



REPORT TO MAYOR AND COUNCIL

PRESENTED: JULY 8, 2019 - REGULAR AFTERNOON MEETING
FROM: ENGINEERING DIVISION
SUBJECT: LED STREET LIGHTING CONVERSION PROJECT

REPORT: 19-114
FILE: 5400-03

RECOMMENDATION:

That Council endorse an implementation strategy for the replacement of all existing high-pressure sodium street lighting fixtures throughout the Township with light-emitting diode light fixtures with the associated funding request, currently estimated at \$4.3 million, to be included as part of the 2020 budget for Council's consideration approval.

EXECUTIVE SUMMARY:

The Township of Langley currently owns, operates and maintains over 7,000 high-pressure sodium (HPS) streetlights, which illuminate both roadways and pedestrian walkways. Annually, these fixtures consume approximately 17,000 Giga Joules (GJ) of energy and cost the Township approximately \$600,000 in utility and maintenance costs. Although they carry higher initial capital costs, recent studies have determined that on a full life-cycle basis, light-emitting diode (LED) street lighting fixtures outperform conventional HPS street lighting fixtures with significant superior lighting quality and performance, reduced operating costs, and safety benefits to all road users.

To date, staff have evaluated the Township's existing street lighting infrastructure, reviewed best practices across the region, conducted LED field tests, and completed a financial business case analysis for a comprehensive LED conversion strategy within the Township. Based on this research, staff recommend replacing all existing Township-owned HPS street lighting with new LED fixtures, and updating the standard streetlight models in the Subdivision and Development Servicing Bylaw 2011 No. 4681 to require all new development projects to install LED fixtures.

If implemented, the LED Street Lighting Conversion Project is projected to result in approximately 50% reduction in energy use over the currently installed HPS fixtures. The anticipated total capital cost for implementation is estimated at approximately \$4.3 Million with a forecasted combined annual utility (\$340,000) and maintenance savings (\$40,000) of approximately \$380,000. Based on the anticipated savings, the project is calculated to have a payback of approximately 11.5 years.

This proposed Conversion Project is consistent with and will augment BC Hydro's plans who are currently working to upgrade all of their leased streetlights around the Province to LED lighting, including approximately 1,600 throughout the Township.

PURPOSE:

To obtain Council's endorsement for the implementation of an LED Street Lighting Conversion Project and to submit the necessary funding request as part of the 2020 capital budget for Council's consideration.

LED STREET LIGHTING CONVERSION PROJECT

Page 2

BACKGROUND/HISTORY:

Township-owned HPS streetlights illuminate both roadways and pedestrian walkways and are a combination of 6,600 Standard HPS fixtures and 400 ornamental HPS fixtures. Together, these fixtures consume 17,000 GJ and cost the Township approximately \$600,000 annually to operate.

In addition to the 7,000 HPS streetlights owned by the Township, there are 1,600 leased HPS streetlights, predominately in rural neighbourhoods, that are owned and maintained by BC Hydro. The LED conversion project only includes the Township-owned HPS streetlights. BC Hydro is currently working to upgrade all of their leased streetlights around the Province to LED.

Staff have completed a comprehensive review and evaluation of the latest advancements in LED street lighting technology. Recent studies have determined that the latest LED street lighting fixtures outperform existing HPS street lighting fixtures and can be directly retrofitted on existing freestanding steel poles, without pole modifications.

A summary of substantiated benefits and opportunities of the LED Conversion Project are as follows:

- Electricity for street lighting represents 19% of the Township's total electrical use;
- The Township's 7,000 existing streetlights consume 17,000 GJ of electricity at a cost of over \$600,000 annually;
- LED streetlights will result in over a 50% energy savings over the currently installed HPS fixtures;
- Energy expenses represent an opportunity to reduce operating costs, while also advancing the Township's energy and greenhouse gas reduction objectives;
- The lifecycle of LED streetlights is expected to be over 20 years, compared to the average seven year life expectancy of the current HPS streetlights, this reduces maintenance costs by approximately 80%; and
- LED technology reduces light trespass, improves lighting quality and performance, road safety, and the environment.

