

SECTION 11A **LIGHTING**

11A.1 Intent and purpose.

Outdoor lighting shall be designed to provide the minimum lighting necessary to ensure adequate safety, night vision, and comfort, reduce light pollution and not create or cause excessive glare on adjacent properties and street rights-of-way.

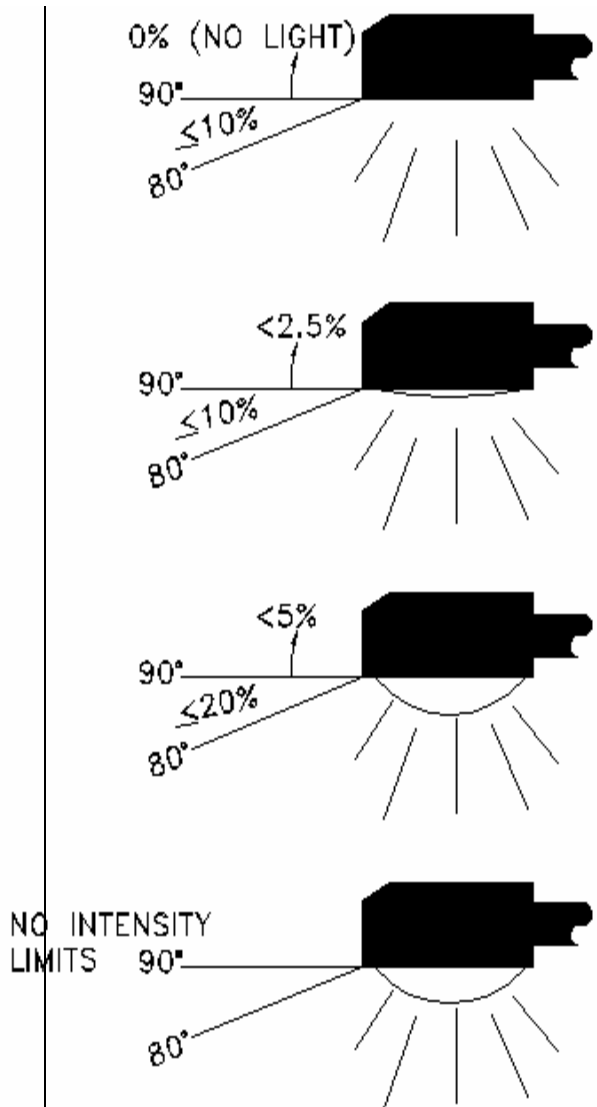
11A.2 IESNA Cutoff Classifications (with minimal wording modifications to provide non-technical clarity)

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

Cutoff—A fixture light distribution where no more than 2.5% of a lamp's light intensity is emitted at or above a horizontal plane drawn through the bottom of the fixture and no more than 10% of the lamp's light intensity is emitted at or above an angle 10 degrees below that horizontal plane, at all lateral angles around the fixture.

Semi-Cutoff—A fixture light distribution where no more than 5% of a lamp's light intensity is emitted at or above a horizontal plane drawn through the bottom of the fixture and no more than 20% of the lamp's light intensity is emitted at or above an angle 10 degrees below that horizontal plane, at all lateral angles around the fixture

Noncutoff—A fixture light distribution where there is no light intensity limitation in the zone above the maximum distribution of light intensity.



1. Full Cutoff—A fixture light distribution where no light intensity is emitted at or above a horizontal plane drawn through the bottom of the fixture and no more than 10% of the lamp's light intensity is emitted at or above an angle 10 degrees below that horizontal plane, at all lateral angles around the fixture.

2. Cutoff—A fixture light distribution where no more than 2.5% of a lamp's light intensity is emitted at or above a horizontal plane drawn through the bottom of the fixture and no more than 10% of the lamp's light intensity is emitted at or above an angle 10 degrees below that horizontal plane, at all lateral angles around the fixture.

3. Semi-Cutoff—A fixture light distribution where no more than 5% of a lamp's light intensity is emitted at or above a horizontal plane drawn through the bottom of the fixture and no more than 20% of the lamp's light intensity is emitted at or above an angle 10 degrees below that horizontal plane, at all lateral angles around the fixture

4. Noncutoff—A fixture light distribution where there is no light

11A.3 Definitions

Candela— A measure of luminous or light intensity in a certain direction. Useful in determining how much light is shining out of a fixture and in what direction.

