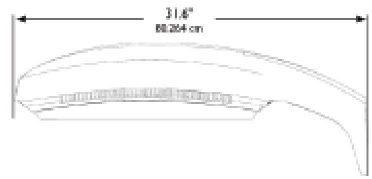
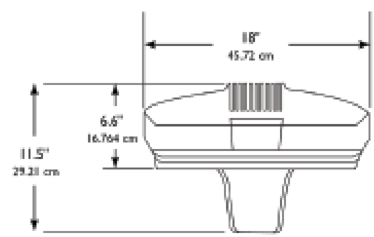
UVA STANDARD POLE LIGHT FIXTURES*

*This document supersedes specifications for standard fixtures in the 2011 Exterior Lighting Study

PHILLIPS GARDCO GULLWING

For use in parking lots, roadways, at crosswalks, service areas



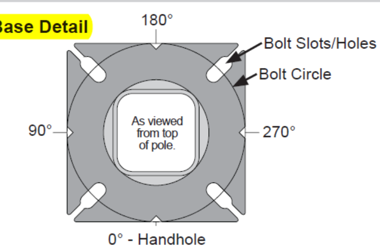


Fixture Housing Nominally 18" x 12"x32" long die cast aluminum housing
Lamp LED Array 3000K
Max Wattage 105
Volts 120 - 277 (UNIVERSAL)
Control Gear Integral power supply
Manufacturer Gardco
Color Bronze
Catalog # GL18-1-5-105LA4870-NW-UNV-BRP-SPR
Pole Height 20'
Pole catalog# SSS4-20-4-11-D1-BRP (Alternate Pole by Valmont: DS330-4"-20')

ANCHORAGE DATA

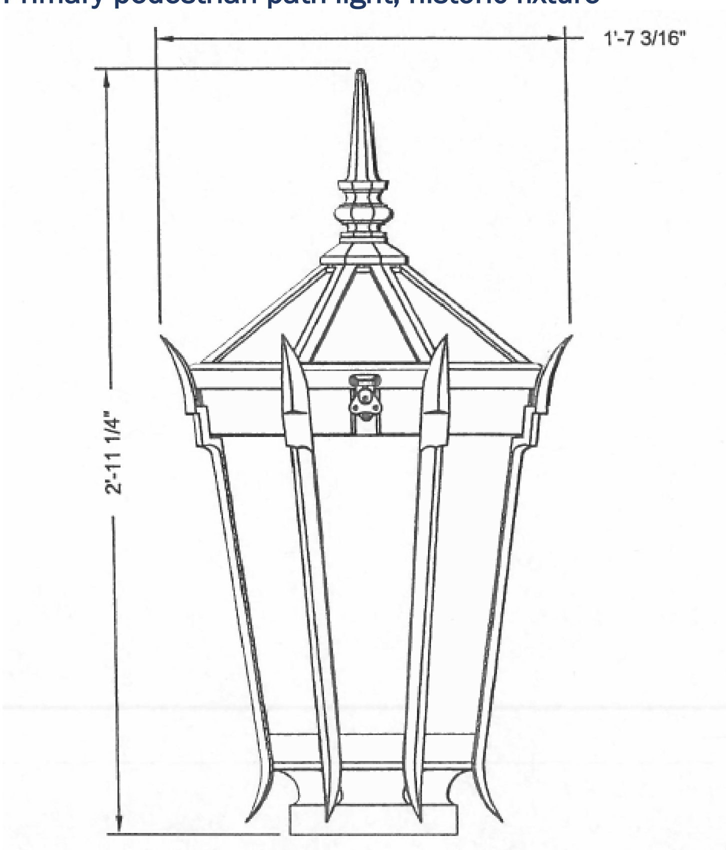
POLE		BASE PLATE				ANCHOR BOLTS		
		BOLT CIRCLE						
POLE BASE SQUARE (IN)	WALL THK (GA)	DIA (IN)	± (IN)	SQUARE (IN)	THK (IN)	DIA x LENGTH x HOOK (IN)	PROJECTION (IN)	± (IN)
4.00	11	8.50	0.50	8.25	0.750	0.75 x 17.00 x 3.00	3.50	0.25
4.00	7	8.50	0.50	8.25	0.875	0.75 x 17.00 x 3.00	3.63	0.25
5.00	11	11.00	1.00	11.00	1.000	0.75 x 17.00 x 3.00	3.75	0.25
5.00	7	11.00	1.00	11.00	1.000	0.75 x 17.00 x 3.00	3.75	0.25
6.00	7	12.00	1.00	12.50	1.000	1.00 x 36.00 x 4.00	4.25	0.25

Anchor Base Detail



EDGEWATER

Primary pedestrian path light; historic fixture



Mounting Fixture head to accept a 3 1/2" diameter x 3" high tenon on campus standard pole Fixture head to be mounted to 12' octagonal cast aluminum pole and base with UVA logo
Housing Nominally 20" diameter x 34" tall cast aluminum housings
Reflector / Lens / Louver Diffuse pebbled acrylic lens
Lamp Quantity LED array
Max Wattage 95-100
Volts 120 - 277 (UNIVERSAL)
Control Gear Integral power supply
Lamp Integral Neutral White LED, 3000K
Pole Height 12'
Color Rookwood Shutter green
Acceptable Products:

1. King Luminaire -K56
2. Spring City Edgewater- ALMEDM-LE095
3. Halophane Jefferson JFE2

Edgewater Pole Alternate: ELA Lighting: P3059-12'-7"x1 ½" Tenon-seal-RSG

BEGA WEDGE
Secondary pedestrian path light; also for use in residential areas and the Observatory Hill sensitive zone

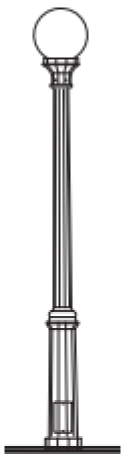
Pole Color Bronze
Pole Height 14'
Reflector / Lens / Louver Clear tempered glass lens
Lamp Integral White LED, 3000K
Max Wattage 26
Volts 120-277V (UNIVERSAL)
Catalog # 77928LED-BRZ
Manufacturer BEGA

BEGA PLAZA
For use in contemporary plaza areas

Catalog# BEGA 88 309
Color Silver
Pole height 12'
Wattage 56W LED .
Temperature 3000K (>80 CRI)
Voltage 120 V through 277 V (UNIVERSAL)

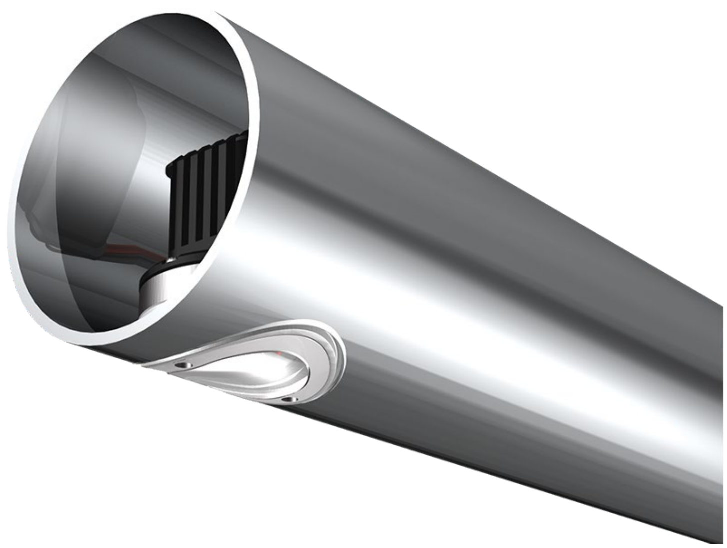
ELA GLOBE

For use in historic areas where scale of Edgewater is inappropriate



Catalog# L9720/P3029
Color Rookwood Shutter Green
Pole height 8’
Wattage 30W LED .
Temperature 3000K
Voltage 120

KLIK LED POD 40
For use on site stairs in contemporary settings* where pole lights are not suitable due to grade and maintenance constraints.



Catalog LP
Color stainless steel
Pod size 25mm dia
Wattage 2W/Pod
Temperature 3000K
Voltage 24VDC (must use class 2 driver)

*for traditional areas where site stair handrail lights are needed, the traditional lamb's tongue handrail can be adapted to accept LED string lights in the "C" channel beneath the handrail.

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Introduction

The University of Virginia commissioned this Exterior Lighting Study with the intent of developing a Master Plan whose implementation will result in the improvement of the nighttime safety, security and aesthetic of the University grounds. In addition, other goals are to reduce maintenance and improve energy efficiency.

Thomas Jefferson founded the University of Virginia in 1819 based on the idea of an Academical Village. He envisioned an environment where the mind could expand and grow and there would be a free exchange of ideas. The University has grown dramatically from the time of Jefferson's Academical Village to now include expanded academics, research, sports facilities, medical research and clinical facilities. Some of these areas are in use 24 hours every day. Originally the University was illuminated with candle and oil lamps lighting and the internal grounds areas may have had minimal exterior lighting, probably limited to lanterns at building entries. Over time the use of outdoor lighting of pathways and roads increased in response to increasing nighttime use. In 1888, the University transitioned from gas lighting to the electric light and from high maintenance to decreasing maintenance cost. As the outdoor lighting has increased so has the nighttime presence of students, faculty and staff after dark.

A variety of pole or building mounted luminaires were installed and a certain "style" has evolved over the years. Some of these luminaires have now become the University standards.

The hierarchies for the use of standards are not always clear and have changed over time. One of the main objectives of the study is to establish hierarchies for the use of these existing standards and determine if any new luminaires and sources should be added to the standards inventory.

With energy Efficiency and sustainability playing a large part in design, all current luminaires need to be reviewed to determine if improvements are possible in energy efficiency, life cycle, maintenance, stray light reduction and controllability. The criteria for making recommendations will include:

1. Identification of specific nighttime activities and uses of areas and major pedestrian paths
2. Selection of the most appropriate lamp and fixture type for each area
3. Evaluation of maintenance considerations for re-lamping, cleaning and repair
4. Review of existing lighting equipment to determine types which are still appropriate and which are redundant or should be eliminated
5. Selection of appropriate new luminaire types as deemed necessary to meet the goals and criteria of the study

The study will address concerns voiced by many of the stake holders on the uniformity of lighting on grounds (or lack thereof) and will establish recommended light levels and quality for:

- Walkways and paths
- Stairs & Ramps
- Plazas & Gathering Spaces
- Building Mounted Lighting
- Bus Stops & Shelters
- Parking Lots
- University Roadways and Crosswalks
- Lighting for Areas with Security Cameras
- Art/Sculpture Lighting
- Building Facade Lighting
- Lighting Controls

Figure 1: Academical Village

Figure 2: Health Systems

Objectives

The main objective for this Lighting Study is to examine the criteria needed to clearly identify tasks and establish guidelines to determine proper luminaire and lamp choices, luminaire types and pole height and hierarchies for the uses of each type of equipment.

In addition, the objectives as set forth by the University Facilities Operation and Office of the Architect and stakeholders for the lighting study are as follows:

1. Provide a standard for lighting that will provide safe and secure nighttime environments on University pathways, plazas, crosswalks and roadways for students, faculty and staff.
2. Improve uniformity of lighting on pathways and streets and avoid over lighting and excessive contrast.
3. Develop a standard for luminaires that encompasses existing standards and replacements for the old inefficient luminaires.
4. Improve overall efficiency and sustainability of the exterior lighting systems through more efficient luminaires and sources in a cost effective manner.
5. Control stray or uplight from luminaires, especially in the "Observatory Sensitive Zone".
6. Improve and unify the nighttime aesthetic appearance of the University.
7. Create a hierarchy for the use of luminaires based on type of location and lighting criteria.
8. Develop standards for the design of specific areas, i.e. walkways and stairs, that can be easily interpreted for new developments or improving existing areas.
9. Address needs of security cameras with existing and new lighting standards.
10. Provide suggestions for improved methods of maintenance, lamp and ballast replacement and monitoring of the lighting systems.

