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APPENDICES

APPENDIX A

The following is a list of artificial light sources grouped by the level of disruption they are likely to cause sea tu tles. The criteria used to group the sources came from studies of physiological spectral sensitivity (Granda an O'Shea, 1972), hatchling orientation with respect to laboratory light sources (Mrosovsky and Carr, 196 Mrosovsky and Shettleworth, 1968; Mrosovsky, 1972; Witherington and Bjorndal, 1991a; Witherington, 1992b and commercial light sources (Dickerson and Nelson, 1988, 1989; Witherington, 1989; Witherington and Bjorn dal, 1991b; Ferreira *et al.*, 1992; Nelson, 1992; Witherington, 1992b), and spectral profiles of commonly used lamp (Anonymous, 1983; Rossotti, 1983; Anonymous, 1989; Witherington and Bjorndal, 1991b). Effects are describe as being extremely disruptive, highly disruptive, moderately disruptive, or minimally disruptive.

White, broad-spectrum, short-arc lighting *(extremely disruptive).*—These light sources include xenon and mercury arc lamps and are the brightest and highest-energy light sources commonly used. They emit wavelengths rather evenly across the visible spectrum (which is why they appear white) and in the ultraviolet spectrum as well. They are used principally for temporary, intense lighting needs.

White, broad-spectrum, electric-discharge lighting *(extremely disruptive).*—Mercury-vapor, metal-halide, and fluorescent-tube lighting are included in this group. Like sources in the preceding group, these sources emit wavelengths across the visible spectrum. They are used both indoors and outdoors. Fluorescent-tube lighting is becoming more common as an indoor source and is frequently used to light porches and outdoor signs.

Color-phosphor and tinted-fluorescent lighting ("blacklight" ultraviolet, violet, blue, green, and mixtures of these colors) *(extremely disruptive).*—As revealed to some extent by their colors, these electric-discharge tube lamps emit light principally in the short-wavelength end of the visible spectrum. The so-called "blacklight"-type fluorescent tubes, however, emit much of their light in the near-ultraviolet region. These blacklight tubes appear as a dim violet color to humans but are very disruptive to sea turtle hatchlings. Blacklights are often used as insect attractants in insect-electrocuting "bug-zappers." Tubes of other colors are principally used for decorative applications.

White, broad-spectrum, incandescent lighting *(extremely disruptive).*—Light emitted from incandescent sources comes from a glowing filament. This group includes quartz-tungsten-halogen and simple tungsten-filament sources. Without tinting, these sources emit wavelengths throughout the visible spectrum but less so in the short-wavelength end of the spectrum than the sources described above. Incandescent sources are commonly used as outdoor floodlights, as indoor lighting (*i.e.*, the common ligh bulb), and as transient lighting (flashlights, lanterns, and electric torches).

Color-tinted incandescent lighting (blue and green) *(extremely disruptive).*—These colored sources are tinted so that they emit principally short-wavelength light; they are often used in decorative applications.

White, pressurized-fuel, glowing-element lanterns *(extremely disruptive).*—These portable lanterns are used for camping, fishing, and other transient nighttime activities.

High-pressure sodium vapor (HPS) lighting *(highly disruptive).*—HPS sources emit light with minor wavelength peaks in the blue and green regions and major peaks in the yellow and orange regions of the visible spectrum. The color of HPS sources is whitish golden to peach. Although less disruptive than the broad-spectrum white sources above, HPS is one of the most commonly used outdoor light sources in the USA and many other countries and is one of the most common causes of hatchling misorientation and mortality.

Open fires *(moderately to highly disruptive).*—Although fires are temporary light sources and emit less short-wavelength light than the sources above, they have been documented as a significant source of hatchling mortality. Unlike other attractive light sources, fires can kill hatchlings quickly (hatchlings are known to crawl into fires and die). The size and temperature of a fire determines how attractive it is to hatchlings.

Yellow-phosphor and amber-tinted fluorescent lighting and red tubes *(moderately disruptive).*—Yellow and amber fluorescent tubes emit principally red, yellow, and green wavelengths but do not exclude light in the blue region of the spectrum as well as yellow incandescent bulbs do. Yellow and amber fluorescent tubes are not generally marketed as "bug lights." Although they are more disrup-

tive to sea turtles than yellow incandescent bulbs, yellow and amber fluorescents are far better than white or other colored tubes for use near nesting beaches. However, the hue of these yellow fluorescent lamps varies between manufacturers and can have a varied effect on sea-finding in hatchlings. Red tubes are typically used for decoration and can be of two types: red (or reddish), phosphor-fluorescent tubes and red, neon tubes. Reddish or red-purple fluorescent tubes can be very disruptive, depending upon the amount of short-wavelength light that they emit (purplish lights emit both blue and red light). Neon tubes are covered below.

Lamps with yellow or orange dichroic long-pass filters *(minimally to moderately disruptive).*—Because these filters are very good at attenuating short wavelengths, the type of lamp used with them matters little. Consequently, these filters may allow the use of lamps like metal-halide and HPS that have small and easily focused elements. These lamps can be used in more directional fixtures in order to reduce stray light. Dichroic filters are not standard off-the-shelf accessories for commercial fixtures but they have been used in some outdoor applications near nesting beaches.

Color-tinted incandescent lighting (yellow and red) *(minimally to moderately disruptive).*—Yellow or amber incandescent light bulbs (bug lights) are generally only weakly attractive to hatchlings for the same reason that they attract few insects — they emit little short-wavelength light. Although they are minimally disruptive for the most part, bug lights can interfere with sea-finding if they are numerous, of high wattage, or close to the nesting beach. Red-tinted incandescent sources are more variable in color than bug lights. Some red sources can turn purple or pinkish over time (an indication of greater short-wavelength emission) and become more attractive to hatchlings.

Low-pressure sodium vapor (LPS) lighting *(minimally disruptive).*—LPS is by far the least disruptive light source among those commonly used. LPS sources emit a light that is pure (monochromatic) yellow, a region of the spectrum that is only weakly attractive or even aversive (at higher intensities for loggerheads only) to orienting hatchlings. Because LPS sources have poor color rendition, they are used principally for outdoor applications.

Red light-emitting diode (LED) lighting *(minimally disruptive).*—LEDs are miniature lamps that are not commonly used outdoors. In the future, LEDs may be used to a greater extent as sign lighting and pathway lighting. Red LEDs come close to being ideal for use near sea turtle nesting beaches. Red LEDs emit a pure-red light that does not vary in color over the life of the lamp, and because they are small, they light only a limited area. They are easy to hide from the beach and have a very long life. Green and amber LEDs are marketed but are much less preferred than red.

Neon tubes *(minimally disruptive).*—True neon tubes (not tinted tubes) are a pure-red light source. At present, neon is used almost exclusively for decorative purposes. Neon tubes can be difficult to shield, but their color makes them minimally disruptive. Potential applications include pathway and ground-level lighting.

Transient light sources (flashlights, electric torches, flash photography) *(disruptive characteristics vary).*—This lighting is placed in a separate category because it is generally in use for relatively short time periods. Most of these sources have white incandescent lamps and can be expected to affect sea turtles as the incandescent sources above do. Transient sources are well-known disruptors of sea-finding behavior in hatchlings and adults, but researchers are less certain about how transient sources may affect nesting turtles or those emerging from the ocean to nest. Many workers in the field believe that flashlights and flashes from cameras can turn emerging turtles back to the sea and alter the behavior of nesting turtles. Until additional evidence suggests otherwise, transient light sources should be used sparingly on sea turtle nesting beaches. If hand-held lighting is to be used, deep-red filters should be fastened over the lens of the source. Red light appears much brighter to humans than it does to sea turtles and does not degrade the night vision of people using it. People using red light are able to acclimate to the dark, and most are surprised by how well they can see by starlight and moonlight alone.

APPENDIX B

A table of lamp types and their efficiency. Information sources were the lighting manufacturers and distributors listed in Appendix G. General suitability is based upon the lamp characteristics that may affect sea turtle nesting and hatchling orientation.

Lamp Type	General Suitability for Sea Turtle Nesting Beaches	Efficiency (lumens per watt, lamp only)	Common Wattages	Directional Control of Light	Initial Fixture Cost
White incandescent (including tungsten halogen)	poor	15–25	15–1,500	excellent	low
White fluorescent	poor	55–100	9–219	fair	moderate
Metal-halide	poor	80–100	70–1,000	good	high
Mercury-vapor	poor	20–60	40–1,000	good	moderate–high
High-pressure sodium vapor	poor–fair	67–140	35–1,000	good	high
Low-pressure sodium vapor	good	180	18–180	fair	high

APPENDIX C

The following table describes the generally available incandescent lamps (yellow, bug-light bulbs) that can be suitable for use near nesting beaches if employed properly. Lighted lamps are properly employed if they are not visible from the beach. These bulbs can be used in place of white light bulbs in incandescent fixtures (*e.g.*, porch, balcony, doorway, walkway, stairway, and security lighting) and can be used in conjunction with motion-detector fixtures.

