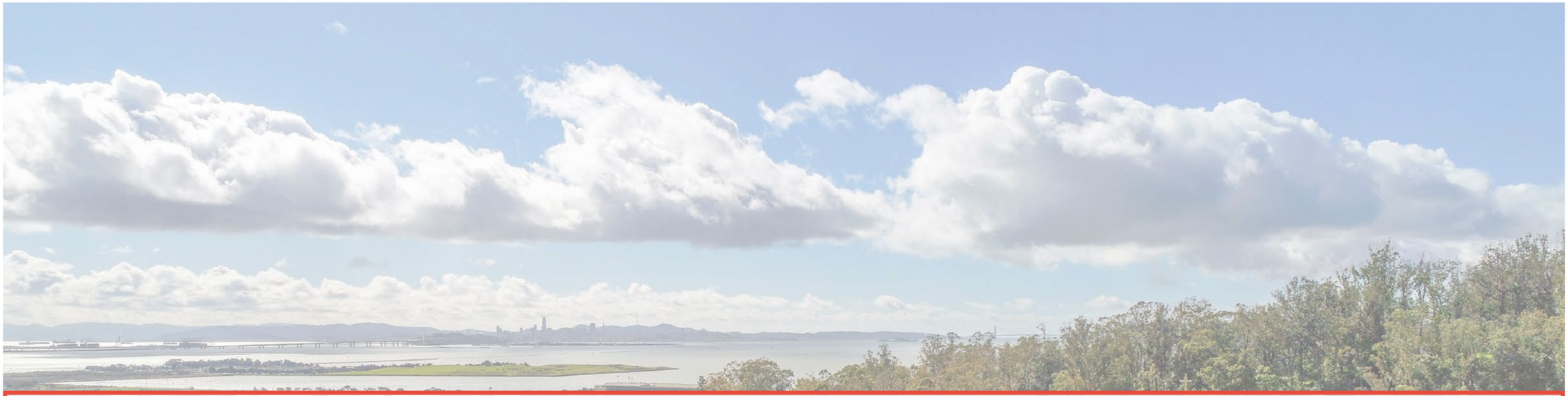
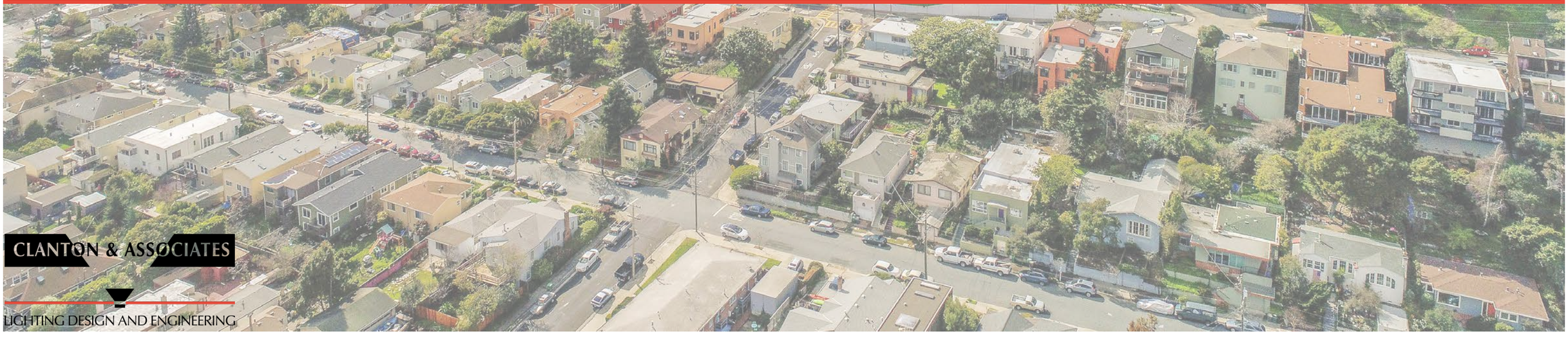


ALBANY - STREET LIGHTING EVALUATION

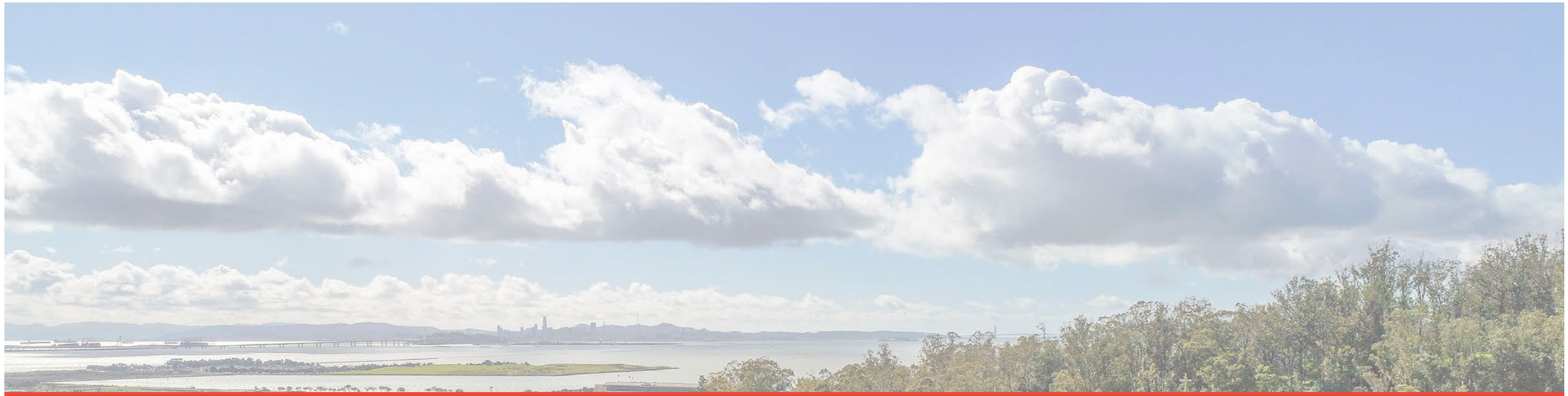
STREET LIGHTING GUIDELINES & FEATURES

12/7/2023



CLANTON & ASSOCIATES

LIGHTING DESIGN AND ENGINEERING



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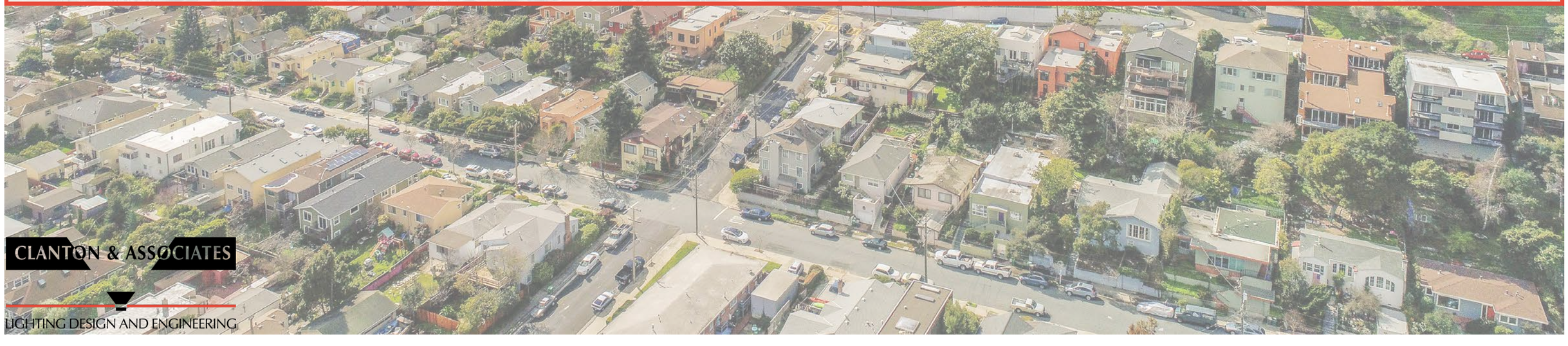
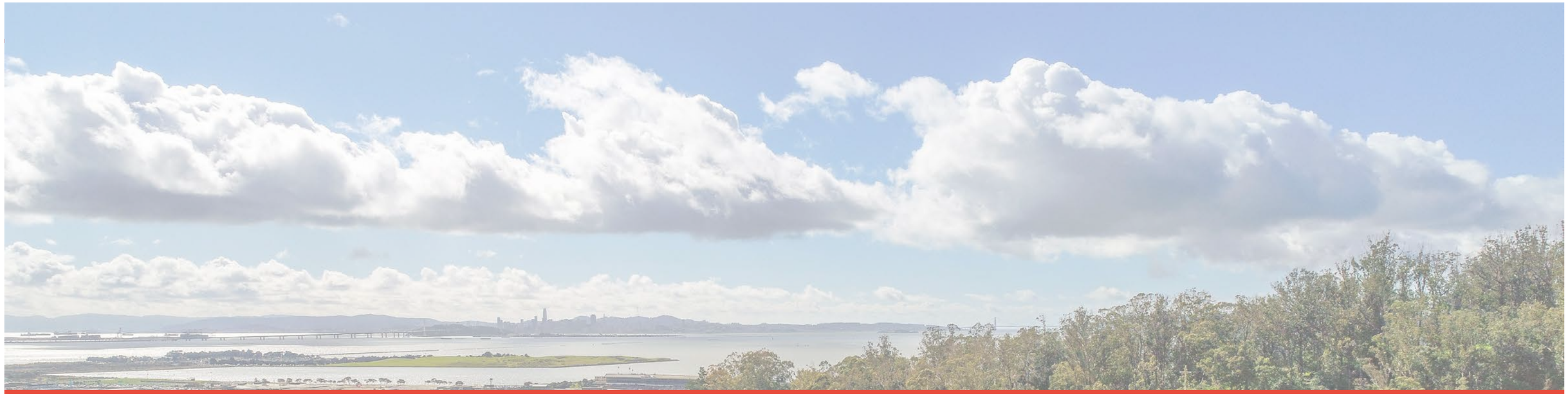


CLANTON & ASSOCIATES

LIGHTING DESIGN AND ENGINEERING



PROJECT STRUCTURE

STREET LIGHTING IN ALBANY

The City of Albany requested an inventory and evaluation of their existing street lighting to assist them in addressing resident concerns and in guiding future upgrades. Every streetlight in the City has been inventoried. This report provides detailed recommendations for lighting improvements and strategies based upon this inventory, site observations, public feedback, and national criteria published by the Illuminating Engineering Society (IES).

SCOPE OF THE STREET LIGHTING EVALUATION

The scope of this evaluation focuses on street lighting, or lighting meant for streets, their accompanying sidewalks, and major bikeways. It excludes exterior lighting from private yards, building facades, or other sources. This evaluation will includes following items:

- Citywide inventory of existing streetlights
- A photo and GIS database of the inventory for the City
- Evaluation of up to ten representative sites through measurements and photographs
- Recommendations for luminaire characteristics, light levels, and appropriate CCT's
- A lighting demonstration for public engagement
- Public feedback in the form of surveys collected and analyzed
- Reports summarizing the results of the evaluation and any recommendations

EXISTING STREET LIGHTING

Clanton & Associates surveyed ten (10) sites throughout Albany in May 2023. The selected sites included commercial corridors and residential areas, representing a range of lighting . Each site was visited during daytime and nighttime hours in order to gain insight into the visual character and activity level of the locations. Those sites included:

1) Marin Avenue (Kains to Talbot)
2) Marin Avenue (Neilson to Peralta)
3) Neilson Street (Sonoma to Francis)
4) Solano Avenue (Carmel to Ramona)
5) Masonic Avenue (Washington to Solano)
6) Solano Avenue (Evelyn to Talbot)
7) San Pablo Avenue (Washington to Garfield)
8) Evelyn Avenue (Garfield to Portland)
9) Madison Street (Washington to Castro)
10) Buchanan Street (Taylor to Madison)

Information gathered at these sites was used to develop strategies for the needed lighting improvements in Albany as well as to develop recommendations for the lighting strategies and technologies that are a good fit for the City's needs. Much of the City's lighting is at its end of service life. The City has a mix of older LED luminaires and some legacy light sources like High Pressure Sodium (HPS). The functionality of these older LED luminaires varies and Albany's narrow streets makes managing light trespass from street lighting a challenge. Many luminaires in the City are experiencing some level of failure and are due improvements.

SAN PABLO AVENUE

NEILSON STREET

SOLANO AVENUE

MADISON STREET

GLOSSARY OF LIGHTING TERMS

- Avg: Average Illuminance (fc) or average Luminance (cd/m^2) should be within a reasonable range of the criteria being used. This is generally 10% above or below the criteria. This allows for site-driven restrictions on luminaire placement to be accommodated within the design and for a reasonable amount of non-uniformity.
- Avg/Min: This use the average illuminance divided by the maximum measured illuminance in an area to measure the uniformity of the lighting. It should be somewhat less than or equal to the stated criteria for any site and usage. It is not desirable for this number to exceed the criteria as excessive uniformity begins to lower contrast, making visibility worse instead of better.
- Candela: The SI unit for measuring luminous intensity (lumens per steradian). Typically used to measure light distribution of luminaires.
- Color Rendering Index (CRI): This is a metric developed using a scale of 0 to 100 to describe the ability of a light source to render an object's colors as if it were being exposed to natural daylight. A score close to 100 indicates an artificial light source is a very close match for natural light.
- Contrast: In lighting this is used to discuss the differences in visibility between objects and their surroundings due to the level of luminance.
  - Positive Contrast: The object has a higher luminance than its surroundings.
  - Negative Contrast: The object has a lower luminance and is seen in silhouette against its surroundings.
- Correlated Color Temperature (CCT): Measured in Kelvin (K). This is the color appearance of the light emitted by a lamp. The CCT rating for a lamp is a measure of the "warmth" or "coolness" of its appearance. Lower CCT (2200K) appears very warm or amber. Medium CCT (2700K – 3000K) appears "warm white". High CCT (4000K +) appears "cool white" or "blue".
- Distribution: The pattern of light cast upon the ground plane by a luminaire. Five distribution types are defined by the IES. Some distributions are more appropriate for use in streetlighting than others.
- Glare: The visual sensation created by a luminance (or brightness) that is significantly higher than the surrounding luminance level that the eyes are adapted to. This can cause annoyance and discomfort (discomfort glare), or even a decrease in someone's visual performance and visibility (disability glare).
- Fixture Height: Height of the light fixture shall be measured as the vertical distance from finished grade or from the nearest walking surface below the fixture up to the centerline of the luminaire.
- Footcandles: A unit of illuminance equal to one (1) lumen per square foot.
- Illuminance: Measured in Footcandles (Fc) or lux. This is the density of light that is falling onto a surface. Commonly measured in the horizontal and vertical planes.
- Illuminating Engineering Society (IES): The IES strives to improve the lit environment by publishing recommended practices to guide decisions made by lighting designers, architects, engineers, sales professionals, and researchers. The IES' The Lighting Handbook and Recommended Practices are the currently recognized authoritative references on the science and applications of lighting.
- Legacy Light Source: All non-LED light sources including incandescent, halogen, high pressure sodium, low pressure sodium, induction, and fluorescent source types.
- Light Level: The amount of light falling on a surface. Also defined as illuminance.
- Light Output: The amount of visible light coming from a luminaire. Measured in lumens.
- Light Trespass: This is light spilling past property lines so it falls onto adjacent properties unintentionally. This can be a neighborhood nuisance, be detrimental to privacy, and is a contributor to light pollution. Light trespass is determined by measuring illuminance in the vertical or horizontal plane. This measurement should be somewhat less than or equal to the maximum criteria.
- Lumen: The unit of measurement for visible light (luminous flux) emitted from a light source.
- Luminaire: The complete electrical light unit including the light source, housing, optics, and driver.
- Luminance: Measured in Candela per meter squared (cd/m2). The light source or surface brightness as it is perceived by the human eye.
- Multiple of Criteria: The multiple of criteria is determined by the measured average light level for an area divided by the specified lighting criteria.Since meeting the criteria exactly would result in a value of 1, an acceptable Multiple of Criteria is generally 0.8 to 1.5. Numbers falling below this range may be underlit while numbers above this range may be overlit.
- One-for-One Replacement: This is when existing streetlights are upgraded to newer luminaires without making any other changes to the existing lighting layout.
- Point Light Source: The exact place from which illumination is produced (e.g. a light bulb filament or LED package) even when behind a clear lens.
- Watt (W): A measurement of energy transfer over a unit of time.
- Wayfinding: Illuminating key locations such as entrances, architectural features, and pathways improves navigation at night for anyone unfamiliar with the area.

