

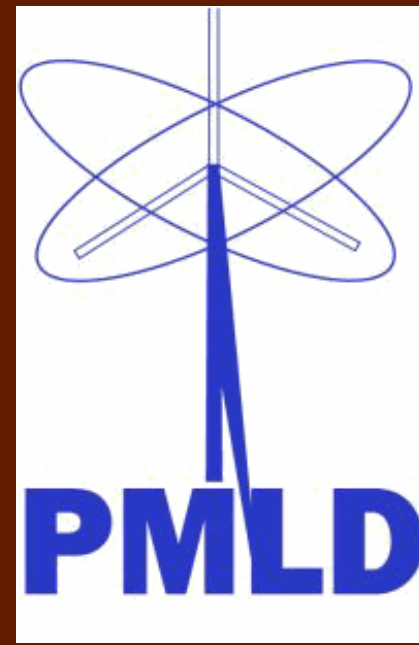
The Bright Darkness

Assessing Public Attitudes Towards Light
Pollution in Princeton, MA and Recommending
Approaches to Mitigation

Liam Cox, Mary Decelles, Alex Kelleher & Sophia Puch



Acknowledgements



Guiding Questions

To what extent is light pollution a problem in Princeton?

What are the views of Princeton residents on light pollution?

What can be done about light pollution?

Our Project Work

Interviews

Princeton Municipal Light Department
Princeton Planning Board
Light Pollution Experts
Aldrich Astronomical Society
International Dark-Sky Association, MA Chapter
Wachusett Mt. Advisory Council

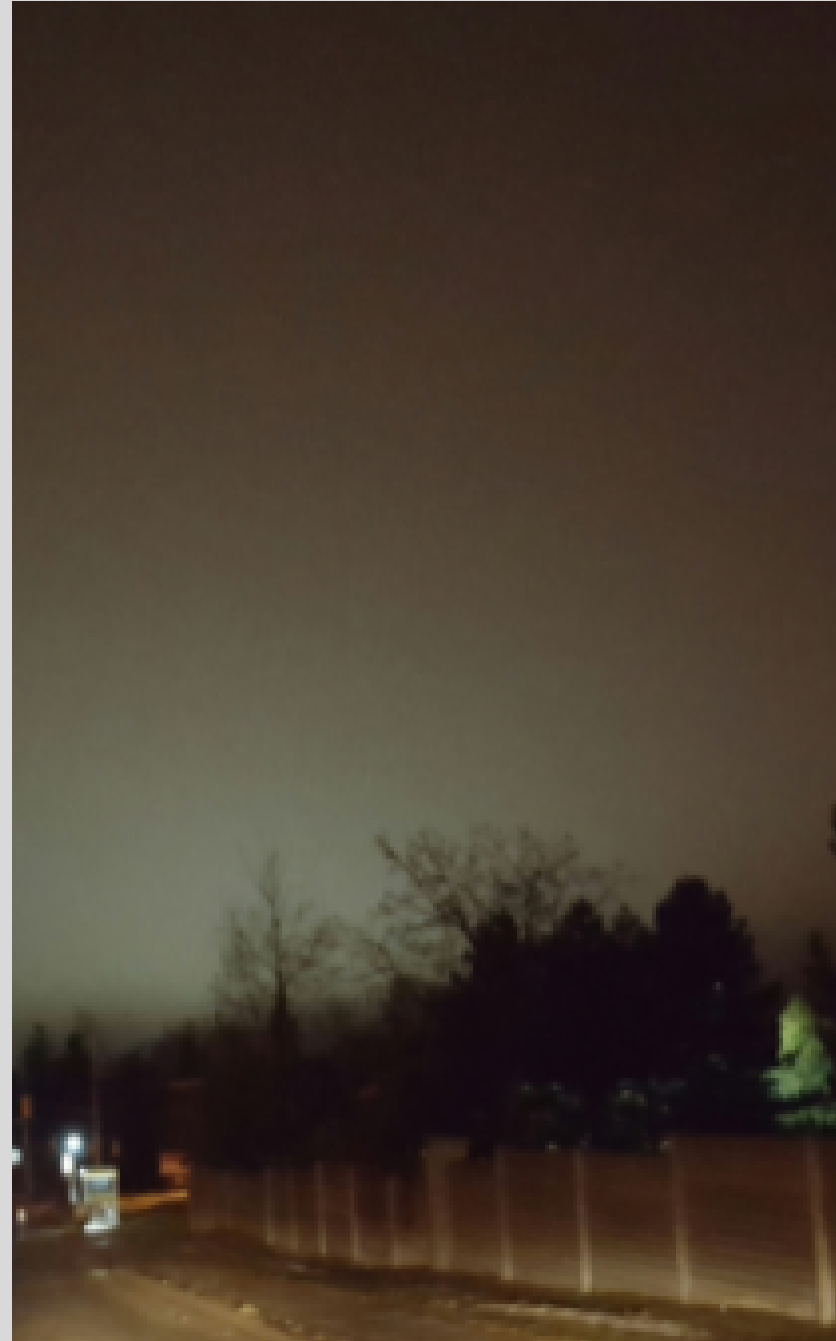
Princeton Outdoor Lighting Survey

April 12th - May 1st
255 residents responded



Defining Light Pollution

Definition: The excessive or misdirected use of artificial light outdoors.



Sky Glow

Brightly illuminated sky



Light Trespass

Unintentionally spills onto nearby property



Glare

Created by light shines horizontally



Humans

- Enjoyment of the night sky
- Human psyche
- Visual discomfort
- Circadian rhythms