Manufacturer	Trade Name	Lamp Wattage
General Electric Lighting	40 A/Y Bug Lite	40
"	60 A/Y Bug Lite	60
"	100 A/Y Bug Lite	100
"	85 PAR/FL/BG Outdoor Floodlight	85
Osram Sylvania	15 A/Y	15
"	25 A/Y	25
"	40 A/Y	40
"	60 A/Y Bug Lite	60
"	100 A/Y Yellow Bug Lite	100
"	100 PAR/EL/Y/RP Yellow Flood	100
"	150 A/Y Yellow Bug Lite	150

Remarks: Other amber or yellow incandescent bulbs and floodlights are available from various manufacturers and are expected to be much better than comparable white incandescent lamps for applications near nesting beaches. However, yellow or amber color alone does not ensure that the lamp will, like true buglights, only moderately disrupt hatchling orientation. Amber-tinted, compact-fluorescent tubes are also sold and are far better than white fluorescent tubes but are not as acceptable as incandescent bug lights. *JANMAR Lighting* (Appendix G) offers 5-, 7-, 9-, and 13-watt (PL-5, PL-7, PL-9, and PL-13), amber-tinted compact-fluorescent tubes.

APPENDIX D

The following tables describe common styles of light fixtures that may be suitable for use near sea turtle nesting beaches if they are employed properly. Fixtures are properly employed if their light is neither directly nor indirectly visible from the beach. Other fixtures are listed here as conditionally acceptable for use near nesting beaches because they contain low-pressure sodium lamps. These light sources should be positioned so that their light is not directly visible from the beach. In all cases, LPS fixtures are greatly preferred to comparable incandescent or HID (high-intensity discharge) fixtures. Abbreviations are as follows: HPS = high-pressure sodium vapor, LPS = low-pressure sodium vapor, MV = mercury vapor, MH = metal halide, Incan. = incandescent, Fluor. = fluorescent.

Low-Profile Luminaires, Tier Lights

Used for safety along walkways and around pools and decks.

Manufacturer	Trade Name	Lamp Type	Lamp Wattage
Intermatic, Inc.	Malibu Tier Lights	Low-voltage incandescent	11
"	Malibu Tier II Lights	"	7
"	Malibu Tier Deck Lights	"	7, 11
"	Malibu Dimension Prismatic	"	11
"	Malibu Shaded Tier Lights	"	11
"	Malibu Metal Tier Lights	"	11
"	Malibu Walklights	"	11
"	Malibu Mushroom Lights	"	11

Remarks: Tier lights are preferable to globe lights, pole-mounted lighting, or floodlights for applications near the crest of the dune or on the seaward side of buildings. However, the fixture should be positioned so that vegetation, topography, or buildings screen the light from the beach, or the fixture should be equipped with shields so that light sources are not visible from the beach. Optional timers are available for the models listed above.

Low-Profile Luminaires, Bollard Lights

Used for safety along walkways and around pools and decks. Also suitable for parking areas.

Manufacturer	Trade Name	Lamp Type	Lamp Wattage
Lithonia Lighting	KBS6 (6" square bollard)[1]	incandescent	116 max.
"	KBS8 (8" square bollard)[1]	"	150 max.
"	KBR6 (6" sound bollard)[1]	"	116 max.
"	KBR8 (8" round bollard)[1]	"	150 max.
Quality Lighting	Design 310 (16" bollard)	HPS[2]	150
"		MH and MV[2]	175
"	Design HB Post-mounted Luminaire	LPS	18 and 35
	Design HBB Bollard	LPS	18
Spaulding Lighting	Fresno I LPS (square bollard)[3]	LPS	18 and 35
"	Fresno II LPS (round bollard)[3]	LPS	18 and 35
Sterner Lighting Systems	Softform Bayshore	incandescent	100 max.
"	Annapolis (square bollard)	"	150 max.
		MV, MH, and HPS[2]	175 max.
"	Annapolis (round bollard)	incandescent	150 max.
		MV, MH, and HPS[2]	175 max.

Remarks: See remarks for tier lighting. Many of the lamp wattages given here are maximum values for the fixture; the lowest-wattage lamp (and corresponding ballast) needed for a specific application should be used. Incandescent bug-light lamps and LPS are the most suitable for use near nesting beaches.

[1]Half shields are available for Lithonia bollards.

[2]HID lamps (HPS, MV, MH) are not recommended for use close to nesting beaches because of the color and high light output of these lamps. LPS and incandescent bug-light lamps are good substitutes.

[3]Spaulding bollards should be used with optional internal louvers that provide a 90° light cutoff (a complete blocking of lateral light).

Low-Profile Luminaires, Miscellaneous Low-Level Lighting

Used for safety along walkways, around pools and decks, and in parking areas. Rail lighting and tivoli lighting are used for lighting stairways, steps, and handrails.

Manufacturer	Trade Name	Lamp Type	Lamp Wattage
Sterner Lighting Systems	Quantico	incandescent	150 max.
"	Softform Illuminated Rail[1]	MH and HPS	175 max.
Lithonia Lighting	Recessed Step Light ELA VSL H1212[2]	fluor. and incan.	varies
Starfire Lighting	Startube Linear Lighting[3]	Low-volt. incan.	12
ERS, Inc.	Single-faced LED Strip Lighting[4]	Low-volt. incan.	0.5
Hydrel	9600 Recessed Wall Lights with Filter[5]	Red LED	2 W per light strip
		MH and HPS	100

Remarks: See remarks for tier and bollard lighting.

[1]This lighting, which is hidden within handrails, is greatly preferred over elevated lighting for illuminating stairways and walkways. Where possible, incandescent bug-light lamps or amber-tinted fluorescent tubes should be used.

[2]This louvered lighting is recessed at foot- to waist-level within walls and is greatly preferred over elevated lighting for illuminating stairways and walkways.

[3]Linear lighting comes encased in plastic strips and is also sold under the trade names Tivoli, Xanadu, Tracktube, Tubelite, and Step Lite. Yellow tubes can be used with this lighting to further reduce effects on sea turtles. Linear lighting mounted at foot-level along walking paths or stairways is greatly preferred over elevated lighting.

[4]A very good light source for beach steps and walkovers. This lighting can be customized for many applications. Red LEDs (light-emitting diodes) should be specified.

[5]This fixture can be equipped with a yellow, dichroic, band-pass filter. This application has been used by *Specified Lighting* (Appendix G).

Wall- and Ceiling-Mounted Downlighting

Used for safety and security along walkways, near doorways, on balconies and porches, and along stairways.

Manufacturer	Trade Name	Lamp Type	Lamp Wattage
Lithonia Lighting	Gotham Incandescent C Series Downlighting (includes wall-, ceiling-, and pendant-mounted cylinders and cuboids)	incandescent	50–300
Voigt Lighting	Pragmatic Universal Indoor/Outdoor Downlights	incandescent	40–60
		LPS	35

Remarks: Matte-black nonreflective baffles are recommended. For high-elevation applications (*e.g.*, upper-story balconies) or applications near the beach, low-wattage bug-light lamps or LPS lamps are recommended.

Recessed, Ceiling Downlighting

Used for safety and security in place of floodlighting and globe lights. These fixtures are recessed into the soffit (positioned under eaves) or into porch and balcony ceilings.

Manufacturer	Trade Name	Lamp Type	Lamp Wattage
Lithonia Lighting	Advantage Incandescent LPJ and LP Frame-in Modules	incandescent	75–150
"	Advantage Incandescent LICS, LICJ, and LICM Housings	incandescent	40–100
"	Gotham Incandescent: A, D, E, and R Series with black baffles	incandescent	100–200

Remarks: See remarks for wall- and ceiling-mounted downlighting.

Arm-Mounted and Pole-Top HID Cutoff Luminaires

Used for safety and security at parking areas, roadways, and other outdoor areas.

Manufacturer	Trade Name	Lamp Type	Lamp Wattage
Lithonia Lighting	KSF: Arm-mounted Premium Cutoff, HID	HPS	70–1,000
		MH	100–1,000
		MV	100–1,000
"	KVS: Arm-mounted Square Cutoff, HID	HPS	150–1,000
		MH	175–1,000
"	KAS: Arm-mounted Rectilinear Cutoff, HID	HPS	70–1,000
		MH	100–1,000
"	KQS: Square Post-top Cutoff, HID	HPS, MH, MV	250–1,000
"	KKS: Square Post-top Cutoff HID	HPS	70–400
		MH	175–400
Quality Lighting	Design SND Arm-mounted Luminaire	HPS	400
		MH	400
"	Design SJ Sharp-cutoff Arm-mounted Rectilinear Luminaire	HPS	150–1,000
		MH	250–1,000
"	Design SNDY Post-top	HPS, MH	400
Sterner Lighting	Executive 20, 25, and 30	incandescent, HPS, MH	1,000 max.
"	Diplomat 20 and 25 (pole-top)	incandescent, HPS, MH	400 max.
"	LeBox (pole-top or wall- mount)	HPS, MH	1,000 max.

Remarks: These HID fixtures are not recommended for applications within 50 meters of a nesting beach or where luminaires are visible from a nesting beach. However, these cutoff luminaires are preferred to less directional luminaires (*e.g.*, globe-style, cube-style, and cobra-head lighting). The luminaires listed here have optional shields that can further reduce the light reaching the beach. Specific reflectors can also be used with each fixture to better direct light. Arm-mounted LPS fixtures are greatly preferred over HID fixtures for the same applications.