OHLONE GREENWAY

LED LUMINAIRES

At this time the LED luminaires in Albany have reached the end of their service life and are experiencing a variety of failures. These failures may look like inoperable LED diodes within a luminaire, a color shift in the light output, or luminaires that are completely inoperable. During Clanton & Associates' site visit we observed a significant amount of LED luminaires with diodes that had failed, leading to insufficient light output. There were also multiple luminaires that had experienced a color shift from a neutral white light to a noticeable yellow-green tint. The cumulative effect of these different failures is reduced quality in the light on Albany's streets.

Most of the LED street lighting in Albany was installed over 10-15 years ago as part of a citywide conversion to LED. Only eight of the City's streetlights are still using a legacy, High Pressure Sodium (HPS) light source. The City of Albany were early adopters of LED technology for outdoor lighting. This has reduced energy costs and consumption for the City since their installation, but there have been many improvements to LED technology since these luminaires were installed.

Modern LEDs offer greater improvements in efficacy, more options for CCT without significant compromises on energy savings, and more shielding options than the initial technologies for outdoor street lighting.

IMPROVEMENTS IN LED TECHNOLOGY

Since Albany was an early adopter of LED technology, the LED luminaires in the City are mostly from the 1st generation of LED street lights. LED technology has made significant advancements over the last 10-15 years. Albany can expect the following improvements from contemporary LED technologies:

- **Improved Efficacy & Reduced Energy:** The efficacy (lumens per watt - LPW) of LED technology has improved significantly, nearly doubling. This has resulted in wattage being reduced by 50% for the same light outputs.
- **Extended Life Expectancy:** The expected life of LEDs is based on the rate of light output degradation over time. When the light output has reduced to 70% of its original output (L70), this is considered end-of-life. Over the last 10 years, the L70 life expectancy has increased from 50,000 hours to over 100,000 hours. This lifespan of LEDs is also extended when they are dimmed, or otherwise operated at a lower drive current.
- **Improved Visual Comfort:** There are more luminaire options available now that are low glare, though some LED street light manufacturers pay more attention to glare control than others. Selecting a low-glare luminaire for use in Albany is important as too much glare can result in annoyance, discomfort, and reduced visibility for residents and lowers the overall visual comfort in the City.
- **Color Stability:** Early generations of LEDs experienced more color shifts from phosphor degradation than contemporary LEDs. Some of the existing LED streetlights in Albany have shifted to a noticeable yellow/green tint, which is distracting and reduces the attractiveness of neighborhoods.

LEGACY COBRAHEAD

LEGACY POST-TOP

MODERN LED COBRAHEAD

STREET & PEDESTRIAN COMBO

PROCESS OF LIGHTING DESIGN

Outdoor lighting at night helps people understand the space they are in by providing visual cues and allows a improved awareness of their surrounding environment through improved visibility. A good lighting design does this while taking into account the needs of different users of a space and the undesirable effects outdoor lighting can have on our environment.

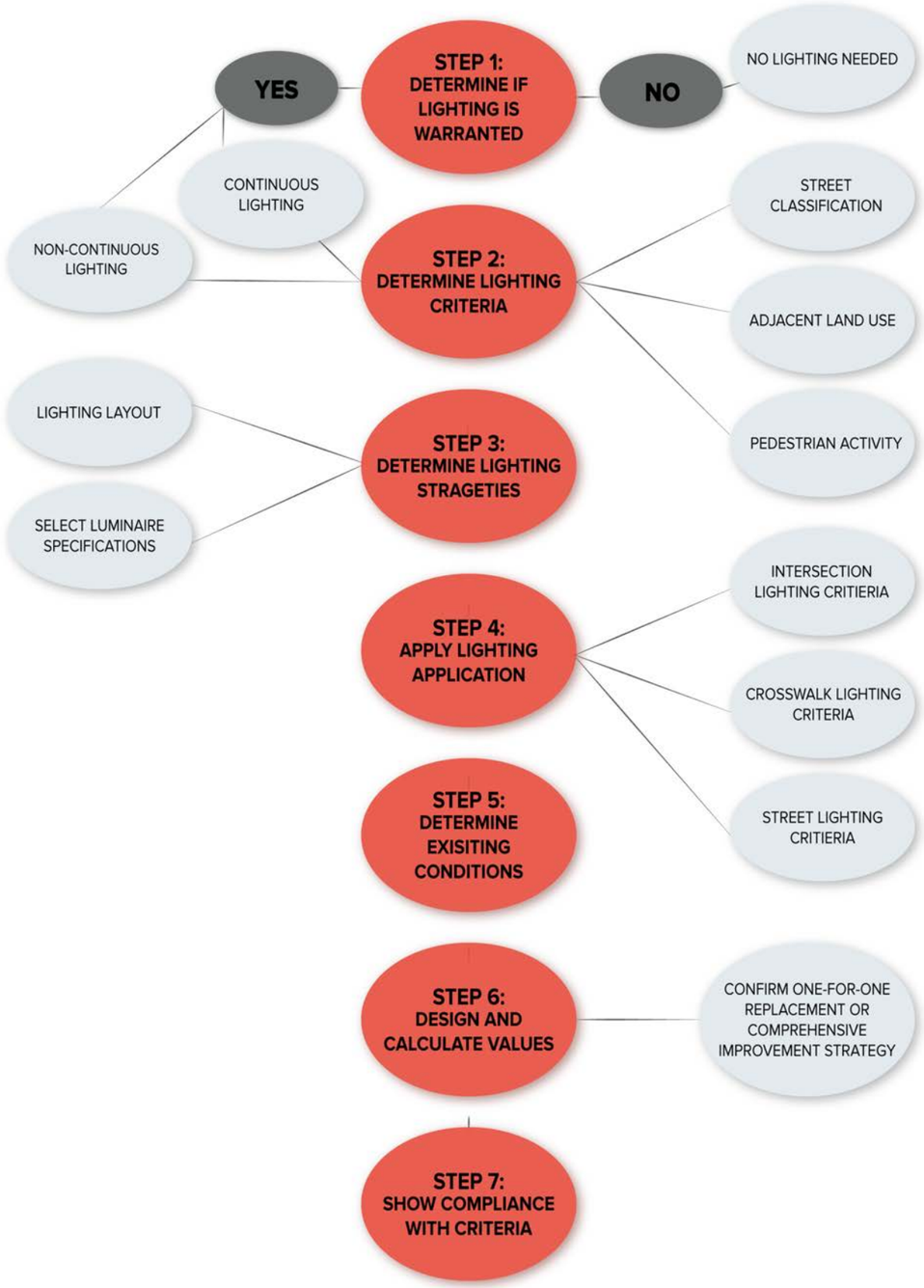
Quality outdoor lighting should be designed in a way that minimizes areas of excessive brightness that make visual adaptation to areas with lower light levels difficult. Adaptation refers to the human eye's ability to adjust its vision between changes in luminance. The eye will automatically adjust itself to the brightest object in our field of view and it takes time for the eye to adjust from being in a bright space to being in a dark one. Transitions between different light levels are important for reasons such as:

- **Accessibility**: Adapting from very bright interior spaces to non-lighted nighttime environments can take up to five minutes for a healthy eye. It can take additional time for the elderly or otherwise visually impaired.
- **Safety**: Gradual transitions between light levels are more comfortable for everyone but are essential to the safety of elderly people and other groups to be able to navigate outdoors at night. Improving the light levels around entries/exits and their immediate surroundings can improve visual adaptation.

The lighting design process is iterative. Elements of a design such as spacing or mounting height are altered until the criteria deemed appropriate for a street typology or site have been satisfied. Lighting design requirements are informed by the process of warranting, which helps guide where and how much lighting should be placed on a site and if that lighting needs to be continuous or only in key locations where there may be conflicts. This process examines many factors of a site such as:

- **Adjacent Land Uses**: This typically uses the community's own zoning maps as well as the area's proximity to any ecologically sensitive locations such as nature preserves or bodies of water.
- **Pedestrian & Cyclist Activity**: IES standards for street lighting use the amounts of pedestrians in an area per hour at night grouped into the categories of low, medium, and high in order to determine the amount of light necessary for a space.
- **Existing Conditions**: This is generally part of step one and takes into account existing luminaires, their age and current performance, and if any luminaires from outside a site are providing lighting to that site.

These first steps of the lighting design process allow for a granular approach to choosing the appropriate lighting for any street. Once these decisions have been made, calculations can be performed to verify the light levels from a design will create good visibility when applied, and to determine which luminaires would be appropriate for use.



LIGHT POLLUTION IN ALBANY

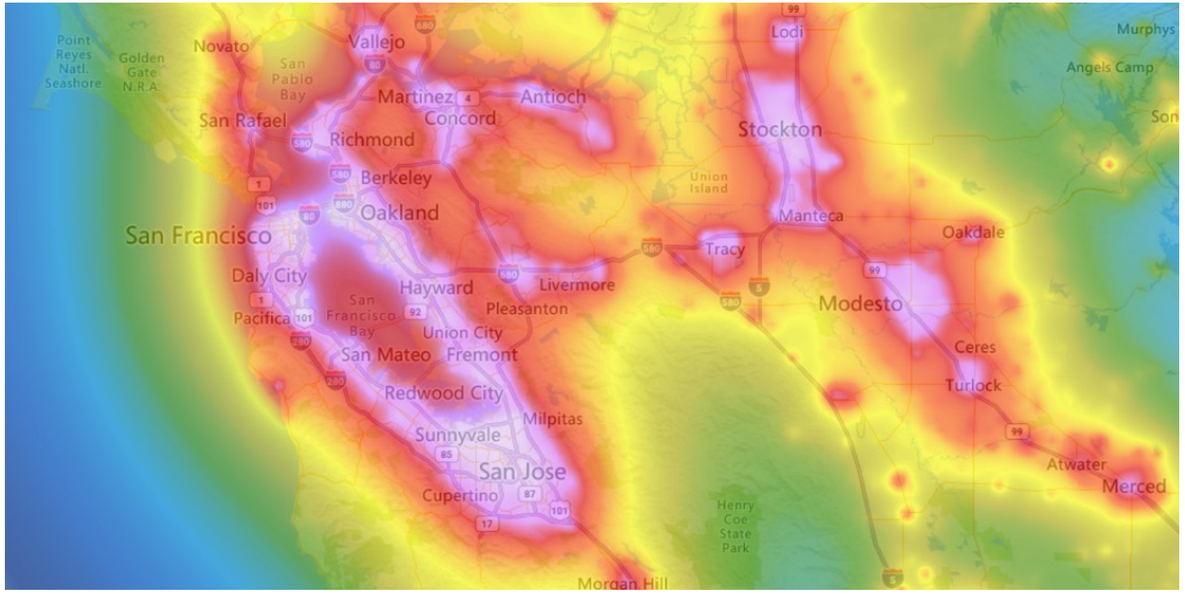
The Bay Area is a regional hotspot for light pollution in California. Light pollution typically comes from light being emitted or reflected upward excessively. This could be due to poorly shielded luminaires, poorly aimed luminaires, or the use of excessive lumen outputs. Outdoor light sources with higher CCT's exacerbate the issue as they generally contain greater amounts of blue spectrum light, which scatters further in the atmosphere. When LEDs for outdoor lighting were a new technology, the energy savings were not as significant with lower CCTs, but this has changed with technological advancements.

Light pollution has negative impacts on the environment and human health by disrupting the natural cycles of light and darkness on earth. It also limits our access to the night sky. Access to the stars at night without having to travel to quality dark sky sites is a critical component of equity in access to this resource for scientific engagement and access to our cultural heritage.

Albany, like its neighboring cities, scores at the higher end of the scale (7-8) for zenith sky brightness, a measurement of night sky quality. The upper right photo, taken May 2023, shows how the current level of light pollution in Albany impacts the appearance of its nighttime cloud cover, with clouds appearing very bright. While changes made in Albany are unlikely to impact the regional levels of light pollution on their own, there is still merit in pursuing better lighting policies for dark skies. These changes have the potential to improve the nighttime experience of the City's residents and set a good example for ecologically responsible lighting for neighboring cities. Light pollution does not have to simply get worse and unlike other forms of pollution leaves no trace once it's addressed. Improving the shielding requirements for luminaires, using the minimum amount of lumens needed for a street typology, limiting the CCT's being used outdoors to lower temperatures, and dimming street lights during hours with lower activity can all help improve a City's light pollution level.

SKYGLOW IN ALBANY

BORTLE SCALE



BAY AREA ZENITH SKY BRIGHTNESS

LIGHTING DESIGN & THE ENVIRONMENT

Lighting & Animals:

The biological processes of wildlife are also affected by lighting. Though the spectral sensitivities vary between species. In general, the closer an artificial light source is to the daylight spectrum the more wildlife (like people) can be negatively affected by it at night. Most small carnivorous mammals are fully nocturnal. Many species that have adapted well to sharing the urban environment with humans are crepuscular, active in the dawn and evening hours, but any species that needs to rest during hours of darkness are just as disturbed by light pollution as urban humans. Lighting affects wildlife beyond sleeping behaviors. Artificial lighting at night has been shown to disrupt numerous natural patterns in wildlife, including:

- Foraging behavior and increased predation
- Internal biological clocks
- Can affect mating success, group-mediated anti-predator vigilance, and other light-stimulated behaviors
- Breeding behavior in birds
- Nest site selection, increased predation, timing of breeding
- Possible support for invasive species (mostly pertains to insects)
- Alteration of territorial behaviors
- Delays and changes in migratory behaviors
- Reductions in populations of nocturnal insects
- Has a cascade effect on their predators and is detrimental to pollination

A healthy urban ecosystem depends on a variety of insects, birds, reptiles, amphibians, and mammals of all shapes and sizes. Lighting that trespasses into nearby waterways or other natural spaces is disruptive.

Lighting & Plants:

Most plants need sunlight during the day and darkness at night to maintain their health over their full lifespan. Plants that are sensitive to photoperiodicity or changes in day length in their flowering, bud dormancy, or leaf senescence behaviors may be adversely affected by any amount of illumination they receive from artificial lighting. Plants have evolved a wide range of photoreceptors that perceive and respond to signals from light in their environment, especially in the ultraviolet, blue, red, and near-infrared regions of the electromagnetic spectrum. Some of the many processes sensitive to light are:

- Seed germination
- Stem elongation
- Leaf expansion
- Flower development
- Fruit development
- Bud dormancy (when leaves stop growing)
- Leaf drop

Landscaping is a significant investment for cities or property owners, and urban trees are a crucial component in managing urban heat. For a city, fall color and spring flowering are a source of community pride. Lighting in a way that could reduce trees and other urban plants health, appearance, and lifespan needs to be avoided.

