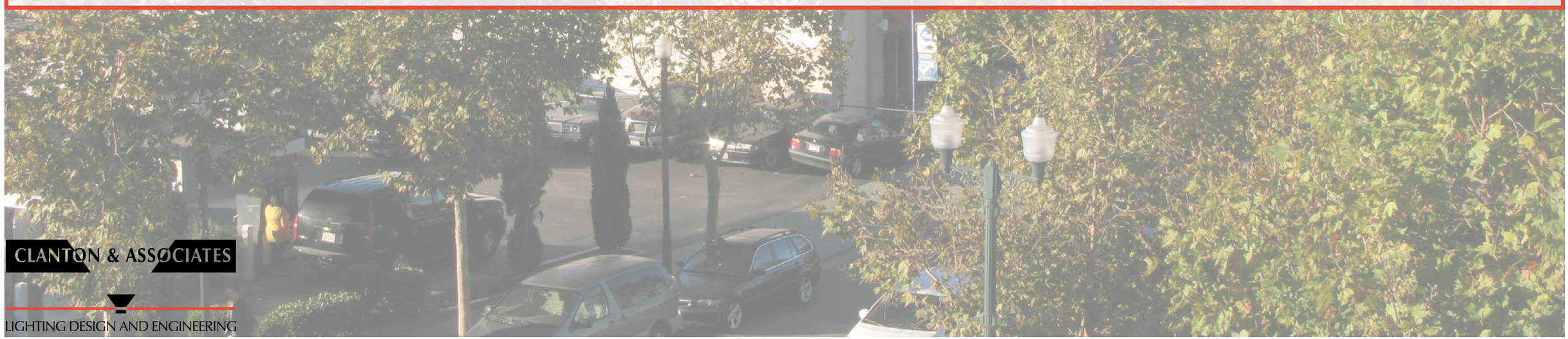
ALBANY - STREET LIGHTING EVALUATION

EXISTING LIGHTING CONDITIONS

07/28/2023



CLANTON & ASSOCIATES

LIGHTING DESIGN AND ENGINEERING

EXISTING LIGHTING CONDITIONS

The City of Albany requested an inventory and evaluation of their existing street lighting to assist in addressing resident concerns and in guiding future upgrades. This evaluation will inventory every streetlight in the City and map them for analysis. This inventory will support improvements for visibility & safety, reducing light trespass, improving environmental impact, and the visual comfort of the community.

SCOPE OF THE STREET LIGHTING EVALUATION

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

- Citywide inventory of existing streetlights by Evari
- A photo and GIS inventory for the City
- Evaluation of up to ten example sites by Clanton & Associates
- Recommendations for luminaire characteristics, light levels, and appropriate CCT's
- A lighting demonstration for public engagement
- Reports summarizing the results and recommendations

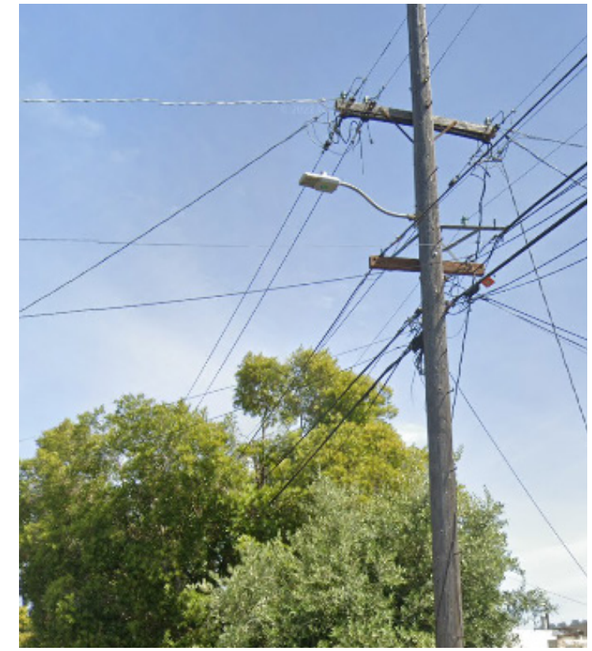
EVALUATION OF EXISTING STREET LIGHTING CONDITIONS

To gain a better understanding of the existing lighting equipment and lighting conditions in use, Clanton & Associates surveyed ten (10) sites throughout Albany in May 2023. The selected sites included commercial corridors and residential areas. 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)

Both horizontal and vertical illuminance measurements were taken at each site. Luminance measurements were also taken to provide an understanding of surrounding surface brightness and glare from light sources. These measured light levels were used to compare the existing light levels in Albany to the light level recommendations made for different uses by the Illuminating Engineering Society (IES) and other best practices described in the Model Lighting Ordinance (MLO). These comparisons help to identify what the successes and weaknesses of the current lighting are and what should be prioritized for improvements to benefit Albany's lighting quality and safety the most.

BUCHANAN STREET



EVELYN AVENUE

SOLANO AVENUE

MASONIC AVENUE

LIGHTING FUNDAMENTALS

Lighting plays a key role in how people perceive the spaces in which they live, work, and play. The following are key elements of quality lighting.

Luminance & Illuminance:

Creating good visibility with street and public lighting depends on two metrics: illuminance (measured in footcandles – fc) which is the amount of light falling on a surface, and luminance (measured in candela per square meter – cd/m^2) which is the amount of light reflecting off a surface towards the eye of an observer. Pedestrian areas, such as trails, crosswalks, and sidewalks are usually based on illuminance criteria. This illuminance is measured on vertical and horizontal surfaces to gain insight into the visibility of 3D environment. Streets are usually based on luminance criteria.

Glare:

Glare is caused by excessive or undesirable light entering the eye from a bright light source. Glare can result in discomfort, annoyance, and decreased visibility. The experience of direct glare can happen when a light source is in direct view. The presence of direct glare depends on the intensity of the light source and its contrast with the surrounding environment. While experiencing direct glare the eye has a harder time seeing contrast and details. A lighting system designed solely around the desired lighting level tends to aim more light at higher viewing angles, thus producing more potential for glare. Direct glare can be minimized with careful equipment selection as well as luminaire placement.

Uniformity & Contrast:

Lighting uniformity refers to the evenness of light. Our eyes are continually adapting to the brightest object in our field of view. Any object lighted to 1/10th the level of the immediate surroundings appears noticeably darker to the human eye. Evenly lit pavement is generally the first indicator of good uniformity in a lighting design. However, good visibility requires clear contrast of an object against its background as the human eye relies on contrast first at night. Perfectly uniform lighting provides low contrast, which reduces visibility at night since contrast is essential. Uniformity criteria are typically structured in ratios of maximum to minimum light level or average to minimum luminance or illuminance. Contrast is the difference between two adjacent luminance values. Lighting design prioritizes a balance between uniformity and contrast for excellent visibility. This is accomplished through appropriate light levels and quality color rendering.

Correlated Color Temperature (CCT):

This 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. 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.

Color Rendering Index (CRI):

This is the standard metric used to evaluate how well a light source renders the true color of an object. CRI is measured on a scale of 0 to 100, with 100 representing how an object would look under a referenced incandescent light source that is very similar to natural daylight. The higher the number, the better the color rendering capacity of the light source. Traditional High-Pressure Sodium (“HPS”) streetlights have a very low CRI of approximately 30, which makes identifying different colors very difficult for the typical human eye. Contemporary LED streetlights have a much higher CRI of around 70 by default. Higher CRI light sources generally contain a fuller spectrum of visible light and thus appear brighter to the human eye even when the lumen output is ostensibly the same.

In the past, higher CCT’s have had better CRI scores, but improvements in LED technology have made higher CRI with lower CCT’s increasingly possible. This has applications in environmentally sensitive areas. Overall these improvements in lighting technology increase color detection, visual acuity, and the overall effectiveness of outdoor lighting in our communities.

IMPACT OF GLARE

IMPACT OF CRI

LEVELS OF ACCEPTABILITY

The measurements taken at each site were used to compare the existing streetlighting levels typical to Albany to the currently recommended lighting criteria. Horizontal and vertical illuminance measurements (fc) were used to evaluate the sidewalk light levels and light trespass. Luminance measurements (cd/m^2) were used to evaluate the light levels of the streets. These measurements were supplemented by observations of each site.

CRITERIA USED FOR STREET LIGHTING ACCEPTABILITY

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. To evaluate the streetlighting in Albany Clanton & Associates will be referring mainly to two documents. These documents are:

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

These documents provide recommendations for appropriate light levels, uniformity of light, and upper limits for light trespass into other areas. It is very difficult for an entire City to exactly meet the criteria as written. Generally as long as light is within 10% of meeting the criteria, above or below, the lighting will acceptable for the users.

CATEGORIES OF EXISTING STREET LIGHTING ACCEPTABILITY

In addition to the lighting criteria, the sites visited by Clanton & Associates were evaluated by our experiences of the light levels, glare from luminaires, perceived safety while navigating, neighborhood characteristics, and appearance of light trespass. These observations supplement the national criteria for a more complete picture of how lighting is performing in an area. Some sites may be above or below the light level criteria but are still providing a quality visual experience for the users.

These observations allowed the ten sites studied to be divided into four categories.

- **Acceptable:** Sites given this classification either met or were generally in an acceptable range of meeting IES criteria. They provided enough quality lighting for safety and visual comfort.
- **Marginal:** Sites given this classification had lighting that was satisfactory by some measurements but provided a poor experience in other categories. There is room for improvement.
- **Poor:** Sites given this classification had light levels that were too far below criteria. Visibility was inadequate and there were safety concerns.
- **Excessive:** Sites given this classification had light levels that were too high above criteria. This leads to glare and difficulties adapting to the lighting in other areas, compromising visibility.

SITE PHOTO: ACCEPTABLE

SITE PHOTO: POOR

SITE EVALUATION LOCATIONS

BASIS 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.

Warrants & Lighting Criteria:

A lighting design uses the process of warranting to help guide where and how much lighting should be placed on a site or along a street type, 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.
- Nighttime Pedestrian & Cyclist Activity: This comes from IES standards and is based on the number 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 Lighting Conditions: This takes into account existing luminaires, their age and current performance, and if any luminaires from outside a site are providing lighting to that site.

This warranting and lighting criteria selection process allows for a more granular approach to choosing the appropriate lighting for any site, pedestrian and cyclist path, or street.

Visual Adaptation:

Quality outdoor lighting should be designed in a way that minimizes how difficult it is for the human eye to adapt to different spaces at night. 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.

Street Typologies & Street Lighting:

Street typologies are based around classifying the different physical characteristics and usage patterns of any street or corridor in order to guide the process of choosing appropriate lighting. Five typologies used frequently in lighting design are:

- Local
- Collector
- Arterial
- Freeway
- Transit Corridor

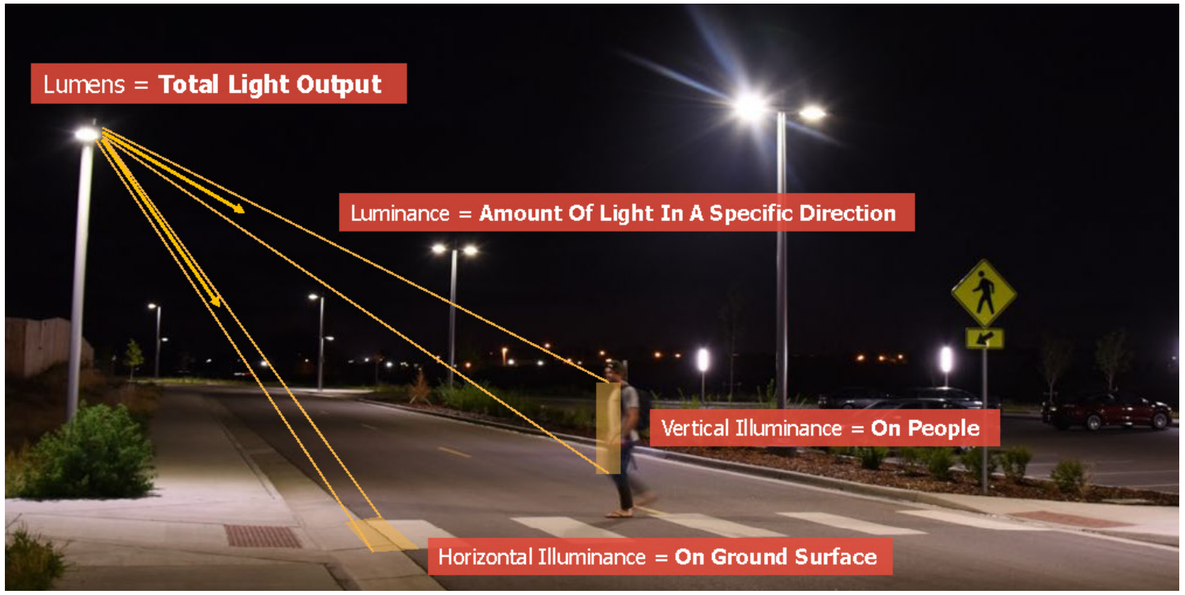
There are also several typical patterns for locating street lighting. Which option is the most appropriate depends on the characteristics of the site and street typology. These are:

- Opposite Street Lighting: Layout of street lighting where luminaires are arranged directly across the street from each other.
- Staggered Street Lighting: Layout of street lighting where luminaires are arranged so they alternate to either side of the roadway in a zig-zag pattern.
- Median Street Lighting: Layout of street lighting where luminaires are placed in the median of a roadway instead of to either side.