Diffusing Panel (lens) – A translucent material covering the lamps in a luminaire in order to reduce the brightness by distributing the light flux over an extended area.

Direct Lighting – Lighting involving luminaries that distribute 90 to 100% of the emitted light in the general direction of the surface to be illuminated. The term usually refers to light emitted in a downward direction.

Fixture— An assembly that holds the lamp (bulb) in a lighting system. It includes the elements designed to give light output control, such as a reflector (mirror) or refractor (lens), the ballast, housing, and the attachment parts.

Flood Lamp— A form of lighting designed to direct its output in a specific direction with a reflector formed from the glass envelope of the lamp itself. Such lamps are so

designated by the manufacturers and are typically used in residential outdoor area lighting.

Flood Light— A form of lighting designed to direct its output in a diffuse, more or less specific direction, with reflecting or refracting elements located external to the lamp.

Footcandle (FC)— A quantitative unit measuring the amount of light (illumination) falling onto a given point. One footcandle equals one lumen per square foot.

Glare— The effect produced by a light source within the visual field that is sufficiently brighter than the level to which the eyes are adapted, to cause annoyance, discomfort, or loss of visual performance and ability.

HID— High intensity discharge lighting is a bulb type including mercury vapor, metal halide, high pressure or low-pressure sodium, which glow when an electric current is passed through a gas mixture inside the bulb.

Holiday/Festive Lighting – Lighting that is installed with the intent to operate during a designated temporary period of time where a specific theme or event is a focus of attention.

IESNA—The Illuminating Engineering Society of North America, a non-profit professional organization of lighting specialists that has established recommended design standards for various lighting applications.

Illuminance— The amount of light falling on a surface-measured in lux or footcandles.

Internal Refractive Lens— A glass or plastic lens installed between the lamp and the sections of the outer fixture globe or enclosure. Refractive refers to the redirection (bending) of the light as it goes through the lens, softening and spreading the light being distributed from the light source thereby reducing direct glare.

Light Source— The element of a lighting fixture that is the point of origin of the lumens emitted by the fixture.

Light Trespass— Light emitted by a lighting installation that falls outside the boundaries of the property on which the installation is sited. This has adverse effects on residents, vehicle operators and pedestrians, the natural environment.

Lumen— A quantitative unit used to identify the amount of light emitted by a light source. A lamp is generally rated in lumens.

Maintained Footcandles— Illuminance of lighting fixtures adjusted for a maintenance factor accounting for dirt build-up and lamp output depreciation. The maintenance factor used in the design process to account for this depreciation cannot be lower than 0.72 for high-pressure sodium and 0.64 for metal halide and mercury vapor.

Medium Base— The size of lamp socket designed to accept a medium or Edison base lamp.

Natural Recreation Area – An area that is intrinsically dark at night where electric lighting should be held to a minimum as designated by Chatham County.

Outdoor Performance Area— An area permanently dedicated to the public presentation of music, dance, theater, media arts, storytelling, oratory, or other performing arts, whether publicly or privately owned, including but not limited to amphitheaters and similar open or semi-enclosed structures.

Outdoor Sports Field— An area designed for recreation (public or privately owned). These areas include, but are not limited to baseball/softball diamonds, soccer fields, football fields, golf courses, golf driving ranges, tennis courts, racetracks, firearm shooting ranges, and swimming pools.

Right-of-Way— An interest in land to the county which provides for the perpetual right and privilege of the county, its agents, franchise holders, successors, and assigns to construct, install, improve, reconstruct, remove, replace, inspect, repair, maintain, and use a public *street*, including related and customary uses of street rights-of-way such as sidewalks, bike paths, landscaping, mass transit facilities, traffic control, traffic control devices and signage, sanitary sewer, storm water drainage, water supply, cable television, electric power, gas, and telephone transmission and related purposes in, upon, over, below, and across the rights-of-way.

Temporary Lighting— Lighting used for a limited duration, but in no case longer than thirty (30) days.

Vehicular Canopy— A roofed, open, drive-through structure designed to provide temporary shelter for vehicles and their occupants while making use of a business' services.

Wall Pack— A type of light fixture typically flush-mounted on a vertical wall surface.

