

TOWN OF BON ACCORD POLICY STATEMENT

SECTION: Administration

POLICY NO.: 15.51

SUBJECT: LIGHT EFFICIENT COMMUNITY POLICY

RESPONSIBLE AUTHORITY: Administration Department

REVIEWED & APPROVED BY COUNCIL: February 17, 2015

PURPOSE AND INTENT:

To provide a framework for Council and a set of minimum standards for the adoption of a light use policy promoting efficient and environmentally responsible lighting in accordance with the Model Lighting Ordinance (MLO).

POLICY STATEMENT:

The Town of Bon Accord will adopt a lighting ordinance which achieves the minimum requirements of the Model Lighting Ordinance created by the International Dark-Sky Association (IDA), the Illuminating Engineering Society of North America (IES), and the Transportation Association of Canada (TAC). The Town is updating their Light Efficient Community Policy to facilitate an application to the International Dark-Sky Association for the designation of an IDA Dark Sky Community, the first such designation to be awarded in Canada.

DEFINITIONS:

1. **“Absolute photometry”** is a photometric measurement (usually of a solid-state luminaire) that directly measures the footprint of the luminaire. Reference Standard IES LM-79.
2. **“Astronomic Time Switch”** is an automatic lighting control device that switches outdoor lighting relative to time of solar day with time of year correction.
3. **“Backlight”** is a reference to an exterior luminaire, lumens emitted in the quarter sphere below horizontal and in the opposite direction of the intended orientation of the luminaire. For luminaires with symmetric distribution, backlight will be the same as front light.
4. **“BUG”** is luminaire classification system that classifies backlight (B), uplight (U) and glare (G).

5. **“Canopy”** is a covered, unconditioned structure with at least one side open for pedestrian and/or vehicular access. (An unconditioned structure is one that may be open to the elements and has no heat or air conditioning.)
6. **“Common Outdoor Areas”** One or more of the following: a parking lot; a parking structure or covered vehicular entrance; a common entrance or public space shared by all occupants of the domiciles.
7. **“Correlated Colour Temperature”** or CCT is a measure of light source color appearance defined by the proximity of the light source's chromaticity coordinates to the blackbody locus, as a single number rather than the two required to specify a chromaticity.
8. **“Development Officer”** is an official of Bon Accord appointed, according to the procedures authorized by Town Council, to act as a development authority according to the *Municipal Government Act*.
9. **“Emergency Conditions”** is lighting that is only energized during an emergency; lighting fed from a backup power source; or lighting for illuminating the path of egress solely during a fire or other emergency situation; or, lighting for security purposes used solely during an alarm.
10. **“Footcandle”** The unit of measure expressing the quantity of light received on a surface. One footcandle is the illuminance produced by a candle on a surface one foot square from a distance of one foot. One footcandle is equal to one lumen per square foot or approximately 10.76391 lux.
11. **“Forward Light”** For an exterior luminaire, lumens emitted in the quarter sphere below horizontal and in the direction of the intended orientation of the luminaire.
12. **“Fully Shielded Luminaire”** is a luminaire constructed and installed in such a manner that all light emitted by the luminaire, either directly from the lamp or a diffusing element, or indirectly by reflection or refraction from any part of the luminaire, is projected below the horizontal plane through the luminaire's lowest light-emitting part.
13. **“Glare”** is lighting entering the eye directly from luminaires or indirectly from reflective surfaces that causes visual discomfort or reduced visibility.
14. **“Hardscape”** is permanent landscape improvements to a site including parking lots, drives, entrances, curbs, ramps, stairs, steps, medians, walkways and non-vegetated landscaping that is three (3) metres or less in width. Materials may include concrete, asphalt, stone, gravel, etc.
15. **“Hardscape Area”** is the area measured in square metres of all hardscape. It is used to calculate the Total Site Lumen Limit in both the Prescriptive Method and Performance Methods. Refer to Hardscape definition.
16. **“Hardscape Perimeter”** is the perimeter measured in linear metres and is used to calculate the Total Site Lumen Limit in the Performance Method. Refer to Hardscape definition.

17. **“IDA”** is the International Dark-Sky Association.
18. **“IESNA”** is the Illuminating Engineering Society of North America.
19. **“Illuminance”** is the total luminous flux incident on a surface, per unit area. It is a measure of how much the incident light illuminates the surface, correlated with brightness perception.
20. **“Initial Lumens”** is the amount of light output from a lamp when it is new. For a metal halide lamp, these ratings are averages based on photometry at rated lamp watts after 100 hours of operation.
21. **Lamp** is a generic term for a source of optical radiation (i.e. “light”), often called a “bulb” or “tube”. Examples include incandescent, fluorescent, high-intensity discharge (HID) lamps, and low pressure sodium (LPS) lamps, as well as light-emitting diode (LED) modules and arrays.
22. **“Landscape Lighting”** is lighting of trees, shrubs, or other plant material as well as ponds and other landscape features.
23. **“Light Efficient Community”** is a community that uses lighting responsibly. It uses the most effective and efficient artificial lighting available to minimize energy waste, glare, light trespass and pollution by employing designs, measures, legislation and good lighting practices. By doing so the community is able to reduce energy costs and its carbon footprint while preserving the natural environment and ensuring health, safety, and a high quality of life for all.¹
24. **“Lighting Equipment”** is equipment specifically intended to provide gas or electric illumination, including, but not limited to, lamp(s), luminaire(s), ballast(s), poles, posts, or lens(es), and related structures, electrical wiring, and other necessary or auxiliary components.
25. **“Light Pollution”** is excessive, misdirected, or obtrusive artificial light which competes with starlight in the night sky for urban residents. This light has adverse health effects on urban residents by interrupting the circadian rhythm as well as surrounding ecosystems.
26. **“Light Trespass”** means the shining of light produced by a luminaire beyond the boundaries of the desired application or property on which it is located.
27. **“Lighting Zone”** is an overlay zoning system establishing legal limits for lighting of particular parcels, areas, or districts in a community.
28. **“Low Voltage Lighting”** is lighting powered at less than 15 volts and limited to luminaires having an initial rated luminaire lumen output of 525 lumens or less.
29. **“Lumen”** is the photometric unit of light output and the unit of measure used to quantify the amount of light produced by a lamp or emitted from a luminaire (as distinct from ‘watt,’ a measure of power consumption).

¹This definition was adopted by Council on 07 February 2012 in Council Meeting-Resolution 12.29.

30. **“Luminaire”** is a complete lighting unit or fixture, consisting of a lamp (bulb), or lamps and ballast(s) (when applicable), together with the parts designed to distribute the light (reflector, lens, diffuser), to position and protect the lamps, and to connect the lamps to a power supply.
31. **“Luminaire Efficiency”** is a ratio of the light emitted by a luminaire to the light emitted by the lamps inside the luminaire.
32. **“Luminaire Lumens”** is a calculated sum of the initial lamp lumens for all lamps within an individual luminaire, multiplied by luminaire efficiency. If the efficiency is not known for a residential luminaire, it shall be assumed to be 70%. For luminaires with absolute photometry per IES LM-79, it is the total luminaire lumens. The lumen rating of a luminaire assumes the lamp or luminaire is new and has not depreciated in light output.
33. **“Lux”** is the International System of Units (SI) unit of illuminance. One lux is one lumen per metre squared. 1 Lux is a unit of incident illuminance approximately equal 1/10 footcandle.
34. **“Model Lighting Ordinance (MLO)”** is a sample ordinance created by the International Dark-Sky Association (IDA) and the Illuminating Engineering Society (IES) which establishes ‘best practices’ in the use and applications of outdoor lighting. This ordinance suggests regulating the use of outdoor light to minimum recommended levels for night-time safety, utility, security, productivity, enjoyment and commerce. By achieving this safe minimum level of lighting the goals of reducing adverse offsite lighting such as light trespass, obtrusive light, light pollution, and sky glow are achieved.
35. **“Mounting height”** is the height of the photometric centre of a luminaire above grade level. The horizontal spacing of luminaires is often measured in units of mounting height. For example, the luminaires can be spaced at 4 mounting heights apart.
36. **“New lighting”** is lighting for areas not previously illuminated; newly installed lighting of any type except for replacement lighting or lighting repairs.
37. **“Outdoor Lighting”** is lighting equipment installed within the property line and outside the building envelopes, whether attached to poles, building structures, the earth, or any other location; and any associated lighting control equipment.
38. **“Partially shielded luminaire”** is a luminaire with an opaque top, translucent or perforated sides that is designed to emit most light downward.
39. **“Pedestrian Hardscape”** is stone, brick, concrete, asphalt or other similar finished surfaces intended primarily for walking, such as sidewalks and pathways.
40. **“Photometry”** is the science of the measurement of light, in terms of its perceived brightness to the human eye. In modern photometry, the radiant power at each wavelength is weighted by a luminosity function that models human brightness sensitivity.
41. **“Photoelectric Switch”** is a control device employing a photocell or photodiode to detect daylight and automatically switch lights off when sufficient daylight is available.

