

4.9.24 DRAFT REGULATIONS AND STANDARDS ON OUTDOOR LIGHTING

AN ORDINANCE OF SMITHFIELD TOWNSHIP, COUNTY OF MONROE, COMMONWEALTH OF PENNSYLVANIA, ADDING REGULATIONS AND STANDARDS RELATED TO OUTDOOR LIGHTING TO THE SMITHFIELD TOWNSHIP CODE OF ORDINANCES.

SECTION 1. The Smithfield Township Code of Ordinances, Chapter _____, Part _____ – Outdoor Lighting Standards is hereby established as follows:

§ ____ Definitions.

For the purposes of this chapter the following terms, phrases, words and their derivations shall have the meanings given herein. When not inconsistent with the context, words used in the present tense include the future; words in plural include the singular; and words in the singular include the plural. Any personal pronoun shall be construed so as to mean either the masculine, feminine, or neuter gender, as the context may require; and the word "shall" is always mandatory and not merely precatory.

ABSOLUTE PHOTOMETRY

Photometric measurements (usually of a solid-state luminaire) that directly measures the footprint of the luminaire. Reference Standard IES LM-79

ARCHITECTUAL LIGHTING

Lighting designed to reveal architectural beauty, shape and/or form and for which lighting for any other purpose is incidental.

AUTHORITY

The adopting municipality, agency or other governing body.

ASTRONOMIC TIME SWITCH

An automatic lighting control device that switches outdoor lighting relative to time of solar day with time of year correction.

BACKLIGHT

For 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.

BUG

A luminaire classification system that classifies backlight (B), uplight (U) and glare (G).

BILLBOARD

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A sign that directs attention to a business, commodity, service or entertainment conducted, sold or offered at a location other than the premises on which the sign is located - an off-site advertising sign.

CANOPY

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.)

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.

CURFEW

A time defined by the authority when outdoor lighting is reduced or extinguished.

EMERGENCY CONDITIONS

Generally, 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.

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.

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.

FULL CUTOFF

A lighting fixture from which no light is emitted at or above a horizontal plane drawn through the bottom of the fixture, and no more than 10% of the lamp's intensity is emitted at or above an angle 10% below that horizontal plane, at all lateral angles around the fixture.

FULLY SHIELDED LUMINAIRE

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.

GLARE

The sensation produced by lighting that causes an annoyance, discomfort or loss in visual performance and visibility to the eye.

HARDSCAPE

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Permanent hardscape improvements to the site including parking lots, drives, entrances, curbs, ramps, stairs, steps, medians, walkways and non-vegetated landscaping that is 10 feet or less in width. Materials may include concrete, asphalt, stone, gravel, etc.

HARDSCAPE AREA

The area measured in square feet of all hard- scape. It is used to calculate the Total Site Lumen Limit in both the Prescriptive Method and Performance Methods. Refer to Hardscape definition.

HARDSCAPE PERIMETER

The perimeter measured in linear feet is used to calculate the Total Site Lumen Limit in the Performance Method. Refer to Hardscape definition.

IDA

International Dark-Sky Association.

IESNA

Illuminating Engineering Society of North America

ILLUMINANCE

A measure of the amount of light falling onto a surface with light coming from an external light source(s). Illuminance, or illumination, is measured in units of footcandles or lux.

IMPERVIOUS MATERIAL

Sealed to severely restrict water entry and movement

INDUSTRY STANDARD LIGHTING SOFTWARE

Lighting software that calculates point-by- point illuminance that includes reflected light using either ray-tracing or radiosity methods.

LAMP

A generic term for a source of optical radia- tion (i.e. "light"), often called a "bulb" or "tube". Examples include incandescent, fluor- escent, high-intensity discharge (HID) lamps, and low pressure sodium (LPS) lamps, as well as light-emitting diode (LED) modules and arrays.

LED
Light-emitting diode.

LANDSCAPE LIGHTING

Lighting of trees, shrubs, or other plant material as well as ponds and other landscape features.

LED

Light Emitting Diode.

LIGHT METER

An instrument called an illuminance meter or light meter which measures the amount of light (illuminance) being received at a location.

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Light Pollution

Any adverse effect of artificial light including, but not limited to, glare, light trespass, sky- glow, energy waste, compromised safety and security, and impacts on the nocturnal environment.

LIGHT TRESPASS

The level of illumination (illuminance) which the light source on one property shines onto another property. This is measured in footcandles (or lux), generally at the property line of the property receiving the light.

LIGHTING

“Electric” or “man-made” or “artificial” lighting. See “lighting equipment”.

LIGHTING EQUIPMENT

Equipment specifically intended to provide gas or electric illumination, including but not limited to, lamp(s), luminaire(s), ballast(s), poles, posts, lens(s), and related structures, electrical wiring, and other necessary or auxiliary components.

LIGHTING ZONE

An overlay zoning system establishing legal limits for lighting for particular parcels, areas, or districts in a community.

LIGHTING EQUIPMENT

Equipment specifically intended to provide gas or electric illumination, including but not limited to, lamp(s), luminaire(s), ballast(s), poles, posts, lens(s), and related structures, electrical wiring, and other necessary or auxiliary components.

LOW VOLTAGE LANDSCAPE LIGHTING

Landscape lighting powered at less than 15 volts and limited to luminaires having a rated initial luminaire lumen output of 525 lumens or less.

LUMEN

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).

LUMINAIRE

The complete lighting unit (fixture), consisting of a lamp, 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 the power supply.

LUMINAIRE LUMENS

For luminaires with relative photometry per IES, it is calculated as the sum of the initial lamp lumens for all lamps within an individual luminaire, multiplied by the luminaire efficiency. If the efficiency is not known for a residential luminaire, assume 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.

LUMINAIRE SHEILDED DIRECTIONAL

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A fully shielded luminaire with an adjustable mounting device allowing aiming in a direction other than straight downward.

LUMINANCE

A measure of brightness of a source emitting light such as a backlit, digital or LED sign or billboard or a surface reflecting light. Luminance, or surface brightness, is most often measured in nits, or candelas per square meter (cd/m^2) which are equivalent.

