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Street Lighting System Upgrade

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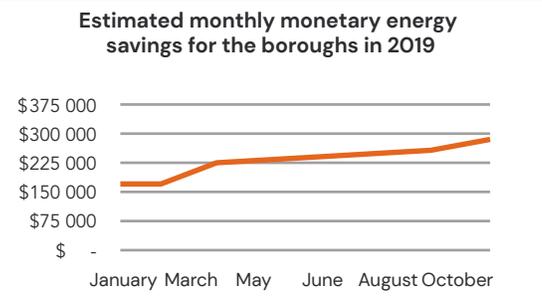
2020 ANNUAL REPORT

Auditor General of the Ville de Montréal

Street Lighting System Upgrade

Background

In 2014, based on the results of pilot tests conducted over the previous two years, the City undertook a massive project to replace the City's approximately 132,000 high-pressure sodium (HPS) bulbs illuminating the City's streets and sidewalks with light-emitting diodes (LED) lights. The purpose of the project was to reduce energy consumption by at least 50% and maintenance costs by 55%. In addition, the City wanted to install a smart communication system for the lights so that it could monitor their condition remotely in real time. In 2015, the central city proposed to take responsibility for the light conversion for all 19 boroughs, and contracted a private firm to manage the project, purchase equipment for the smart system and outsource the work of installing lights to three subcontractors. The City, for its part, handled the purchase of LED lights. The total authorized budget for all this work was \$110 million.



Purpose of the Audit

The purpose of this audit was to ensure that the upgrade of the City's street lighting system to light-emitting diodes enabled the City to achieve the projected savings in energy and maintenance costs.

Results

To date, the street light upgrade has enabled the City to achieve energy savings that exceeded the 50% expectations. However, these savings are based on data generated by the firm managing the project then transferred to the City, without any validation by the City. We also did not obtain evidence from the City that it has the necessary information to show that it has achieved maintenance savings of approximately 55% as a result of the street light conversion. What is more, the City was paying for repair work that the boroughs should have done, and in other cases, the boroughs themselves were doing the repair work without allowing the equipment supplier to honour the clauses dealing with equipment quality in the contract for the purchase of lights and their attendant warranties and without claiming the compensation to which it is entitled under these contracts.

Main Findings

Pre- and Post-Conversion Comparison of Energy Costs

- The City does not assess the energy savings brought about by the street light conversion. It receives from the firm responsible for managing the project a monthly count of the HPS lights removed and the LED lights installed, along with their respective intensities, but it does not do a field validation or calculation of the energy savings realized.
- The firm responsible for managing the project assesses the monetary savings that should be achieved by the boroughs, without the City doing a field check of these savings or validating the information that is forwarded to the boroughs.

Process for the Maintenance and Repair of Lights for Efficient Operation

- The boroughs do not share a standard process to manage how repairs under warranty are to be carried out.
- Clauses in the contracts with the firm responsible for managing the project and with the equipment suppliers provide that if they fail to rectify a malfunction in equipment within a specified period, the City can claim compensation. However, some boroughs do the repair work themselves, which does not allow the City to inform the firm or the supplier, and it loses all recourse in connection with this compensation.
- In other cases, the City asks the firm in charge of the project to correct problems that should have been repaired by the boroughs. The firm then bills the City for this work over and above its contract work for street light conversion.
- The City replaces parts for equipment under warranty without obtaining written confirmation from the manufacturer that this does not violate the warranty.

Project Management

- There was no approval file for this project, as set out in the administrative framework for large-scale projects subject to the *Cadre de gouvernance des projets et des programmes de gestion d'actifs municipaux*.
- The interactive map, which is used to inform the public of the progress of the light conversion project, does not take into account lights that were replaced outside this project.

In addition to these results, we have formulated various recommendations to the business units that are presented in the following pages. These business units were given the opportunity to agree to the recommendations.

List of Acronyms

BPPI	Bureau des projets et programmes d'immobilisations
HPS	high-pressure sodium
K	Kelvin degrees
LED	light-emitting diodes
SUM	Service de l'urbanisme et de la mobilité



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1. Background

The Ville de Montréal (the City) consists of a road system of approximately 4,050 kilometres. To ensure the safety of its citizens, approximately 110,000 street lamps,^{1,2} some with two lights, illuminate the streets and sidewalks, for a total of roughly 132,500 lights. These street lamps can be of two types, either functional³ (80% of the lights on the City's territory) or decorative⁴ (20% of the lights on the City's territory) (see Appendix 5.3 for a diagram of the components of a street lamp).

According to the Service de l'urbanisme et de la mobilité (SUM),⁵ the energy costs paid to Hydro-Québec in 2012 for all the City's street lamps amounted to \$12,422,822. At that time, most of the luminaires associated with these street lamps consisted of high-pressure sodium (HPS) bulbs whose power could range from about 100 watts to several hundred watts, even up to 1,100 watts. Considering that, according to the SUM, a light is lit 345 hours a month, or 4,140 hours a year, the approximate annual consumption of these lights ranges from 400 kWh to 4,500 kWh.⁶

From 2012 to 2014, the SUM conducted various tests to replace HPS lights with more energy-efficient light-emitting diode (LED) lights. To maintain an equivalent lighting level, the difference in power between the old HPS light and the LED replacement light varied from 45% to 61%. Furthermore, according to the SUM, the lifespan of an HPS light is 15,000 hours, compared with 75,000 hours for an LED light, reducing the frequency of operations that need to be carried out to replace the lights at the end

¹ The street lamp consists of a lamp post (a vertical structure also commonly referred to as a pole), an arm (metal cantilever part interposed between the lamp post and the luminaire) and a luminaire (complete unit consisting of one or more lamps and parts designed to distribute the light, to position and protect the lamps and to connect the lamps to the power supply).

² Decision-making summary of the Service des infrastructures, de la voirie et des transports presented to city council in August 2015 to make a proposal to the City's 19 borough councils to manage and implement the street light upgrade program (File 1153113001).

³ Functional lights consist of a large lamp post, an arm and a luminaire and are more suitable for streets with several traffic lanes. Their height of more than 6 metres provides illumination over a long distance.

⁴ Decorative lights consist of a small lamp post topped by a light and have a total height of less than 6 metres, so that they can provide light beneath tree canopies. They are adapted for local streets that do not need a high level of lighting.

⁵ At the time, the Direction des transports, which is responsible for this Project, reported to the Service des infrastructures, de la voirie et des transports (now the Service des infrastructures du réseau routier), but in 2018, this department was transferred to the SUM. For the sake of simplification, the SUM will be used in this text to refer to the department responsible for this dossier, regardless of the period covered.

⁶ According to Hydro-Québec, the average electricity-heated home consumes an average of 22,000 kWh a year. Therefore, five 1,100-watt street lamps consume the equivalent of such a home every year.

of their service life. Over a 20-year time horizon, or roughly the lifespan of an LED light, the SUM estimated that it would be possible to reduce maintenance costs by approximately 55%.

On the basis of these tests, the City developed a project in the fall of 2014 aimed at converting the street lighting system from HPS to LED. The decision-making summary for the project presented to elected officials specified at the time that the City's public lighting assets constituted one of the largest municipal inventories in Canada.⁷ These assets are likely to grow because of a desire on the part of the Montréal municipal administration to develop vacant lots in order to accommodate new families and businesses, to better adapt the lighting to the urban environment in order to improve public safety and create an environment that promotes the use of active transportation (Transportation Plan), and to enhance the lighting of public squares, bicycle paths and other specific facilities through the addition of new street lamps.