In addition to the street's physical characteristics, warrants such as usage rates help determine if continuous or non-continuous lighting is the more appropriate lighting design choice.

- 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 only conflict areas such as intersections, crosswalks, ingress/egress ramps, and other navigational hazards. Uniformity is not a priority with this strategy.

More details about these topics and their application will be included in the Street Lighting Criteria & Features Report.



MEASURING LUMINANCE AND ILLUMINANCE

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 tolerance in the lighting criteria.
- Avg/Min: The average illuminance divided by the minimum measured illuminance in an area to asses 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 and will be able to accurately render the colors of surfaces and objects.
- 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 light source. 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. An IES Type II distribution is a narrow, linear distribution that is commonly used in streetlighting. The IES Type 3 distribution is wider and is therefore more suitable for wider, arterial streets.
- 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: Light that spills beyond 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 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/m^2) and also referred to as "photometric brightness". This metric best describes the perceived brightness of a light source, surface, or object.
- 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 electrical power, which is the 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.

CORRELATED COLOR TEMPERATURE (CCT)

DATA MAPPING

FIGURE COUNT BY LUMINAIRE TYPE & WATTAGE MAP

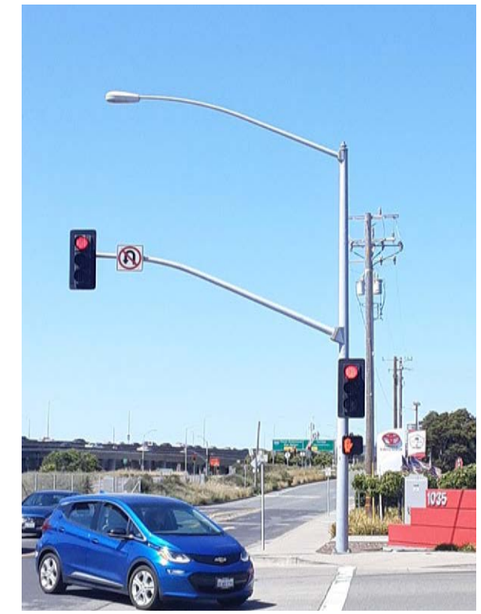
LUMINAIRE TYPE & WATTAGE EXAMPLES

LED COBRAHEAD 24W-59W

LED COBRAHEAD 60W-90W

LED COBRAHEAD 91W-139W

LED COBRAHEAD 140W-189W



HPS COBRAHEAD 190W-310W

POST-TOP LUMINAIRE

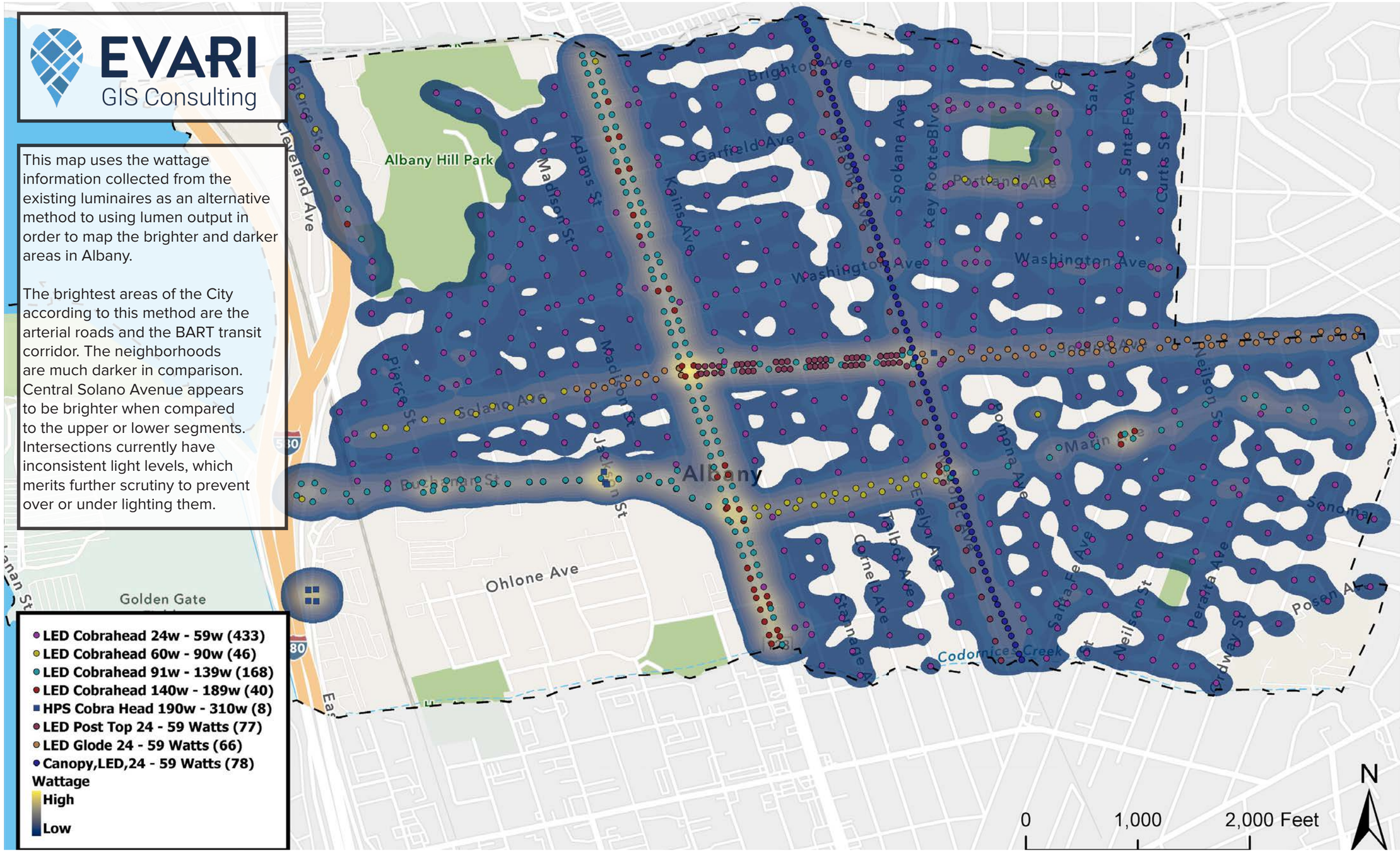
GLOBE LUMINAIRE

DUAL-HEAD LED LUMINAIRE

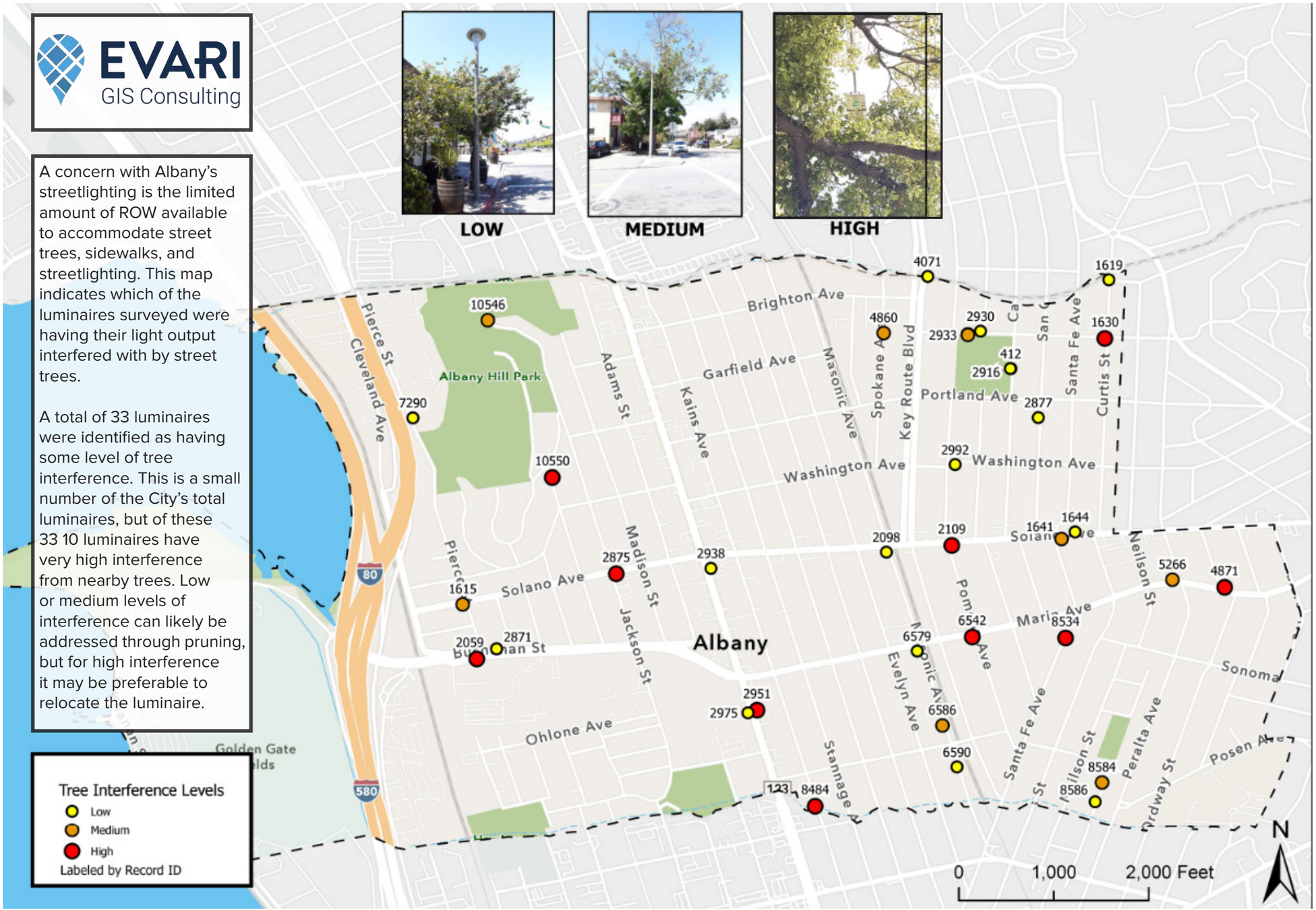
LED CANOPY 59W

LED CANOPY 24W

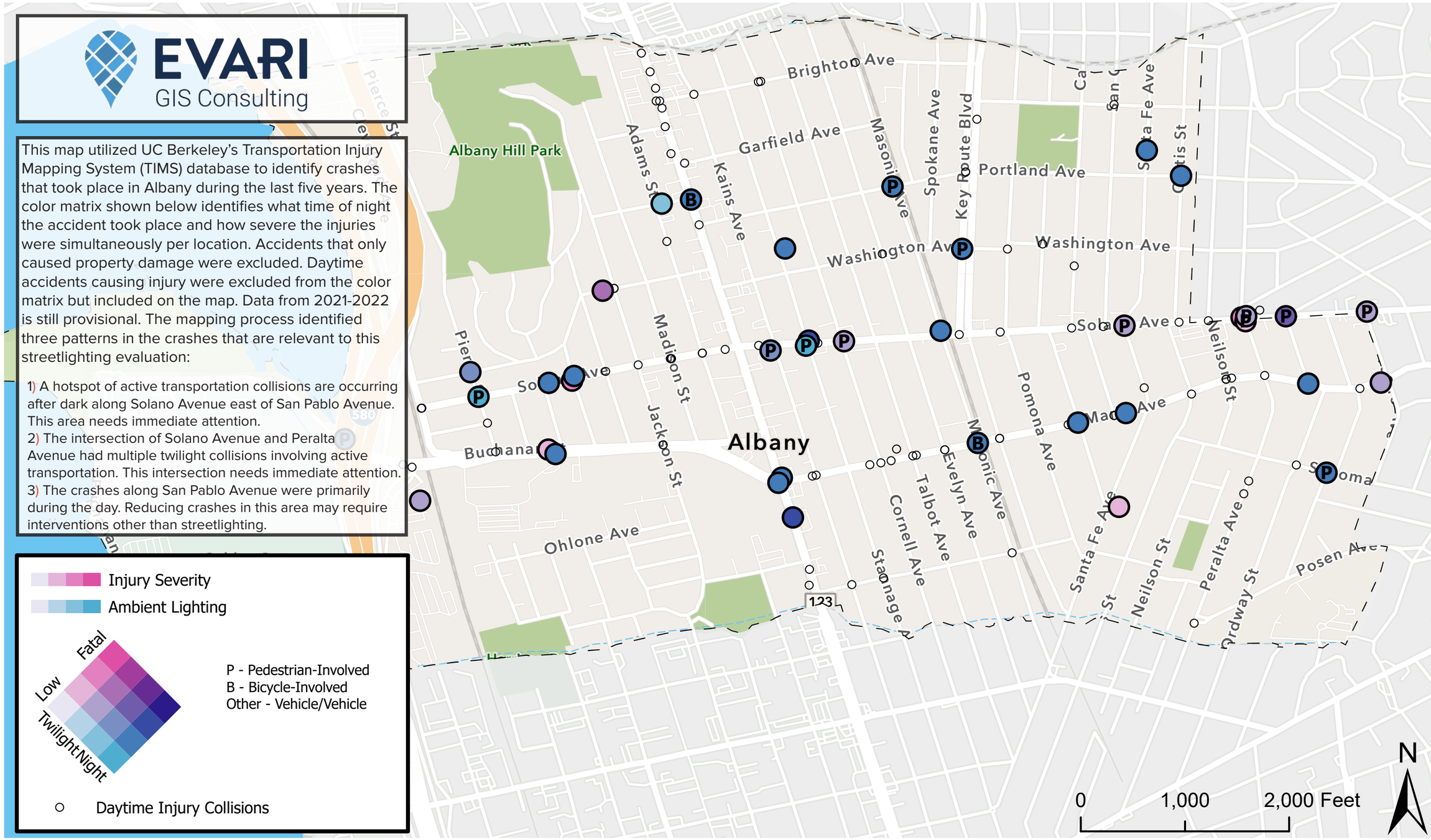
DENSITY OF STREETLIGHT WATTAGE



TREE INTERFERENCE MAP



NON-DAYTIME 5-YEAR COLLISION HISTORY MAP (2018 - 2022)



SITE OBSERVATIONS

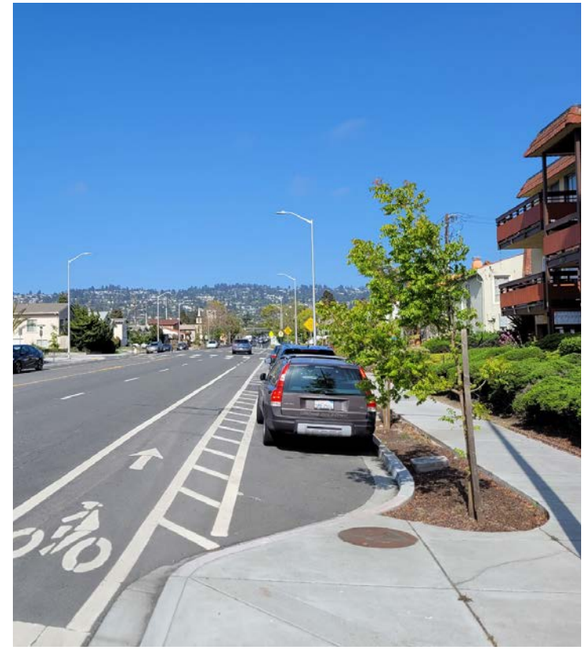
1 SITE 1 - MARIN AVENUE

Span: (Kains to Talbot)

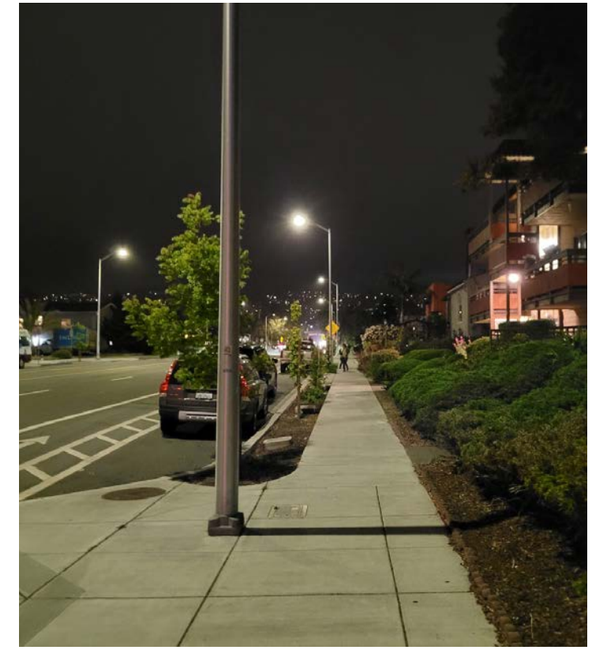
Street Classification: Arterial

Initial Site Observations:

- **Time:** Site was visited at approximately 4:40 PM & 9:40 PM
- **Location:** Site is along an arterial street with Class II bicycle lanes and low pedestrian activity at night
- **Street:** Lighting on the street is appropriate, visually comfortable with low glare, and provides excellent uniformity. The light level currently provides excellent visibility for travel lanes, bike lanes and on-street parking.
- **Sidewalk:** Lighting on the sidewalk is higher than criteria but is still within a reasonable range. The lighting currently provides excellent visibility and reassurance for pedestrians.
- **Light Trespass:** Light spilling beyond the sidewalk and into private property is somewhat excessive and could be disturbing residents trying to sleep. However, with higher density multi-family residential, some residents may object to reducing the light in shared outdoor space.