Arm-Mounted and Pole-Top LPS Cutoff Luminaires

Used for safety and security at parking areas, roadways, and other outdoor areas.

Manufacturer	Trade Name	Lamp Type	Lamp Wattage
Voigt Lighting	Slimliner LPS[1]	LPS	35, 55, 90, 135, 180
"	Wideliner LPS	LPS	35, 55, 90, 135
"	SEPOL (Sea turtle Environment Protective Outdoor Luminaire)[1]	LPS	18, 35, 55, 90, 135
Lithonia Lighting	KT: Arm-mounted Cutoff, LPS	LPS	90
Spaulding Lighting	Palomar LPS	LPS	35, 55, 90, 135, 180
"	Oakland LPS	LPS	35, 55, 90, 135, 180
"	Berkeley LPS	LPS	35, 55, 90, 135, 180
"	Phoenix LPS	LPS	35, 55, 90, 135, 180
"	Sunnyvale LPS	LPS	90, 135, 180
Quality Lighting	SM Series Arm-mounted Cutoff LPS	LPS	35, 55, 90, 135, 180
"	Designs SS/SE Rectilinear LPS	LPS	55, 90, 135, 180
Thomas Industries	Form Ten/LPS Rectilinear		
Gardco Lighting	Sharp Cutoff Luminaire[2]	LPS	90, 135, 180
Sterner Lighting	Softform Pacific LPS	LPS	90, 135
Solar Outdoor Lighting	Solar LPS[2]	LPS	18, 35,
C-Ran Corp.	Anytime Lighting, LPS[2]	LPS	18, 35

Remarks: These cutoff luminaires are preferred to less directional luminaires (*e.g.*, globe-style, cube-style, and cobra-head fixtures). Optional shields on some fixtures can further reduce the light reaching the beach. Specific reflectors can also be used with each fixture to better direct their light. Arm-mounted LPS fixtures are greatly preferred over HID fixtures for the same applications.

[1]Optional shields are available for these fixtures.

[2]These luminaires are powered by solar panels for use at remote locations.

LPS Ceiling-Mounted Fixtures

Used for safety and security at parking garages and large doorway and stairway areas.

Manufacturer	Trade Name	Lamp Type	Lamp Wattage
Voigt Lighting	Slimliner LPS[1]	LPS	35, 55, 90, 135, 180
"	Under-decker LPS	LPS	35, 55, 90, 135, 180
"	SEPOL (Sea turtle Environment Protective Outdoor Luminaire)[1]	LPS	18, 35, 55, 90, 135
"	Indoor/Outdoor Frugalume II	LPS	35, 55
Spaulding Lighting	Troy LPS Ceiling Mount Luminaire	LPS	18, 35, 55, 90, 135, 180
Thomas Industries, Benjamin Division	New Horizon/OLH Ceiling Mount Luminaire	LPS	35
"	Intensifier/IVP Ceiling Mount Luminaire	LPS	35, 55, 90, 135, 180

Remarks: Ceiling-mounted luminaires on upper stories facing the beach should be shielded or positioned so that their light is not visible from the beach.

[1]Optional shields are available for these fixtures.

LPS Wall-Mounted Fixtures

Used for safety and security at parking garages, walkways, and large doorway and stairway areas.

Manufacturer	Trade Name	Lamp Type	Lamp Wattage
Lithonia Lighting	KTW: Wall Pak, LPS with Full Shield	LPS	90
"	TWH: Glass Refractor Wall Pak	LPS	35
Quality Lighting	Design NW-II: Aluminum Wall Pak	LPS	18
"	Design NW-IV: Aluminum Wall Pak	LPS	90, 135, 180
Spaulding Lighting	Mesa LPS Wall Pack	LPS	35, 55, 90
"	Phoenix LPS Luminaire, PWM	LPS	35, 55, 90, 135, 180
"	Scottsdale LPS Wall Mount	LPS	35, 55
Thomas Industries, Benjamin Division	LEO, OLB, and OLW Luminaires	LPS	18
"	OWP Wall Mount LPS	LPS	35, 55
Voigt Lighting	Pragmatic Universal Downlight	LPS	35
"	Little Protector Wall Mount	LPS	10, 18
"	Midas Touch Wall Mount[1]	LPS	18

Remarks: The light from these wall-mounted fixtures is typically poorly directed, but these fixtures are highly recommended when their light will not be directly visible from the beach. Small 10- and 18-watt LPS fixtures are greatly preferred to incandescent and HID luminaires for porches, balconies, and doorways on the beach side of buildings.

[1]Has an optional internal shield.

Floodlighting Fixtures, LPS and HID

Used for safety and security at large walkways, parking lots, road intersections, and other expansive areas.

Manufacturer	Trade Name	Lamp Type	Lamp Wattage
Voigt Lighting	Wall-Most LPS Flood[1]	LPS	35, 55, 90, 135, 180
Sterner Lighting	Model 871, 872, 875, and 876 Area Lighting	HPS	250, 400, 1,000

Remarks: Floodlighting can be directed well. Floodlighting is properly directed if it faces away from the beach and is mounted at an elevated position facing downward rather than mounted low and facing upward. LPS fixtures are greatly preferred over HID fixtures for applications near nesting beaches. In all cases, care should be taken not to brightly illuminate buildings and other large objects visible from the nesting beach.

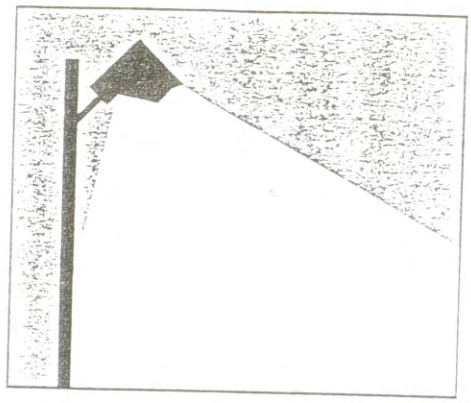
[1]This fixture has an optional internal uplight shield.

Motion-Detector Lighting

Used for safety and security at walkways, yards, doorways, stairways, and storage areas.

Manufacturer	Trade Name	Lamp Type	Lamp Wattage
Heath Zenith	Reflex Professional Motion Sensor Model SL 5314	incandescent	15–300
Intelectron	Motion Detector Conversion Kit Model BC 8950	incandescent	15–300
"	Motion Detector Security Light Model BC 8700 KW	incandescent	15–300

Remarks: Motion-detector lighting fixtures switch on when approached by moving objects and remain on for a specified time, which can be set at the fixture. This specified time should be 30 seconds or less for fixtures near nesting beaches. To reduce impacts to sea turtles to the greatest extent, yellow bug-light bulbs should be used with these fixtures. If floodlights are used, they should be directed away from the nesting beach.



POLE-MOUNTED FLOODLIGHTING WITH FULL VISOR

MOUNTING SUITABILITY:

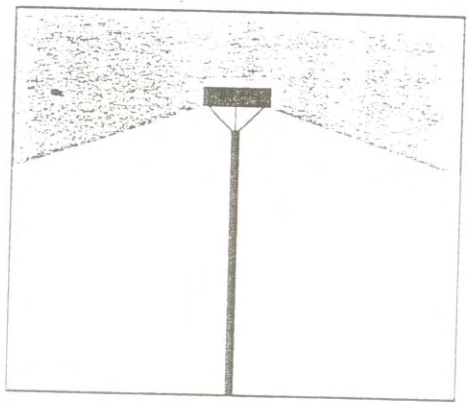
Good if directed downward and away from the beach.

DIRECTIONAL SUITABILITY:

Good.

OVERALL SUITABILITY:

Good if directed downward and away from the nesting beach and if light does not illuminate objects visible from the beach.



POLE-TOP-MOUNTED CUTOFF LIGHTING, "SHOEBOX" FIXTURE

MOUNTING SUITABILITY:

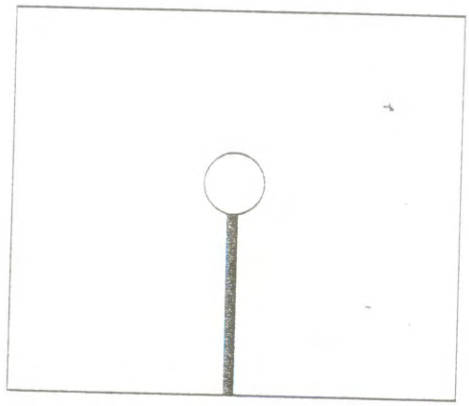
Good to poor, depending on mounting height. Mounting height should be no more than 5 m within 100 m of a nesting beach.

DIRECTIONAL SUITABILITY:

Fair to good, as determined by reflectors.

OVERALL SUITABILITY:

Fair to good when mounting heights are low.