Plants & Animals

- Hunting
- Breeding
- Migratory patterns
- Mating

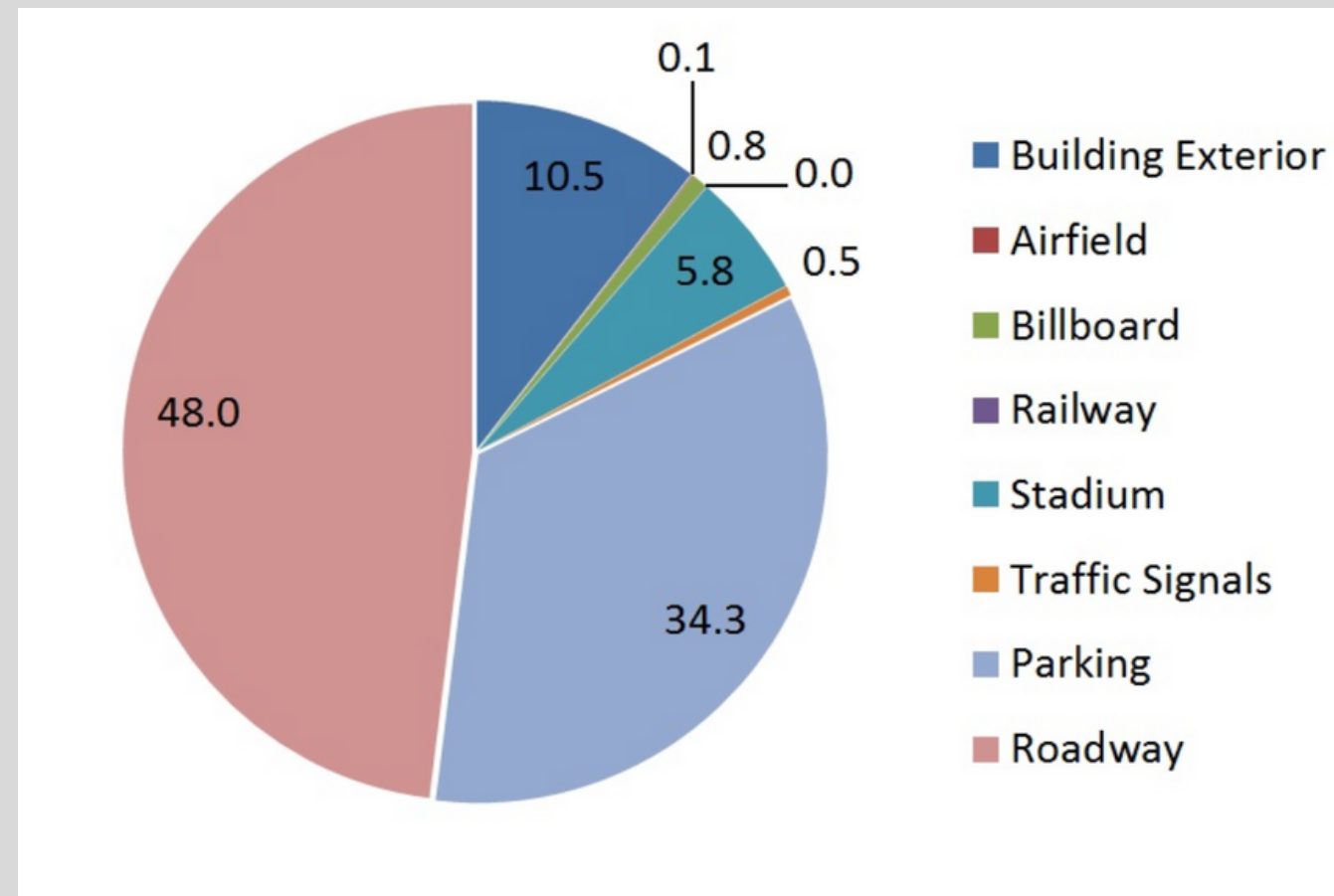
Light Pollution Affects Humans, Plants, & Animals