42. **"Property line"** is the edges of the legally defined extent of privately owned property.
43. **"Relative Photometry"** is photometric measurements made of the lamp plus luminaire, and adjusted to allow for light loss due to reflection or absorption within the luminaire. Reference Standard IES LM-63.
44. **"Repair"** is reconstruction or renewal of any part of an existing luminaire for the purpose of its ongoing operation, other than re-lamping or replacement of components including capacitor, ballast or photocell. Note that retrofitting a luminaire with new lamp and/or ballast technology is not considered a repair and for the purposes of this ordinance the luminaire shall be treated as if new. "Repair" does **not** include normal re-lamping or replacement of components including capacitor, ballast or photocell.
45. **"Replacement Lighting"** is lighting installed specifically to replace existing lighting that is sufficiently broken to be beyond repair.
46. **"Shielded Directional Luminaire"** is a luminaire that includes an adjustable mounting device allowing aiming in any direction and contains a shield, louver, or baffle to reduce direct view of the lamp.
47. **"Sign"** is advertising, directional or other outdoor promotional display of art, words and/or pictures.
48. **"Sky Glow"** is the brightening of the nighttime sky that results from scattering and reflection of artificial light by moisture and dust particles in the atmosphere. Sky glow is caused by light directed or reflected upwards or sideways and reduces one's ability to view the night sky.
49. **"Temporary lighting"** is lighting installed and operated for periods not to exceed 60 days, completely removed and not operated again for at least 30 days.
50. **"Time Switch"** is an automatic lighting control device that switches lights according to time of day.
51. **"Unshielded Luminaire"** is a luminaire capable of emitting light in any direction including downwards.
52. **"Uplight"** is a reference to an exterior luminaire, lumens emitted or radiated in the hemisphere at or above the horizontal plane.
53. **"Vertical Illuminance"** is illuminance measured or calculated in a plane perpendicular to the site boundary or property line.
54. **"Watt"** is a derived unit of power. The unit, "W" is defined as joule per second and can be used to express the rate of energy conversion to light with respect to time.

PROCEDURES:

1. All new or retrofitted luminaires on public or private land within the legal and corporate limits of the Town of Bon Accord shall comply with the minimum requirements of the MLO, namely:
 - a. All lighting fixtures or luminaires over 1000 lumens initial lamp output shall be fully shielded, AND;
 - b. Restrictions on total amount of unshielded lighting, such as a limit on lumens per acre or total site lumens in unshielded fixtures, AND;
 - c. A policy to address over-lighting, such as energy density caps, lumens/acre caps, or maximum illuminance specifications, AND;
 - d. Any outdoor lighting owned by the Town of Bon Accord installed after the adoption of this *Policy* shall have a Correlated Colour Temperature (CCT) of 3,300° K or less. It is recommended that all lighting installed follow this CCT limitation.
 - e. A draft ordinance shall be attached in the Light Efficient Community Bylaw.

2. This Policy shall apply to all luminaires lawfully installed and operational since the adoption of Resolution 12.29, passed unanimously by Council on 07 February 2012. This previous Policy created an exception to allow for the “grandfathering” of existing luminaires. All grandfathered luminaires must comply with the Light Efficient Community Bylaw. Upon adoption of this Policy, the exemptions shall be as follows:
 - a. Permanent Exemptions:
 - i. Previously Existing Fixtures;
 - ii. Fossil Fuel Light;
 - iii. Federal and Provincial Facilities;
 - iv. Emergency Conditions;
 - v. Holiday or Seasonal Lighting; OR
 - vi. Event Lighting.

 - b. Special Requirements:
 - i. Regional or County Airports;
 - ii. Correctional Institutions.

 - c. Any exemptions not covered by the above shall be dealt with by the Chief Administrative Officer of the Town of Bon Accord or their designated officials or assignees.

 - d. A full description of the above exemptions is found in the Light Efficient Community Bylaw.

3. Upon adoption of this Policy by council, this Policy will be integrated into all related Town policies, standards and regulations, including, but not limited to the Engineering Servicing Standards, the Municipal Development Plan, and the Land Use Bylaw. These policies will address the specific needs of stakeholders in the Town and be created in tandem with educational programs for Town staff, residents and businesses. These policies will respect the following principles:

- a. The Town of Bon Accord will adopt policies and regulations to prevent the installation of any lighting on Town-controlled/owned/operated property that is not dark sky compliant. Further it agrees to continue to implement reasonable lighting curfews on Town-controlled properties and facilities. Further, the Town agrees to install adaptive controls where appropriate and feasible.
- b. Lighting will be used where it is needed, when it is needed, and at levels suited to the required task(s). In some cases, such as natural areas, this may mean a total absence of artificial light. Council or administration will create appropriate lighting zones as defined in the Light Efficient Community Bylaw.
- c. All new or retrofitted luminaires shall employ adaptive controls and reasonable curfews such as but not limited to motion detection sensors, timers, wireless remote monitoring and turn on/off capabilities, photo sensitive light controls, etc. Reasonable curfews shall be determined for all non-essential lights.
- d. Lighting technology will be selected to address visibility needs in the most energy efficient form that is practical.
- e. Luminaires will confine light to the area(s) needing illumination.
- f. Light trespass will be minimized.
- g. Lighting that creates unsafe conditions or harmful glare will not be permitted.
- h. New outdoor lighting fixtures shall be allowed when new Town owned buildings and infrastructure are constructed and when existing buildings and infrastructures are modified with physical alterations or by a change of use and the need for outdoor lighting to provide nighttime safety and utility is deemed necessary by the Town. New lighting fixtures may also be installed on existing buildings and infrastructure in the case where the Town determines that a hazardous nighttime situation exists.
- i. Nothing in this Policy shall be interpreted in such a way that prevents adequate lighting on roadways or other similar public spaces in order to ensure public safety. The definition of adequate lighting will be guided by accepted engineering standards and principles of Crime Prevention through Environmental Design.
- j. Voluntary light curfews will be encouraged for all residential, commercial, recreational and institutional use of exterior night time illumination.
- k. All types of outdoor lighting are subject to this Policy, including, but not limited to light for streets, trails, signs, walls, and landscaping.

ROLES AND RESPONSIBILITIES

The role of **Administration** is to:

1. Ensure alignment of this *Policy* with the Strategic Plan and Integrated Community Sustainability Plan.
2. In collaboration with Planning and Development, oversee creation of appropriate lighting zones and ensure they remain up to date in accordance with the Light Efficient Community Bylaw.
3. Draft a new class of business license which incorporates membership into the IDA and adoption of the dark sky principles by the applicants.

The role of **Planning and Development** is to:

1. Update the Municipal Development Plan and Land Use Bylaw to reflect the principles and goals of this *Policy*.
2. Review all outdoor lighting plans of projects in development and applying for construction permits.
3. Establish lighting zones for existing development and ensure all future development follows the goals and aims of this *Policy*.
4. Provide exceptions for certain intermittent activities such as construction and holiday lighting, while ensuring the goals and principles of this *Policy* remain intact.
5. Develop and implement plans to retrofit existing outdoor lighting owned by the Town to ensure its compliance with this *Policy*.
6. Work with private entities to retrofit lighting on land not owned by the Town to achieve the overall goal of a reduction in light pollution and light trespass in town.
7. Adopt new light efficient standards within the Engineering Services Standards applicable to all zones and land uses.

The role of **Operations** is to:

1. Update lifecycle programs to reflect the principles of this *Policy* and related Schedules as it relates to outdoor lighting.
2. Replace non-conforming luminaires with conforming luminaires anytime repair or replacement to outdoor facility lights is required.
3. Introduce automatic time switches to new and existing facility lights so that luminaires are only lit when facilities are in use.
4. Develop and implement plans to replace non-conforming luminaires with conforming luminaires when upgrading any Town infrastructure.

The role of **Arena, Parks, and Recreation** is to:

1. Update the Open Space and Recreation Facilities Strategy to reflect the principles of this *Policy*.
2. Replace non-conforming luminaires with conforming luminaires when upgrading outdoor lights in public parks and trails, or any time major repair or replacement is required.

The role of **Economic Development and Tourism** is to:

1. Incorporate the principles of this *Policy* into the Economic Development Strategy.
2. Develop a communications plan to create awareness of this *Policy* and ensure compliance with this *Policy* by the business community.

The role of **Communications** is to:

1. Develop a Communications Plan and education strategy to create awareness of this *Policy* in the community. This may include:
 - a. A Light Efficient Community education program for Town staff.
 - b. A website for public education highlighting responsible lighting, the benefits of the *Policy*, and links to further responsible lighting information.

- c. Planning of community events to encourage public participation in adopting the mindset of becoming a Light Efficient Community.
- d. Materials regarding responsible lighting practices and methods to distribute within the community.

The Bylaw

The bylaw was the project to work on that really put Bon Accord onto a whole new level of commitment to the niche being defined.

It has had both positive and negative resident feedback from residents but it really has identified that as a strategy the Town is committed to moving forward towards the goal of becoming a niche community.

**TOWN OF BON ACCORD
BYLAW 2015-07
LIGHT EFFICIENT COMMUNITY STANDARDS BYLAW**

A BYLAW OF THE TOWN OF BON ACCORD, IN THE PROVINCE OF ALBERTA TO ESTABLISH TERMS FOR REDUCING LIGHT POLLUTION AND GLARE; ENHANCING THE WELL-BEING OF THE COMMUNITY THROUGH ENVIRONMENTAL ACTION

WHEREAS, pursuant to section 7 of the *Municipal Government Act*, R.S.A. 2000, c. M-26, a council may pass bylaws for municipal purposes respecting, inter alia, the following matters:

- a) the safety, health and welfare of people and the protection of people and property;
- b) nuisances, including unsightly property;
- c) businesses, business activities and persons engaged in business;
- d) the enforcement of bylaws made under this or any other enactment; and

WHEREAS, pursuant to section 8 of the *Municipal Government Act*, R.S.A. 2000, c. M-26, a council may, in a bylaw, inter alia:

- a) regulate or prohibit;
- b) provide for a system of licenses, permits or approvals; and

WHEREAS, pursuant to section 640 (4) of the *Municipal Government Act*, R.S.A. 2000, c. M-26, a Council may prohibit or regulate and control the use and development of land and buildings, inter alia:

- a) the design, character and appearance of buildings;
- b) the lighting of land, buildings or other things; and

WHEREAS, the safety and welfare of motorists, pedestrians, and cyclists depend upon the reduction of glare and the establishment of consistent and well-defined levels of lighting; and

WHEREAS, proper direction and use of light will minimize energy wasted on unnecessary and indiscriminate illumination; and

WHEREAS, the Town of Bon Accord recognizes the need to preserve the rural character, aesthetic value, and the unique quality of life of Bon Accord residents by preserving and enhancing the ability to view the night sky; and

WHEREAS, establishing a predetermined standard for outdoor illumination will provide residents, business owners, and developers with a clear set of guidelines by which to follow; and

WHEREAS, a clear set of guidelines for outdoor lighting will eliminate the need for commercial establishments to compete for visual attention by escalating outdoor lighting levels; and

WHEREAS, excessive illumination is harmful.