Figure 3: McCormick Road and West Range non-uniform lighting on sidewalks and dark crosswalks

Figure 4: University Standard Edgewater pole & luminaire

Figure 5: Non-Standard Post Light

Evaluation of Existing Lighting

This study began with a series of meetings at the University with the main stakeholders representing all aspects of campus safety, maintenance, power and utilities, energy, sustainability, transportation, health systems, parking, University Police, astronomy, housing, Historic Preservation and the Office of the Architect for the University and Landscape Architect. From these meetings a list of problem areas and issues were developed, see insert A on page 4. The two strongest themes that were repeated at the meetings were:

1. The need to improve the uniformity of the lighting on pathways
2. The importance of increasing the quality of lighting on University roads where pedestrian and vehicular conflicts are prevalent.

Complicating these tasks is that many of the roads are not in the University's jurisdiction and the safety of students at crosswalks is a major concern.

In conjunction with the meetings there were tours of the University. GWA's team with assistance from several students began the task of surveying the Grounds by day and by night. Existing luminaire types were documented during the survey and measurements were taken after dark at some of the key problem areas.

GIS mapping of the University, including pole locations and luminaire types, was obtained from the University GIS group. This information was compared to the survey notes and photographs and discrepancies were corrected on the GWA plans for each of the University areas. The resulting maps clearly show the distribution of the various luminaire types on Grounds and provided a starting point for establishing recommended hierarchies for illumination of pathways and walkways.

Roadways & Crosswalks

Complicating any lighting plan is that the roadways which pass through and around the University are maintained by different entities, they are:

- University of Virginia
- City of Charlottesville
- County of Albemarle & State of Virginia

Of these different entities, the roadways on which the University-owned luminaires can be used are the State and the University. On City roads, the standard City luminaires are used unless outside of the City Right-of-Way in which case the University's luminaires can be used. Lighting of walkways adjacent to roadways is most often accomplished from the University's right of way. See Map on Appendix: III which shows the classification of the area roadways.

During site visits, illuminance measurements were taken on roadways and crosswalks, parking lots, walkways and plazas. These measurements are summarized on Appendix: XXIV and validate many of the comments made at the stakeholders meetings. Uniformity is an issue in most of these areas; for example, Crispell Road has the greatest variation in illuminance with an average to minimum ratio of 27 to 1. Hospital employees walking to their vehicles at late hours from bright areas to areas that are very dark causes them to feel vulnerable.

Another example is McCormick Road which has a very high density of students during the day and after dark, crossing the road, waiting for buses and riding bicycles. All of these activities create a potential for accidents. The road is lined with Edgewater metal halide luminaires, which are closely spaced. The Edgewater metal halide luminaires are bright sources defining the edge, and generally provide adequate lighting on the sidewalk. However, at crosswalks and on the road itself, the optics do not distribute the light adequately to the center of the roadway especially at bends in the road. Adding luminaires with more appropriate distribution to light crosswalks would enhance safety.

Several crosswalks have in-ground pedestrian crossing lights. This helps to alert oncoming vehicles of the presence of pedestrians, but actually seeing the pedestrian, especially in dark clothing, is very difficult.


Figure 6: Varsity Hall cul-de-sac

Walkways and Paths

Through the grounds of the University there are several types of pathways, those adjacent to roadways, some between buildings and others through open grass areas or wooded paths. Some of these pathways are heavily used both during the day and the night, others are more heavily used during the day. The location of the pathway also has an impact on the usage; such as in very public paths between classroom buildings or libraries or more private internal pathway in a student or faculty residential area.

Currently there are numerous pathway pole mounted luminaires in use on Grounds. One of the goals of the study is to reduce the number of luminaire types and develop a hierarchy for their use. This hierarchy would be based on the type of pathway and the recommended illuminance levels.

Light levels on the pathways vary greatly, some paths are not lighted and others are excessively lighted to 3 footcandles when .5 to 1 footcandle would suffice. The uniformity on existing pathways varies greatly and is one of the concerns voiced repeatedly during the initial stakeholders meetings.

Evaluation of Existing Lighting - Continued

INSERT A: Problem Areas Identified By Stakeholder Group

ROADWAYS

1. Massie Road Between Copeley Road and Leonard Sandridge Road
2. Emmet Street Between Massie Road and Copeley Road
3. University Way Between Lambeth Lane and Rugby Road
4. Intersection at Culbreth Road and Rugby Road
5. Bayly Drive
6. Emmet Street Between McCormick Road and Ivy Road
7. McCormick Road Between Emmet Street and University Avenue
8. McCormick Road Between Alderman Road and Edgemont Road
9. Alderman Road Between McCormick Road and Stadium Road
10. Stadium Road Between Maury Avenue and Piedmont Faculty Housing Road
11. Crispell Drive Between South Hospital Parking Garage and Roosevelt Brown Boulevard
12. Drive South-West of South Hospital Parking Garage to Outpatient Surgery Center
13. Copeley II & III Housing

PARKING LOTS

14. Judge Advocate General's School Parking Lots

WALKWAYS & PLAZAS

15. Walk Around Lambeth Field From Lambeth Commons to Lambeth Residences
16. Stairs between Rouss Hall and Pavilion X
17. Chemistry Building Plaza
18. Engineering School Walkways
19. Walkway at Lower lawn between Cocke and Rouss Halls
20. Bus Stops with shelters (John Paul Jones Arena)
21. Observatory Sensitive Zone – Edgewaters at O-Hill Dining Hall
22. Observatory Sensitive Zone – use of non-cutoff wall packs
23. Gooch-Dillard Dormitories– wooded area

STAIRS AND RAMPS

The hilly terrain of the grounds necessitates stairs and ramps. Critical for safety after dark is proper lighting. Step lights have been used in the majority of cases to illuminate the stairs. Difficulties in re-lamping due to corrosion or faulty wiring buried in walls have been responsible for the failure of many of these luminaires. The maintenance staff has removed many of the non-functioning step lights and replaced them with surface mounted fixtures, retrofitted onto plates which cover the existing hole. This is a viable solution in locations were the wiring is still functioning. The fixture used most often, however, does not meet ADA requirements for lighting fixtures surface mounted below 68”. The maximum allowable projection is 4” and many of these fixtures project as much as 6”. This is a tripping hazard, especially for the visually impaired.

Another solution has been locating historical post top fixtures adjacent to the stairs. This solution effectively lights the stairs and the adjacent grounds and provides light on people's faces. In many cases, this location has complicated maintenance because re-lamping cannot be accomplished simply with a lift truck, instead ladders are required and often there is no level, paved location to accommodate a ladder.

PLAZAS AND GATHERING SPACES

Throughout the Academic grounds and the Health System, there are numerous plazas provided for student, staff and faculty use. These create a sense of place as well as expressing an entry point for a building or sports facility. Lighting plays a major role in attracting people and making these spaces pleasant after dark.

A new plaza lighting standard was recently established and has been used successfully on the Clemons Library plaza. Previously some plazas have been lighted by low, wall mounted step lights around the perimeter. These illuminate the ground and establish the boundaries of the plazas. They do not provide any lighting onto tables, benches or the faces of people gathered in the area. The new post top mounted indirect luminaires, in contrast, provide a soft glow of light throughout the plaza, creating an inviting environment for nighttime informal gatherings and study groups.

Bollards have been used in some entry plazas, such as the Carl Smith Center. These also do not light faces and in this particular case have very little optical control and are offensively glaring to pedestrians. Glare causes the pupils of the eye to contract and hampers vision by the scattering of light on the retina. Bavaro Hall is another location where bollards were used to light an entry path. Here there is an excessive quantity of fixtures but faces are still unlit.

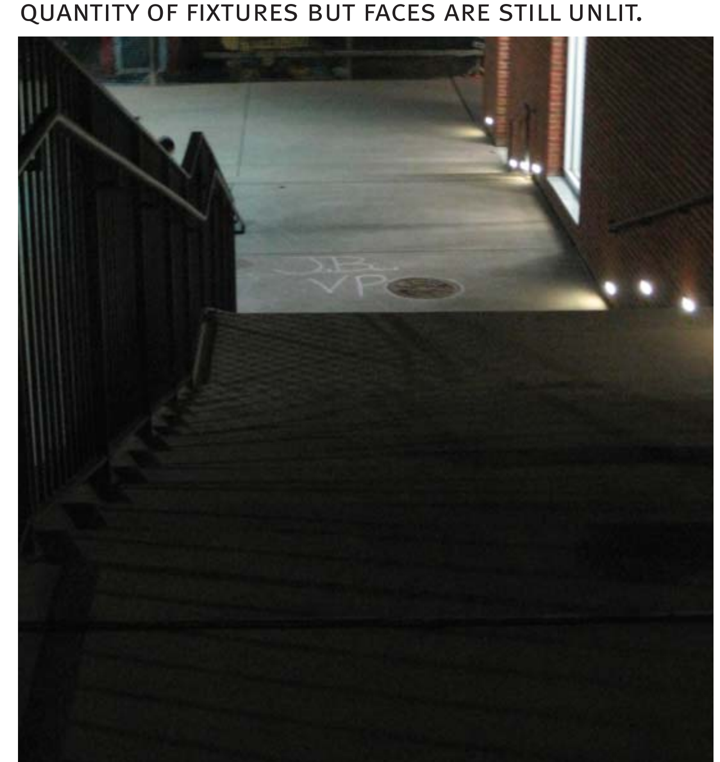


Figure 7: Dark Stairway

Figure 8: Dark Ramp & Plaza

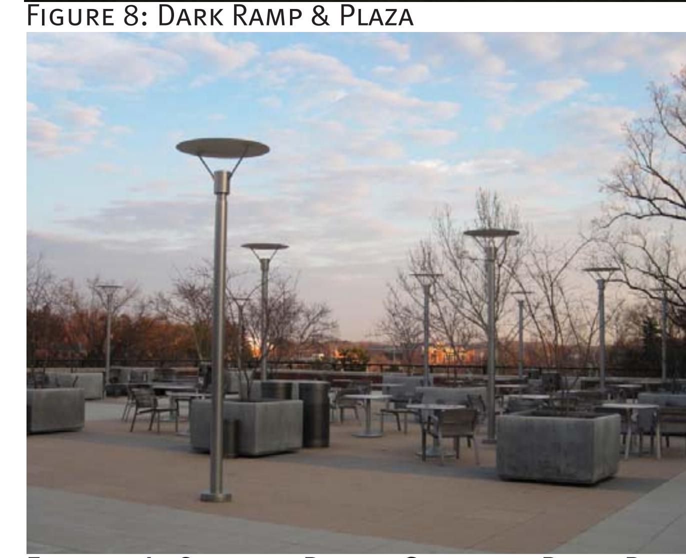


Figure 9A: Clemons Plaza - Standard Plaza Poles

Figure 9B: Clemons Plaza - Standard Plaza Poles

Evaluation of Existing Lighting - Continued

In this case, the bollards are spaced very close on center to provide the required light level at the sidewalk but again, faces are not lit and this contributes to a perception that the area is not safe.

University Bus Stops

Light levels at bus stops and adjacent roadway cross walks are insufficient in many locations for the safety of pedestrians. This is a major concern in remote parking lots at night. Most bus shelters have translucent roofs and do not contain integral lighting. They rely on adjacent poles. A new bus shelter design is being introduced with an opaque roof. Internal lighting in these shelters is required to provide a safe and inviting location for pedestrians after dark.