Obstacles to Addressing Light Pollution



Prioritized Pollution

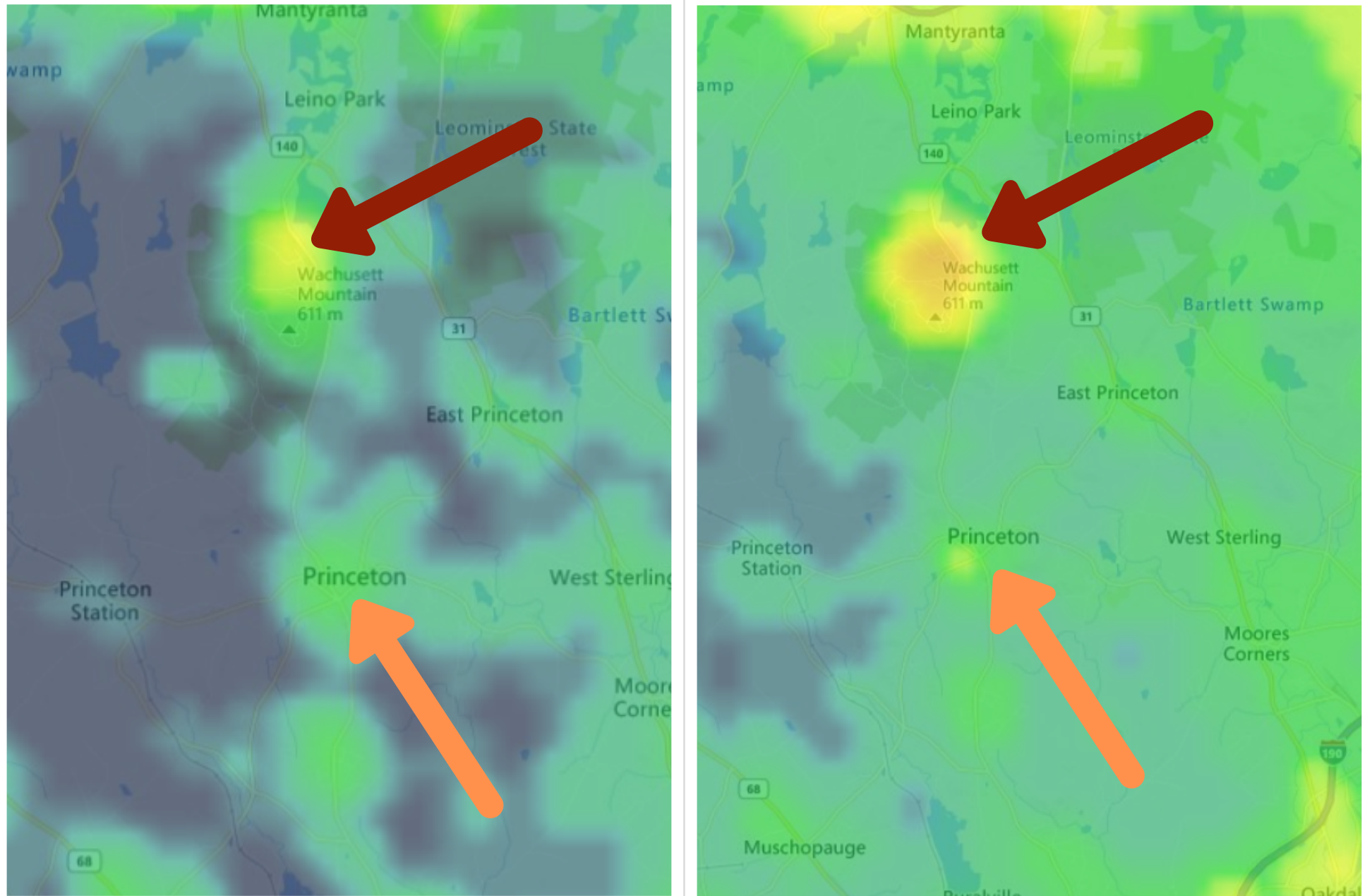


Development

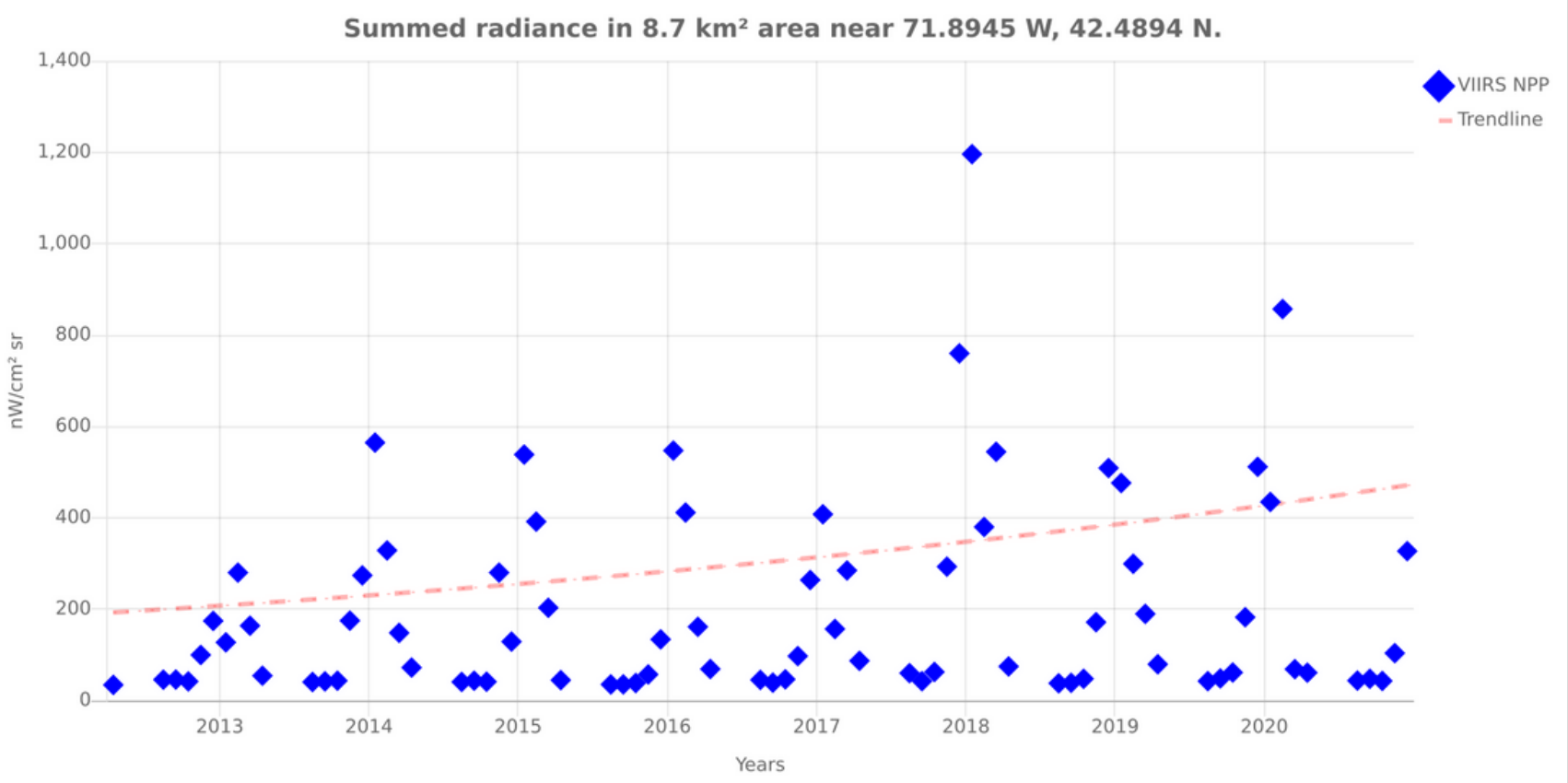


Enforcement

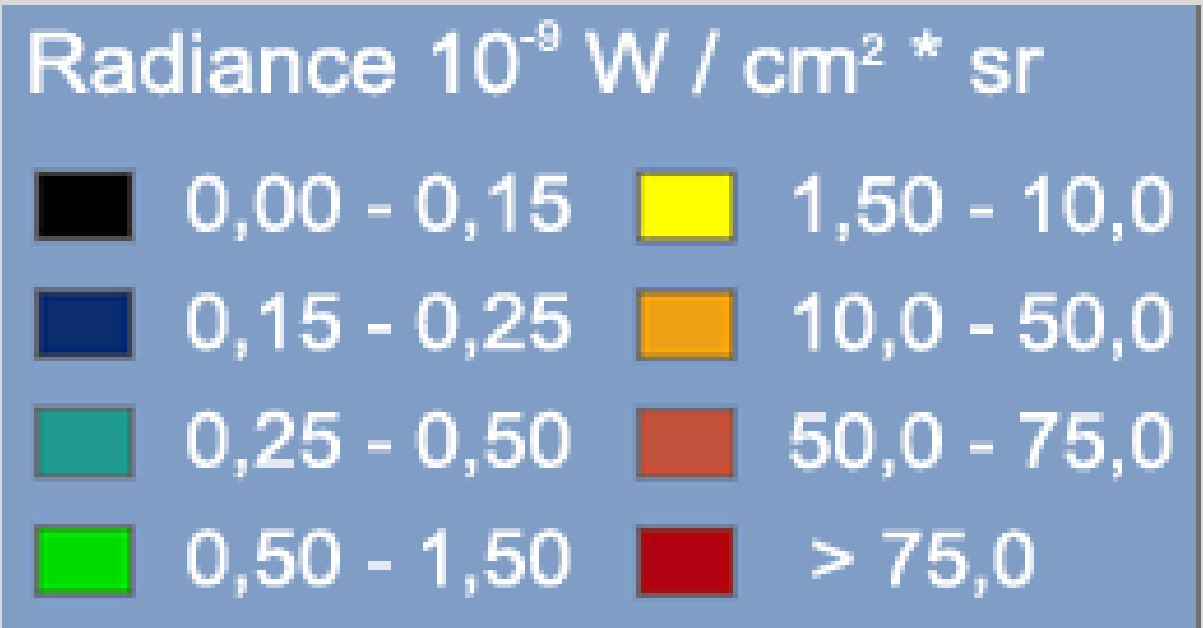
Light Pollution is Increasing in Princeton