Wide-body Refractive Globe— A translucent lamp enclosure used with some outdoor fixtures to provide a decorative look (including but not limited to acorn- and carriage light-style fixtures). "Wide-body" refers to a wider than average size globe (greater than 15.75" in diameter). "Refractive" refers to the redirection (bending) of the light as it goes through the lens, rendering the light fixture more effective. Wide-body refractive globes are intended to soften and spread the light being distributed from the light source thereby reducing direct glare.

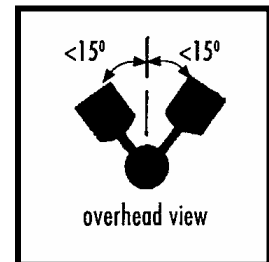
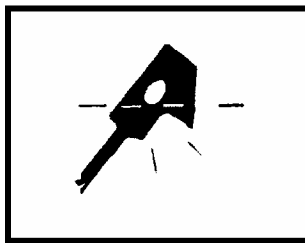
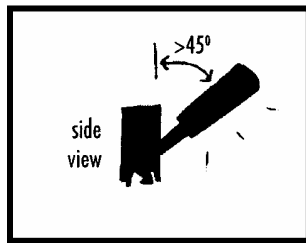
11A.4 Light Measurement Technique

Light level measurements shall be made at the property line of the property upon which the light to be measured is being generated. If measurement on private property is not possible or practical, light level measurements may be made at the boundary of the right-of-way that adjoins the property of the complainant or at any other location on the property of the complainant. Measurements shall be made at finished grade (ground level), with the light-registering portion of the meter held parallel to the ground pointing up. The meter shall have cosine and color correction and have an accuracy tolerance of no greater than plus or minus five (5) percent. Measurements shall be taken with a light meter that has been calibrated within the previous two years. Light levels are specified, calculated and measured in footcandles (FC). All FC values are maintained footcandles unless specified otherwise. See the definition for maintained footcandles in section 11A.3 for maximum allowed light loss factors.

11A.5 General Standards for Outdoor Lighting

- (1) Lighting Plan—A lighting plan shall be provided for review and must be approved prior to the issuance of the building permit. The lighting plan shall demonstrate a consideration for reduced energy consumption through the selection of energy efficient fixtures.

- (2) Unless otherwise specified in the following subsections, the maximum light level shall be 0.5 maintained footcandle at any property line in a residential district, or on a lot occupied by a dwelling, congregate care or congregate living structure, unless otherwise approved by the county.
- (3) All floodlights shall be installed such that the fixture shall be aimed down at least forty-five (45) degrees from vertical. These lights shall be positioned such that any such fixture located within fifty feet (50) of a public street right-of-way is mounted and aimed perpendicular to the right-of-way, with a side-to-side horizontal aiming tolerance not to exceed fifteen (15) degrees from perpendicular to the right-of-way. The Planning Director may require shields to be installed on floodlights before, during or after the installation when needed to further reduce lighting trespass, glare and light pollution. Flood lights shall not be aimed at residential property.



- (4) All flood lamps emitting 1,000 or more lumens shall be aimed at least sixty (60) degrees down from horizontal or shielded such that the main beam from the light source is not visible from adjacent properties or the public street right-of-way.
- (5) All wall pack fixtures shall be full cutoff fixtures.
- (6) All fixtures installed, owned, or leased by governmental or public agencies, or their agents, for the purpose of illuminating public streets are otherwise exempt from this regulation. Fixtures installed through private development are not exempt.
- (7) The lighting plan shall demonstrate a consideration for reduced energy consumption through the selection of energy efficient fixtures.
- (8) With the exception of essential all-night security lighting, the plan shall demonstrate lighting reduction procedures, implemented using timers or other methods (such as fixtures that automatically change wattage output). Said lighting reduction shall be active between approximately 12 midnight and dawn. For 24-hr commercial activities, this requirement may be adjusted by approval of the Board of County Commissioners.

11A.6 Lighting in Outdoor Areas (Residential and Non-Residential)

- (1) Other than flood lights and flood lamps, all outdoor area and parking lot lighting fixtures of more than 2,000 lumens shall be full cutoff fixtures, or comply with subsection (4) below.
- (2) The mounting height of all outdoor lighting, except outdoor sports field lighting and outdoor performance area lighting shall not exceed thirty-seven (37) feet above finished grade, unless approved by the Board of County Commissioners as having no adverse effect.
- (3) Security Lighting for Open Parking Facilities: For lighted parking lots the minimum light level shall be no less than 0.2 footcandles. All light levels are measured at ground level. The minimum light level requirements vary depending on

the activity classification. The specified minimum FC value above 0.2 FC as outlined in the following table means that the lowest light level point or location in the parking lot must not exceed the minimum stated FC value in the table (i.e. 0.9 FC for large shopping centers). An average to minimum uniformity ratio of 4:1 means that the average FC to minimum FC ratio cannot be worse (higher) than 4:1. See the following table:

<u>Security Light Levels for Open Outdoor Parking Facilities*</u>		
<u>Use/Task</u>	<u>Maintained Footcandles</u>	<u>Uniformity Avg/Min</u>
<u>(a) Parking, residential, multi-family</u> • <u>Low to medium vehicular/pedestrian activity</u>	<u>Range from 0.2 Min to 0.6 Min</u>	<u>4:1</u>
<u>(b) Parking, industrial/commercial/Institutional/municipal</u> • <u>High activity, i.e. large shopping centers/fast food facilities, major athletic/civic cultural events</u> • <u>Medium/low activity, i.e. community shopping, office parks, hospitals, commuter lots, cultural/civic/recreational events, residential neighborhood shopping, industrial employee parking, schools, church parking</u>	<u>0.9 Min</u> <u>Range from 0.2 Min to 0.7 Min</u>	<u>4:1</u> <u>4:1</u>

* Source: IESNA 8th Edition Lighting Handbook; Modification: Medium and Low Activity Level recommendations have been combined.

Notes:

- a. Illumination levels are horizontal on the task, e.g. pavement or area surface.
- b. Uniformity ratios dictate that average illuminance values shall not exceed minimum values by more than the product of the minimum value and the specified ratio. For example, for commercial parking medium/low activity, the average footcandles shall not be in excess of 2.8 (0.7 x 4).
- c. A low/medium activity can be reclassified upward when appropriate and only with Chatham County Planning Department approval.
- d. Examples of lighting measurements taken during the development of this ordinance are available from the Planning Department.

(4) Exceptions:

- a. Non-cutoff decorative post-mounted fixtures may be used but must be equipped with a solid top when available to direct the light downward or meet the cutoff classification. Mounting heights of 18 feet or less above ground are allowed when the maximum initial lumens generated by each fixture does not exceed 9500 initial lamp lumens.
 1. All metal halide, mercury vapor, fluorescent, induction, white high pressure sodium and color improved high pressure sodium lamps used in non-cutoff

fixtures shall be coated with an internal white frosting inside the outer lamp envelope.

2.All metal halide solid-top decorative post fixtures equipped with a medium base socket must use an internal refractive lens, a diffusing panel (lens) or a wide-body refractive globe as described in section 11A.3 Definitions.

- b. Dusk-to-dawn open bottom security lights must be fully shielded to provide a full cutoff light distribution.
- c. Temporary lighting for special events of short duration. Typically these are low wattage or low voltage applications for public festivals, celebrations, and the observance of holidays, carnivals, and celebrations. Portable (non-permanent) internally-illuminated signs come under this classification and, as such, can be used for up to thirty (30) days only.
- d. Airport lighting controlled by the Federal Aviation Administration (FAA).
- e. Lighting of the United States of America and State of North Carolina flags and other flags or insignia of any governmental entity.

11A.7 Lighting for Vehicular Canopies

Areas under a vehicular canopy shall have an average maximum horizontal illuminance of twenty-four (24) maintained footcandles (FC). Areas outside the vehicular canopy shall be regulated by the standards of subsection 11A.6 above. Lighting under vehicular canopies shall be designed so as not to create glare off-site. Acceptable methods include one or both of the following:

- (1) Recessed fixture incorporating a lens cover that is either recessed or flush with the bottom surface (ceiling) of the vehicular canopy that provides a full cutoff or fully-shielded light distribution.
- (2) Surface mounted fixture incorporating a flat glass that provides a full cutoff or fully-shielded light distribution.

11A.8 Outdoor Sports Field /Outdoor Performance Area Lighting

- (1) The mounting height of outdoor sports field and outdoor performance area lighting fixtures shall not exceed eighty (80) feet from finished grade unless approved by the Chatham County Zoning Board of Adjustment.
- (2) All outdoor sports field and outdoor performance area lighting fixtures shall be equipped with a glare control package (louvers, shields, or similar devices).
- (3) The fixtures must be aimed so that their beams are directed and fall within the primary playing or performance area. The maximum light level shall be 0.5 maintained footcandles at any property line in a residential district, or on a lot occupied by a dwelling congregate care or congregate living structure.
- (4) As outdoor sport field/outdoor performance area lighting non-conforming fixtures fail, maintenance replacement fixtures must be installed that comply with the requirements of these lighting standards.
- (5) The hours of operation for the lighting system for any game or event shall not exceed one hour after the end of the event.