LUX

The SI unit of illuminance. One lux is one lumen per square meter. 1 Lux is a unit of incident illuminance approximately equal to 1/10 footcandle.

MOUNTING HEIGHT

The height of the photometric center of a luminaire above grade level.

NEW LIGHTING

Lighting for areas not previously illuminated; newly installed lighting of any type except for replacement lighting or lighting repairs.

NIT

A nit is a measurement of luminance whose standard is the amount of light that one candle gives off in one square meter of area. A nit measures light force given off from a curved surface such as a light bulb or an LED. The nit is a unit of measurement that is used for "brightness" given by such sources as digital signs, displays, lighted billboards, etc.

OBJECT

A permanent structure located on a site. Objects may include statues or artwork, garages or canopies, outbuildings, etc.

OBJECT HEIGHT

The highest point of an entity, but shall not include antennas or similar structures.

ORNAMENTAL LIGHTING

Lighting that does not impact the function and safety of an area but is purely decorative, or used to illuminate architecture and/or land- scaping, and installed for aesthetic effect.

ORNAMENTAL STREET LIGHTING

A luminaire intended for illuminating streets that serves a decorative function in addition to providing optics that effectively deliver street lighting. It has a historical period appearance or decorative appearance, and has the following design characteristics:

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designed to mount on a pole using an arm, pendant, or vertical tenon; opaque or translucent top and/or sides; an optical aperture that is either open or enclosed with a flat, sag or drop lens; mounted in a fixed position; and with its photometric output measured using Type C photometry per IESNA LM-75-01.

OUTDOOR LIGHTING

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.

PARTLY SHIELDED LUMINAIRE

A luminaire with opaque top and translucent or perforated sides, designed to emit most light downward.

PEDESTRIAN HARDSCAPE

Stone, brick, concrete, asphalt or other similar finished surfaces intended primarily for walking, such as sidewalks and pathways.

PHOTOELECTRIC SWITCH

A control device employing a photocell or photodiode to detect daylight and automatically switch lights off when sufficient daylight is available.

PROPERTY LINE

The edges of the legally-defined extent of privately owned property.

RELATIVE PHOTOMETRY

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.

REPAIR(S)

The reconstruction or renewal of any part of an existing luminaire for the purpose of its on-going operation, other than relamping 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 relamping or replacement of components including capacitor, ballast or photocell.

REPLACEMENT LIGHTING

Lighting installed specifically to replace existing lighting that is sufficiently broken to be beyond repair.

SALES AREA

Uncovered area used for sales of retail goods and materials, including but not limited to automobiles, boats, tractors and other farm equipment, building supplies, and gardening and nursery products.

SEASONAL LIGHTING

Temporary lighting installed and operated in connection with holidays or traditions.

SHIELDED

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The description of a luminaire from which no direct glare is visible at normal viewing angles, by virtue of its being properly aimed, oriented, and located and properly fitted with such devices as shields, barn doors, baffles, louvers, skirts or visors.

SHIELDED DIRECTIONAL LUMINAIRE

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.

SIGN

Any structure, building, wall, or other outdoor surface, or any device or part thereof, which displays or includes any letter, word, model, banner, flag, pennant, insignia, device, or other representations used for announcement, direction or advertisement. The word "sign" includes the word "billboard" but does not include the flag, pennant, or insignia or any nation, state, city or other political unit nor public traffic or directional signs.

SKY GLOW

The brightening of the nighttime sky that results from scattering and reflection of artificial light by moisture and dust particles in the atmosphere. Skyglow is caused by light directed or reflected upwards or sideways and reduces one's ability to view the night sky

TEMPORARY LIGHTING

Lighting installed and operated for periods not to exceed 60 days, completely removed and not operated again for at least 30 days.

THIRD PARTY

A party contracted to provide lighting, such as a utility company.

TIME SWITCH

An automatic lighting control device that switches lights according to time of day.

TRANSLUCENT

Allowing light to pass through, diffusing it so that objects beyond cannot be seen clearly (not transparent or clear).

UNSHIELDED LUMINAIRE

A luminaire capable of emitting light in any direction including downwards.

UPLIGHT

For an exterior luminaire, flux radiated in the hemisphere at or above the horizontal plane.

VERTICAL ILLUMINANCE

Illuminance measured or calculated in a plane perpendicular to the site boundary or property line.

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§ ____ Applicability

This ordinance applies to all properties located within (or partially within) Smithfield Township. Except as described below, all outdoor lighting installed after the date of effect of this Ordinance Chapter 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.

§ ____ Exemptions

A) The following are not regulated by this Ordinance:

- 1) Lighting within the public right-of-way or easement for the principal purpose of illuminating roads and highways. No exemption shall apply to any street lighting and 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.
- 2) Lighting for public monuments and statuary.
- 3) Repairs to existing luminaires not exceeding 25% of total installed luminaires.
- 4) Temporary lighting for theatrical, television, performance areas and construction sites;
- 5) Underwater lighting in swimming pools and other water features
- 6) Temporary lighting and seasonal lighting (e.g., Christmas lights, Halloween decorations); that will be fully removed after the holiday ends; or after 30 days from the date of installation, whichever is shorter.
- 7) Lighting that is only used under emergency conditions as declared by Monroe County Emergency Control Center.
- 8) In lighting overlay zones 2, 3 and 4, low wattage (below 10 watts) landscape lighting controlled by an automatic device that is set to turn the lights off at one hour after the site is closed to the public or after sunset.

B) Exceptions Special Requirements. All lighting shall follow provisions in this ordinance; however, any special requirements for lighting listed in 1) and 2) below shall take precedence.

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- 1) Lighting specified or identified in a specific use permit.
- 2) Lighting required by federal, state, territorial, commonwealth or provincial laws or regulations.

C) Exceptions to Lighting Control requirements:

Lighting reductions are not required for any of the following:

- a. With the exception of landscape lighting, lighting for residential properties including multiple residential properties not having common areas, provided that there is no light spillover onto adjacent properties, and the illumination level does not exceed the limits established in the Overlay Zones for that particular parcel.
- b. When the outdoor lighting consists of only one fully shielded luminaire.
- c. Low wattage lighting for steps, stairs, walkways, and building doorway entrances.
- d. Motion activated lighting, as long as the lights return to the off state within 10 minutes of activation from motion.
- e. Lighting governed by a temporary special use permit in which times of operation are specifically identified.
- f. Businesses that operate on a 24 hour basis.