DECORATIVE GLOBE LIGHT

MOUNTING SUITABILITY:

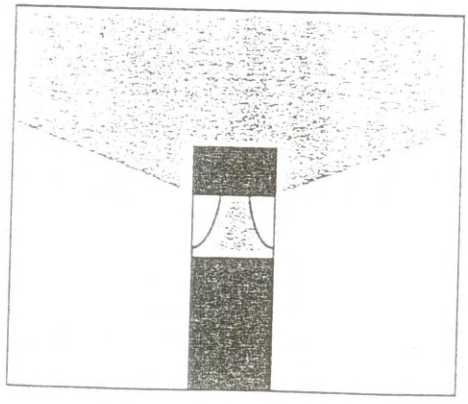
Fair if mounted at heights lower than 2 m. Poor if mounted higher.

DIRECTIONAL SUITABILITY:

Very poor.

OVERALL SUITABILITY:

Very poor. This fixture is difficult to shield and should not be used near nesting beaches.



LIGHTING BOLLARD WITH HIDDEN LAMP

MOUNTING SUITABILITY:

Good if mounting height is near 1 m.

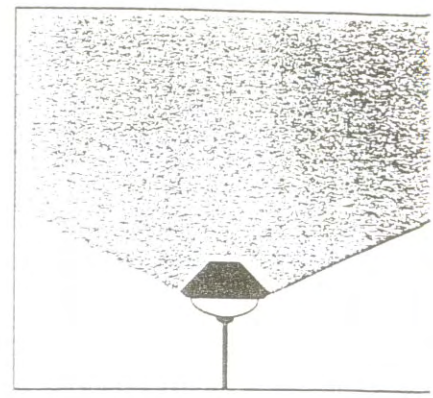
DIRECTIONAL SUITABILITY:

Poor to fair.

OVERALL SUITABILITY:

Fair. Good if additional shields on the beach side of the fixture are used.

LOW-LEVEL "MUSHROOM" LIGHTING



MOUNTING SUITABILITY:

Good if mounted at foot level.

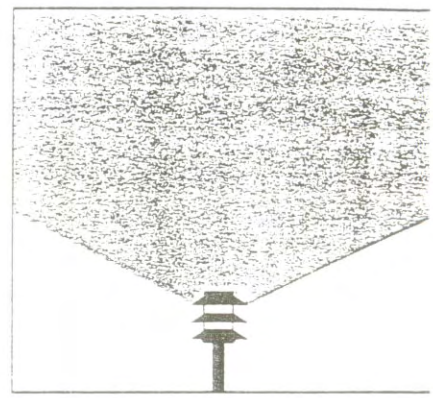
DIRECTIONAL SUITABILITY:

Poor.

OVERALL SUITABILITY:

Fair. Good to excellent if used so that vegetation and topography block its light from the beach.

LOW-LEVEL "TIER" LIGHTING



MOUNTING SUITABILITY:

Good if mounted at foot level.

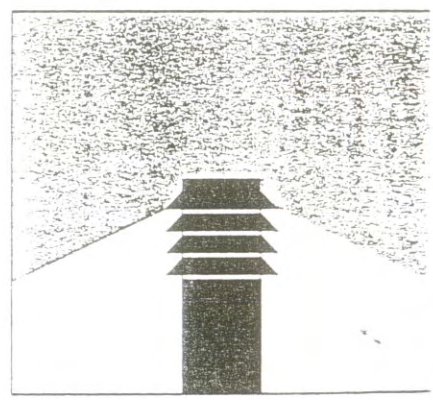
DIRECTIONAL SUITABILITY:

Poor but can be good if the fixture has louvers that eliminate lateral light.

OVERALL SUITABILITY:

Fair. Good to excellent if used so that vegetation and topography block its light from the beach.

LIGHTING BOLLARD WITH LOUVERS



MOUNTING SUITABILITY:

Good if mounting height is near 1 m.

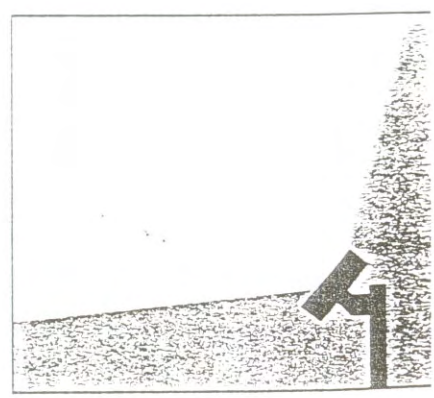
DIRECTIONAL SUITABILITY:

Good.

OVERALL SUITABILITY:

Good.

GROUND-MOUNTED FLOODLIGHTING



MOUNTING SUITABILITY:

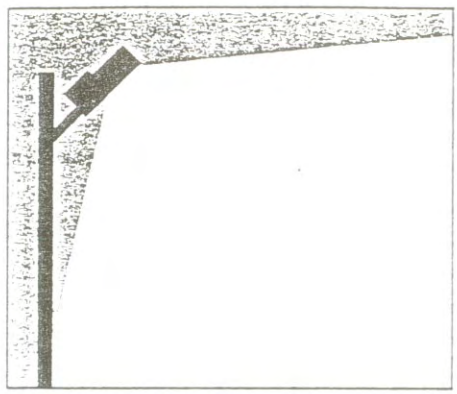
Poor, because of its upward aim.

DIRECTIONAL SUITABILITY:

Fair to good.

OVERALL SUITABILITY:

Fair to poor if directed away from the beach. Very poor if directed toward the beach.



POLE-MOUNTED FLOODLIGHTING

MOUNTING SUITABILITY:

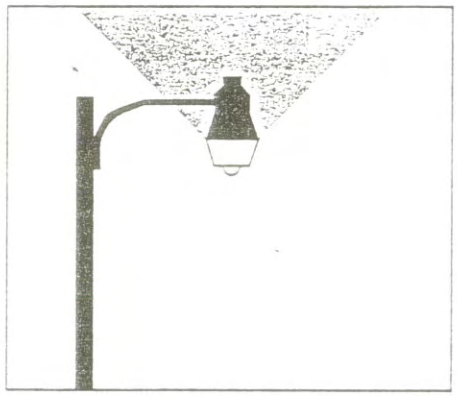
Fair if directed downward and away from the beach.

DIRECTIONAL SUITABILITY:

Fair to good.

OVERALL SUITABILITY:

Fair to good if aimed downward and directly away from the nesting beach and if light does not illuminate objects visible from the beach. Otherwise, poor to very poor.



ARM-MOUNTED AREA LIGHTING, "OPEN-BOTTOM" OR "BARN LIGHT" FIXTURE

MOUNTING SUITABILITY:

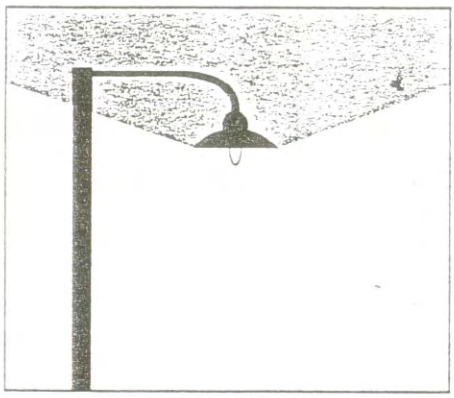
Poor to very poor, depending upon mounting height. Should not be mounted higher than 5 m within 150 m of a nesting beach.

DIRECTIONAL SUITABILITY:

Poor if unshielded. Fair if shielded.

OVERALL SUITABILITY:

Poor.



ARM-MOUNTED AREA LIGHTING, DECORATIVE "PENDANT" FIXTURE

MOUNTING SUITABILITY:

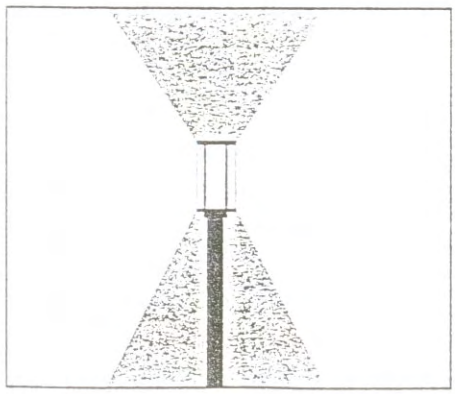
Poor to very poor, depending upon mounting height. Should not be mounted higher than 5 m within 150 m of a nesting beach.

DIRECTIONAL SUITABILITY:

Poor. Difficult to shield properly.

OVERALL SUITABILITY:

Poor.



DECORATIVE "CARRIAGE" LIGHTING

MOUNTING SUITABILITY:

Fair if mounted at heights lower than 2 m. Poor if mounted higher.

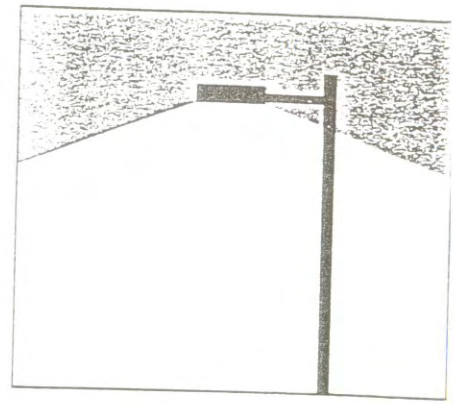
DIRECTIONAL SUITABILITY:

Very poor. Fair if properly shielded.