SITE PHOTO: DAY



SITE PHOTO: NIGHT

Site 1 - Marin Avenue (Kains to Talbot)						
Street Classification	Arterial					
Land Use	Residential / School					
Pedestrian Activity	Low					
Illuminance Summary (fc)						
	Avg	Max	Min	Avg/Min	Max/Min	Multiple of Criteria
Sidewalk Criteria	0.2			10		HIGH
Sidewalk Summary Eh	0.4	0.6	0.2	2.8	3.4	2.21
Sidewalk Summary Ev	0.3	0.5	0.1	2.1	3.5	1.39
Light Trespass Criteria		0.3				HIGH
Light Trespass Eh		0.6				2.0
Light Trespass Ev		0.5				1.6
Street Luminance Summary - cd/m²						
	Avg	Max	Min	Avg/Min	Max/Min	
Criteria	0.6			3.5		ADEQUATE
Street Summary	0.5	0.7	0.3	1.4	2.2	0.8

Lighting Measurements:

- **Avg**: Average Illuminance (fc) or Luminance (cd/m²) should be within a reasonable range (+/-) of the criteria. An acceptable Multiple of Criteria is therefore 0.8 to 1.5. The light on the sidewalk and trespass onto private property is excessive, while the light on the street is within expected range of criteria.
- **Avg/Min**: This measures uniformity and should be somewhat less than or equal to the stated criteria. The lighting on this site is extremely uniform, which may unintentionally result in reduced visual performance due to lowered contrast.
- **Light Trespass**: This measurement significantly exceeds the maximum criteria appropriate for this street typology. Lighting is not being confined to street and sidewalk surfaces appropriately.

Proposed Improvements:

- **Additional Shielding:** This could lower the amount of light trespass without changing the luminaires. Backlight shields could be added near any buildings with residences. A few luminaires could be shielded as a pilot to gauge if the residents prefer the change or not.
- **Part-Night Dimming:** These lights could be dimmed during the late-night hours while still maintaining appropriate visibility and safety for any drivers that may pass through this arterial at those times. Part-night dimming saves energy and does not negatively impact drivers as their headlights are sufficient for the reduced amount of conflicts encountered late at night.

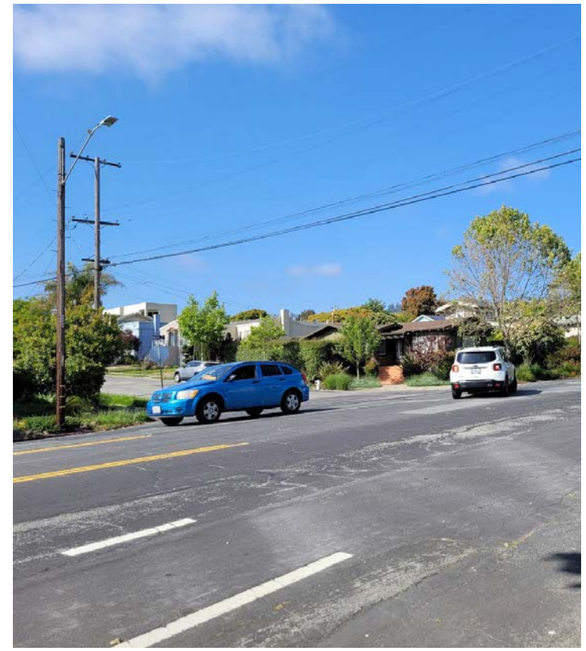
2 SITE 2 - MARIN AVENUE

Span: (Neilson to Peralta)

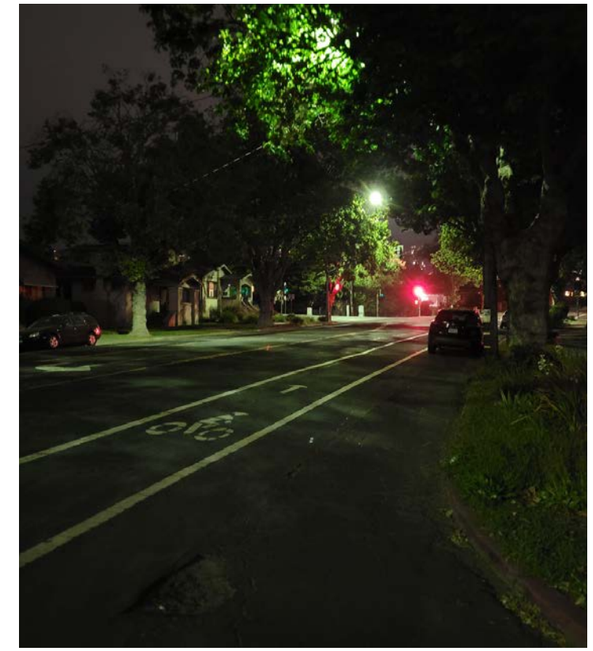
Street Classification: Arterial

Initial Site Observations:

- **Time:** Site was visited at approximately 4:50 PM & 10:10 PM
- **Location:** Site is along an arterial street in a residential area with Class II bicycle lanes and low pedestrian activity at night
- **Street:** Lighting around this site is generally located at intersections with some additional mid-block lights. When only one streetlight was present at some large intersections the crosswalk lighting feels too low and uneven.
- **Sidewalk:** The sidewalks are mostly shadowed by the large street trees. While the sidewalks are dark, it may be preferred by this neighborhood. Some areas near the brighter intersections were dark enough they may be a tripping hazard.
- **Light Trespass:** The mature street trees prevented most streetlights from trespassing backwards onto private residential properties. Front yards and residential windows were not being negatively impacted by streetlighting.