ALBANY BULB SHORELINE

LIGHTING DESIGN & WELLBEING

While the previous two pages mainly discuss the impacts of outdoor lighting choices on the night sky and the environment, overlighting and the resultant light trespass have some more direct negative effects on human beings.

Light trespass is more commonly discussed as a neighborhood nuisance, defined as stray light crossing a property boundary where it then often enters windows. Annoying light from a neighboring property is a familiar complaint in cities. However overlighting and light trespass from outdoor lighting which enters indoor spaces at night can have measurable impacts on the stress levels and sleep quality of a community.

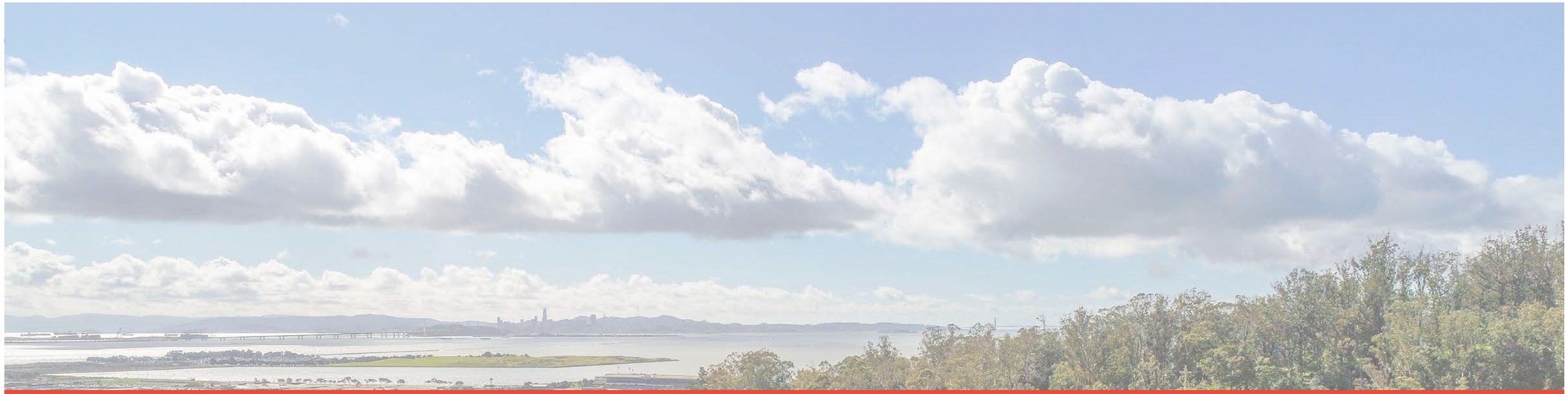
Overlighting, like excessive noise or crowding, is an environmental stressor in urbanized areas that can add to the overall stress load of any individual. This is typically measured through cortisol levels. How stressed someone is influences their healing rates and longevity. While environmental stressors have less of an impact than personal stressors, when a city can act to reduce them in the public realm overall community wellbeing is improved.

Exposure to electric light during hours of darkness can disrupt the melatonin production that manages human sleep-wake cycles, or our circadian rhythms. For sensitive individuals, it can significantly disrupt these rhythms or exacerbate existing sleeping disorders. Darkness at night is needed to allow the natural production of melatonin for healthy and complete sleep. While people can control the lights in their indoor environment, it's important that the potential glare and light trespass from outdoor luminaires that residents cannot control be minimized through design standards for everyone's health.

RESIDENTIAL LIGHT TRESPASS

RESIDENTIAL LIGHT TRESPASS

RESIDENTIAL LIGHT TRESPASS



SITE CHARACTERISTICS

LAND USES & LIGHTING WARRANTS

The adjacent land uses along a street is a key factor in determining the appropriate lighting strategy as it directly correlates to the likely number of users during nighttime hours. Areas of increased activity at night generally accompany more intense land uses and will warrant additional lighting, whereas areas that typically do not have much traffic after dark and have low density zoning may only warrant minimal lighting for safety.

Albany's current land use zoning includes 11 zones and 6 overlay zones. The land uses are:

- Residential Single Family
- Residential Medium Density
- Residential High Density
- Residential Towers
- Residential Hillside Development
- Solano Commercial
- San Pablo Commercial
- Commercial Mixed Use
- Public Facilities
- Waterfront

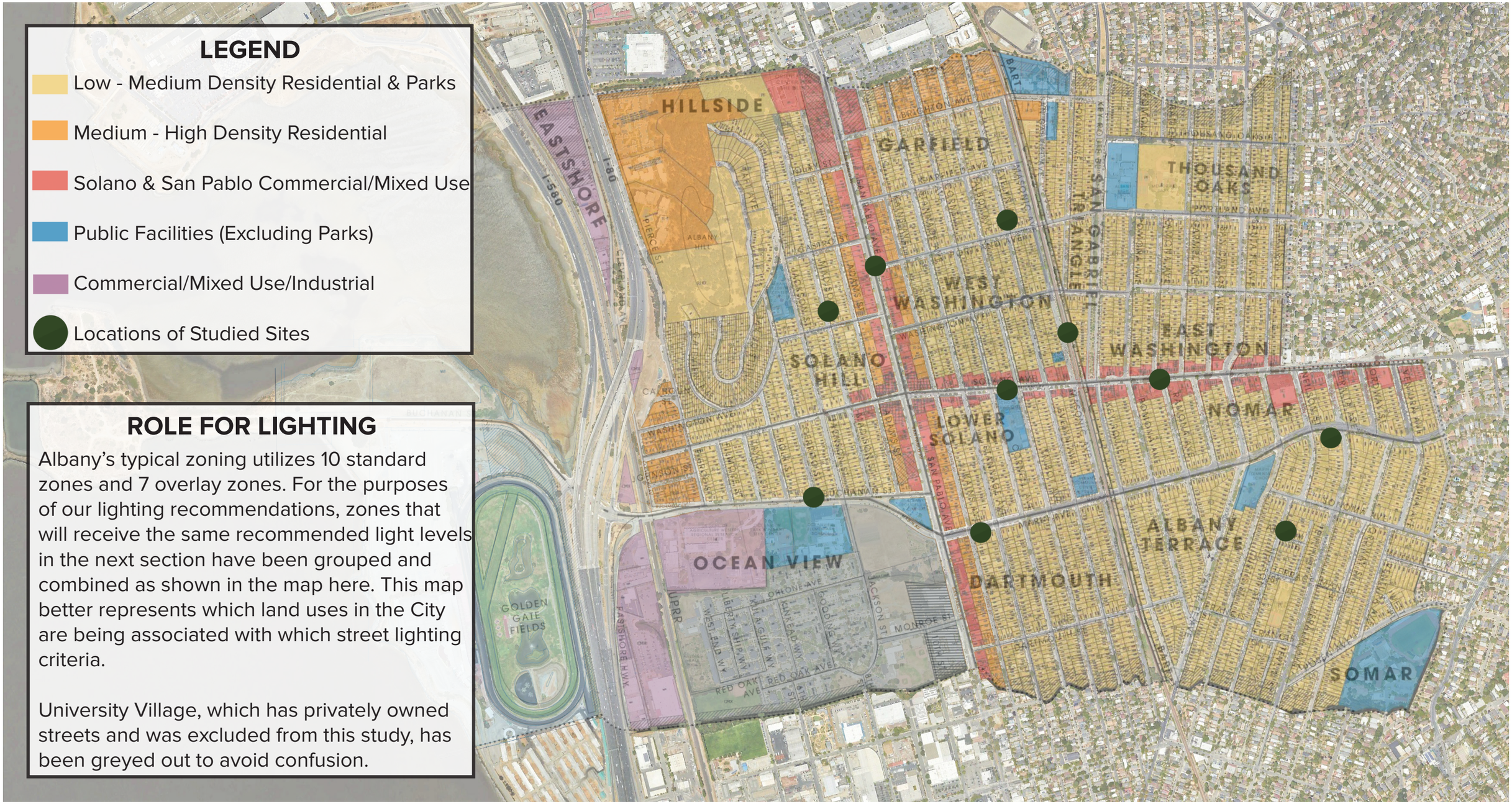
For the purposes of this street lighting evaluation, several of these zones merit the same recommended lighting levels and were grouped on the following page to reduced the number of land use categories needed for the criteria later in this document.

COMMERCIAL AREA

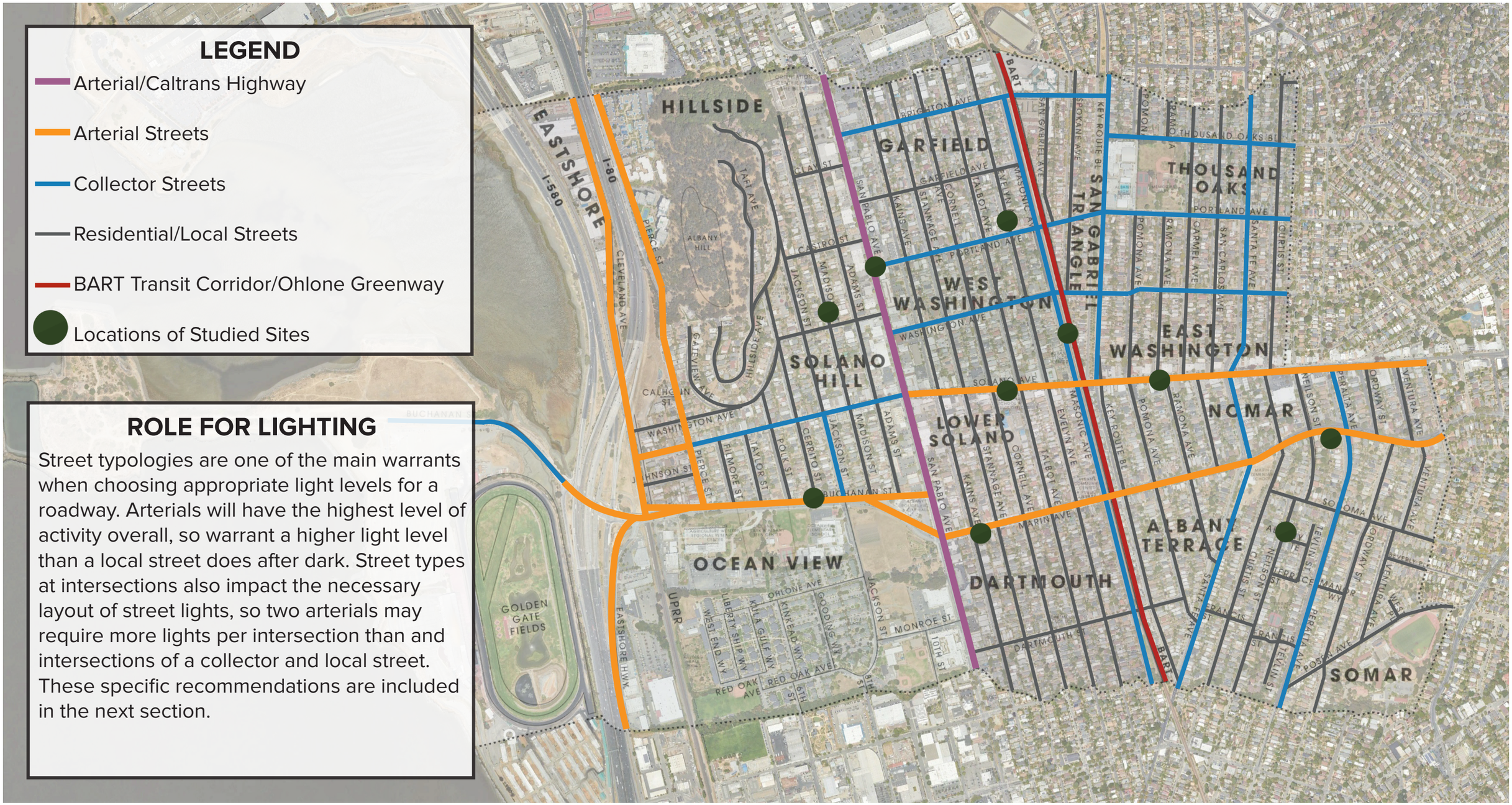
MEDIUM-DENSITY RESIDENTIAL AREA

LOW-DENSITY RESIDENTIAL AREA

SIMPLIFIED LAND USE MAP



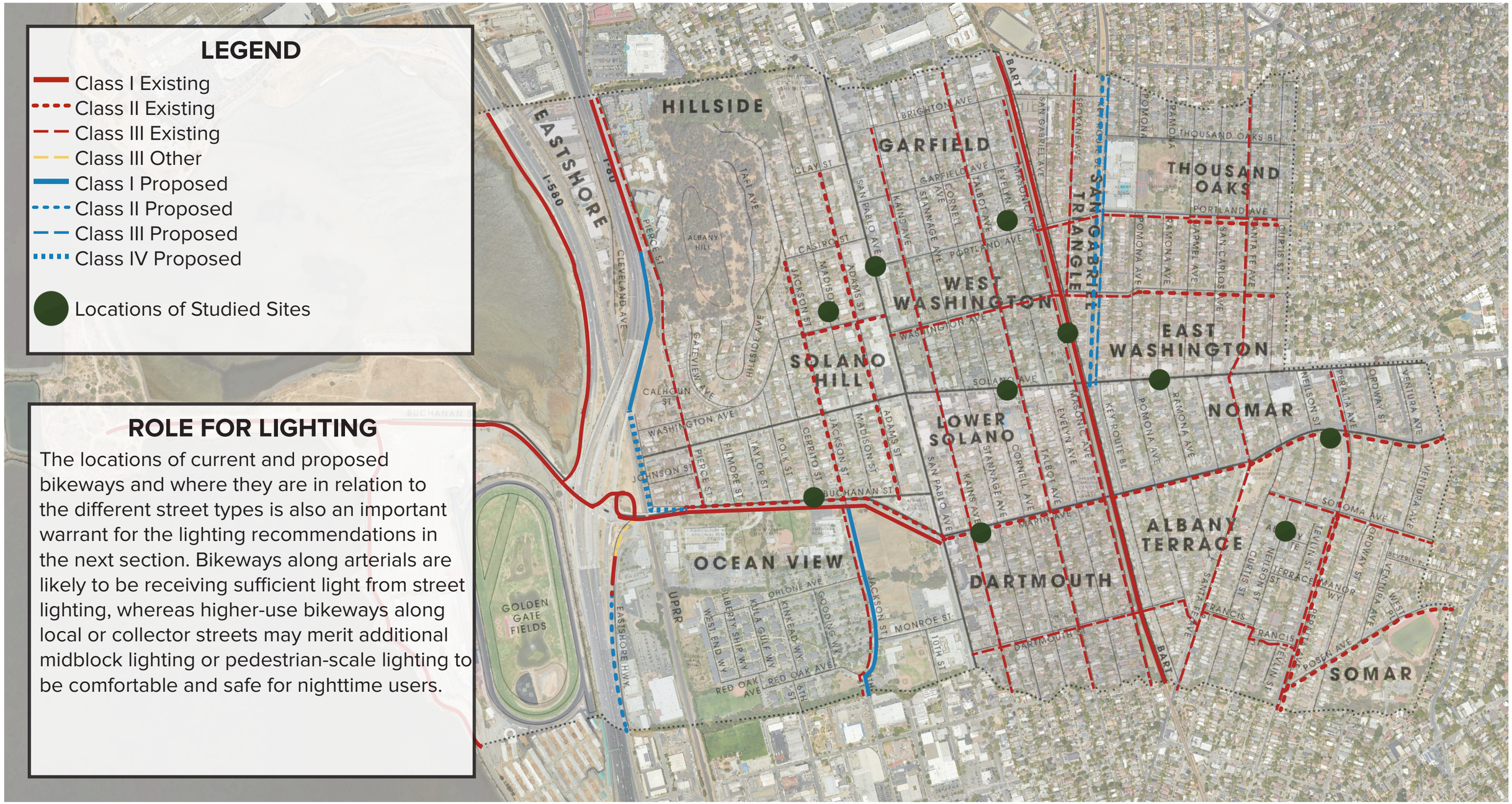
STREET TYPOLOGY MAP



ROLE FOR LIGHTING

Street typologies are one of the main warrants when choosing appropriate light levels for a roadway. Arterials will have the highest level of activity overall, so warrant a higher light level than a local street does after dark. Street types at intersections also impact the necessary layout of street lights, so two arterials may require more lights per intersection than and intersections of a collector and local street. These specific recommendations are included in the next section.