In June 2015, city council agreed that, under section 85 of the *Charter of Ville de Montréal*,⁸ the SUM submit a proposal to the 19 boroughs through the *Table de concertation des directeurs d'arrondissement* to manage and implement the Street Lighting System Upgrade Project for all boroughs ("the Project"). Replacing the HPS lights was supposed to take place from the spring of 2016 to the end of 2020. According to the proposal made by the SUM to the boroughs, the estimated savings for the boroughs would be approximately 50% of their electricity bill and 55% of their maintenance costs. According to the SUM, the \$110 million Project, which had the full support of the central city, was to generate savings of \$278 million over the lifespan of the LED lights (20 years), for a break-even point at about eight years. In addition to the economic benefits, the SUM argued that the Project would help standardize the lighting and improve night-time visibility while providing safer, more pleasant lighting. The Project was also to include a "Smart System" component to manage and control lights remotely, provide information on their condition in order to facilitate their management and maintenance and provide information in real time on the functioning and power consumption of the lights. According to this proposal, the SUM took on responsibility for:

- submitting proposals to the competent authorities of each borough of the types of lights that will be installed on their territories for approval;
- preparing the plans and specifications for the purchase and installation of lights;
- preparing the calls for tenders for the purchase and installation of lights;
- managing the installation contracts by electrical contractors;
- preparing the plans and specifications for the purchase and installation of the smart lighting system;
- preparing the calls for tenders for the purchase and installation of the smart lighting system;
- training the staff required to run the new smart lighting system.

⁷ Decision-making summary of the Service des infrastructures, de la voirie et des transports presented to city council in August 2015 for the proposal made to the City's 19 borough councils to manage and implement the street light upgrade program (File 1153113001).

⁸ Chapter C-11.4.

In return, the boroughs assumed responsibility for:

- participating in the meetings necessary for the smooth functioning of the Project;
- issuing public property occupancy permits to contractors in a timely manner;
- ensuring that their staff participate in the training to be delivered by the Direction des transports.

All of the City’s 19 borough councils agreed to the SUM’s proposal between August 2015 and January 2016. Since, at that time, Saint-Laurent borough had already started the work of converting lights fastened to wooden Hydro-Québec posts to LED, it agreed to the proposal, but excluding these lights from the Project.

Tables 1 and 2 summarize the contractual relations established by the SUM for the implementation of the Project.

TABLE 1

Division of Responsibilities in the Implementation of the Street Lighting System Upgrade Project

Body responsible	Procurement of equipment			Management		Installation	Accountability
	LED light	Smart system		Planning of the work	Lights inventory		
		Node/gateway	Software				
City (SUM)	X			X			
Firm A		X	X		X	X ^[a]	X
Contractor 1						X ^[a]	

^[a] Contractor 1 is responsible solely for the installation of LED lights for underpasses and tunnels, while Firm A is responsible for installing all other lights by outsourcing the work out to contractors 2, 3 and 4.

TABLE 2

Contracts Concluded by the SUM for the Implementation of the Street Lighting System Upgrade Project

Type of contract	Value ^[a]	Successful bidder	Subcontractor
Management, coordination and installation of LED lights	\$29.2 million	Firm A	Contractors 2, 3, 4 (street light installation)
Procurement and installation of Smart System	\$28.0 million	Firm A	Firm B (software programming)
Purchase of functional lights	\$18.5 million	Supplier i	None
Purchase of decorative lights	\$29.7 million	Suppliers j, k, l	None
Purchase of lights for underpasses and tunnels	\$1.7 million	Supplier m	None
Installation of lights for underpasses and tunnels	\$3.4 million	Contractor 1	None

^[a] The value of contracts includes taxes and contingencies.

At the time we started our audit, in March 2020, the SUM estimated that 89,033 of the 132,500 lights that needed to be replaced had already been converted, for a technical progress of 67%. From a budget standpoint, commitments of \$110 million, which is the total value of the Project budget, had already been made. These commitments included the purchase of LED lights that are not yet installed and therefore do not contribute yet to the percentage of technical progress. With respect to meeting the deadline, the SUM stated at the start of our audit that the Project was to be completed only at the end of 2023, not the end of 2020, as originally planned, as a result of new spending control rules related to the budgets of the Three-Year Capital Expenditures Program.

2. Purpose and Scope of the Audit

Under the provisions of the *Cities and Towns Act*, we completed a value-for-money audit mission on the Street Lighting System Upgrade. We performed this mission in accordance with the Canadian Standard on Assurance Engagement (CSAE) 3001, described in the *CPA Canada Handbook – Certification*.

The purpose of this audit was to ensure that the City's Street Lighting System Upgrade to LED helps achieve the expected savings in energy and maintenance costs.

The role of the Auditor General of the Ville de Montréal is to provide a conclusion regarding the objectives of the audit. To do so, we collected a sufficient amount of relevant evidence on which to base our conclusion and to obtain a reasonable level of assurance. Our assessment is based on criteria we have deemed valid for the purposes of this audit. They are presented in Appendix 5.1.

The Auditor General of the Ville de Montréal applies Canadian Standard on Quality Control (CSQC) 1 from the CPA Canada Handbook and, accordingly, maintains a comprehensive system of quality control, including documented policies and procedures regarding compliance with ethical requirements, professional standards and applicable legal and regulatory requirements. In addition, it complies with the independence and other ethical requirements of the *Code of ethics of chartered professional accountants*, which are founded on fundamental principles of integrity, professional competence and due diligence, confidentiality and professional conduct.

Our audit work focused on the period from June 15, 2015, to June 30, 2020. However, for some aspects, data prior to this period was also considered. It was primarily completed from March 2020 to August 2020. We also took into account information that was sent to us up to January 2021.

The work was primarily performed with the following business units:

- The SUM;
- Anjou borough;
- Lasalle borough;
- Rosemont–La Petite–Patrie borough.

Upon completing our audit, we submitted a draft audit report to the managers of each audited business unit for discussion purposes. The final report was then forwarded to the management of each business unit involved in the audit to obtain action plans and timelines for implementing the recommendations concerning it, as well as to the Direction générale. A copy of the final report was also forwarded to the deputy director-general of Service aux citoyens, and the director of the Service de concertation des arrondissements. A copy of the final report was also submitted, for information purposes, to borough directors not directly targeted by our audit so they could implement recommendations if appropriate.

3. Audit Results

3.1. Purpose of the Project and Achievement of the Expected Results

3.1.1. Actual Energy Efficiency Gains

Evaluation of Actual Energy Efficiency Gains

As early as the planning stage of the Project, the SUM expressed the view that energy reductions of 50% were foreseeable as a result of the conversion of HPS lights to LED. This is what appears in the feasibility study produced in June 2014, as well as in presentations that were given subsequently, in January 2015, at the *Table de concertation des directeurs d'arrondissement* and, in August 2015, to the City's mayor. These savings are based on a pilot project conducted in Ville-Marie borough, where the energy gains varied from 39% to 61%, depending on the power of the HPS light replaced and that of the LED light added. While this Project was presented to borough directors and the mayor of the City, there was no final version of the 2014 feasibility study, and it was not approved by the department manager at the time.

