approaches and give industry time to respond
4 – Two Shifts	Cost $600K	Medium: Some risk staff unwilling to work all overtime and/or exceed permitted operating hours	Pay standby and/or schedule small third shift (10) – reduces risks, and with some deferral of plow runs, could reduce costs

Analysis of Options

The four options listed above compare the extreme situations. They demonstrate that the use of contracted resources could achieve the higher service levels without additional investment, and a two shift system could achieve the higher service levels with modest additional cost or risk. But both these approaches must be modified to manage the risks involved.

For the two shift system:

- A preferred approach would be to plan a small third shift of approximately 10 operators to provide salting on the P1 routes. That would ensure the City can respond as quickly as it currently does to icy conditions, freezing rain, dropping temperatures and unexpected snowfall. For larger or anticipated events, the third shift could be complemented with staff kept on or called in early from the other two shifts.
- With both primary shifts having increased staff to cover all routes, the sidewalks and some snow removal simultaneously, adequate resources should be available to bring in on overtime as required and to meet the new service levels.
- This approach would add approximately $360,000 to the costs.

For the contracted loader approach:

- The City should test two approaches to contracting for loaders and evaluate which best meets its goals:

1. Engage loaders on a hired equipment basis as it does for snow removal trucks. They would be given a combination of standby pay and hourly rates when called out.
2. Engage contractors to carry out snow operations in a limited area of the City, with the contractor being required to meet the service standards and deploy equipment as required.

- The City has some older loaders and many newer leased loaders. The size of the test contracts should be modest and consider the number of loaders ready to be retired, unless some leased loaders can be sub-let to contractors.

Suggested Approach

The two approaches, a "two-and-a-half" shift system, and the use of leased loaders for some snow plowing operations are not mutually exclusive and to some extent using both approaches would help mitigate some of the risks of the other.

Therefore we suggest that the City consider the following hybrid approach:

- Moving to an "unbalanced" shift system, with one or two shifts expanded to cover full sidewalk and snow removal requirements during plow runs, with the other shift(s) reduced to the minimum size required to salt/light plow runs;
- Gradually phase in the use of contracted equipment to help address peak requirements during plow runs:
  - Begin with small contracts using both the hired equipment model and the area contract models to find the best approach and help the industry to build capacity.

Additional funding may be required, or some service level improvements may need to be deferred if contracting cannot be introduced quickly enough.

Capital funding will also be required if contracted equipment is introduced quickly enough. Covering new requirements will require, based on the recent costs of equipment purchased by St. John's as reported by staff:

- Two additional salt trucks @ approximately $240,000 each
- Four additional loaders @ approximately $240,000 each (could be leased)
- Eight additional sidewalk plows (each valued at approximately $100,000) will be required to cover additional sidewalk routes and snow removal during plow runs. The need to purchase additional sidewalk equipment depends upon the success of Fleet Services in improving availability. This should be considered in the Fleet Services Review, along with the appropriate replacement schedule for the existing salt trucks, city-owned loaders, blower attachments, and sidewalk plows.

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Service Delivery Approach

Staffing Issues

Staffing

With virtually all winter maintenance services delivered by City staff, the recruitment, training, management and retention of that staff is key.

There are some important issues that impact operations. Most staff, including forepersons, are hired for the winter period (generally December to March). Many are rehired for work over the summer period, but there is an employment gap in the spring and again in the fall for many employees. That leads to more turnover than might otherwise occur and makes recruiting more challenging.

Forepersons are a particular challenge as there are more forepersons required in winter than in summer, and the collective agreement limits the ability of staff to take foreperson jobs in the winter and a CUPE position in the summer. Furthermore, the position requires a Certified Engineering Technologist designation, is paid at a lower rate than some other City foreperson positions, and does not provide compensation for the extensive overtime required for the job. As a consequence, forepersons are difficult to recruit, forepersons with experience even harder to recruit, and seasonal forepersons are reluctant to return the following season.

The result is that there are new operators, even those with heavy equipment experience, and new forepersons with limited experience in winter operations, that require training every year with the particular equipment used in winter operations and in the snow related techniques. When winter arrives early, there is not much time for training and higher equipment breakdown rates are experienced. Recruiting is also hindered by the requirement that all equipment operators have a grade 12 education. This may unduly eliminate some very experienced operators who could be very effective in winter operations.

Last winter experienced a late storm after most staff were laid off. While the remaining staff dealt with it, it took longer than usual to address.

Staffing Season

Winter staffing has been planned for 16 weeks from early December to late March.

The table below shows how often, on average over a thirty year period, snowfalls of various depths occur each month in St. John's. For example, in December the City will average 4 small 5 cm snowfalls on a typical year. It could be 3 one year and 5 the next, but it averages 4. On average, there will be 2 snowfalls in December that reach 10 cms.

November will usually have a 5 cm snowfall, and every second year have a snowfall over 10 cms.

April, after the winter staffing is dispersed, is similar with a snowfall under 5 cm very likely and a 10 cm snowfall expected at least every two years.

Note that the table does not list events with less than 5 cm that would require salt runs.

	5 cm (2 inches)	10 cm (4 inches)	25 cm (10 inches)
October	0.1	0.1	0.0
November	1.3	0.6	0.0
December	4.1	2.0	0.2
January	5.9	2.6	0.3
February	4.8	1.8	0.3
March	3.7	1.6	0.3
April	1.5	0.7	0.1
May	0.4	0.1	0.0
Total for Year	**21.8**	**9.3**	**1.1**

Data from: http://www.currentresults.com/Weather/Canada/Newfoundland-Labrador/Places/st-johns-snowfall-totals-snow-accumulation-averages.php

Staffing Season (cont.)

Fredericton and Halifax start their winter season in mid-November, which is earlier than St. John's, while Mount Pearl starts a small night shift as of November 15 and the full winter staffing in mid-December. All three stay with winter staffing until the first or second week of April.

Before and after the snow season, the majority of winter operators are dispersed to other positions.

- Around 60 remain with the Roads division but are put on a day shift. They are the first to be reassigned when there is an early or late snowfall, and they can generally handle any of the 5 cm events which only require plowing by the salt trucks. Response may be slower than in winter, particularly if the event is not predicted accurately;
- The larger snowfalls are usually handled by loaders, requiring a larger workforce and/or more time. Staff can be called back from other departments, generally parks or water/sewer, but that takes more time or more notice; and
- The early snowfall last winter also interrupted the training schedule for winter operations staff. Both new forepersons and new operators were put to the test before receiving sufficient training on winter processes and the specific equipment used for winter operations.

The City should consider expanding capacity in the shoulder seasons by:

- Engaging seasonal workers for a longer season (18 or 19 weeks instead of 16 weeks, maintaining coverage to the end of March) to provide resources for early or late events and allow more time for training early in the season. Workers transferring from other departments or positions can remain in those departments or positions unless they are new to winter operations and require training, or are required to assist with an actual snow event.

Staff Training

St. John's has attempted to train new operators early in the season but the early snowfalls last year resulted in the need to deploy staff as soon as possible. While new hires generally have good heavy equipment experience, they often do not have experience in operating the equipment for snow and ice control and they generally do not have knowledge of the full range of equipment used by the City.

The City has had difficulty recruiting trainers among the current operators. Extra pay is offered but with little response. This may have resulted from the positions not being dedicated to training throughout the year.

Some other cities reported holding classroom sessions for forepersons and for operators (Halifax), providing operator training using videos (Halifax), and using simulators (Quebec). All cities reported using job shadowing whereby they assign a trainee to work with an experienced operator for a period of time.

Training of forepersons is a particular requirement, as more forepersons are required in the winter than in the summer. Experienced operators are generally in union positions over the summer, and the union resists having individuals serve as supervisors of unionized workers in the winter and co-workers during the summer. Thus, the City has been hiring forepersons with supervisory experience but little or no winter maintenance experience.

Staff Training (Cont.)

Based on the interviews, reviews with management, and our experience with other cities, we suggest that the City consider the following:

- Supplement the existing trainer position and one shift trainer with two additional shift trainers. The shift trainers should report to the Lead Foreperson on each shift (or their designate), but should follow a protocol developed with the trainer.

- Early season training:
  - All forepersons should receive at least 16 hours of classroom time devoted to: policies, procedures, winter operations processes, typical problems and trouble shooting approaches; authority levels of operators, forepersons and lead forepersons; people management skills; and contractual issues both with labour and contractors, as required; and for those without experience as winter maintenance operators, training in the use and operations of typical winter equipment. The Lead Forepersons and experienced forepersons should have roles in delivery. This would typically occur in November;
  - Each shift should have a debrief session after the first event (or more frequently at the discretion of the Lead Foreperson) to identify issues/concerns, particularly those faced by new forepersons and to identify solutions;
  - All operators should receive an 8 hour refresher – half classroom time, half reviewing equipment, particularly on any changes or new equipment. This would typically occur in a number of groups in November and early December (as weather permits);
  - New operators should receive 8 hours of classroom training before the regular operator training reviewing policies, procedures, roles and responsibilities and expectations, as well as equipment and attachment types including capacity and circumstances in which each is appropriately used. They should also receive at least 8 hours of training on specific equipment with more, as required, to be certified on each type of equipment; and
  - During events, trainers should ride with operators to help them refine and improve their techniques. Priority should go to operators with less experience but should continue later in the season with experienced operators to build the trainer's knowledge of best practices and improve consistency in approach.

Staff Training (Cont.)

We suggest that the City also consider the following:

- Involve trainers during the winter in the relationship with Fleet Services to identify practices that can damage equipment and serve as a non-disciplinary means to train operators in how to minimize equipment downtime, individually or collectively, as required;
- Reduce the educational requirement for operators from grade 12;
- Accept supervisors with relevant experience in lieu of the Certified Engineering Technologist designation; and
- Review the compensation and overtime policies that apply to forepersons to improve the attractiveness of the position.

Staffing Sidewalk Plows

Operating the sidewalk plows is one of the least desirable jobs.

The plows are small, bumpy and a little uncomfortable, at least in comparison to the larger trucks and loaders. As a result, the staff with the least seniority, and hence the least experience, are generally assigned to the sidewalk plows.

However, the sidewalk plows must often manage difficult conditions - deep mounds of snow, narrow gaps between front porches and light posts or parked cars, and icy sloped sidewalks. The skills of the operators are therefore important to achieving clear sidewalks with minimum damage.

Creating a dedicated sidewalk crew scheduled on day shift may address this concern while improving the focus and commitment to sidewalks and the accountability for sidewalk conditions. The stable assignment to a day shift on weekdays may prove attractive enough that some experienced operators would opt to work on the sidewalk plows, thus improving the quality of the outcomes.

Staffing Sidewalk Plows (cont.)

We suggest that the City consider the following:

- Establish a separate daytime sidewalk crew for this winter as a pilot project (approved with Interim Report):
  - Appoint a foreperson should with prime responsibility for sidewalk operations and snow removal planning (ensuring sidewalks receive priority in snow removal planning) with the responsibility to assist with other work when available; and
  - Dedicate a day shift of 8 sidewalk equipment operators to carry out sidewalk plowing, blowing and related snow removal activities as long as required. They could be assigned to other tasks when not required.

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Service Delivery Approach

Approach to Routes

Routes

The City is divided into a series of routes that individual operators handle for salting and/or plowing. The plowing routes are shown on the next page.

There are 9 “high service” routes that each cover about 20 kms of P1 routes. They are salted by a salt truck and plowed by the salt truck, taking 2 - 2.5 hours to complete. Note: when plowing, each lane must be plowed separately thus increasing the distance from 40 to 60 lane kms per route.

There are 19 other standard salting routes that cover around 25 kms of roads of various priority levels. A typical example is provided on the next pages. A typical salt run should be completed within 3 hours. The same routes are used for light plowing (generally under 10 cms) by the salt trucks. Note: this requires plowing each road in both directions which requires covering around 60 kms and takes at least 4 hours for a full run with potentially another 4 hours for a push back to widen the roadway.