BIKEWAY TYPOLOGY MAP



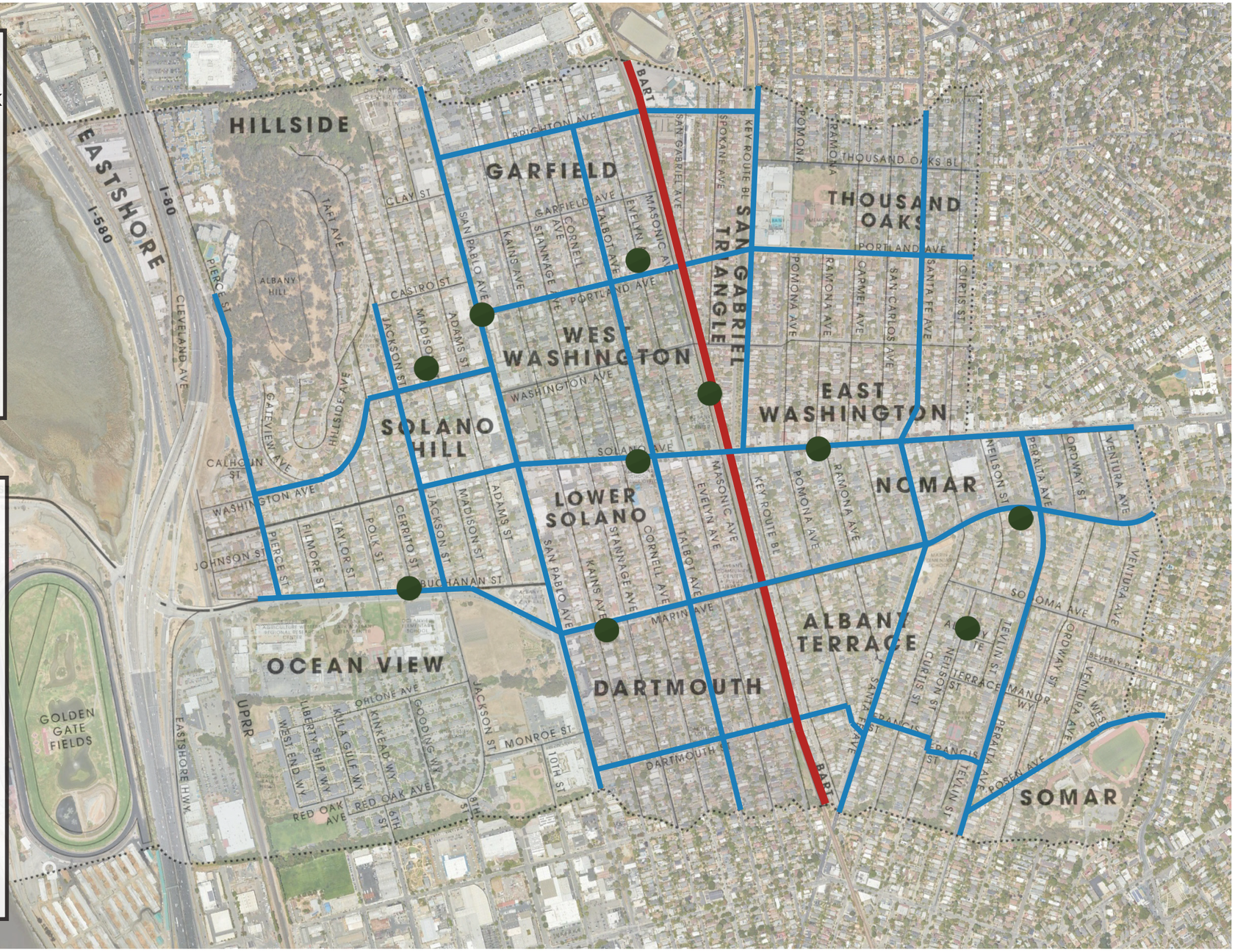
SIDEWALK PRIORITY MAP

LEGEND

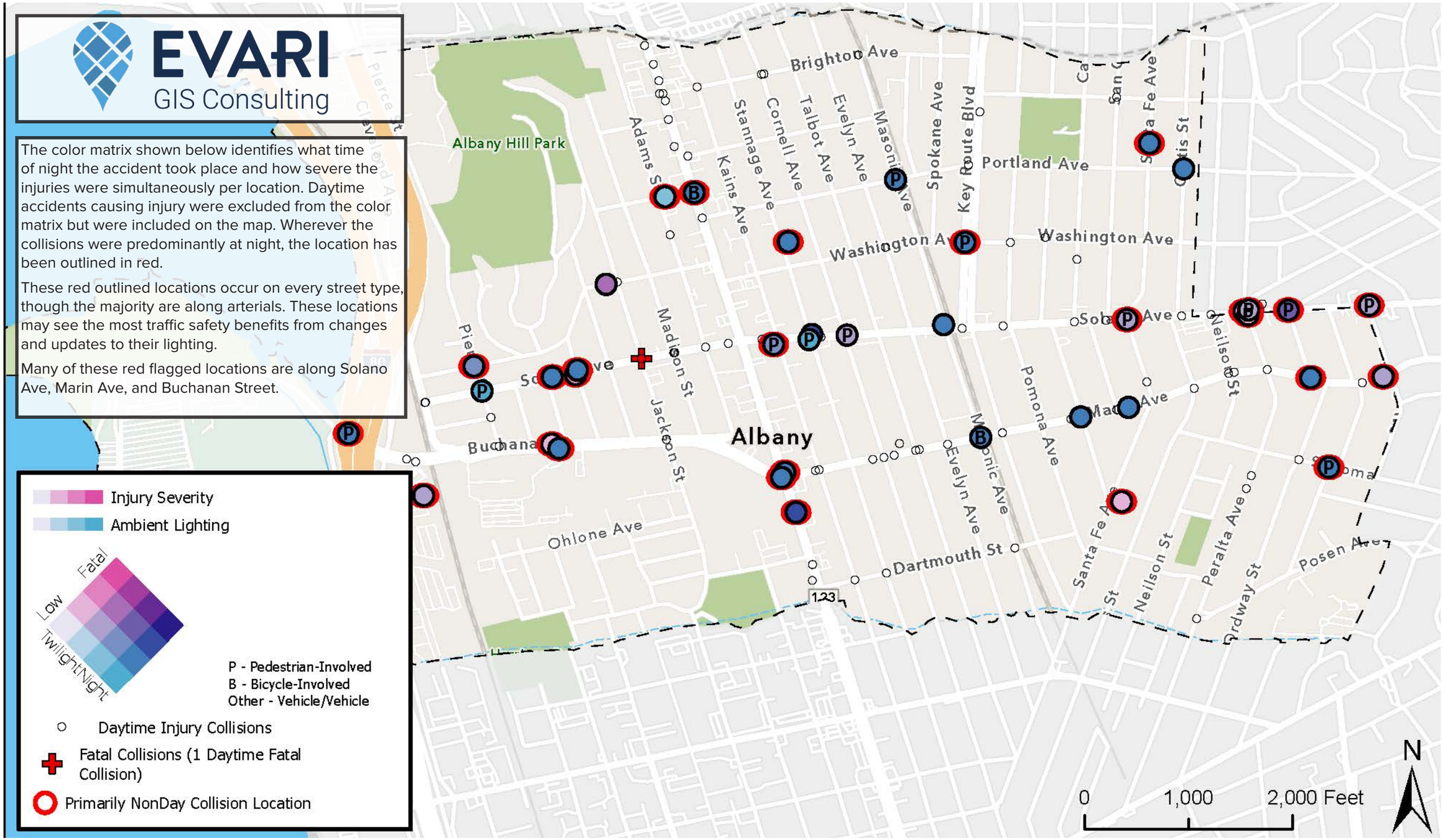
- Active Transportation Plan Priority Sidewalk Network
- BART Transit Corridor/Ohlone Greenway
- Locations of Studied Sites

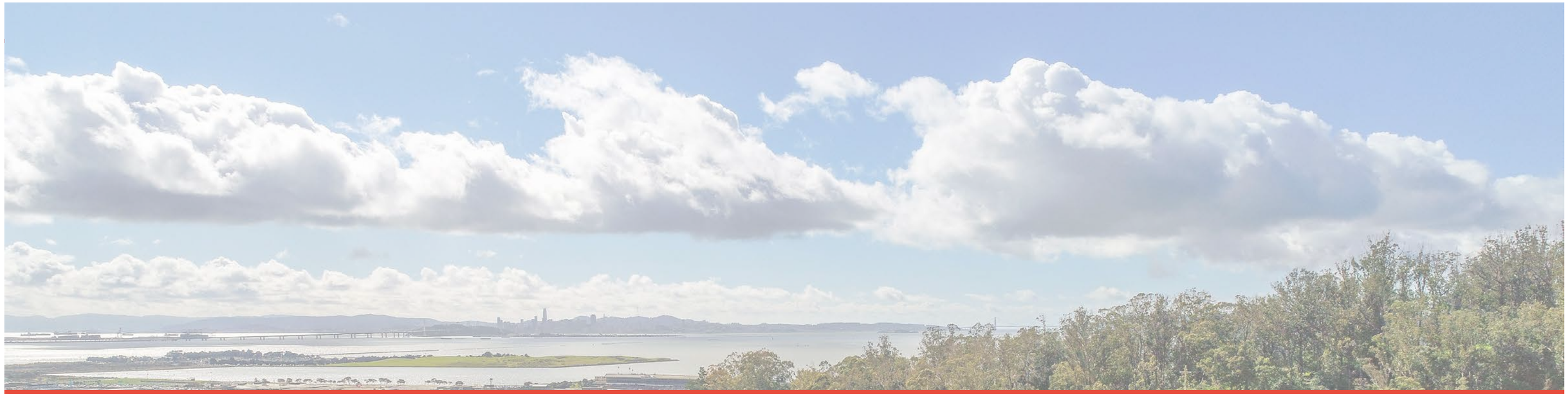
ROLE FOR LIGHTING

Albany's Priority Sidewalk Network is intended to create a safe network of streets for the majority of pedestrians to utilize to get around the City. Similar to the bikeways, many sidewalks in this network are likely to be receiving sufficient light from street lighting, whereas locations along local or collector streets may merit additional midblock lighting or pedestrian-scale lighting to be comfortable and safe for nighttime users. These options are discussed in more detail in the following section.



NON-DAYTIME 5-YEAR COLLISION HISTORY MAP (2017 - 2021)





STREET LIGHTING STRATEGIES

LIGHTING STRATEGIES & FEATURES PER LAND USES

The table below summarizes the lighting strategies and features that are being recommended for the different typical land use zones in Albany and provides an overview for the rest of this section. It uses the grouped zoning shown on page 13 earlier in this document. The lighting characteristics shown are intended to balance the need for appropriate lighting while minimizing the negative and obtrusive effects of light at night. They serve as a basis for the luminaire specifications later in the document.

The following pages in this section will expand upon and apply these strategies to the different street classifications and intersection types throughout Albany - arterial, collector, and local.

Strategy	San Pablo/Solano Commercial (SPC, SC)	Public Facilities PF	Commercial Mixed Use CMX	Residential High Density/ Towers/ Hillside (R-3, R-4, RHD)	Residential Low and Medium Density (R-1, R-2)
Example Lighting Strategy	Continuous Street	Continuous Street & Continuous Ped	Intersection Only Street	Continuous Street Non-Continuous Pedestrian	Intersection-Only Street Non-Continuous Pedestrian
Shielding (Backlight)	B3	B3	B1	B2 (+ Shielding Accessories)	B1 (+ Shielding Accessories)
Shielding (Uplight)	U0 – U2	U0 – U2	U0	U0	U0
Shielding (Glare)	G1 – G2	G1 – G2	G1 – G2	G0 – G1	G0 – G1
Spectrum / Color Temperature	≤2700 K	≤2700 K	≤2700 K	≤2700 K	≤2700 K

ROLE OF LIGHTING CRITERIA

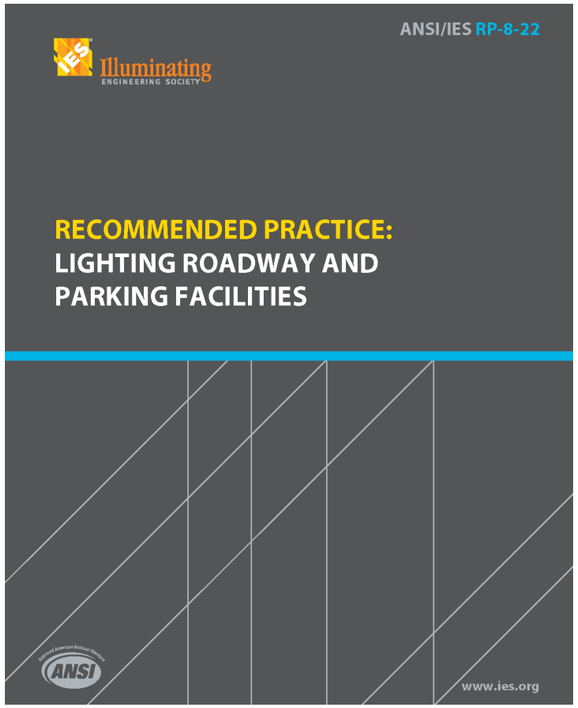
The national best practices for outdoor lighting are guided mainly by criteria developed by the Illuminating Engineering Society (IES) and the Model Lighting Ordinance (MLO), which was developed jointly by the IES and the International Dark Sky Association (IDA) in 2011. These documents provide recommendations for appropriate light levels, uniformity of light, and upper limits for light trespass into other areas.

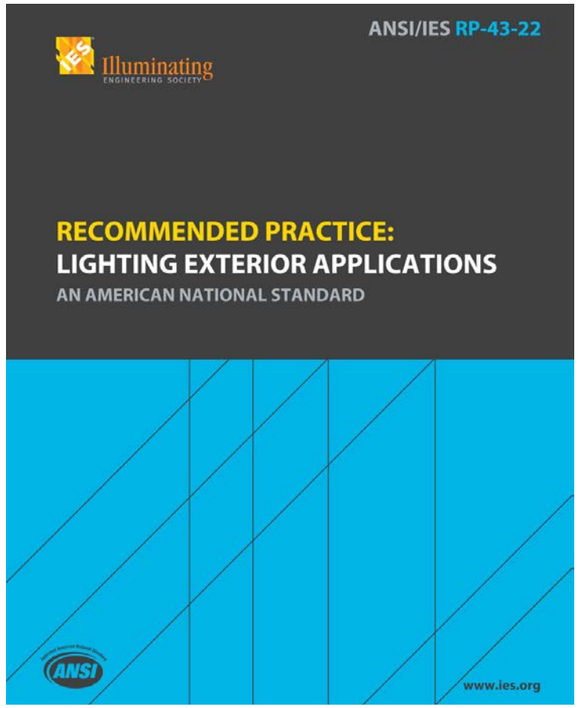
Clanton & Associates has used mainly to two documents to develop these recommendations for Albany. While these documents are used mainly by lighting designers and engineers, they are available for anyone to purchase as a reference. These documents are:

- IES/ANSI Recommended Practice 8 2022 - Lighting Roadway & Parking Facilities
- IES/ANSI Recommended Practice 43 2022 - Lighting Exterior Applications

ANSI/IES-RP-8 provides the critical information for safe street lighting such as which light levels are safe and appropriate for different street classifications like arterials, collectors, and local streets.