§ ____ Lighting Zone Overlay Districts

- A) Zoning Overlay Districts.** The Township Zoning Ordinance Chapter ____ shall be amended ____ to include lighting overlay zones in which lighting is allowed or restricted commensurate with the need to control light trespass, glare and the need for more or less illumination.

LZO: 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.

National Recreation Area Parcels; E. Stroudsburg Reservoir Parcels; Township Open Space Parcels

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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.

RC District, R2 district

LZ2: Moderate ambient lighting: Lighting Zone 2 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 serving recreational and playing fields and/or mixed use development with a predominance of residential uses

R1 district

LZ3: Moderately high ambient lighting: Lighting Zone 3 pertains to areas with moderately high lighting levels. 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.

RE District, ED district

LZ4: High ambient lighting: Lighting zone 4 pertains to areas of very high ambient lighting levels. LZ-4 should only be used for special cases and is not appropriate for most cities. LZ-4 may be used for extremely unusual installations such as high density entertainment districts, and heavy industrial uses.

MI District

§ ____ Zoning Overlay District Standard and Criteria Tables; and Backlight, Uplight, Glare (BUG): Tables shall accompany this ordinance. The tables are based on IES developed TM-15 Luminaire Classification System for Outdoor Luminaires.

A) The three components of BUG ratings are based on IES TM-15-07 (revised). [See Table C 1, C 2, C 3; See Figure 1 for visual reference.](#)

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- 1) **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. **Table C-1 Shall govern.**
 - 2) **Uplight**, which causes artificial sky glow. Lower uplight (zone UL) causes the most sky glow and negatively affects 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). **Table C-2 Shall govern.**
 - 3) **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. **Table C-3 Shall govern.**
- A) The lumen limits established for each lighting zone overlay apply to all types of lighting within that overlay zone. 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**).
- B) 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.

§ ____ Lighting Control Requirements

- A) 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 time switch or equivalent functions

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from a programmable lighting controller, building automation system or lighting energy management system, all with battery or similar backup power or device.

Exceptions to 3 (A). Automatic lighting controls are not required for the following:

- a) Lighting under closed canopies.
- b) Lighting for tunnels, parking garages, garage entrances, and similar conditions.

B) Automatic Lighting Reduction Requirements

The Municipality shall establish curfew time(s) from **11PM-dawn**. **During this curfew time**, total outdoor lighting lumens shall be reduced by at least 30% or extinguished.

- C) Unless otherwise permitted by the Board of Supervisors, e.g., for safety or security or all-night commercial/industrial operations, lighting for commercial, industrial and public recreational and institutional applications shall be controlled by automatic switching devices such as time clocks or combination motion detectors and photocells to permit extinguishing sources between 11:00 p.m. and dawn.

Security lighting proposed for use after 11:00 p.m., or after the normal hours of operation for commercial, industrial, institutional or municipal applications, shall be reduced by 75% from the levels normally permitted by this chapter from then until dawn.

- D) Directional fixtures for such applications as facade, fountain, feature and landscape illumination shall be aimed so as not to project their output beyond the objects intended to be illuminated and shall be extinguished between the hours of 11:00 p.m. and dawn.

§ ____ User Guide

The Chapter User guide is hereby incorporated and intended to clarify the sections of the Ordinance for the lighting designers, engineers, residents, and residents of the Municipality.

§ ____ Non-Residential Lighting

This brief explanation shall be incorporated:

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This section addresses non-residential lighting and multiple-family residences having common spaces, such as lobbies, interior corridors or parking. Its intent is to Limit the amount of light that can be used; minimize glare by controlling the amount of light that tends to create glare; minimize sky glow by controlling the amount of uplight; minimize the amount of off-site impacts or light trespass

This Section provides two methods for determining compliance in non-residential districts. 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 ordinance. 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.

Prescriptive Method. An outdoor lighting installation complies with this section if it meets the requirements of subsections 1 and 2, below. 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. 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 Smithfield Township 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.

A. Prescriptive Method.

An outdoor lighting installation complies with this section if it meets the requirements of subsections 1 and 2, below.

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 limit 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, existing lighting shall be included in the calculation of total installed lumens.

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

2. *Limits to Off Site Impacts*

All luminaires shall be rated and installed according to **Table C**.

3. *Light Shielding for Parking Lot Illumination*

All parking lot lighting shall have no light emitted above 90 degrees.

B. Performance Method

This abbreviated explanation shall be incorporated:

The first step in the Performance Method regulates overlighting by establishing the Total Initial Site Lumens (Table D) that are allowed. Table E allows additional lumens for unique site conditions. 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 use computer lighting calculations show compliance with Maximum Vertical Illuminance at any point in the plane of the property line in Table F.

For the performance method, Option B (2) requires photometric calculations for the site perimeter, to a height of no less than 33 feet (10 meters) 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.

1. Total Site Lumen Limit

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

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

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2. Limits to Off Site Impacts

All luminaires shall be rated and installed using either Option A or Option B (below). 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:

1) 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. These recommended practices are hereby incorporated by reference as though more fully set forth herein. Copies of the recommended practices are available for use at the Township Municipal Building.

A) IES Guidelines referenced herein: Illuminating Engineering Society of North America (IESNA) as contained in the current issue of:

B) IESNA RP-33 Lighting for Exterior Environments;

C) IESNA RP-6 Sports and Recreational Area Lighting;

D) IESNA RP-8 Roadway Lighting; and

E) IESNA RP-20 Lighting for Parking Facilities.

2) Analysis shall utilize an enclosure comprised of calculation planes with zero reflectance values around the perimeter of the site. The top of the enclosure shall be no less than 33 feet (10 meters) above the tallest luminaire. Calculations shall include total lumens upon the inside surfaces of the box top and vertical sides and maximum vertical illuminance (footcandles and/or lux) on the sides of the enclosure.