NOW THEREFORE, THE COUNCIL OF THE TOWN OF BON ACCORD, IN THE PROVINCE OF ALBERTA, DULY ASSEMBLED, ENACTS AS FOLLOWS:

**TOWN OF BON ACCORD
BYLAW 2015-07
LIGHT EFFICIENT COMMUNITY STANDARDS BYLAW**

SECTION 1 – SHORT TITLE

1.1. This Bylaw may be referred to as "The Light Efficient Community Standards Bylaw".

SECTION 2 - DEFINITIONS

- 2.1. **"Absolute photometry"** is a photometric measurement (usually of a solid-state luminaire) that directly measures the footprint of the luminaire. Reference Standard IES LM-79.
- 2.2. **"Astronomic Time Switch"** is an automatic lighting control device that switches outdoor lighting relative to time of solar day with time of year correction.
- 2.3. **"Backlight"** is a reference to an exterior luminaire, lumens emitted in the quarter sphere below horizontal and in the opposite direction of the intended orientation of the luminaire. For luminaires with symmetric distribution, backlight will be the same as front light.
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**TOWN OF BON ACCORD
BYLAW 2015-07
LIGHT EFFICIENT COMMUNITY STANDARDS BYLAW**

- 2.12. "Fully Shielded Luminaire"** is a luminaire constructed and installed in such a manner that all light emitted by the luminaire, either directly from the lamp or a diffusing element, or indirectly by reflection or refraction from any part of the luminaire, is projected below the horizontal plane through the luminaire's lowest light-emitting part.
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**TOWN OF BON ACCORD
BYLAW 2015-07
LIGHT EFFICIENT COMMUNITY STANDARDS BYLAW**

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**TOWN OF BON ACCORD
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- 2.43. "Property line"** is the edges of the legally defined extent of privately owned property.
- 2.44. "Relative Photometry"** is photometric measurements made of the lamp plus luminaire, and adjusted to allow for light loss due to reflection or absorption within the luminaire. Reference Standard IES LM-63.
- 2.45. "Repair"** is reconstruction or renewal of any part of an existing luminaire for the purpose of its ongoing operation, other than re-lamping or replacement of components including capacitor, ballast or photocell. Note that retrofitting a luminaire with new lamp and/or ballast technology is not considered a repair and for the purposes of this *Bylaw* the luminaire shall be treated as if new. "Repair" does **not** include normal re-lamping or replacement of components including capacitor, ballast or photocell.
- 2.46. "Replacement Lighting"** is lighting installed specifically to replace existing lighting that is sufficiently broken to be beyond repair.
- 2.47. "Shielded Directional Luminaire"** is a luminaire that includes an adjustable mounting device allowing aiming in any direction and contains a shield, louver, or baffle to reduce direct view of the lamp.

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- 2.48. **“Sign”** is advertising, directional or other outdoor promotional display of art, words and/or pictures.
- 2.49. **“Sky Glow”** is the brightening of the nighttime sky that results from scattering and reflection of artificial light by moisture and dust particles in the atmosphere. Sky glow is caused by light directed or reflected upwards or sideways and reduces one's ability to view the night sky.
- 2.50. **“Temporary lighting”** is lighting installed and operated for periods not to exceed 60 days, completely removed and not operated again for at least 30 days.
- 2.51. **“Time Switch”** is an automatic lighting control device that switches lights according to time of day.
- 2.52. **“Unshielded Luminaire”** is a luminaire capable of emitting light in any direction including downwards.
- 2.53. **“Uplight”** is a reference to an exterior luminaire, lumens emitted or radiated in the hemisphere at or above the horizontal plane.
- 2.54. **“Vertical Illuminance”** is illuminance measured or calculated in a plane perpendicular to the site boundary or property line.
- 2.55. **“Watt”** is a derived unit of power. The unit, “W” is defined as joule per second and can be used to express the rate of energy conversion to light with respect to time.

SECTION 3 - PREAMBLE

The problems of light pollution first became an issue in the 1970s when astronomers identified the degradation of the night sky due to the increase in lighting associated with development and growth. As more impacts to the environment by lighting are being identified, an international “dark sky” movement is advocating for the precautionary approach to outdoor lighting design. Many communities have passed anti-light pollution laws and ordinances. However, there is little or no agreement among these laws, and they vary considerably in language, technical quality, and stringency. This leads to ambiguity for designers, engineers, and code officials looking to meet these regulations. The lack of a common basis prevents the development of standards, educational programs, and other means of achieving the goal of effective lighting control. The purpose of this *Bylaw* is to provide regulations for outdoor lighting in the Town of Bon Accord in accordance with an international standard. This lighting includes, but is not limited to all lighting that is provided by the Town of Bon Accord for purposes of public safety and public information, as well as lighting on private property that encompasses commercial development, single family dwellings, and property which has more than one residence on it. As a result of adopting this *Bylaw*, goals aligning with Bon Accord’s “*Building for Tomorrow*” strategy will be achieved, reducing adverse environmental impacts of outdoor lighting in two categories: carbon footprint (energy used in the life of a lighting product) and obtrusive light. This bylaw is based on and adopted from the Model Lighting Ordinance created by the Illuminating Engineering Society and the International Dark-Sky Association. These regulations will:

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- 3.1 Permit the use of outdoor lighting that is consistent with the minimum levels specified in Illuminating Engineering Society of North America (IES) recommended practices for nighttime safety, utility, security, productivity, enjoyment, and commerce (Lighting Zones).
- 3.2 Minimize adverse offsite impacts of lighting such as light trespass, and obtrusive light.
- 3.3 Curtail light pollution, reduce skyglow, and improve the nighttime environment for astronomy.
- 3.4 Help protect the natural environment from the adverse effects of night lighting from gas or electric sources, while conserving energy and resources to the greatest extent possible.

SECTION 4 – LIGHTING ZONES

Lighting zones reflect the base (or ambient) light levels desired in Bon Accord. Lower lighting zone(s) be given preference when establishing zoning criteria. Using lighting zones allows a great deal of flexibility and customization without the burden of excessive regulation. Selection of lighting zone or zones should be based not on existing conditions but rather on the type of lighting environments the Town seeks to achieve. For instance, new development on previously rural or undeveloped land may be zoned as LZ-1. Additionally, the Town may choose to establish vertical lighting zones with the lighting zone at street level at a higher zone than the residential housing on upper levels. The Lighting Zone shall determine the limitations for lighting as specified by this *Bylaw*. Lighting Zones shall be defined as follows:

LZ0: No ambient lighting

Areas where the natural environment will be seriously and adversely affected by lighting. Impacts include disturbing the biological cycles of flora and fauna and/or detracting from human enjoyment and appreciation of the natural environment. Human activity is subordinate in importance to nature. The vision of human residents and users is adapted to the darkness, and they expect to see little or no lighting. When not needed, lighting should be extinguished. This zone typically includes undeveloped areas of open space, wilderness parks and preserves, areas near astronomical observatories, or any other area where the protection of a dark environment is critical. This is the recommended default zone for wilderness areas, parks and preserves, and undeveloped rural areas.

LZ1: Low ambient lighting

Areas where lighting might adversely affect flora and fauna or disturb the character of the area. The vision of human residents and users is adapted to low light levels. Lighting may be used for safety and convenience but it is not necessarily uniform or continuous. After curfew, most lighting should be extinguished or reduced as activity levels decline. These typically include single and two family residential communities, rural town centers, business parks, and other commercial or industrial/storage areas typically with limited nighttime activity and may also include the developed areas in parks and other natural settings. This is the recommended default zone for rural and low density residential areas.

LZ2: Moderate ambient lighting

Areas of human activity where the vision of human residents and users is adapted to moderate light levels. Lighting may typically be used for safety and convenience but it is not

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necessarily uniform or continuous. After curfew, lighting may be extinguished or reduced as activity levels decline. This zone pertains to areas with moderate ambient lighting levels. These typically include multifamily residential uses, institutional residential uses, schools, churches, hospitals, hotels/motels, commercial and/or businesses areas with evening activities embedded in predominately residential areas, neighborhood recreational and playing fields and/or mixed use development with a predominance of residential uses. Can be used to accommodate a district of outdoor sales or industry in an area otherwise zoned LZ-1. This is the recommended default zone for light commercial business districts and high density mixed-use residential districts.

LZ3: Moderately high ambient lighting

Areas of human activity where the vision of human residents and users is adapted to moderately high light levels. Lighting is generally desired for safety, security and/or convenience and it is often uniform and/or continuous. After curfew, lighting may be extinguished or reduced in most areas as activity levels decline. These typically include commercial corridors, high intensity suburban commercial areas, town centers, mixed use areas, industrial uses and shipping and rail yards with high night time activity, high use recreational and playing fields, regional shopping malls, car dealerships, gas stations, and other nighttime active exterior retail areas. Recommended default zone for large cities' business districts. It is recommended this zone is not used in Bon Accord.

Tables providing maximum allowable lumens per Lighting Zone are included in this document.

SECTION 5 - CONFORMANCE WITH PROVINCIAL AND FEDERAL CODES

All outdoor lighting shall be installed in conformance with the provisions of this *Bylaw*, applicable Electrical and Energy Codes, and applicable sections of the Building Code.

SECTION 6 - APPLICABILITY

Except as below, all outdoor lighting installed after the date of adoption of this *Bylaw* shall comply with these requirements. This includes, but is not limited to, new lighting, replacement lighting, or any other lighting whether attached to structures, poles, the earth, or any other location, including lighting installed by any third party.