OVERALL SUITABILITY:

Poor.

ARM-MOUNTED CUTOFF LIGHTING, "SHOEBOX" FIXTURE



MOUNTING SUITABILITY:

Good to poor, depending on mounting height. Mounting height should be no more than 5 m within 100 m of a nesting beach.

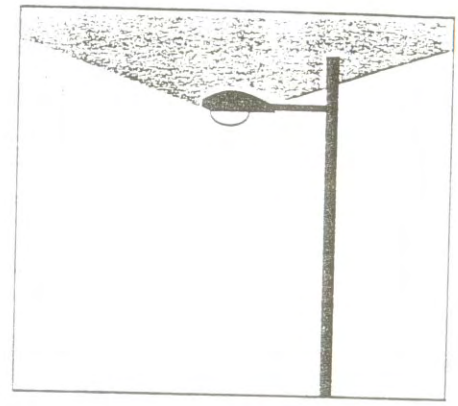
DIRECTIONAL SUITABILITY:

Fair to good, as determined by reflectors.

OVERALL SUITABILITY:

Fair to good when mounting heights are low and fixtures are aimed directly downward.

ARM-MOUNTED AREA LIGHTING, "COBRAHEAD" FIXTURE



MOUNTING SUITABILITY:

Poor to very poor, depending on mounting height. Mounting height should be no more than 5 m within 150 m of a nesting beach.

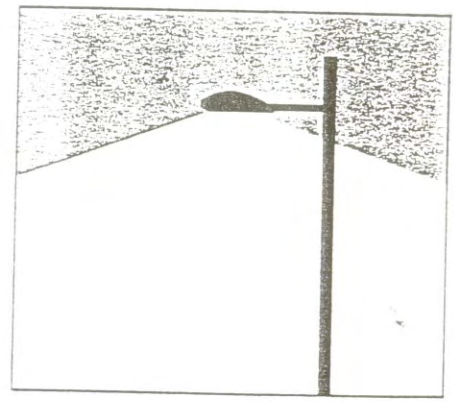
DIRECTIONAL SUITABILITY:

Poor. Difficult to shield properly.

OVERALL SUITABILITY:

Poor.

ARM-MOUNTED AREA LIGHTING, "FLAT-FACE" CUTOFF FIXTURE



MOUNTING SUITABILITY:

Good to poor, depending on pole height. Mounting height should be no more than 5 m within 100 m of a nesting beach.

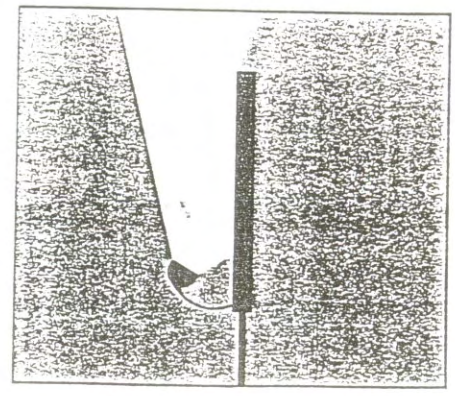
DIRECTIONAL SUITABILITY:

Fair to good, as determined by reflectors.

OVERALL SUITABILITY:

Fair to good when mounting heights are low.

SIGN LIGHTING, BOTTOM-UP STYLE



MOUNTING SUITABILITY:

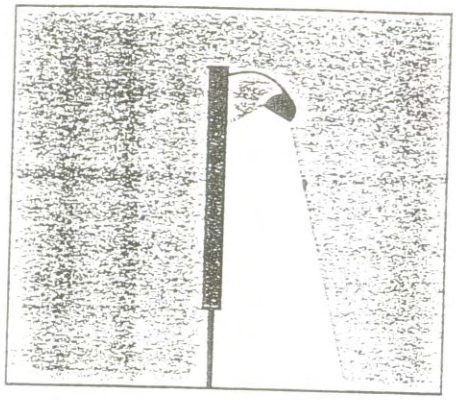
Poor, because of its potential for producing uplight scatter.

DIRECTIONAL SUITABILITY:

Poor to good.

OVERALL SUITABILITY:

Poor. Signs near nesting beaches should be lighted from the top down. In no case should lighted signs be visible from the beach.



SIGN LIGHTING, TOP-DOWN STYLE

MOUNTING SUITABILITY:

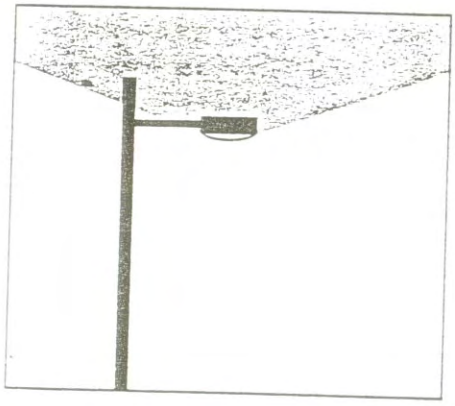
Good.

DIRECTIONAL SUITABILITY:

Poor to good.

OVERALL SUITABILITY:

Generally good if the sign is not visible from the beach and if the lighting is well aimed.



ARM-MOUNTED AREA LIGHTING, FIXTURES WITH REFRACTING GLOBES OR CONVEX LENSES

MOUNTING SUITABILITY:

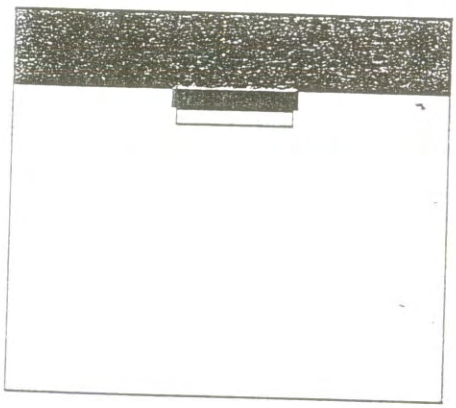
Poor to very poor, depending upon mounting height. Mounting height should be no more than 5 m within 150 m of a nesting beach.

DIRECTIONAL SUITABILITY:

Poor. Fair to good if shielded properly.

OVERALL SUITABILITY:

Poor.



CEILING-MOUNTED AREA LIGHTING, FIXTURES WITH REFRACTING GLOBES OR CONVEX LENSES

MOUNTING SUITABILITY:

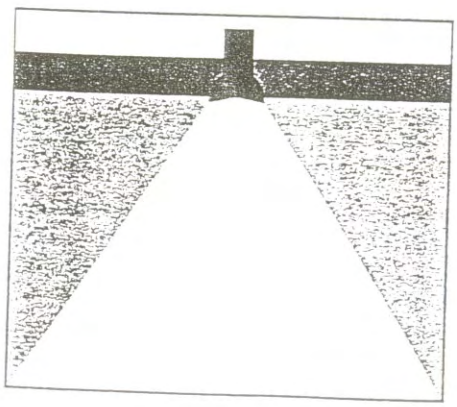
Poor if mounted on the beach sides of buildings or on upper stories. Good if shielded from the beach by buildings.

DIRECTIONAL SUITABILITY:

Poor.

OVERALL SUITABILITY:

Poor to fair, depending upon mounting location.



CEILING-RECESSED DOWNLIGHTING WITH BAFFLES TO ELIMINATE LATERAL LIGHT

MOUNTING SUITABILITY:

Good to excellent when mounted in lower-story ceilings and soffits.

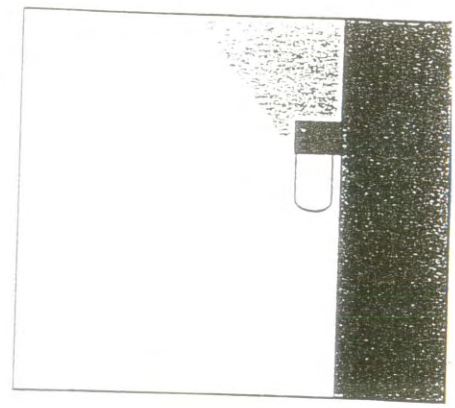
DIRECTIONAL SUITABILITY:

Excellent.

OVERALL SUITABILITY:

Good to excellent.

WALL-MOUNTED AREA LIGHTING. "JELLY-JAR" PORCH LIGHT FIXTURE



MOUNTING SUITABILITY:

Poor. Very poor when mounted on upper stories.

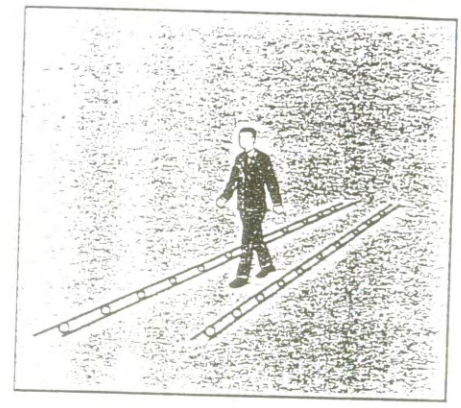
DIRECTIONAL SUITABILITY:

Poor.

OVERALL SUITABILITY:

Poor.