Parking Lots

There are both minor parking lots scattered throughout the grounds and major lots adjacent to sports complexes for event parking as well as daily commuter parking. Most concerns voiced about parking lots are from hospital employees using lots in outlying areas during night shift changes. Employees who park in these lots use University buses to transport them to and from their place of employment. Some return to their vehicles very late at night. The safety of these employees is a concern when they wait for buses and as they walk to their vehicles. While the light levels in many of these lots are sufficient, the bus stops in the parking lots, in many cases are poorly illuminated. Another issue with these lots is that because of the late night shift changes the lights are kept on all night at full brightness and are major consumers of energy.

Sculpture Lighting

Except in a few recent installations, sculptures on Grounds are not illuminated. There are two sculptures adjacent to the Lawn which were recently lighted using ground mounted low voltage accent lights, which are effective. In addition, LED accent lights have been installed outside of the Art Museum to highlight changing sculptural pieces.

University Gateways

As the University grew beyond Jefferson's Academical Village, with the addition of academic buildings and additional residences to the west, the Health System to the east, the athletic areas to the north and more recently, the Law and Darden Business School, the exact boundaries of the University became less clear. As part of this study, major vehicle and pedestrian entries have been defined and are shown on a Map in Appendix IV. As an example of a monumental entry point, the Senff Gates, built in 1920, demark the entrance to the historical grounds by day. At night, however, their presence is not perceptible.

Figure 10: Senff University Gateway

Figure 11: Bollard at Bavaro Hall used to light an entry pathway

Figure 12: New Bus Shelter Style

Figure 13: Existing Translucent Roof Bus Shelters

Evaluation of Existing Lighting - Continued

Existing Fixture Standards


Figure 14: Parking Lots - KAD Lithonia


Figure 15: Kellog-Alderman Road Residential Area - 7928LED BEGA


Figure 16: Bollard - BEGA


Figure 17: Plazas - 8304MH BEGA


Figure 18: Law School - Arlington Holophane


Figure 19: Grounds & Roadway - Edgewater King Luminaire, Spring City & Antique


Figure 20: Pavilion Alleys - Globe ELA

Recommendations

The process of the Lighting Study, beginning with meetings with University stakeholders and surveying of grounds, had multiple steps leading to the recommendation phase. Each of these steps has been described in the report.

The data collected by GWA's survey team with the assistance of UVA engineering students, was compiled and compared to the University GIS maps. Maps which were created by the GWA team in conjunction with a detailed fixture schedule, as accurately as possibly, demonstrate the density of each luminaire type on Grounds.

This existing luminaire vocabulary was evaluated to determine what potential modifications could be made to the luminaires to improve efficiency and decrease energy costs and simplify maintenance. Following is a summary of the process:

- Daytime survey
- Nighttime illuminance measurements
- Cross reference of survey with GIS data
- Evaluation of existing luminaire vocabulary
- Determine potential improvements to luminaires and lamp sources to reduce maintenance, energy consumption and improve controllability
- Define hierarchies for roadways and pathways
- Recommend new luminaires for the lighting vocabulary as replacements for existing luminaires of poor lighting quality and to supplement existing luminaires for the purpose of establishing hierarchies on Grounds
- Define solutions to problem areas
- Develop typical recommended lighting layouts
- Orchestrate mock-ups to compare and evaluate potential luminaires
- Finalize report and specifications for luminaires and poles

The Edgewater luminaire has been a strong standard for the University, starting back in the 1930's and is a unifying element. The optical characteristics of the luminaire performs well for the lighting of pathways both internal on Grounds and along roadways. Care must be taken in positioning the Edgewater near dormitory windows since the "house side" distribution will cause light trespass into windows. Since the Edgewater is not a full cutoff luminaire, it is also not appropriate in the Observatory Sensitive zone. Furthermore it does not lend itself to effective lighting of roadways, in particular, crosswalks. This can be seen along McCormick Road where additional Edgewater poles have been installed and yet the roadway itself is not well illuminated. Consequently pedestrians who cross the road are not clearly visible.

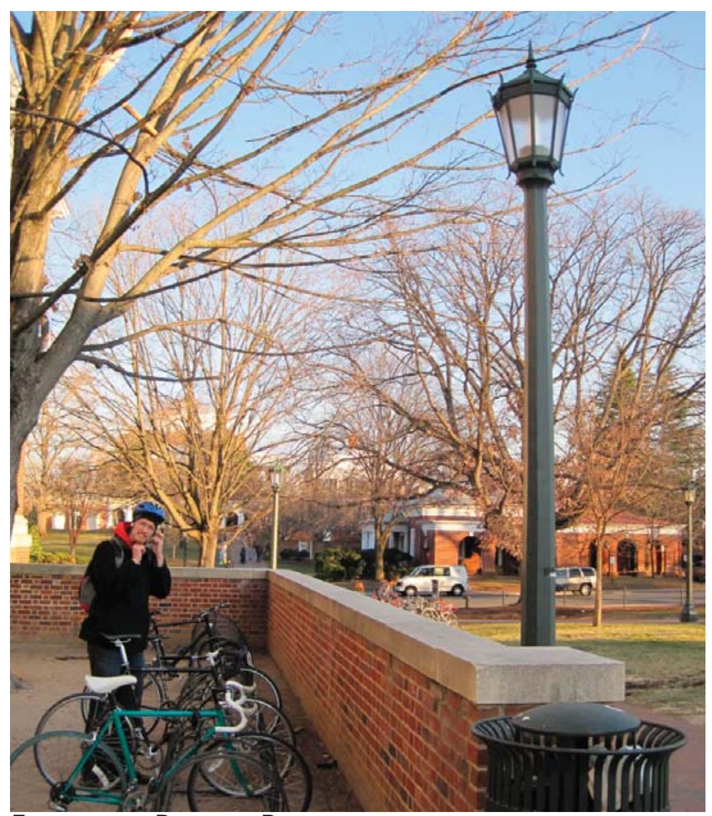


Figure 21: Bicycle Parking illuminated by an Edgewater Luminaire

The Edgewater is recommended to be maintained as the Primary Pathway luminaire. A new cutoff Secondary Pathway luminaire is recommended to light secondary pathways and especially areas around dormitories and in the observatory sensitive area where light spill is not appropriate.

Complete specifications for all recommended luminaires and poles are included in the report. Light Level and uniformity recommendations are found in Appendix xlvi.

Following is a description of the recommendations for specific areas:

<u>Roadways and Crosswalks</u>

For roadways which are under the University jurisdiction two separate designations have been made:

1. Primary Roadway/Pathways – Within this designation there are two different approaches.
   - Primary University Roadways with adjacent walkways: These are typically lighted by Edgewater Luminaires. **It is recommended to Increase illumination at crosswalks by adding 20' high cutoff roadway poles using the new LED standard.**
   - Primary roadways with pedestrian walkways separated by a tree/grass lawn, (such as Massie in North Grounds): These are currently lit inconsistently with some Edgewaters' along the path and little or no roadway lighting. **It is recommended to add twenty foot high roadway luminaires to uniformly light the roadway and the Edgewater Luminaires will uniformly light the walkways. Both types of luminaires are recommended using LED sources. (See typical fixture layouts for an example on pages 12 through 19)**
2. Secondary Roadway/Pathways – Roadway and pathway lighting to be provided by 20' high cutoff roadway poles. See page 20.

<u>Walkways and Pathways</u>

1. Primary Pathways – **Continue the use of the Edgewater pole and luminaire using the new LED version or 150 watt ceramic metal halide for prominent University walkways.**
2. Secondary Pathways – In order to light less prominent pathways throughout Grounds and especially in residential areas, a cutoff luminaire with controlled distribution is recommended. **A new luminaire is recommended with an optical distribution to light pathways with low wattage, long life LEDs. This controlled distribution will reduce light trespass into dormitory rooms and provide the needed illumination on pathways. See page 22.**
3. Historical Pathways and Alleys - **The historical globe and pole has been used in the Pavilion Alley's and other significant historical areas and will continue to be used in these applications.**

Figure 22: Edgewater fixtures along Walkway adjacent to roadway

Recommendations - Continued

Stairs and Ramps

One of the most critical areas of the University from a safety standpoint are stairways. The elevation changes of the University grounds necessitate a large number of exterior stairways. Over time these have been lighted with many different approaches, some more successful than others. There are two key issues with the stairways, one is providing sufficient illumination for safety and the second is allowing for ease of maintenance.

1. Several different approaches are recommended. Pole mounted fixtures will provide a broad spread of light, but care must be taken in using this solution in that the luminaires can be maintained from level areas adjacent to the stairs for safety of the workers.
2. Step lights can provide sufficient lighting if the appropriate light distribution and intensity is chosen. To maximize uniformity, 18" mounting height is optimal. for lower cheek wall conditions, mount as high above tread as possible. To reduce maintenance, **LED luminaires are recommended** and a surface mounted version has been chosen for retrofiting existing locations. See page 29.

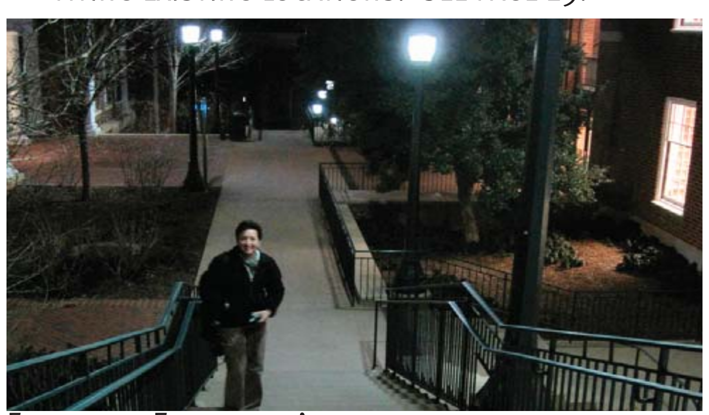


Figure 23: Edgewater's along stairs

Commons and Entry Plazas

A new luminaire with indirect optics was introduced recently at UVA to light Plaza areas. The indirect optics provide a diffuse glow over the plaza areas creating an inviting setting for nighttime gathering. Metal halide lamp sources are currently used in these luminaires. A new luminaire with an LED source by the same manufacturer is being introduced within the next 6 months. The connected load for this LED source will be lower than the existing and the life will increase. **The new luminaire has been evaluated on grounds and deemed a viable, more sustainable solution, therefore it is being recommended for new commons and plaza areas on campus.**

Low Height Bollards

There are several areas where bollards have been used, as in the entrances of Scott Stadium, near the Hospital helicopter landing pad and at several building entrances. Bavaro Hall entrance walkway is lighted with numerous bollards which achieve pathway lighting of the horizontal surface but do not light faces. Many of the bollards used are glaring, and like some of building mounted luminaires, can be counter to achieving good visibility. **A new LED bollard with excellent optical control is recommended for locations where bollards are desired.** See page 31. In general the use of bollards is discouraged. Due to their low height, they do not light people's faces and therefore do not help in providing a sense of security which is gained from seeing the faces of other pedestrians approaching. They also do not provide suitable illumination for security cameras.

Similar in function to the recommended wall mounted luminaire, the bollard can provide low/high light levels to respond to activity in the area while reducing maintenance and energy consumption.

Building Mounted Lighting

Across grounds, there are a myriad of building mounted luminaires used. Some of these are cutoff luminaires and provide the necessary illumination for safety and security without causing glare. Others are designed with vertical lenses and are excessively bright thus causing a decrease in visibility. As one approaches a building with high brightness wall packs, one's pupil will actually contract in response to the high brightness of the luminaires.

Cutoff LED luminaires are recommended for this standard. The advantage of the LED is not only increased life and lower connected load but they can also be easily controlled, offering the possibility of motion sensing control. This technology can reduce light levels when there is no one in the area and when motion is detected, instantaneously increasing the light to provide for safety and resulting in energy savings as well. See page 27.