The design shall comply only if:

a) The total lumens on the inside surfaces of the virtual enclosure are less than 15% of the total site lumen limit; and

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- b) The maximum vertical illuminance on any vertical surface is less than the allowed maximum illuminance per **Table F**.

§ ___ Residential Lighting

A. General Requirements

For residential properties including multiple residential properties not having common areas, all outdoor luminaires shall be fully shielded and shall not exceed the allowed lumen output in Table G, row 2.

Exceptions

1. One partly shielded or unshielded luminaire at the main entry, not exceeding the allowed lumen output in Table G row 1.
2. Any other partly shielded or unshielded luminaires not exceeding the allowed lumen output in Table G row 3.
3. Low voltage landscape lighting aimed away from adjacent properties and not exceeding the allowed lumen output in Table G row 4.
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.
5. Open flame gas lamps.
6. Lighting installed with a vacancy sensor, where the sensor extinguishes the lights no more than 15 minutes after the area is vacated.
7. Lighting exempt.

B. *Requirements for Residential Landscape Lighting*

1. Shall comply with Table G.
2. Shall not be aimed onto adjacent properties.

§ ___ Other Standards and Criteria for Outdoor Lighting and for the Control of Light and Glare

A. Lighting fixture design:

- (1) Fixtures/luminaires shall be fully shielded and designed appropriate to the lighting application and aesthetically acceptable to the Township. Figure 1.

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- (2) All lighting shall be aimed, located, designed, fitted and maintained so as not to present a hazard to drivers or pedestrians by impairing their ability to safely traverse and so as not to create a nuisance by projecting or reflecting objectionable light onto a public roadway or neighboring use or property.
- (3) Vegetation screens shall not be employed to serve as the primary means for controlling glare..
- (4) Only the United States and the Pennsylvania state flag shall be permitted to be illuminated from dusk to dawn, and each flagpole shall be illuminated by a single source with a beam spread no greater than necessary to illuminate the flag(s). Flag lighting sources shall not exceed 7,000 lumens per flagpole.
- (5) The use of white strobe lighting for tall structures such as smokestacks, chimneys and radio/communications/television towers is prohibited during hours of darkness, except as specifically required by Federal Aviation Administration.
- (6) Canopy lighting, for such applications as gas/service stations and bank and fast-food drive-throughs, shall be accomplished using flat- lens, full-cutoff fixtures aimed straight down and shielded in such a manner that the lowest opaque edge of the fixture shall be level with or below the light source.
- (7) Uses that require the projection of light out at 45° or higher shall not be illuminated.

B. Installation.

- (1) For new installations, electrical feeds for pole-mounted fixtures shall be run underground, not overhead.
- (2) Poles supporting lighting fixtures for the illumination of parking areas and located directly behind parking spaces or where they could be hit by snowplows or wide-swinging vehicles shall be placed a minimum of four feet outside paved areas or tire stops, or on concrete pedestals at least 30 inches high above the pavement, or suitably protected by other Township-approved means.
- (3) Pole-mounted fixtures shall be aimed straight down.
- (4) Electrical installation of streetlighting shall be in accordance with prevailing regulations and specifications established by the Metropolitan Edison Company. It shall be the responsibility of the installing contractor, or his agent, to have final construction inspected by an electrical inspection agency and a written report attesting to this fact submitted to the Metropolitan Edison Company, thereby allowing the utility to provide pole illumination.

C. Post-installation inspection. The Township reserves the right to conduct post-installation nighttime inspections to

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verify compliance with the requirements of this chapter and if appropriate, to require remedial action at no expense to the Township.

§ ____ Plan Submission Requirements

- A. For any subdivision and land development applications where outdoor site lighting is proposed by the applicant or required by this chapter, lighting plans shall be submitted to the Township for review and approval with any preliminary or final subdivision and any land development plan application. The Township shall also require that lighting plans be submitted for conditional use applications, special exception applications, and variance applications (for any standard/criteria in this chapter seeking relief upon). Lighting plans shall include:
- (1) A site plan, complete with all structures, parking spaces, building entrances, traffic areas (both vehicular and pedestrian), vegetation (both leaf out, no leaf for deciduous species) that might interfere with lighting, and adjacent uses that might be adversely impacted by the lighting, containing a layout of all proposed fixtures by location, mounting height and type. The submission shall include, in addition to area lighting, exterior architectural, building entrance, landscape lighting, etc.
 - (2) A ten-foot-by-ten-foot illuminance-grid (point-by-point) plot of maintained footcandles/illumination level units overlaid on the site plan, plotted out to 0.0 footcandles/illumination level units, which demonstrates compliance with the light trespass, intensity and uniformity requirements as set forth in this chapter or as otherwise required by the Township.
 - (3) The applicant shall also submit a visual-impact plan that demonstrates appropriate steps have been taken to mitigate on-site and off-site glare, including but not limited to a plot plan with a matrix of the calculated footcandles with measurements 10 feet into the neighboring properties including those on the opposite side of a public right-of-way or public roadway, at five feet above the ground.
 - (4) Description and artistic rendering of the proposed equipment, including fixture catalog cuts, photometries, glare reduction devices, lamps, on/off control devices, mounting heights, pole foundation details and mounting methods.
 - (5) Landscaping plans (with leaf and without leaf for deciduous species) shall contain lighting fixture locations and shall demonstrate that the site lighting and landscaping have been coordinated to minimize conflict between vegetation and intended light distribution, both initially and at vegetation maturity.
- B. Limits to Off Site Impacts analysis. For any subdivision/land development application, and conditional use application,

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the applicant shall conduct an Off-Site Impacts Analysis.

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/fixture 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.

- C. Plan notes: The following notes shall appear on the lighting plan:
 - (1) Post-approval alterations to lighting plans or intended substitutions for approved lighting equipment shall be submitted to the Township for review and approval.
 - (2) The Township reserves the right to conduct post-installation nighttime inspections to verify compliance with the requirements of this chapter and as otherwise agreed upon by the Township and, if appropriate, to require remedial action at no expense to the Township.
 - (3) All site lighting shall meet IESNA full-cutoff criteria.

- D. Notification must be sent to the Township Manager or his/her/Their designee, and/or considered by the Board of Supervisors and/or code enforcement officer before any post-approval alterations to lighting plans or intended substitutions from approved lighting equipment are made. Post-approval alternations or intended substitutions to the approved lighting plan must meet the requirements of the originally approved plan.