LINEAR TUBE LIGHTING



MOUNTING SUITABILITY:

Excellent if mounted at foot level.

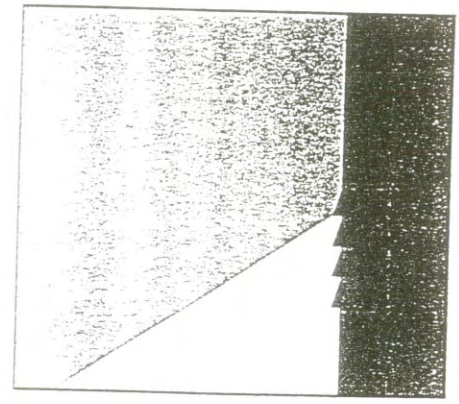
DIRECTIONAL SUITABILITY:

Fair to poor, but this lighting is of concern only if mounted high or if large numbers of high-wattage (>3 W) lamps are used.

OVERALL SUITABILITY:

Excellent if low-wattage strips are used sparingly in recessed areas.

LOUVERED STEP LIGHTING



MOUNTING SUITABILITY:

Excellent if mounted at foot level.

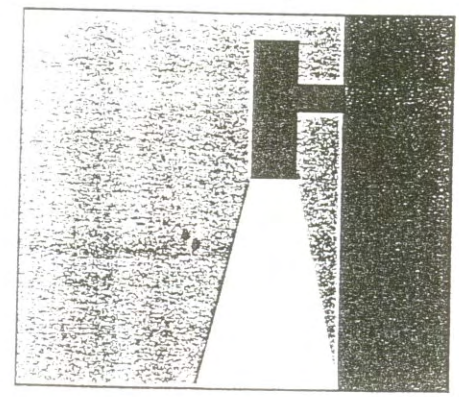
DIRECTIONAL SUITABILITY:

Excellent.

OVERALL SUITABILITY:

Excellent.

WALL-MOUNTED DOWNLIGHTING



MOUNTING SUITABILITY:

Good to excellent when mounted on lower-story walls.

DIRECTIONAL SUITABILITY:

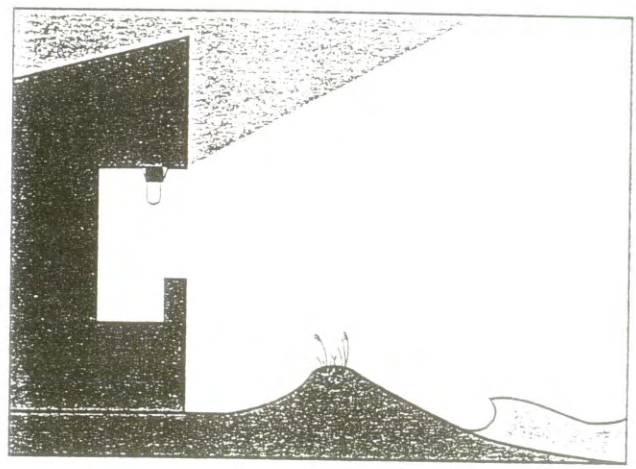
Excellent.

OVERALL SUITABILITY:

Good to excellent.

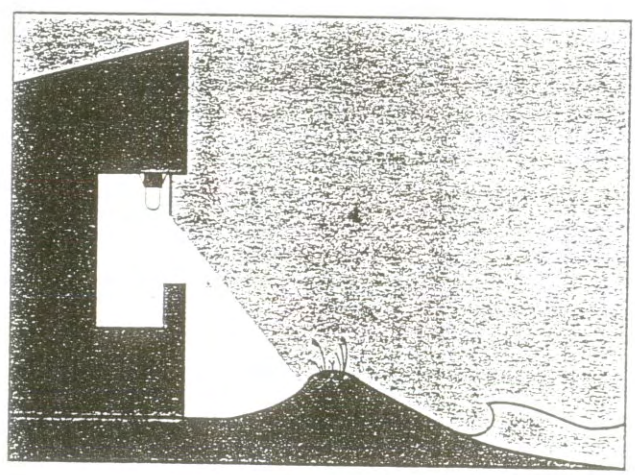
APPENDIX F

Diagrams depicting solutions to two common lighting problems near sea turtle nesting beaches: balcony or porch lighting and parking-lot lighting.



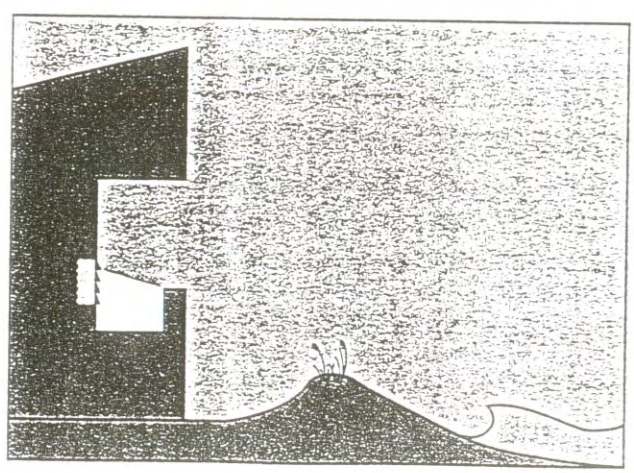
POOR

Poorly directed balcony lighting can cause problems on sea turtle nesting beaches.



BETTER

Completely shielding fixtures with a sheet of metal flashing can reduce stray light reaching the beach.

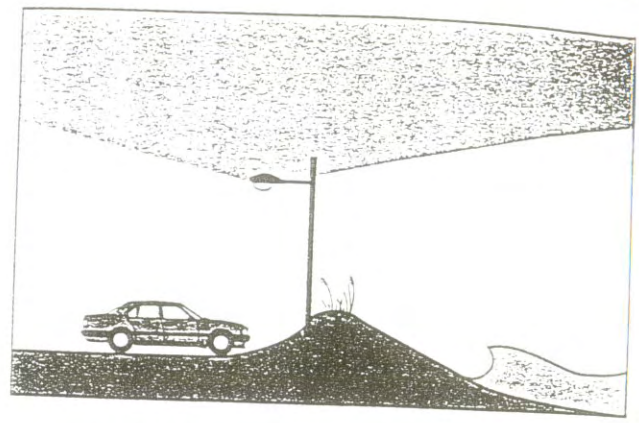


BEST

Louvered step lighting is one of the best ways to light balconies that are visible from nesting beaches.

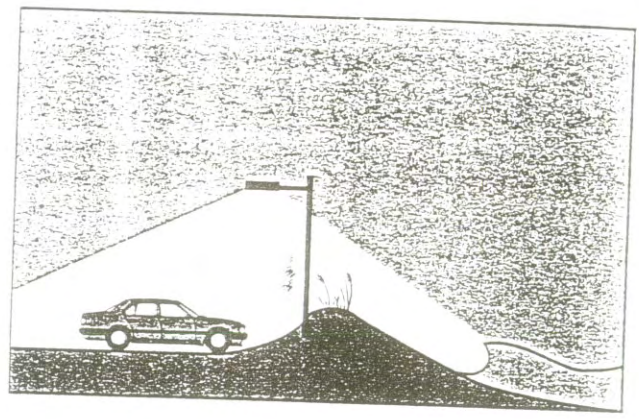
POOR

Poorly directed parking lot lighting can cause problems on sea turtle nesting beaches.



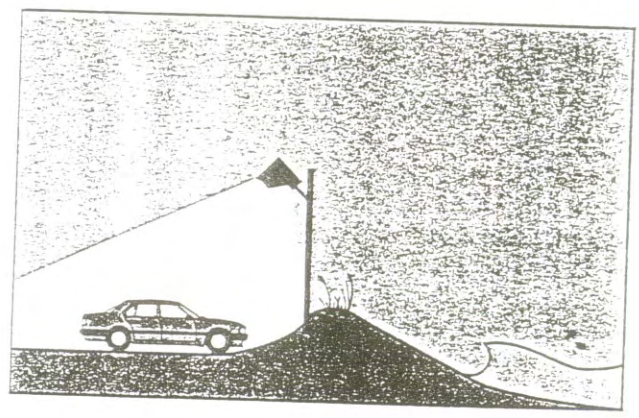
BETTER

Fixtures with 90°cutoff angles can reduce the amount of stray light reaching the beach.



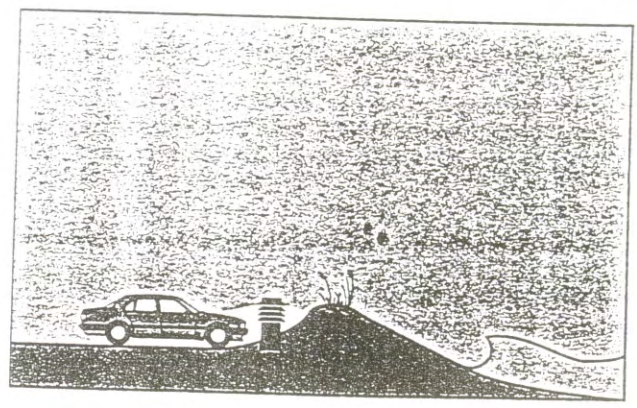
MUCH BETTER

Fully hooded floods can direct light accurately and reduce stray light even more.