Satellite imagery from the NOAA's VIIRS 2012 (left) and 2020 (right) data, depicting the level of radiance of light pollution in Princeton. (Lightpollutionmap, 2020)



Wachusett Mountain Ski Area produces a change in radiance of 10.79% per year during ski season





Commercial Lights Add to Light Pollution

- Directed upwards
- Not properly shielded



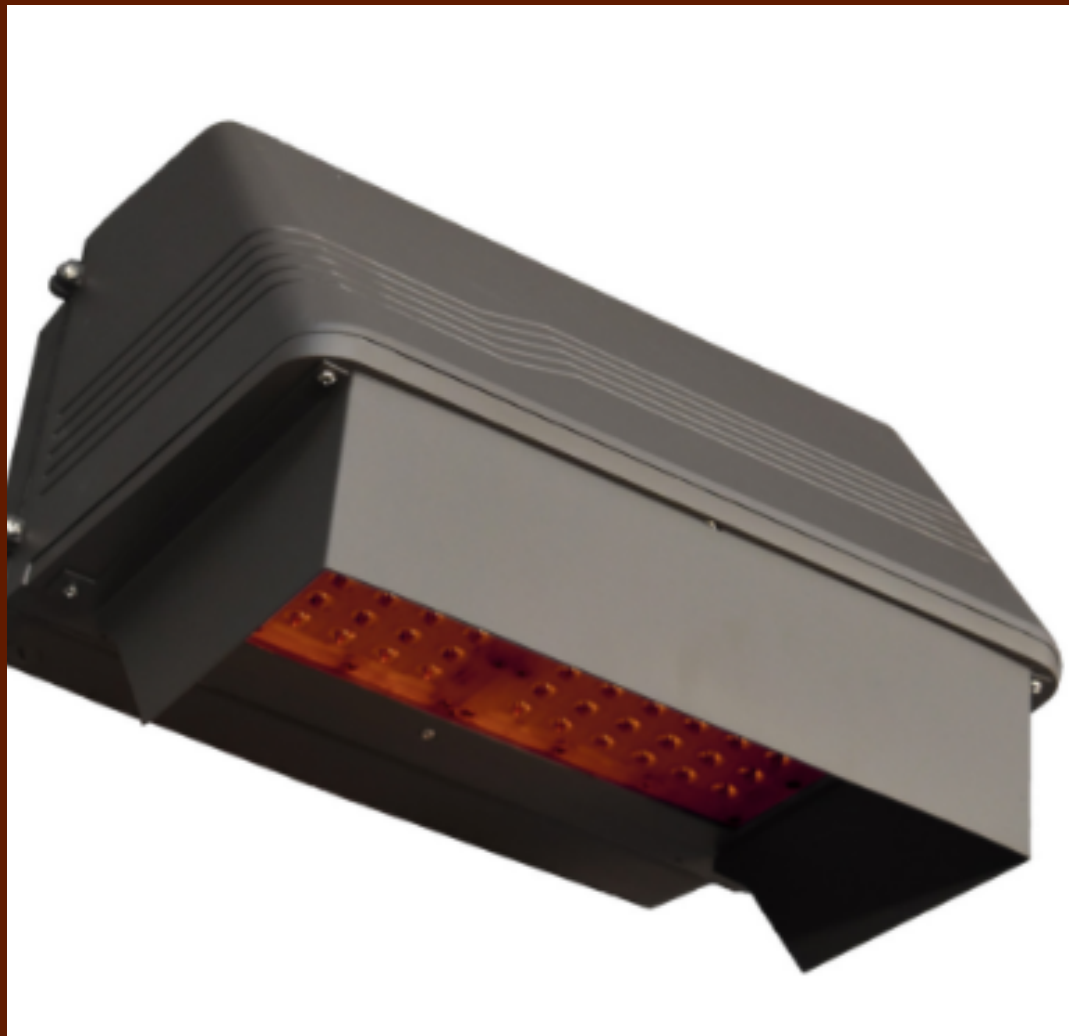
Security/Business Lighting Intrudes on the Night Environment