It is very difficult for an entire City to meet lighting criteria exactly as written. Lighting that is within 10% of meeting criteria in either direction is typically accepted, but it is not uncommon for communities to prefer light levels up to 30% lower than criteria when surveyed. These preferences may be driven by demographics, interest in dark skies, or the nighttime activity level the community is accustomed to.





PEDESTRIAN ACTIVITY LEVELS

Land uses and street typologies are useful for determining the likely activity levels in an area, but activity levels after dark often do not strictly follow zoning or street types. While several areas may all be residential, if their densities are different they may have very different levels of activity on their streets after dark. High-density urban housing will have more activity due to the greater amount of people present, even when their is no mixed use component, when compared to a low density residential neighborhood.

ANSI/IES-RP-8 defines pedestrian activity levels in three categories:

- Low - 10 or fewer pedestrians per hour
- Medium - 10 to 100 pedestrians an hour
- High - over 100 pedestrians an hour

This metric may need to be altered for a smaller city, but is important for examining the expectations of residents about activity in their neighborhood, and the activity level a city wishes to promote in an area. For neighborhoods that have and desire very low activity levels at night, an increase in mid-block lighting may be an unwelcome change. However, an example of where there may be a reason to support or anticipate higher activity levels in a low density area with only local streets would be near a school or other facility that needs to accommodate events at night.

POORLY LIT CROSSWALK

STREET LIGHTING LAYOUTS

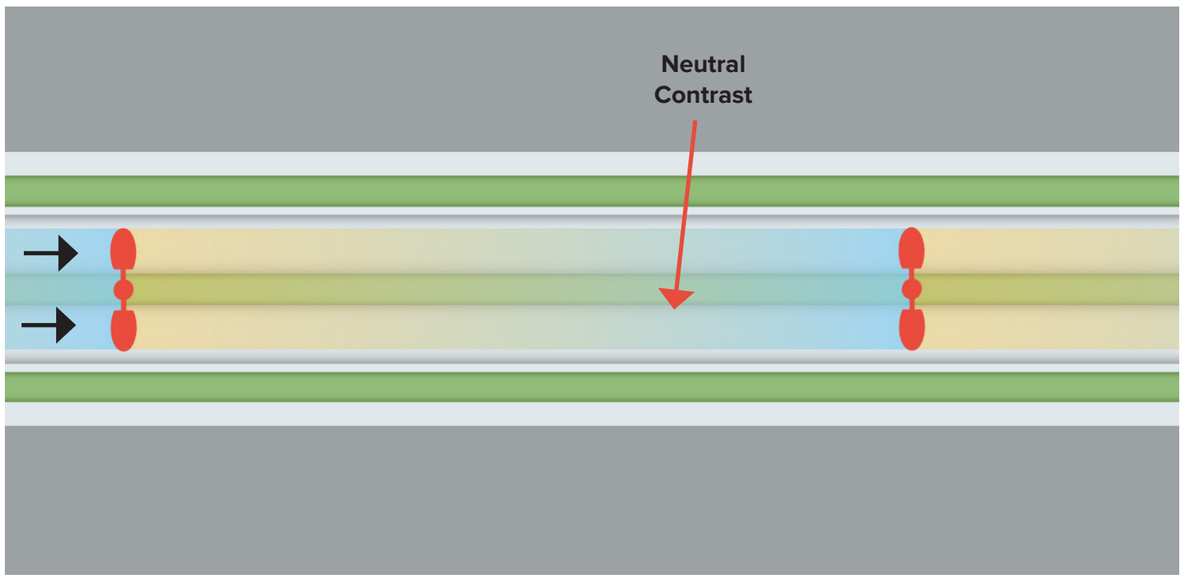
In addition to nearby land uses and lighting criteria, warrants such as usage rates help determine if continuous or non-continuous lighting is the more appropriate spacing to use for a street.

- Continuous Lighting: An outdoor lighting system made up of regularly spaced luminaires along a street. IES criteria typically defines the minimum and maximum illuminance or luminance values and the overall uniformity needed along a continuously lighted area.
- Non-Continuous Lighting: A non-continuous outdoor lighting system typically lights all conflict areas such as intersections, crosswalks, ingress/egress ramps, and other navigational hazards. Lights are spaced so they are in view from light to light, but uniformity is not a priority with this strategy.

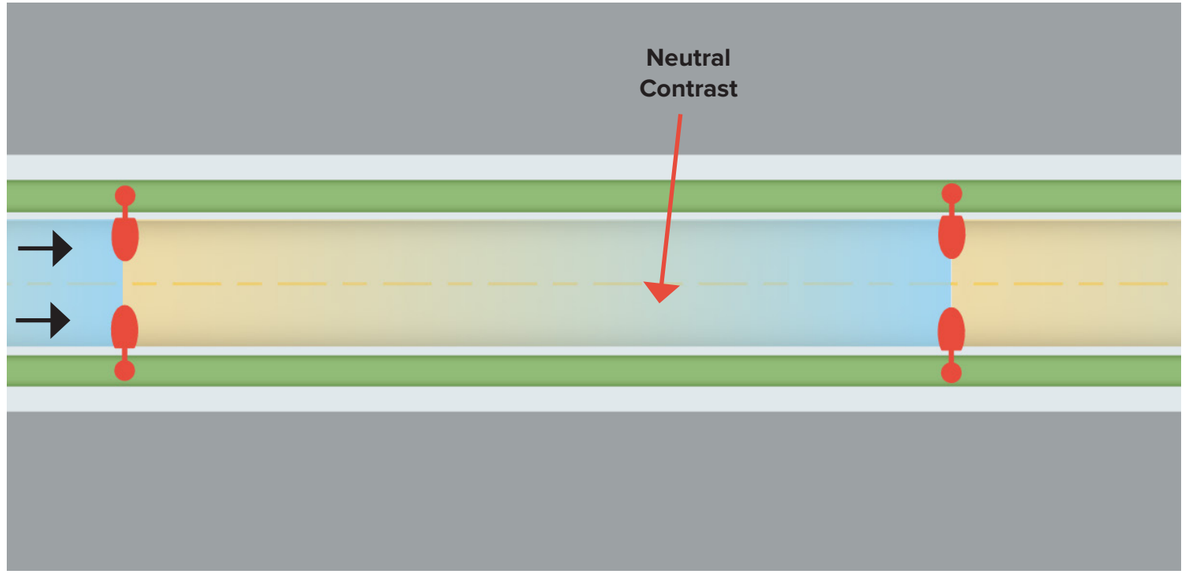
There are also several typical patterns for locating the street lighting. Which option is the most appropriate depends on the characteristics of the site, the street typology, and street widths. These are:

- Opposite Street Lighting: Layout of street lighting where luminaires are arranged directly across the street from each other.
- Median Street Lighting: Layout of street lighting where luminaires are placed in the median of a roadway instead of to either side.
- Single-Sided Street Lighting: Layout of street lighting where luminaires are placed along one side of a narrow street.

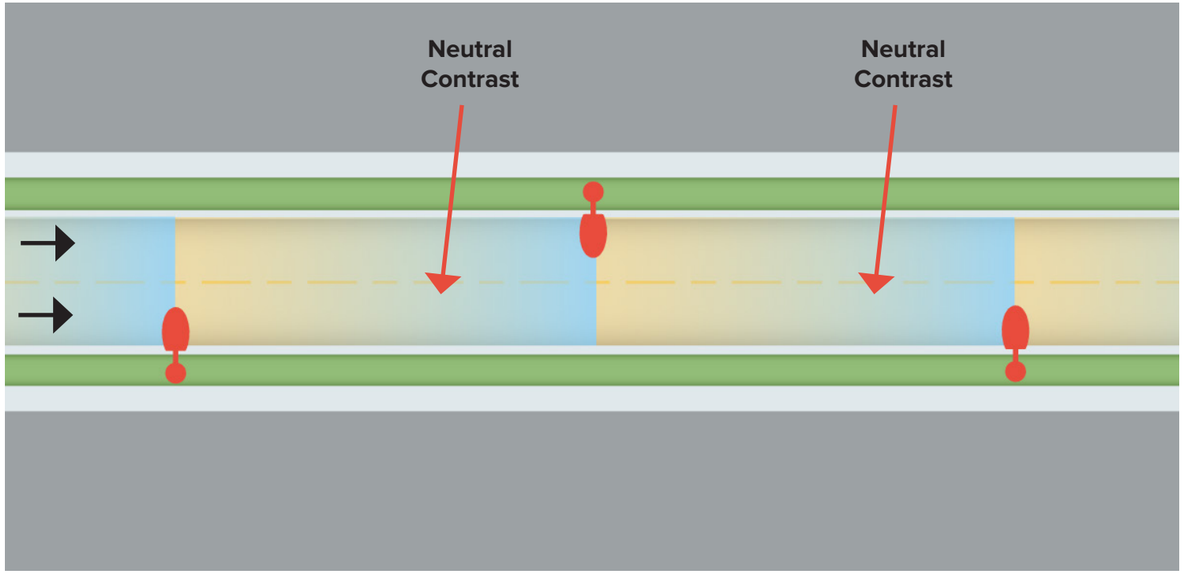
These patterns help minimize the occurrence of neutral contrast, where objects in the street are lit similarly from all sides and become more difficult to see. Layouts where the lighting is staggered from side to side of a street increase the amount of neutral contrast and are thus not recommended for use.



MEDIAN STREET LIGHTING



OPPOSITE STREET LIGHTING



STAGGERED STREET LIGHTING - NOT RECOMMENDED

STREET LIGHTING LAYOUTS FOR ARTERIALS

Several arterial streets traverse Albany. These routes primarily serve through traffic and secondarily provide access to abutting property. Traffic on these streets is likely to be moving at higher speeds and later into the nighttime hours than other street classifications. When continuous lighting is warranted, the design must meet the lighting criteria set forth by IES RP-8-22.

The table below details the appropriate lighting strategy for each land use an arterial street may be adjacent to in Albany.

MARIN AVENUE - ARTERIAL

Arterial								
Adjacent Land Use	**Zone Designations**	**Lighting Layout Option**	**Layout Type**	**Maximum CCT**	**Street Light Type**	**Spacing Range (ft)**	**Lumen Output Range (lumens)**	**Mounting Height (ft)**
Solano and San Pablo Commercial and Public Facilities	SC, SPC, PF	Street Lighting	Continuous***	2700K	S1	150-180	10,000-14,000	30
		Pedestrian Lighting	Continuous***	2700K	P1	30-60	2,500-3,500	12-15
		Street Lighting & Pedestrian Lighting**	Continuous***	2700K	S1 & P1	120-180	10,000-14,000 2,500-3,500	30 12-15
Commercial Mixed Use	CMX	Street Lighting	Non-Continuous	2700K	S2	N/A	8,000-12,000	30
		Street Lighting	Intersections Only	2700K	S2	N/A	8,000-12,000	30
Residential - Medium and High Density, Towers and Hillside	R-2, R-3, R-4, RHD	Street Lighting	Continuous***	2700K	S1	150-180	10,000-14,000	30
		Pedestrian Lighting	Continuous***	2700K	P1	30-60	2,500-3,500	12-15
		Street Lighting & Pedestrian Lighting**	Continuous***	2700K	S1 & P1	120-180	10,000-14,000 2,500-3,500	30 12-15
Residential - Low and Medium Density	R-1, R-2	Pedestrian Lighting	Continuous*	2700K	P1	30-60	2,500-3,500	12-15
		Street Lighting	Non-Continuous	2700K	S2	300-400	8,000-12,000	30
		Pedestrian Lighting	Non-Continuous	2700K	P1	90-150	2,500-3,500	12-15

* Only with Driveways facing the Arterial or bike lanes when posted speeds are > 30 mph
**Spacing is for alternating Pedestrian and Street lights
***Continuously lit Arterial roadway spacings are based on lights arranged opposite each other on both sides of the roadway

STREET LIGHTING LAYOUTS FOR COLLECTORS

There are collector streets throughout Albany. These routes serve residential and commercial areas. They also make connections to schools in the City. Traffic on these streets is likely to vary throughout the day. When continuous lighting is warranted, the design must meet the lighting criteria set forth by IES RP-8-22.

The table below details the appropriate lighting strategy for each land use a collector street may be adjacent to in Albany.

MASONIC AVENUE - COLLECTOR

Collector								
Adjacent Land Use	**Zone Designations**	**Lighting Layout Option**	**Layout Type**	**Maximum CCT**	**Street Light Type**	**Spacing Range (ft)**	**Lumen Output Range (lumens)**	**Mounting Height (ft)**
Public Facilities	PF	Street Lighting	Continuous**	2700K	S2	180-230	8,000-12,000	30
		Pedestrian Lighting	Continuous***	2700K	P1	30-60	4,000-6,000	12-15
		Street & Pedestrian Lighting*	Continuous**	2700K	S1 & P1	80-120	8,000-12,000 4,000-6,000	30 12-15
Commercial Mixed Use	CMX	Street Lighting	Non-Continuous	2700K	S3	300-400	6,000-10,000	30
		Street Lighting	Intersections Only	2700K	SG3	N/A	6,000-10,000	30
Residential - Medium and High Density, Towers and Hillside	R-2, R-3, R-4, RHD	Street Lighting	Continuous**	2700K	S2	180-230	8,000-12,000	30
		Pedestrian Lighting	Continuous***	2700K	P2	30-60	4,000-6,000	12-15
Residential - Low and Medium Density	R-1, R-2	Street Lighting	Non-Continuous	2700K	S3	150-240	6,000-10,000	30
		Street Lighting	Intersections Only	2700K	SG3	N/A	6,000-10,000	30
		Pedestrian Lighting	Non-Continuous	2700K	P2	90-150	4,000-6,000	12-15
Residential adjacent to the Greenway	R-1, R-2, R-3	Pedestrian Lighting	Continuous***	2700K	P2	60-90	3,000-5,000	12-15

* Spacing is for alternating Pedestrian and Street lights
**Continuously lit Collector roadway spacings with streetlights are based on poles located on a single side of the roadway
***Continuously lit Collector roadway spacings with pedestrian lights are based on poles arranged opposite each other on both sides of the roadway

STREET LIGHTING LAYOUTS FOR LOCAL ROADS

There are local streets throughout Albany which tend to be quite narrow. These routes serve residential neighborhoods. Traffic on these streets is slower with less activity at night. When continuous lighting is warranted, the design must meet the lighting criteria set forth by IES RP-8-22.

The table below details the appropriate lighting strategy for each land use a local street may be adjacent to in Albany.