SITE PHOTO: DAY



SITE PHOTO: NIGHT

Site 2 - Marin Avenue (Nielson to Peralta)						
Street Classification	Arterial					
Land Use	Residential					
Pedestrian Activity	Low					
Illuminance Summary (fc)						
	Avg	Max	Min	Avg/Min	Max/Min	Multiple of Criteria
Sidewalk Criteria	0.2			10		LOW
Sidewalk Summary Eh	0.1	0.2	0.0	9.3	22.3	0.37
Sidewalk Summary Ev	0.0	0.3	0.0	4.3	22.8	0.24
Light Trespass Criteria		0.3				APPROPRIATE
Light Trespass Eh		0.1				0.5
Light Trespass Ev		0.2				0.8
Street Luminance Summary - cd/m2						
	Avg	Max	Min	Avg/Min	Max/Min	
Criteria	0.6			3.5		LOW
Measurement Summary	0.2	0.3	0.1	3.0	5.2	0.4

Lighting Measurements:

- **Avg**: Average Illuminance (fc) or Luminance (cd/m²) should be within a reasonable range (+/-) of the criteria. An acceptable Multiple of Criteria is therefore 0.8 to 1.5. At this site, the lighting on the street and sidewalk are below the criteria. The low light levels on the street and intersections creates some safety concerns for pedestrians and cyclists
- **Avg/Min**: This measures uniformity and should be somewhat less than or equal to the stated criteria. While the lighting on this site is non-continuous and has some significant shadowing from large trees, the Avg/Min uniformity within the areas measured areas meets the criteria.
- **Light Trespass**: This measurement met the intended criteria for this street typology.

Proposed Improvements:

- **Intersection & Crosswalk Lighting:** The poorly illuminated intersections and crosswalks on Upper Marin Ave should be prioritized for investment in improved street lighting. This is a safety concern for any pedestrians or cyclists in this area at night.
- **Relocate lights within Tree Canopies:** Some streetlights are currently located within the tree canopies which are shadowing most of the light from these luminaires. When possible these streetlights should be relocated rather than damage the mature trees.

3 SITE 3 - NEILSON STREET

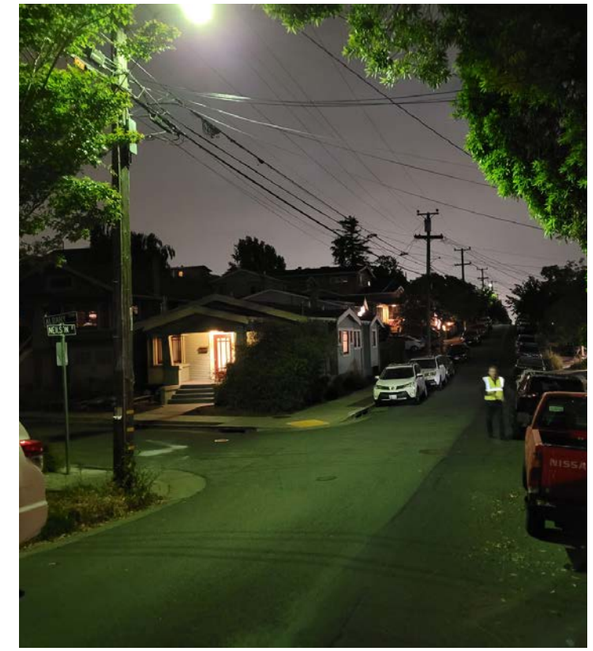
Span: (Sonoma to Francis)

Street Classification: Residential/Local

Initial Site Observations:

- **Time:** Site was visited at approximately 5:00 PM & 10:30 PM
- **Location:** Site is along a local, residential street with low pedestrian activity at night
- **Street:** This area only has streetlights at intersections. The streets are narrow and thus have small intersections with very low traffic. The lighting seems appropriate for the neighborhood, even though the light levels are below criteria.
- **Sidewalk:** The sidewalks near this intersection light measured lower than criteria, yet feels appropriate for the activity level of this neighborhood. There is limited contribution from porch lights.
- **Light Trespass:** The light distribution and low output of these luminaires results in low levels of light trespass. Light is also prevented from spilling into many residential windows by the neighborhood's typical landscaping.

SITE PHOTO: DAY



SITE PHOTO: NIGHT

Site 3 - Neilson Street (Sonoma to Francis)						
Street Classification	Local / Local					
Land Use	Residential					
Pedestrian Activity	Low					
Illuminance Summary (fc)						
	Avg	Max	Min	Avg/Min	Max/Min	Multiple of Criteria
Sidewalk Criteria	0.2			10		LOW
Sidewalk Summary Eh	0.1	0.3	0.0	4.0	10.9	0.53
Sidewalk Summary Ev	0.1	0.4	0.0	7.1	29.8	0.46
Light Trespass Criteria		0.1				APPROPRIATE
Light Trespass Eh		0.2				0.8
Light Trespass Ev		0.2				0.8
Street Luminance Summary - cd/m²						
	Avg	Max	Min	Avg/Min	Max/Min	
Criteria	0.3			6.0		LOW
Measurement Summary	0.1	0.2	0.0	2.5	5.3	0.2

Lighting Measurements:

- **Avg**: Average Illuminance (fc) or Luminance (cd/m²) should be within a reasonable range (+/-) of the criteria. An acceptable Multiple of Criteria is therefore 0.8 to 1.5. At this site, the lighting on the street and sidewalk are below the criteria, but the lighting seems appropriate for the neighborhood.
- **Avg/Min**: This measures uniformity and should be somewhat less than or equal to the stated criteria. While the lighting on this site is non-continuous and only at intersections, the Avg/Min uniformity within the areas measured meets the criteria.
- **Light Trespass**: This measurement met the intended criteria for this street typology.

Proposed Improvements:

- **Lower CCT's:** On local residential streets, CCT's lower than California's upcoming typical 2700K can be considered. In neighborhood settings with lower traffic and pedestrian volumes, CCT's of 1800K to 2200K can be considered. This can be determined by neighborhood preference or by proximity to natural spaces that would benefit.
- **Part-Night Dimming:** These lights could be dimmed during the late-night hours while still maintaining appropriate visibility and safety for any drivers or pedestrians that may pass through. The low overall activity level expected in a residential area late at night means there are less potential conflicts occurring on the streets and more need for healthy darkness for sleeping.

4 SITE 4 - SOLANO AVENUE

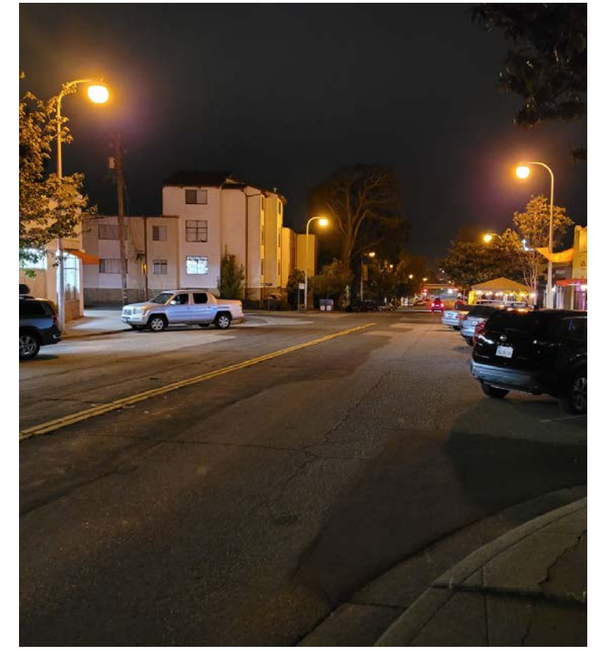
Span: (Carmel to Ramona)

Street Classification: Arterial

Initial Site Observations:

- **Time:** Site was visited at approximately 5:20 PM & 10:40 PM
- **Location:** Site is along an arterial street with mixed land uses and medium pedestrian activity
- **Street:** This area is lit continuously by unshielded luminaires with inconsistent CCT's. However, the street's surface itself felt evenly and adequately lit and while unshielded the luminaires were not creating a lot of glare.
- **Sidewalk:** The sidewalks near this area were dimly lit on average but felt comfortable. The intermittent bright light coming from storefronts along this site created some visual discomfort and adaptation issues that cannot be addressed through streetlighting.
- **Light Trespass:** The unshielded globe lights in this area create significant light trespass, which is especially concerning near the residential buildings along Solano Ave.

SITE PHOTO: DAY



SITE PHOTO: NIGHT

Site 4 - Solano Avenue (Carmel to Ramona)						
Street Classification	Arterial / Local					
Land Use	Residential / Community Center / Commercial					
Pedestrian Activity	Medium					
Illuminance Summary (fc)						
	Avg	Max	Min	Avg/Min	Max/Min	Multiple of Criteria
Sidewalk Criteria	0.5			5		LOW
Sidewalk Summary Eh	0.3	3.9	0.3	1.0	14.0	0.57
Sidewalk Summary Ev	0.3	2.9	0.1	4.4	42.1	0.62
Light Trespass Criteria		0.3				HIGH
Light Trespass Eh		0.4				-
Light Trespass Ev		0.4				-
Street Luminance Summary - cd/m2						
	Avg	Max	Min	Avg/Min	Max/Min	
Criteria	0.9			3.0		LOW
Measurement Summary	0.5	0.9	0.3	2.0	3.3	0.6

Lighting Measurements:

- **Avg**: Average Illuminance (fc) or Luminance (cd/m²) should be within a reasonable range (+/-) of the criteria. An acceptable Multiple of Criteria is therefore 0.8 to 1.5. At this site, the lighting on the street and sidewalk are below the criteria, yet feels appropriate and provides good visibility.
- **Avg/Min**: This measures uniformity and should be somewhat less than or equal to the stated criteria. The lighting at this site meets the uniformity criteria.
- **Light Trespass**: The light trespass measurement significantly exceeds the maximum criteria appropriate for this street typology. Light from streetlights near residences along this site is excessive and is overall not being confined to street and sidewalk surfaces appropriately.

Proposed Improvements:

- **Comprehensive Lighting Redesign:** As a core retail/commercial/mixed use corridor, Solano Ave will be a priority for the City when streetscape updates take place. A street and pedestrian lighting design that enhances the visual character of the City should be a key component of any future streetscape project.
- **Additional Shielding**: All street and pedestrian lighting along this corridor should be converted to luminaires with limited uplight and backlight in order to reduce the current light trespass and light pollution issues.

5 SITE 5 - MASONIC AVENUE

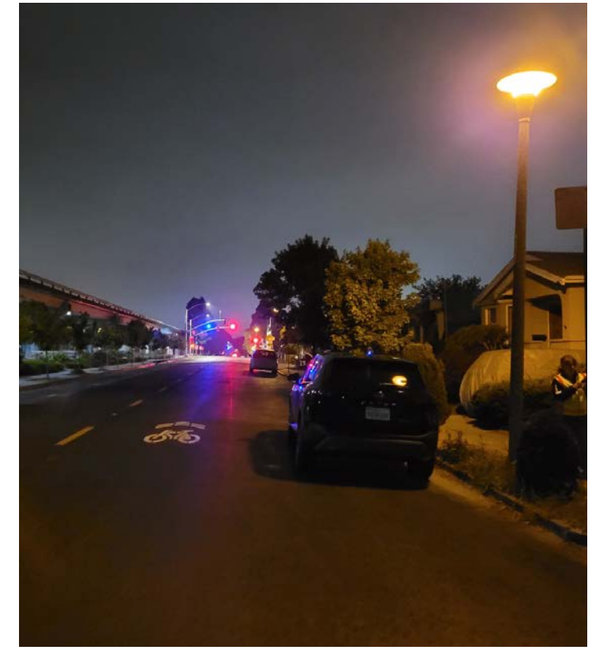
Span: (Washington to Solano)

Street Classification: Collector

Initial Site Observations:

- **Time:** Site was visited at approximately 5:30 PM & 10:40 PM
- **Location:** Site is along a collector street in residential/park areas with medium pedestrian activity
- **Street:** This area is mainly receiving streetlighting from pedestrian-scale, post-top luminaires and from spill light from the underdeck lighting on the BART rail line. Most of this spill light is poorly directed and is not adequately lighting the street's surface.
- **Sidewalk:** The sidewalks along this area were inconsistently lit. Due to the luminaire currently in use, more light was reaching residential facades than the sidewalk itself in some locations. Unexpected gaps in the spacing of the luminaires led to some uncomfortably dark spaces.
- **Light Trespass:** In some areas there is more measurable light on the facades of homes than on the street or sidewalks. This is severe light trespass from unsuitable luminaires. This is likely disturbing residents and is contributing to light pollution in the region.