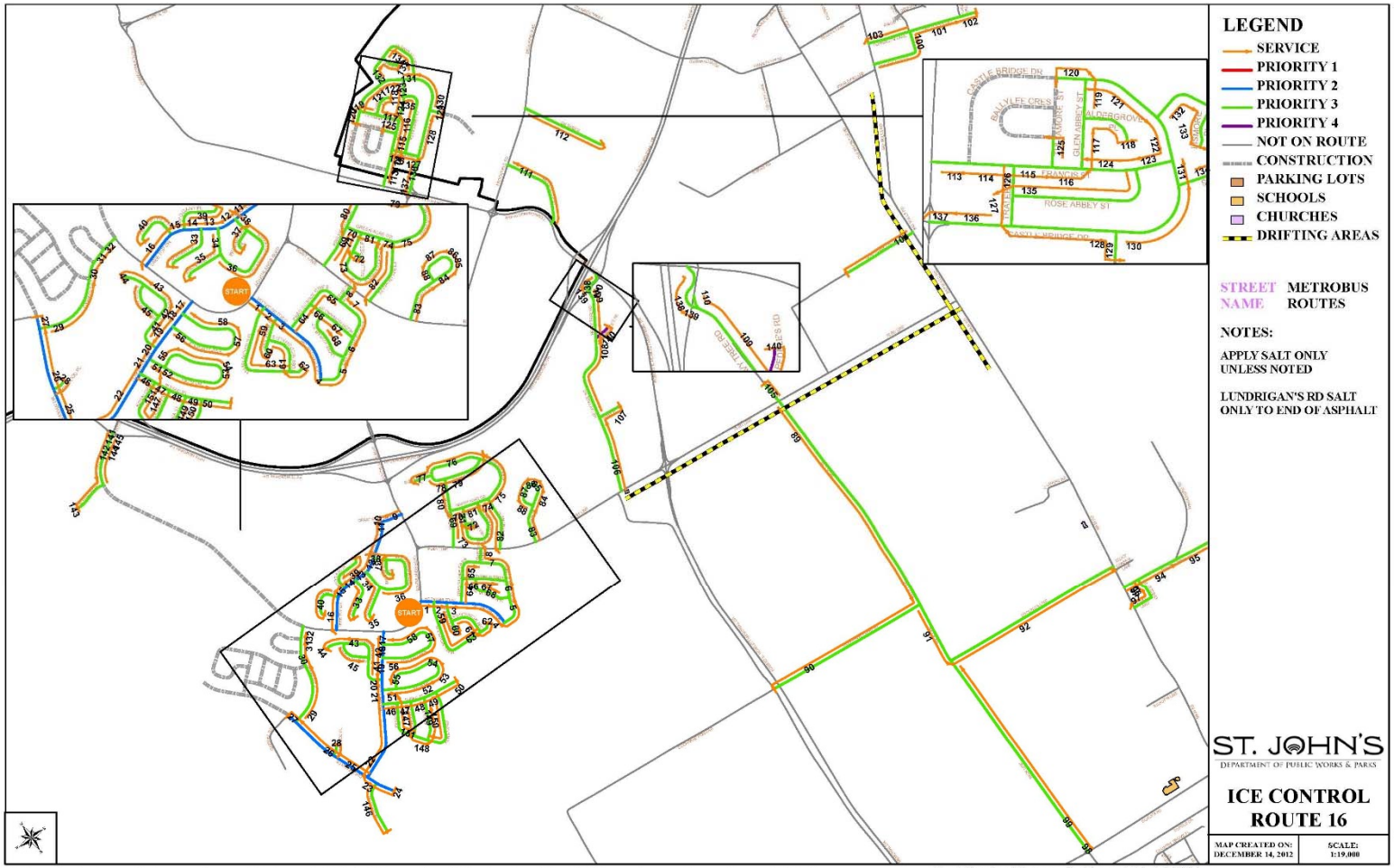
If the snowfall exceeds 10 cms, loaders are generally brought out to plow the standard salting routes with each salting route broken into two plowing routes as shown the page after next. The loaders travel slower and the snow is heavier resulting in each of these routes of 20 to 30 kms expected to take about 8 hours to complete. There are two plow routes (44A and 44B on the list) that are shorter and include some scattered roadways that must be plowed by smaller vehicles.

On standard routes, both salt trucks and loaders are expected to address their highest priority roads first and work down through the streets in priority order. Some lower priority streets are included if plows are deadheading on them.

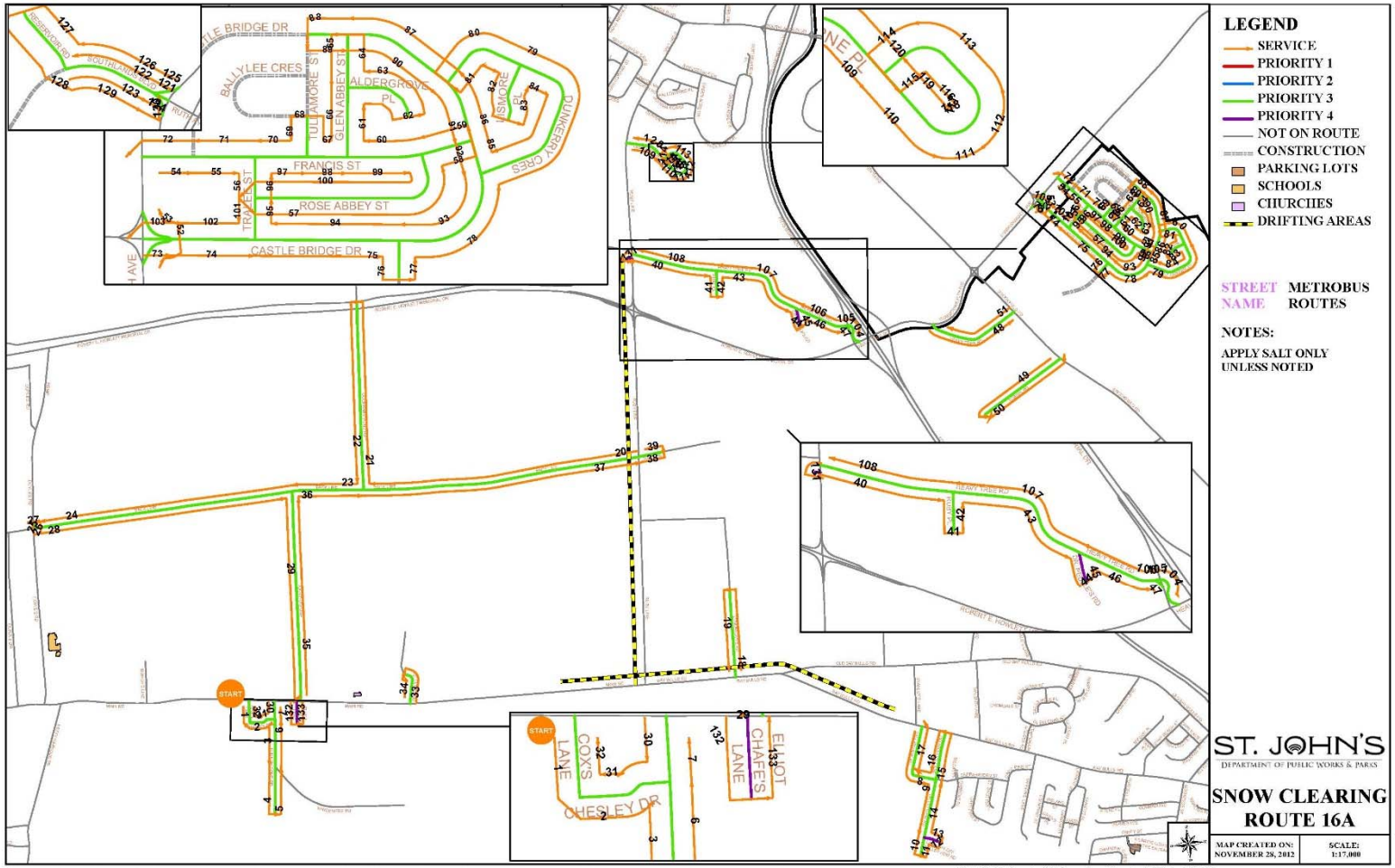
List of Snow Plowing Routes with Length and Priority of Roads

SNOW ROUTE	LANE KILOMETRES					PERCENT IN PRIORITY			
	TOTAL	PRIORITY							
		1	2	3	4	1	2	3	4
1	53.77	53.77				100%			
2	62.36	62.36				100%			
3	47.11	47.11				100%			
4	54.18	54.18				100%			
5	58.71	58.71				100%			
6	41.45	41.45				100%			
7	39.47	39.47				100%			
8	48.60	48.60				100%			
9	50.07	50.07				100%			
15A	25.87	0.05	6.12	16.78	2.92	0%	24%	65%	11%
15B	29.52		5.16	23.91	0.45		17%	81%	2%
16A	32.09			31.43	0.66			98%	2%
16B	28.73		5.95	23.11			21%	80%	
17A	26.43		2.64	23.78			10%	90%	
17B	25.64	0.57	12.80	11.45	0.81	2%	50%	45%	3%
18A	21.71		3.46	18.16	0.10		16%	84%	0%
18B	26.17		9.39	16.78			36%	64%	
19A	27.84		9.87	17.89	0.08		35%	64%	0%
19B	23.11		8.86	14.25			38%	62%	
20A	25.87	3.56	10.88	11.43		14%	42%	44%	
20B	22.33	2.93	9.97	8.86	0.57	13%	45%	40%	3%
21A	25.86		9.06	16.80			35%	65%	
21B	25.50		6.01	19.13	0.36		24%	75%	1%
22A	32.23		7.27	24.96			23%	77%	
22B	28.60		11.01	17.28	0.32		38%	60%	1%
23A	19.68	1.07	7.73	10.88		5%	39%	55%	
23B	22.60	5.27	5.23	12.10		23%	23%	54%	
24A	25.86	6.98	4.87	13.48	0.53	27%	19%	52%	2%
24B	22.62	2.06	6.23	14.33		9%	28%	63%	
25A	23.89	5.90	6.35	11.55	0.08	25%	27%	48%	0%
25B	21.14	10.83	4.84	4.91	0.56	51%	23%	23%	3%
26A	20.87	7.68	4.66	8.15	0.37	37%	22%	39%	2%
26B	16.79	8.99	1.40	6.33	0.07	54%	8%	38%	0%
27A	21.44	4.12	7.46	9.11	0.75	19%	35%	43%	4%
27B	17.68	1.70	5.54	8.44	2.00	10%	31%	48%	11%
28A	19.67	1.12	6.85	11.70		6%	35%	59%	
28B	22.61		4.29	18.33			19%	81%	
29A	22.34	3.07	0.13	18.49	0.65	14%	1%	83%	3%
29B	22.20	0.31	3.94	17.53	0.42	1%	18%	79%	2%
30A	21.41		2.64	18.53	0.24		12%	87%	1%
30B	25.94		0.95	24.44	0.55		4%	94%	2%
31A	25.02		11.69	12.89	0.44		47%	52%	2%
31B	23.97	0.16	5.05	18.76		1%	21%	78%	
32A	29.36		7.38	21.98			25%	75%	
32B	26.85		3.26	23.59			12%	88%	
44A	5.45	0.47	2.72	2.08	0.18	9%	50%	38%	3%
44B	2.97	0.04	0.43	2.34	0.15	2%	15%	79%	5%

Sample Salting Route



Sample Plowing Route (1/2 of a salting route)



Disclaimer: The directions provided are computer generated and may not reflect actual traffic conditions. Traffic rules and regulations shall take precedence over the computer generated directions.

Total Estimated Time for Route 16A is 10:19

Routes

There are a number of issues with the design of the routes:

- 23 of the 36 loader plow routes have no P1 roads. However, there are 2 routes with as much as 50%+ of their runs being P1 roads and 4 routes where over 25% are P1. These are generally areas with steep hills, and two pieces of equipment are often assigned to each areas when available. That means that many routes are plowing P2 and even P3 routes before the P1 roads on other routes are addressed;
- There are two distinct types of P1 roads: (1) arterial roads such as Columbus Drive, Topsail Road and LeMarchant Road which are P1 because of the high volumes of traffic; (2) roads with particularly steep hills which are P1 because they become hazardous with even modest snow loads;
- For the small number of loader routes with significant arterial routes and hills, it takes over 4 hours to get to all the P1 roads and often longer for some of the hills if the arterials need to be redone as snow continues to fall;
- Some of the loader plow routes have become longer as new streets have been added in growing areas. Three of them are planned to take over 10 hours, and 6 take over 9 hours. As some of the growth areas are at higher elevations where snowfall is deepest, this can create challenges; and
- Some routes “dead-end” at the municipal border. In some cases a road enters Mount Pearl and then re-enters St. John’s, with the equipment having to plow (or salt) to the border, then suspend operations and then re-initiate operations.

Routes (cont.)

Mixed Approach

The route design currently pulls elements from two different approaches:

- Some municipalities have P1 routes, P2 routes and P3 routes. The P1 routes are the shortest, the P2 routes are longer, and the P3 routes are the longest. Thus, something is done on all streets from the beginning, but the P1 routes will be plowed two or three times during the event before the last street on the P3 route is completed. The high service verses regular routes are consistent with this approach, except for the P1 roads that are included in some of the regular routes.
- Some municipalities complete all the P1 and P2 routes before starting any of the P3 routes. This gives a more economical (less equipment and staff) way to keep the major roads working, but can provide a problem when events last so long or produce so much snow that the P3s become impassable before they can be plowed. With snow levels and density in St. John's, this is not a practical approach. However, the standard routes do borrow from this concept, with the P1s being done first (on routes that have them) and P2s generally getting attention before the P3s in each route.

Overall, the route design concept makes sense but the implementation must improve to address the anomalies we note earlier, the routes with considerable P1s, and the very long routes.

Routes - Critical Paths

The routes have been taken one step further with a “critical path” designed for each route.

The critical path is the specific path to be followed when salting or plowing (start here, turn right here, then continue until you turn right here, etc.). The critical paths were designed by the Routesmart software, following some defined rules, and were modified based on review.

The intent was to ensure the highest priority roads were addressed first, and to go straight or use right turns whenever possible to ensure the windrow was properly tucked. The critical path also provides assurance that all roads would be addressed, that management would know how the route would be addressed so they could respond to resident enquiries, and to ensure inexperienced operators knew how to proceed.