Figure 24: Existing Building Mounted Cutoff luminaire

Bus Shelters and Stops

1. For existing shelters with opaque roofs, add post top mounted Edgewater or new secondary luminaires to provide for a safe level of light both under the shelter and on the adjacent sidewalk.
2. The new shelter design should incorporate lighting within the interior of the roof. The current manufacturer can provide roof mounted solar panels and an integral LED luminaire to light the interior of the shelter. This solution will eliminate the need for wiring to the shelter. If this is not possible or cost prohibitive, a linear LED fixture can be incorporated into the interior of the roof structure.

Figure 25: Illiminated Bus Stop - Richmond, VA

Parking Lots

1. Most parking lots are currently illuminated with shoe box type cutoff luminaires on 20 or 25 foot poles. The lamping in these fixtures is 250 or 400 watt metal halide lamps. Overall light levels in the parking lots are not a problem. The bigger issue is the high energy consumption as some of these lots are used dusk to dawn.
2. **A new LED parking lot luminaire is recommended to both reduce the connected load of the individual luminaire and to provide for the opportunity to reduce the lighting level after a certain time based on usage.** Through the use of sensors, the light level will automatically increase when movement is detected. The recommended luminaire are 100 watts. See page 20.

Recommendations - Continued

Lighting for Areas with Security Cameras

A subcontractor is working with the University to evaluate the need for security cameras around Grounds. A meeting was held with representatives of the security consultant to determine lighting needs. From this meeting it was determined that the light levels and lighting uniformity as recommended in the report were sufficient for the cameras being implemented on Grounds. Color is another concern and with the sources already used on campus and the LED's selected color rendition will be excellent for the cameras. Bollards or any lighting that does not light faces is not recommended. The importance of a good relamping program was also stressed, to avoid any lighting deficiencies which would effect proper functioning of the cameras.

Art/Sculpture Lighting

Although the use of sculpture around the grounds is minimal, it may increase in the future. Sculpture should be thoughtfully lighted for protection as well as nighttime appreciation. The type of luminaire and its placement will depend on the type and size of the piece and its location. Each sculpture should be carefully evaluated and an appropriate lighting design implemented.

Building Facade Lighting

Historically, building facades on grounds have not been lighted. Colonnades and porticoes are internally illuminated and provide an inviting nighttime presence, along with decorative building mounted luminaires at building entrances. This practice should continue to be encouraged and improved. On some buildings, i.e. Clark Hall, historical decorative fixtures have been removed and replaced with fixtures with an industrial appearance and poor color rendering lamps. Regular maintenance of these fixtures is imperative. Lamps colors may shift as they age and need to be group re-lamped to elevate this problem. The front facade of Old Cabell Hall is a good example of the importance of group re-lamping to avoid incongruous colors. Bugs are also a big problem and regular cleaning is important to prevent the bug accumulation from obscuring the light as can be seen at Alderman Library in the exterior recessed downlights in the entry portico.

There are a few facades which are lighted, such as the upper façade of the John Paul Jones Arena which is bathed in light and acts as a beacon at night.

There are many significant historical buildings on grounds, the Rotunda being the most important. The University may want to consider lighting the North side of the building in the future to give a nighttime presence to the building from University Avenue. The key is to first develop a hierarchy of buildings by significance, location and vistas and then use a subtle approach to lighting the facades or accentuating features. Another technique is to provide interior trans-illumination. A good example of this is the stained glass windows of the University Chapel which currently glow at night when the internal Chapel lights are on.

University Gateways

Subtle lighting to highlight gateways at night would strengthen entry points and give a clear identity to the University. There are numerous important entries to the grounds and through techniques of accent lighting of structural elements such as walls, piers or bridges and sculptures or adding multi-headed luminaires. Each gateway should be carefully studied for lighting opportunities as funding becomes available.

Lighting Controls

The current exterior lighting controls consist of either:

1. Photocells mounted to individual luminaires
2. Photocells mounted to a wall or other structure, controlling a group of luminaires

Maintenance is managed by weekly nighttime drive-by inspections followed by a team performing replacements of lamps and ballasts during the day. The drawback to this approach is that pedestrian-only areas can be missed.

To increase energy efficiency, reduce energy usage, and reduce maintenance, the following improvements are recommended for controlling lights on Grounds.

1. Provide a University wide control system to accomplish:
   - Provide feedback on hours of usage
   - Alerts of outages of lamps and ballasts
   - Allow for reducing light levels after designated time
   - Energy Savings as high as 30 to 50%
   - Control and monitoring from a central point

2. Install new or replacement LED fixtures for standard luminaires with demand response where possible:
   - Provide bi-level lighting to reduce energy consumption when pedestrian activity is low
   - Motion sensor in luminaire detects a person approaching within 20 feet and switches to the high mode. (For example, in a bollard the low mode would be 8 watts and the high mode 41 watts)
   - Install new luminaires with demand response for parking lots with low or sporadic nighttime use.

Testing and Warranties

To ensure the quality of all new LED luminaires and luminaire replacement kits, they shall be tested according to IESNA LM79-80, Approved Method: electrical and photometric measurements of solid state lighting products.

Warranty of all LED products shall be 5 years minimum for both LED modules and Drivers.

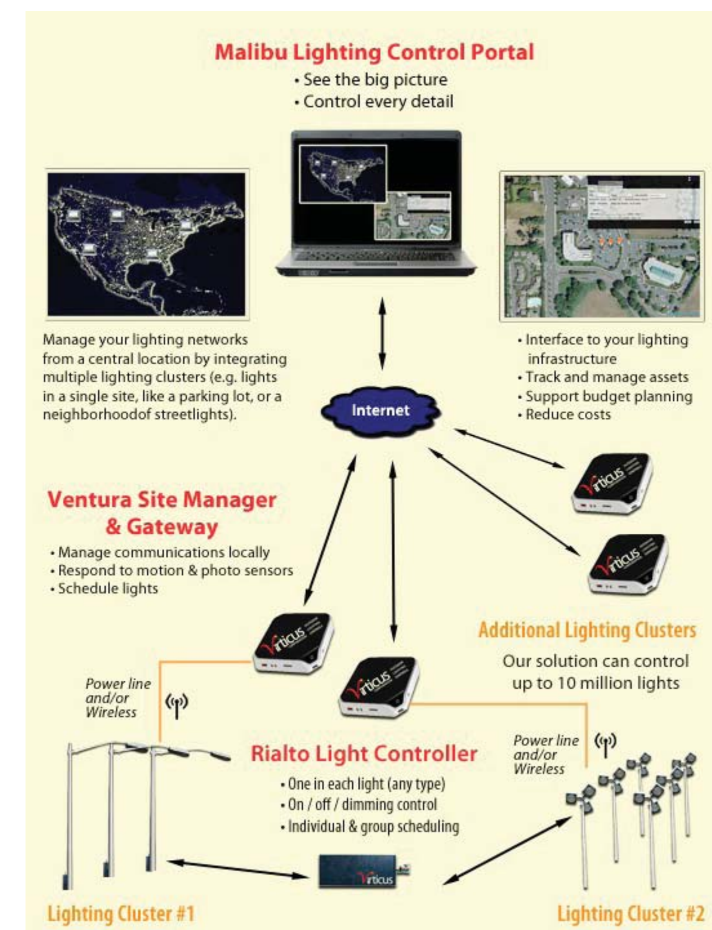
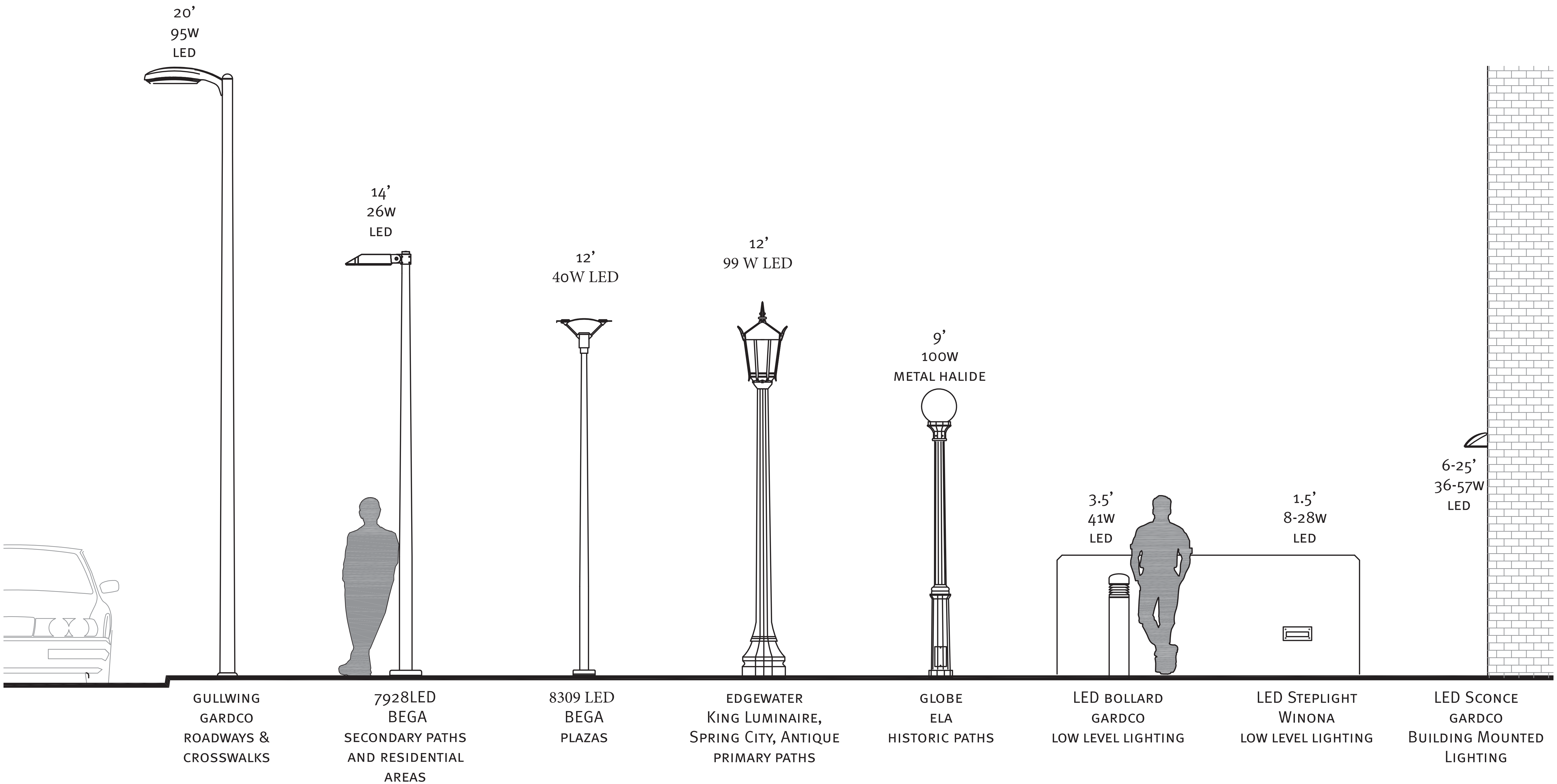


Figure 26: Lighting Control Schematic

Recommended University Fixture Vocabulary



Summary & Conclusions

Establishing a clear foundation of criteria for proper illimination and refining the lighting fixture vocabulary to meet the current needs of the University with an eye to the future were critical goals of this lighting study.

The nighttime exterior lighting at the University of Virginia currently has many strengths and many challenges. This study outlines methods by which the current luminaire vocabulary can be strengthened with improvements in technology, sources and optics and also with the addition of several new luminaire types. This new fixture vocabulary will improve illumination and uniformity, reduce glare and decrease energy consumption through the use of lower wattage LED sources, improve optics and in some cases, step-down control options.