- E. For all applications, the Township may impose more stringent lighting standards requiring less illumination as a condition of any such approval when it determines the same to be necessary to protect adjoining properties or streets from light pollution and/or glare.

§ ____ Compliance Monitoring & Notice of Violation

- A. Safety hazards.
 - (1) If the Township Code Enforcement Officer determines that a lighting installation creates a safety or personal security hazard, the person(s) responsible for the lighting shall be notified, in writing, and required to take remedial action.

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- (2) If appropriate corrective action has not been effected and if no appeal of the determination has been filed with the Board of Supervisors within 30 days of written notification, the violation shall be deemed a strict liability offense, and the Township may commence legal action as provided in this chapter.
- B. Nuisance glare and inadequate illumination levels.
- (1) When the Township Code Enforcement Officer determines an installation produces unacceptable levels of nuisance glare, skyward light, excessive or insufficient illumination levels or otherwise varies from this chapter, the Township may cause written notification of the person(s) responsible for the lighting and require appropriate remedial action.
 - (2) If appropriate corrective action has not been effected and if no appeal of the determination has been filed with the Smithfield Township Board of Supervisors within 30 days of written notification, the violation shall be deemed a strict liability offense, and the Township may commence legal action as provided in this chapter.

§ ___ Non-Conforming Lighting

Any lighting fixture or lighting installation existing on the effective date of this chapter that does not conform with the requirements of this chapter shall be brought into conformance when:

- A. Minor corrective action, such as reaiming or shielding can bring conformity with the applicable requirements of the chapter.
- B. It is deemed by the Township Code Enforcement Officer to create a safety hazard or any possible other health and welfare concerns.
- C. It is replaced with another fixture or fixtures, abandoned or relocated.
- D. There is a change in use.
- E. 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. 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 Ordinance.

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 Ordinance.

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F. Minor Modifications, Additions, or New Lighting Fixtures for Non-residential and Multiple Dwellings

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 Ordinance 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 Ordinance.

G. Resumption of Use after Abandonment. If a property with non-conforming lighting is abandoned for a period of six months or more, then all outdoor lighting shall be brought into compliance with this Ordinance before any further use of the property occurs

§ _____ Temporary Waivers and Lighting by Special Permit

Upon written application for a Special Event Permit to the Township not less than 30 days in advance, a temporary waiver from strict compliance with the noise standards specified herein may be granted to persons if they can demonstrate compliance with the ordinance, as determined by the Board of Supervisors.

The Special Event Permit process is defined as follows:

A. High Intensity and Special Purpose Lighting

The following lighting systems are prohibited from being installed or used except by special use permit:

1. Temporary lighting in which any single luminaire exceeds 20,000 initial luminaire lumens or the total lighting load exceeds 160,000 lumens.
2. Aerial Lasers.
3. Searchlights.
4. BOther very intense lighting defined as having a light source exceeding 200,000 initial luminaire lumens or an intensity in any direction of more than 2,000,000 candelas.

B. Complex and Non-Conforming Uses

Upon special permit issued by the Authority, lighting not complying with the technical requirements of this ordinance but consistent with its intent may be installed for complex sites or uses or special uses including, but not limited to, the following applications:

1. Sports facilities, including but not limited to unconditioned rinks, open courts, fields, and stadiums.
2. Construction lighting.
3. Lighting for industrial sites having special requirements, such as petrochemical manufacturing or storage,

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- shipping piers, etc.
- 4. Parking structures.
- 5. Urban parks
- 6. Ornamental and architectural lighting of bridges, public monuments, statuary and public buildings.
- 7. Theme and amusement parks.
- 8. Correctional facilities.

To obtain such a permit, applicants shall demonstrate that the proposed lighting installation:

- a. Has sustained every reasonable effort to mitigate the effects of light on the environment and surrounding properties, supported by a signed statement describing the mitigation measures. Such statement shall be accompanied by the calculations required for the Performance Method.
- b. Employs lighting controls to reduce lighting at a Project Specific Curfew (“Curfew”) time to be established in the Permit.
- c. Complies with the Performance Method after Curfew.

The Township shall review each such application. A permit may be granted if, upon review, the Township standards are met as prescribed in this ordinance for the zoning overlay district and that all standards in that zoning overlay district shall apply.

§ _____ Violations and Penalties

- A. Any person who is found to have violated an order of the Township or who willfully or negligently failed to comply with the provisions of this chapter and the orders, rules, regulations and permits issued hereunder shall be prosecuted by action brought before a District Justice in the same manner provided for the enforcement of summary offenses under the Pennsylvania Rules of Criminal Procedure. The Municipal Solicitor or the Code Enforcement Officer may assume charge of prosecution without the consent of the District Attorney as required by Pa. R.Crim.P. No. 83 (relating to trial in summary cases). The Board shall prescribe criminal fines not to exceed \$1,000 for the violation of this chapter. Each day or portion thereof that such violation continues or is permitted to continue shall constitute a separate offense, and each section of this chapter that is violated shall also constitute a separate offense.

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- B. The Smithfield Township Supervisors may take any appropriate action at law or in equity, civil or criminal, to enforce the provisions of this chapter, and this chapter shall in no way restrict any remedies or otherwise available and provided by law.
- C. In all actions instituted and successfully prosecuted by the Township, it shall have a further right to reimbursement from the violator for attorney's fees and costs related to the action.

§ _____ Reserved for Sign Lighting

§ _____ Reserved for Street Lighting

SECTION 2. Severability. In the event any provision, section, sentence, clause, or part of this Ordinance shall be held invalid, such invalidity shall not affect or impair any remaining provision, section, sentence, clause or part of this Ordinance, it being the intent of this Township that such remainder shall be and shall remain in full force and effect.

SECTION 3. Repealer. All other ordinances or parts of ordinances inconsistent herewith shall be and the same expressly are repealed.