- Not properly directed
- Not shielded
- Cool light color



Street Lighting in Princeton Produces More Glare

- 4000 Kelvin
- Creates bright darkness



IDA Standards

Fully Shielded

- Directed downwards
- Emit no light upwards

Minimize Blue Light Emission

- "warm-white" LEDs
- CCT of 3000K or lower

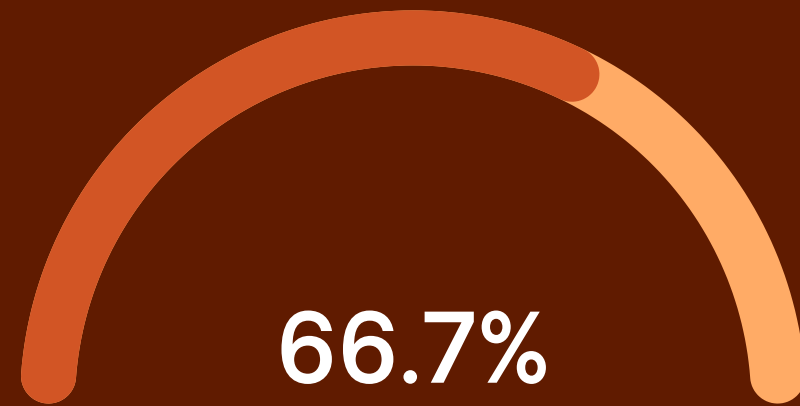
Recommends

- Motion Sensors
- Dimmers
- Timers

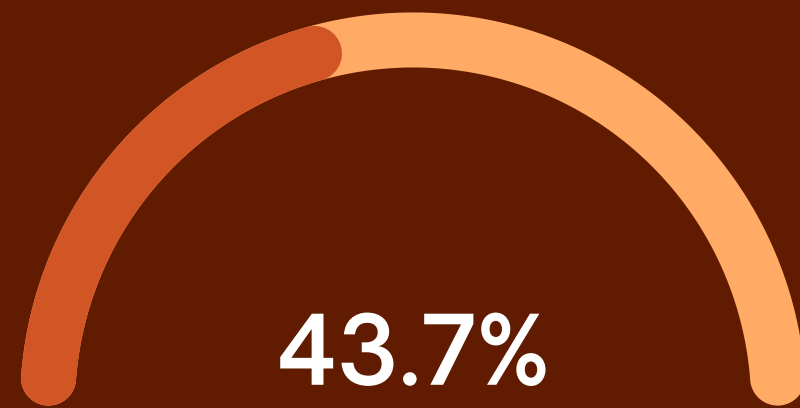


Princeton Residents Identify Sources of Light Pollution

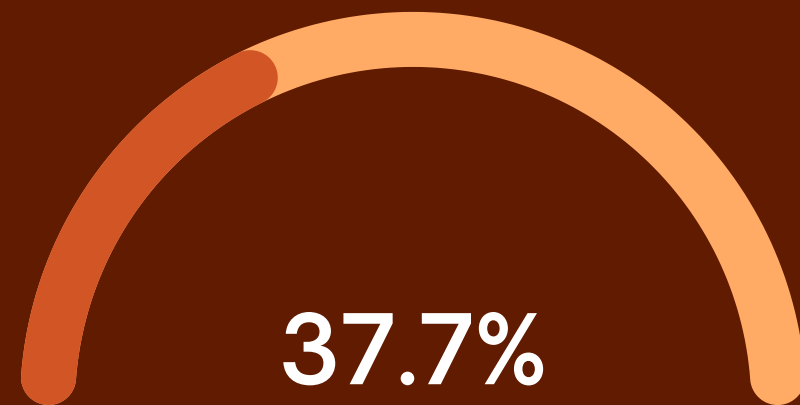
Results from
our survey



Wachusett Mountain Ski Area



Residential Lighting

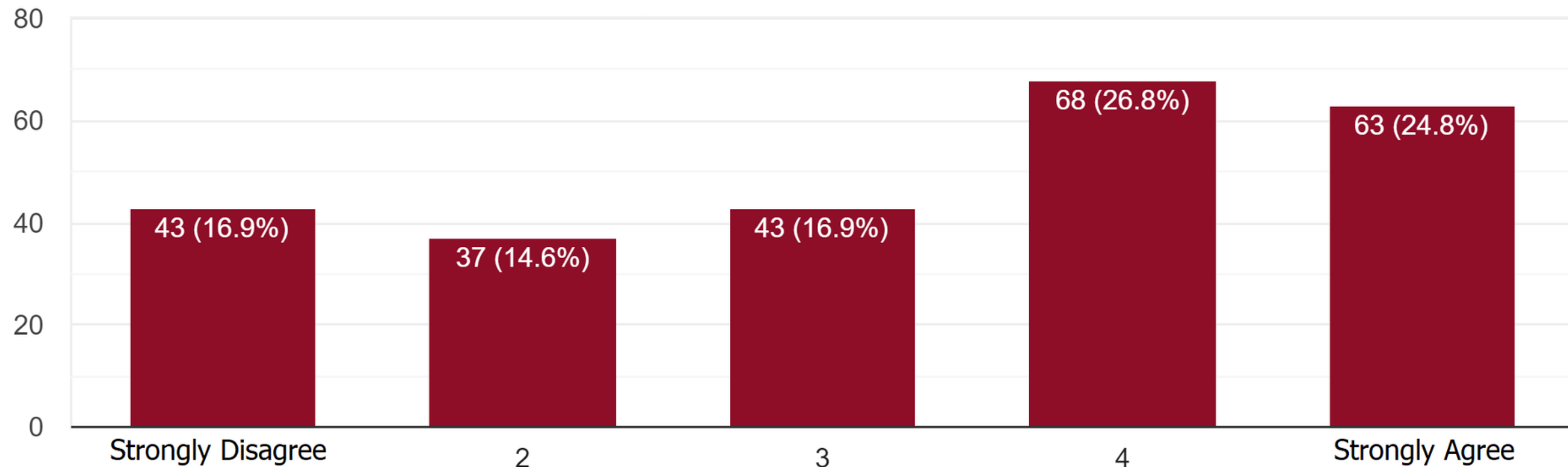


Streetlights

Survey Respondents are Affected by Light Pollution