For pathway lighting, energy consumption can be reduced simply by the replacement of the metal halide lamps in existing Edgewater luminaires with LED light sources as funding allows. New projects should specify LED Edgewaters as appropriate. The introduction of a new secondary luminaire with a lower wattage and more effective distribution for lighting of the secondary pathways and residenial areas furthers energy saving opportunities.

The problem areas as defined by the Stakeholders at the beginning of the study should take priority when the opportunity for lighting improvement projects occurs. New projects will incorporate the new fixture standards.

An overall University wide control system should be evaluated and selected to monitor the hours of use of the exterior lighting and provide a method to reduce light levels based on schedules or events on grounds. This sytstem will also monitor lighting outages to simplify maintenance and reduce safety /security risks.

In conclusion, the needs of the exterior lighting have been reviewed; constraints and alternatives have been addressed and evaluated. Implementation can now move forward with new projects using the recommended vocabulary and typical layouts documented in this report.

At a five year interval, the fixture vocabulary should be evaluated to allow for the inclusion of technological advances in sources or luminaires.

ACTION PLAN

There are many areas discussed in the report as potential locations for lighting improvements as well as more general recommendations for future capital projects. Following is a suggested Action Plan to be implemented as capital funding permits.

1. Improve lighting at major areas of concern including the following:
   - Crosswalks on McCormick Road between University Avenue and Emmet Street.
   - Crosswalks in vicinity of major events where temporary lighting is currently used
   - Crispell Drive link from South Parking Deck to Hospital
   - Bus Shelters at large commuter lots, especially those serving 24 hour hospital staff.
2. Improve uniformity of lighting on heavily traveled pedestrian walkways, for example, the area around the Rotunda, Chapel and Brooks Hall lawn.
3. Replace all non-ADA compliant step lights on ramps and steps and improve lighting uniformity for example Chemistry Plaza ramp and stairs.
4. Replace existing non-cutoff wall packs in "Observatory Sensitive Zone" with new standard LED cutoff wall pack.
5. Implement new standards on all new construction projects.
6. Incorporate Lighting Standards into all University design guidelines, for example Facility Management Design Guidelines.
7. Continue to investigate University wide monitoring and control system costs and feasibility.
8. Establish a regular interval for the review of the lighting standards of 5 years at a maximum.

Figure 27: LED Edgewater Mock-up

Figure 28: Gardco LED Bollard

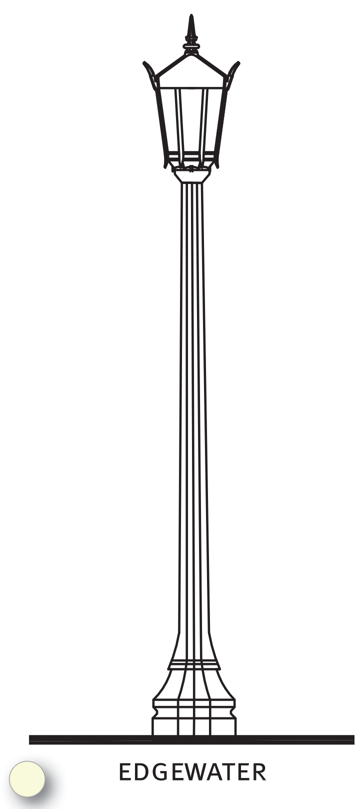
Figure 29: Wall Sconce with Demand Response Hi-Lo Mode

Figure 30: Roadway & Parking Lot Cutoff Mock-up

Recommended Typical Fixture Layout

Primary Path

12'
99W LED



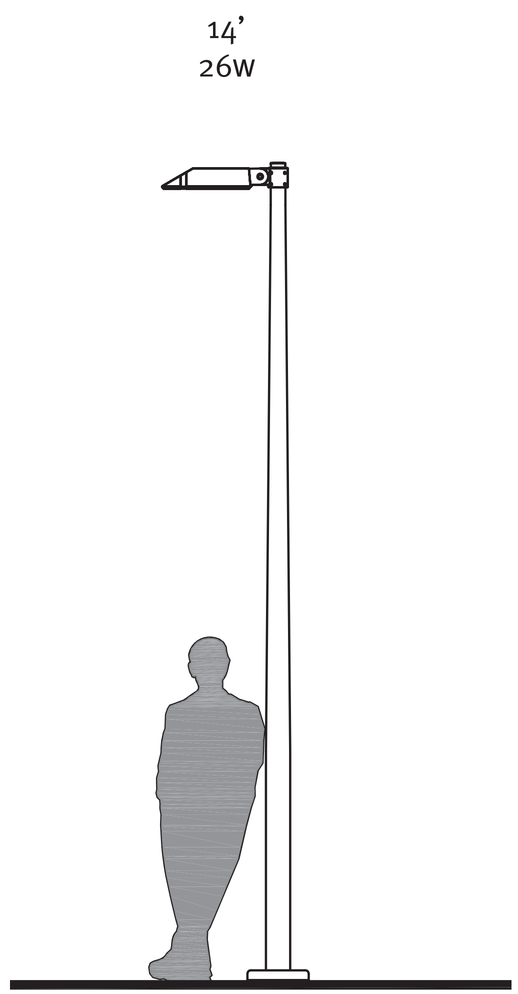
EDGEWATER

LIGHTING RECOMMENDATIONS							
	POLE LUMINAIRE					ILLUMINANCE	
CATEGORY	HEIGHT (FEET)	TYPE	LAMP	WATTS	SPACING (FEET)	AVERAGE (FOOTCANDLES)	UNIFORMITY RATIO
PATH	12	SPRING CITY* EDGEWATER	LED	99	72	1.07	2.10 : 1

* MANUFACTURER LISTED IS BASIS OF CALCULATION, OTHER APPROVED MANUFACTURERS ARE IN SPECIFICATION

Recommended Typical Fixture Layout

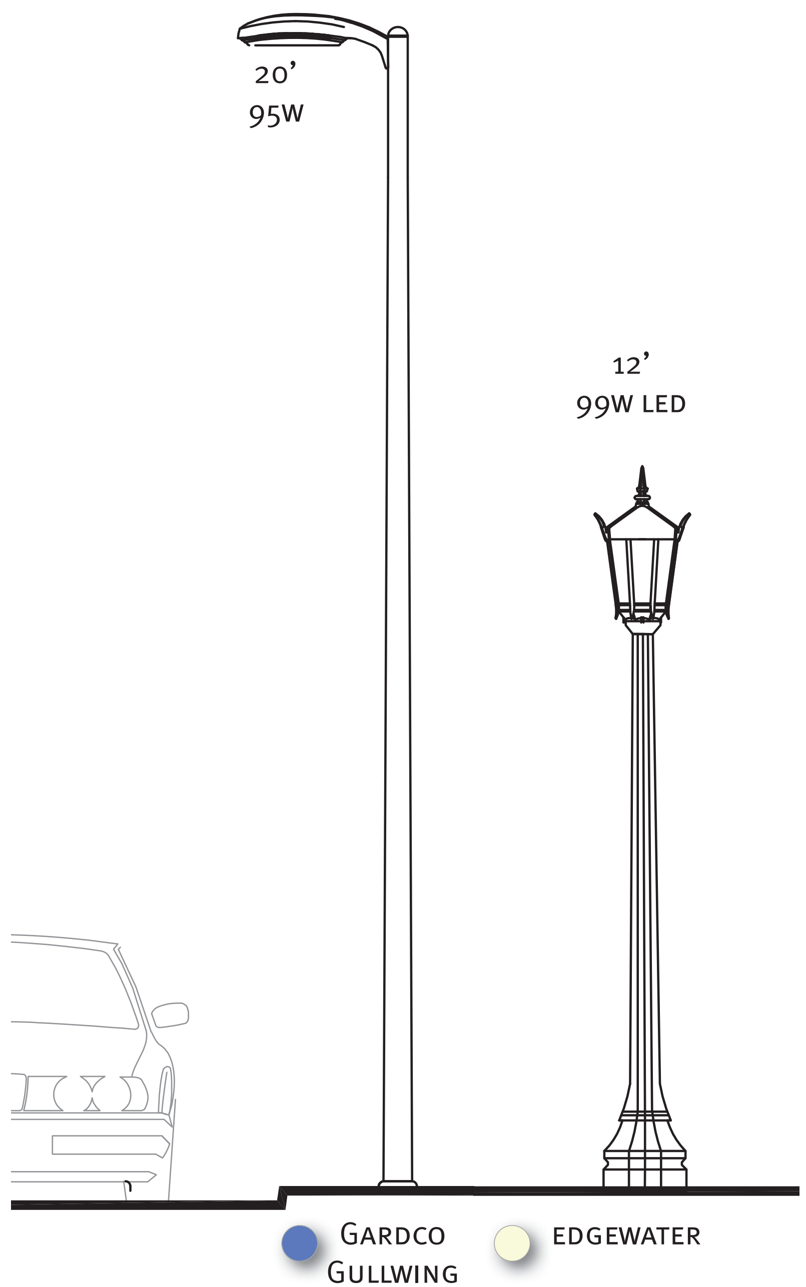
Secondary Path

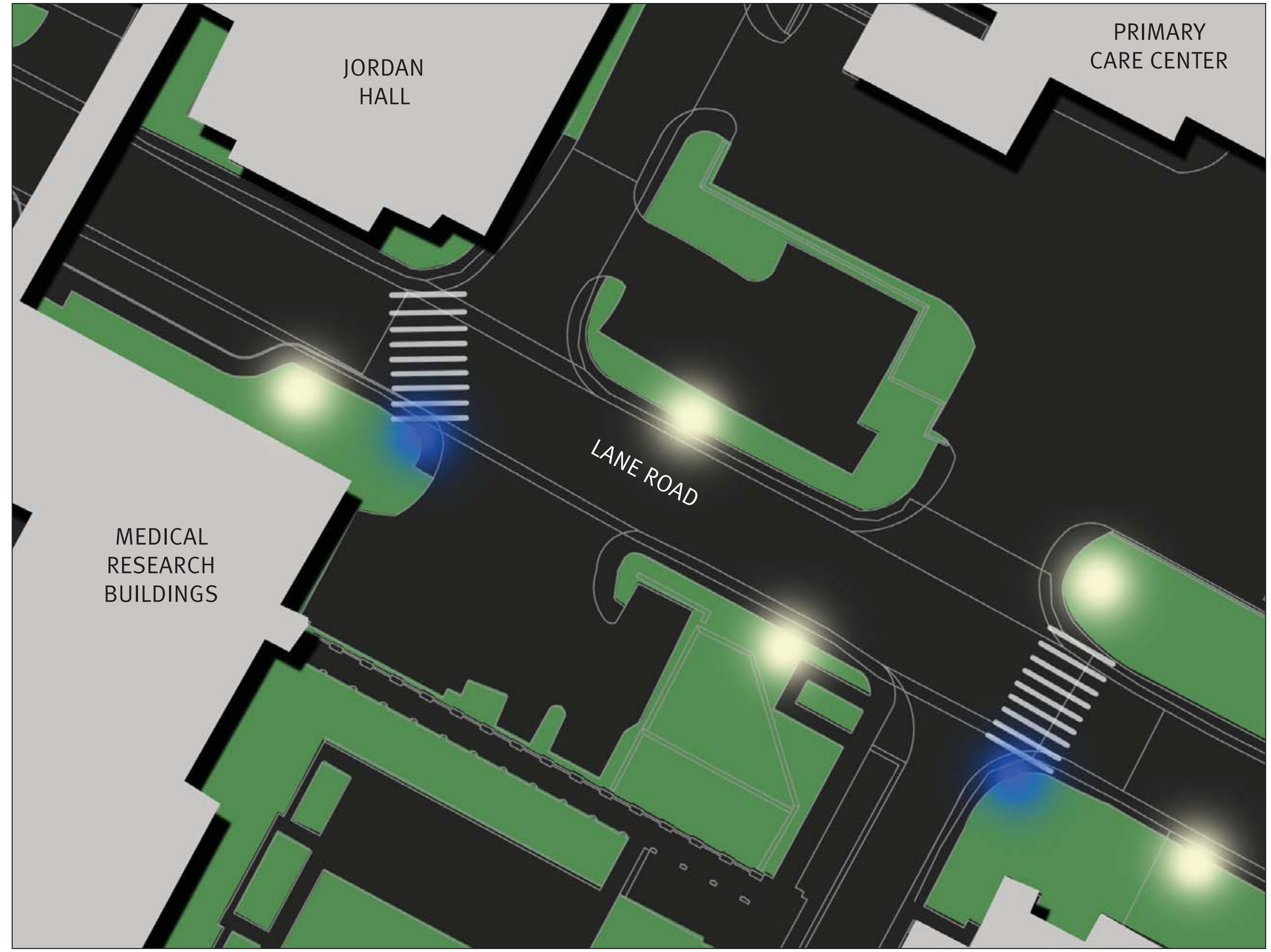


LIGHTING RECOMMENDATIONS							
CATEGORY	POLE LUMINAIRE					ILLUMINANCE	
	HEIGHT (FEET)	TYPE	LAMP	WATTS	SPACING (FEET)	AVERAGE (FOOTCANDLES)	UNIFORMITY RATIO
Path	14	BEGA 7928 LED	LED	26	96	0.51	5.10 : 1