11A.9 Natural Recreation Areas

These locations are intrinsically dark landscapes at night. Such areas include state and national parks, conservation areas, natural recreation areas, and areas adjacent to optical astronomical observatories. These places are used for camping, etc., where a naturally dark environment is desired and are designated by Chatham County.

1. Light reduction procedures begin at approximately 12 midnight with limited essential safety and security lighting.
2. All fixtures shall be full cut-off.

11A.10 Lighting of Outdoor Display Areas

The following provisions apply to outdoor display areas except for car dealership parking lots, as specified in item (4), below:

- (1) Parking lot outdoor areas shall be illuminated in accordance with the requirements for subsection 11A.6 above. Outdoor display areas shall have a maximum average maintained illuminance of twenty-four (24) maintained footcandles.
- (2) All light fixtures shall meet the IESNA definition of cutoff fixtures. Forward throw fixtures (type IV light distribution, as defined by the IESNA) are required within twenty-five (25) feet of any public street right-of-way. Alternatively, directional fixtures (such as floodlights) may be used provided they shall be aimed in accordance with subsections 11A.5 (3) and 11A.5 (4) of this ordinance.
- (3) The mounting height of outdoor display area fixtures shall not exceed thirty-seven (37) feet above finished grade.
- (4) For car dealership parking lots, the following provisions shall apply:
 - a. Full cutoff fixtures shall be used.
 - b. Mounting Heights: Up to a maximum of thirty-five (35) plus 2-foot raised base for parking areas as needed.
 - c. Lighting at the first row, the car bumper may not exceed a maximum average maintained illuminance of 24 footcandles.
 - d. Lighting in the non-display area of the parking lot after hours shall be no higher than 7 FC average maintained.

11A.11 Lighting of Buildings

- (1) Lighting fixtures shall be selected, located, aimed, and shielded so that direct illumination is focused exclusively on the building façade, plantings, and other intended site features, and away from adjoining properties and the public street right-of-way.
- (2) Illumination on any vertical surface or angular roof shall not exceed 5.0 FC average maintained
- (3) To the extent practical and where possible, lighting fixtures shall be directed downward rather than upward
- (4) When upward aiming is used, placement of low wattage fixtures with shields (as needed) close to the building to graze the façade is required to minimize reflected light from windows and other surfaces. The Planning Department can waive this

requirement in rare and unusual cases if it is demonstrated that the physical location of light fixtures close to the building to accomplish this design is not possible.

11A.12 Permanent Sign and Billboard Lighting

Lighting fixtures illuminating signs and billboards shall be aimed and shielded so that direct illumination is focused exclusively on the sign. Externally lighted signs shall be lighted from the top of the sign downward. The Planning Department can waive this requirement in rare and unusual cases if it is demonstrated that the physical location of light fixtures for top down aiming is not possible. The maximum watts permitted to illuminate a sign are determined by multiplying the sign face area by 2 watts per square foot. For additional guidance, see the sign section of the County Zoning Ordinance.

Exception: Signs less than 7 feet (2 meters) in height above grade may be illuminated by ground mounted uplighting not exceeding 100 lamp watts per sign face.

NOTE: Refer to Section 11A.6 (4)(c) regarding portable internally illuminated signs.

11A.13 Holiday/Festive Lighting

Holiday/festive lighting is allowed provided it complies with the definition outlined in section 11A.3. The connection of multiple holidays and/or festive events over a number of weeks and/or months is not permitted. Lamps below 7 watts are exempt and have no restrictions on use.

11A.14 Walkways, Bikeways and Parks (Section to be lighted)

The walkway, pathway, or ground areas that are to be lighted shall be illuminated to a level of at least 0.2 and no more than 0.5 average horizontal maintained footcandles.

11A.15 Landscape Lighting

All landscape and residential façade lighting systems shall employ shielded directional luminaires not to exceed 40 lamp watts. The luminaires shall be aimed such that the light source cannot be seen from any reasonable viewing point on an adjacent property.