6.1. Permanent Exemptions

6.1.1. Previously Existing Fixtures: All outdoor luminaires existing and lawfully in place prior to the adoption of this *Bylaw* are exempt from the requirements of *this Bylaw*, except that:

6.1.1.1. When existing luminaires become inoperable, replacement in compliance with this *Bylaw* is required.

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6.1.1.2. This exemption shall cease to apply when the parcel is subject to a change in use or ownership.

6.1.1.3. Upon renewal of business license, the required fees can, at the discretion of the appropriate officials be reduced by a percentage of costs incurred to achieve compliance with this *Bylaw*.

6.1.1.4. Lighting exempted under Section 6.1.1 shall comply with Section 11 of this *Bylaw*.

6.1.2. Fossil Fuel Light: All outdoor light fixtures producing light **directly** by the consumption of fossil fuels (such as gas lamps, kerosene lanterns, etc.) are exempt from this *Bylaw*.

6.1.3. Federal and Provincial Facilities: Outdoor light fixtures on, in, or in connection with facilities and land owned by the Crown in right of Canada or the Crown in right of Alberta are exempt from this *Bylaw*. Voluntary compliance with the intent of this *Bylaw* is encouraged.

6.1.3.1. Regional or County Airports: Outdoor lighting not regulated by Provincial or Federal agencies or statute, such as lighting for parking lots and pedestrian access shall comply with the *Bylaw*.

6.1.3.2. Correctional Institutions: Outdoor lighting not regulated by Provincial or Federal agencies or statute, such as lighting for parking lots shall be fully shielded.

6.1.4. Emergency Conditions: Under any emergency, real or perceived, by local, provincial or federal authorities, any and all restrictions created by this *Bylaw* shall be, for the duration of the emergency, suspended in order that emergency responders and citizens may carry out their duties to the best of their abilities.

6.2. Special Requirements and Other Exemptions.

The following are not regulated by this *Bylaw*:

6.2.1. Lighting within the public right-of-way or easement for the principal purpose of illuminating roads and highways required by Provincial or Federal legislation. This exemption **shall not** apply to any street lighting installed under the jurisdiction and authority of Bon Accord, or to any lighting within the public right of way or easement when the purpose of the luminaire is to illuminate areas outside of the public right of way or easement.

6.2.2. Lighting used for public monuments and statuary.

6.2.3. Lighting solely for signs (lighting for signs is regulated by **Section 8, Outdoor Signs and Illumination** section of this *Bylaw*.).

6.2.4. Repairs to existing luminaires not exceeding 25% of total installed luminaires.

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- 6.2.5. Temporary lighting for theatrical, television, sports areas, and performance areas, only with permit from the authority and recognizing that steps need to be taken to minimize glare and light trespass, and will utilize sensible curfews, as determined by appropriate Town authorities.
- 6.2.6. Intermittent and seasonal lighting required under Alberta Occupational Health and Safety (OH&S) codes for lighting required on construction sites. While not superseding or supplanting the Provincial OH&S code, all lighting shall be restricted to hours during which work is actively taking place and such lighting must be shrouded or shielded to prevent glare and light trespass outside of the property lines of the construction site.
- 6.2.7. Underwater lighting in swimming pools and other water features.
- 6.2.8. Temporary lighting and seasonal lighting provided that individual lamps are less than ten (10) watts and seventy (70) lumens, for the duration of the holiday season. The holiday season shall be defined as lasting from the first day of December to the end of the second week of January.
- 6.2.9. Lighting specified or identified in a specific use permit, which shall not grant permanent exception to this *Bylaw*.
- 6.2.10. Any other exceptions not covered by the above shall be dealt with by designated Town of Bon Accord officials or their assignees. All exceptions must comply with this *Bylaw*, Section 6.2.9.

SECTION 7 - LIGHTING CONTROL REQUIREMENTS

Nothing in this section shall be interpreted to provide exemptions to the goals of this *Bylaw*. This section is intended to provide lighting controls which prohibit operation of outdoor lighting when sufficient outdoor lighting is available or such lighting is unnecessary. Additionally, this section will ensure that all outdoor lighting has the capability, either through circuiting, dimming, or alternating sources to guarantee the ability to reduce lighting without necessarily turning all lights off.

7.1. Automatic Switching Requirements. Controls shall be provided that automatically extinguish all outdoor lighting when sufficient daylight is available using a control device or system such as a photoelectric switch, astronomic timer switch or equivalent functions from a programmable lighting controller, building automation system or lighting energy management system, all with batteries or similar backup power or device. If motion sensors are used to comply with this section, the range of the sensor shall not exceed the property line.

7.2. Automatic Lighting Reduction Requirements. The Council or Administration shall establish curfew time(s) for each lighting zone, after which total outdoor lighting lumens shall be reduced by at least 30% or extinguished. The following items are exceptions for which no reduction is required:

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- 7.2.1. Lighting for residential properties including multiple residential properties not having common areas. This exemption shall not apply to landscape lighting, and all such lighting shall comply with all applicable BUG ratings.
- 7.2.2. When the outdoor lighting consists of only one luminaire. This does not circumvent the requirement that such luminaires will be shielded according to applicable BUG ratings.
- 7.2.3. Code required lighting for steps, stairs, walkways, and building entrances. All such luminaires installed under this provision shall be in compliance with this *Bylaw* and “Dark-Sky Friendly” and comply with all applicable BUG ratings.
- 7.2.4. When in the opinion of the Town, lighting levels must be maintained.
- 7.2.5. Motion activated lighting, where the light is extinguished no more than 5 (five) minutes after illumination.
- 7.2.6. Lighting governed by a special use permit in which times of operation are specifically identified.
- 7.2.7. Businesses that operate on a 24-hour basis.

SECTION 8 - OUTDOOR SIGNS AND ILLUMINATION

This section deals with signs located in the Town, on public or private property. This section will ensure that the number, appearance, and location of signs balances the need for signs and expression, with safety and aesthetics while providing an adequate and flexible means of identification for commercial and industrial enterprises. This will improve the quality of sign design and upkeep, and minimize the adverse effect of signs on nearby property. It is the responsibility of the owner and the occupier of the lands that are subject to this *Bylaw* to ensure that signs conform to this bylaw.

- 8. All signs shall be maintained in good structural condition at all times so as to ensure that pedestrian and vehicular traffic are not compromised.
- 8.1. All sign copy shall be fastened securely to the sign structure. Where a portion of a copy area has been removed, it shall be replaced within a reasonable timeframe, either with new copy or filled in with material consistent with the sign, as determined by the Development Officer.
- 8.2. All burned out bulbs or damaged panels on a sign shall be replaced within a reasonable timeframe, not exceeding 60 days, or as determined by the Development Officer.
- 8.3. Where a panel is damaged or removed, it shall be replaced with a blank panel until such time as a new panel is installed.
- 8.4. The area within five (5) metres of a Freestanding Sign on private property shall allow access for maintenance. This standard does not exempt any landscaping requirements within this *Bylaw*; however, the landscaping shall allow access for maintenance.

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- 8.5. It shall be the responsibility of the landowner to ensure maintenance of a sign is in compliance with the provisions of this *Bylaw*.
- 8.6. A sign with illumination or a sign with an electronic message feature shall not be allowed in agricultural or residential districts.
- 8.7. Any sign located within thirty (30) metres of a residence or a residential district shall not be illuminated between 10:00 p.m. and 6:00 a.m. unless dimmed to no more than 30% of its daytime operation.
- 8.8. Notwithstanding Section 8.8 of this *Bylaw*, a Development Officer may restrict the illumination of any sign, or place conditions on a development permit for a sign that would effectively mitigate any adverse effect as a result of the illumination of the sign on a residential development where, in the opinion of the Development Officer, the sign could cause an adverse effect on a residential development.
- 8.9. Signs that are illuminated shall not:
 - 8.9.1. shine or reflect light directly onto neighboring properties or, in the direction of oncoming traffic;
 - 8.9.2. create hazards for pedestrians or motorists;
 - 8.9.3. be of an intensity or brightness that would interfere with the space, comfort, convenience, and general welfare of residents or occupants of adjacent properties or, with vehicular traffic, in the opinion of the Development Officer.
- 8.10. To prevent “luminance creep,” and in accordance with Section 8.10.3, no sign shall be illuminated with an intensity or brightness greater than 200 lux.
- 8.11. Signs with an electronic message feature shall have automatic timers. These signs shall comply with Section 8.8 of this *Bylaw* and be subject to the same lighting curfew outlined in Section 8.8.
- 8.12. All illuminated signs shall have the capability to be dimmed to the satisfaction of the Development Officer.
- 8.13. Externally illuminated signs shall:
 - 8.13.1. use full cut-off or, shielded and screened external light sources; and
 - 8.13.2. be positioned in a manner that directs the light directly onto the sign; and
 - 8.13.3. minimize any glare off-site.
- 8.14. Internal illuminated signs, where permitted, shall have the light source completely shielded from direct view.
- 8.15. Sign lighting shall be designed to prevent light spill into the sky.

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- 8.16. Coloured lights shall not be used at a location or in a manner so as to be confused with, or construed as traffic control devices.
- 8.17. Where a sign is allowed with a changeable display feature for frequently changing messages, the message shall not change more than once every six (6) seconds with a one (1) second transition (hold time) between messages; and the messages on the changeable display feature shall relate to:
 - 8.17.1. special event; or
 - 8.17.2. a use, business or occupant of the site where the sign is located.
 - 8.17.3. All signs regulated by this section of the *Bylaw* shall have a CCT which does not exceed 2,200° K, as determined by the manufacturer.

SECTION 9 -NON-RESIDENTIAL LIGHTING

This section addresses commercial and non-residential lighting, including multiple-family residences having common spaces, such as outdoor lobbies; internal roadways, walkways, or parking. Its intent is to:

- 9. Limit the amount of light that can be used;
 - 9.1. Minimize glare by controlling the amount of light that tends to create glare;
 - 9.2. Minimize sky glow by controlling the amount of uplight; and
 - 9.3. Minimize the amount of off-site impacts or light trespass.