The boroughs also noted that the projected energy savings were supposed to be approximately 50%, since the decision-making summaries of the borough councils that agreed to the SUM proposal to implement the Project under section 85 of the *Charter of Ville de Montréal* all mention such energy savings. However, from 2017 to 2019, the decision-making summaries prepared by the SUM for the awarding of contracts to manage the Project and purchase lights cited energy savings of only about 35%. These decision-making summaries do not explain why the SUM was then considering lower energy savings than those forecast in 2014–2015. During our audit, this department justified these reductions in energy savings by explaining that they resulted from the decision to install lights with a light intensity of 3,000 Kelvin degrees (K) instead of 4,000 K,⁹ as originally planned. According to the SUM, a 3,000 K light requires more energy to obtain a lighting level similar to that provided by a 4,000 K light.¹⁰

Considering that the justification for the Project was based largely on the realization of energy savings for the boroughs, we would have expected the SUM to monitor the actual savings and to be able to provide an assessment of the percentage of savings generated by the Project. We were not, however, given a formal demonstration that the SUM is conducting such an evaluation. At the very most, the firm responsible for managing the Project (Firm A) produces a monthly summary table listing the number of HPS lights removed and the number of LED lights added, each classified by power, for each borough and for each month. The SUM does not conduct any assessment or analysis of this light replacement table. To assess the energy savings generated by the Project, we extracted data from the summary table to determine the total power

⁹ A 4,000 K light produces colder (white) lighting than a 3,000 K light, which appears more yellow (so-called warm light).

¹⁰ This decision to install 3,000 K rather than 4,000 K lighting was made in response to pressure from citizens' groups, even though the Institut national de santé publique du Québec (INSPQ) issued the opinion that risks to human health from these two types of lighting were similar.

of all the HPS lights removed and the total power of all the LED lights added. We were able to do this for the period covered by the most recent summary table that we obtained, which was October 1, 2017, to March 15, 2020. Based on our calculations, which are not intended to determine the effectiveness of the Project with precision and accuracy but to determine its order of magnitude, we established that the energy gain for the Project was greater than 70%, which is better than initially forecast by the SUM (see Table 3).

We nevertheless feel that this high performance, which exceeds predictions, does not justify the SUM's failure to periodically monitor the evolution of energy gains achieved by the Project.

TABLE 3

Assessment by the Bureau du vérificateur général of the Order of Magnitude of Energy Savings Achieved by Replacing HPS Lights with LED Lights from October 1, 2017, to March 15, 2020

Lights	Quantity	Total power	Average power per light
HPS lights removed	83,667	12,985,812 watts	155.2 watts ^[b]
LED lights added	84,748 ^[a]	3,414,985 watts	40.3 watts
Savings	---	73.7%	74.0%

^[a] The SUM added more lights than it removed in order to correct lighting in areas that were not considered sufficiently illuminated at night.

^[b] Average power is obtained by dividing the total power by the number of lights.

Source: SUM.

3.1.1.A. Recommendation

We recommend that the Service de l'urbanisme et de la mobilité periodically assess the energy savings generated by the Street Lighting System Upgrade Project to ensure that it can show that these savings are at least similar to those that had been planned at the time of the original presentation of the Street Lighting System Upgrade Project to the boroughs, or to be able to examine various reasons that might explain why savings were lower than anticipated.

Reduction in Energy Costs for Boroughs

In 2015, when the Project was presented to the borough directors, the SUM had expressed the view that boroughs would achieve savings of about 50% as a result of the replacement of HPS lights with LED lights. We therefore sought to determine whether the boroughs are periodically informed of these monetary savings related to the energy savings resulting from the Project.

Firm A produces, on a monthly basis, a table of monetary savings achieved by each borough based on the progress of the Project. The SUM receives this file and forwards it to the boroughs.¹¹ According to the information obtained from the SUM, Firm A calculates energy savings by assessing the difference in power between the old light and the new light, considering each light to be operational 345 hours a month. This is the basis for assessing the differential (pre-/post-replacement) in energy consumption for each light and, by applying Hydro-Québec's rate for general public lighting service, for assessing how much less it now costs to use this light for one month. Hydro-Québec also receives the table of monetary savings achieved by each borough, which the SUM says it can refer to in order to adjust the billing for the boroughs' energy costs so that they will benefit from the savings realized based on the progress of the project.

However, while the SUM transfers this file to the boroughs, it does not check the values before sending them to the boroughs, and it does not check with the boroughs to assess the accuracy of these savings and whether the boroughs are actually benefiting from them. According to the SUM, it is at present impossible to assess what a borough is actually required to pay Hydro-Québec for street lighting because, at the beginning of the Project, the Crown Corporation did not have an up-to-date inventory of all the City's street lights and was charging the boroughs a flat rate based on an estimate of the total kilowattage of lights in the borough. An agreement has been concluded with Hydro-Québec providing that at the end of the Project, the actual LED light inventory becomes the official profile of the City's inventory of lights. According to this agreement, neither of the two parties will then be able to make claims for amounts overpaid or due for the period prior to this Project.

We sought to reproduce the savings calculated by Firm A by referring to the summary table of the removal and addition of lights. We calculated the reduction in energy consumption for each borough following one year, then two years, of Project implementation, and we converted the total amounts into monetary savings, using the Hydro-Québec rate. We compared these values with the monetary savings communicated to the boroughs by the SUM for these same two periods. The discrepancy for the first year is 1.1%, and for the second year, it is not much higher (1.4%). However, the second figure conceals a discrepancy of 26.1% for Lachine

¹¹ At the time of our audit, the SUM stated that it did not forward any files in 2020 because of the work stoppage resulting from COVID-19 and did not forward any files in 2018 because the work of replacing lights had only started in October 2018. However, the summary table of lights removed and lights added produced by Firm A shows that lights were replaced prior to October 2018; for example, 1,901 lights were replaced in May 2018 in Mercier-Hochelaga-Maisonneuve borough, and 805 lights were replaced in August 2018 in Saint-Léonard borough.

borough and 59.8% for Outremont borough.¹² When asked what might account for these discrepancies, the SUM forwarded the question to Firm A, which replied by sending estimates of monetary savings for January 2020 that corresponded, within two dollars, to the estimates that we had made for these two boroughs. However, for the 19 City boroughs as a whole, these new estimates for January 2020 differ by 5.5% from the figures in the file that Firm A had already sent to the SUM. These discrepancies between the two versions of documents obtained from Firm A go as high as 53.76% for a single borough.¹³ It must be concluded that errors had been made in the calculations of monetary savings, or that the data initially sent by Firm A was incomplete or inaccurate. We feel that if the SUM had checked the data obtained from Firm A before forwarding the information to the boroughs, it would have been possible to detect such errors.

In addition to the lights replaced as part of the Project, some lights are replaced during road rehabilitation projects.¹⁴ According to the information obtained from the SUM, it is the road rehabilitation project manager's responsibility to inform Hydro-Québec of the light conversion carried out. Neither the summary table of replacements nor the monthly monetary savings file take into account these light replacements carried out outside the Project. When asked how Hydro-Québec was supposed to have a complete, exhaustive inventory of every street light actually installed on the City's territory, the SUM stated that a validation with the Crown Corporation will have to be done in the future to ensure that all the information on lights in its possession is similar to the City's information on lights. However, we think this future endeavour will be difficult to carry out if the City does not already have centralized information on all lights, including those covered by the Project (installed by Firm A or by the City) and those replaced as part of road rehabilitation projects. We therefore have concerns about the accuracy of billing that boroughs will receive in connection with street lighting.

3.1.1.B. Recommendation

We recommend that the Service de l'urbanisme et de la mobilité monitor the quality and validity of the information it sends to the boroughs and third parties in order to ensure the accuracy of the information before forwarding it.