BEST

Low-mounted, louvered bollard fixtures are the best way to light parking lots near nesting beaches.



APPENDIX G

The following is a list of the lighting and window-treatment manufacturers and distributors mentioned in this manual.

AFG Industries, Inc.
(tinted glass)
P.O. Box 929
Kingsport, Tennessee 37662 USA
PHONE: 615-229-7200

C-Ran Corporation
(solar lighting)
699 4th Street
Largo, Florida 34640-2439 USA
PHONE: 813-585-3850
FAX: 813-586-1777

ERS
(lamps, fixtures)
5106 Bird Lane
Winter Haven, Florida 33884 USA
PHONE: 813-324-7291

General Electric
(lamps)
GE Lighting
Nela Park
Cleveland, Ohio 44112 USA
PHONE: 216-266-2653
FAX: 216-266-2780

Heath-Zenith
(lamps, fixtures)
455 Riverview Drive
Benton Harbor, Michigan 49022 USA

Hubbell Lighting, Inc.
(lamps, fixtures, shields)
2000 Electric Way
Christiansburg, Virginia 24073-2500 USA
PHONE: 703-382-6111
FAX: 703-382-1526

Hydrel
(lamps, fixtures)
12881 Bradley Avenue
Sylmar, California 91342 USA
PHONE: 818-362-9465
FAX: 818-362-6548

Intermatic, Inc.
(lamps, fixtures)
Intermatic Plaza
Spring Grove, Illinois 60081-9698 USA
PHONE: 815-675-2321 or 312-282-7300

Janmar Lighting
(lamps, fixtures)
892 West 10th Street
Azusa, California 91702-1935 USA
PHONE: 818-969-4111

Lithonia Lighting
(lamps, fixtures)
P.O Box A
Conyers, Georgia 30207 USA
PHONE: 404-922-9000
FAX: 404-483-2635

Luminaire Technologies, Inc.
(lighting shields)
212 West Main Street
Gibsonville, North Carolina 27249 USA
PHONE: 910-449-6310

Osram Sylvania Incorporated
(lamps)
National Consumer Support Center
18725 North Union Street
Westfield, Indiana 46074 USA
PHONE: 508-777-1900 or 800-842-7010
FAX: 800-842-7011

Phifer Sunscreen
(window light shades)
P.O. Box 1700
Tuscaloosa, Alabama 35403 USA
PHONE: 205-345-2120 or 800-633-5955

PPG Industries
(tinted glass)
Flat Glass Technical Services
One PPG Place, 31N
Pittsburgh, Pennsylvania 15272 USA
PHONE: 412-434-2858
FAX: 412-434-3675

SOL, Solar Outdoor Lighting, Inc.
(solar lighting)
3131 SE Waaler Street
Stuart, Florida 34997 USA
PHONE: 407-286-9461
FAX: 407-286-9616

Southwall Technologies
(tinted glass)
1029 Corporation Way
Palo Alto, California 94303 USA
PHONE: 415-962-9111

Spaulding Lighting
(lamps, fixtures)
1736 Dreman Avenue
Cincinnati, Ohio 45223 USA
PHONE: 513-541-3486
FAX: 513-541-1454

Specified Lighting, Inc.
(lamps, fixtures)
1322 Southeast 35th Terrace
Cape Coral, Florida 33904 USA

Starfire Lighting
(lamps, fixtures)
317 Saint Pauls Avenue
Jersey City, New Jersey 07306-5021 USA
PHONE: 201-656-7888 or 800-443-8823
FAX: 201-656-0666

Sterner Lighting Systems Incorporated
(lamps, fixtures)
351 Lewis Avenue
Winsted, Minnesota 55395 USA
PHONE: 612-473-1251 or 800-328-7480
FAX: 612-485-2899 or 800-328-3635

Thomas Industries, Benjamin Division
(lamps, fixtures)
P.O. Box 180, Route 70 South
Sparta, Tennessee 38583 USA

Thomas Industries, Gardco Lighting
(lamps, fixtures)
2661 Alvarado Street
San Leandro, California 94577 USA
PHONE: 415-357-6900 or 800-227-0758

Quality Lighting
(lamps, fixtures)
P.O. Box 309
Franklin Park, Illinois 60131-0309 USA
PHONE: 708-451-0040
FAX: 708-451-6768

Voigt Lighting
(lamps, fixtures)
135 Fort Lee Road
Leonia, New Jersey 07605 USA
PHONE: 201-461-2493
FAX: 201-461-7827

APPENDIX H

CHAPTER 16B-55 Model Lighting Ordinance for Marine Turtle Protection

16B-55.001 Purpose and Intent.
16B-55.002 Definitions.
16B-55.003 Marine Turtle Nesting Areas.
16B-55.004 General Guidance to Local Governments.
16B-55.005 Prohibition of Activities Disruptive to Marine Turtles
16B-55.006 Model Standards for New Lighting.
16B-55.007 Model Standards for Existing Lighting.
16B-55.008 Proposed Enforcement and Penalties.
16B-55.009 Monitoring and Reporting Guidance.

16B-55.001 Purpose and Intent.–The purpose of this rule is to implement Section 161.163, Florida Statutes, which requires the department to designate coastal areas utilized, or likely to be utilized, by sea turtles for nesting, and to establish guidelines for local government regulations that control beachfront lighting to protect hatching sea turtles. This rule is intended to guide local governments in developing ordinances which will protect hatchling marine turtles from the adverse effects of artificial lighting, provide overall improvement in nesting habitat degraded by light pollution, and increase successful nesting activity and production of hatchlings.
Specific Authority 161.163 F.S., Law Implemented 161.163 F.S., History–New 3-93.

16B-55.002 Definitions.
(1) "Artificial light" or "artificial lighting" means the light emanating from any human-made device.
(2) "Beach" means the zone of unconsolidated material that extends landward from the mean low water line to the place where there is a marked change in material or physiographic form, or to the line of permanent vegetation, usually the effective limit of storm waves.
(3) "Bug" type bulb means any yellow colored light bulb that is marketed as being specifically treated in such a way so as to reduce the attraction of bugs to the light.
(4) "Coastal construction activities" means any work or activity that is likely to have a material physical effect on existing coastal conditions or natural shore and inlet processes.
(5) "County" means Bay, Brevard, Broward, Charlotte, Citrus. Collier, Dade, Dixie, Duval, Escambia, Flagler, Franklin, Gulf, Hernando, Indian River, Jefferson, Lee, Levy, Manatee, Martin, Monroe, Nassau, Okaloosa, Palm Beach, Pasco, Pinellas, St. Johns, St. Lucie, Santa Rosa, Sarasota, Suwanee, Taylor, Volusia, Wakulla, and Walton Counties.
(6) "Cumulatively illuminated" means illuminated by numerous artificial light sources that as a group illuminate any portion of the beach.
(7) "Department" means the Florida Department of Natural Resources.
(8) "Directly illuminated" means illuminated as a result of glowing elements(s), lamp(s), globe(s), or reflector(s) of an artificial light source which is visible to an observer on the beach.
(9) "Dune" means a mound or ridge of loose sediments, usually sand-sized, lying landward of the beach and deposited by any natural or artificial mechanism.
(10) "Frontal dune" means the first natural or man-made mound or bluff of sand which is located landward of the beach and which has sufficient vegetation, height, continuity, and configuration to offer protective value.
(11) "Ground-level barrier" means any vegetation, natural feature or artificial structure rising from the ground which prevents beachfront lighting from shining directly onto the beach-dune system.
(12) "Hatchling" means any species of marine turtle, within or outside of a nest, that has recently hatched from an egg.
(13) "Indirectly illuminated" means illuminated as a result of the glowing element(s), lamp(s), globe(s), or reflector(s) of an artificial light source which is not visible to an observer on the beach.

(14) "Local government" means any county listed in (4) above and any municipality, community dev opment district, or special taxing district within those counties.
(15) "Marine turtle" means any marine-dwelling reptile of the families Cheloniidae or Dermochelyid found in Florida waters or using the beach as nesting habitat, including the species: *Caretta caretta* (lo gerhead), *Chelonia mydas* (green), *Dermochelys coriacea* (leatherback), *Eretmochelys imbricata* (hawksbil and *Lepidochelys kempi* (Kemp's ridley). For purposes of this rule, marine turtle is synonymous with s turtle.
(16) "Nest" means an area where marine turtle eggs have been naturally deposited or subsequent relocated.
(17) "Nesting season" means the period from May 1 through October 31 of each year for all countie except Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward. Nesting season for Brevar Indian River, St. Lucie, Martin, Palm Beach, and Broward counties means the period from March through October 31 of each year.
(18) "Nighttime" means the locally effective time period between sunset and sunrise.
(19) "Person" means individuals, firms, associations, joint ventures, partnerships, estates, trusts, syndi cates, fiduciaries, corporations, and all other groups or combinations.
(20) "Tinted glass" means any glass treated to achieve an industry-approved, inside-to-outside ligh transmittance value of 45% or less. Such transmittance is limited to the visible spectrum (400 to 70 nanometers) and is measured as the percentage of light that is transmitted through the glass.