Recommended Typical Fixture Layout

Primary Roadway with Adjacent Path - Crosswalk Condition



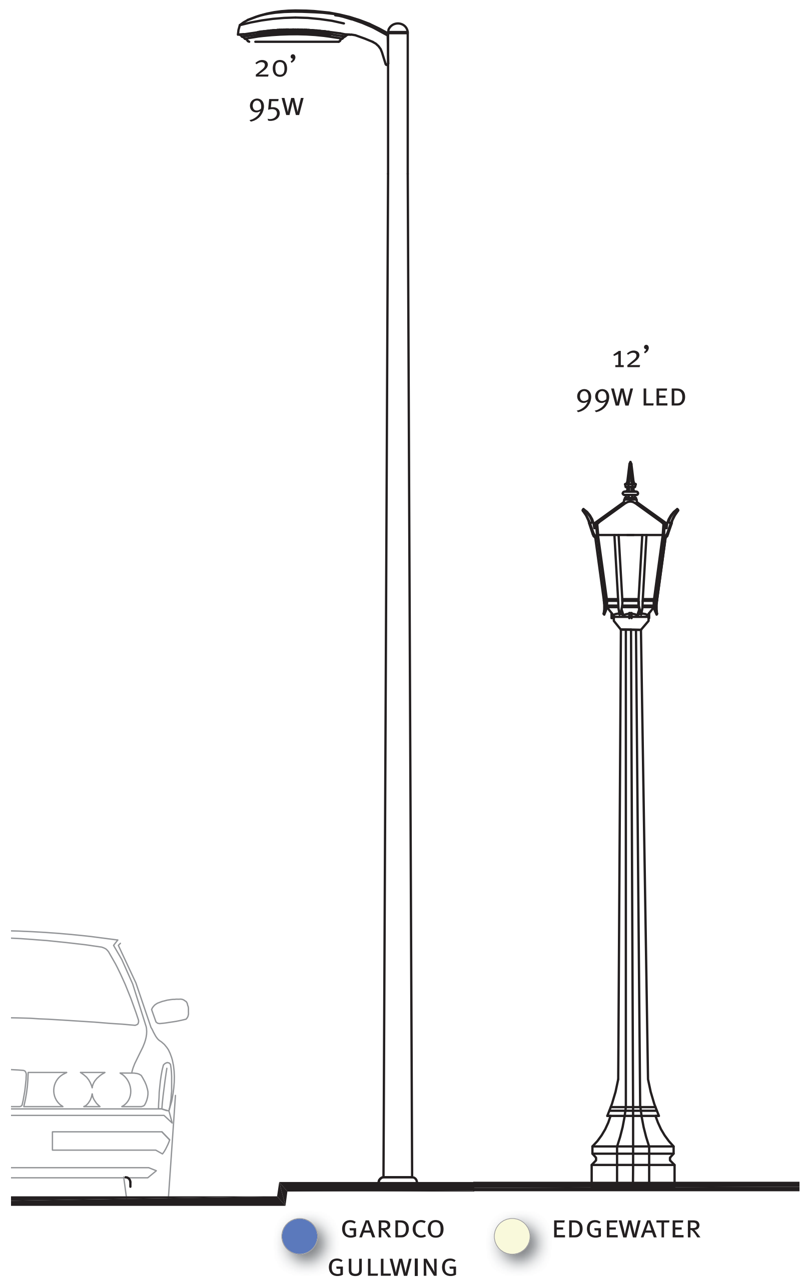


LIGHTING RECOMMENDATIONS							
CATEGORY	POLE LUMINAIRE					ILLUMINANCE	
	HEIGHT (FEET)	TYPE	LAMP	WATTS	SPACING (FEET)	AVERAGE (FOOTCANDLES)	UNIFORMITY RATIO
CROSSWALK	20	GARDCO GULLWING	LED	95	N/A	1.86	2.07 : 1
PATH	12	SPRING CITY* EDGEWATER	LED	99	72	0.64	6.40 : 1

* MANUFACTURER LISTED IS BASIS OF CALCULATION, OTHER APPROVED MANUFACTURERS ARE IN SPECIFICATION

Recommended Typical Fixture Layout

Primary Roadway with Removed Path

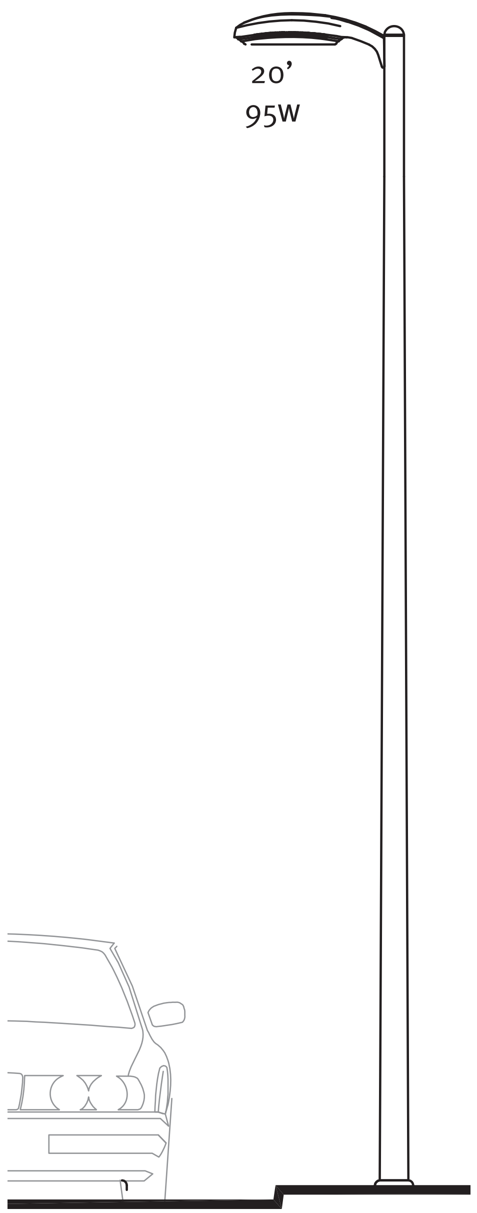


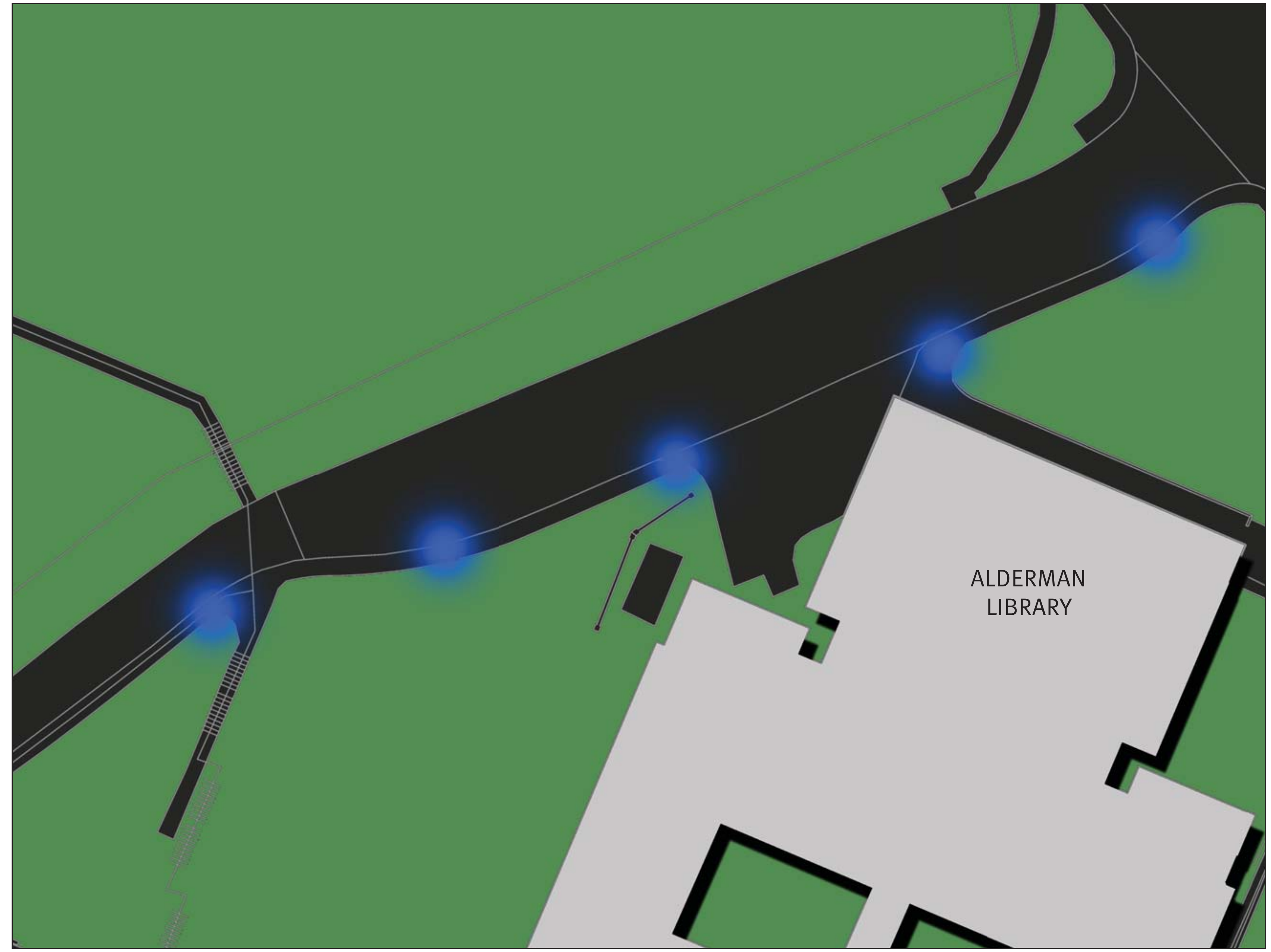
LIGHTING RECOMMENDATIONS							
CATEGORY	POLE LUMINAIRE					ILLUMINANCE	
	HEIGHT (FEET)	TYPE	LAMP	WATTS	SPACING (FEET)	AVERAGE (FOOTCANDLES)	UNIFORMITY RATIO
ROAD	20	GARDCO GULLWING	LED	95	78	1.20	2.00 : 1
PATH	12	SPRING CITY* EDGEWATER	LED	74	72	0.76	2.17 : 1