¹² Overall, the monetary savings for these two boroughs are relatively low compared with the overall savings of all boroughs, because few lights had been converted during the first two years in these boroughs. For this reason, a large discrepancy for the borough does not significantly affect the overall discrepancy for the boroughs.

¹³ The greatest discrepancies are for the Lachine (-27.5%), Rivière-des-Prairies-Pointe-aux-Trembles (34.3%), l'Île-Bizard-Sainte-Geneviève (35.3%) and Outremont (53.7%) boroughs.

¹⁴ These lights are acquired through the road rehabilitation budget for the street concerned and are installed by the contractor responsible for the rehabilitation work. No relationship is established with the Street Lighting System Upgrade Project.

3.1.1.C. Recommendation

We recommend that the Direction générale ensure that each manager of a project involving the conversion of a street lighting system to LED, including the Street Lighting System Upgrade Project, forwards the information on lights removed and lights added to Hydro-Québec to ensure that Hydro-Québec has an exhaustive inventory of the City's lights and that the bills it sends to the boroughs progressively reflect the monetary savings related to the energy savings resulting from the conversion.

3.1.2. Repair of Lights and Maintenance of Public Service

Under city council By-law 08-055 concerning the delegation to borough councils of certain powers relating to the arterial road system, the boroughs were given responsibility for the maintenance, repair and replacement of street lighting. With respect to local streets, under By-law 02-003 concerning the arterial and local road system, the boroughs are responsible for all streets that are not part of the City's arterial system.¹⁵

Within the scope of the Project, neither the draft version of the feasibility study nor the decision-making summary of the SUM proposal that was presented to the boroughs in 2015 sets forth the boroughs' responsibilities with respect to maintaining and repairing LED lights. Only the presentation given at the *Table de concertation des directeurs d'arrondissement* in January 2015 stated that street light maintenance management would remain unchanged following the conversion.

The call for tenders for the acquisition of professional services for the management, coordination and installation of LED lights¹⁶ makes no mention of the successful bidder's responsibility for repairing the LED lights that it installs. As shown in Table 1, Firm A is also responsible for the installation of lights by contractors to which it outsources this work. We would have expected the technical specifications to address the issue of the repair or of the warranty for installation services.

Moreover, even though the responsibility for the maintenance and repair of street lights falls to the boroughs, Firm A and the equipment suppliers will be involved in repairing defective Smart System lights and other equipment under the warranties that come with this equipment or its installation. It therefore seems essential to us that there be in place a sharing of roles and responsibilities and a warranty management system, including a process for following up on repair requests. This would in particular enable the City to enforce the various clauses covering compensation in the event of defects in equipment under warranty. However, based

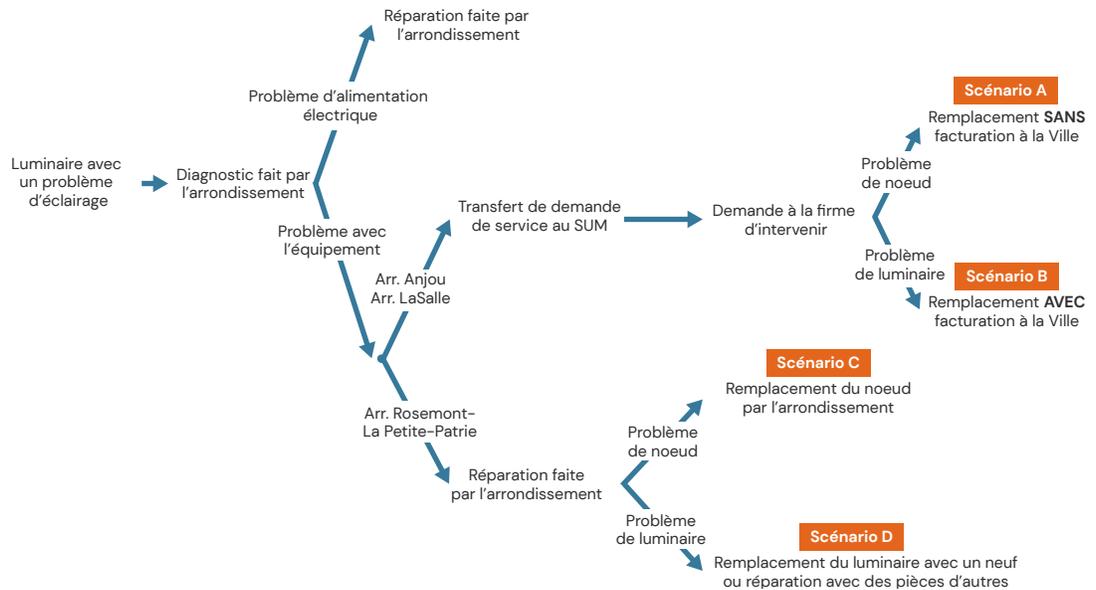
¹⁵ The Direction de l'entretien de l'éclairage, de la signalisation et du marquage sur la chaussée of Rosemont-La Petite-Patrie borough is responsible for the maintenance and repair of both its own street lights and those of the boroughs of the former Ville de Montréal, i.e., Ahuntsic-Cartierville, Côte-des-Neiges-Notre-Dame-de-Grâce, Plateau-Mont-Royal, the Sud-Ouest, Mercier-Hochelaga-Maisonneuve, Rivière-des-Prairies-Pointe-aux-Trembles, Ville-Marie and Villeray-Saint-Michel-Parc-Extension boroughs. The other boroughs handle the maintenance and repair of lights on their respective territories.

¹⁶ Call for tenders 17-16015.

on our audit, we found that there is no standard approach for managing repairs under warranty. We identified four different possible scenarios, depending on whether the defect occurs in one borough or another, and on whether a luminaire or a Smart System component is affected (see Figure 1).

FIGURE 1

Responsibility for Repair Work Performed on a Luminaire with a Lighting Problem, Depending on the Borough



Problem with a Node or Other Smart System Component

According to the technical specifications in the call for tenders for the procurement and commissioning of a smart urban lighting management system,¹⁷ the equipment provided, including labour, upgrading of the equipment and software required, must be guaranteed for a 10-year period. During this period, a service call for a malfunction must be taken by the successful bidder within a period of less than 8 hours, and the repair work must begin within 48 hours and must be completed within 96 hours. If the successful bidder does not comply with these timelines, the City proceeds to do the repair work itself at the expense of the successful bidder and demands compensation of \$200 for each replaced node or \$500 for each replaced gateway. In the case of software, if problems arise in the course of the 10 year warranty period and the successful bidder is unable to meet the same deadlines to correct the problem, the City must receive compensation of \$500 for each missed deadline.

¹⁷ Call for tenders 15-14912.

In practice, when a service request is placed in a borough because of a malfunction in a light, if the problem is not related to the power supply, Anjou and LaSalle boroughs transfer the service request to the SUM, which, in turn, will ask Firm A to ask one of the three contractors to step in and do the repair work. If a Smart System component is the source of the problem (**Scenario A**), Firm A handles the replacement of the equipment, since it provided the equipment within the scope of the Project.