SITE PHOTO: DAY



SITE PHOTO: NIGHT

Site 5 – Masonic Avenue (Washington to Solano)						
Street Classification	Collector / Collector					
Land Use	Residential / Commercial / Park					
Pedestrian Activity	Medium					
Illuminance Summary (fc)						
	Avg	Max	Min	Avg/Min	Max/Min	Multiple of Criteria
Sidewalk Criteria	0.5			5		LOW
Sidewalk Summary Eh	0.2	0.4	0.0	11.6	22.8	0.37
Sidewalk Summary Ev	0.1	0.4	0.0	6.2	31.6	0.17
Light Trespass Criteria		0.2				HIGH
Light Trespass Eh		0.3				1.1
Light Trespass Ev		0.4				1.5
Street Luminance Summary - cd/m2						
	Avg	Max	Min	Avg/Min	Max/Min	
Criteria	0.6			3.5		LOW
Measurement Summary	0.1	0.2	0.1	1.9	3.1	0.2

Lighting Measurements:

- **Avg**: Average Illuminance (fc) or Luminance (cd/m²) should be within a reasonable range (+/-) of the criteria. An acceptable Multiple of Criteria is therefore 0.8 to 1.5. At this site, the lighting on the street and sidewalk are below the criteria and the street itself feels dim.
- **Avg/Min**: This measures uniformity and should be somewhat less than or equal to the stated criteria. The uniformity on the street itself is low but adequate. The uniformity on the sidewalks is below criteria and is visually poor due to shadowing from landscaping and inappropriate luminaires.
- **Light Trespass**: This measurement exceeds the intended criteria for this street typology. Lighting is not being confined to street and sidewalk surfaces appropriately.

Proposed Improvements:

- **One-for-One Replacements:** The existing spacing of the post-top luminaires along this part of Masonic is generally sufficient. There are some gaps in the spacing due to conflicts with driveways where alternative spacing should be considered. The luminaires should be replaced in a one-for-one strategy with a low-glare luminaire with better backlight shielding to address the high light trespass.
- **Comprehensive Lighting Redesign**: The Ohlone Greenway is an ideal location for a distinctive lighting redesign along this well-traveled bike and pedestrian path. Lighting could be better layered and coordinated around the greenway to create a more welcoming space.

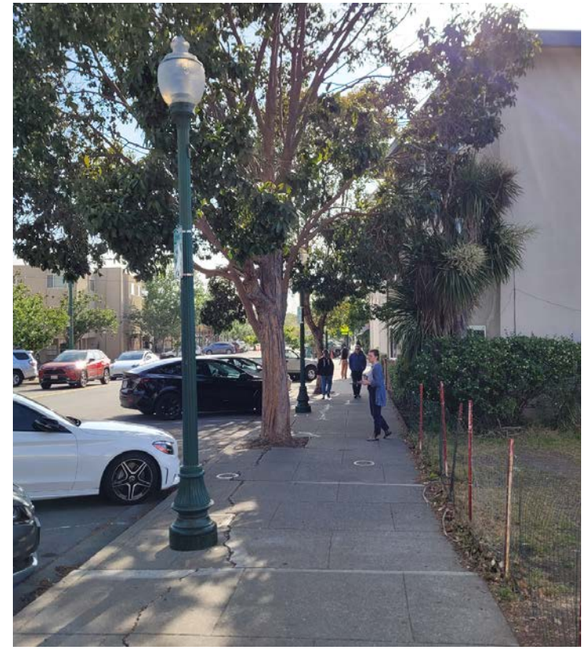
6 SITE 6 - SOLANO AVENUE

Span: (Evelyn to Talbot)

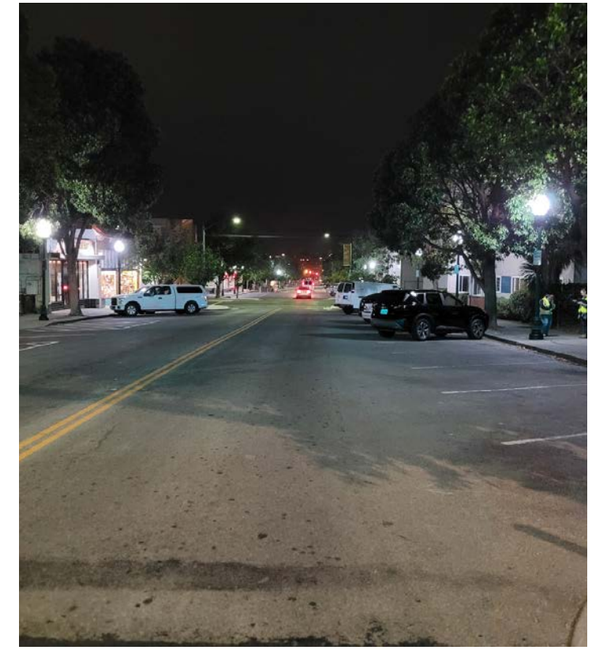
Street Classification: Arterial

Initial Site Observations:

- **Time:** Site was visited at approximately 5:45 PM & 11:10 PM
- **Location:** Site is along an arterial street in a commercial area with low pedestrian activity at night
- **Street:** This area is receiving streetlighting from pedestrian-scale acorn lights. While the roadway feels comfortably and uniformly lit, this type of luminaire can be glary for drivers.
- **Sidewalk:** The sidewalks are uniformly lit and are comfortable to walk around at night. However, this area feels brighter than other similar areas in the City.
- **Light Trespass:** The light trespass in this area is severe. The acorn luminaires offer no shielding and is using a bright light source with a high color temperature. This is not energy efficient and is very detrimental to the night sky and nearby residences. This is likely disturbing residents and is contributing to light pollution in the region.



SITE PHOTO: DAY



SITE PHOTO: NIGHT

Site 6 – Solano Avenue (Evelyn to Talbot)						
Street Classification	Arterial					
Land Use	Commercial					
Pedestrian Activity	Low					
Illuminance Summary (fc)						
	Avg	Max	Min	Avg/Min	Max/Min	Multiple of Criteria
Sidewalk Criteria	0.2			10		HIGH
Sidewalk Summary Eh	0.8	1.5	0.1	5.3	10.8	3.79
Sidewalk Summary Ev	0.5	1.5	0.1	3.6	10.8	2.53
Light Trespass Criteria		0.3				HIGH
Light Trespass Eh		0.0				0.0
Light Trespass Ev		1.1				3.6
Street Luminance Summary - cd/m2						
	Avg	Max	Min	Avg/Min	Max/Min	
Criteria	0.6			3.5		ADEQUATE
Measurement Summary	0.5	0.8	0.3	1.8	3.0	0.8

Lighting Measurements:

- **Avg**: Average Illuminance (fc) or Luminance (cd/m²) should be within a reasonable range (+/-) of the criteria. An acceptable Multiple of Criteria is therefore 0.8 to 1.5. The light levels on the sidewalk are excessive while the light on the street itself is within the expected range of criteria.
- **Avg/Min**: This measures uniformity and should be somewhat less than or equal to the stated criteria. The lighting on this site is extremely uniform, which may unintentionally result in reduced visual performance due to lowered contrast.
- **Light Trespass**: This measurement significantly exceeds the intended criteria for this street typology. Lighting is not being confined to street and sidewalk surfaces appropriately.

Proposed Improvements:

- **Comprehensive Lighting Redesign:** As a core retail/commercial/mixed use corridor, Solano Ave will be a priority for the City when streetscape updates take place. A street and pedestrian lighting design that enhances the visual character of the City should be a key component of any future streetscape project.
- **Change CCT:** The current CCT being used here is 5000K. This is inappropriate for outdoor use, especially near residences and in an unshielded luminaire. The CCT should be reduced to a maximum of 2700K as soon as possible.

7 SITE 7 - SAN PABLO AVENUE

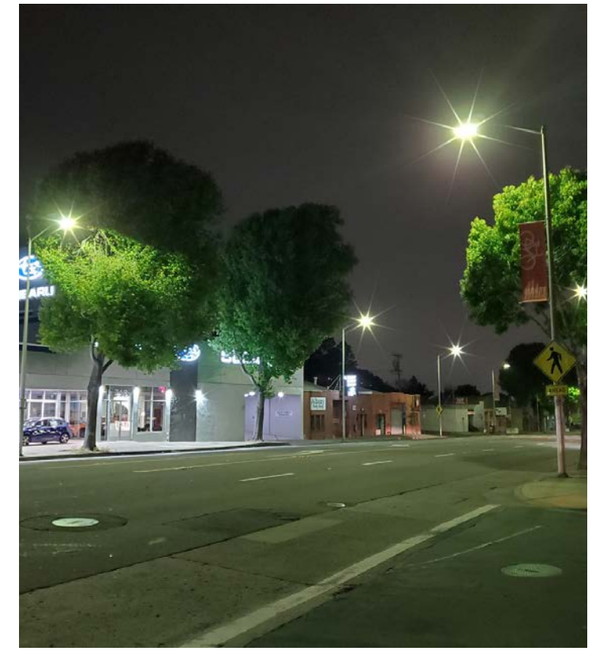
Span: (Washington to Garfield)

Street Classification: Arterial

Initial Site Observations:

- **Time:** Site was visited at approximately 5:50 PM & 11:40 PM
- **Location:** Site is along an arterial street in a commercial area with low pedestrian activity at night. This arterial is managed by Caltrans and an updated design for the corridor is pending.
- **Street:** The streetlighting in this area is from typical LED cobraheads. When part of a signalized intersection these luminaires are owned by Caltrans. The lighting in the street wasn't uncomfortable, but felt high for the low activity level when the site was observed.
- **Sidewalk:** The sidewalks are uniformly lit and are comfortable to walk around at night. However, this area feels brighter than other areas in the City. Combined with lighting from businesses, some areas feel overbright and harsh.
- **Light Trespass:** While this site is mainly commercial, there is still a significant amount of streetlighting on building facades. This is detrimental to the night sky and the environment. It could also diminish the impact of these businesses' decorative lighting and architecture.

SITE PHOTO: DAY



SITE PHOTO: NIGHT

Site 7 – San Pablo Avenue (Washington to Garfield)						
Street Classification	Arterial					
Land Use	Commercial					
Pedestrian Activity	Low					
Illuminance Summary (fc)						
	Avg	Max	Min	Avg/Min	Max/Min	Multiple of Criteria
Sidewalk Criteria	0.2			10		HIGH
Sidewalk Summary Eh	0.6	1.2	0.2	3.1	6.0	3.14
Sidewalk Summary Ev	0.3	1.0	0.1	5.2	16.2	1.57
Light Trespass Criteria		0.3				HIGH
Light Trespass Eh		0.0				0.0
Light Trespass Ev		0.3				1.0
Street Luminance Summary - cd/m2						
	Avg	Max	Min	Avg/Min	Max/Min	
Criteria	0.6			3.5		HIGH
Measurement Summary	0.9	1.8	0.5	1.6	3.3	1.4

Lighting Measurements:

- **Avg**: Average Illuminance (fc) or Luminance (cd/m²) should be within a reasonable range (+/-) of the criteria. An acceptable Multiple of Criteria is therefore 0.8 to 1.5. The light levels on the sidewalk and street are excessive.
- **Avg/Min**: This measures uniformity and should be somewhat less than or equal to the stated criteria. The lighting on this site is extremely uniform, which may unintentionally result in reduced visual performance due to lowered contrast.
- **Light Trespass**: This measurement exceeds the intended criteria appropriate for this street typology. Lighting is not being confined to street and sidewalk surfaces appropriately.