* MANUFACTURER LISTED IS BASIS OF CALCULATION, OTHER APPROVED MANUFACTURERS ARE IN SPECIFICATION

Recommended Typical Fixture Layout

Secondary Roadway/Path

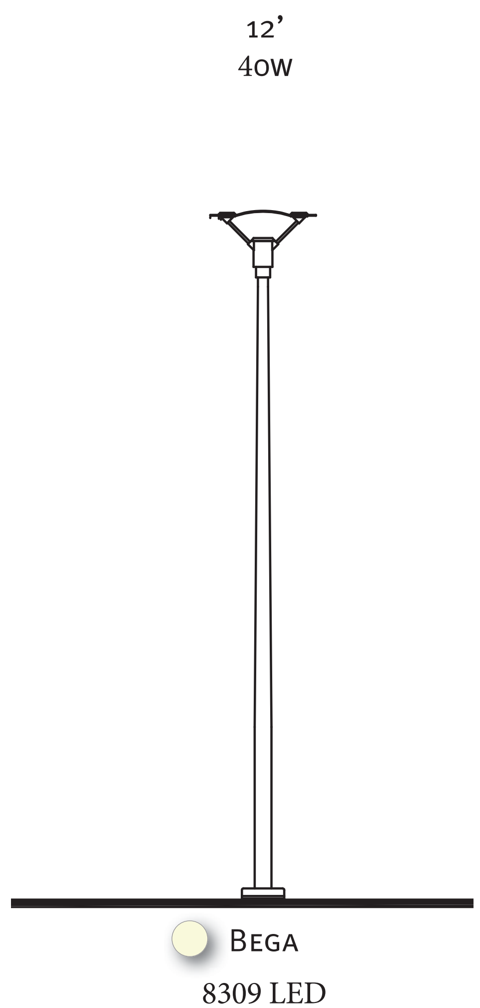


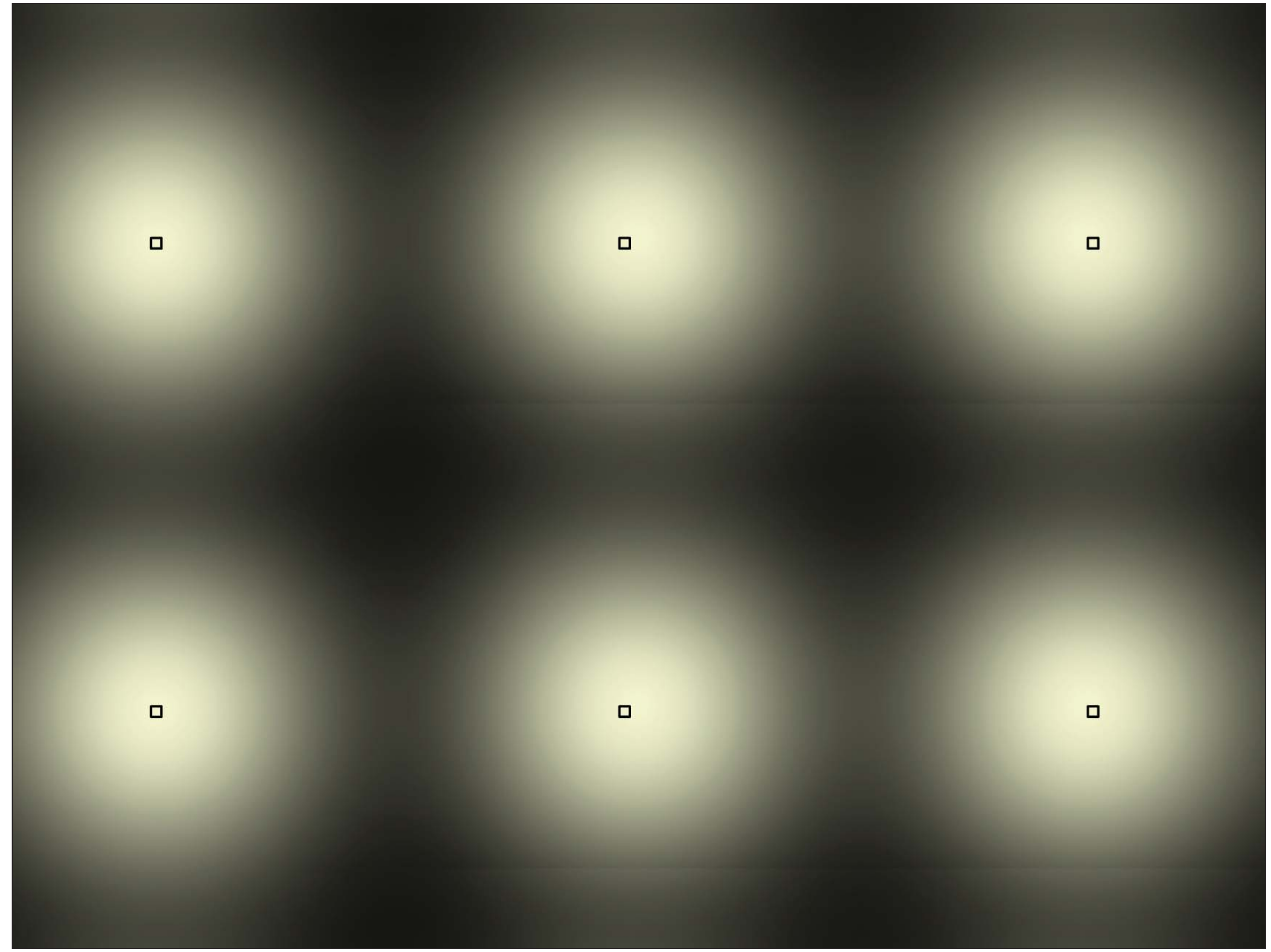


LIGHTING RECOMMENDATIONS							
	POLE LUMINAIRE					ILLUMINANCE	
CATEGORY	HEIGHT (FEET)	TYPE	LAMP	WATTS	SPACING (FEET)	AVERAGE (FOOTCANDLES)	UNIFORMITY RATIO
PATH	20	Gardco Gullwing	LED	95	83	0.89	4.45 : 1