NEILSON STREET - LOCAL

Local								
Adjacent Land Use	**Zone Designations**	**Lighting Layout Option**	**Layout Type**	**Maximum CCT**	**Street Light Type**	**Spacing Range**	**Lumen Output Range**	**Mounting Height**
Public Facilities	PF	Street Lighting	Continuous**	2700K	S3	170-200	6,000-10,000	25
		Pedestrian Lighting	Continuous***	2700K	P2	60-90	3,000-5,000	12-15
		Street Lighting & Pedestrian Lighting*	Continuous**	2700K	S3 & P2	80-120	6,000-10,000 3,000-5,000	25 12-15
Commercial Mixed Use	CMX	Street Lighting	Non-Continuous	2700K	S3	300-400	6,000-10,000	25
		Street Lighting	Intersections Only	2700K	SG3	N/A	6,000-10,000	30
Residential - Medium and High Density, Towers and Hillside	R-2, R-3, R-4, RHD	Street Lighting	Non-Continuous	2700K	S4	300-400	4,000-8,000	25
		Street Lighting	Intersections Only	2700K	SG3	N/A	6,000-10,000	30
		Pedestrian Lighting	Continuous***	2700K	P2	60-90	3,000-5,000	12-15
Residential - Low and Medium Density	R-1, R-2	Pedestrian Lighting	Non-Continuous	2700K	P2	120-200	3,000-5,000	12-15
		Street Lighting	Non-Continuous	2700K	S4	300-400	4,000-8,000	25
		Street Lighting	Intersections Only	2700K	SG3	N/A	6,000-10,000	30

* Spacing is for alternating Pedestrian and Street lights
**Continuously lit Local roadway spacings with streetlights are based on poles located on a single side of the roadway
***Continuously lit Local roadway spacings with pedestrian lights are based on poles arranged opposite each other on both sides of the roadway

INTERSECTION TYPOLOGIES

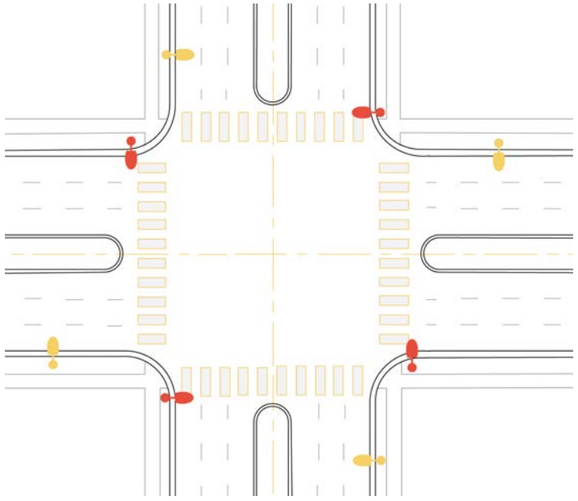
The number and placement of luminaires at an intersection depends on the street typologies intersecting, locations of crosswalks, and whether the intersection is signalized or not. Signalized intersections will generally have a streetlight on the traffic signal pole, with additional lighting nearby as needed.

Crosswalk lighting is typically provided by either nearby streetlights or pedestrian-scale lights. The lighting should be installed either 1/2 of the pole height or equal to the pole height of the luminaire in front of the crosswalk to ensure adequate light is falling on anyone or anything in the path of an oncoming driver.

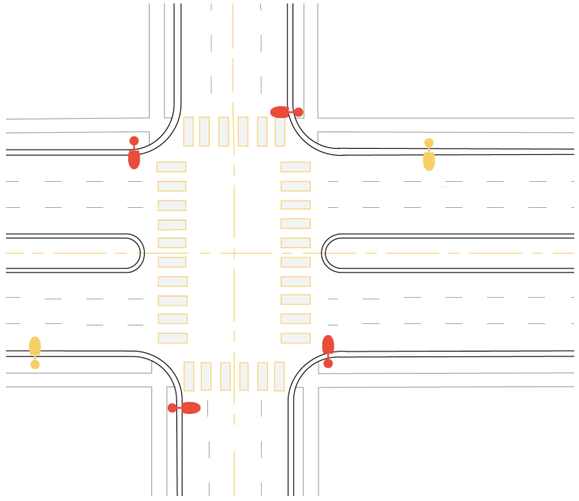
Currently many intersections in Albany are lit by a single luminaire. While one luminaire may provide enough horizontal illuminance at some smaller intersections, providing adequate vertical illuminance to improve visibility of pedestrians and cyclists at four-way intersections requires two or more luminaires.

It is recommended that four-way intersections along streets with bikeways and priority sidewalks be prioritized for lighting improvements according to the typical intersection lighting layouts and criteria shown in this section. Lighting criteria for each of these intersection types are shown on the following two pages.

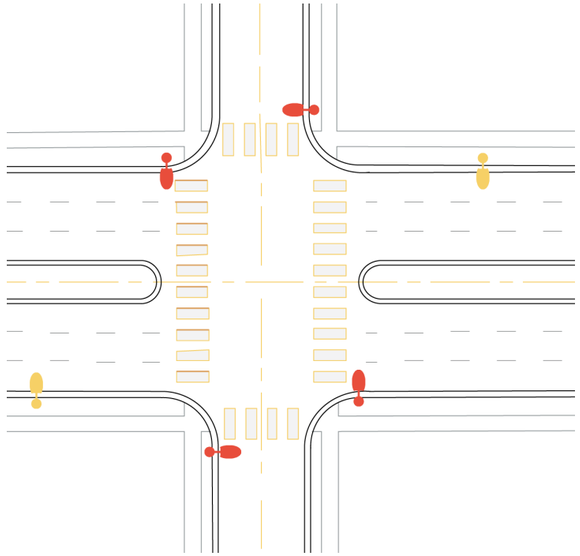
- Streetlight mounted on a traffic signal
- Typical streetlight
- Typical pedestrian light



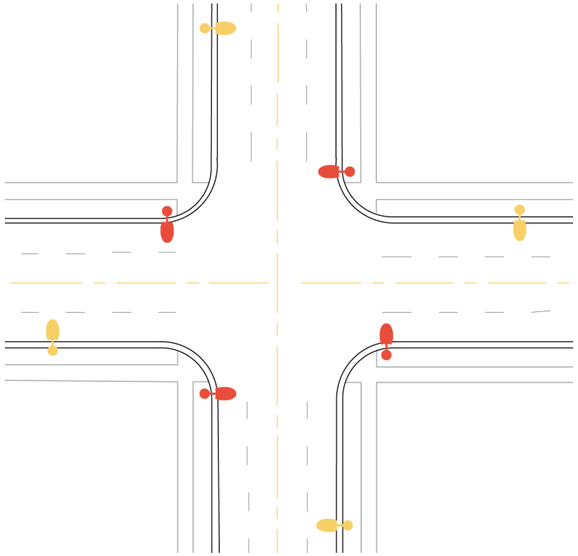
ARTERIAL/ARTERIAL



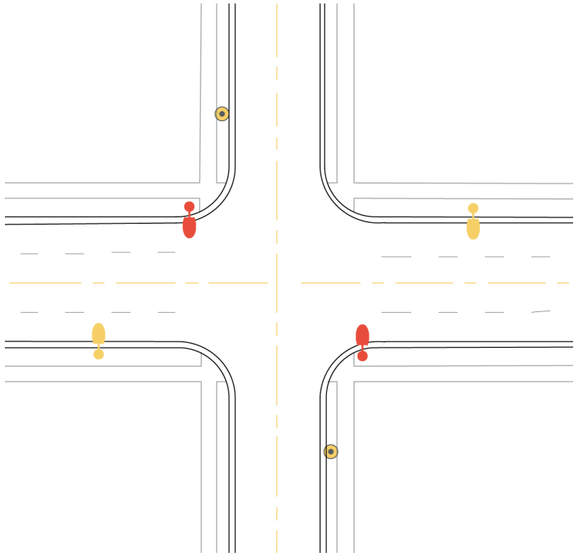
ARTERIAL/COLLECTOR



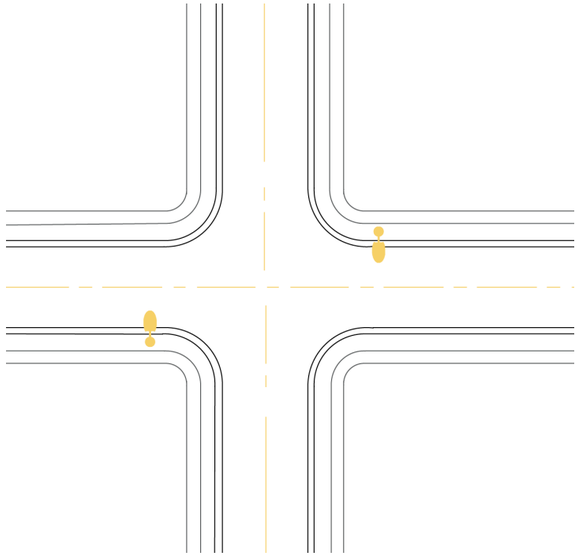
ARTERIAL/LOCAL



COLLECTOR/COLLECTOR



COLLECTOR/LOCAL



LOCAL/LOCAL

INTERSECTION CRITERIA FOR ARTERIALS

The tables shown on this page provide guidance on street lighting for any arterial Intersection in Albany. Each type of intersection and its adjacent land use is given a minimum and preferred number of street lights to be provided. Each intersection is also given a luminaire typology code. These are expanded upon in the luminaire schedule on page 31.

Lighting at intersections should include multiple luminaires to provide appropriate coverage for the whole intersection. Larger intersections with higher pedestrian usage should have one street light at each corner of the intersection in order to provide full coverage. This is recommended for the majority of intersections involving arterial streets. The placement of lighting at these intersections should consider the vertical illuminance needed at crosswalks to provide adequate illumination of pedestrians crossing the street.

Arterial/Arterial

Adjacent Land Use	Zone Designations	Quantity of Intersection Lights	Maximum CCT	Intersection Light Type
Solano and San Pablo Commercial and Public Facilities	SC, SPC, PF	Three (3)* to four (4) at each corner	2700K	SG1
Commercial Mixed Use	CMX	Three (3)* to four (4) at each corner	2700K	SG1
Residential - Medium and High Density, Towers and Hillside	R-2, R-3, R-4, RHD	Three (3)* to four (4) at each corner	2700K	SG1
Residential - Low and Medium Density	R-1, R-2	Three (3)* to four (4) at each corner	2700K	SG1

* Four lights are preferred. Three are acceptable when it is not possible to locate a fourth light due to conflict with overhead lines, trees, or at T-intersections.

Arterial/Collector

Adjacent Land Use	Zone Designations	Quantity of Intersection Lights	Maximum CCT	Intersection Light Type
Solano and San Pablo Commercial and Public Facilities	SC, SPC, PF	Three (3)* to four (4) at each corner	2700K	SG1
Commercial Mixed Use	CMX	Three (3)* to four (4) at each corner	2700K	SG1
Residential - Medium and High Density, Towers and Hillside	R-2, R-3, R-4, RHD	Three (3)* to four (4) at each corner	2700K	SG1
Residential - Low and Medium Density	R-1, R-2	Three (3)* to four (4) at each corner	2700K	SG1

* Four lights are preferred. Three are acceptable when it is not possible to locate a fourth light due to conflict with overhead lines, trees, or at T-intersections.

Arterial/Local

Adjacent Land Use	Zone Designations	Quantity of Intersection Lights	Maximum CCT	Intersection Light Type
Solano and San Pablo Commercial and Public Facilities	SC, SPC, PF	Three (3)* to four (4) at each corner	2700K	SG1
Commercial Mixed Use	CMX	Two (2) to three (3) located at the major crossings	2700K	SG2
Residential - Medium and High Density, Towers and Hillside	R-2, R-3, R-4, RHD	Three (3)* to four (4) at each corner	2700K	SG1
Residential - Low and Medium Density	R-1, R-2	Two (2) to three (3) located at the major crossings	2700K	SG2

* Four lights are preferred. Three are acceptable when it is not possible to locate a fourth light due to conflict with overhead lines, trees, or at T-intersections.

INTERSECTION CRITERIA FOR COLLECTOR & LOCAL

The tables shown on this page provide guidance on street lighting for any collector or local Intersection in Albany. Each type of intersection and its adjacent land use is given a minimum and preferred number of street lights to be provided. Each intersection is also given a luminaire typology code. These are expanded upon in the luminaire schedule on page 31.

Lighting at intersections should include multiple luminaires to provide appropriate coverage for the whole intersection. One luminaire is only sometimes sufficient for smaller, local/local intersections. Larger intersections with higher pedestrian usage should have one street light at each corner of the intersection in order to provide full coverage. The placement of lighting at these intersections should consider the vertical illuminance needed at crosswalks to provide adequate illumination of pedestrians crossing the street.

Collector/Collector

Adjacent Land Use	Zone Designations	Quantity of Intersection Lights	Maximum CCT	Intersection Light Type
Public Facilities	PF	Three (3)* to four (4) at each corner	2700K	SG1
Commercial Mixed Use	CMX	Two (2) to three (3) located at the major crossings	2700K	SG2
Residential - Medium and High Density, Towers and Hillside	R-2, R-3, R-4, RHD	Three (3)* to four (4) at each corner	2700K	SG1
Residential - Low and Medium Density	R-1, R-2	Two (2) to three (3) located at the major crossings	2700K	SG2
Residential adjacent to the Greenway	R-1, R-2, R-3	Two (2) to three (3) located at the major crossings	2700K	SG2, SG3

* Four lights are preferred. Three are acceptable when it is not possible to locate a fourth light due to conflict with overhead lines, trees, or at T-intersections.

Collector/Local

Adjacent Land Use	Zone Designations	Quantity of Intersection Lights	Maximum CCT	Intersection Light Type
Public Facilities	PF	Two (2) to three (3) located at the major crossings	2700K	SG2
Commercial Mixed Use	CMX	Two (2) to three (3) located at the major crossings	2700K	SG2, SG3
Residential - Medium and High Density, Towers and Hillside	R-2, R-3, R-4, RHD	Two (2) to three (3) located at the major crossings	2700K	SG2
Residential - Low and Medium Density	R-1, R-2	Two (2) to three (3) located at the major crossings	2700K	SG2, SG3

Local/Local

Adjacent Land Use	Zone Designations	Quantity of Intersection Lights	Maximum CCT	Intersection Light Type
Solano and San Pablo Commercial and Public Facilities	SC, SPC, PF	Two (2) to three (3) located at the major crossings	2700K	SG2, SG3
Commercial Mixed Use	CMX	One (1) or Two (2) located on opposite corners	2700K	SG3
Residential - Medium and High Density, Towers and Hillside	R-2, R-3, R-4, RHD	Two (2) to three (3) located at the major crossings	2700K	SG2, SG3
Residential - Low and Medium Density	R-1, R-2	One (1) or Two (2) located on opposite corners	2700K	SG3

LIGHTING CLASS 1 BIKEWAYS

Class I Bikeways provide increased opportunities for commuting by bicycle, allowing higher speeds and providing less potential conflicts along routes than other bike path types. When located in a park or greenway setting there is potential for conflict with pedestrians. With this in mind, continuous lighting is recommended along Class I Bikeways within the City of Albany.

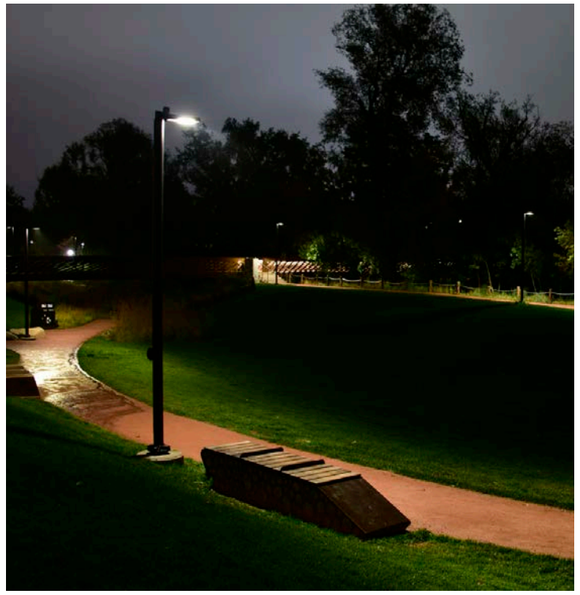
Along the Ohlone Greenway, existing lighting on the elevated BART structure already provides a continuous level of lighting along the majority of the bikeway. Other Class I Bikeways in Albany may be receiving some contribution of light from the adjacent street lighting. Where the adjacent existing lighting does not adeqautely meet the Walkway and Bikeway Lighting Criteria, this study recommends providing additional pedestrian scale lighting to meet this criteria.