Proposed Improvements:

- **Additional Shielding:** Street and pedestrian lighting in this core retail/commercial/mixed-use area should be replaced with luminaires that have better shielding to reduce light trespass and light pollution. Better shielding would also reduce glare that may be uncomfortable for drivers and keep streetlighting from conflicting with businesses' facade lighting.
- **Part-Night Dimming:** These lights could be dimmed during the late-night hours while still maintaining appropriate visibility and safety for any drivers that may pass through this arterial at those times. Part-night dimming saves energy and does not negatively impact drivers as their headlights are sufficient for the reduced amount of conflicts encountered late at night.

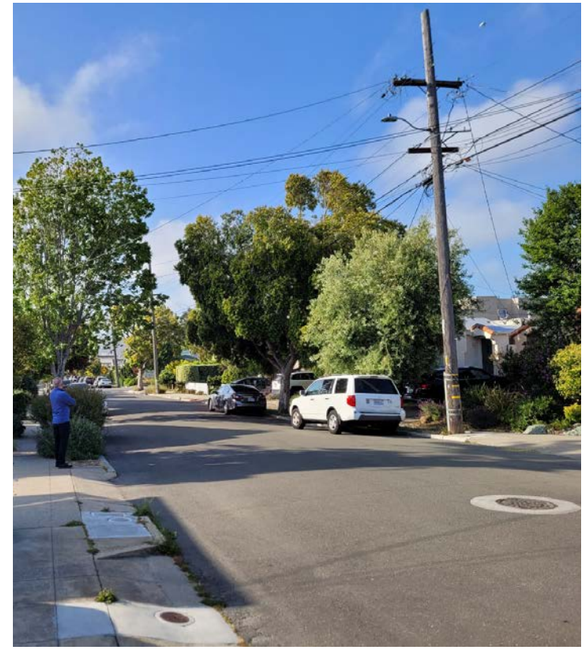
8 SITE 8 - EVELYN AVENUE

Span: (Garfield to Portland)

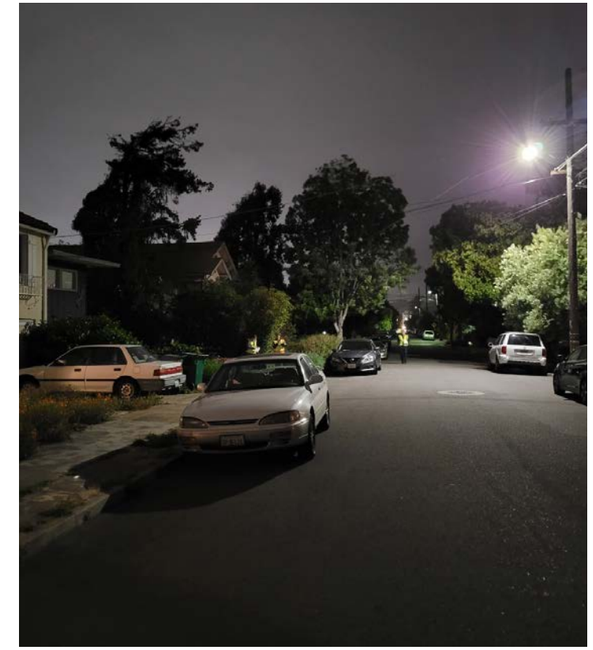
Street Classification: Residential/Local

Initial Site Observations:

- **Time:** Site was visited at approximately 5:55 PM & 11:30 PM
- **Location:** Site is along a local, residential street with low pedestrian activity at night
- **Street:** This site was illuminated by mid-block lighting. While the area was not lit continuously, visibility was sufficient for navigating the street.
- **Sidewalk:** The sidewalks in this area were adequate, but the areas closer to the mid-block luminaire felt significantly brighter than areas several houses down.
- **Light Trespass:** The light trespass on this site is severe. The narrow streets exacerbate the issue. Facades and windows of homes are being brightly lit due to poor shielding and an inappropriate light distribution pattern. This is likely disturbing residents and is contributing to light pollution.



SITE PHOTO: DAY



SITE PHOTO: NIGHT

Site 8 – Evelyn Avenue (Garfield to Portland)						
Street Classification	Local / Local					
Land Use	Residential					
Pedestrian Activity	Low					
Illuminance Summary (fc)						
	Avg	Max	Min	Avg/Min	Max/Min	Multiple of Criteria
Sidewalk Criteria	0.2			10		ADEQUATE
Sidewalk Summary Eh	0.2	0.5	0.0	13.6	33.0	0.95
Sidewalk Summary Ev	0.1	0.5	0.0	12.9	54.6	0.64
Light Trespass Criteria		0.1				HIGH
Light Trespass Eh		0.0				0.0
Light Trespass Ev		0.4				1.2
Street Luminance Summary - cd/m2						
	Avg	Max	Min	Avg/Min	Max/Min	
Criteria	0.3			6.0		LOW
Measurement Summary	0.2	0.4	0.0	6.1	14.0	0.6

Lighting Measurements:

- **Avg**: Average Illuminance (fc) or Luminance (cd/m²) should be within a reasonable range (+/-) of the criteria. An acceptable Multiple of Criteria is therefore 0.8 to 1.5. At this site the lighting on the sidewalk is appropriate. The street is below the criteria yet also feels appropriate and provides good visibility.
- **Avg/Min**: This measures uniformity and should be somewhat less than or equal to the stated criteria. The lighting for this site meets this criteria.
- **Light Trespass**: This measurement significantly exceeds the intended criteria appropriate for this street typology. Lighting is not being confined to street and sidewalk surfaces appropriately.

Proposed Improvements:

- **Evaluate Mid-block Lighting:** Continuous street lighting is not warranted in this type of residential neighborhood, especially with the short block lengths here. Adding mid-block lighting should be driven by neighborhood preferences but should not be considered compulsory. Extra care should be given to shielding options to reduce light trespass.
- **Additional Shielding:** This could lower the amount of light trespass without changing the luminaires. Backlight or front-side shields should be considered depending on the street. A few luminaires could be shielded as a pilot to gauge if the residents prefer the change or not.

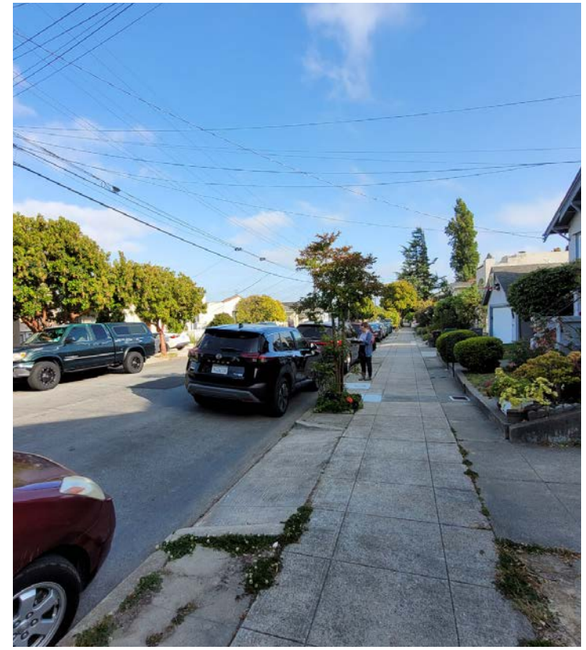
9 SITE 9 - MADISON STREET

Span: (Washington to Castro)

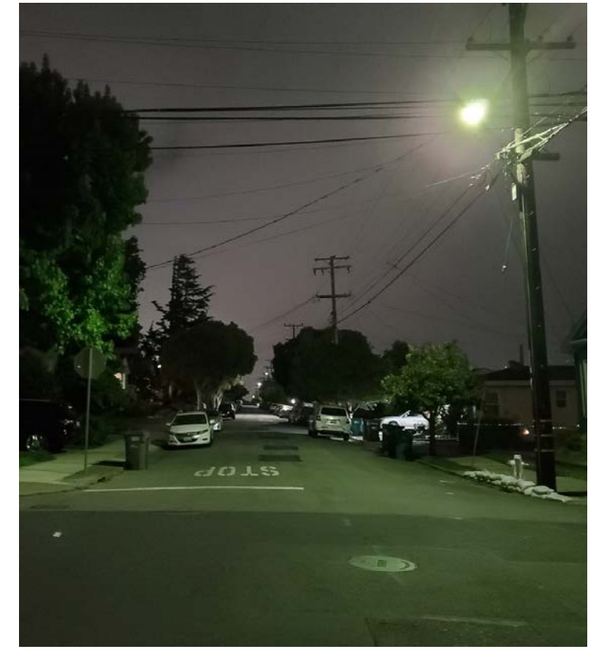
Street Classification: Residential/Local

Initial Site Observations:

- **Time:** Site was visited at approximately 6:00 PM & 12:00 PM
- **Location:** Site is along a local, residential street with low pedestrian activity at night
- **Street:** This site was mainly illuminated by mid-block lighting. Longer block lengths in this area made the mid-block lighting feel more appropriate for navigating the street.
- **Sidewalk:** The sidewalks along this site were visually comfortable with few areas of intense shadow or excessive brightness.
- **Light Trespass:** Mature trees and wider streets reduced the intensity of the light trespass taking place when compared to similar sites. However, the amount of streetlighting spilling into yards and windows was noticeable. This sites proximity to the Albany Hill park space makes light trespass a heightened concern due to the potential for negative environmental impact.



SITE PHOTO: DAY



SITE PHOTO: NIGHT

Site 9 – Madison Street (Washington to Castro)						
Street Classification	Local / Local					
Land Use	Residential					
Pedestrian Activity	Low					
Illuminance Summary (fc)						
	Avg	Max	Min	Avg/Min	Max/Min	Multiple of Criteria
Sidewalk Criteria	0.2			10		ADEQUATE
Sidewalk Summary Eh	0.2	0.4	0.0	4.7	10.0	0.92
Sidewalk Summary Ev	0.1	0.4	0.0	6.1	23.2	0.58
Light Trespass Criteria		0.1				HIGH
Light Trespass Eh		0.0				0.0
Light Trespass Ev		0.3				1.0
Street Luminance Summary - cd/m2						
	Avg	Max	Min	Avg/Min	Max/Min	
Criteria	0.3			6.0		ADEQUATE
Measurement Summary	0.2	0.6	0.0	7.4	19.7	0.7

Lighting Measurements:

- **Avg**: Average Illuminance (fc) or Luminance (cd/m²) should be within a reasonable range (+/-) of the criteria. An acceptable Multiple of Criteria is therefore 0.8 to 1.5. At this site, the lighting on the sidewalk and the street both met criteria satisfactorily.
- **Avg/Min**: This measures uniformity and should be somewhat less than or equal to the stated criteria. The lighting for this site meets this criteria.
- **Light Trespass**: This measurement exceeds the intended criteria appropriate for this street typology. Lighting is not being confined to street and sidewalk surfaces appropriately.

Proposed Improvements:

- **Lower CCT's:** On local residential streets, CCT's lower than California's upcoming typical 2700K can be considered. In neighborhood settings with lower traffic and pedestrian volumes, CCT's of 1800K to 2200K can be considered. This can be determined by neighborhood preference or by proximity to natural spaces that would benefit.
- **Part-Night Dimming:** These lights could be dimmed during the late-night hours while still maintaining appropriate visibility and safety for any drivers or pedestrians that may pass through. The low overall activity level expected in a residential area late at night means there are less potential conflicts occurring on the streets and more need for healthy darkness for sleeping.