Table A - Allowed Total Initial Luminaire Lumens per Site for Non-residential 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	LZ-4
350 lms/space	490 lms/space	630 lms/space	840 lms/space	1,050 lms/space

Table B - Allowed Total Initial Lumens per Site for Non- residential Outdoor Lighting, Hardscape Area Method. May be used for any project. When lighting intersections of site drives and public streets or road, a total of 600 square feet for each intersection may be added to the actual site hardscape area to provide for intersection lighting.

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LZ-0	LZ-1	LZ-2	LZ-3	LZ-4
Base Allowance				
0.5 lumens per SF of Hardscape	1.25 lumens per SF of Hardscape	2.5 lumens per SF of Hardscape	5.0 lumens per SF of Hardscape	7.5 lumens per SF of Hardscape

Table B - Lumen Allowances, in Addition to Base Allowance

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Table B (CONTINUED)- Lumen Allowances, in Addition to Base Allowance

	LZ 0	LZ 1	LZ 2	LZ 3	LZ 4
Additional allowances for sales and service facilities. No more than two additional allowances per site, Use it or Lose it.					
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. To use this allowance, luminaires must be within 2 mounting heights of sales lot area.	0	4 lumens per square foot	8 lumens per square foot	16 lumens per square foot	16 lumens per square foot
Outdoor Sales Frontage. This allowance is for lineal feet 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	0	0	1,000 per LF	1,500 per LF	2,000 per LF
Drive Up Windows. In order to use this allowance, luminaires must be within 20 feet horizontal distance of the center of the window.	0	2,000 lumens per drive-up window	4,000 lumens per drive-up window	8,000 lumens per drive-up window	8,000 lumens per drive-up window
Vehicle Service Station. This allowance is lumens per installed fuel pump.	0	4,000 lumens per pump (based on 5 fc horiz)	8,000 lumens per pump (based on 10 fc horiz)	16,000 lumens per pump (based on 20 fc horiz)	24,000 lumens per pump (based on 20 fc horiz)

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Table C - Maximum Allowable Backlight, Uplight and Glare (BUG) Ratings

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.

TABLE C-1	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Allowed Backlight Rating*					
Greater than 2 mounting heights from property line	B1	B3	B4	B5	B5
1 to less than 2 mounting heights from property line and ideally oriented**	B1	B2	B3	B4	B4
0.5 to 1 mounting heights from property line and ideally oriented**	B0	B1	B2	B3	B3
Less than 0.5 mounting height to property line and properly oriented**	B0	B0	B0	B1	B2

For property lines that abut public walkways, bikeways, plazas, and parking lots, the property line may be considered to be 5 feet 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 center-line 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.

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

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TABLE C-2	Lighting Zone	Lighting Zone	Lighting Zone	Lighting Zone	Lighting Zone
	0	1	2	3	4
Allowed Uplight Rating	U0	U1	U2	U3	U4
Allowed % light emission above 90° for street or Area lighting	0%	0%	0%	0%	0%

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

TABLE C-3	Lighting Zone	Lighting Zone	Lighting Zone	Lighting Zone	Lighting Zone
	0	1	2	3	4
Allowed Glare Rating	G0	G1	G2	G3	G4
Any luminaire not ideally oriented*** with 1 to less than 2 mounting heights to any property line of concern	G0	G0	G1	G1	G2
Any luminaire not ideally oriented*** with 0.5 to 1 mounting heights to any property line of concern	G0	G0	G0	G1	G1
Any luminaire not ideally oriented*** with less than 0.5 mounting heights to any property line of concern	G0	G0	G0	G0	G1

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

Table D Performance Method Allowed Total Initial Site Lumens

May be used on any project.

Lighting Zone	LZ 0	LZ 1	LZ 2	LZ 3	LZ 4
Allowed Lumens Per SF	0.5	1.25	2.5	5.0	7.5
Allowed Base Lumens Per Site	0	3,500	7,000	14,000	21,000

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 in plan view unless otherwise noted.

Lighting Application	LZ 0	LZ 1	LZ 2	LZ 3	LZ 4
Additional Lumens Allowances for All Buildings except service stations and outdoor sales facilities. A MAXIMUM OF THREE (3) ALLOWANCES ARE PERMITTED. THESE ALLOWANCES ARE “USE IT OR LOSE IT”.					
Building Entrances or Exits. This allowance is per door. In order to use this allowance, luminaires must be within 20 feet of the door.	400	1,000	2,000	4,000	6,000
Building Facades. This allowance is lumens per unit area of building façade that are illuminated. To use this allowance, luminaires must be aimed at the façade and capable of illuminating it without obstruction.	0	0	8/SF	16/SF	24/SF

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Lighting Application	LZ 0	LZ 1	LZ 2	LZ 3	LZ 4
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.	0	3/SF	6/SF	12/SF	18/SF
Guard Stations. This allowance is lumens per unit area of guardhouse plus 2000 sf per vehicle lane. In order to use this allowance, luminaires must be within 2 mounting heights of a vehicle lane or the guardhouse.	0	6/SF	12/SF	24/SF	36/SF
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	0	1/SF	5/SF	10/SF	15/SF
Drive Up Windows. This allowance is lumens per window. In order to use this allowance, luminaires must be within 20 feet of the center of the window.	0	2,000 lumens per drive-up window	4,000 lumens per drive-up window	8,000 lumens per drive-up window	8,000 lumens per drive-up window
Additional Lumens Allowances for Service Stations only. Service stations may not use any other additional allowances.					
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.	0	4/SF	8/SF	16/SF	24/SF

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Lighting Application	LZ 0	LZ 1	LZ 2	LZ 3	LZ 4
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.	0	8/SF	16/SF	32/SF	32/SF
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. 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.	0	4/SF	8/SF	12/SF	18/SF
Outdoor Sales Frontage. This allowance is for lineal feet 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.	0	0	1,000/LF	1,500/LF	2,000/LF

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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	Lighting Zone 4
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	1.5 FC or 15.0 LUX