For all boroughs served by Rosemont–La Petite–Patrie borough, the borough itself handles the repairs, replacing the defective node (the SUM provides the borough with replacement nodes) (**Scenario C**). The borough proceeds in this way to minimize the duration of a malfunction in a light and the public inconvenience associated with it. However, the borough, in replacing a Smart System component itself, does not inform the SUM of the problem, and the SUM, in turn, cannot inform Firm A of the problem. If such a notice is not sent to Firm A, the City cannot enforce the compensation clause. Moreover, in a letter to the SUM dated June 30, 2020, Firm A reiterated that it did not authorize [TRANSLATION] “any operation on devices closely connected with the [smart lighting management system, and that] ... if the Ville de Montréal carries out certain operations, they will be at the expense of the Ville de Montréal and [Firm A] can never be held responsible for the associated expenses”. In this context, we question whether the borough, by taking direct action to repair Smart System components, deprives the City of any recourse against Firm A if any additional problem is encountered with this equipment.

Problem with a Lighting Component

The call for tenders for the procurement of LED street lights¹⁸ (Cobra lights) stipulates that the lights must be guaranteed for at least 10 years¹⁹ and that [TRANSLATION] “installed lights that do not reflect the characteristics specified by the manufacturer, whether they have a manufacturing or performance defect, an insufficient useful life or other irregularities, will be replaced and subject to enforcement of a lump sum payment of \$200 each, in order to cover additional expenses resulting from light replacement activities related to this installation”.

For decorative lights, the call for tenders for the procurement of LED decorative lights and arms²⁰ stipulates that the lights must be guaranteed against any defect in design, manufacture and materials for a 10-year period. Furthermore, if the City returns a defective light to the supplier, the supplier must repair it and return it to the City no later than 7 days following the notice of defect, failing which the supplier must replace the light while it is being repaired.

Moreover, for both Cobra lights and decorative lights, the technical specifications state that during the validity period of the warranty (10 years), the City will conduct photometric field measurements in order to ensure that the lights are performing.

¹⁸ Call for tenders 17-15727.

¹⁹ The 10-year warranty must cover the integrity and functioning of the luminaire housing and finish, the optical system, the wiring and connections, the LED light sources and the LED current regulator.

²⁰ Call for tenders 18-16647.

If a discrepancy between the field measurement and a light intensity simulation for this type of light is more than 10%, the supplier will be required to replace it at its own expense, including labour costs for the replacement. Moreover, if the number of lights with such a defect exceeds 1% of all the luminaires installed in a year, the supplier will be required to not only replace them, but also pay the City \$200 per luminaire in excess of this figure of 1% as compensation. However, it is not possible for the City to enforce the portion of the warranty covering the performance of luminaires, because the SUM does not carry out photometric field measurements once the LED lights are installed.

For Anjou and LaSalle boroughs, since they ask the SUM to respond in the event of a light malfunction (if it is not a power supply problem), and the SUM transfers this request to Firm A, Firm A asks one of the contractors to replace the light (**Scenario B**). However, since neither the contractor nor Firm A are responsible for the purchase of the defective light (it was the City that provided it — see Table 1), Firm A bills the City for the operation.

For boroughs served by Rosemont–La Petite–Patrie borough, ever mindful of minimizing the duration of the malfunction of the light for the sake of the public, the borough itself proceeds to replace the defective light with another one supplied by the SUM or to replace the defective component using parts recovered from other LED lights that were removed from the network following an accident or breakage not covered by the warranty²¹ (**Scenario D**).

If the technical specifications for the acquisition of lights also contain a compensation clause, there is no register either in Rosemont–La Petite–Patrie borough or at the SUM to distinguish breakages covered by the warranty from accidental breakages not covered by it. Without this register, the SUM states that it cannot know how much compensation it can claim from the supplier. Therefore, in the end, it is Rosemont–La Petite–Patrie borough, in this case, that assumes labour costs for the replacement of a light under warranty (**Scenario D**), without compensation.

We questioned the SUM to determine whether the fact that the worker opens up lights in order to repair them with parts that come from other lights or were obtained from the SUM would affect the light warranty (**Scenario D**). According to the SUM, this type of repair has no effect on the light warranty. The SUM, however, was unable to provide us with a notice from the light manufacturer stating that the light warranty was still in force following repair work done on a light by the City.

Therefore, since there is no strategy for managing repairs and warranties for lights and Smart System components, we think that the City is paying for operations that it should have done itself (**Scenario B**), that it cannot enforce the compensation clauses in its calls for tenders (**Scenario C**), or that it is simply not claiming this compensation (**Scenario D**), and that it does not have the assurance that it is not jeopardizing the validity of the light warranty by doing repair work itself.

²¹ A light that is damaged in a traffic accident or by an act of vandalism, such as a rock thrown at it, is not covered by the supplier's warranty.

Since the City has no register of defective, replaced or repaired lights, we were unable to assess the amount of compensation and penalties that the City failed to seek from Firm A or suppliers.

3.1.2.A. Recommendation

We recommend that the Service de l'urbanisme et de la mobilité develop a strategy for repairing lights and Smart System components and managing warranties and notify the boroughs of this strategy, in order to ensure that repair work is done quickly, to promote the enforcement of the various compensation clauses and to keep light warranties in force, while allowing boroughs to be compensated for work they were not required to do.

3.1.2.B. Recommendation

We recommend that the Service de l'urbanisme et de la mobilité create a register of damaged, replaced and repaired lights and Smart System components, so that compensation can be managed more effectively under the warranties for this equipment.

3.1.2.C. Recommendation

We recommend that the Service de l'urbanisme et de la mobilité obtain from its light suppliers a written notice concerning the validity of manufacturers' warranties when the Ville de Montréal itself proceeds to replace a defective component of a light under warranty, in order to ensure that the Ville de Montréal can enforce the specifications clauses if there are any additional problems with lights repaired in this manner.

3.2. Project Management and Monitoring

Tracking Costs for the Acquisition of Lights

The SUM is responsible for acquiring lights from suppliers, which deliver them to warehouses, where contractors subcontracted by Firm A procure supplies in order to perform the conversion work. We sought to determine whether the SUM was doing fair and accurate monitoring of the costs associated with the purchase and installation of these lights, as well as monitoring the management of light inventories managed by Firm A.

Three Excel files are used to manage and monitor expenses associated with the SUM Project:

- File A: Project Monitoring Table, which shows all the costs, by supplier and bill, for the Smart System, the lights, their installation and other professional services associated with the implementation of the Project;
- File B: Overall tracking of orders and bills for light suppliers. The content of this file is a subset of File A;
- File C: Monitoring of bills sent by Firm A for the management, coordination and installation of lights.

We sought to reconcile the contents of File B with those of File A, since the first is theoretically a subset of the second. For the three light suppliers, we found discrepancies between the two files.

- For Supplier 1 (“Cobra”-type lights — the largest number of lights in the Project), a discrepancy of 1.1% was measured due to three bills that were missing from File B but were present in File A;
- For Supplier 2 (decorative lights), one bill present in File A was not found in File B, and in another case, it was the other way around, for a discrepancy of 2.5% in the total values between the two files for this supplier;
- For Supplier 3 (also decorative lights), we found a total amount of \$494,542 in File A for which no follow-up of bills was entered in File B, and \$512,715 of bills in File B that we were unable to reconcile with entries in File A, for a total error of \$1,007,257, or about 16.9% of the bill totals for this supplier. The non-reconciliation for this supplier affects 25 bills.

Therefore, in all, 30 bills out of a total of 357, or 8.4%, were not reconciled. Based on this finding, we feel there is a lack of monitoring and rigour in tracking bills for the purchase of lights in the Project.