11A.16 Permitting and Approval Process

The following section applies generally to the Permitting and Approval Process and outlines requirements of the applicant seeking a permit for work involving outdoor lighting for residential subdivision single family and multi-family developments, commercial, multi-use, office, institutional and industrial projects. Specific permitting requirements are to be in compliance with the procedures established by the Chatham County Planning Department and the Chatham County Central Permitting Department. These aforementioned requirements shall serve as the framework by which this ordinance is implemented.

As with any permitting process, the applicant shall be required to submit the appropriate supporting documentation at the time the application is submitted for review. The documentation submitted shall contain, but not be limited to the following, all or part of

which may be part of, or in addition to, the information required elsewhere in this Ordinance, and by the policies and procedures established by the Chatham County Planning Department and the Chatham County Central Permitting Department.

- (1) The applicant for any permit required for work involving outdoor lighting for commercial, office, institutional and industrial projects with a gross floor area of more than 5,000 square feet, residential projects other than detached single family dwellings of more than 6 units, all vehicular canopies and all outdoor display areas shall submit documentation at time of site plan or plot plan approval that the proposed lighting plan complies with the provisions of this lighting standard.
- (2) A lighting plan to scale is required that shows a point-by-point footcandle array on a 10' by 10' grid in a printout format indicating the location and aiming of illuminating devices. The printout shall include a summary table to indicate compliance with the average maintained and minimum footcandles and average to minimum uniformity ratios. FC point values in the appropriate areas to determine light trespass compliance is also required. The lighting plan shall include as a minimum an arrangement of the subject outdoor lighting, a fixture schedule detailing the mounting height & technique, fixture type, bulb type & wattage, controls, lenses, etc. The lighting plan shall demonstrate a consideration for reduced energy consumption through the selection of energy efficient fixtures as well as the implementation of the stated lighting practices as outlined throughout this ordinance.
- (3) A point-by-point photometric footcandle array created from industry recognized lighting software systems and/or manual calculations created by a professional engineer, lighting certified professional, vendor or an individual that possesses the skills to perform such calculations. Methods used for calculating the lighting footcandle levels shall be indicated in the application documentation. The footcandle array shall be provided in a hardcopy printed format indicating the location and aiming of all applicable illuminating devices covered under the subject application based on the site and/or building arrangement plan complete with consideration of adjoining properties and roadways.
- (4) Description of the illuminating devices, fixtures, lamps, supports, reflectors, poles, raised foundations and other devices (including but not limited to manufacturers or electric utility catalog specification sheets and/or drawings, and photometric report indicating fixture classification [cutoff fixture, wall pack, flood light, etc.]).

Projects that are not required to submit items identified in sub-section (1) above are still subject to comply with the provisions of this ordinance and may be required to provide this information upon request.

The Chatham County Planning Department personnel may modify and/or waive any part(s) of the above referenced permit requirements, provided the applicant can otherwise demonstrate compliance with this Code. Note: An example of this provision might be where a contractor or utility repeatedly installs the same lighting equipment on different projects in the county. One submittal containing the specification sheets of a particular group of fixtures may be sufficient for the Planning Department to modify the project requirement and require that only the other provisions of the ordinance be met since the

fixture specification provisions have already been met. This modification would conserve county personnel and lighting supplier/installer resources.

11A.17 Nonconformities

- (1) Any lighting fixture lawfully in place or approved by the county prior to the adoption of this ordinance shall be exempt from these requirements. At the time that a non-conforming fixture is replaced, moved, upgraded, or otherwise changed, the fixture must be brought into compliance with the requirements of this ordinance. Any expansion of, or addition to, an existing lighting system must conform to the requirements of this ordinance.
- (2) Routine maintenance, including changing the lamp, ballast, starter, photo control, lens, and other required components, is permitted for all existing fixtures. When the fixture housing is changed, the fixture must come into compliance.
- (3) Vehicular Canopies do not qualify for this exemption and have five years from the adoption date of this ordinance to bring the outdoor lighting into compliance. If a major renovation of the canopy (50% or more of the existing light fixtures) occurs at this facility prior to the expiration of the five-year term, the earlier date will apply regarding compliance.
- (4) Property owners that install lighting fixtures after the effective date of this ordinance and are found to be in non-compliance shall receive written notification according to this ordinance.
- (5) See section 11A.12 (h)(4) for nonconformity provisions for outdoor sports fields and performance areas.