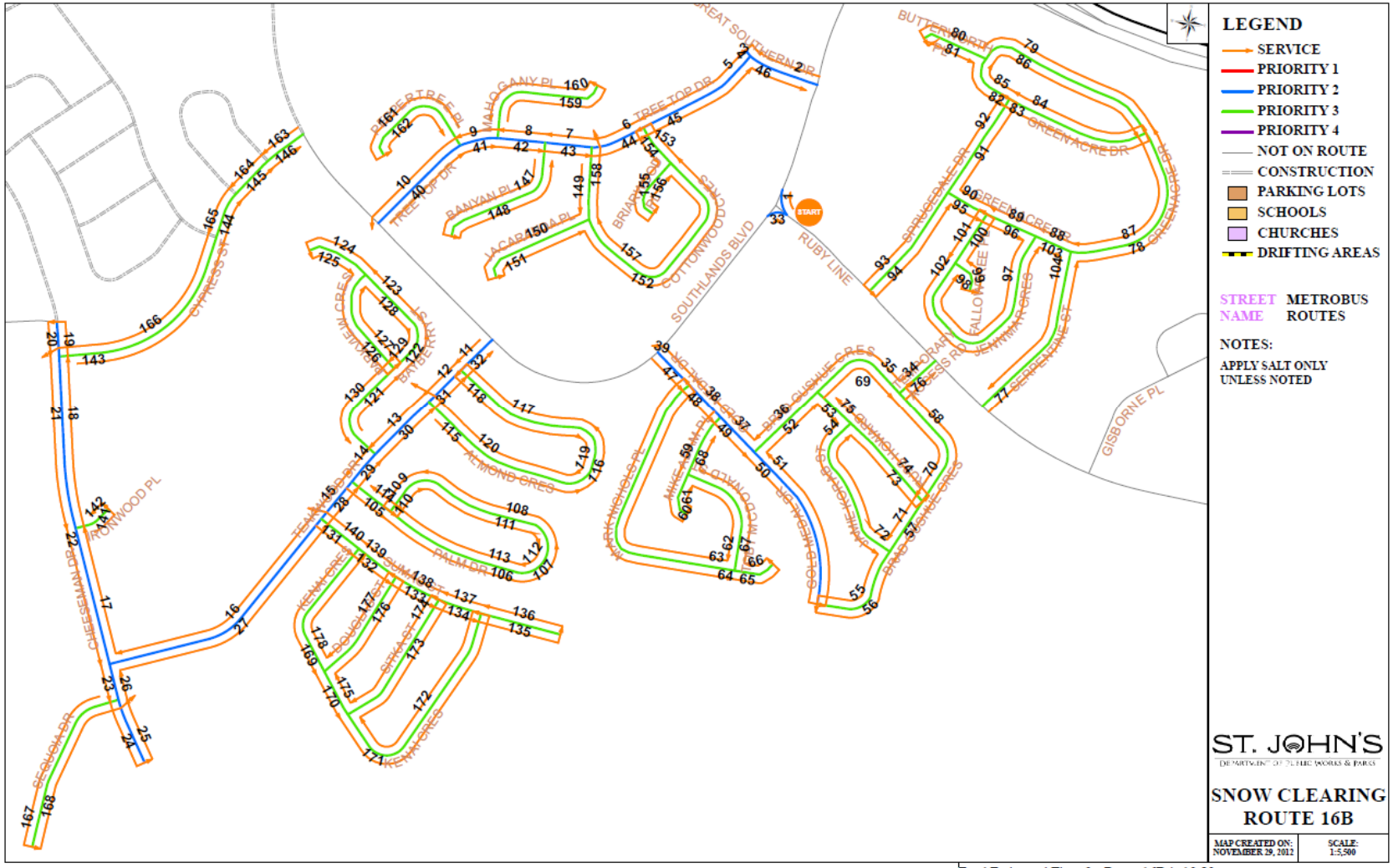
The approach was launched following an audit of snow clearing by auditors which identified that some operators did not follow the priorities as they followed what they thought should be the priority. Some did one side of the street and then did the other side resulting in all streets not receiving at least one cut for extended periods of time. With the three shifts and equipment breakdowns resulting in more than one operator doing a particular route, there were many times when the new operator started from the "beginning" resulting in double plowing while other streets were not addressed for a long time. In some cases, streets were missed because there was no consistent way of doing the streets and there was a lack of communication between operators and forepersons on different shifts on what was actually done.

Routes - Critical Paths (cont.)

A number of issues have emerged:

- The routing maps are very difficult to read as the information is complex and dense and requires the use of small fonts. Reading them at night while driving a truck or loader in a raging blizzard is even more difficult. While operators can study routes during downtime, they may get assigned to new routes when someone is absent, etc.;
- On some routes, very short sections of P3 road (perhaps a cul-de-sac) were to be ignored while plowing or salting a long collector road. This will leave a windrow across the P3 street and may leave the operator deadheading considerable distance to come back and address it, when taking a minute or two to go in and out of the cul-de-sac would reduce total run time and improve access to the P3 road. While some were adjusted, others were not. No criteria were established on when to pick up a lower priority road. For example, if doing a lower priority road early will save you a 1 km deadhead back to pick it up, is that worthwhile? Or is it 500 m? or 2 km? The route on the following page shows the issue. Should Ironwood be done when the collectors are, or should the operator go back and do it later? How about Sequioia?; and
- The critical path only takes into account local conditions, hills, good snow storage areas, and particular land uses that suggest alternative approaches when brought to attention of the planner. However, this did not happen frequently.

Routes – Sample



Disclaimer: The directions provided are computer generated and may not reflect actual traffic conditions. Traffic rules and regulations shall take precedence over the computer generated directions.

Total Estimated Time for Route 16B is 10:20

Routes - Critical Paths (cont.)

The situation was aggravated last winter when some operators were using maps from the previous year which did not include new streets opened in some areas.

The staff member that prepared the critical paths indicated it was very difficult to get input from the operators when asked. After using them, the operators now clearly think the critical paths need modification to recognize their concerns and suggestions, but nobody is currently assigned to modify them.

This process (as well as any changes, updates or revisions to the routes or the critical paths) has been put on hold because the only resource skilled in the use of Routesmart has been transferred to a new position.

There is a plan to implement a “GPS-like” interface in the coming years – an electronic device that would have the map on it, show the route to be traveled (large enough to be seen), and announce directions verbally to the operators.

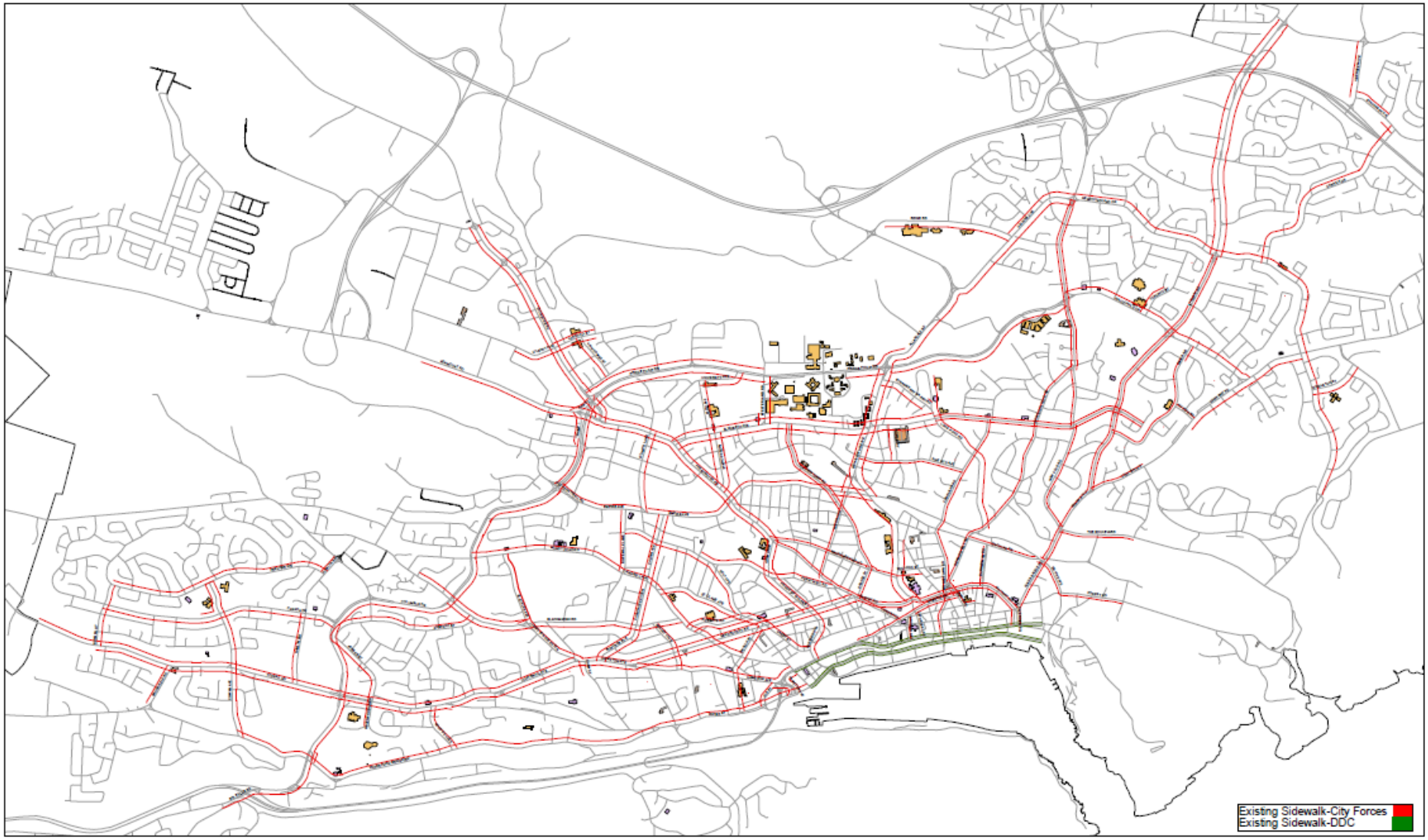
Sidewalk Routes

There are four sidewalk routes (see next page) that cover an average 33.5 kms. This is much longer than even the high service ice control routes, and sidewalk plows are much slower to operate.

Some sidewalks are clearly more used than others. Saguenay, Quebec and Mount Pearl all set priorities generally giving highest priority to commercial areas and school (including university) zones.

The St. John's routes have been prioritized with the downtown and MUN area sidewalks generally highest priority as they are considered to be the heaviest used. However, not all routes have some P1 sidewalks. After a light snow, it may be possible to cover the entire route in four hours, however the routes are not generally started until well after the snow has stopped. By that time, the roadways will have been plowed onto the sidewalk in many places, and there may well have been a freeze thaw cycle. Operators report that it can take a week to complete a route under such circumstances.

Sidewalk Routes (cont.)



Sidewalk Routes (cont.)

Sidewalks have many different circumstances:

- Some are next to the road, while some have a median between the road and the sidewalk;
- Some have houses or businesses adjacent to the sidewalk, while others have buildings set back from the sidewalk by various distances;
- Some sidewalks have light or hydro poles or other obstructions between the sidewalk and road, or on the sidewalk itself, while others have no obstructions inhibiting winter maintenance;
- Some sidewalks have driveways or other accesses interrupting potential snow storage areas beside the sidewalk, while others do not; and
- Some are on level ground, while others are on steep inclines, and may even include sections of stairway.

These circumstances influence how the sidewalks can/should be cleared such as:

- The type of equipment that can be used (sidewalk equipment, or loaders, with plows or with blowers);
- Whether blow back or snow removal is required; and
- Whether a truck with a right mounted spreader could salt the sidewalks.

While circumstances may vary along a street, they do need to be considered when designing routes to minimize the need to change equipment during a run.

Routes

In summary, we suggest that the City consider the following:

- Hire or train a new resource skilled in the use of Routesmart;
- Redesign roadway routes with a view to:
  - Adding another high service route to handle most or all of the P1 arterials that are currently included in standard routes. It may need to be shorter than the others as it will include roads like Lemarchant Road, Queen's Road and New Gower Street where high speeds are not attainable;
  - Rebalancing the routes recognizing recent growth;
  - Making routes with substantial P1 hills even shorter, recognizing the attention required, or formally assigning two pieces of equipment to each of the routes; and
  - Planning more "echelon" runs (two or three plows together) where possible when plows are leaving the depot at the beginning of a shift and potentially when returning to the depot;
- The critical path concept is useful in ensuring consistency and predictability, helping explain the process to residents, and providing guidance to operators not familiar with a route. However, they currently do not necessarily show the best way to complete a route. Give forepersons authority to approve deviations from the critical path, but require coordination of changes across the three shifts;
- Consider using a "GPS-like" navigation device that will provide legible and audible directions to operators.
- The critical paths should be redesigned with operator input over a winter period and the redesign should:
  - Seek to address roads generally in order of priority but servicing connecting links enroute and doing lower priority roads earlier when it will reduce deadhead time by at least 1 km; and
  - Seek to go both ways on a road, particularly for a P1 or P2, within a short enough timeframe that the initial cut will not be lost so the second pass will result in two lanes open.

Routes (cont.)

With respect to sidewalk routes, we suggest that the City consider the following:

- Conduct an inventory of sidewalks, recording their specific characteristics (as discussed earlier, such as proximity to roads and buildings, snow storage capacity, etc.);
- Redesign the sidewalk routes for the 2015-2016 winter based on:
  - Identifying routes that can be completed in 3 - 4 hours considering typical conditions (and recognizing the impact of expanded snow removal);
  - Identifying P1 sidewalks based upon proximity to schools (including post-secondary) and commercial and employment areas with significant pedestrian volume;
  - Including other sidewalks to be cleared on P2 routes; and
  - Building routes where sidewalk circumstances are reasonably consistent so one piece of machinery is appropriate throughout. Some may anticipate blowing away from the road, some plowing to the curb, etc. Some routes may have two plans, e.g. plow to the curb during the storm and blow to a truck after the road plow has passed.
- P1 sidewalks should be done first starting as soon as snow accumulation reaches 5 cm. They should be done overnight and again in the afternoon when snowfall timing warrants.
- P2 sidewalks should be addressed after the P1s are completed (or all assigned).

Note: staff levels will require some adjustments once new routes are set so that new routes accommodating growth areas are covered.

Also noteworthy is that any transfer of major roads from the province to the City (e.g. Team Gushue Highway) will require additional staff and equipment that is not discussed in this report.

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Service Delivery Approach

Staff Empowerment

Staff Empowerment

There are several issues with communications and decision making that impact effectiveness.

Most organizations struggle with the extent to which employees should follow specified processes and procedures versus the extent to which employees should be empowered to make their own decisions based on the circumstances they experience in the field. There are particular issues that impact winter maintenance:

- When traveling to your route on a road that has not been plowed, should you put your blade down?;
- When you see that the salt is not working or conditions are worse than normal and you do not expect the normal salt application to work, can you increase salt application rates?; and
- Can you deviate from the critical path when you think another approach will be more efficient?