Corporate Energy Management Policy and Strategic Energy Management Plan

In 2017, Council adopted the Corporate Energy Management Policy and Strategic Energy Management Plan (SEMP) with the purpose of promoting energy conservation, increasing energy efficiency and reducing greenhouse gas emissions in municipal operations.

The policy and SEMP include several initiatives that support the conversion of Township street lighting to LED, including:

- To implement initiatives identified in the SEMP; including developing a plan to transition existing streetlights to LED;
- business case development to evaluate energy and maintenance costs and savings over the lifespan of new or retrofitted assets that have a measurable impact on energy consumption or greenhouse gas emissions; and
- Selecting the best available technology for facilities, fleet and infrastructure where economically feasible.

LED STREET LIGHTING CONVERSION PROJECT

Page 3

Sustainability Charter

The Township's Sustainability Charter has several goals that would support the conversion of Township street lighting to LED, including:

- To make innovative green investments in infrastructure;
- To provide safe and affordable transportation infrastructure; and
- To provide leadership for sustainability practice and innovation.

Official Community Plan

The Township's Official Community Plan Bylaw 1979 No. 1842, as amended, (OCP) contains provisions relating to energy and climate action. A number of policies in the OCP would support the conversion of Township street lighting to LED, including:

- Policy 3.8.6 suggests considering roadway construction standards that fit within a "complete streets" strategy to reflect the needs of all users and protect and preserve the community's environment and character;
- Policy 3.10.5 suggests prioritizing infrastructure maintenance, renewal, and maintenance programs and projects to reduce environmental, social, and financial risks;
- Policy 3.16.19 suggests ensuring decision making is structured to achieve energy goals and greenhouse gas emissions reduction targets; and
- Policy 3.17.1. Support the British Columbia Climate Action Charter by developing strategies to achieve the goals of the agreement:
 - be carbon neutral in municipal operations by 2012
 - create complete, compact, energy-efficient rural and urban communities

Regional LED Street Lighting Projects

Many municipalities across the Metro Vancouver region have initiated or fully implemented the transition to LED street lighting, including the following:

- City of Surrey
- City of Abbotsford
- City of Langley
- City of Burnaby
- City of Coquitlam
- City of Richmond
- City of Vancouver
- District of North Vancouver
- City of North Vancouver
- City of West Vancouver
- District of Saanich
- City of Kamloops
- City of Victoria

LED STREET LIGHTING CONVERSION PROJECT

Page 4

The majority of these jurisdictions have chosen to install NXT or American Electric LED fixtures, in combination of 3000K and 4000K colour temperatures, supplied through the Province's Corporate Supply Agreement (CSA). Jurisdictions have also chosen a variety of LED ornamental fixtures that fit within their given neighbourhood aesthetics.

DISCUSSION ANALYSIS:

Staff have recently completed a detailed inventory of all existing street lighting, field tests for various LED fixtures, consultation with industry experts and other municipalities, and a financial business case to formulate recommendations for the LED Conversion Project that maximizes both performance and value.

LED Field Tests

Since early 2014, staff have completed several LED street lighting field tests to assess various aspects of LED street lighting technology including light quality, control, uniformity, maintenance requirements, and life expectancy. LEDs were installed with new construction projects or when HPS lamps were at end of life. LED field tests were conducted in the following areas of the Township:

- Glover Road and University Drive;
- Fraser Highway from 268 Street to 270 Street;
- Surrounding area of Routley Park, including 198A Street and 70 Avenue;
- Walnut Grove Neighbourhood - areas East of 212 Street and North of 88 Avenue;
- Murrayville Neighbourhood along 48 Avenue and 224 Street; and
- Roundabout on 232 Street and 56 Avenue.