The table below details the appropriate lighting strategy for Class I Bikeways, based on trail use rates.

Class I Bikeways							
Pedestrian & Cyclist Activity	**Lighting Layout Option**	**Layout Type**	**Maximum CCT**	**Street Light Type**	**Spacing Range**	**Lumen Output Range**	**Mounting Height**
Medium	Pedestrian Lighting	Continuous	2700K	P1	60-90	2,500 - 3,500	12-15
Low	Pedestrian Lighting	Continuous	2700K	P2	80-120	1,500 - 2,500	12-15

OHLONE GREENWAY BIKE PATH

EXAMPLE OF BIKEWAY LIGHTING



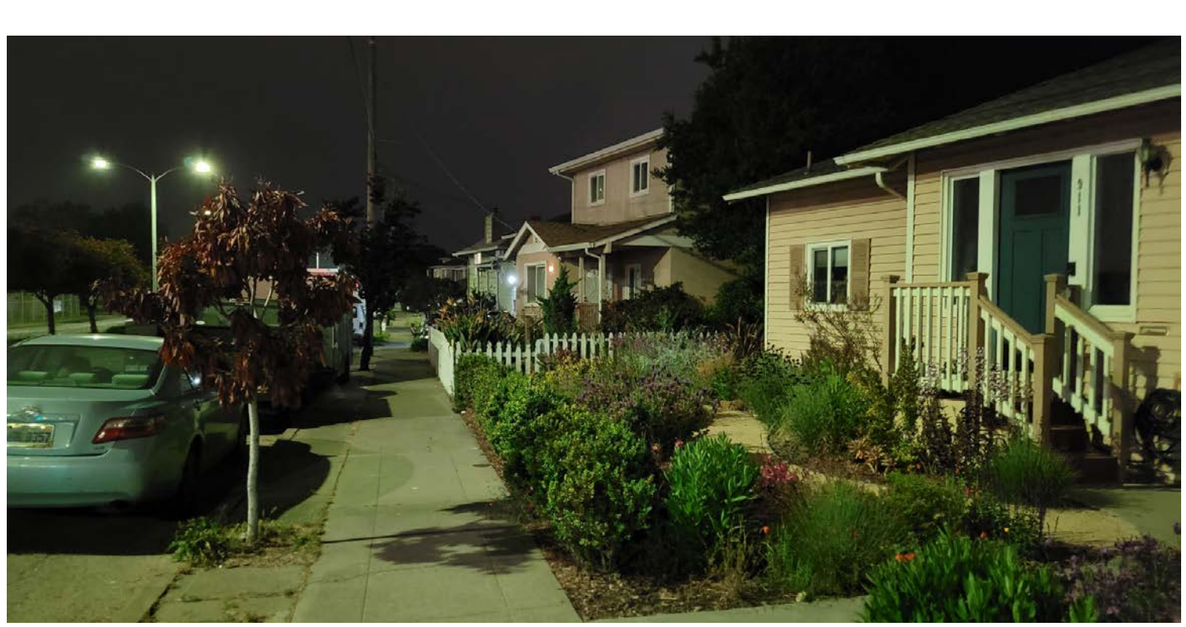
EXAMPLE OF TRAIL LIGHTING

CITYWIDE CRITERIA

These tables shown on this page provide light level criteria for streets, walkways & bikeways, and intersections.

Street lighting criteria is expressed in luminance (L), which is measured through candela per square meter (cd/m2). This represents the brightness of light reflected off of the roadway's surface. Luminance calculations must account for different street pavement reflectance properties of concrete or asphalt and their ages. Albany's typical street surface has been accounted for in these charts.

Walkways, bikeways and intersection lighting criteria is expressed in illuminance (E), which is measured through lumens per square foot using footcandles (fc), which represents light falling onto the surface and does not require any surface reflectance properties to calculate.



BUCHANAN STREET - LIGHT TRESPASS

Street Lighting Criteria

Street Classification	Pedestrian Activity	Avg Luminance Lavg (cd/m²)	Avg Uniformity L Avg/Min	Max Uniformity L Max/Min
Arterial	Med	0.9	3.0	5.0
Arterial	Low	0.6	3.5	6.0
Collector	Med	0.6	3.5	6.0
Collector	Low	0.4	4.0	8.0
Local	Med	0.5	6.0	10.0
Local	Low	0.3	6.0	10.0

Walkway & Bikeway Lighting Criteria

Pedestrian Activity	Avg Illuminance (Horiz) Eavg (fc)	Avg Illuminance (Vert) Eavg (fc)	Avg Uniformity Eavg/ Emin
Medium	0.5	0.2	5.0
Low	0.2	0.1	10.0

Intersection Lighting		Pedestrian Activity				
Street Classification 1	Street Classification 2	Avg Illuminance (Horiz) Eavg (fc)		Avg Illuminance (Vert) Eavg (fc)		Avg Uniformity Eavg/Emin
		Medium	Low	Medium	Low	
Arterial	Arterial	2.4	1.7	1.7	1.2	3.0
Arterial	Collector	2.0	1.4	1.4	1.0	3.0
Arterial	Local	1.9	1.2	1.3	0.8	3.0
Collector	Collector	1.7	1.1	1.2	0.8	4.0
Collector	Local	1.5	0.9	1.1	0.6	4.0
Local	Local	1.3	0.7	1.4	0.5	6.0

LUMINAIRE SPACING COMPLIANCE MAP

EVARI
GIS Consulting

Using the lighting criteria that was developed in this section, this map shows where the spacing of the current luminaires is in compliance, close to compliance, or out of compliance with the spacing being recommended.

The areas showing spacing that is significantly closer than the recommended criteria are mainly criteria. This suggests that as luminaires are updated, fewer luminaires may be needed to light these streets or a lower wattage many

be needed to avoid overlighting.

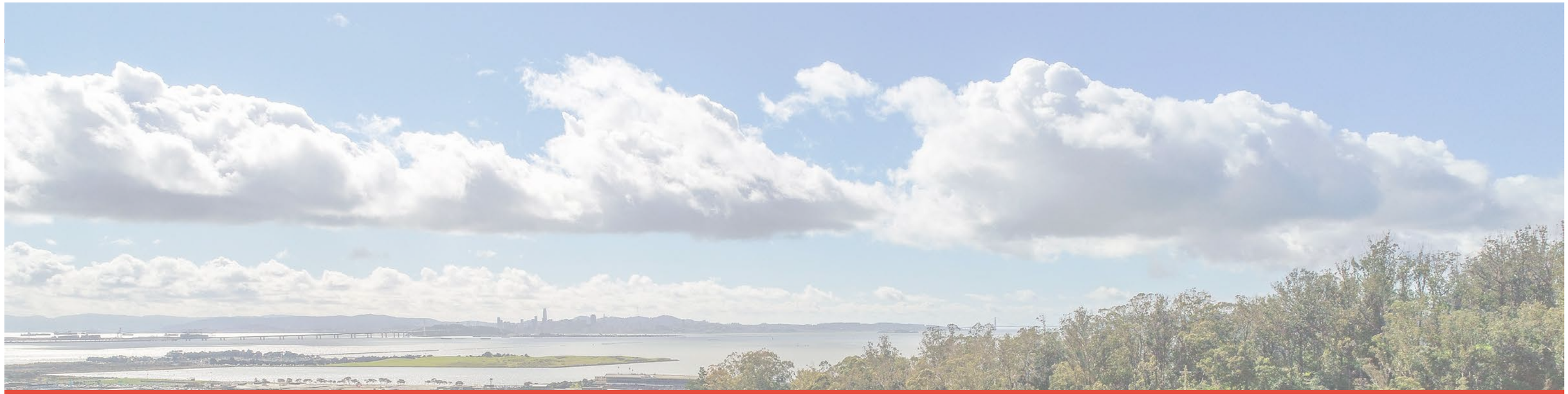
More of Albany overall is shown by this map to have luminaires spaced too far apart than too closely, but many of these are on local street where continuous or even non-continuous lighting spacings may not be desired.

The streets showing many changes in their spacing category merit additional attention to if their spacing could be improved or if it is the result of existing obstructions that can't be changed.

Albany Streetlight Pole Spacing Ranges
- **Spacing 20%-100% Less Than Expected Range**
- **Spacing Up to 20% Less Than Expected Range**
- **Within Spacing Range**
- **Spacing Up to 20% More Than Expected Range**
- **Spacing 20%-100% More Than Expected Range**
- **Streetlighting**
- **Pedestrian Lighting**

0 1,250 2,500 Feet

N



STREET LIGHTING TYPES

LUMINAIRE SCHEDULE

The following table details the recommended specifications for each type of luminaire that could be used for street lighting in Albany. These luminaire specifications describe the minimum quality requirements for lighting equipment in order for Albany's street lighting to minimize contribution to light trespass or light pollution. All recommended luminaire types are using a CCT of 2700K or lower.

Some of the types shown here as distinct could potentially be satisfied by the same luminaire in order to reduce variety in the lighting inventory and improve maintenance response times.

Streetlight Typologies

Luminaire Type Name	Luminaire Type	Adjacent Land Use	Street Classification	Maximum CCT	Maximum Luminaire Lumen Output	Spacing Range* (ft)	Maximum BUG Rating	Distribution	Shielding Accessories	Mounting Height
S1	Streetlight	SC, SPC, PF, R-2, R-3, R-4, RHD	Arterial	2700K	12,000-16,000	150-200	B2-U0-G2	Type 2 or 3	House side shield near residential	25-30ft.
S2	Streetlight	SC, SPC, PF, R-1, R-2, R-3, R-4, RHD, CMX	Arterial or Collector	2700K	8,000-12,000	150-230	B2-U0-G2	Type 2	House side shield near residential	25-30ft.
S3	Streetlight	PF, R-2, R-3, R-4, RHD, CMX	Collector or Local	2700K	6,000-10,000	150-240	B1-U0-G1	Type 2	House side shield near residential	25-30ft.
S4	Streetlight	PF, R-1, R-2, R-3, R-4, RHD, CMX	Collector or Local	2700K	4,000-8,000	170-240	B1-U0-G1	Type 2	80° shield, House side shield	25ft.
P1	Pedestrian Light	R-1, R-2, CMX	Arterial or Collector	2700K	2,500-3,500	60-90	B1-U0-G1	Type 2	80° shield, House side shield	12-15ft.
P2	Pedestrian Light	R-1, R-2, CMX	Local	2700K	1,500-2,500	60-90	B1-U0-G1	Type 2	80° shield, House side shield	12-15ft.
SG1	Intersection Light	SC, SPC, PF, R-2, R-3, R-4, RHD	Arterial	2700K	14,000-16,000	3-4 at Intersection	B2-U0-G2	Type 3 or 4	House side shield near residential	25-30ft.
SG2	Intersection Light	SC, SPC, PF, R-1, R-2, R-3, R-4, RHD, CMX	Arterial or Collector	2700K	10,000-14,000	3-4 at Intersection	B2-U0-G2	Type 3	House side shield near residential	25-30ft.
SG3	Intersection Light	PF, R-1, R-2, R-3, R-4, RHD, CMX	Collector or Local	2700K	6,000-10,000	1-3 at Intersection	B1-U0-G1	Type 2	80° shield, House side shield	25ft.

* Spacing Range is based on a range to achieve continuous lighting. For non-continuous lighting increase spacing by 1.5 to 2 times.

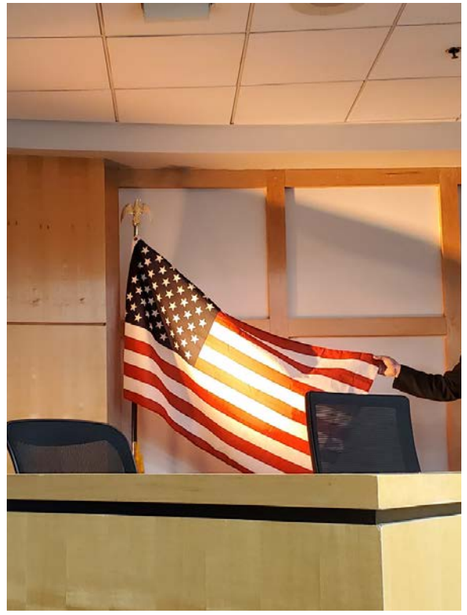
CORRELATED COLOR TEMPERATURES

The Correlated Color Temperature (CCT) rating system is a metric used in the lighting industry to describe how “warm” or “cool” a light source appears to be to the human eye. Clanton & Associates has previously utilized a demonstration kit to show five common CCT’s for outdoor lighting and how they influence the appearance of a familiar object like the national flag.

- 2200K - This CCT is often encouraged near ecologically sensitive areas such as natural parks, waterways, or coastlines. Light sources of this temperature generally contain the least amount of disruptive blue light.
- 2700K - This CCT is being pursued as a standard outdoor lighting CCT by California. It is now a standard offering by many manufacturers. This is recommended for anything being installed in Albany in order to future-proof the City’s investments in lighting.
- 3000K - This CCT has become the standard maximum temperature for most outdoor lighting. It’s often referred to as warm white.
- 3500K - This CCT is less standard for outdoor use but is available. Sometimes individuals struggle to distinguish it from a 3000K light temperature.
- 4000K - This CCT was standard when LED technology was new but is no longer recommended as a default outdoor CCT. Some residents tend to find this CCT too “blue” or too harsh for outdoor use at night.

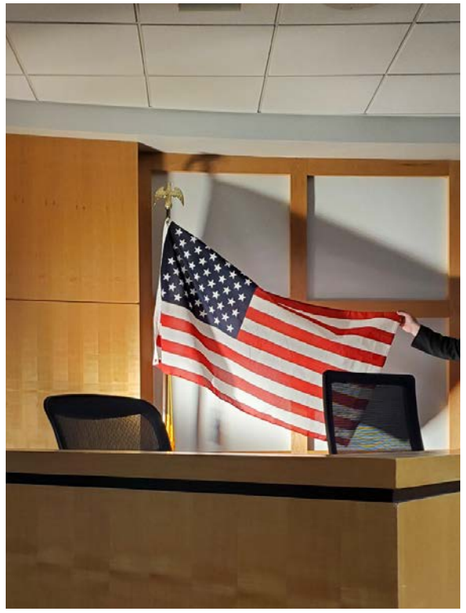
Some areas of Albany are currently using light sources with a CCT of 5000K outdoors, which is not appropriate for outdoor use especially when near residential areas. Some areas still have the legacy light sources HPS in use, which has a CCT closer to 1800K. During the Street Lighting Demonstration that took place September 19th, there was a general consensus from the community that they preferred a “warmer”, lower CCT to a “cooler” light source.

Light sources with a CCT rating below 3200K are usually considered “warm” and more closely match firelight while those with a CCT at or above 4000K are usually considered “cool” in appearance. Anything in between 3200K and 4000K is typically considered “neutral.” In reality, “warmer” colors of light have lower temperatures as measured in degrees Kelvin.