With respect to when to put the blade down:

- Some members of the public find it frustrating to watch plows travel down roads that clearly need a plow without putting their plow down;
- Usually these are vehicles on their way to designated routes and they keep their plow up so they get to that route as quickly as possible and so they do not do anything that will make the job harder for the plow assigned to clear the road in question;
- For loaders, the delay is a particular problem as they are slow vehicles that are much slower when they are plowing; and
- The salt trucks can salt or plow without losing much time. Two approaches are group or “echelon” plow runs with trucks leaving the group as they approach their routes (see Suggestions under the “Routes” section), and delegating authority to the forepersons to set standing directives to particular operators depending upon where they are working and how experienced they are. A directive can be as simple as “plow when it makes sense” for an experienced operator or “plow enroute in these circumstances”.

Staff Empowerment (cont.)

With respect to salt application rates:

- The City has reduced the salt application rates in recent years, partly as a result of the attention the federal government has given to efforts to reduce the environmental impact of salt, and partly to reduce costs;
- The incorporation of “pre-wetting” capabilities on all salt trucks has improved the effectiveness of the salt applied;
- Operators still report that the approved salt levels are inadequate for certain circumstances and seek to apply salt more liberally. They argue that one salting with a higher rate of application will reduce the need for repeated trips through the same route; and
- Operators are rarely in a position to see the impact of the salt they distribute behind them. Some degree of consistency with the Salt Management Plan and the related environmental plans is appropriate. It is suggested that the forepersons be the ones to authorize increased (or decreased) rates of salt application based on particular local conditions.

With respect to critical paths:

- As noted earlier, the requirement to follow the critical path even when it could be changed to be more efficient, is a particular aggravation to operators; and
- Until new routes and critical paths are developed with operator input to the critical paths, forepersons should have the authority to approve changes to the critical path or authorize operators to deviate from the critical path (see Suggestions under the “Routes” section).

Staff Empowerment (cont.)

Forepersons must spend more time on the road to monitor the conditions in the field, determine when changes in strategy or direction are required, and supervise operators and troubleshoot problems.

The current car allowance approach actually discourages staff to go out on the road and must be fixed. The City has moved away from supplying City vehicles and compensates supervisors for use of their personal vehicles. This approach is good, but the compensation is a fixed amount each month regardless of how much the vehicle is used.

Staffing Authority and Communications

We suggest that the City consider the following:

- Delegate authority to the forepersons to:
  - Set standing directives to particular operators concerning when to put “blade down” depending upon where they are working and how experienced they are;
  - Approve increased (or decreased) rates of salt application based on local conditions; and
  - Amend the critical path for particular routes, coordinating the changes between all three shifts.
- Amend the car allowance system to eliminate the disincentive to spending time in the field.

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Service Delivery Approach

Snow Removal Approach

Snow Removal

St. John's performs a lot of snow removal because of the snow volumes and the narrow streets in the older parts of town in particular. As noted in the section on Service Levels, more snow removal is required which makes the cost of conducting snow removal and disposal a major concern.

City polices for snow removal require:

- Providing notice on the website and by email to subscribers of streets where snow removal will occur;
- Closing the street by establishing manned barricades at each end of the street and placing signage at cross streets to prevent vehicles entering the street;
- Knocking on the doors of residences during the day to seek removal of parked cars. Remaining vehicles are only towed during nighttime snow removal, between 1 am and 7 am. In the daytime, the crews must work around any vehicles that remain;
- An escort vehicle when snowblowers are travelling to a work area; and
- A spotter walking 10 to 20 metres in front of a snowblower in operation with a strobe light and an operable red coned flashlight for signalling.

The following page shows the composition of typical crews for snow removal and for "cut to curb", which involves taking all the snow already piled in the curb lane without attention to snow on the sidewalk or boulevard, or snow on the other side of the street. Although the cut to curb approach does not directly remove snow from sidewalks, it does reduce the amount of snow that road plows will push onto sidewalks and the weight of snow that sidewalk plows must move to open the sidewalk.

Snow Removal (cont.)

As noted earlier, conducting snow removal requires a substantial crew which makes for a costly process. The City reports that it currently uses crews made up as follows:

Moving Snow

- 1 blower
- 2 or 3 sidewalk plows to push onto the street, one possibly equipped with a blower
- 2 loaders (and/or a grader) to push all show into one windrow
- 8-12 trucks to carry snow away

Managing/Assisting

- 1 foreperson at the site
- 1 foreperson at the wharf (shared)
- 1 or 2 directing traffic at wharf (shared)
- 2 spotters with one pick-up
- Up to 6 people in pick-ups blocking streets and moving signs

In summary, 15 staff are generally required to staff the first snow removal crew (plus trucks, whether hired or staff), while 11 are generally enough for a second and when used, third crew.

Cut to the curb requires a smaller crew – but the difference is not significant

Moving Snow

- 1 blower
- 1 loader into one windrow
- 8-12 trucks to carry snow away

Managing/Assisting

- 1 foreperson at the site
- 1 foreperson at the wharf (shared)
- 2 spotters with one pick-up
- 1 or 2 directing traffic at wharf (shared)
- 2 spotters with one pick-up
- Up to 6 people in pick-up, blocking streets and moving signs

Snow Removal (cont.)

Snow Removal Techniques

Snow removal costs may be higher than some other cities because of the policies adopted. Although some cities have eliminated the spotter position, it does reduce the chances of harm to any individual in the way (e.g. child in a snow fort, person sleeping on snow bank). For snow removal, the spotter can also keep the truck lined up under the blower chute.

St. John's also has people blocking traffic at both ends of the street where removal is undertaken. This ensures no vehicles interrupt snow removal. This is a practice other cities do not use, with some using a barricade and a sign while others simply relying on the spectacle (flashing lights, many large vehicles) to warn motorists to take another route. Staff are concerned that some vehicles, particularly taxis, will cause problems without the manned barricades. With some public education this should be minimal. The resources currently assigned to the barricades could be much better used operating equipment or carrying out other duties.

St. John's has a very low cost approach to snow disposal to the envy of other cities. Depositing snow in the harbour reduces trucking costs (and diesel usage), places the salt (the major foreign substance in road snow) where it is not an environmental concern (as opposed to disposal on land) and minimizes the impact of trucking and disposal sites on residential areas or parks. There is some concern this option could be lost and, over time, the City will need to remove snow from more areas outside the downtown where the harbour would not be a good a disposal option. This issue is considered further in the section of this report dealing with long-term issues.

Snow Removal Techniques

Snow removal in St. John's has generally used City vehicles, although last year they were supplemented with hired trucks when the snow built up. In practice, this means snow removal cannot proceed until the push back is at least largely completed which is 24 hours after the snow stops. In the event of another storm, snow removal is deferred further.

The delays in snow removal are not only an issue for roads (although it certainly impacts parking on the street in the commercial areas), it is also a major challenge faced by St. John's in keeping its sidewalks clear. On narrow roads, keeping the roads clear means plowing onto the sidewalk. This makes clearing the sidewalk very difficult with the light sidewalk equipment, and even if the snow is pushed back onto the road it gets plowed back onto the sidewalk. Early removal is the only way to end this cycle and help ensure reasonably clear sidewalks and accessible parking spaces.

The use of hired equipment last winter allowed for much more snow removal. As noted under the Contracting section, it would be more economical to develop an approach that uses hired trucks on a regular basis to build interest, capacity and competitiveness in the industry. This is consistent with the suggested increase in the level of service by starting snow removal earlier in the event cycle when City trucks are still doing salting and/or plowing.

Snow Removal Techniques (cont.)

We suggest that the City consider following:

- Use hired trucks on a regular basis to allow snow removal to begin earlier during an event (approved with Interim Report for this winter);
- Eliminate the use of manned barricades as the standard for snow removal operations and use more signage instead; and
- Expand public education to keep cars away from snow removal operations and involve the taxi licensing authorities if taxis continue to be a problem.

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Service Delivery Approach

Parking Restrictions

Parking Restrictions

All cities impose some restrictions on parking on the street to facilitate winter maintenance operations.

Fredericton and Mount Pearl have overnight on-street parking bans that last through the winter (starting December 1), while Halifax and Quebec City have overnight bans that take effect only during snow events, and Mount Pearl adds a ban at any time of day during a snow event. All have the ability to restrict parking during snow removal operations. Quebec City has installed yellow lights along many streets that are turned on when parking is banned to accommodate snow operations, which improves compliance but is costly to set up.

St. John's imposes a winter-long on-street parking ban throughout the City (except downtown) to facilitate snow operations. Last winter it was not imposed until January 8th after a number of storms had created a difficult situation. Imposing the ban on December 1st could generate complaints if there is no significant snow until much later. Moving to a system of "bans during snow storms" would require a substantial public education campaign or an on-street warning system like Quebec City has to ensure general compliance when required.

Having a winter long ban that begins the first time there is a major snowfall would be an appropriate first step that would help winter maintenance (compared to a January start) without demanding an entirely new communications system. However, as the City's electronic communication with residents improves, an intermittent ban could be considered. An activated light system could be worthwhile for Water and Duckworth Streets where parking creates particular challenges for plowing and snow removal.

The parking ban currently provides exceptions for certain vehicles (e.g. police). An exception should also be granted to home care workers while on duty aiding an infirmed individual at night.

Parking Restrictions (cont.)

Ensuring vehicles do not interfere with snow removal is also important, and with parking downtown exempted from the parking ban, managing on-street parking is particularly important downtown. The City can and does tow cars that interfere with snow operations, but only at night. In the daytime, the city knocks on doors to attempt to have vehicles moved, but works around any that remain.

Towed vehicles are brought to an impound lot at the Blackler Avenue depot where owners can retrieve their vehicles after paying the cost of the tow and a small storage fee. This approach requires that vehicles be towed all the way to the depot and occupy valuable space, and requires the City to manage the process of returning vehicles to their owners and collecting the charges.

Two other approaches could be considered:

- Transfer the impound responsibility to a contractor. This would require identifying a contractor to handle the towing and storage of towed vehicles, and recover the costs from the vehicle owners; and
- Change the process so the City issues tickets to vehicles and hires a tow truck to move the vehicles around the corner, or to some other location that does not interfere with the winter maintenance activities. The City would cover its costs through collecting ticket revenues, and residents would get their vehicles back quicker and at a lower cost. 311 and 911 operators would need to be aware of the vehicles moved to respond to calls from vehicle owners missing their vehicles. Ottawa uses this approach.

Parking Restrictions (cont.)

Both approaches may require some change in bylaws and/or provincial legislation. Legal advice would be required. Either approach frees up space at the depot for other uses, and the second approach would be more convenient to vehicle owners (easier to recover vehicle, and likely lower costs).

Other interference with Winter Maintenance

Some residents, businesses and private snow plowing contractors simply push or shovel snow from the properties they are maintaining onto City roads and sidewalks. This is contrary to the City by-law and interferes with ongoing maintenance. The City has legislative authority to charge those who plow snow from private parking lots onto City streets and sidewalks. However, the legislation requires giving notice to the property owner and providing a fine if the snow is not removed. In practice, the City must act quickly to remove the snow, so it is difficult to give notice and return to remove the snow and charge the costs to the owner.

Two possible approaches to help address the problem of owners and contractors pushing their snow onto city streets and sidewalks include:

1. Seeking a legislative change that allows the City to issue tickets without providing notice, and to recover the costs of removing the snow on any second or subsequent offence; and

2. Unless and until the legislation is changed, the City could consider:

   - Securing one or more contractors to respond to notices of snow moved onto the sidewalk or road, provide a notice to the owner, move the snow back onto the property, and charge costs to the owner;
   - 311 would refer complaints, and reports from City staff, to the contractor(s); and
   - Provide the contractor with the right to act on its behalf, subject to some reasonable limitations.

Parking Restrictions (cont.)

We suggest that the City consider the following:

- Have the City wide (except downtown) overnight parking ban go into effect with the first major snowfall (expected to be 10 cms. or more);
- Exempt home care workers from the overnight ban while they are delivering service to clients;
- Develop an approach to banning overnight parking (from 1 am to 6 am) on Water and Duckworth Streets during snow events. This could be tested with notice given by social media and subscription email/text messages, but may require an on-street visual notice like Quebec City uses;
- Post signs and provide social media notices one day for snow removal activities planned the next day during the day, and tow vehicles that remain on the street when snow removal begins (as is done with overnight removals); and
- Based on legal advice and further consultation, determine an approach for towing parked vehicles, the ticket and tow around the corner approach, or the contractor towing and vehicle storage approach.

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Vehicles, Equipment and their Maintenance

Vehicles and Equipment Used

Roads uses a variety of vehicles for winter maintenance as follows:

- 36 trucks are used for salting (with pre-wet capability), sanding (very selected locations), plowing (generally front plow and wing), and hauling snow during snow removal (28 salting routes to cover). Most are tandem axle units, with 9 single axle trucks. They are generally referred to as salt trucks,
- Four anti-icing trucks (3 tandem axle) are used before storm to spread brine, and two can also handle salting and plowing routes. Two have been recently acquired, very large vehicles capable of carrying large quantities of brine for anti-icing large quantities of roads without refilling;
- 45 Loaders are used for plowing, blowing and filling salt trucks (2 for Parks, 36 routes to cover, plus one for salt loading and 7 spares). Most are leased units with the lessor responsible for maintenance;
- Six graders with wing blades are used for plowing on high speed roads, along with a salt truck, and for cutting ice;
- Four self-contained snow blowers and 14 blower attachments for the loaders are used for widening streets (blowing to adjacent storage areas, or into trucks for removal). Two of the self contained snowblowers are a Swiss brand, and parts availability has been particularly problematic;
- 20 sidewalk plows (with 4 salt trailers and several rear mounted salt spreaders), 7 tracked Bombardiers and 13 trackless units are shared with Parks and Open Spaces Division;
- Many attachments, as most equipment is multi-purpose and capable of switching its purposes with the appropriate attachment. There are 147 plow blades of various types (front, wing, or for a truck, a loader or a sidewalk plow). There are 4 small loader buckets for handling salt and sand, 12 larger buckets for handling snow, and 14 blower attachments for loaders. There are 22 sidewalk unit blower attachments; and
- Due to the unusual winter conditions last winter and the challenges with equipment availability, the City made a special arrangement for supply of tandem axle dump trucks to assist with snow removal in early 2014, and hired trucks through the latter part of the winter.
- The replacement value of this specialized equipment is about $30 Million, although some is leased rather than owned directly by the City,

Vehicles and Equipment Used

The Parks and Open Spaces Division generally uses smaller equipment as follows:

- 1 skidsteer loader;
- 1 farm tractor;
- 1 Kubota blower;
- 4 tailgate spreaders (mounted on half tons); and
- 5 snow blowers (walk behind).