4. Light pollution affects my enjoyment of the night sky.

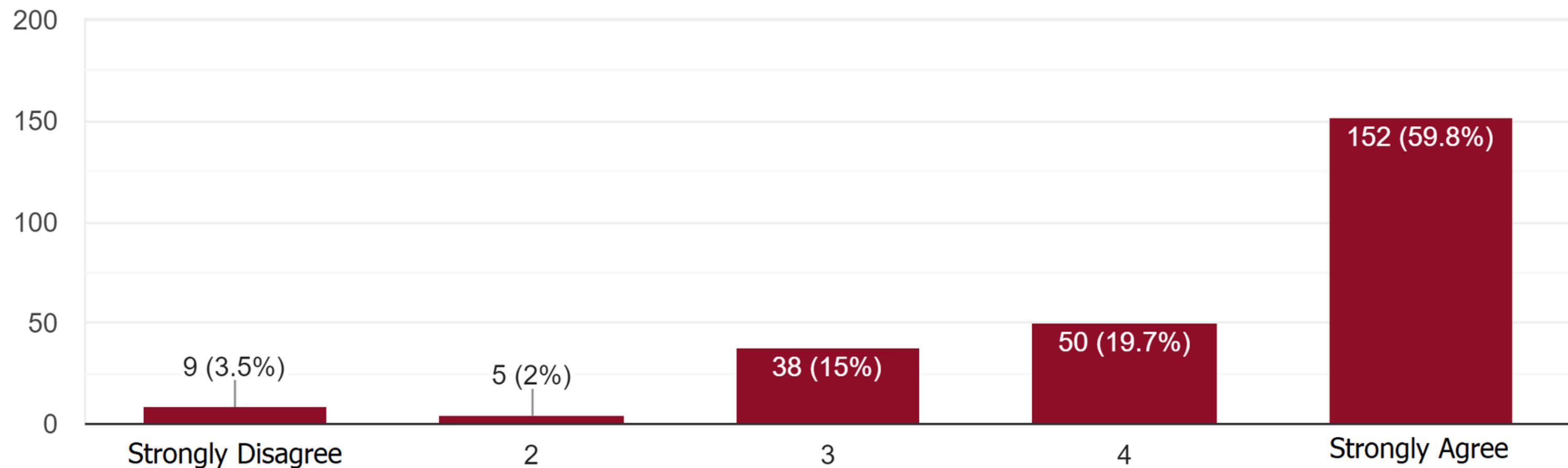
254 responses



Survey Respondents Care About the Night Sky

5. Everyone in Princeton should be able to see a clear, starry night sky.

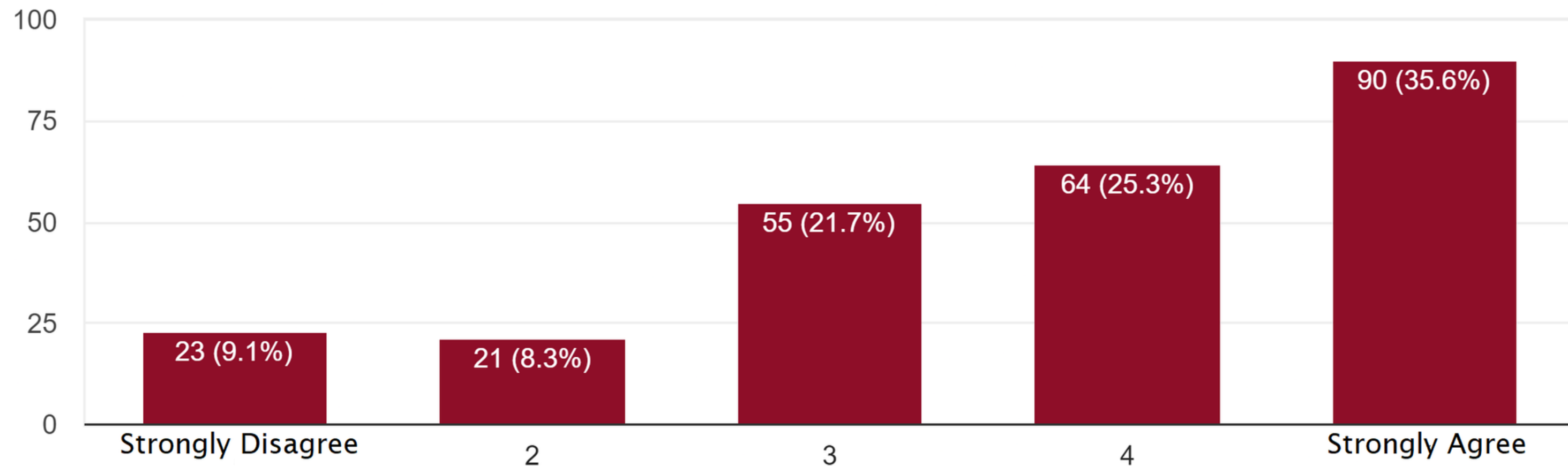
254 responses



Survey Respondents are Concerned About Light Pollution

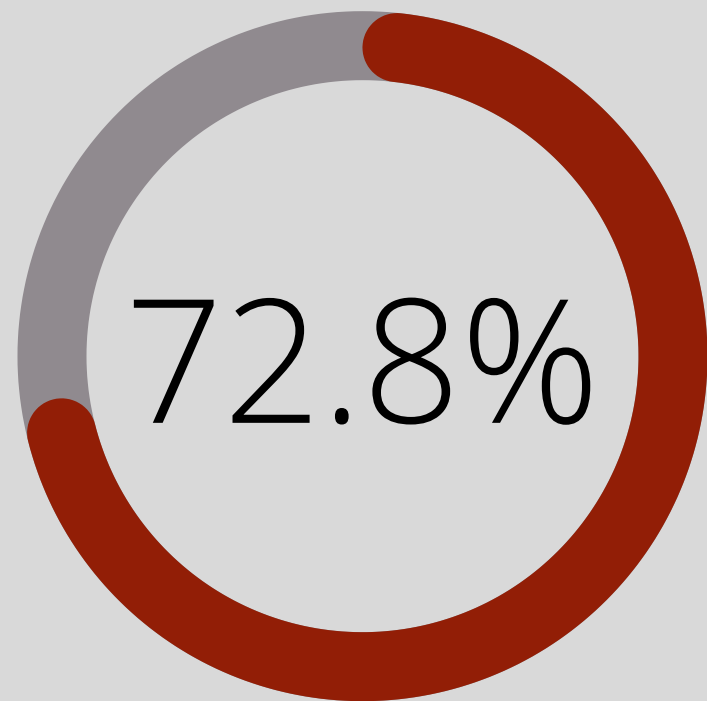
11. I am concerned about how light pollution might negatively impact the night sky in Princeton in the future.

253 responses

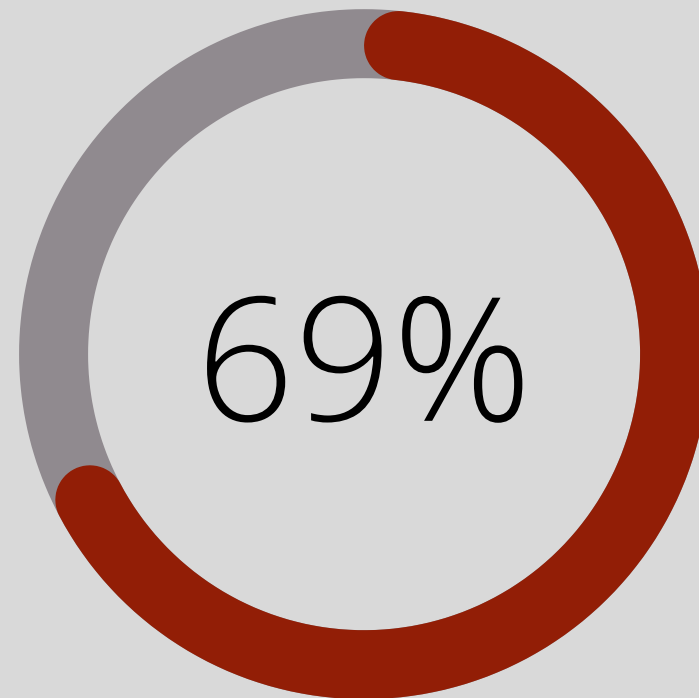


Survey Results

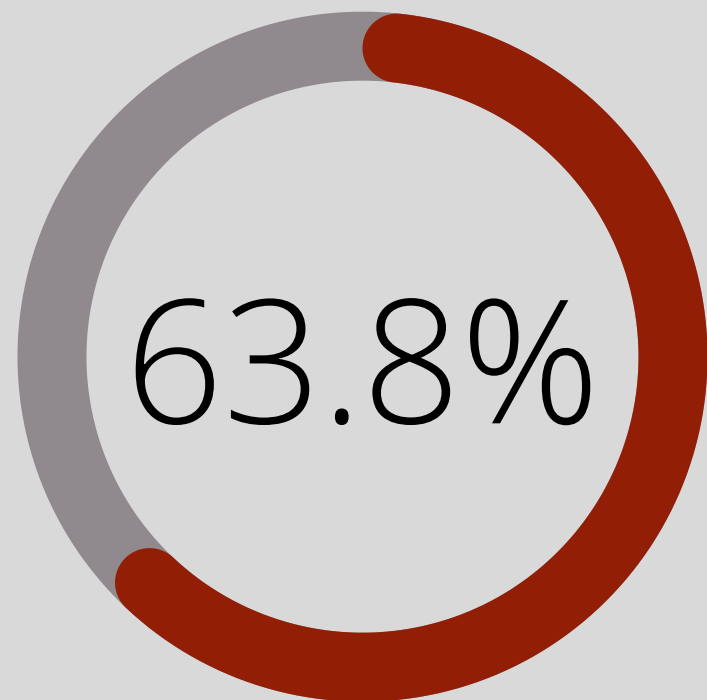
These four provisions were the most popular according to our survey