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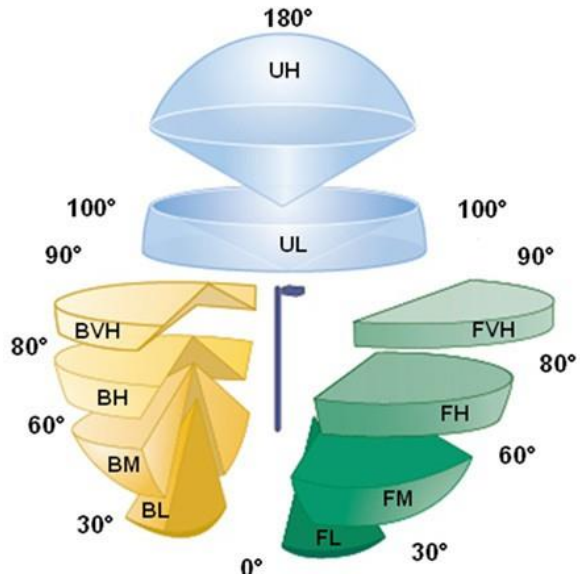
Table G - Residential Lighting Limits

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

* Luminaire lumens equals Initial Lamp Lumens for a lamp, multiplied by the number of lamps in the luminaire

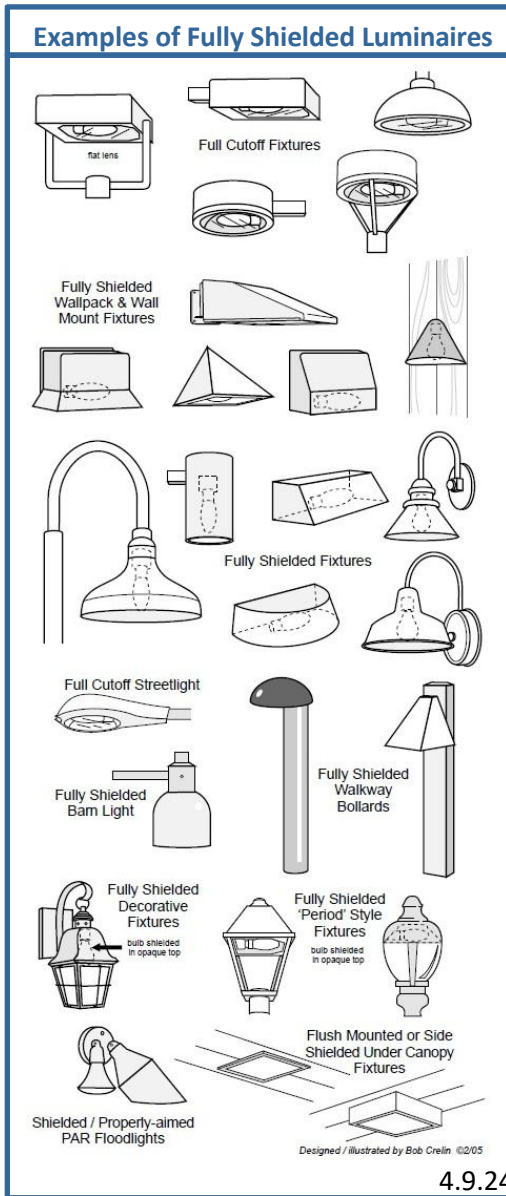
4.9.24 DRAFT REGULATIONS AND STANDARDS ON OUTDOOR LIGHTING

Figure 1: BUG Visual explanation. (Key: UH=Uplight High, UL=Uplight Low, BVH=Backlight Very High, BH=Backlight High, BM=Backlight Medium, BL=Backlight Low, FVH=Forward Light Very High, FH=Forward Light High, FM=Forward Light Medium, FL=Forward Light Low.)



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Figure 2. Examples of Fully Shielded Luminaires.



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Figure 3. Examples of some luminaires that **cannot** be used: Barn lights, Non-Shielded Wall Packs, Floodlights or lights not aimed downward



Smithfield Township Lighting Standards Chapter User Guide

Part 1: Non-Residential Lighting

This section addresses non-residential lighting and multiple-family residences having common spaces, such as lobbies, interior corridors or parking. Its intent is to:

- Limit the amount of light that can be used
- Minimize glare by controlling the amount of light that tends to create glare
- Minimize sky glow by controlling the amount of uplight
- Minimize the amount of off-site impacts or light trespass This ordinance provides 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 ordinance. 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,

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because it is simple and does not require engineering expertise.

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 rural towns and is a simple method for small retail operations without drive lane access and where the parking lot is immediately adjacent to the road. A jurisdiction 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 officials 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.

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 **in this ordinance**. 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 hard- scape 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 250,000 lumens allowed. Because this value is greater than the value calculated for the site, the project complies. Listed below is an example on a typical compliance worksheet for the Prescriptive Method.

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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 250,000 lumens allowed. Because this value is greater than the value calculated for the site, the project complies.

TABLE 1: Prescriptive Method Example

PRESCRIPTIVE METHOD EXAMPLE – COMPLIANCE CHART			
<i>Lamp Descriptions</i>		<i>Initial Luminaire Lumens</i>	<i>Total</i>
70 W Metal Halide		3,920	31,360
150 W Metal Halide		9,600	192,000
18 W LED		1,020	24,480
TOTAL INITIAL LUMINAIRE LUMENS			247,840
SITE ALLOWED TOTAL INITIAL LUMENS*			250,000
PROJECT IS COMPLIANT?			YES

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*Table 1 Footnote – references Table 2 Listed below is the method of determining the allowed total initial lumen for non-residential outdoor lighting using the hardscape area method. (Table 2).

SITE ALLOWED TOTAL INITIAL LUMENS	
<i>Site Description</i>	Light Commercial
<i>Lighting Zone</i>	LZ-2
<i>Hardscape Area (SF)</i>	100,000
<i>Allowed Lumens per SF of Hardscape (Table B)</i>	2.5
<i>Site Allowed Total Initial Lumens (lumens per SF X hardscape area)</i>	250,000

The prescriptive method of this ordinance restricts uplighting, including upward light emitted by decorative luminaires.

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.

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 User Guide).

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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 ordinance.

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 summation of the following (Table D):

- 1) Initial lumen allowance per site
- 2) Per area (SF) of hardscape

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

- 1) Per building entrance/exit
- 2) Per length (linear feet) of Outdoor Sales Frontage Perimeter
- 3) Per area (SF) of Vehicle Service Station Canopy
- 4) Plus more ...