In addition, it uses these items from the equipment listed on the previous page:

- 2 loaders used for plowing; and
- 1 sidewalk plow.

Vehicle and Equipment Comparison

Three cities provided details on the equipment they use for winter maintenance for comparison with the equipment used by St. John's.

	St. John's	Fredericton	Halifax	Mount Pearl
Trucks with front plows		5		
4 x 4 plows		2 (1 route)		
Tractors			2	
Sanders / salters (no plow)				3
Sanders / salters with front plow	41 (27 routes)	14 (10 routes)	46 plus 48 hired	7 also with front blade and wing
Graders	6	8 (4 routes)	1 plus 6 hired	
Sidewalk plow Bombardiers or Trackless	20 (8 routes plus 2 for snow removal)	15 (13 routes)	10	4
Blowers / blower attachments	4 / 14	0 / 3	2 / 2	4 / 1
Front end loaders (on streets / sidewalks)	42 (36 routes)	14 (13 routes)	61 hired	17
Yard loaders	1	4 (2 spare)		1
Bulldozers / front end loaders (snow storage areas)		2	4	1
Dump trucks (removal)	(use salt trucks)	16-25	15 tandems plus 35 on call list	2

All use the salt/sand truck (salt truck) for salting, sanding and plowing. The St. John's vehicles provide for pre-wetting the salt before distribution, which reduces salt requirements and improves effectiveness. The City has GPS tracking on salt trucks (and other vehicles) reporting their location. It is currently testing having the units provide operating characteristics (plow up/down, salt distribution rate), which is consistent with best practices. The use of the same vehicles for snow removal and as dump trucks in the summer is unusual (although also done in Fredericton) and gets enormous value from the vehicles, although it does increase downtime and limit snow removal operations.

Vehicles and Equipment for Winter Maintenance

For heavy plowing, all cities use a mix of loaders and graders. Fredericton uses 4 trucks that serve as plows, but are not salt trucks, including one 4x4 used for narrow streets.

Halifax relies on hired equipment (vehicle and operator hired hourly) for a significant part of its “in-house” salt trucks, loaders and snow removal trucks. This allows it to maintain a smaller full-time operation and augment the full-time staff during snow events.

All cities focus on loaders for plowing deep snow, with varying involvement of graders and plow trucks. The loaders are also multi-use, with the blower attachments giving a second major function for snow blowing and removal. St. John’s, Halifax and Mount Pearl use single purpose snow blowers. Mount Pearl also finds the blowers have frequent maintenance requirements.

The sidewalk equipment, the tracked Bombardier and Trackless vehicles, are consistent with those used elsewhere and also have attachments that allow them to serve as snow blowers (smaller scale).

The City has invested in some specialized equipment. The Swiss snow blowers handle good volumes but have reliability and parts availability issues. The large, new anti-icing vehicles are very versatile (for winter uses), handling brine distribution, salting and plowing.

The City continues to test different vehicles to identify the best for salting and plowing the very narrow, hilly streets downtown. It has tried using 4x4 trucks but found reliability an issue. (Fredericton has two vehicles to cover one route to handle the reliability issue). This year St. John’s is also trying two smaller loaders.

St. John’s has two plow routes in areas such as the Battery where a variety of small equipment is used because of the narrow streets. They have used sidewalk plows, pick-ups with salters in the back, and are planning to use two small loaders this coming winter.

Vehicle Availability

Fredericton provided information on the number of “spare” vehicles they have in some categories. For example they have salt trucks of which 10 are required to service the routes and 4 serve as spares to cover breakdowns. St. John’s has 41 salt trucks to cover 27 routes, leaving 14 available as spares. Fredericton has 2 spares among 15 sidewalk plows, which is very low, while St. John’s has 10 spares among 20 units. This comparison, and general industry practices (20% spare ratio is a frequent target), suggest St. John’s has an adequate number of spares.

The Fleet Services Division records how much equipment is available at the beginning of each day.

On average, over the course of the past winter, availability as reported by Fleet Services was as follows:

Salt trucks	71%
Loaders	85%
Blower attachments (for loaders)	50%
Stand-alone blowers	66%
Graders	75%
Sidewalk snow blowers	84%
Trackless sidewalk plows	62%
Bombardier sidewalk plows	70%

The Roads Division tracked equipment condition as well, and often reported lower availability either because vehicles (particularly for sidewalk plows) would not start after sitting outside the maintenance shop overnight, or because equipment breakdowns occurred during the first shift.

Vehicle Availability

Only the loaders (mostly leased with the owner responsible for maintenance) and sidewalk snowblower attachments (not the vehicles) were available over 80% of the time – even at the beginning of the day.

The average includes days when there is no snow event and no need for the full fleet to be operational. The actual availability rates when required for service may be lower than the average rates.

The core of the fleet are the salter/plows. There are 41 trucks available to cover 27 routes, meaning 66% must be available at any time to cover the routes. With 29 salt trucks available on average, they were several short on some days, with no spares available to cover trucks with malfunctions during the work.

The usual practice is to conduct an annual inspection and preventative maintenance review of winter equipment during the off season. Last year this was not completed for all the sidewalk equipment. The trackless sidewalk plows started the winter with only 60% ready, and by early January only 8% were operating (it improved through January). The tracked Bombardier sidewalk plows started the year with 80% ready, but went through many of the storms with less than half in operating condition.

The standalone blowers did very well through February, but only 2 of 4 were available most of March, and in late December and early January there were two days when none were available.

The blower attachments for the loaders were an ongoing challenge, with only 50% available for service on average and many days with fewer available. Many of these are now 13 years old with the “young” ones being 8 years old. One city reports they plan to keep blower attachments 10 years. One manufacturer reports that blower attachments can last 15 – 20 years if they are well maintained, with annual preventative maintenance and periodic replacement of major components. It reports that other cities replace them after 5 years to avoid the costs of replacing major components. Preventative and daily maintenance is crucial to maximizing the useful life.

Vehicles and Equipment for Winter Maintenance

The analysis and interviews conducted suggest a number of factors that may have contributed to the equipment availability problem including:

- Difficulty in obtaining parts to carry out repairs which, in turn, may have been caused by inadequate inventory and having too many types of equipment which requires too many types of parts to be stocked;
- Damage caused by operators with inadequate training, or other factors resulting in unnecessary breakdowns;
- Outdoor storage of vehicles, particularly sidewalk plows and blower attachments for loaders;
- Inefficient Fleet operations;
- Poor communications between Fleet, Roads and Supply; and
- Failure to complete annual maintenance and inspections.

Each of these potential causes is examined in the pages that follow. As noted, the number of spare vehicles is not the problem. While some equipment may be approaching the end of its useful lifetime (e.g. blower attachments), it is generally not too old.

Vehicles and Equipment for Winter Maintenance (cont.)

Parts availability:

- Difficulty obtaining parts is often characterized as a problem related to the St. John's island location and the transportation disruptions (ferry and air) that occur during the winter. There is undoubtedly some validity to this, but that is all the more reason to have important parts held in inventory. While there is a cost to carrying inventory, there is also a substantial cost to non-functional equipment, whether the cost is realized by carrying more spare equipment, renting or leasing equipment, or simply failing to provide service;
- The parts inventory records are maintained in the Microsoft Dynamics Great Plains software which was recently installed as an ERP for St. John's. The previous Avantis system had the capacity to review inventory min/max levels based on historical usage, economic order quantities, delivery times, etc., but this capacity was not used extensively, although reports on usage were used to make manual adjustments in minimum/maximum levels. It is not clear whether it is a question of the capability of the new software, or the familiarity of the staff with its capabilities, but staff in Fleet Services that used the previous software to review inventory usage and update minimum/maximum inventory levels do not know how to do this effectively with the new software, even manually;
- As a consequence, although minimum/maximum levels are adjusted manually when issues are brought to the attention of staff, there is no regular program to review the inventory levels and adjust them based on either recent experience (parts drawn) or forecast demand;
- Leading practice is to use computerized routines to examine minimum/maximum levels monthly to identify potential changes in levels that can then be reviewed manually before being implemented. A good computerized review would consider the historical demand for particular parts, the cost of the parts, the delivery time for the parts, the criticality of the parts (and the equipment it supports), and the point in the lifecycle of the equipment supported;

Vehicles and Equipment for Winter Maintenance (cont.)

Parts availability (cont.)

- There is no regular communication between Fleet and Supply whereby Supply is informed of planned vehicle maintenance activities that are likely to require certain parts. As a consequence, events that involve a high demand for certain parts (e.g. the annual inspections of certain equipment, or a planned upgrade or revision of equipment) is often delayed by predictable parts shortages;
- The preferred approach would use a fleet management information system to plan maintenance activities tied to a supply inventory system, so planned maintenance can automatically ensure parts are available. More commonly, maintenance schedules are produced from a fleet management information system and provided to the supply group, which then performs manual enquiries to ensure inventory is adequate. Even this practice is not followed in St. John's;
- The range of equipment used for winter maintenance is not unusual but is more diverse than necessary. For example, the salt trucks were acquired over a number of years and each annual model has different specifications for engines, transmissions, electronics, etc. Some differences are inevitable. It is not preferable to purchase the entire fleet of salt trucks in one year and have them all age at the same time. However, it could be useful to buy one-third of the units at a time to reduce the range of parts required; and
- It is tempting to suggest that purchases such as the Swiss snow blowers and/or the newer tandem anti-icing machines be avoided as they create a need for yet another type of parts (and with the snow blowers, parts that are particularly difficult to source). However, experimentation is important to finding the best equipment for the purpose (or purposes as there are many different specialized tasks to perform). If, for example, a decision such as purchasing the Swiss snow blowers proves to be unduly problematic, the experiment should be completed and the units sold.

Vehicles and Equipment for Winter Maintenance (cont.)

Operators:

- Fleet Services reports that many instances of repair requests result from inadequate operator training or performance, or inadequate communication of the problem to Fleet Services. For example:
  - Reports of malfunctioning equipment when the operator simply did not know how to operate the equipment to perform the task required;
  - Reports equipment will not start when actually out of fuel;
  - Faults due to inadequate fluid levels;
  - Incomplete reports noting a fault with the equipment, with more faults found on inspection, or reported when the equipment was put back in service;
  - Reports of faults that could not be identified and did not appear to exist;
  - Reports of blower chute jams that operators should have cleared, or broken blowers resulting from storing while the chute is full of slush; and
  - Bent pins on connector units for blower attachments.
- While most of these issues could be avoided with improved operator training, others would improve with indoor parking for blower attachments. For example, connecting them can be difficult in bad weather.
- Fredericton assigns an operator to a piece of equipment and a particular route. While they are switched to a spare when required, this practice ensures operator familiarity with the route and the equipment, and gives the operator a reason to keep their equipment operational. St. John's does something similar, but the equipment is assigned to three individuals on different shifts. Therefore, the sense of ownership, attachment and accountability is not as strong.

Vehicles and Equipment for Winter Maintenance (cont.)

Outdoor storage:

In St. John's, most winter maintenance equipment is stored outdoors. This is problematic for many reasons:

- This contributes to particular problems with sidewalk plows. Although they operate from the former bus depot and are stored indoors, they are maintained at the main depot and stored outside when the maintenance is completed. Some do not start the next morning, which delays sidewalk plowing;
- There is a particular problem with the loader attachments being stored outside. It is challenging to make the electrical connection between the blower and the attachment in inclement weather, and sometimes when a blower attachment is not used for a shift, or even between shifts, the slush in the blower can turn to ice, resulting in a breakage when it is activated;
- Mount Pearl stores its sidewalk plows indoors. The other cities reported they store most or all their equipment indoors. While indoor storage for most/all equipment is probably excessive, it almost certainly would improve equipment reliability and time in service;
- St. John's used to have all indoor storage. The space has since been transferred to Fleet Services. The space formerly used by Fleet Services is currently being reconfigured for a variety of uses which does not include indoor storage of winter maintenance vehicles;
- The sidewalk crew operates from the old Metrobus garage where sidewalk machines are stored indoors. The project to accommodate the farmers market may require some physical changes to isolate the uses;
- Fleet Services currently stores sidewalk plows outdoors after performing repairs, which results in some plows that will not start when picked up; and
- Lifecycle planning is a key component of fleet planning and maintenance. All equipment appears to be within expected lifecycles, with the possible exception of blower attachments. The maintenance and upgrade/rebuilding practices should be reviewed by Fleet Services

Vehicles and Equipment for Winter Maintenance (cont.)