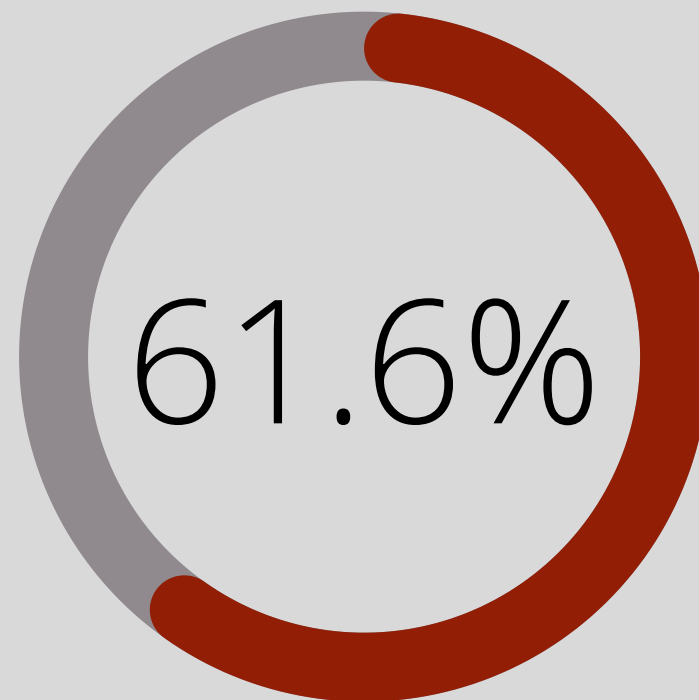
Shielding of Commercial / Municipal Lights



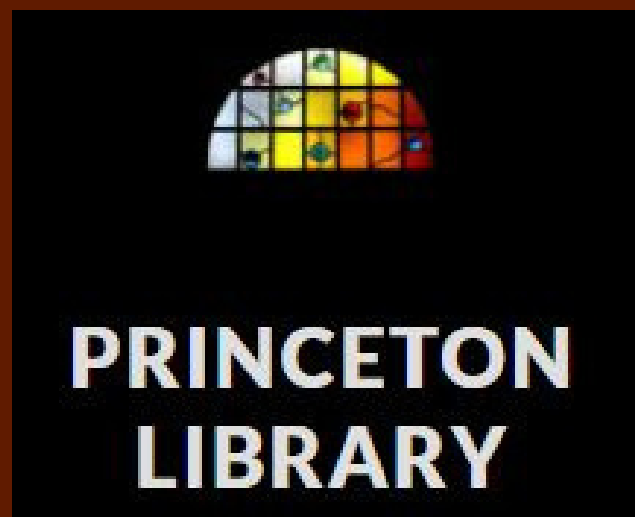
Shielding of Streetlights



Motion Sensors for Commercial / Municipal Lights



Retrofitting of Bulbs for Streetlights



Paths to Combat Light Pollution

- Spreading awareness
 - Astrophotography
 - Available lighting technologies
- IDA outreach materials
- Workshops
- Citizen Science
 - Globe At Night

Nantucket, MA has Raised Awareness for Light Pollution

Unsuccessful Methods

- Night sky observation night
- Light bulb giveaway

Successful Methods

- Facilitate conversation among residents
- Public Forum w/ expert speakers



Town & County of
NANTUCKET, MA

Key Takeaways from Interviews

Knowing your audience.

Meeting residents where they are.

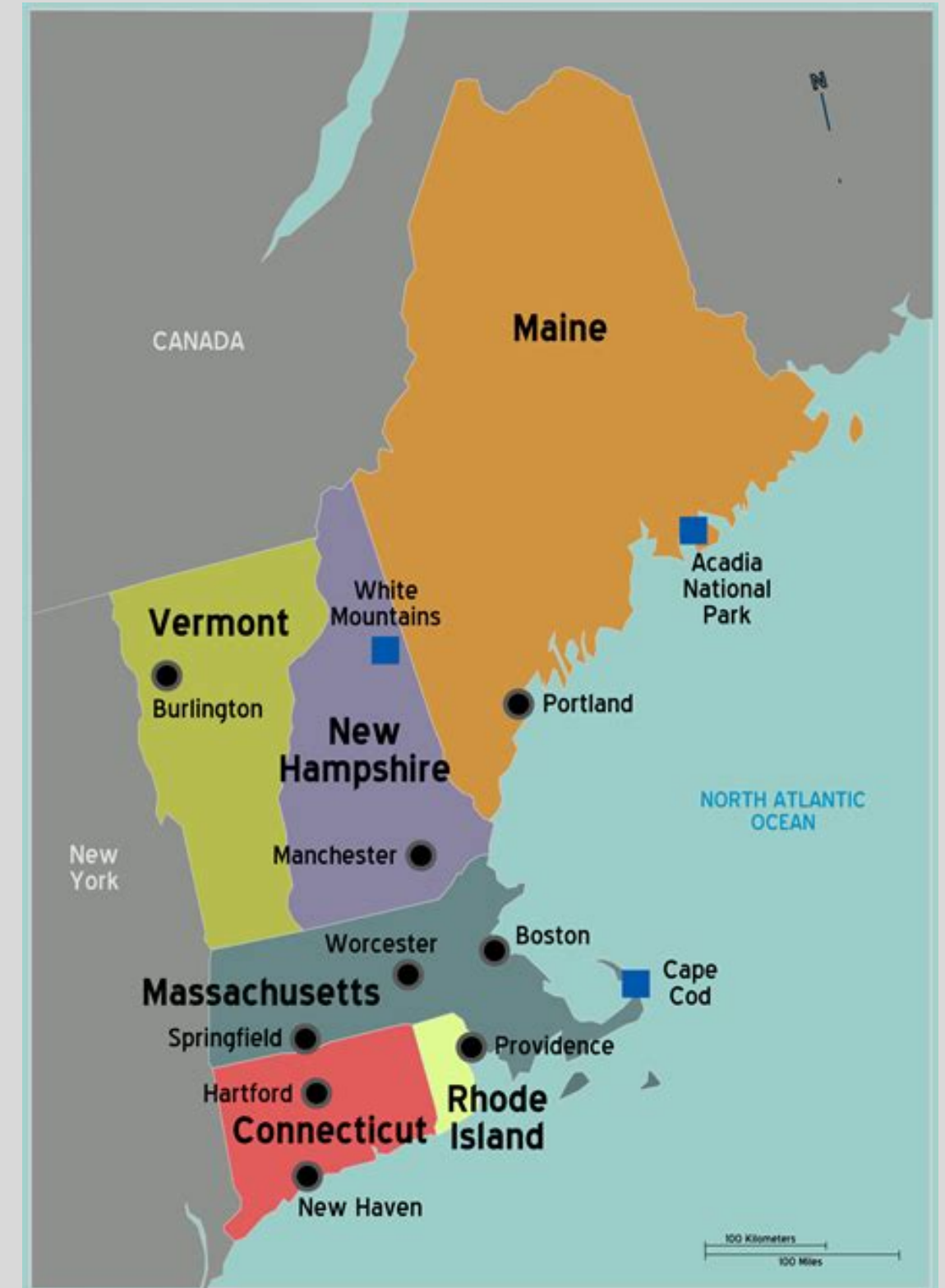
Linking light pollution issue to existing concerns.