This section, and accompanying tables in this document provide two methods for determining compliance. The *prescriptive method* contains precise and easily verifiable requirements for luminaire light output and fixture design that limit glare, uplight, light trespass, and the amount of light that can be used. The *performance method* allows greater flexibility and creativity in meeting the intent of the *Bylaw*. Note that both the prescriptive and the performance method limit the *amount* of light that can be used, but do not control *how* the lighting is to be used. Most outdoor lighting projects that do not involve a lighting professional will use the prescriptive method, because it is simple and does not require engineering expertise. **Only one of the two outlined methods may be used.**

9.4. *Prescriptive Method*

- 9.4.1. Total Site Lumen Limit. The total installed initial luminaire lumens of all outdoor lighting shall not exceed the total site lumen limit. The total site lumen shall be determined using *either* the Parking Space Method (Table A) or the Hardscape Area Method (Table B). Only one method shall be used per permit application, and for sites with existing lighting, all existing lighting shall be included in the calculation of total installed lumens.

The total installed initial luminaire lumens is calculated as the sum of the initial luminaire lumens for all luminaires.

- 9.4.2. Limits to Offsite Impacts. All luminaires shall be rated and installed according to Table C.

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9.4.3. Light Shielding for Outdoor Illumination. All outdoor luminaires emitting more than 1000 lumens shall have no light emitted above ninety (90) degrees as illustrated in Figure 1.

9.4.4. Exception to this restriction is ornamental lighting permitted by special permit only, and shall meet the requirements of Tables C-1, C-2, and C-3 for Backlight, Uplight, and Glare, respectively, without the need for external, field-added modifications.

9.4.4.1. An example for application of the *Prescriptive* method is included in this *Bylaw*.

9.5 Performance Method

Total Site Lumen Limit. The total installed initial luminaire lumens of all lighting systems shall not exceed the allowed total initial site lumen. The allowed total initial site lumens shall be determined using Tables D and E. For sites with existing lighting, all existing lighting shall be included in the calculation of total installed lumens.

9.6 The total installed initial luminaire lumens is calculated as the sum of the initial luminaire lumens for all luminaires.

9.6.1 Limits to Off Site Impacts. All luminaires shall be installed using either Option A or Option B. Only one option may be used per permit application.

Option A: All luminaires shall be rated and installed according to Table C.

Option B: The entire outdoor lighting design shall be analyzed using industry standard lighting software including inter-reflections in the following manner: Input data shall describe the lighting system including luminaire locations, mounting heights, aiming directions, and employing photometric data tested in accordance with IES guidelines. Buildings or other physical objects on the site within three object heights of the property line must be included in the calculations.

9.6.2 Analysis shall utilize an enclosure comprised of calculation planes with zero reflectance values around the perimeter of the site.

The design complies if:

- i. The total lumens on the inside surfaces of the virtual enclosure are less than fifteen (15%) percent of the total site lumen limit; and
 - ii. The maximum vertical illuminance on any vertical surface is less than the allowed maximum illuminance per Table F.
- a. An example application of the *Performance* method is included in this *Bylaw*.

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SECTION 10 - RESIDENTIAL LIGHTING

This section applies to single family homes, duplexes, row houses, and low rise multi-family buildings of four (4) dwelling units or less. For residential properties including multiple residential properties not having common areas, all outdoor luminaires shall not exceed the allowed lumen output in Table G, row 2.

The following exceptions shall apply to this section:

- 10.1 One partly shielded or unshielded luminaire at the main entry, which shall not exceed the allowed lumen output in Table G, row 1;
- 10.2 Any other partly shielded or unshielded luminaires not exceeding the allowed lumen output in Table G, row 3;
- 10.3 Low voltage landscape lighting aimed away from adjacent properties and not exceeding the allowed lumen output in Table G, row 4;
- 10.4 Shielded directional flood lighting aimed so that direct glare is not visible from adjacent properties and not exceeding the allowed lumen output in Table G, row 5;
- 10.5 Open flame gas lamps;
- 10.6 Lighting installed with a vacancy sensor, where the sensor extinguishes the lights no more than 5 minutes after the area is vacated;
- 10.7 Lighting controlled by movement or other sensors shall be positioned so the range of their trigger mechanism does not exceed the property line, as determined by the land title of the property;
- 10.8 All Residential Landscape Lighting shall:
 - 10.8.1 Comply with Table G of this *Bylaw*; and
 - 10.8.2 Shall not be aimed into adjacent properties.
- 10.9 Lighting exempt per Section 6 of this *Bylaw*.

An example of the application of this section can be found in this *Bylaw*.

SECTION 11 - EXISTING LIGHTING

Amortization allows existing lighting to gradually and gracefully come into compliance. Substantial changes or additions to existing properties are considered the same as new construction, and must comply. Most outdoor lighting can be fully depreciated once it is fully amortized, usually no longer than

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10 years, if not sooner, from the date of initial installation. Bon Accord Administration may require compliance sooner for “easy fixes” such as re-aiming or lowering lumen output of lamps. Where lighting is judged to be a safety hazard, immediate compliance shall be required. Lighting installed prior to the effective date of this *Bylaw* shall comply with the following:

11.1 *Amortization* On or before January 1, 2023, all outdoor lighting shall comply with this Code.

11.2 *New Uses or Structures, or Change of Use*

Whenever there is a new use of a property (zoning or variance change) or the use on the property is changed, all outdoor lighting on the property shall be brought into compliance with this *Bylaw* before the new or changed use commences.

11.3 *Additions or Alterations* Major Additions

If a major addition occurs on a property, lighting for the entire property shall comply with the requirements of this Code. For purposes of this section, the following are considered to be major additions:

11.3.2 Additions of 25 percent or more in terms of additional dwelling units, gross floor area, seating capacity, or parking spaces, either with a single addition or with cumulative additions after the effective date of this *Bylaw*.

11.3.3 Single or cumulative additions, modification or replacement of 25 percent or more of installed outdoor lighting luminaires existing as of the effective date of this *Bylaw*.

11.3.4 Minor Modifications, Additions, or New Lighting Fixtures for Non-residential and Multiple Dwellings:

11.3.5 For non-residential and multiple dwellings, all additions, modifications, or replacement of more than 25 percent of outdoor lighting fixtures existing as of the effective date of this *Bylaw* shall require the submission of a complete inventory and site plan detailing all existing and any proposed new outdoor lighting. **Any new lighting shall meet the requirements of this *Bylaw*.**

11.3.6 Resumption of Use after Abandonment

11.3.6.1 If a property with non-conforming lighting is abandoned for a period of 180 days or more, then all outdoor lighting shall be brought into compliance with this *Bylaw* before any further use of the property occurs.

SECTION 12 - PROCEDURAL REQUIREMENTS AND PLAN SUBMISSION

For all subdivision, land-development applications, and building permits where outdoor lighting is required or proposed, lighting plans shall be submitted to Town Administration for review and approval. Plan submission for residential renovations is voluntary; however any changes to lighting shall comply

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with this *Bylaw*. Field verification can be achieved by asking the applicant and/or owner to verify that the luminaire type, lamp type and wattages specified have been used. The applicant shall provide the photometric data for each luminaire, since the initial luminaire lumens and B-U-G ratings are stated on the photometric report. However, if a jurisdiction requires additional on-site verification, it may also request a point-by-point photometric plan. While this will not be a true measure of compliance with the criteria of this *Bylaw*, comparing the actual measured levels on site to the photometric plan can be an indication whether or not the installed lighting varies from the approved design. The minimum requirements for these plans shall include:

- 12.1 A site plan complete with all structures, parking spaces, building entrances, traffic areas (both vehicular and pedestrian), vegetation or landscape features that may interfere with lighting, and all adjacent uses. The site plan shall show, by location, and identify each existing and proposed luminaire and shall specify its installed height, pole foundation details, and mounting methods;
- 12.2 A summary table identifying the maximum and minimum light levels for all parking entryways, signs, and walkways.
- 12.3 A description of each luminaire identified in the site plan including the manufacturer, model number, a photograph or catalog cut, photometric data verifying compliance requirements specified within this *Bylaw*, light output in initial lumens, shielding or glare reduction devices, lamp type, and on/off control devices.
- 12.3 If a developer or other entity is using the *Performance Method*, as outlined in Section 9, the following shall also be supplied:
 - 12.3.1 Iso-footcandle plots illustrating each typical installation for all luminaire types, or 3m by 3m illuminance-grid plots for multi-fixture lighting installations, which demonstrate compliance with all applicable requirements set forth within this *Bylaw*. The plots shall indicate the location of each existing and proposed luminaire, the installed height of said luminaires, and the overall light levels in **foot-candles** on the entire zoned.

SECTION 13 - TABLES AND CALCULATIONS

**Table A
Allowed Total Initial Luminaire Lumens per Site for Nonresidential Outdoor Lighting, Per Parking Space Method**

May only be applied to properties up to 10 parking spaces (including handicapped accessible spaces).

LZ-0	LZ-1	LZ-2	LZ-3
300 lms/space	450 lms/space	630 lms/space	840 lms/space

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**Table B
 Allowed Total Initial Lumens per Site for Nonresidential Outdoor Lighting,
 Hardscape Area Method**

May be used for any project. When lighting intersects off site driveways and public streets or roads, a total of 55 square metres for each intersection may be added to the actual site hardscape area to provide for intersection lighting.

LZ-0	LZ-1	LZ-2	LZ-3
Base Allowance			
5.5 lumens per m ² of Hardscape	15 lumens per m ² of Hardscape	26.75 lumens per m ² of Hardscape	55 lumens per m ² of Hardscape

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**Table B-1
Allowed Total Initial Lumens per Site for Nonresidential Outdoor Lighting,
Hardscape Area Method**

Lumen Allowances, in Addition to Base Allowance.