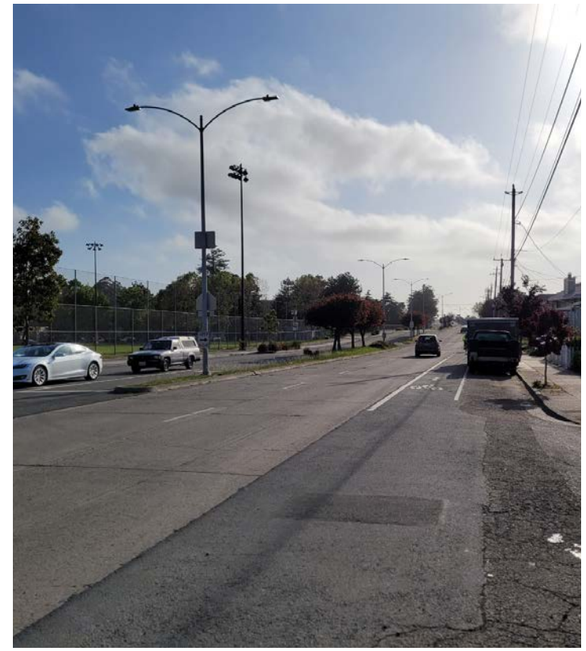
10 SITE 10 - BUCHANAN STREET

Span: (Taylor to Madison)

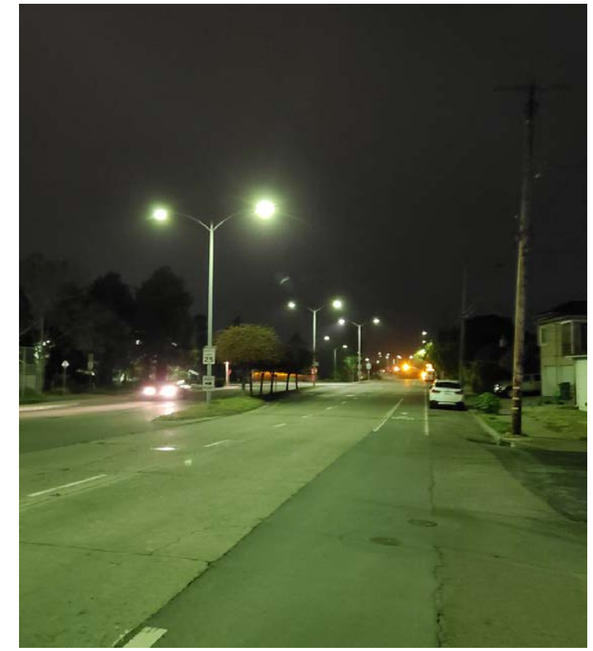
Street Classification: Arterial

Initial Site Observations:

- **Time:** Site was visited at approximately 6:10 PM & 12:10 AM
- **Location:** Site is along an arterial street with a Class I bicycle path, Class II bicycle lane, and low pedestrian activity at night. All measurements were taken on the north side of the site.
- **Street:** Streetlighting is being provided to this site through median-mounted, LED cobraheads mounted at a height suitable for lighting a major roadway. There was some variation in CCT's and luminaire type.
- **Sidewalk:** The sidewalks are uniformly lit and are comfortable to walk around at night. However, this area feels brighter for pedestrians than other areas in the City.
- **Light Trespass:** The light trespass on this site is severe. Facades and windows of homes are being brightly lit due to poor shielding and light distribution. This is likely disturbing residents and is contributing to light pollution in the region.



SITE PHOTO: DAY



SITE PHOTO: NIGHT

Site 10 – Buchanan Street (Taylor to Madison)						
Street Classification	Arterial					
Land Use	Residential / Park / School					
Pedestrian Activity	Medium					
Illuminance Summary (fc)						
	Avg	Max	Min	Avg/Min	Max/Min	Multiple of Criteria
Sidewalk Criteria	0.5			5		LOW
Sidewalk Summary Eh	0.2	0.5	0.1	4.2	8.5	0.48
Sidewalk Summary Ev	0.2	0.7	0.1	2.9	8.3	0.45
Light Trespass Criteria		0.3				HIGH
Light Trespass Eh		0.0				0.0
Light Trespass Ev		0.5				1.8
Street Luminance Summary - cd/m2						
	Avg	Max	Min	Avg/Min	Max/Min	
Criteria	0.9			3.0		LOW
Measurement Summary	0.5	0.8	0.2	2.4	3.7	0.6

Lighting Measurements:

- **Avg**: Average Illuminance (fc) or Luminance (cd/m²) should be within a reasonable range (+/-) of the criteria. An acceptable Multiple of Criteria is therefore 0.8 to 1.5. The lighting on the street meets criteria.
- **Avg/Min**: This measures uniformity and should be somewhat less than or equal to the stated criteria. The lighting for this site meets this criteria.
- **Light Trespass**: This measurement significantly exceeds the intended criteria appropriate for this street typology. Lighting is not being confined to street and sidewalk surfaces appropriately.

Key Improvement:

- **Reduce Pole Heights:** A reduction in pole height as the current poles reach their end of service, around 5' shorter, could help reduce the light spilling outwards into neighboring properties in addition to any shielding options and keep it closer to the road's surface.
- **Part-Night Dimming:** These lights could be dimmed during the late-night hours while still maintaining appropriate visibility and safety for any drivers that may pass through this arterial at those times. Part-night dimming saves energy and does not negatively impact drivers as their headlights are sufficient for the reduced amount of conflicts encountered late at night.

RECOMMENDATIONS & OBSERVATIONS

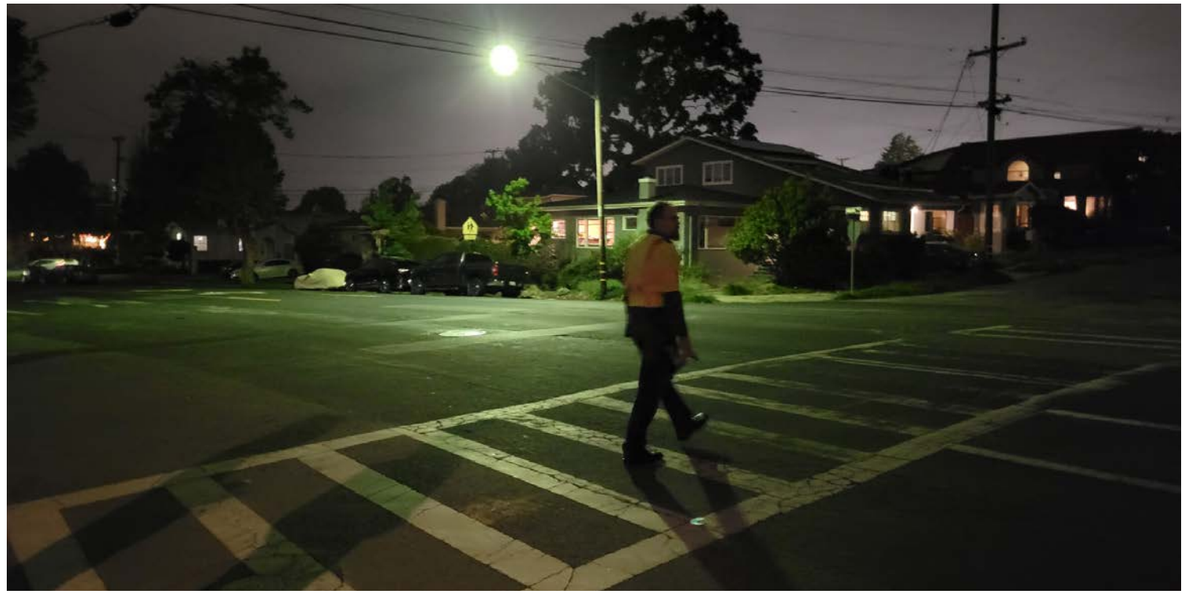
ROLE OF CROSSWALKS IN ALBANY

Most of Albany's pedestrian and cyclist traffic moves through the City via sidewalks or on-street bikeways. While there are several off-street trails that see high usage rates, especially the Ohlone Greenway, these trails are in few locations throughout the City. Most of the lighting for pedestrians and cyclists is therefore provided by streetlighting. Since there are many sidewalks and short block lengths in Albany there are many crosswalks. These crosswalks are often the key conflict zone between pedestrians and vehicles and require extra care be taken with their lighting.

The first photo to the right shows a crosswalk that is lit evenly all the way across the street, providing a consistent visual experience for the pedestrian and driver. The second photo below shows a crosswalk that is not lit consistently. The intended crossing relies on lighting pedestrians in silhouette from a single luminaire on the opposite side of the street, which leaves them less visible to oncoming vehicles. Pedestrians may choose to cross elsewhere at this intersection as the side of the road without the painted crosswalk has more even lighting. The third photo shows a crosswalk being lit by two different CCT's from above and from across the street, which is not ideal for good visibility. The pedestrian pole seen on the corner of this particular Ohlone Greenway crossing is out of service.

Improving the consistency and quality of crosswalk lighting throughout Albany would be a significant improvement for pedestrian safety for the community.

WELL-LIT CROSSWALK



POORLY-LIT CROSSWALK

UNEVENLY-LIT CROSSWALK

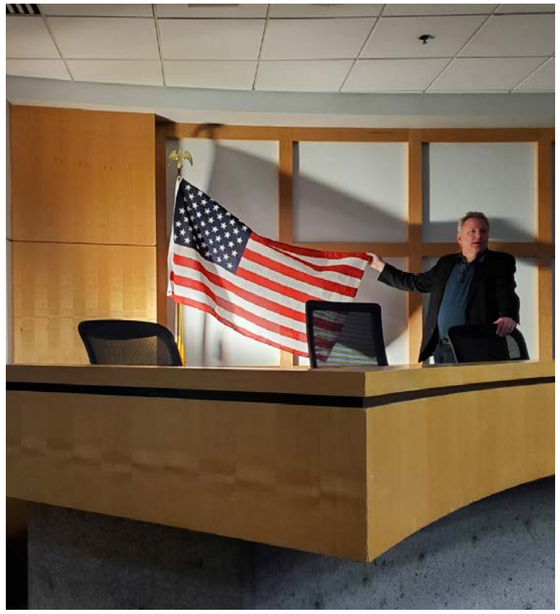
CORRELATED COLOR TEMPERATURES

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. The five (5) color temperatures shown are 2200K, 2700K, 3000K, 3500K, 4000K.

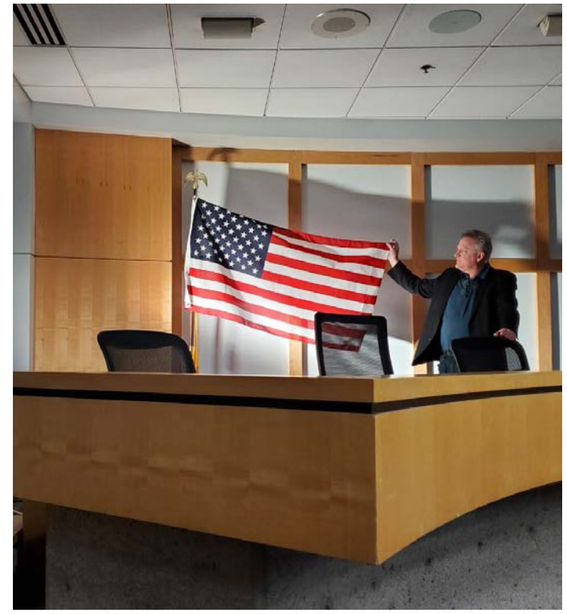
- 2200K - This CCT is often encouraged near ecologically sensitive areas such as natural parks, waterways, or coastlines. Light sources of this temperature generally contain the least amount of disruptive blue light.
- 2700K - This CCT is being pursued as a standard outdoor lighting CCT by California. It is now a standard offering by many manufacturers.
- 3000K - This CCT has become very standard for 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.