Building a team to spearhead efforts.

Outreaching effectively to three main groups in town.

Lighting Bylaws Regulate Outdoor Lighting

- Massachusetts vs. New England
- Town Bylaws

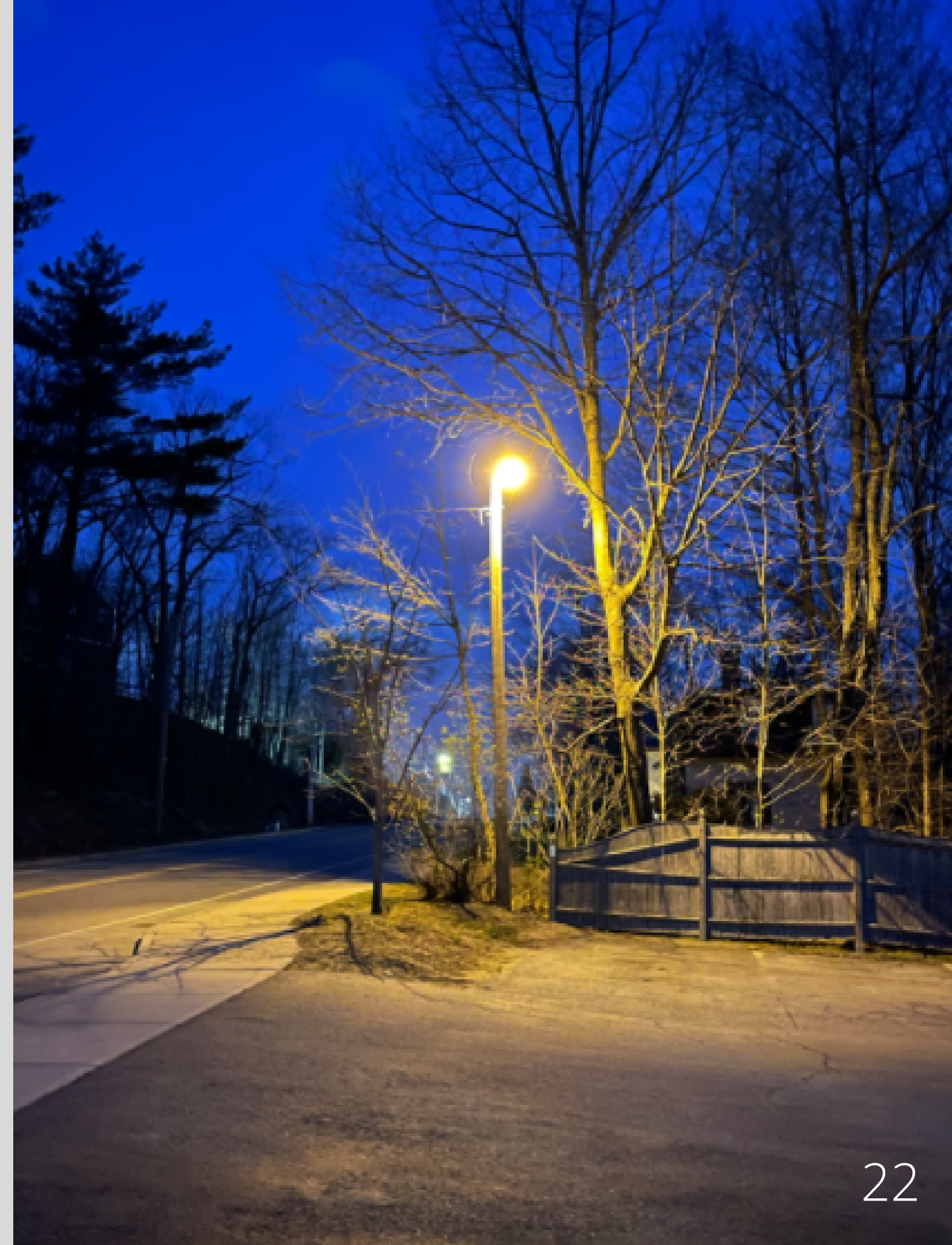


Towns in Massachusetts Regulate Lighting with Bylaws

Town	Light Type	Shielding	Direction	Lumens	Kelvin	Hours of Operation	Pole Height	Residential	Streetlights	Commercial	Municipal	Zoning or General	Grandfathering
Truro		x	x	x			x	x		x	x	General	5 years to update
Boxborough	x	x	x	I		x	x	x	I	x	x	Zoning	Anything predating
Rowley		x	x	x		x	x	I		x	x		Pre-2001
Dalton		x										Zoning	
Lincoln	x	x	x									Zoning	
Blackstone		x	x				x	x	x	x	x	Zoning	
Georgetown		I	I									Zoning	
Plainville		x	x	I								Zoning	Anything predating
Lancaster	x	x	x	x	x	x	x	I		x	x	Zoning	Anything predating
Littleton	x	x	x				x			x	x	Zoning	
Middleton	x	x	x	I		x		x		x	x	Zoning	
Townsend	x	x	x	x	x	x		I	x	x	x	Zoning	Anything predating
Pepperell	x	x	I	I	x	x	x	x	x	x	x	General	Anything predating
	Key:	Symbol	Meaning										
		x	This provision is present in the bylaw										
		I	This provision is present in the bylaw, but is irregular in some way										

Looking to the future

- Outreach and Awareness
- Technical Lighting Changes
- Legislative Method consideration



Questions?