	LZ-0	LZ-1	LZ-2	LZ-3
Additional allowances for sales and service facilities. No more than two additional allowances per site. See accompanying notes.				
Outdoor Sales Lots	0	40 lumens per m ² .	85 lumens per m ² .	170 lumens per m ² .
Outdoor Sales Frontage	0	0	305 per linear metre	450 per linear metre
Drive Up Windows	0	2,000 lumens per drive up window	4,000 lumens per drive up window	8,000 lumens per drive up window
Vehicle Service Station	0	4,000 lumens per pump (based on 5fc horiz)	8,000 lumens per pump (based on 10fc horiz)	16,000 lumens per pump (based on 20fc horiz)

Notes accompanying Table B-1:

Outdoor Sales Lot refers to an allowance in lumens per square metre of uncovered sales lots used exclusively for the display of vehicles or other merchandise for sale and may not include driveways, parking or other non-sales areas. To use this allowance, luminaires must be within 2 mounting heights of sales lot area.

Outdoor Sales Frontage refers an allowance for linear metres of sales frontage immediately adjacent to the principle viewing location(s) and unobstructed for its viewing length. A corner sales lot may include two adjacent sites provided that a different viewing location exists for each side. In order to use this allowance, luminaires must be located between principle viewing location(s) and the frontage outdoor sales area.

Drive Up Windows refers to an allowance which require the luminaires to be within 6 horizontal metres of the centre of the window.

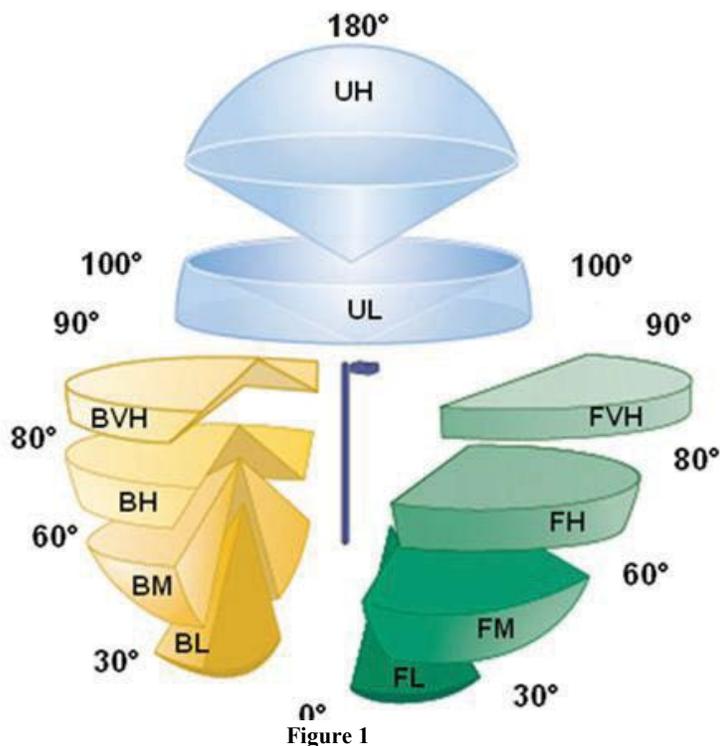
Vehicle Service Station refers to an allowance of lumens per installed pump.

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Tables C1-C3

Maximum Allowable Backlight, Uplight and Glare (BUG) Ratings

May be used for any project. A luminaire may be used if it is rated for the lighting zone of the site or lower in number for all ratings B, U and G. Luminaires equipped with adjustable mounting devices permitting alteration of luminaire aiming in the field shall not be permitted. As this is a relatively new and not yet well-known rating system, more explanation of how the rating system works is provided here. For example, more traditional terms such as “full cutoff” are used in this *Bylaw*. It will be very important that all groups recognize that older terms and concepts are inadequate for the complex tasks of controlling light pollution. It is recommended that the new rating system adopted in TM-15, the *Luminaire Classification System for Outdoor Luminaires*, developed in 2005 by the IES and followed herein by the **Table C**, be used intact and exclusively. BUG requires downlight only with low glare (better than full cut off) in lighting zones (LZ) 0, 1 and 2, but allows a minor amount of uplight in lighting zone 3. In lighting zone 3, the amount of allowed uplight is enough to permit the use of very well shielded luminaires that have a decorative drop lens or chimney so that dark sky friendly lighting can be installed in places that traditional-appearing luminaires are required. BUG typically cannot be used for residential luminaires unless they have been photometrically tested. For non-photometrically tested residential luminaires, shielding description is used instead. The lumen limits established for each lighting zone apply to all types of lighting within that zone. Lighting installed under **Section 9 and Section 10** shall comply with all necessary BUG ratings described below. This includes, but is not limited to, specialty lighting, façade lighting, security lighting and the front row lighting for auto dealerships. BUG rating limits are defined for each luminaire and are based on the internal and external design of the luminaire, its aiming, and the initial luminaire lumens of the specified luminaires. The BUG rating limits also take into consideration the distance the luminaire is installed from the property line in multiples of the mounting height (See Table C).



The three components of BUG ratings are based on IES TM-15-07 (revised):

Backlight, which creates light trespass onto adjacent sites. The B rating takes into account the amount of light in the BL, BM, BH and BVH zones, which are in the direction of the luminaire OPPOSITE from the area intended to be lighted.

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Uplight, which causes artificial sky glow. Lower uplight (zone UL) causes the most sky glow and negatively affects both professional and academic astronomy. Upper uplight (UH) not reflected off a surface is mostly energy waste. The U rating defines the amount of light into the upper hemisphere with greater concern for the light at or near the horizontal angles (UL).

Glare, which can be annoying or visually disabling. The G rating takes into account the amount of frontlight in the FH and FVH zones as well as BH and BVH zones. BUG ratings apply to the Lighting Zone of the property under consideration.

Figure 1

Key:

UH=Uplight High	BVH=Backlight Very High	FVH=Forward Light Very High
UL=Uplight Low	BH=Backlight High	FH=Forward Light High
	BM=Backlight Medium	FM=Forward Light Medium
	BL=Backlight Low	FL=Forward Light Low

In general, a higher BUG rating means more light is allowed in solid angles, and the rating increases with the lighting zone. However, a higher B (backlight) rating simply indicates that the luminaire directs a significant portion of light behind the pole, so B ratings are designated based on the location of the luminaire with respect to the property line. A high B rating luminaire maximizes the spread of light, and is effective and efficient when used far from the property line. When luminaires are located near the property line, a lower B rating will prevent unwanted light from interfering with neighboring properties.

At the 90-180 degree ranges:

1. Lighting Zone 0 allows no light above 90 degrees.
2. Lighting Zone 1 allows only 10 lumens in the UH and UL zones, 20 lumens total in the complete upper hemisphere. (This is roughly equivalent to a 5W incandescent lamp).
3. Lighting Zone 2 allows only 50 lumens in the UH and UL zones, 100 lumens total (less than a 25W incandescent lamp).
4. Lighting Zone 3 allows only 500 lumens in the UH and UL zones, 1000 lumens total (about the output of a 75W incandescent bulb).

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**Table C-1
Maximum Allowable Backlight (BUG) Ratings**

Table C-1	LZ-0	LZ-1	LZ-2	LZ-3
Allowed Backlight Rating*				
Greater than 2 mounting heights from property line	B1	B3	B4	B5
1 to less than 2 mounting heights from property line and ideally oriented.**	B1	B2	B3	B4
0.5 to 1 mounting heights from property line and ideally oriented.**	B0	B1	B2	B3
Less than 0.5 mounting heights to property line and properly oriented.**	B0	B0	B0	B1

* For property lines that abut public walkways, bikeways, plazas, and parking lots, the property line may be considered to be 1.5 metres beyond the actual property line for purpose of determining compliance with this section. For property lines that abut public roadways and public transit corridors, the property line may be considered to be the centerline of the public roadway or public transit corridor for the purpose of determining compliance with this section.

NOTE: This adjustment is relative to Table C-1 and C-3 only and shall not be used to increase the lighting area of the site.

** To be considered 'ideally oriented', the luminaire must be mounted with the backlight portion of the light output oriented perpendicular and towards the property line of concern.

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**Table C-2
Maximum Allowable Uplight (BUG) Ratings - Continued**

Table C-2	LZ-0	LZ-1	LZ-2	LZ-3
Allowed Uplight Rating	U0	U1	U2	U3
Allowed Percentage (%) light emission above 90° for street or area lighting	0%	0%	0%	0%

**Table C-3
Maximum Allowable Glare (BUG) Ratings - Continued**

Table C-3	LZ-0	LZ-1	LZ-2	LZ-3
Allowed Glare Rating	G0	G1	G2	G3
Any luminaire not ideally oriented*** with 1 to less than 2 mounting heights to any property line of concern	G0	G0	G1	G1
Any luminaire not ideally oriented*** with 0.5 to 1 mounting heights to any property line of concern	G0	G0	G0	G1
Any luminaire not ideally oriented*** with less than 0.5 mounting heights to any property line of concern	G0	G0	G0	G0

***Any luminaire that cannot be mounted with its backlight perpendicular to any property line within 2x the mounting height of the luminaire location shall meet the reduced Allowed Glare Rating in Table C-3.

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Table D

Performance Method Allowed Total Initial Site Lumens

May be used for any project.

Lighting Zone	LZ 0	LZ 1	LZ 2	LZ 3
Allowed Lumens per m ²	5	12	25	50
Allowed Base Lumens per Site	0	3,500	7,000	14,000

Table E

Performance Method Additional Initial Luminaire Lumen Allowances.

All of the following are “use it or lose it” allowances. All area and distance measurements are in plan view unless otherwise noted.