Based on the analysis of existing infrastructure, field tests and industry and regional best practices, staff recommend the following:

- Replace all existing HPS street lighting fixtures throughout the Township with new LED street lighting fixtures by 2021;
- Consider borrowing from the Municipal Finance Authority to obtain the necessary capital funding for implementation of the full-scale project; and
- Update the standard streetlight models in the Subdivision and Development Servicing Bylaw to ensure that all new streetlights installed are LED's.

Street Lighting Infrastructure

NXT LED lighting fixtures manufactured by LED Roadway Lighting (LRL) are the preferred lighting product to replace the 6,600 existing Township-owned standard HPS streetlights. The NXT model series, have been pre-qualified as part of the CSA for the supply and delivery of LED Streetlight Luminaires.

The CSA is a centralized procurement offering to assist public entities across the Province in converting to LED streetlights. Purchasing from the CSA ensures competitive pricing through bulk buying but also provides assurances on the product selection and quality, based on trusted experience from the industry. LED lighting products offered as part of the CSA process have undergone extensive evaluation related to compliance with applicable standards, including a product's ability to meet:

LED STREET LIGHTING CONVERSION PROJECT

Page 5

- Illumination Engineering Society of North America (IESNA) design/testing criteria, including backlight, uplight and glare ratings;
- American National Standards Institute (ANSI) and Institute of Electrical and Electronics Engineers (IEEE) surge voltage and vibration specifications;
- Federal Communications Commission (FCC) 47 CFR part 15 radio emission rules;
- CSA, ULC or ETLc certification;
- Restriction of Hazardous Substances (RoHS) Directive compliance; and
- Design Lights Consortium Qualified Products List qualifications.

There are only five LED street lighting fixtures included in the CSA. The NXT series was chosen as the preferred fixture model based on:

- Provincial CSA performance criteria;
- Eligibility as direct maintenance for HPS lighting fixtures by the BC Ministry of Transportation and Infrastructure (Recognized Products List – published March, 2017);
- Number of available light distribution patterns, integrated dimming technology, and driver current variance to meet varying street lighting needs;
- Manufacturing point of origin;
- Product warranty; and
- Purchase price.

The Township's 400 existing ornamental HPS streetlights will also need to be converted to LED fixtures. As there are various ornamental fixture models throughout the community, staff will need to procure various LED models that match the existing aesthetics established for each neighbourhood.

Preferred fixture models and colour temperature details are outlined in Table 1.

Table 1: Preferred Fixture Models and Colour Temperatures

Area of Use	Residential Roadways	Arterial/Collector Roads	Intersections	Pedestrian Walkways
Preferred LED Fixture	<ul style="list-style-type: none"> • NXT-Series • Ornamental LEDs 	<ul style="list-style-type: none"> • NXT-Series • Ornamental LEDs 	<ul style="list-style-type: none"> • NXT-Series • Ornamental LEDs 	<ul style="list-style-type: none"> • NXT-Series • Ornamental LEDs
Colour Temperature	3000K	4000K	4000K	3000K-4000K

Staff will retain the services of a qualified professional to conduct lighting models for each type of fixture conversion and road configuration to ensure sufficient lighting levels and light uniformity to meet current roadway lighting standards. The modelling process will also ensure the appropriate LED fixture is chosen to reduce the amount of wasted light and “uplight” or “skyglow”, ensuring light is focused on roads and walkways where drivers and pedestrians will benefit from it the most.

To ensure all future street lighting infrastructure installed throughout the Township of Langley is LED, staff have proposed updates to the street lighting fixture models in the Subdivision and Development Servicing Bylaw to be considered by Council in 2019. The updates include the addition of LED street lighting fixture models and the removal of HPS or high-intensity discharge fixtures.

LED STREET LIGHTING CONVERSION PROJECT

Page 6

Energy and Maintenance Savings

The replacement of the existing HPS streetlights with LED streetlights throughout the community will result in annual energy savings of 50%, with energy costs reduced by \$340,000 annually.