Furthermore, we questioned the SUM to determine how it was validating the monitoring of the inventory of lights that were purchased, installed or remaining in the warehouses of Firm A, which is responsible for managing both inventories and light installation. The SUM has confirmed that, even though Firm A carries out an inventory reconciliation in an Excel file and sends it every month to the SUM, no validation is done by the department, which claims that it relies completely on the information provided by Firm A, not knowing whether it is comprehensive and accurate.

Tracking Light Installation Costs

Every month, Firm A updates an Excel file (called SuiviFacturation), to keep track of the progress of installations (in terms of both the number of lights installed and billing done by the City). Every month, Firm A sends a series of bills to the SUM for the lights installed during the previous month.²² Before authorizing the payment of these bills, the SUM checks the number of lights that were installed during the billing period by extracting from the database the number of replaced lights that was loaded by Firm A. By comparing this data with the data from the previous month, the SUM is able to estimate the number of lights replaced for this billing month. If there are differences between this estimate and the information provided by Firm A with the current bills,²³ it notifies Firm A of the discrepancies, requesting that the bill in question be corrected. Once the correction is made and the new bill is obtained, the SUM authorizes its payment. However, we would like to point out two problems with this procedure. First, the steps to be followed for this process are not documented. The employee responsible for carrying out the process has a good command of the procedure, but since it is not documented, there is a risk here that the SUM will no longer be able to perform such checking, at least not as effectively, if the employee assigned to do it should leave. Moreover, both sources of information used by the SUM to do the checking are mainly from Firm A; the database from which the data is extracted is loaded by Firm A and the bills are also produced by Firm A. The SUM therefore has no oversight that is independent of Firm A to monitor the installation of lights. In this regard, the SUM has confirmed that it does not do a field check of the lights installed, and relies on the information provided by Firm A. This is how we found out that there was agreement between all the bills and the progress report produced by Firm A for two months selected at random (February 2019 and September 2019). However, as we pointed out above, this is a case of an artificial agreement, since all the information originates from the same source.

²² The contract for managing and installing lights for Firm A is not paid at a flat rate but is based on the number of lights installed.

²³ The SUM may take the view that even though a light was replaced, it is still defective and the light is not fully functional.

We also attempted to reconcile the billing data appearing in the SuiviFacturation file with the data in File A (Overall Project Monitoring Table — purchase and installation of lights). The exercise proved to be conclusive only for the months from October 2018 to May 2019, whereas data was available from September 2017 to September 2019. Therefore, there was agreement for only eight months out of 25, or 32%. The SUM explained that the discrepancy arises from the fact that the bills are entered in File A for the other months, including the deductions and taxes, which was not done for the months from October 2018 to May 2019. This leads us to conclude that the data entered in File A is not standardized, which limits its use for analyses by the SUM. It is worth repeating that File A is used mainly to check the bills issued by Firm A.

Overall Cost Tracking for the Project

This Project involves a large number of transactions involving the City, light suppliers and Firm A. We wanted to ensure that, other than the uniformity and agreement issues we identified in connection with the monitoring tools put in place by the SUM, as shown above, there was equivalence between the transactions authorized and reconciled using these tools and the information in the City's central financial system (the General Ledger) which, in the end, is the ultimate tool used to determine the total amount of expenses incurred for a project.

Based on data extracted from the transactions entered in the General Ledger for the Project accounting code from 2015 to 2020, we identified 61 entries that the SUM had not entered in its File A, which should cover all the expenses associated with the Project for a total of \$1.17 million. Table 4 shows the five firms for which the total amounts are the highest. In 2019 and 2020, 10 transactions associated with the Société de transport de Montréal (STM) were entered in the General Ledger under this SUM Project for a total of \$376,000. After checking, the SUM confirmed that the expenses paid to the STM had been erroneously charged to the wrong project. This was an error in inputting the unique accounting code specific to each project.²⁴ Based on this finding, we have concerns about the accuracy of the allocation of other transactions in Table 4 in the Project audited.

Our work of reconciling entries in the General Ledger and File A also enabled us to determine that the SUM file takes into account bills with two suppliers of LED lights, for a total of \$1.67 million, that are not found in the General Ledger (see Table 4). The total (in absolute value) of the discrepancies between the entries in the General Ledger and File A is therefore approximately \$2.84 million.²⁵ While, out of a total projected budget of \$110 million for the Project, these discrepancies account for only a 2.6% error, they nevertheless reveal a lack of oversight in the compilation and monitoring of expenses for the Project. Furthermore, in view of the incomplete compilation of expenses for the Project, both in File A and

²⁴ This observation was made by the Auditor General of the Ville de Montréal in connection with her audit of the City's financial statements.

²⁵ This discrepancy of \$2.84 million takes into account both the discrepancy of \$1.17 million for the 61 entries that do not appear in File A and the discrepancy of \$1.67 million for bills missing from the General Ledger.

in the General Ledger, we question the ability of the SUM to assert in its accountability reports to the Bureau des projets et programmes d'immobilisations (BPPI) that no cost overruns are projected for the Project.

TABLE 4

Total Discrepancies for Each Supplier in the General Ledger Entries and in the SUM Project Monitoring Table (File A)

	2015	2016	2017	2018	2019	2020	Total
Transactions entered in the General Ledger for the Project, but not found in the SUM Project Monitoring Table (File A)							
Société de transport de Montréal (STM)	\$0	\$0	\$0	\$0	\$124,208	\$251,972	\$376,180
Firm X.1	\$0	\$0	\$0	\$0	\$166,940	\$0	\$166,940
Firm X.2	\$12,250	\$43,543	\$70,188	\$26,989	\$0	\$0	\$152,970
Firm X.3	\$0	\$38,997	\$0	\$75,999	\$0	\$0	\$114,996
Firm X.4	\$0	\$102,721	\$0	\$0	\$0	\$0	\$102,721
Firm X.5	\$0	\$0	\$58,226	\$13,784	\$0	\$0	\$72,010
All other firms	\$11,305	\$75,433	\$58,541	\$94,319	\$40,784	\$(91,863)	\$188,519
Subtotal	\$23,555	\$260,694	\$186,955	\$211,091	\$331,932	\$160,109	\$1,174,336
Transactions entered in the SUM Project Monitoring Table (File A), but not found in the General Ledger for the Project							
Firm X.6	\$0	\$0	\$0	\$0	\$0	\$230,667	\$230,667
Firm X.7	\$0	\$0	\$0	\$0	\$1,026,072	\$410,124	\$1,436,196
Subtotal	\$0	\$0	\$0	\$0	\$1,026,072	\$640,791	\$1,666,863
TOTAL	\$23,555	\$260,694	\$186,955	\$211,091	\$1,358,004	\$800,900	\$2,841,199

3.2.A. Recommendation

We recommend that the Service de l'urbanisme et de la mobilité establish control mechanisms so that the files used for monitoring the Street Lighting System Upgrade Project contain comprehensive, consistent and accurate information, in order to ensure that it can do appropriate cost monitoring for a project of this scope.

3.2.B. Recommendation

We recommend that the Service de l'urbanisme et de la mobilité carry out a periodic control of the inventory of lights in the possession of the firm responsible for managing the Street Lighting System Upgrade Project, in order to ensure, in an independent manner, that the information obtained for this purpose is fair and accurate.

3.2.C. Recommendation

We recommend that the Service de l'urbanisme et de la mobilité do a periodic field check of the lights replaced as part of the Street Lighting System Upgrade Project, in order to ensure, irrespective of any information obtained from the firm responsible for managing the Street Lighting System Upgrade Project, that the lights were actually replaced and that the information obtained from this firm is fair and accurate.