Lighting Application	LZ 0	LZ 1	LZ 2	LZ 3
Additional Lumens Allowances for All Buildings except service stations and outdoor sales facilities. A MAXIMUM OF THREE (3) ALLOWANCES ARE PERMITTED.				
Building Entrance or Exits	400	1,000	2,000	4,000
Building Facades	0	0	85/m ²	170/m ²
Sales or Non-sales Canopies	0	30/m ²	60/m ²	130/m ²
Guard Stations	0	60/m ²	130/m ²	255/m ²
Outdoor Dining	0	10/m ²	50/m ²	110/m ²
Drive Up Windows	0	2,000 lumens per window	4,000 lumens per window	8,000 lumens per window
Additional Lumens Allowances for Service Stations only. Service stations may not use any other additional allowances.				
Vehicle Service Station Hardscape	0	40/m ²	85/m ²	170/m ²
Vehicle Service Station Canopies	0	85/m ²	170/m ²	340/m ²
Additional Lumens Allowances for Outdoor Sales facilities only. Outdoor Sales facilities may not use any other additional allowances. NOTICE: lighting permitted by these allowances shall employ controls extinguishing this lighting after a curfew time to be determined by the Authority.				
Outdoor Sales Lots	0	40/m ²	85/m ²	130/m ²
Outdoor Sales Frontage	0	0	305/linear metre	450/linear metre

Notes accompanying Table E:

Sales or Non-sales Canopies. This allowance is lumens per unit area for the total area within the drip line of the canopy. In order to qualify for this allowance, luminaires must be located under the canopy.

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Guard Stations. This allowance is lumens per unit area of guardhouse plus 185 m² per vehicle lane. In order to use this allowance, luminaires must be within 2 mounting heights of a vehicle lane or the guardhouse.

Outdoor Dining. This allowance is lumens per unit area for the total illuminated hardscape of outdoor dining. In order to use this allowance, luminaires must be within 2 mounting heights of the hardscape area of outdoor dining.

Drive Up Windows. This allowance is lumens per window. In order to use this allowance, luminaires must be within 1.85 m² of the center of the window.

Vehicle Service Station Hardscape. This allowance is lumens per unit area for the total illuminated hardscape area less area of buildings, area under canopies, area off property, or areas obstructed by signs or structures. In order to use this allowance, luminaires must be illuminating the hardscape area and must not be within a building, below a canopy, beyond property lines, or obstructed by a sign or other structure.

Vehicle Service Station Canopies. This allowance is lumens per unit area for the total area within the drip line of the canopy. In order to use this allowance, luminaires must be located under the canopy.

Outdoor Sales Lots. This allowance is lumens per square foot of uncovered sales lots used exclusively for the display of vehicles or other merchandise for sale, and may not include driveways, parking or other non-sales areas and shall not exceed 25% of the total hardscape area. To use this allowance, Luminaires must be within 2 mounting heights of the sales lot area.

Outdoor Sales Frontage. This allowance is for lineal metres of sales frontage immediately adjacent to the principal viewing location(s) and unobstructed for its viewing length. A corner sales lot may include two adjacent sides provided that a different principal viewing location exists for each side. In order to use this allowance, luminaires must be located between the principal viewing location and the frontage outdoor sales area.

The allowable light levels for the uses defined in Table E may be used to set a prescriptive lighting allowance for these uses in each lighting zone. It should be noted that the lighting allowance defined in Table E is only applicable for the area defined for that use and cannot be transferred to another area of the site. For some uses, such as outdoor sales, the jurisdiction is encourages to define a percentage of the total hardscape area that is eligible for the additional lighting allowance. For example, a set percentage of a car dealership's lot may be considered a display area and receive the additional lighting allowance where the remainder of the lot would be considered storage, visitor parking, etc. and cannot exceed the base light levels defined in Table A.

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**Table F
Maximum Vertical Illuminance at any point in the plane of the property line.**

Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3
0.05 FC or 0.5 LUX	0.1 FC or 1.0 LUX	0.3 FC or 3.0 LUX	0.8 FC or 8.0 LUX

**Table G
Residential Lighting Limits**

Lighting Application	LZ 0	LZ 1	LZ 2	LZ 3
Row 1 Maximum Allowed Luminaire Lumens* for Unshielded Luminaires at one entry only.	Not Allowed	420 lumens	630 lumens	630 lumens
Row 2 Maximum Allowed Luminaire Lumens* for each Fully Shielded Luminaire.	630 lumens	1,260 lumens	1,260 lumens	1,260 lumens
Row 3 Maximum Allowed Luminaire Lumens* for each Unshielded Luminaire excluding main entry.	Not Allowed	315 lumens	315 lumens	315 lumens
Row 4 Maximum Allowed Luminaire Lumens* for each Landscape Lighting.	Not Allowed	Not Allowed	1,050 lumens	2,100 lumens
Row 5 Maximum Allowed Luminaire Lumens* for each Shielded Directional Flood Lighting.	Not Allowed	Not Allowed	1,260 lumens	2,100 lumens
Row 6 Maximum Allowed Luminaire Lumens* for each Low Voltage Landscape Lighting.	Not Allowed	Not Allowed	525 lumens	525 lumens

* Luminaire lumens equals Initial Lamp Lumens for a lamp, multiplied by the number of lamps in the luminaire lot, and at the property lines.

SECTION 14 - EXAMPLE OF THE PRESCRIPTIVE METHOD

For the prescriptive method, the initial luminaire lumen allowances defined in Table A (Parking Space Method) or B (Hardscape Area Method) will provide basic lighting (parking lot and lighting at doors and/or sensitive security areas) that is consistent with the selected lighting zone. The prescriptive method is intended to provide a safe lighting environment while reducing sky glow and other adverse offsite impacts. The Per Parking Space Method is applicable in small rural towns and is a simple method for small retail “mom and pop” operations without drive lane access and where the parking lot is immediately adjacent to the road. The Town may also allow a prescriptive method for classes of sites, such as car dealerships, gas stations, or other common use areas.

Note that the values are for initial luminaire lumens, not footcandles on the target (parking lot, sidewalk, etc). Variables such as the efficiency of the luminaire, dispersion, and lamp wear can affect the actual amount of light so the lumens per square foot allowance is not equal to footcandles on the site. By specifying initial luminaire lumen values, it is easier for the Development Officer to verify that the requirement is being met. Initial luminaire lumens are available from photometric data. Each initial luminaire lumens calculation should be supplied on the submittal form.

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Solid state luminaires, such as LEDs, do not have initial lamp lumens, only initial luminaire lumens (absolute photometry). Other luminaires tested with relative photometry will have initial luminaire lumens which can be calculated by multiplying initial lamp lumens by the luminaire efficiency. In this example, three types of luminaires are used to light a parking area and building entry in a light commercial area. Two of these three luminaires use metal halide lamps: 70 watt wall mounted area lights and 150 watt pole mounted area lights. For these, the Initial Luminaire Lumens is equal to the initial lamp lumens multiplied by the luminaire efficiency. These values are entered into the compliance chart. The lumen value for the building mounted LED luminaires is equal to the lumens exiting the luminaire. Therefore, the value already represents the Initial Luminaire Lumens and no luminaire efficiency is needed. The total Luminaire Lumens for the site is equal to 247,840.

The allowable lumens are based on the lighting zone and the total hardscape area. Referencing Table B, the allowed lumens are 26.75/m² for LZ2. Multiplying this by the total hardscape area gives a value of 248,507.5 lumens allowed. Because this value is greater than the value calculated for the site, the project complies.

In this example, three types of luminaires are used to light a parking area and building entry in a light commercial area. Two of these three luminaires use metal halide lamps: 70 watt wall mounted area lights and 150 watt pole mounted area lights. For these, the Initial Luminaire Lumens is equal to the initial lamp lumens multiplied by the luminaire efficiency. These values are entered into the compliance chart. The lumen value for the building mounted LED luminaires is equal to the lumens exiting the luminaire. Therefore, the value already represents the Initial Luminaire Lumens and no luminaire efficiency is needed. The total Luminaire Lumens for the site is equal to 247,840. The allowable lumens are based on the lighting zone and the total hardscape area. Referencing Table B, the allowed lumens are 2.5/SF for LZ2. Multiplying this by the total hardscape square footage gives a value of 248,507.5 lumens allowed. Because this value is greater than the value calculated for the site, the project complies.

Prescriptive Method			
Lamp Descriptions	Qty	Initial Luminaire Lumens	Total
70 W Metal Halide	8	3,920	31,360
150 W Metal Halide	20	9,600	192,000
18 W LED	24	1,020	24,480
Total Site Initial Luminaire Lumens			247,840
Site Allowed Total Luminaire Lumens*			248,507.5
Project Compliance			Yes

*Listed below is the method of determining the allowed total initial lumens for non-residential outdoor lighting using the hardscape area method (Table B).

Site Allowed Total Initial Lumens	
Site Description	Light Commercial
Lighting Zone	LZ-2
Hardscape Area (m ²)	9,290
Allowed Lumens per m ² of Hardscape	26.75

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Site Allowed Total Initial Lumens (Lumens per m ² x hardscape area)	248,507.5
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The prescriptive method of this *Bylaw* restricts uplighting, including upward light emitted by decorative luminaires. The Town of Bon Accord may choose to preserve some types of lighting, including lighting of monuments or historic structures. In this case, the Town shall exempt or otherwise regulate these types of lighting carefully so that it does not inadvertently allow glaring or offensive lighting systems.