2200K

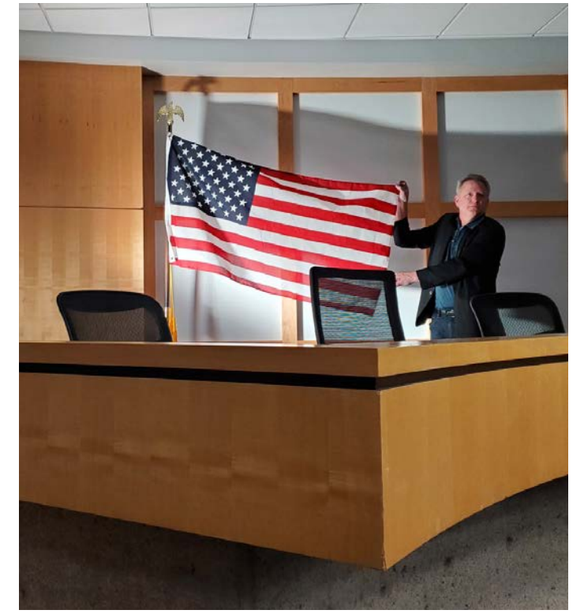
2700K



3000K



3500K



4000K

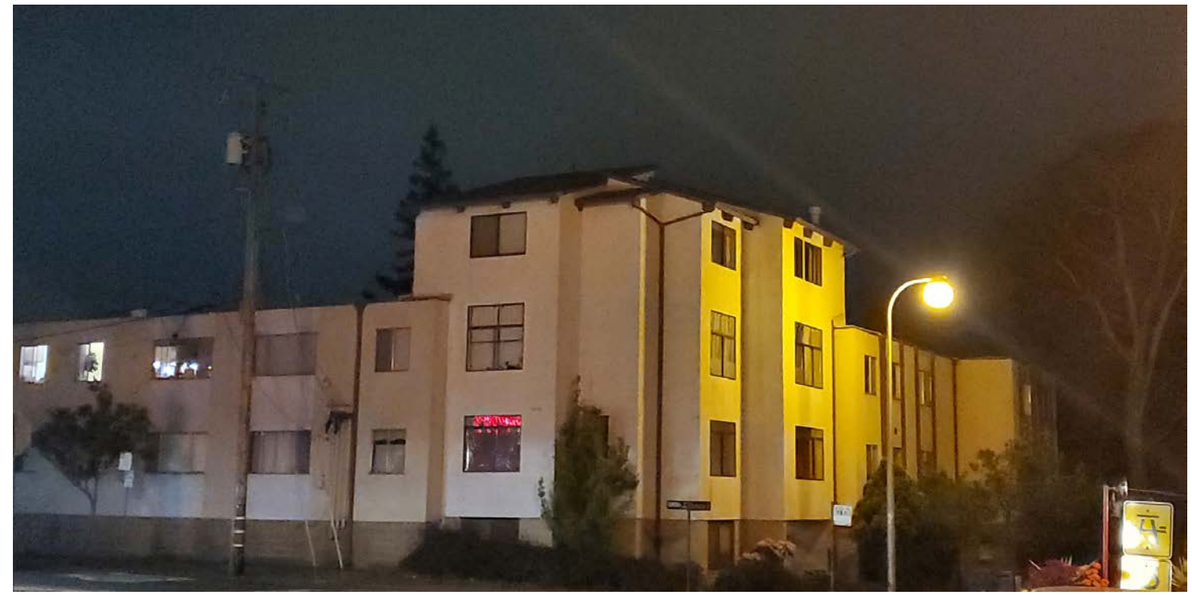
LIGHT TRESPASS

Light trespass occurs when light is shining beyond the area intended to be lit. This can occur due to overlighting, using the wrong luminaire for the needs of the site, poor luminaire shielding, or poor luminaire placement. Even a well-controlled, fully shielded luminaire may cause light trespass if it is not located or oriented properly on a site. Topography and other unchangeable site conditions can easily lead to this.

These photos show examples of light trespass taking place when streetlighting shines into residential windows and onto residential facades instead of onto street and sidewalk surfaces.

Light trespass can be a significant neighborhood nuisance, resulting in disturbed sleep or loss of privacy for residents. Light trespass is also a waste of energy due to the amount of light being paid for through energy bills that is then missing its target. There are also negative environmental impacts from unmitigated light trespass. Light trespass from busier, denser areas into natural spaces can disrupt both plants and animals health and behaviors.

Light trespass can be addressed through using appropriate light levels for the area being lit, adding backlight shielding to existing luminaires if needed, and the use of luminaires with no measurable uplight.



LIGHT TRESPASS FROM UNSHIELDED LUMINAIRE

LIGHT TRESPASS FROM EXCESSIVE STREET LIGHTING

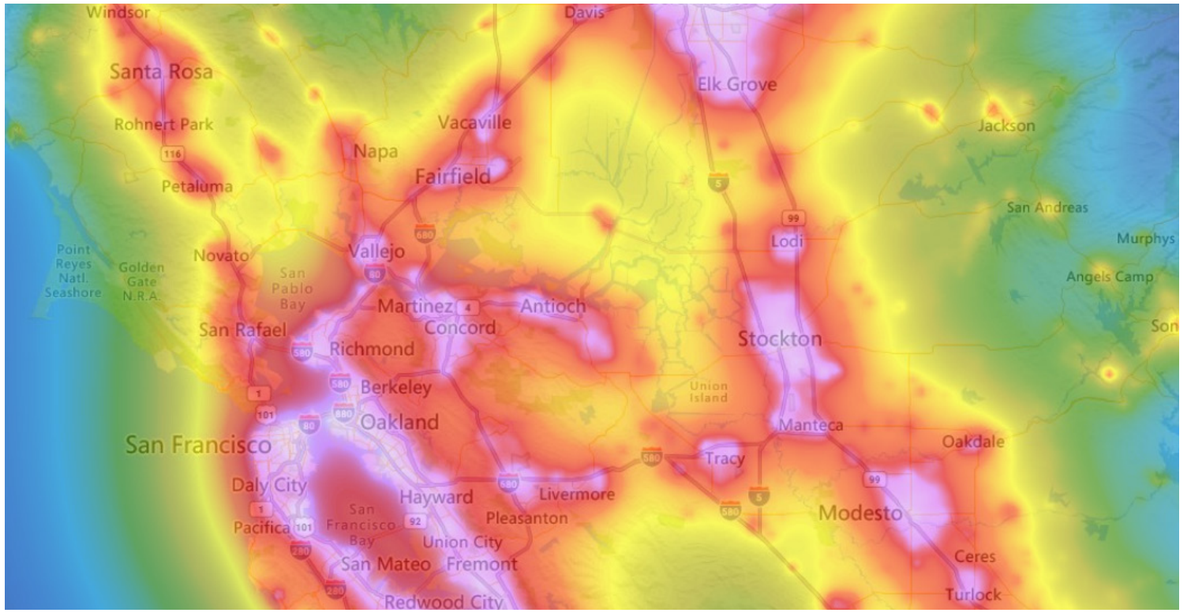
LIGHT TRESPASS FROM UNSHIELDED LUMINAIRE

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. Albany, like its neighboring cities, scores at the highest end of the scale for zenith sky brightness, a measurement of night sky quality. The upper right photo shows how the current level of sky glow in Albany impacts the appearance of its nighttime cloud cover.

Improving the shielding requirements for luminaires, using the minimum amount of lumens needed for a street typology, limiting the CCT's being used outdoors, and dimming street lights during hours with lower activity can all help improve a City's light pollution level. While changes made in Albany are unlikely to impact the regional levels of light pollution, there is still the potential to improve the nighttime experience of the City's residents and set a good example for ecologically responsible lighting for neighboring cities.

SKY GLOW OVER ALBANY



REGIONAL LIGHT POLLUTION

ZENITH SKY BRIGHTNESS

GENERAL RECOMMENDATIONS

Most of the following recommendations can be applied to many areas in Albany. While some currently are only applicable to a few locations, the lighting design principles behind would still apply should they become relevant in other locations of the City in the future.

- **Additional Shielding:** 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 nearing their end-of-service period. Back side shielding would help prevent light trespass from taking place behind the luminaire and front side shielding would prevent light from spilling too far across the street and sidewalk. Some backlight can be useful for sidewalks and entries, so a few luminaires could be shielded in an area as a pilot to gauge if the residents prefer the change or not.
- **Comprehensive Lighting Redesign**: A street and pedestrian lighting design that enhances the visual character of the City should be a key component of any future streetscape project. There are many opportunities to incorporate lighting into new landscaping or street furniture and these should be considered for any major street redesign project or master planning effort in Albany. Major retail/commercial/mixed use corridors where there is higher pedestrian traffic at night should take priority. Solano Avenue should be considered for this type of effort. The Ohlone Greenway also presents an opportunity to enhance visual character and improve the pedestrian experience in the area.
- **Evaluate Usage of Mid-block Lighting:** Adding mid-block lighting should be driven by neighborhood preferences but should not be considered compulsory. IES criteria would usually not warrant continuous lighting on residential streets with low activity at night, especially with the short block lengths in many areas of Albany. Extra care should be given to providing shielding options to reduce light trespass when this type of lighting has been requested by a street or neighborhood. It is recommended mid-block lighting not be installed when it is only being requested by a singular household. This recommendation applies to Sites 3 and 8, could also apply to Site 9, and would also apply to any similar areas throughout the City.
- **Intersection & Crosswalk Lighting:** Crosswalk improvements have been an ongoing project in the City. Poorly illuminated intersections and crosswalks such as the ones along Upper Marin Ave should be prioritized for investment in improved street lighting. This is a safety concern for any pedestrians or cyclists in this area at night.
- **One-for-One Replacements:** The existing spacing of the post-top luminaires in some locations such as along Masonic Avenue or Solano Avenue is generally acceptable. The luminaires should be replaced in a one-for-one strategy with a low-glare luminaire with better backlight shielding to address the serious light trespass. As these areas mostly would not require changes to electrical designs or existing poles, they may be faster to upgrade and could serve as pilot areas for the City if prioritized.
- **Part-Night Dimming:** This strategy reduces the output of lumens during the part of the night with reduced outdoor activity, often somewhere in the range between 11 PM and 5 AM. This strategy is appropriate for arterials and collectors that don't experience much late night traffic and for residential areas where it could otherwise disturb people trying to sleep. Part-night dimming saves energy, reduces environmental impacts of outdoor lighting, and could be applied throughout the City. This would require luminaires with dimming capabilities. There are set-it-and-forget-it options, but a 7-pin photocell receptacle for any future wireless lighting control systems should be part of any chosen luminaire in order to future-proof the system.
- **Pedestrian Scale Lighting**: Albany should consider incorporating more pedestrian scale lighting options. Pedestrian scale poles could be used to supplement street lighting at intersections or as an alternative for mid-block lighting whenever additional lighting is needed or requested. This should be driven by neighborhood preference. There may be interest in this option or residents may prefer a darker nighttime environment.
- **Reduce Pole Heights:** A reduction in pole height for several arterial streets as the current poles reach their end of service, around 5' shorter, could help reduce the light spilling outwards into neighboring properties. This would be in addition to adding any shielding options, but would keep the light closer to the road's surface.
- **Reduce Uplight:** There are several locations in the City 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 U0 strongly encouraged. This will improve light trespass and light pollution.
- **Relocate lights within Tree Canopies:** Some streetlights are currently located within the tree canopies which are shadowing most of the light from these luminaires. This is energy inefficient and negatively impacts the health of the tree. When possible these streetlights should be relocated rather than damage the mature trees. As seen in the map on page 12, this occurs throughout the City but not severely for overwhelming numbers of luminaires.
- **Standardize CCT's:** It is typically recommended that outdoor lighting for most outdoor applications not exceed a CCT of 3000K. California has been pursuing a maximum outdoor CCT of 2700K. Many locations in Albany are currently using 5000K, which is not appropriate for use in or near neighborhoods and increases sky glow. 2700K is appropriate for use along Albany's arterial and collector streets. 2200K is an appropriate temperature for use in residential neighborhoods or parks. 1800K may be more appropriate in some parks or near the coastline. A maximum CCT of 2700K is recommended for anything being installed in Albany in order to future-proof the City's investments in lighting against future changes to state policy.