3.2.D. Recommendation

We recommend that the Service de l'urbanisme et de la mobilité document the process for checking light installation invoices, in order to ensure continuity of monitoring independently from the person who is carrying it out.

3.2.E. Recommendation

We recommend that the Service de l'urbanisme et de la mobilité establish control mechanisms in order to ensure that only transactions actually associated with a project are charged to said project, for the purpose of providing fair, accurate accounting of changes in the costs of a project based on the Ville de Montréal's global financial data.

3.3. Accountability Reporting

Since 2010, the City has had in place a *Cadre de gouvernance des projets et des programmes de gestion d'actifs municipaux*, which provides a framework for the management of projects requiring an investment of more than \$50 million or more than \$10 million a year. These projects and programs must go through various phases and obtain the approval of elected officials in order to move forward and enter the operating phase (project implementation). Since April 20, 2015, an administrative framework²⁶ for developing an approval file for projects subject to the *Cadre de gouvernance des projets et des programmes de gestion d'actifs municipaux* has been in place which establishes a formal process for obtaining these authorizations in order to proceed to the next phase. The Project, which has an operating budget of approximately \$110 million and was adopted by city council on June 18, 2015, after the administrative framework came into effect, did not comply with this *Cadre de*

²⁶ C-OG-DG-P-15-001.

gouvernance and was not presented to the City's executive committee, in accordance with this management framework, in order to obtain authorization to proceed to the execution phase.²⁷ According to the SUM, this was not a large-scale project, which would explain why it did not follow this approval process. However, in view of the fact that the SUM submits quarterly accountability reports²⁸ to the BPPI,²⁹ we find it difficult to maintain that the Project was not considered large-scale. The Auditor General of Ville de Montréal, in her 2020 annual follow-up report, also discusses monitoring of the implementation of the *Cadre de gouvernance des projets et des programmes de gestion d'actifs municipaux*. We will therefore not go into the reasons here why the Project did not adhere to this governance framework.

Under the proposal the SUM made to the boroughs in 2015 to take responsibility for the Project, the department had not committed to monitor the progress of the Project with the boroughs. However, at the time we were conducting our audit, the boroughs complained that they were not receiving sufficient information on the progress of the Project. In particular, they wanted to know how the planning of street lighting conversion work for the future would affect their territories so that they would be better able to plan the operations they needed to carry out, either on these lights or related to other projects in their vicinity. They complained about the lack of visibility associated with the progress of the Project.

The boroughs also state that they do not know how to use the software for monitoring the functioning of the lights in real time (monitoring is made possible by nodes on each light that create a Smart System). Firm A must provide training to [TRANSLATION] "field equipment maintenance staff"³⁰ on the use of the Smart System, particularly with respect to general functional analysis of the system, its detailed operation, the different units or major components and their functions, as well as repair work, corrective measures, preventive maintenance and front-line troubleshooting for them. However, even though the Project is well under way and the boroughs are already doing maintenance and repair work on LED lights and Smart System components, the boroughs claim that they received no training in connection with the Smart System, from either Firm A or the SUM. The SUM told us, at the time of our audit that Firm A had not yet provided this training because the software program used to control LED lights had not yet been completed by a subcontractor of Firm A, even though it should have been completed in 2018. While we were finalizing our audit, the City was engaged in litigation with Firm A over the programming of the IT tool used to control the Smart System.

²⁷ This lack of compliance with the *Cadre de gouvernance des projets et des programmes de gestion d'actifs municipaux* and the administrative framework for the development of a project approval file does not mean that the Project was not authorized by elected officials, but rather that it was authorized gradually, each time a request was made to authorize the awarding of a service contract or light purchasing contract.

²⁸ In this regard, we noted that the SUM produces this accountability reporting at the frequency and according to the requirements established by the BPPI.

²⁹ The BPPI is responsible, on behalf of the Direction générale of the City, for implementing this *Cadre de gouvernance des projets et des programmes de gestion d'actifs municipaux*.

³⁰ Technical specifications in Call for tenders 15-14912.

As part of its contract for the management, coordination and installation of lights, Firm A had to [TRANSLATION] “place a monitoring tool/web application at the City’s disposal to observe the progress of work in real time and monitor the progress of each of the teams in the field”³¹. To meet this requirement, Firm A uses a commercial application marketed by Intel Opp that enables it to produce a map displaying the information contained in the database in which Firm A enters information on each light that is to be replaced or is replaced. The SUM posted a read-only version of this map online,³² without the technical details of each light. This map, which is seen by the SUM as a way of ensuring public accountability, gives the progress status of projects³³ for each street light on the City’s territory. However, since the Project does not concern street lights that are replaced as part of a road rehabilitation project (rehabilitation of the entire street and sidewalks), those are identified on this map as “PRR” (*Projet Réfection Routière*), without any subsequent updating after the rehabilitation has taken place, because Firm A, which is responsible for loading the database used to generate this map, does not manage the PRR. Thus, the SUM discloses information that it cannot update, since it is not fully responsible for it.

3.3.A. Recommendation

We recommend that the Service de l’urbanisme et de la mobilité ensure that all the department’s project managers follow and comply with the *Cadre de gouvernance des projets et des programmes de gestion d’actifs municipaux* and the administrative framework for the development of a project approval file for projects subject to this framework, in order to ensure that the necessary authorizations are obtained for the execution of future projects and to ensure accountability reporting to the Ville de Montréal’s Direction générale.

3.3.B. Recommendation

We recommend that the Service de l’urbanisme et de la mobilité periodically inform the boroughs of the progress status of the Street Light Conversion Project and regularly inform them of the areas where the next street light conversion work will take place, so that boroughs can plan their own civil engineering projects on their territory.

³¹ Call for tenders 17-16015.

³² https://intelopp.com/projects/montreal/maps/public_map_v2.html

³³ A colour-coded legend indicates whether the conversion is completed, additional work is required, a light is ready to be converted, the conversion is under way, a problem was encountered during the conversion or whether a road rehabilitation project is involved.

3.3.C. Recommendation

We recommend that the Service de l'urbanisme et de la mobilité ensure that the boroughs receive adequate, appropriate training for doing repair work, undertaking corrective measures and doing preventive maintenance and front-line troubleshooting on the different components of the Smart System that is connected to the light-emitting diodes lights, so that boroughs can work effectively and efficiently on these lights.

3.3.D. Recommendation

We recommend that the Service de l'urbanisme et de la mobilité either publish information related to street lights that are solely under its jurisdiction in the project of converting street lighting to light-emitting diodes or require all business units also performing such street light conversion work to provide it with information allowing it to update the interactive map once a road rehabilitation project is completed, in order to ensure that it releases comprehensive, accurate information to the public.

4. Conclusion

In 2017, the Ville de Montréal (“the City”) embarked on a Project to convert 132,500 high-pressure sodium (HPS) lights used for street lighting in the 19 boroughs to light-emitting diodes (LED) lights. This Project had several objectives, namely, to achieve energy and monetary savings (lower energy consumption and reduction of the maintenance and repair work needed) and to establish a smart communication network to allow monitoring of the functioning of the lights in real time.

As of March 2020, two thirds of the lights had been replaced and the Service de l’urbanisme et de la mobilité (SUM), which is responsible for the Project, anticipated that it would be entirely completed by the end of 2023. From a budget standpoint, commitments of \$110 million, which is the total value of the Project budget, had already been made. These commitments include the purchase of LED lights that are not yet installed and therefore do not contribute yet to the percentage of technical progress. Management and implementation of this Street Light Conversion Project was contracted out to a private firm, which outsourced its implementation to subcontractors. The firm is also responsible for purchasing the Smart System components, while the City purchases and provides it with lights.