Fleet operations:

- Fleet Services has staff on two shifts through the winter to service winter maintenance vehicles when required during events. However, there is some timing conflict with Roads staff reporting they bring vehicles to Feet, only to be told it is break time and they should wait until break is over. The end of Fleet's break time may be the Road staff's break time. This issue has been addressed for this winter;
- There are other communication issues as operators are currently required to complete a defect form and report the problem to their foreperson, who then reports the problem to the Fleet foreperson, who then directs a mechanic to deal with the problem. This creates a number of problems. The Roads foreperson may not submit the work request immediately as they may be dealing with many other issues in the middle of a storm. If the Fleet foreperson requires further information, the Roads foreperson is unlikely to have it as they have not witnessed the issue. If the mechanic wants to know what happened and the symptoms, he only has the initial defect report which is often incomplete. If the mechanic finds the problem is likely caused by the operator (e.g. they do not know something about the equipment), there is no way to bring this to the attention of the operator. If the problem relates to an accident, there is a formal process (which takes weeks) to impose some discipline on the operator, but no way to simply bring new information to their attention or ask them to do something differently next time. In the context of inadequate basic training, this is a particular problem;
- It is challenging for mechanics to gather information on vehicles and defects. With vehicles becoming increasingly sophisticated and the electronic systems becoming more central, mechanics do not have access to the Internet to search for technical manuals or identify solutions to unusual problems. They are currently forced to perform such searches at home or to simply do the best they can with the information available, which can delay the repair process;

Vehicles and Equipment for Winter Maintenance (cont.)

Fleet operations (cont.):

- Fleet Services' in-house operations is focused primarily on heavy vehicles, with work on the light vehicle fleet largely contracted out. The current lease arrangement with the loaders requires the loader owners to handle all required maintenance. This seems to be working well and has high equipment availability. This may be because the equipment is relatively new as much as the maintenance practices of the owners, but it is a clear improvement of the results. There may be opportunities to expand this concept to other equipment categories. For example, there is a local Bombardier dealer with some (limited) maintenance capacity, and there may be businesses who would be willing to build a capacity in some other equipment categories if given a viable business opportunity; and

- Fleet Services was unable to complete all seasonal inspections before last winter and was unable to keep winter maintenance vehicles on the roads consistently, or adequately, to support operations. This is at least partly the result of factors noted previously such as parts availability and communications, but it may also be related to the staffing level and/or the efficiency of the operations of Fleet Services (both of which are matters beyond the scope of this review). A separate review should be performed. In the meantime, and particularly for this coming winter as such a review would not be concluded and the recommendations implemented, Fleet must expand its use of contract resources and/or increase its staffing to ensure it can provide an adequate level of service for winter maintenance equipment.

Vehicles and Equipment for Winter Maintenance (cont.)

We suggest that the City consider the following to improve vehicle availability:

- Improve inventory management - Inventory minimum/maximum levels should be reviewed at least every spring and fall using appropriate software, with staff providing parameters and reviewing results. If the current software package cannot conduct the sophisticated forecasts required, particularly for crucial but infrequently required items, a "bolt-on" forecasting package should be added; and
- Initiate immediate steps to improve communications, coordination and cooperation between Fleet, Roads and Supply as follows:
  - Have operators report defects directly to the Fleet foreperson on duty (while also informing their own foreperson so they can change work assignments as required);
  - Establish meetings every two weeks between Fleet, Roads and Supply to review vehicle defects reported and identify possible actions to reduce future occurrences (training, new procedures, equipment modifications, etc.) and review plans for the coming periods (forecast maintenance, unusual operational requirements, etc.);
  - Establish a position of "Equipment Coordinator" within Roads who would be responsible for managing the relationship, tracking vehicle status and troubleshooting issues, providing content for operator training on vehicle operations, managing the Fleet/Roads review committee identified above, and managing Roads' involvement in future equipment retirements and purchases. The Equipment Coordinator (and the trainers) could also be a conduit for messages to particular operators about changes in procedures that would reduce maintenance and repair requirements; and
  - Adjust shift timing as required to minimize conflict between Fleet and Roads shifts.

Vehicles and Equipment for Winter Maintenance (cont.)

We suggest that the City consider the following to improve vehicle availability (cont.):

- Fleet Services should provide input, through the Equipment Coordinator, by identifying items that should be included in the enhanced operator training program;
- Fleet Services should contract out some seasonal inspections of winter maintenance equipment if it is unable to guarantee all equipment will be ready for winter operations by December 1. The equipment contracted should be those the industry has experience handling, giving Fleet the capacity to handle the specialized equipment generally used only by the City;
- Install an unfiltered Internet access to allow Fleet Services to perform parts searches, manual reviews, etc.;
- Explore the market capacity and interest in expanding the equipment lease concept used with loaders (i.e. contractor supplies loader and any required maintenance) for items such as the blower attachments and sidewalk Bombardiers;
- Conduct a review of Fleet Operations to consider at least:
  - How to improve Fleet responsiveness to customer requirements;
  - Whether Fleet is following industry best practices for lifecycle management;
  - How to improve efficiency and effectiveness;
  - Whether to integrate the parts group of Supply into Fleet or otherwise improve communications and coordination; and
  - Whether to recruit mechanics with heavy equipment tickets without the need for a light ticket as well.

Vehicles and Equipment for Winter Maintenance (cont.)

We suggest that the City consider the following to improve vehicle availability (cont.):

- Adopt vehicle and equipment acquisition policies to standardize the fleet as much as possible:
  - For larger fleets (salt trucks, loaders, sidewalk units), buy at least one-third to one-half of units at one time, or through one order; and
  - For vehicles with continuous intake (half tons, etc.), consider tendering for more than one year's requirements at a time;
- Monitor blower attachment performance this winter and review the maintenance and rebuild history. Based on the results, determine whether to replace at least some of them before the winter of 2015-16;
- Keep sidewalk equipment indoors by Fleet Services after servicing and until picked up by Roads; and
- Provide indoor storage/attachment space for blower attachments and for connecting them to loaders. Such an indoor space could be built in the compound used for towed vehicles or in some of the outdoor equipment storage areas. Consideration should be given to including sidewalk plows to consolidate operations and allow the market to grow at the old bus depot. Development of such a facility is expected to cost between $4.5 and $5.0 in 2015 dollars (before taxes and any municipal fees).

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External Communications

Communications with the General Public

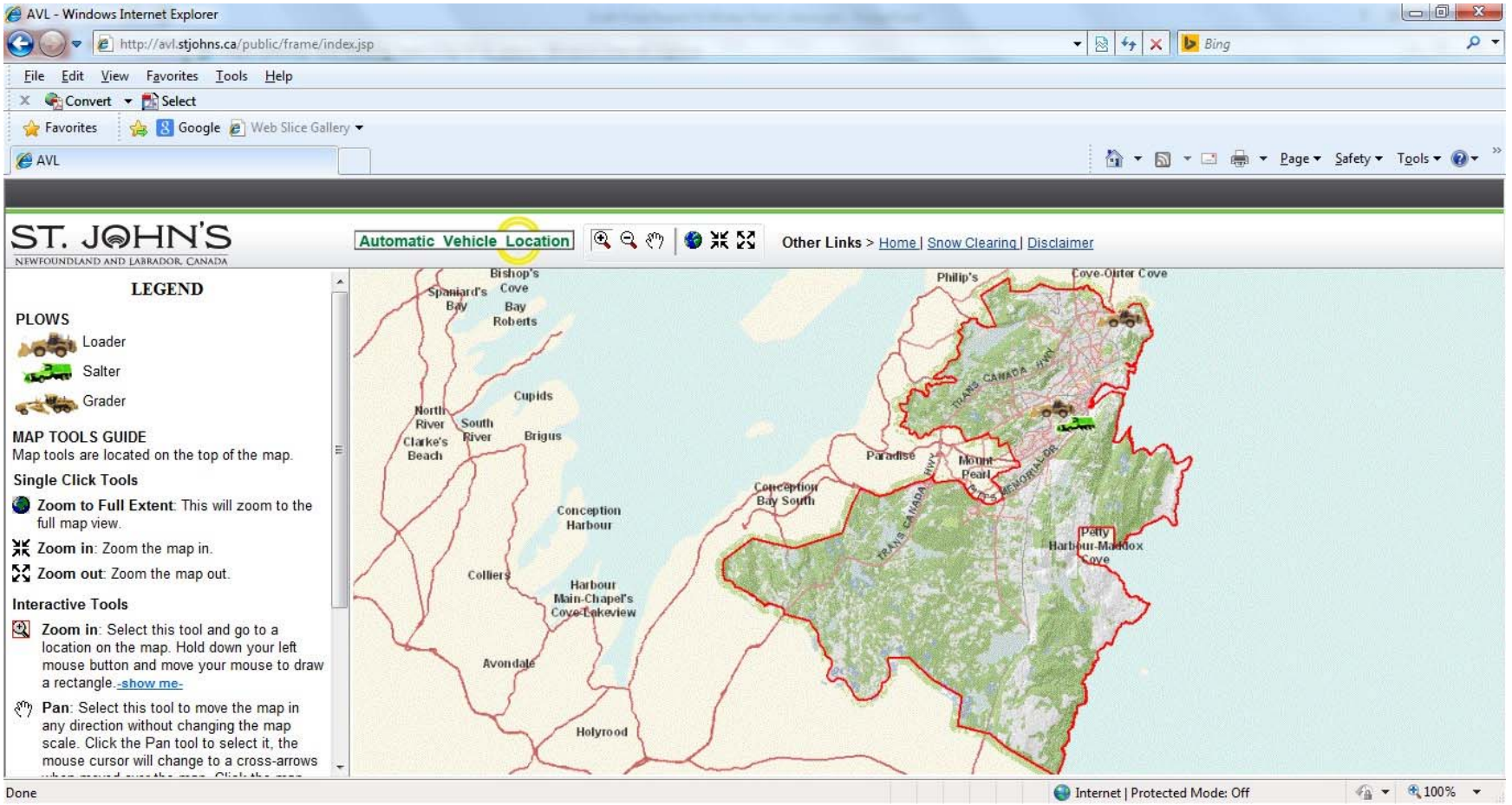
A variety of communications vehicles are used to advise the public of City winter maintenance activities including:

- Winter services information brochure mailed to all residences;
- Parking restriction information advertised in The Telegram;
- The City's website;
- Downtown snow removal line 576-snow (576-7669) and downtown snow removal email subscription;
- Evolving social media and public engagement protocols;
- Advertisings for parking ban and first downtown snow removals;
- *"Where's my plow"* system on City's website; and
- Call centre (311) which is available 24/7/365 to handle all inquiries/complaints.

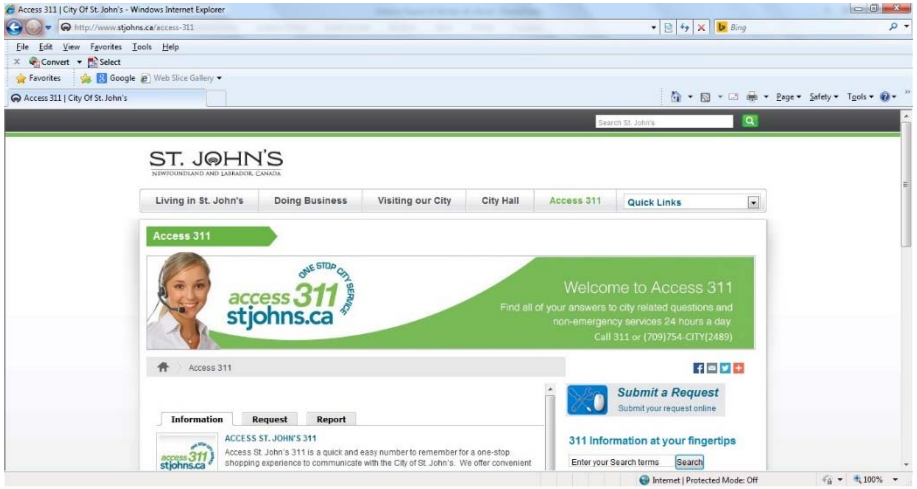
External Communications

Automatic Vehicle Location

The AVL data feeds a website giving residents information on winter maintenance activities and provides data for supervising operations and reviewing incidents.



External Communications (cont.)



Incoming communications are generally funneled through the 311 group, generally by telephone or email. 311 must balance satisfying customer requests (ideally making something happen and perhaps reporting back to them that it has occurred) with minimizing the impact on operations (as it is better that forepersons and managers are dealing with the snow rather than pursuing complaints about activities that are underway as planned but not yet completed).

It is felt by some that 311 may currently be too much on the “minimizing impact” side, not taking client requests, even repeated client requests, seriously and not passing information on to the Roads Department even when service levels are missed. Agencies such as Metrobus, the Post Office and the School District find this particularly frustrating.

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External Communications (cont.)

We suggest that the City consider the following:

- The Roads division work with 311 to develop a revised protocol and knowledge base articles for handling 311 calls on snow issues. Some elements could include:
  - For all calls, record address/phone number and identify duplicate/follow-up calls;
  - When a call is for something that should occur at a future time period (e.g. “plow my street” while it is still snowing), provide and record an estimated response time (e.g. within 12 hours after snow stops) and invite the caller to call back if it is not completed by the estimated time;
  - If a subsequent call occurs before the estimated response time, repeat a message that work is underway and invite the caller to call back if it is not completed by the estimated time;
  - If a subsequent call occurs after the estimated response time, direct the issue to Roads for action;
  - When a call is for something that may NOT be in progress and/or that will NOT necessarily happen:
    - Inform the caller that the requested service is not something the City does (e.g. clear my driveway), or
    - Send the request to the division for action (e.g. sight lines need to be restored at an intersection). If a snow event is underway, indicate that it may take some time to get to it;
  - Make the division aware of streets or issues with multiple calls, or other unusual circumstances; and
  - Forward any snow calls more than 12 hours after snow stops falling to the division for action.

External Communications (cont.)