16B-55.003 Marine Turtle Nesting Areas.–Scientific investigations have demonstrated that marine turtles can nest along the entire coastline of the state. Historical data are not sufficient to exclude any county as an area utilized by marine turtles for nesting. For the purposes of this rule, however, the coastal areas of the state utilized, or likely to be utilized, by marine turtles for nesting include all beaches adjoining the waters of the Atlantic Ocean, the Gulf of Mexico, and the Straits of Florida and located within Bay, Brevard, Broward, Charlotte, Collier, Dade, Duval, Escambia, Flagler, Franklin, Gulf, Indian River, Lee, Manatee, Martin, Monroe, Nassau, Okaloosa, Palm Beach, Pinellas, St. Johns, St. Lucie, Santa Rosa, Sarasota, Volusia, and Walton Counties; and all inlet shorelines of those beaches.

16B-55.004 General Guidance to Local Governments.
(1) The responsibility for protecting nesting female and hatchling marine turtles should be a joint responsibility of local government and the department. Local governments are encouraged to adopt, implement, and enforce the guidelines provided herein to assist in that responsibility. Local governments that have adopted less stringent regulations should consider amending existing ordinances to provide greater protection to nesting marine turtles and hatchlings. In the process of implementing these guidelines, the following management goals should also be considered by local governments:
(a) Public Awareness. Any person submitting an application for coastal construction activities within the jurisdictional boundaries of the local government should be informed of the existence of and requirements within the local government's ordinances concerning artificial lighting and marine turtle protection.
(b) Local Government–Department Communication. Upon adoption of these guidelines, a system of communication between the local government and the department should be developed if it does not already exist. Protection of marine turtle nesting habitat, nesting females, and hatchlings is greatly enhanced when local governments manage their beaches and coastal activities in a manner consistent with prudent marine turtle conservation strategies. The department is ready to assist local governments by providing such conservation information and other technical assistance.
(c) Inter-Governmental Cooperation. Upon adoption of these guidelines, local governments should develop a system for receiving copies of permits issued by the department, the Department of Environmental Regulation, or the United States Army Corps of Engineers for any coastal construction within the local government's jurisdiction. Activities permitted by these agencies should be assessed for compliance with the local government's lighting ordinance.
(d) Enforcement. Local governments should develop a process for the consistent and effective

enforcement of adopted guidelines. This process should include at least one compliance inspection of the beach conducted at night prior to the commencement of the main portion of the marine turtle nesting season and one compliance inspection conducted during the marine turtle nesting season.

(2) The department considers the provisions of this Chapter to be minimum guidelines for the protection of nesting habitat, nesting females, and hatchling marine turtles from the negative effects of artificial lighting. More stringent standards for marine turtle protection may be adopted by local governments. Prior to adoption of any additional standards, local governments are encouraged to consult with the department to ensure that the proposed standards are consistent with the guidelines set forth herein and with all other applicable department rules.

16B-55.005 Prohibition of Activities Disruptive to Marine Turtles.

The following activities involving direct illumination of portions of the beach should be prohibited on the beach at nighttime during the nesting season for the protection of nesting females, nests, and hatchling marine turtles:

(1) The operation of all motorized vehicles, except emergency and law enforcement vehicles or those permitted on the beach for marine turtle conservation or research.

(2) The building of campfires or bonfires.

16B-55.006 Model Standards for New Beachfront Lighting.

In order to provide the highest level of protection for nesting marine turtles and their hatchlings, local governments should adopt all of the following standards for artificial light sources on all new coastal construction:

(1) Exterior artificial light fixtures shall be designed and positioned so that:

(a) The point source of light or any reflective surface of the light fixture is not directly visible from the beach;

(b) Areas seaward of the frontal dune are not directly or indirectly illuminated; and

(c) Areas seaward of the frontal dune are not cumulatively illuminated.

(2) Exterior artificial light fixtures within direct line-of-sight of the beach are considered appropriately designed if:

(a) Completely shielded downlight only fixtures or recessed fixtures having low wattage (*i.e.*, 50 watts or less) "bug" type bulbs and non-reflective interior surfaces are used. Other fixtures that have appropriate shields, louvers, or cutoff features may also be used if they are in compliance with subsection (1)(a), (b), and (c) above; and

(b) All fixtures are mounted as low in elevation as possible through use of low-mounted wall fixtures, low bollards, and ground-level fixtures.

(3) Floodlights, uplights or spotlights for decorative and accent purposes that are directly visible from the beach, or which indirectly or cumulatively illuminate the beach, shall not be used.

(4) Exterior lights used expressly for safety or security purposes shall be limited to the minimum number and configuration required to achieve their functional role(s). The use of motion detector switches that keep lights off except when approached and that switch lights on for the minimum duration possible are preferred.

(5) Only low intensity lighting shall be used in parking areas within line-of-sight of the beach. Such lighting shall be:

(a) Set on a base which raises the source of light no higher than 48 inches off the ground; and

(b) Positioned or shielded so that the light is cast downward and the source of light or any reflective surface of the light fixture is not visible from the beach and does not directly or indirectly illuminate the beach.

(6) Parking areas and roadways, including any paved or unpaved areas upon which motorized vehicles will park or operate, shall be designed and located to prevent vehicular headlights from directly or indirectly illuminating the beach.

(7) Vehicular lighting, parking area lighting, and roadway lighting shall be shielded from the beach through the use of ground-level barriers. Ground-level barriers must not interfere with marine turtle nesting or hatchling emergence, or cause short- or long-term damage to the beach/dune system.

(8) Tinted glass shall be installed on all windows and glass doors of single or multi-story struc within line-of-sight of the beach.

(9) Use of appropriately shielded low-pressure sodium-vapor lamps and fixtures shall be preferre high-intensity lighting applications such as lighting parking areas and roadways, providing sec and similar applications.

(10) Temporary lighting of construction sites during the marine turtle nesting season shall be res ed to the minimal amount necessary and shall incorporate all of the standards of this section.

16B-55.007 Model Standards For Existing Beachfront Lighting. In order to provide the highest lev protection for nesting marine turtles and their hatchlings, local governments should adopt all of the follo standards for existing artificial beachfront lighting sources:

(1) Existing artificial light fixtures shall be repositioned, modified, or removed so that:

(a) The point source of light or any reflective surface of the light fixture is not directly vis from the beach;

(b) Areas seaward of the frontal dune are not directly or indirectly illuminated; and

(c) Areas seaward of the frontal dune are not cumulatively illuminated.

(2) The following measures shall be taken to reduce or eliminate the negative effects of existing ext or artificial lighting:

(a) Reposition fixtures so that the point source of light or any reflective surface of the light ture is no longer visible from the beach;

(b) Replace fixtures having an exposed light source with fixtures containing recessed li sources or shields;

(c) Replace traditional light bulbs with yellow "bug" type bulbs not exceeding 50 watts;

(d) Replace non-directional fixtures with directional fixtures that point down and away fr the beach;

(e) Replace fixtures having transparent or translucent coverings with fixtures having opaq shields covering an arc of at least 180 degrees and extending an appropriate distance below t bottom edge of the fixture on the seaward side so that the light source or any reflective surfa of the light fixture is not visible from the beach;

(f) Replace pole lamps with low-profile, low-level luminaries so that the light source or a reflective surface of the light fixture is not visible from the beach;

(g) Replace incandescent, fluorescent, and high intensity lighting with the lowest wattage lo pressure sodium-vapor lighting possible for the specific application;

(h) Plant or improve vegetation buffers between the light source and the beach to screen lig from the beach;

(i) Construct a ground level barrier to shield light sources from the beach. Ground-level bar ers must not interfere with marine turtle nesting or hatchling emergence, or cause short- long-term damage to the beach/dune system;

(j) Permanently remove or permanently disable any fixture which cannot be brought into con pliance with the provisions of these standards.

(3) The following measures shall be taken to reduce or eliminate the negative effects of interior ligl emanating from doors and windows within line-of-sight of the beach:

(a) Apply window tint or film that meets the standards for tinted glass;

(b) Rearrange lamps and other moveable fixtures away from windows;

(c) Use window treatments (*e.g.*, blinds, curtains) to shield interior lights from the beach; and

(d) Turn off unnecessary lights.

16B-55.008 Proposed Enforcement and Penalties.–Enforcement, appeal, and remedy of matters relate to this Chapter should be regulated pursuant to procedures established under local ordinances. Penalties fo non-compliance should be established and should be sufficient to discourage violations. Enforcement capa bility should be adequate to respond to possible violations within the timeframe necessary to prevent contin ued and prolonged impacts to marine turtles and hatchlings.

16B-55.009 Monitoring and Reporting Guidance.
The following information should be compiled on an annual basis and submitted to the department.
(1) Number of lighting applications reviewed;
(2) Number of potential violations reported;
(3) Number of potential violations investigated;
(4) Disposition of all potential violations including results of enforcement actions and amounts of penalties assessed;
(5) Results of compliance checks conducted prior to and during the marine turtle nesting season; and
(6) Status of local lighting ordinances and any amendments to those ordinances.