Our audit leads us to conclude that the City, through this Street Light Conversion Project, will achieve and even surpass its objective of reducing energy consumption for street lighting, albeit with a delay from its initial timeline. While the City targeted 50% energy reductions, the magnitude of the reductions, based on data provided by the firm responsible for managing the project but not validated by the SUM, seems to be greater than 70%. However, we noted that even though the City was successful in generating energy savings, it was not monitoring management of the Project. In fact, it does not undertake a rigorous regular assessment of the energy savings generated by the Project. We had to work using the data provided by the firm responsible for managing the project to establish that the 50% target would be exceeded. Moreover, the City does not control the quality of information produced by the firm and submitted to Hydro-Québec and to the boroughs concerning the number and types of lights replaced and the monthly monetary savings that the boroughs can expect to achieve. We also identified errors in these monetary savings that the City could have detected before it forwarded the information to the boroughs if monitoring had been in place. The City does not do field checks, either, to make sure that the project is being implemented, and instead relies on the information it obtains from the firm responsible for managing the Project. Moreover, the City does not carry out an inventory of the lights that are purchased, installed and still in the firm’s warehouses in order to ensure that all the lights purchased are actually used for the City’s Project. We noted that the City uses several separate files to monitor the progress of the Project and that there is no agreement between the information found among these different files or between these files and the City’s General Ledger. Finally, we found that the boroughs audited are not sufficiently informed of the progress status of the Project.

Moreover, since there is no standard, defined structure for the roles and responsibilities for the repair and maintenance of these new lights across the central city, the boroughs and the firm responsible for managing the Project, the City was unable to prove to us that the objective of reducing maintenance costs has been achieved or was in the process of being achieved, and consequently, we cannot draw conclusions concerning this part of the mission objective. In fact, we noted that the approach taken to repair new lights that are still under warranty varies from one borough to the next. This leads the City to outsource to the firm repair work that the City itself should have handled, and as a result pay for work performed externally that should have been done under City management. We also noted that in some cases, the City responds too quickly when there is a lighting problem and that it handles the replacement of defective equipment itself. By acting in this way, the City denies the firm responsible for the Project or the suppliers the opportunity to take action, and, depending on the speed of repair and the number of defects, to enforce the penalties provided for in the calls for tenders. Moreover, the City was not able to prove to us that the warranty on the new lights remained valid if the City itself replaced defective components of these lights. Finally, even though the City created a clause in the call for tenders for the acquisition of lights allowing it to claim compensation for lights that did not have an adequate illumination performance, as well as the replacement of these lights, to date it has not conducted any photometric tests to assess this performance. We therefore find that the City does not enforce the compensation clauses provided for in all calls for tenders associated with this Project. However, since there was no repair register, we were not able to assess the extent to which the City failed to claim compensation from its suppliers within the scope of this Project.

In light of these findings, we have recommended, in particular, that the SUM:

- periodically assess the energy savings generated by the Project that show that these savings are at least similar to those that had been planned;
- control the quality and validity of the information forwarded to boroughs and third parties;
- develop a strategy for repairing lights and Smart System components and for managing warranties and inform the boroughs of the strategy;
- create a register of damaged, repaired and replaced lights and Smart System components, so that compensation can be managed more effectively under the warranties for this equipment;
- carry out a periodic control of the inventory of lights in the possession of the firm responsible for managing the Project and of the lights replaced and already installed;
- implement control mechanisms so that the Project tracking files contain comprehensive, consistent and accurate information and only the transactions actually associated with a project are accounted for correctly and charged to said project;

- ensure that the boroughs receive adequate, appropriate training for the purpose of maintaining and managing the lights and the various Smart System components;
- inform the boroughs periodically of the progress status of the Street Light Conversion Project.

This municipal Street Light Conversion Project yields energy savings benefits that appear to exceed expectations, even though the SUM has not officially validated the data that would allow it to assert this. From the standpoint of accountability reporting by the SUM, this is a project that can pass under the radar. However, in our estimation, all the City's projects, especially the large-scale projects, need to be monitored rigorously, and the departments responsible for them need to establish control mechanisms that can provide a guarantee of the quality and accuracy of the project-related data that is generated and shared with third parties. It is important to realize that, just because a project achieves its objectives, this does not necessarily mean that its implementation is adequately monitored, allowing the City to control every aspect of it.

5. Appendices

5.1. Objective and Evaluation Criteria

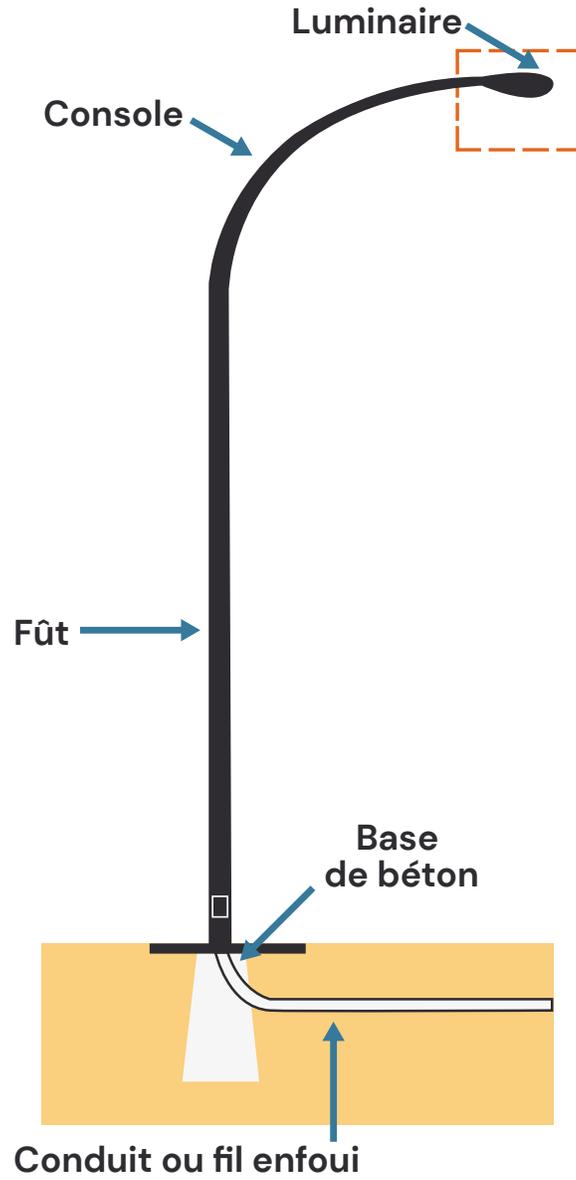
Objective

Ensure that the City's Street Lighting System Upgrade to light-emitting diodes (LED) helps achieve the projected savings in energy and maintenance costs.

Evaluation Criteria

- The City conducts comparisons of energy costs before and after the lights are converted to LED, in order to assess the savings realized with the new street lighting system.
- The units responsible for the maintenance and repair of lights have access to clear processes and adequate knowledge to ensure that LED lights are repaired quickly and effectively.
- The Project is conducted in a manner consistent with best project management practices promoted by the Bureau des projets et programmes d'immobilisations and the *Cadre de gouvernance des projets et des programmes de gestion d'actifs municipaux*.

5.2. Diagram of Street Lamp Components



Source: SUM