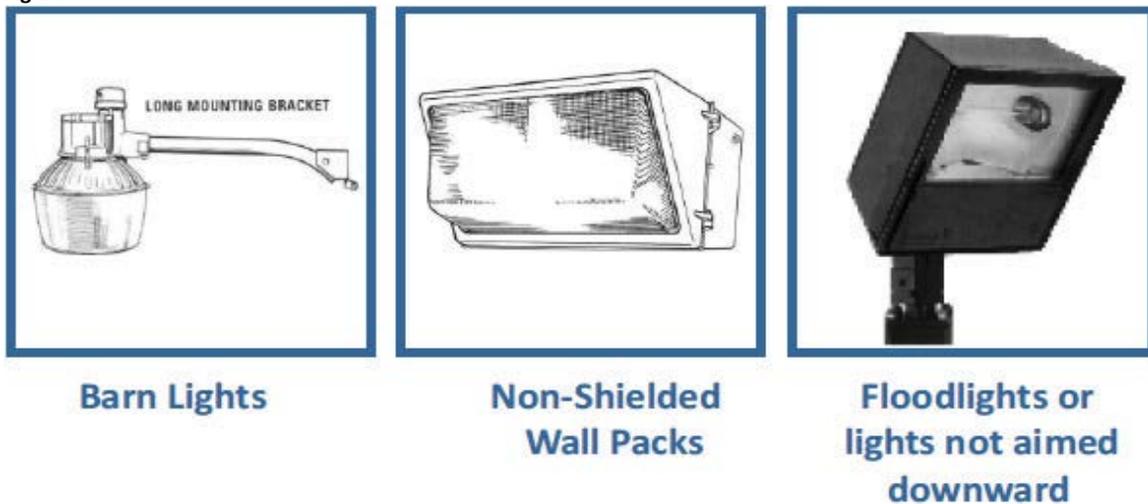
Offsite effects of light pollution include glare, light trespass, sky glow, and impacts on the nocturnal environment. All of these are functions of the fixture or luminaire design and installation. This *Bylaw* replaces the previous luminaire classification terminology of full cut-off, semi cut-off, and cut-off because those classifications were not as effective in controlling offsite impacts as with the IESNA luminaire classification system as described in TM-15-07.

A traditional method of defining light trespass is to identify a maximum light level at or near the property line. However, this method does not address offensive light that is not directed toward the ground, or the intensity of glaring light shining into adjacent windows. The requirements defined in Table C limit the amount of light in all quadrants that is directed toward or above the property line. The Backlight/Uplight/Glare (BUG) rating will help limit both light trespass and glare. (A detailed explanation of the BUG system is provided in this *Bylaw*. Tables C1 - C3 provide further details.) The limits for light distribution established in Table C (for the BUG rating system) prevent or severely limit all direct upward light. A small amount of uplight reflected by snow, light-colored pavement or a luminaire's supporting arms is inevitable and is not limited by the prescriptive method of this *Bylaw*.

A seemingly non-compliant fixture, such as a post-top translucent acorn luminaire, may in certain cases meet the BUG ratings, as long as it has proper interior baffling within the acorn globe. However, the BUG ratings in Table C will limit the use of the following types of luminaires in all lighting zones:

Figure

2



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SECTION 15 - EXAMPLE OF THE PERFORMANCE METHOD

The performance method is best for projects with complex lighting requirements or when the applicant wants or needs more flexibility in lighting design. The performance method is also used when any lighting designer plans to aim or direct any light fixture upward (above 90 degrees). An engineer or lighting professional generally will be required to design within the performance method. An adopting jurisdiction may also wish to hire an engineer or lighting professional to review and approve projects using this method and/or incorporate review of the performance method into special review procedures. The performance method is also best for projects where higher lighting levels are required compared to typical area lighting. An example might be a car sales lot where more light might be required on the new cars than would be needed for a standard parking lot. Another example is a gas station canopy requiring more light than a building entrance canopy. The first step in the performance method regulates overlighting by establishing the Total Initial Site Lumens (Table D) that are allowed.

Allowances include the total of the following (Table D):

1. Initial lumen allowance per site
2. Per area (m²) of hardscape

Table E allows additional lumens for unique site conditions. Examples of allowances include:

1. Per building entrance/exit
2. Per length (linear mere) of Outdoor Sales Frontage Perimeter
3. Per area (m²) of Vehicle Service Station Canopy
4. Plus other examples described in Table E.

The Site Total Initial Site Lumens allowed are a combination of allowances from Table D and Table E. The second step in the performance method is to determine if the proposed luminaires are producing off site impacts such as glare, sky glow and light trespass. One may either use Option A which are the Maximum Allowable BUG Ratings in Table C, or Option B through computer lighting calculations show compliance with Maximum Vertical Illuminance at any point in the plane of the property line in Table F. Option B will be required for all non-residential luminaires that:

1. Do not have BUG ratings, or
2. Exceed the BUG ratings,
3. Are not fully shielded, or
4. Have adjustable mountings.

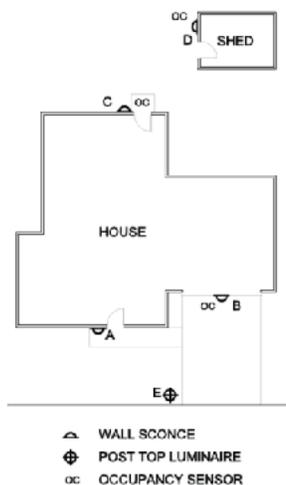
For the performance method, Option B (2) requires photometric calculations for the site perimeter, to a height of no less than 33 feet (10 metres) above the tallest luminaire. Vertical illuminances at eye height (5 feet above grade) will give values that can be used to verify compliance by comparing actual site conditions to the photometric plan submitted during review.

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Note that the MLO specifies 'total initial luminaire lumens' as a measurement in addition to footcandles/lux. The footcandle (lux) is equal to one lumen per square metre. Lux is the metric unit and is equal to one lumen per square metre.

SECTION 16 - EXAMPLE OF THE RESIDENTIAL METHOD

Most residential lighting has traditionally used incandescent lamps which are identified by their wattage. However, since new technologies provide more light for fewer watts, it is no longer possible to regulate residential lighting solely by providing a maximum wattage. Table G, therefore, lists maximum initial luminaire lumens only. In this example, five different luminaires are used on a residential property. Each luminaire must comply to meet the requirements. The site plan following shows luminaire types followed by a tabulation of each luminaire, whether or not it is fully shielded lamp type, and initial luminaire lumens. If the luminaire lumens are not known, multiply the initial lamp lumens by the luminaire efficiency. If the efficiency is not known, multiply the initial lamp lumens by 0.7 as a reasonable assumption. The maximum allowable lumen values come from Table G, based on the shielding classification and location on the site. In this case, each luminaire complies with the requirements of Table G.



Output (Lumens)	Power (Watts)		
	Incan	CFL	LED
500	40	8 - 10	9
850	60	13 - 18	12 - 15
1,200	75	18 - 22	15
1,700	100	23 - 28	18

Luminaire Type	Location	Luminaire Description	Fully Shielded	Lamp Type	Initial Lumen Lumens *	Maximum Allowed Initial Luminaire Lumens	Controls	Compliant
A	Front Entry	Decorative wall sconce	No	9W CFL	420	420	None	Yes
B	Garage Door	Fully shielded wall pack	Yes	23W CFL	1050	1260	Motion Sensor	Yes

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C	Back Entry	Decorative wall sconce	No	7W CFL	280	315	Motion Sensor	Yes
D	Shed Entry	Fully shielded wall pack	Yes	40W INC	343	1260	Motion Sensor	Yes
E	Driveway	Fully shielded post top	Yes	13W CFL	1260	1260	None	Yes

*Initial Luminaire Lumens are calculated by multiplying the total initial lamp lumens by the luminaire efficiency. If the luminaire efficiency is not known, assume an efficiency of 70%.

SECTION 17 - CONVERSION OF UNITS

Where a measurement is provided in both imperial and metric units, and the two measurements do not correspond precisely, the metric measurement shall take precedence for purposes of interpretation of this bylaw.

SECTION 18 - COMPLIANCE WITH OTHER LEGISLATION

Compliance with the requirements of this bylaw does not exempt a person, company, or organization from:

1. The requirements of any federal, Provincial, or municipal legislation;
2. Complying with any easement, covenant, agreement, or contract affecting development.

SECTION 19 – EFFECTIVE DATE

This Bylaw comes into force on the final passing thereof.

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SCHEDULE A

VIOLATIONS AND PENALTIES

The purpose of this *Bylaw* is educational, not punitive. There are, however, certain practices that will promote compliance with lighting regulations. Education is a key tool in promoting compliance. Proactive enforcement procedures will include providing a copy of the lighting regulations to every contractor at the time they consult the Town of Bon Accord to obtain a building permit. Another effective tool is a requirement that the builder or developer acknowledge in writing that the he or she is familiar with the lighting requirements and shall submit a lighting plan for approval. Submission of the Lighting Plan shall be required as a precondition to approval of any development undertaken in the Town's corporate limits or authority. The submitted Lighting Plan shall include the location and BUG rating for each luminaire, specify whether compliance is by the performance or prescriptive method, and a worksheet to show that the luminaires and their BUG ratings are compliant. The following penalties shall apply to all non-compliant landowners:

1. The first disciplinary action shall be a verbal warning by the Development Officer or any of their assignees, along with suggested methods to bring the offending luminaire(s) into compliance with this *Bylaw*.
2. A written warning outlining the non-compliant luminaire as well as methods to bring the luminaire into compliance.
3. If the land owner does not take measure to bring the offending luminaire(s) into compliance with this *Bylaw* within thirty (30) days after issue of written warning by the Development Officer or their assignees, a fine of two hundred and fifty dollars (\$250) shall be issued to each non-compliant premise under the authority of by-law enforcement of the Town of Bon Accord.
4. If the offending luminaire(s) are not replaced or modified to comply with this *Bylaw* thirty (30) days after the issuance of the monetary fine outlined in Section 3. above, the Town of Bon Accord shall be entitled to deactivate the luminaire(s) or replace them at the cost of the holder of the land deed in addition to the monetary fine issued in Section 3.

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READ A FIRST TIME THIS 3rd DAY OF MARCH, 2015.

Mayor Randolph Boyd

Acting Chief Administrative Officer Patrick Earl

READ A SECOND TIME THIS 17th DAY OF MARCH, 2015.

Mayor Randolph Boyd

Acting Chief Administrative Officer Patrick Earl

READ A THIRD TIME THIS 21st DAY OF APRIL, 2015.

Mayor Randolph Boyd

Acting Chief Administrative Officer Patrick Earl