We suggest that the City consider the following (cont.):

- Establish a communication protocol and process for key stakeholders, such as the Eastern School District and Metrobus, to communicate with designated and informed individuals within Roads on matters related to service suspension or interruption (not specific snow or road issues as they would remain with 311);
  - For example, have Metrobus (Dispatch Supervisor) take and process all complaints from operators. Routine concerns (e.g. slippery street) should be conveyed through 311, but the supervisor at Metrobus should have ability to contact Roads for critical situations;
- Involve the City's improved Communications capability in getting the "snow story" out:
  - Ensure a quicker response to identify and explain the real story when controversy arises; and
  - Provide better and regular event status information to the press, Councillors and senior management to improve the consistency and accuracy of public messages;
- Use two specific approaches that may help improve communication of snow removal information:
  - Upgrade the subscription email service to provide notices targeted at particular streets/blocks for snow removal, parking bans, etc.; and
  - Collect the email / text message number / telephone phone number associated with every on-street parking permit and send notices of pending snow removals by email, text message or automated telephone call as preferred.

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Long-Term Issues

Long-Term Issues

There are three long-term issues the City should consider addressing including

1. Future depot requirements:

   - The City currently manages most of its field operations from the Blackler Avenue depot. Having a single operating location has important benefits such as the opportunity to build synergies between departments and collocate with shared services like Fleet and the fueling capacity. However, the depot property has been developed considerably and has limited future expansion capacity. Furthermore, expected growth areas are a considerable distance from Blackler Avenue. A long-term strategy for future depot requirements should be adopted while large tracts of land within a reasonable distance are still available.

2. Future snow disposal requirements:

   - Most snow removed from city streets is disposed in the harbour. This arrangement may be threatened by operational requirements of the harbour authority and/or environmental concerns. In addition, snow removal requirements are increasing. A long-term and contingency plan should be considered.

3. Improving the “snowability” of City infrastructure:

   - There are some aspects of the design of City infrastructure that increases the cost of winter maintenance. Some improvements in the design of new infrastructure and improvement of the old could likely be achieved over time.

Future Depot Requirements

There is one main Depot on Blackler Avenue

The depot provides a large storage area for salt and sand required for ice control.

The depot contains a state-of-the-art brine production system.

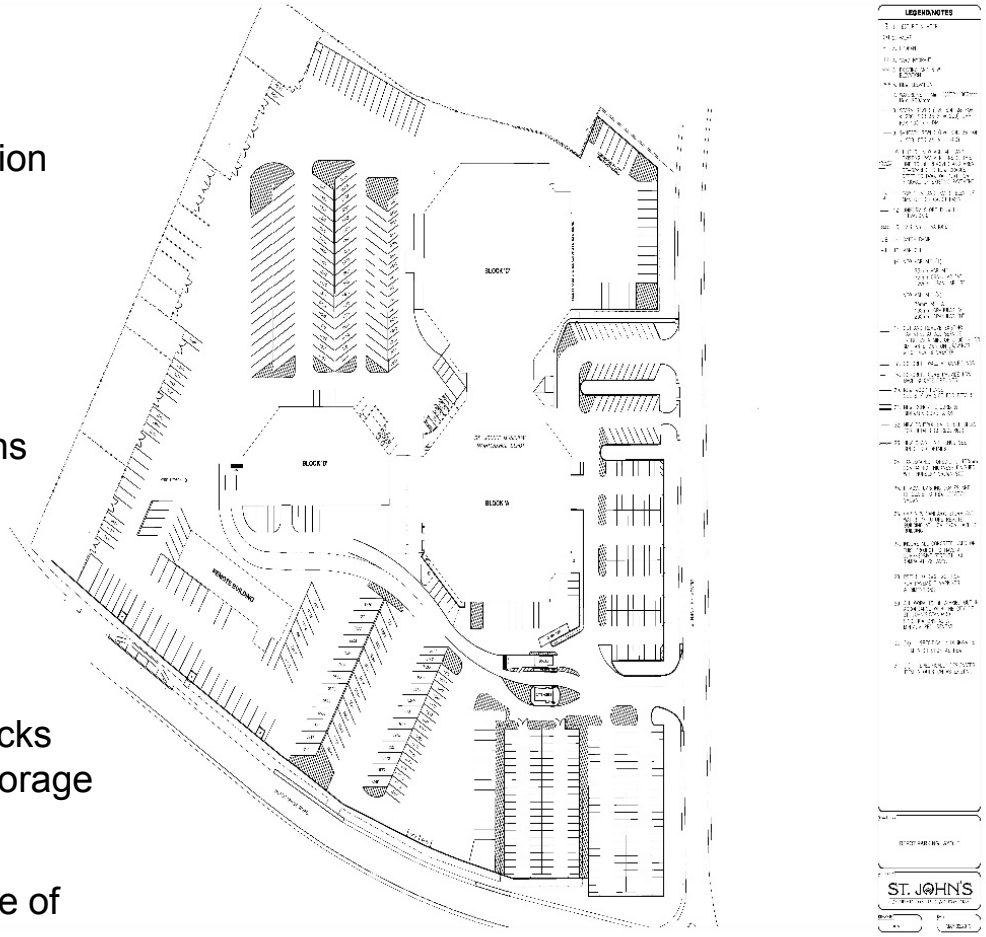
There is only outdoor storage for Road and Parks equipment, which is a problem for sidewalk plows and blower attachments for loaders.

The Fleet Services Division operation that maintains the equipment is located at the depot.

Offices for Roads Division and Parks and Open Spaces Division, along with other public works groups, are located at the depot.

There is a small depot in Goulds that holds salt trucks and loaders for local use, but does not have salt storage facilities and has little room for expansion.

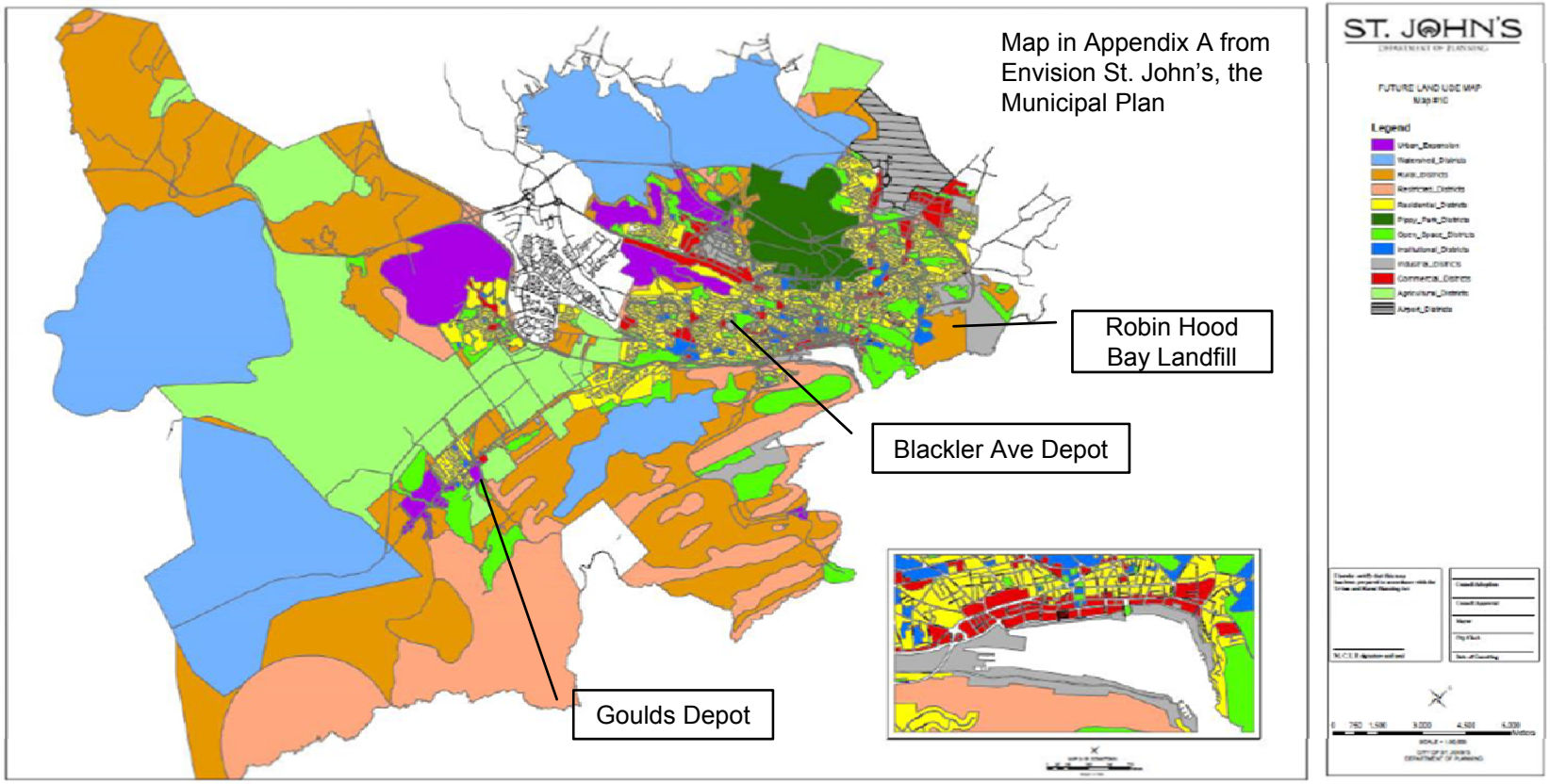
The former transit garage is used for indoor storage of sidewalk plows.



Future Depot Requirements (cont.)

The Blackler Avenue depot is central to the current developed area of St. John's

The map below shows the expected future development of St. John's. The purple areas are designated areas for expansion of the urban footprint. The largest areas are in the southwest where expansion of Southlands and the Galway development with 5,000 additional residential units plus commercial and industrial development is anticipated. Modest expansion in the area north of Mount Pearl and in Goulds is anticipated.



Future Depot Requirements (cont.)

The Blackler Avenue depot is an excellent facility, gaining from the synergy between departments and the availability of support services like Fleet and fueling.

The depot is approaching capacity with increasing uses over time. There is some opportunity to continue expanding by using the car impound area for other purposes or by building on some of the outdoor storage areas. Outsourcing the towing and impoundment, or moving to a system of towing around the corner, would facilitate freeing up the impound area. The most urgent requirements in terms of winter maintenance are for indoor storage of the blower attachments and sidewalk plows. It is preferable to have the sidewalk plows operating from Blackler Avenue versus the old transit building to allow easier coordination of operations and a closer relationship with Fleet. This may also be necessary as the old transit facility is being developed for other uses.

In the long-term, as the City continues to grow it will require a second depot. The depot should be similar to the Blackler Avenue depot in terms of accommodating the needs of all City groups in the field, incorporating a Fleet facility and fueling facility, and containing adequate space for protected salt and sand storage and some indoor vehicle storage.

The Goulds depot is too small to grow into this facility without substantial expansion either into the park land to the north or the properties to the south.

The depot in Goulds is in a suboptimal location as the larger communities will be built to the southwest. Therefore, a new large facility would be more useful in that area. With planning of the new development now underway, it would be appropriate to identify and secure a location before land prices escalate with development.

Future Depot Requirements (cont.)

In the shorter-term, any agreement to use the fueling and salt storage facilities of the provincial Department of Transportation and/or the City of Mount Pearl would help operations in the southwest, removing the need to return to Blackler Avenue for fuel and salt in particular. If this cannot be achieved, a salt storage facility could be developed as a first step in the development of a second depot.

Planning for the longer-term could also consider co-operative arrangements with the Department of Transportation and/or the City of Mount Pearl, although these may be difficult to achieve.

In the very long-term, a third depot facility may be required in the northeast. The most likely location would be in the area east of East White Hills Road and south of the Robin Hood Bay landfill site. Acquisition of land for snow disposal facilities as discussed in the next section should consider the potential depot requirement.

Future Depot Requirements

We suggest that the City consider the following:

- Removal of the vehicle impound facility at Blackler Avenue following a change in towing approach;
- Construction of indoor parking/storage facilities for the blower attachments (with room to attach and detach from loaders) and sidewalk plows at Blackler Avenue;
- Identification of and acquisition of a suitable site for a second major depot in the southwest urban area. The site should be large enough to accommodate long-term needs of all field operations groups in Public Works and the Fleet, with a fuel supply and materials storage required to support operations; and
- Identification and acquisition or reservation of a suitable site for a third depot in the very long-term in the northeast section of the City. This should be coordinated with the snow disposal requirements discussed in the next section.

Future Snow Disposal Requirements

The vast majority of snow removal is from the downtown area, and is currently disposed in the harbour.

Streets Requiring Snow Removal, by District, 2013-14					
	North Central	West End	East End	Goulds	South Central
To Harbour	31	27	0	0	132
To Landfill	0	11	5	0	0

The Robin Hood Bay landfill was the primary supplementary site used this past winter. Wishing Well Park has been used in the past but has very limited capacity. While the majority of snow removal activity is downtown, there is also some removal from suburban areas in major arterials and areas where the street design does not provide sufficient capacity for snow storage over the winter.

Sidewalk clearing improvements will require more snow removal, which again will be primarily downtown but will also include arterials outside downtown that do not have sufficient snow storage. The requirement for removal on suburban streets without adequate snow storage is expected to increase over time as public expectations increase. There would be a very substantial increase if the City decides to remove snow from cul-de-sacs.

In addition to these growing snow disposal requirements, there is concern that access to the harbour for snow disposal could be limited in the future given high levels of vessel traffic using all available wharf space, as well as potential environmental, or security concerns.

Future Snow Disposal Requirements (cont.)

The alternative approaches to snow disposal that are available are:

- Disposal in the harbour;
- The use of snow melters;
- Snow dump sites on land; and
- Use of storm water retention ponds.

Other options such as disposal in the ponds and lakes have been ruled out due to the environmental impact of the salt, and disposal on active City park sites has been ruled out given the impact on park use as the snow may not completely melt until June or July.

It is possible that the City could lose access to the harbour as a result of harbour operational requirements, rather than environmental concerns. Should that occur, the preferred option would be to acquire harbour access through lands not controlled by the Harbour Authority (if possible). The balance of this analysis, however, assumes that an alternative to harbour disposal may be required for environmental or other considerations that prevent direct disposal from any location.