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

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at any point in the plane of the property line in Table F. Option B will be required for all non-residential luminaires that

- A) do not have BUG ratings, or
- B) exceed the BUG ratings,
- C) are not fully shielded, or
- D) 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 meters) 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. 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 meter. Lux is the metric unit and is equal to one lumen per square meter.

The application to Smithfield Township will require information about the number of luminaires, the number of lamps in each luminaire, the initial luminaire lumens for each luminaire and the initial lumen output for each lamp (based on the wattage and type of lamp selected) as well as plans showing the site area measurements. This will allow the reviewer to verify that the lumen output of all the luminaires does not exceed the allowance.

For enforcement, Township Professionals, field verification by Smithfield Township will be achieved by asking the applicant and/or owner to verify that the luminaire type, lamp type and wattages specified have been used. Also the Township may ask the applicant for photometric data for each luminaire, since the initial luminaire lumens and B-U-G ratings are stated on the photometric report.

Smithfield Township may also request a point-by-point photometric plan. 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.

Part 2: Residential Lighting

Residential Lighting Example

In this example on the following page, 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

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G, based on the shielding classification and location on the site. In this case, each luminaire complies with the requirements of Table G.

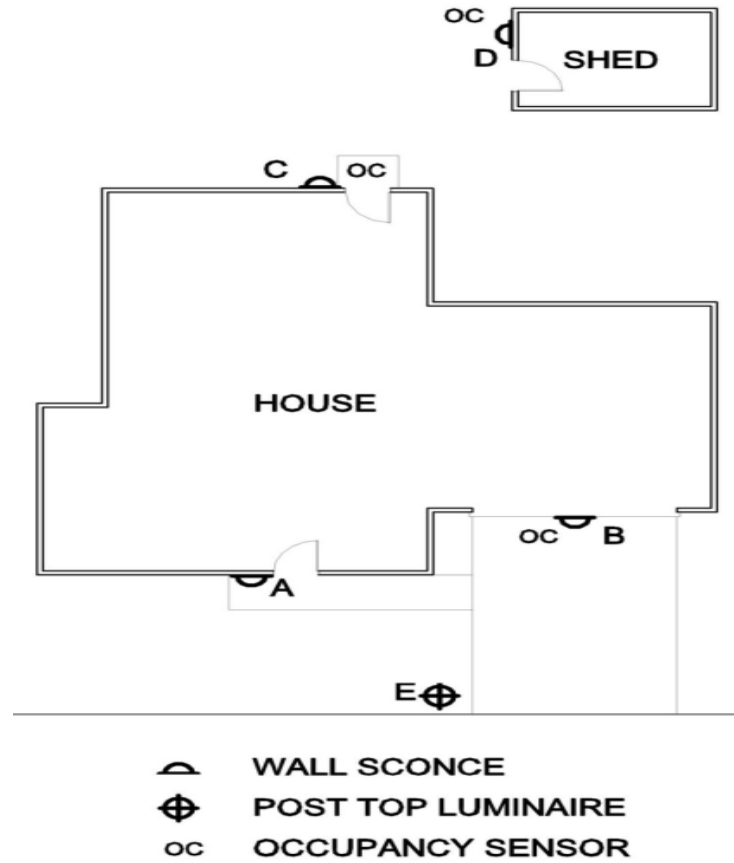
Figure 1.

Comparison of efficacy by power (120 Volt Incandescent lamps)

Output (Lumens)	Power (Watt)	
500		
	CFL	LED
500	8 - 10	9
850	13 - 18	12 - 15
1,200	18 - 22	15
1,700	23 - 28	18

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Figure 2



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Table 3.

Property Type: Residential Lighting Zone 1								
Luminaire Type	Location	Luminaire Description	Fully Shielded	Lamp Type	Initial Luminaire Lumens*	Maximum Allowed Initial Luminaire Lumens (Table G)	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	Occupancy Sensor	Yes
C	Back Entry	Decorative wall sconce	No	7W CFL	280	315	Occupancy Sensor	Yes
D	Shed Entry	Fully shielded wall pack	Yes	40W INC	343	1260	Occupancy 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% and multiply the lamp lumen value by 0.7.

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Part 3: Tables & Table C BUG Rating

IES developed TM-15 *Luminaire Classification System for Outdoor Luminaires*. As this is a relatively new rating system, and many people may not be familiar with it, more explanation of how the rating system works is provided here. The new rating system adopted in TM-15, as adopted herein by the Smithfield Township Board of Supervisors will be used intact and exclusively.

BUG requires downlight only with low glare (better than full cut off) in lighting zones 0, 1 and 2, but allows a minor amount of uplight in lighting zones 3 and 4. In lighting zones 3 and 4, 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. 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.

Uplight, which causes artificial sky glow. Lower uplight (zone UL) causes the most sky glow and negatively affects 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 **harmful to the welfare of the community** 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.

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BUG ratings apply to the Lighting **Overlay** Zone of the property under consideration.

(Key: UH=Uplight High, UL=Uplight Low, BVH=Backlight Very High, BH=Backlight High, BM=Backlight Medium, BL=Backlight Low, FVH=Forward Light Very High, FH=Forward Light High, FM=Forward Light Medium, 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:

- Zone 0 allows no light above 90 degrees.
- 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 5 W incandescent lamp).
- Zone 2 allows only 50 lumens in the UH and UL zones, 100 lumens total (less than a 25W incandescent lamp)
- Zone 3 allows only 500 lumens in the UH and UL zones, 1000 lumens total (about the output of a 75W incandescent bulb).
- Zone 4 allows only 1,000 lumens in the UH and UL zones, 2000 lumens total (about the output of a 100W incandescent bulb).

Table D Example, Performance Method

The first step in the Performance Method is to establish the Site Total Initial Site Lumens which regulates overlighting. The performance method allows layers of light depending on the complexity of the site.

Table D establishes the basic total initial site lumens allowed. These lumen allowances are added together for a total initial site lumen allowance.

Allowances include:

- 1) Initial lumen allowance per site
- 2) Per area (SF) of hardscape

Table E. Performance method

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The allowable light levels for these 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 encouraged 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.

Table G. Residential Lighting

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.