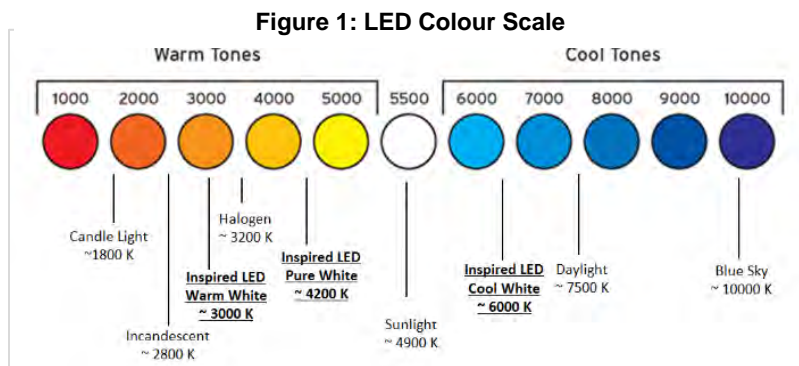
HPS fixtures require re-lamping and cleaning every five to seven years. The LED fixtures recommended have a life expectancy of 20 years and do not require re-lamping, thereby significantly reducing maintenance frequency and associated costs. As a result, with LED lighting installed throughout the Township of Langley, maintenance cost savings of approximately \$40,000 per year are expected, a savings of 80%.

With full replacement of all HPS street lighting, there will be a cost savings of approximately \$380,000 per year, based on current inventory.

Colour Temperature

The Township of Langley's existing HPS streetlight fixtures emit a warm yellow light that measures a colour temperature of approximately 2200K.

LED streetlights come in various temperatures. The temperature of the light depends on the amount of red (warm) or blue (cool) colour in the output (see Figure 2). LED fixtures are now supplied in "warmer" 3000K temperatures.



Compared to HPS fixtures, LED fixtures offer superior lighting colour, making it easier for road users to see pedestrians and signs. Control of light concentration and improved lighting uniformity is also achievable with LED's, leading to reduced road user eyestrain and fatigue.

The 3000K LED fixtures are endorsed by the International Dark Sky Association, as they minimize glare and intensity. This colour temperature avoids the blue-rich light that potentially disrupts wildlife and human sleeping/eating/exercising patterns. Staff will install 3000K lighting in most residential applications, and reserve the use of 4000K lighting for high volume vehicle corridors where additional illumination is required.

Adaptive Technologies

The recommended LED NXT fixtures, include a standardized socket for the implementation of adaptive technologies (dimming, Wi-Fi, signal alerts, data collection). These adaptive technologies can be administered in the future once the technology is more widely tested and costs for adding these adaptive features decreases.

Environmental Benefits

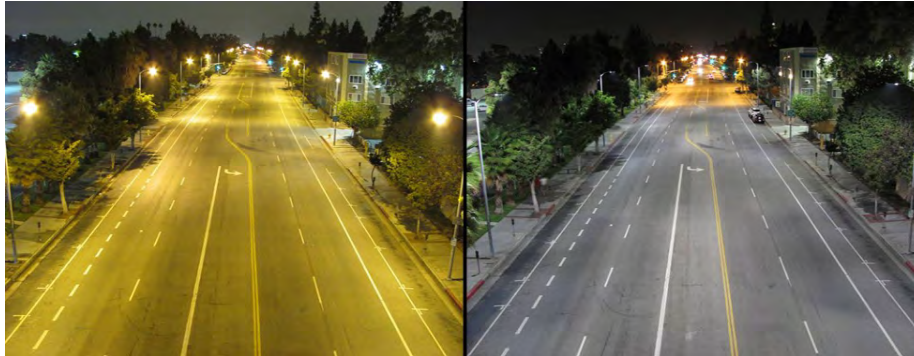
Staff have undertaken considerable research in order to assess the environmental benefits of LED streetlights compared to the existing HPS lighting infrastructure in the Township of Langley. Below are environmental benefits that will be realized by the project:

LED STREET LIGHTING CONVERSION PROJECT

Page 7

- Compared to HPS, LEDs offers superior lighting colour, making it easier for road users to see pedestrians and signs and improves drivers' ability to assess distance more accurately;
- LED lighting achieves control of light concentration and improved lighting uniformity, leading to reduced road user eyestrain and fatigue as well as reduced light spillage onto neighboring houses and the sky. Figure 3 provides a comparison of HPS and LED street lighting;

Figure 2: HPS streetlight illumination (left) compared to LED streetlight illumination (right)



- LED fixtures are designed to manage both light pollution and light trespass. Light pollution that enters private, undesirable space is referred to as light trespass. Using the inherently good directional properties of LEDs, and a flat lens, there is a reduction in the amount of light radiating from it compared to the round glass style HPS fixtures. Staff will assess the wattage and reflector/optic design for each location to control the amount and directional properties and prevent unwanted trespass; and
- To help address concerns regarding wildlife and human sleep pattern impacts, staff have specified a relatively warm colour temperature output of 3000K in residential areas and 4000K on major roadways and intersections. These colour temperatures avoid the blue-rich light that potentially disrupts wildlife and human sleeping/eating/exercising patterns. LED fixtures are also expected to be much less attractive to nocturnal insects compared to HPS lighting technology due to lack of ultraviolet and infrared spectrum emitted by LED lighting.

Staff will work with a qualified professional to conduct engineered modelling for each type of fixture replacement and road configuration to ensure sufficient lighting levels and light uniformity to meet current roadway lighting standards

Project Implementation

Should Council provide support for the project and authorize staff to submit the associated funding request as part of the 2020 budget process and subsequently provide approval, implementation would commence in 2020 and is anticipated to be completed by 2021.

FINANCIAL ANALYSIS:

The anticipated total capital cost for implementation of the LED Street Lighting Conversion Project is expected to be approximately \$4.3 Million. Due to the large capital investment required for the project, staff are considering borrowing from the Municipal Finance Authority as part of the 2020 budget for Council's consideration.

LED STREET LIGHTING CONVERSION PROJECT

Page 8

Through this financing, the project would incur a 3.14% interest rate (current rate) compounded semi-annually. The annual loan payments will be \$297,000 per year for the life of the project (20 years) which includes annual principal and interest payments. The payments for the loan would be re-paid through utility and maintenance cost savings. The savings are expected to increase every year because of rising BC Hydro rates and cumulatively could equate to an approximate average of \$380,000 annually. Through these savings, this project has a payback of 11.5 years.

The project's Net Present Value (NPV) is \$1.8 Million. This overall value of the project takes into account the capital cost of the LED lighting fixtures, cost of financing, installation costs, maintenance and energy savings over the 20-year life of the project (including anticipated BC Hydro rate increases). The savings are based on a comparison to the alternative "business as usual" model of maintaining existing HPS roadway lighting over the same 20 year period.

The estimated greenhouse gas savings is around 25 tonnes of CO₂e per year. Although not very significant, because electricity from BC Hydro is 98% renewable, the benefits of this project lie on the improved road safety, maintenance and electrical cost savings.

Staff did assess a number of different funding avenues for the LED Street Lighting Conversion Project including possible grant opportunities. Unfortunately, both BC Hydro and the Federation of Canadian Municipalities (FCM) no longer offer grants for LED street lighting as the technology is considered mainstream and no longer innovative. We also considered an Energy Savings Performance Contract (ESCO) but using a loan from the MFA would be favourable as the interest rate would be much lower.

Respectfully submitted,

Ryan Schmidt
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for
ENGINEERING DIVISION

Respectfully submitted,

Roeland Zwaag
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for
ENGINEERING DIVISION

This report has been prepared in consultation with the following listed departments.

CONCURRENCES	
DIVISION / DEPARTMENT	NAME
FINANCE	S. Nam