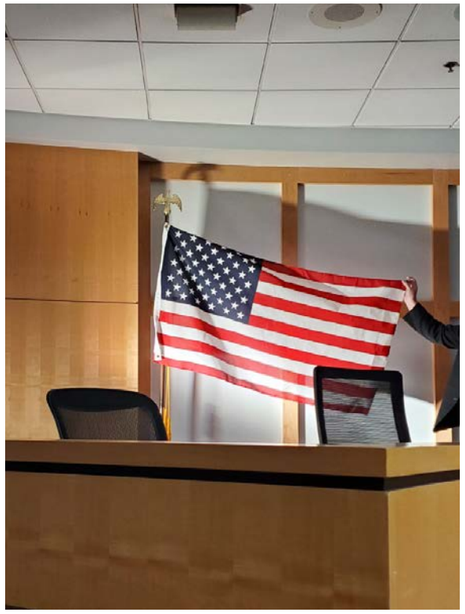


2200K

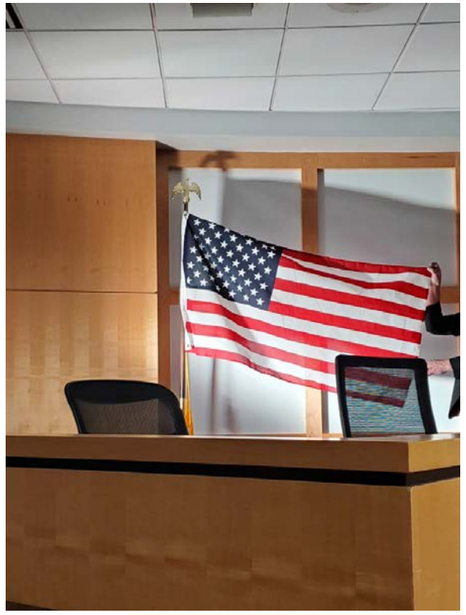
2700K



3000K



3500K



4000K

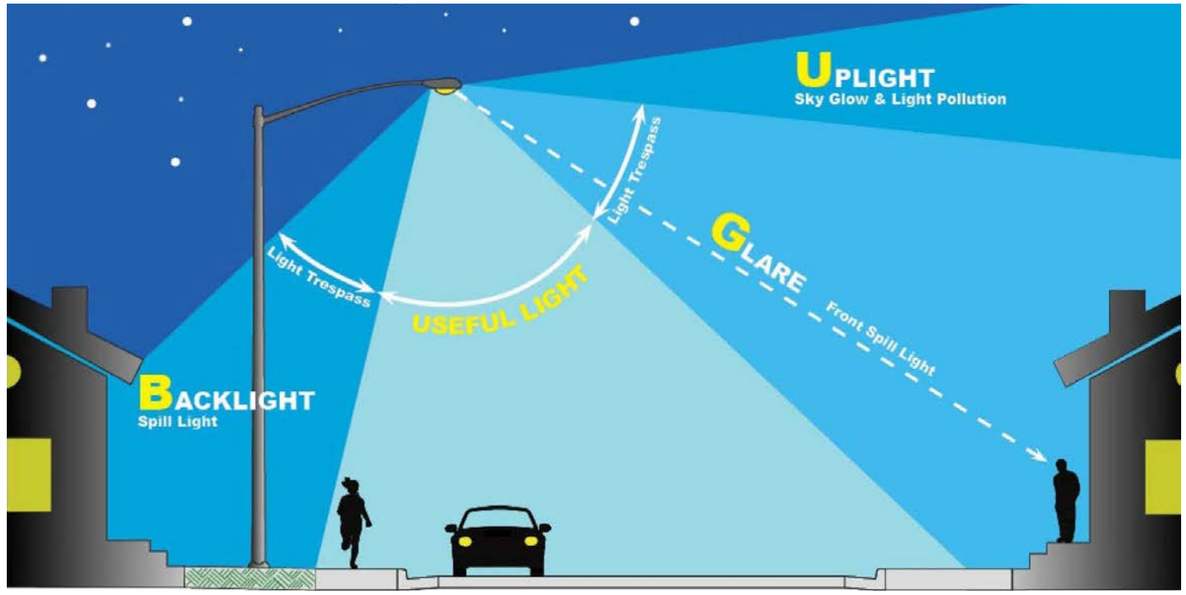
BACKLIGHT, UPLIGHT, & GLARE

The B.U.G. Rating system (Backlight, Uplight, and Glare) was developed as part of the MLO to help better communicate and score outdoor luminaire performance. Luminaires are given a score from 0 to 4 in three categories. These categories are:

- Backlight: Refers to light falling behind the luminaire. Backlight may be undesirable, or some backlight may be beneficial depending on the land uses and activity level along the street.
- Uplight: Refers to light shining above the horizontal plane. It is undesirable due to the potential for glare, the negative impacts on sky quality and the environment, and the wasted energy consumed by the misdirected light.
- Glare: Refers to light coming from the luminaire at any angle above 60°, especially when a bright light source is in a dark area. This can be very uncomfortable in the eyes of trail users and can lead to light spilling too far in front of the luminaire.

There are several locations in the City currently using zero-cutoff or U4 B.U.G rated luminaires. These are inappropriate for outdoor use. The City should consider a City-wide maximum uplight score of U1, with the use of U0 strongly encouraged. This will improve both light trespass and light pollution. It will also reduce the amount of glare experienced by drivers and pedestrians, which is important for safety because the eye has a harder time seeing contrast and details while experiencing direct glare. What amount of backlight is appropriate is more context dependent, since street lighting could be providing needed lighting to a sidewalk or contributing to light trespass into a residence depending on the site.

UPLIGHT - SOLANO AVENUE



BUG DIAGRAM

BACKLIGHT - MARIN AVENUE

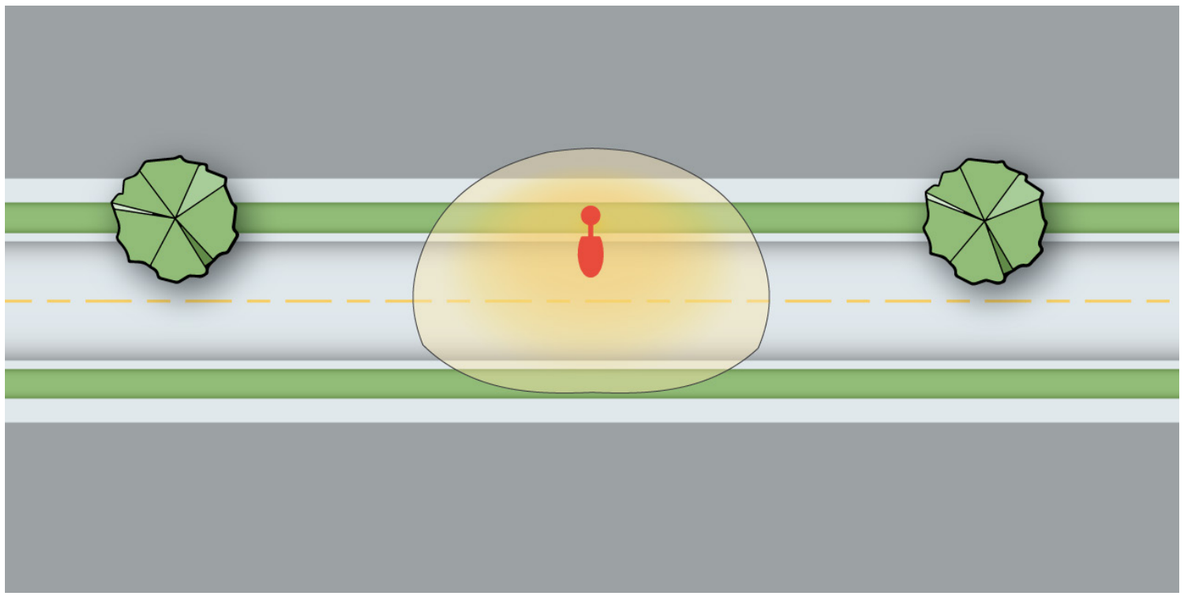
LIGHTING DISTRIBUTIONS

A lighting distribution refers to the pattern of the light being cast upon the ground by a given luminaire. There are 5 typical distribution patterns recognized by the IES. Three of these patterns are being recommended through the street lighting typologies as appropriate for use in Albany. These distributions are:

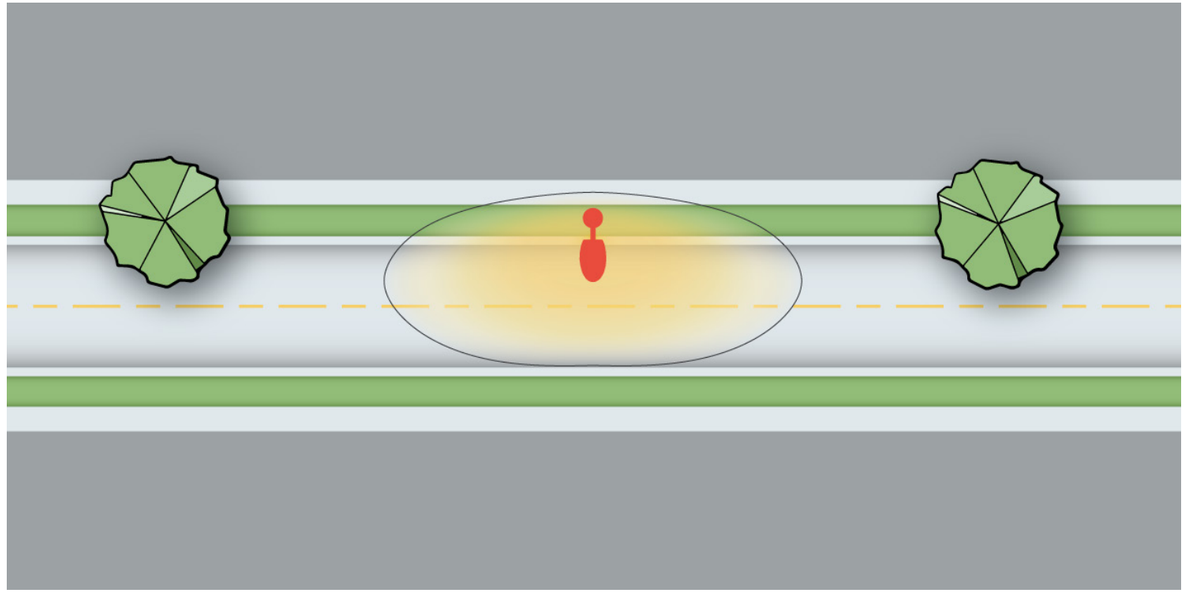
- Type 2 Distribution - A linear and narrow distribution pattern suitable for narrower streets.
- Type 3 Distribution - A wider linear distribution suitable for parking areas or wider streets.
- Type 4 Distribution - A shorter, wider distribution suitable for intersections or parking areas.

In Albany, a Type 2 distribution will be suitable for most streets due to their narrower widths. Type 3 distributions would only be appropriate from some wider arterials or their intersections. At larger intersections the broader distribution patter of the Type 3 can be beneficial for uniformity. There may also be some intersections where a Type 4 distribution is a better fit due to intersection width or limitations on pole placement.

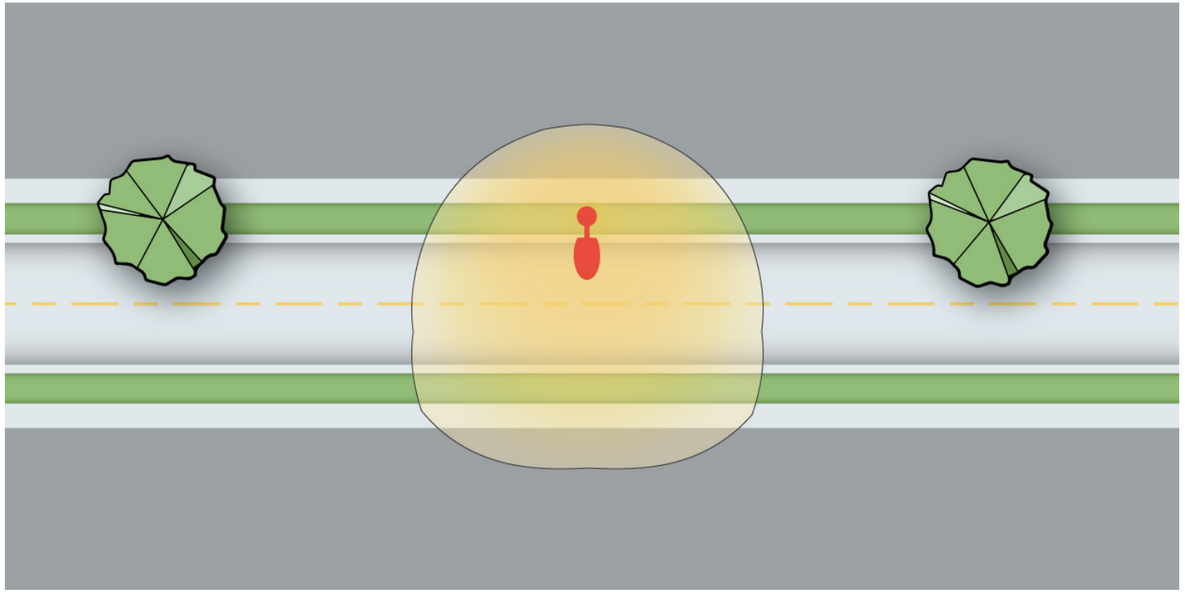
These three distributions used in their correct locations will improve uniformity and reduce the light trespass throughout Albany.



TYPE 3 DISTRIBUTION



TYPE 2 DISTRIBUTION



TYPE 4 DISTRIBUTION

SHIELDING OPTIONS

There are many opportunities for Albany to add shielding to existing luminaires to improve their performance for the community by reducing light trespass, especially for luminaires that are not yet nearing their end-of-service period. While shielding for legacy luminaires was often bulky and noticeable, new LED shields are inconspicuous and easy to install. These shielding types are:

- House-side Shield
- Front-side Shield
- Cul-de-sac Shield
- 80° Shield

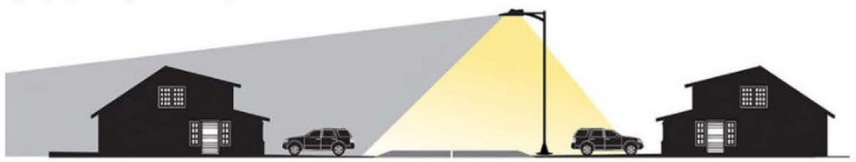
Clanton is recommending the use of house-side shields for most local streets in Albany due to their narrow widths. House side shielding would help prevent light trespass from taking place into yards and windows behind the luminaire. Front-side shielding could prevent light from spilling too far across the street and sidewalk. In addition, 80° shields are recommended throughout Albany due to the glare reduction they provide and Albany's narrow street widths. Unless light trespass behind the luminaire is the main concern for the street, the 80° shield should be the first choice for shielding.

Some level of backlight can be useful for providing light to sidewalks and entryways. Dark sidewalks have been mentioned by multiple residents as a concern so far in the public engagement process. When considering which shielding option to use, the residents' opinions about how they want their street to feel should be taken into account.

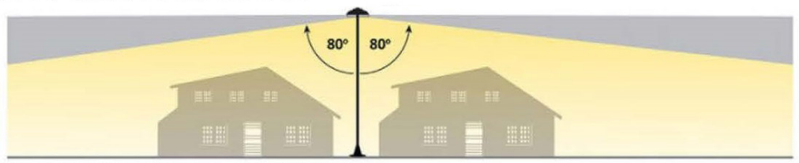
LEGACY HOUSE-SIDE SHIELD

LEGACY FRONT-SIDE SHIELD

HOUSE-SIDE SHIELD



FRONT-SIDE SHIELD



GLARE CUT-OFF SHIELD

LED HOUSE-SIDE SHIELD

LED 80° SHIELD