Future Snow Disposal Requirements (cont.)

Alternative	Advantages	Disadvantages
Disposal in harbour	Salt goes back to ocean Low trucking cost/impact Low visual impact Lowest Greenhouse Gas (GHG) impact	Uncertain availability Some solids enter harbour with snow
Snow melters	Low trucking cost/impact if properly located Small site required All solids contained	Substantial cost of fuel to melt snow Increased GHG impact from melting High capital cost Salty run-off, an issue at some locations
Snow dumps on land	All solids contained	Difficult to locate near downtown Truck traffic and site noise problematic if near or through residential areas High capital cost Trucking costs and GHGs (depending upon location) Operating costs of managing site Unsightly through spring, into summer
Storm water retention ponds	All solids contained Land already committed, most capital spent Dispersed locations near many suburban communities, reduced GHG impact	None near downtown Truck traffic and site noise could be an issue Unsightly through spring Salty run-off Design must accommodate snow and run-off

Future Snow Disposal Requirements (cont.)

For the downtown snow removal, disposal in the harbour is by far the best solution. It has the lowest cost and the smallest environmental impact, particularly for greenhouse gases as the alternatives include trucking the snow some distance or using fossil fuels to melt it.

However, the City should devise a backup plan in case it loses access to the harbour:

- **Snow melters** – Are an option, however, they have limited capacity. Toronto continues purchasing larger and larger snow melters to achieve the capacity required. Moving the "portable" snow melters is time consuming, and the timeframe grows as the machines get larger. To obtain the volume capacity required for downtown St. John's, we have assumed a permanent in-ground snow melter draining to the harbour to allow a steady stream of trucks to traverse the site and dump their loads into the melter. This could likely be accommodated on a relatively small lot, about 300 square metres plus the access roads. Mount Pearl has a small snow melter and uses it intermittently. Toronto has snow melters because it has found it impossible (or at least very expensive) to find land it can use for snow dumps. Quebec City, which does considerable snow removal, does not use snow melters, nor do Montreal or Ottawa, both of which do considerable snow removal. The key concern is the operating cost, although the capital cost would likely be about $2 Million based on initial estimates provided by a snow melter supplier;

- **Land based snow disposal site** – The City does not have any large unused land parcels in or near the downtown. Many of other large, vacant parcels nearest downtown are inappropriate (e.g. Signal Hill) or are very difficult to access with heavy trucks (east of Pitts Memorial Drive). There is a large parking lot at the end of the harbour between Water Street and the Waterford River that could be used for snow disposal, although it may be expensive to acquire as a back-up plan and would put an unsightly pile of snow in a very visible location. The best available long term option appears to be the same general area being used now, at the Robin Hood Bay Landfill.

Future Snow Disposal Requirements (cont.)

There is a large, rural area east of East White Hills Road and south of the current landfill that is likely available from the federal government. There is also a quarry in the area that could become a snow disposal site once it is no longer used as a quarry. These sites would require a 4 - 6 km trip from the downtown depending upon how the site is accessed. Although cost estimates have not been prepared to date, the cost of acquiring the land and preparing it for snow disposal could be as high as the melter site when a plan to capture and control the run-off from the site are factored in.

Comparing the options:

- The primary tradeoff is between the increased travel by truck to a snow dump location and the cost of melting the snow;
- One snow melter manufacturer indicates that in ideal conditions melting snow takes 5.6 litres of diesel per ton of snow – or roughly $7.30 per ton;
- A tandem-tandem truck will generally carry 10 to 15 tons of snow and costs about $100 per hour (current City contract), including the cost of the operator. That suggests that the tandem could drive 35 - 55 kms (in each direction) for the same cost as melting the snow. This is much further than required to travel to the Robin Hood Bay Landfill site area. Trucking would use much less fuel and create fewer greenhouse gasses. For example, at 10 tons per truckload, the snow melter would use 56 litres of diesel for the 10 tons, while the truck driving 6 kms each way to Robin Hood Bay would only use 6 litres of diesel.

Future Snow Disposal Requirements (cont.)

Options in suburban areas:

- The east end will be relatively well served by the Robin Hood Bay location, but the south and west ends would not be well served;
- The concept of the storm water retention ponds serving as snow dumps is relatively new and should be explored in more detail as they do provide an accessible location in most new suburban areas and certainly will in the areas yet to be built. The major concern is the suitability of the runoff in the watershed and the destinations of the storm water in the pond. If there is compatibility, consideration will be required in the design of the retention ponds;
- It is appropriate to consider purchasing a large snow dump site in the west end. This should be combined with the search for an appropriate depot site. They may not need to be co-located, but both have similar site requirements - particularly the need to be separate from residential environments. It would be prudent from a cost point of view to acquire the site(s) before development occurs.

Future Depot and Snow Disposal Requirements

We suggest that the City consider the following:

- Identify and acquire for future use suitable sites for a southwest end depot and a southwest end snow disposal site;
- Acquire land in the area bound by East White Hills Road, the Robin Hood bay landfill site and the ocean with highest priority for a site(s) that can accommodate a permanent snow disposal site large enough to replace the use of the harbour should that become necessary, and to accommodate the potential requirement for a third depot well into the future; and
- Investigate the potential for storm water retention ponds as snow disposal facilities. This would include consideration for the potential of existing storm water retention ponds where there is current demand for snow disposal, and developing future ponds so they can be used for snow disposal when required in the future.

Future Depot and Snow Disposal Requirements

Financial Impact

There are a number of uncertainties that will impact the potential cost of the items listed above:

- The scope of the new depot and snow disposal site in the southwest end of St. John's is yet to be determined, including the number of departments involved, the scale of buildings, parking and support services (fuel, vehicle maintenance, materials storage) to be included, and the timing and phasing that may be involved. It would be appropriate to secure land for the facility in the near future. A site (or two sites if the snow disposal is at an alternative location) of about 40 acres would be appropriate and would likely cost in the range of $4 Million to $5 Million depending upon the location, size and timing of acquisition. Construction of the depot and development of the snow disposal site would cost in the order of $42M to $48M, all in 2015 dollars, although implementation could be phased as the southwest end of the City grows.

- The acquisition of land for the east end snow disposal site should proceed in the short-term to ensure that options are available should access to the harbour be lost. Development of the site could be accomplished in one construction season, assuming a plan was prepared and any required approvals obtained. It is therefore proposed that a design be developed, but development not proceed until required. The acquisition or a 20 acre site could costs between $2 Million and $2.5 Million depending upon the site involved, its size, accessibility to roadways and particular site conditions. Developing the site to accommodate 250,000 cubic metres of snow would be sufficient for current requirements. Given increasing demands for sidewalk clearing and related snow removal, it is likely the site will need to accommodate more snow in the future - perhaps 500,000 cubic metres at some point in the future. Initial development of the site should be budgeted at $4M to $5M in 2015 dollars, although it may not be required for some time..

“Snowability” of Infrastructure

The requirement to maintain infrastructure in the winter, particularly roads and sidewalks, has not generally been a key consideration when developing infrastructure. How the infrastructure is maintained has evolved over time as well.

There are two primary issues:

- In many locations, utility poles or other barriers exist between roadways and sidewalks or infringe on roadways or sidewalks, thus inhibiting snow operations. Some progress has been achieved over the years (e.g. the parking meters are now generally out of the way). But there is considerable reluctance to relocate a utility pole even when it requires replacement, at least in part because putting one pole out of line with the others requires guy wires or other supports for the poles. However, replacing a pole in the “wrong” location creates a new asset with a long life, making it more difficult to relocate the entire line later.
- New subdivisions are being developed with very little room for snow storage. Between the sidewalks and driveways (often widened to accommodate two or even three cars), it is very difficult to keep streets open and the snow piles can become very high. We understand this issue is already under review by the Planning Department and the Roads Division is being consulted to ensure its requirements are understood. This is challenging when the primary focus is on achieving intensification. However, creating new areas that will require snow removal on a regular basis is inconsistent with sustainability.

“Snowability” of Infrastructure (cont.)

We suggest that the City consider the following:

- Continue the review of design criteria for new subdivisions that consider winter maintenance requirements;
- Have the Roads Division review the legal authority of the City related to the placement of infrastructure in the road right-of-way, form a working group to review areas where current road right-of-way use is inconsistent with efficient winter maintenance, and develop ways to address those issues over time considering the value of support or incentives, cost sharing, or other approaches to build a long-term plan that will reduce costs.

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Summary of Financial Implications

Summary of Financial Implications

In considering the Interim Report, Council approved additional funding as follows:

– Hired Trucks to improve Snow Removal and Sidewalk Clearing Standards	$800,000
– City staff snow removal crews	$250,000
– Sidewalk Crew Pilot	$225,000
– Longer Winter Season	$200,000
– Training	$120,000
– Other Items	$60,000
Total Estimated Costs for Quick Hits	$1,655,000

In considering the financial implications of this report, the “as is” baseline is assumed to include these amounts.

Summary of Financial Implications

All forecasts of future financial implications are based on a number of assumptions and the outcome of future events, which cannot be known at this time. As a result, actual results may differ from these estimates and the differences may be material.

The recommendations in this report may have these financial implications:

Annual Costs

- Cost of implementing higher standards – Net operating cost will depend upon the approach taken. If unbalanced shifts and contracted loaders are used, the funding already provided should be sufficient. If it is decided to expand all three shifts to meet the needs, up to $2M additional funding will be required
- Capital costs for new equipment will exceed $1.5M, however $1M of this could be avoided by leasing or hiring the loaders. More capital requirements for replacements and additional spares may be identified in the Fleet Review
- Extended season. Expanding staffing to 19 weeks rather than 18 weeks some years $100,000
- Fleet Equipment Coordinator $75,000

One Time/Capital Costs (before taxes and municipal fees – all costs in 2014$)

- Fleet Review, parts management software $.3 to $.6M
- Indoor equipment storage building in the “compound” area $4.5 to $5.0M
- East End Snow Disposal site
  - Land acquisition (now) $2.0 to 2.5M
  - Development (when needed) $4.0 to 5.0M
- West End Depot and Snow Disposal site
  - Land acquisition (now) $4.0 to 5.0M
  - Development (when needed, likely multiple phases) $42.0 to 48.0M

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Appendix A
Assumptions and Savings Calculations

Assumptions

The calculations on the following pages are largely based on data presented in the report, in particular:

- Future operator staffing levels required for the option as identified on each option page;
- Current staffing requirements identified by the City (59 on each of three shifts, plus the 8 new sidewalk operators approved for this winter);
- The cost of an operator based on $26.12 per hour 2014 rate, plus 5% for the coming winter, plus 53% for benefits and other employer costs as identified in the City budget estimates, multiplied by 40 hours, and assuming the longer 18 week period proposed;
- Overtime rates for 1.5 time was estimated based on the same wage rate multiplied by 1.5 with a mark-up of 13% for benefits and employer costs as identified in the City budget reports. For double time overtime, the wage rate was multiplied by 2.0 and the 13% added. The first four hours of overtime each week was assumed to be 1.5 times and the balance at 2.0 times standard wage rates;
- The cost of the 26 leased loaders was identified based on the budget figures. The cost of in-house loaders is expected to be higher, but without specific data was assumed to be the same as leased loaders;
- Hired trucks were estimated to cost $100/hour based on recent City hires. Hired loaders were estimated at $150/hour in discussion with City staff based on the higher capital cost; and
- The number of events was assumed to be 40 salt/light plow runs and 10 full plow runs per year (on average) based on the historical data shown in the report. They were prorated to standard time or overtime based on the number of shifts in the scenario, and assuming a random distribution of events through the week. Salting/light plow runs were assumed to take 8 hours. Plow runs were assumed to take 48 hours on average, including push back.

Option Costing Calculations

Option 1	
Extra Cost If Increased Staffing	
90	per shift
270	Total for 3 shifts
59	per shift now
3	shifts
8	extra on days
185	Total now
85	Extra operators required
$30,155	per operator
$2,563,140	Extra Costs

Option 2	
Extra Costs if Overtime	
62	operators
24	hours
10	events
14880	Hours OT
2480	Hrs 1.5 times (4 per event)
12400	Hrs. 2.0 times
$ 46.28	Cost /Hr @1.5
$ 61.71	Cost /Hr @2.0
$ 879,963	extra costs

Option Costing Calculations

Option 3	
Leased Loaders	
43	Operators required per shift
129	for 3 shifts
59	per shift now
3	shifts
8	extra on days
185	Total now
56	Staff reduced
$30,155	per staff reduced
$1,688,657	staff saving
$1,074,000	Eliminate 26 leased loaders
$578,307.69	Eliminate 14 City loaders
$3,340,965	Total Savings
New Costs	
40	loaders
10	events
48	hours per event
$150	per hour
$2,880,000	costs
($460,965)	Net saving

Option 4	
2 shifts	
90	Operators required per shift
180	for 2 shifts
59	per shift now
3	shifts
8	extra on days
185	Total now
5	Staff reduction
$30,155	per operator
$150,773	Potential saving
Extra Costs of Overtime	
12	operators
8	hours
13	salt events
77	operators
13	plow event days (20 days, 1/3 not covered)
12	hours
13260	Hours OT
4004	Hrs 1.5 times (4 hours per event, 82 operators)
9256	Hrs. 2.0 times
$46	Cost /Hr @1.5
$62	Cost /Hr @2.0
$756,485	extra costs
($605,712)	Net saving (Costs)
Two and a half shifts, add	
12	Operators (allowing for spare)
$30,155	per Operator
$361,855	Total

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This final report is delivered subject to the agreed written terms and conditions of KPMG's agreement with the City of St. John's dated June 2, 2014.

This final report is provided solely for the benefit of the parties identified in our agreement with the City of St. John's and are not to be copied, quoted, or referred to in whole or in part without KPMG's prior written consent. KPMG accepts no responsibility to anyone other than the parties identified in the engagement letter for the information contained in this presentation.