Recommended Typical Fixture Layout

Plaza: Recommended Layout

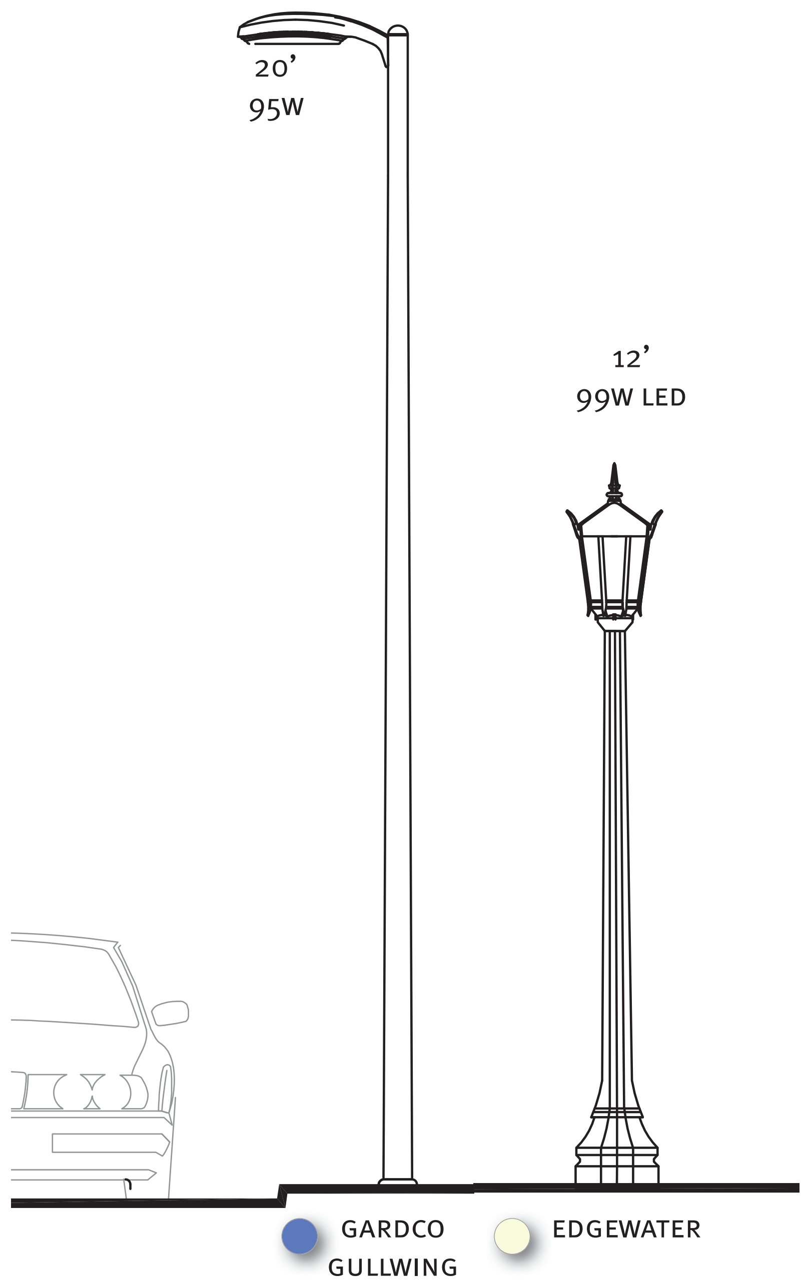


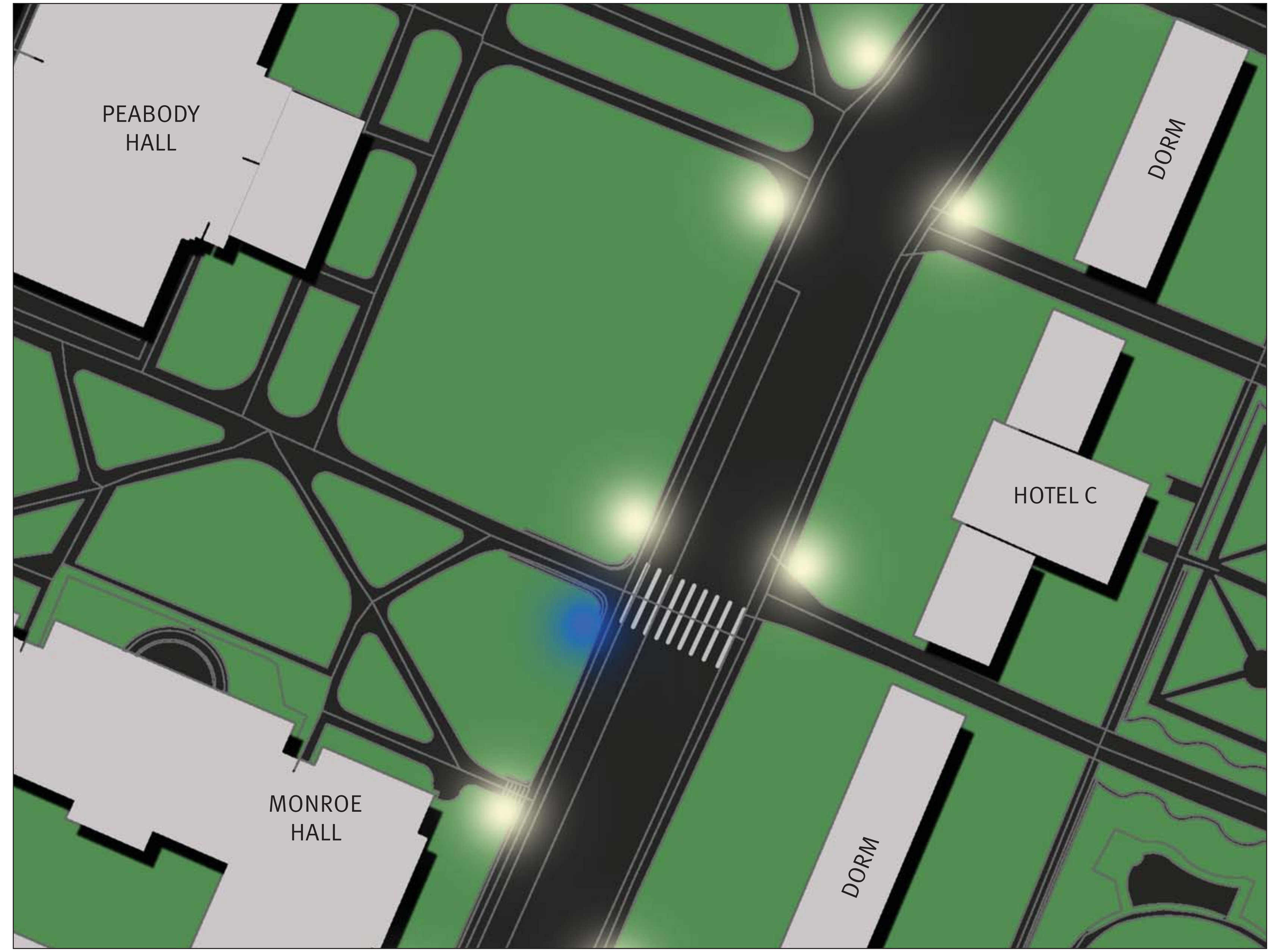


Lighting Recommendations							
Category	Pole Luminaire					Illuminance	
	Height (Feet)	Type	Lamp	Watts	Spacing (Feet)	Average (Footcandles)	Uniformity Ratio
Plaza	12	Bega 8309 LED	LED	40	45	0.59	2.95 : 1

Recommended Typical Fixture Layout

McCormick Road: Recommended Layout





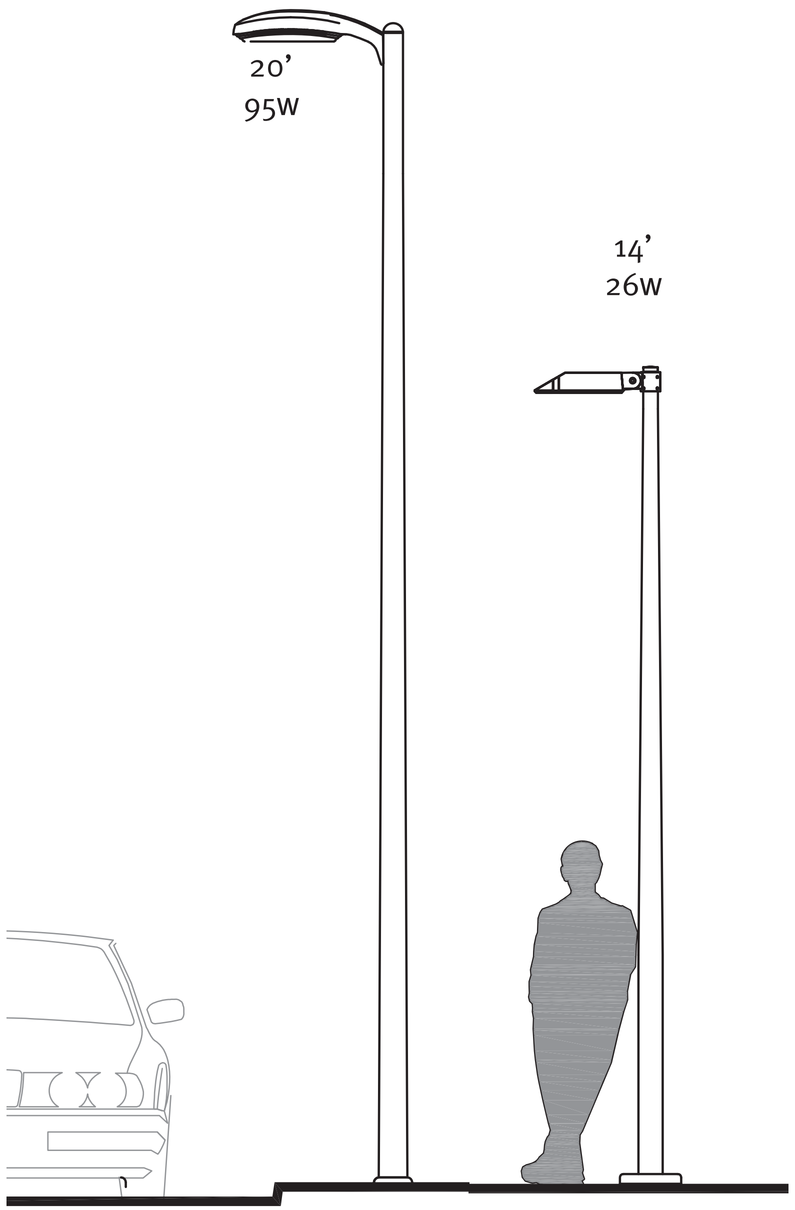
Lighting Recommendations							
Category	Pole Luminaire					Illuminance	
	Height (Feet)	Type	Lamp	Watts	Spacing (Feet)	Average (Footcandles)	Uniformity Ratio
Crosswalk	20	Gardco Gullwing	LED	95	N/A	1.86	2.07 : 1
Path	12	Spring City* Edgewater	LED	99	115	1.14	11.4 : 1

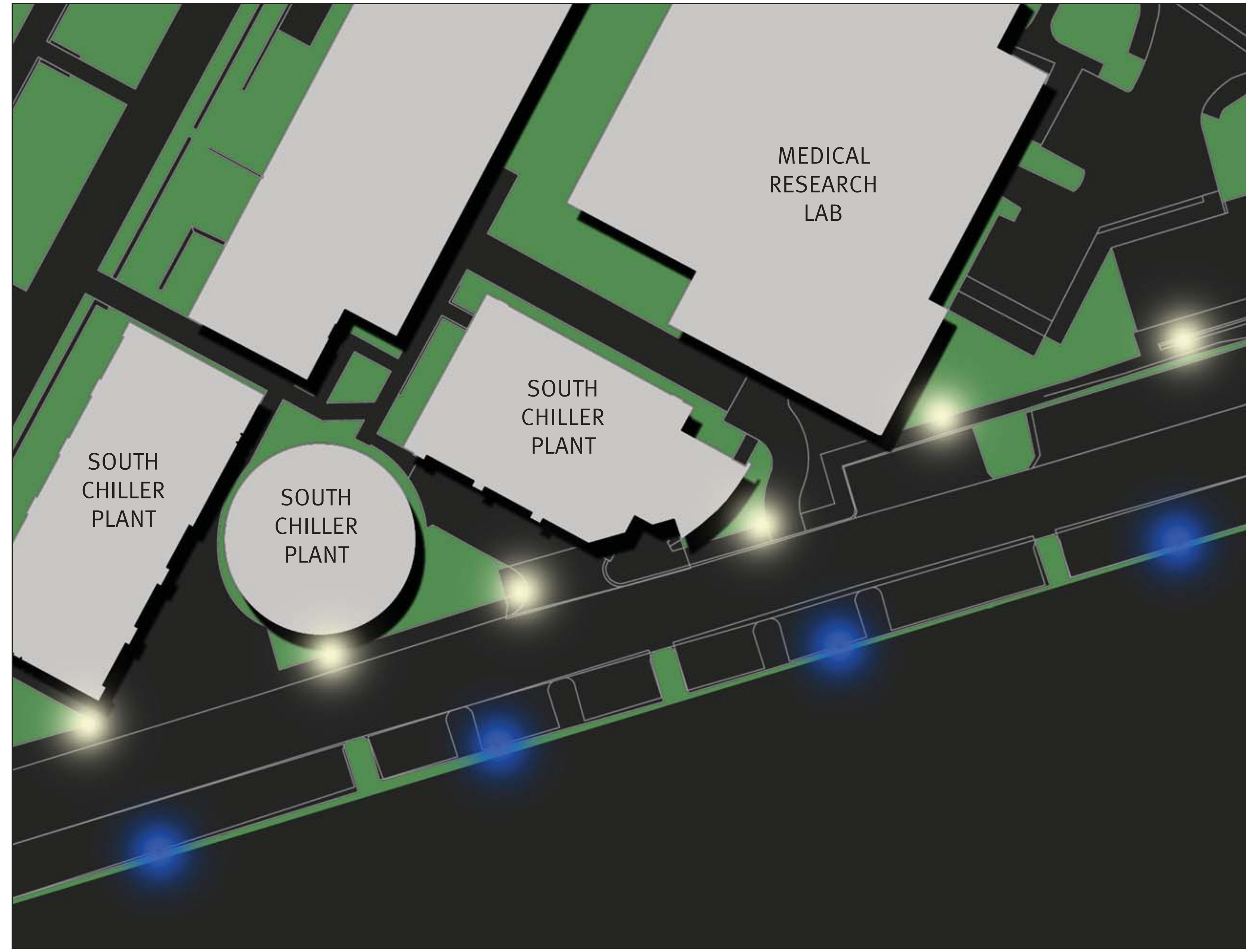
* Manufacturer listed is basis of calculation, other approved manufacturers are in specification

**Uniformity is high due to additional fixture at crosswalk

Recommended Typical Fixture Layout

Crispell Drive: Recommended Layout





Lighting Recommendations							
Category	Pole Luminaire					Illuminance	
	Height (feet)	Type	Lamp	Watts	Spacing (feet)	Average (footcandles)	Uniformity Ratio
Road/Parking	20	Gardco Gullwing	LED	95	120	0.90	3.60 : 1
Path	14	Bega 7928 LED	LED	26	85	0.88	3.83 : 1

Fixture Specification Sheets

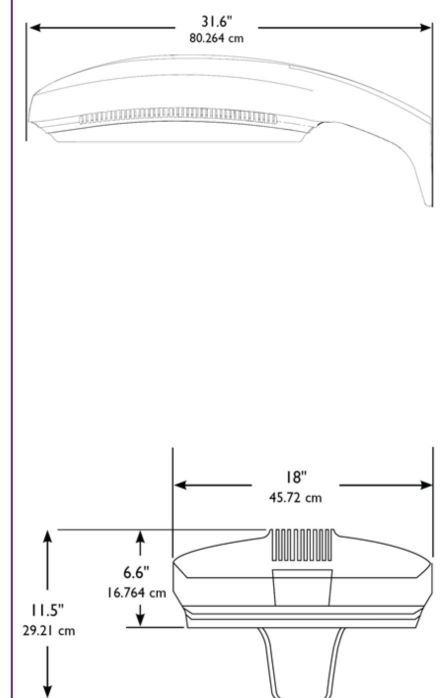
Description
LED Roadway and Crosswalk Fixture

Mounting
Anchor bolt fixture to concrete foundation

Fixture head to be mounted 20' above grade

Housing
Nominally 18" wide x 12" tall x 32" long die cast aluminum housing

Remarks / Accessories / Location



PERFORMANCE INFORMATION

Reflector / Lens / Louver
High transmission glass lens
Type II beam distribution

ELECTRICAL INFORMATION

Lamp Quantity	Max Wattage
LED Array	95

Lamp	Volts
Integral Neutral White LED, 4000K 75CRI	120 - 277

Control Gear
Integral power supply

ORDERING INFORMATION

Manufacturer | **Manufacturer Contact**
Gardco

Catalog # GL18350LANWUNIVBRP
~~GL18-1-2-95LA-NW-UNIV-BLP-SPR~~ (to add motion response add MR50 to catalog number)
Pole: SSS4-20-4-11-D1-BLP

Alternate Manufacturer
None

GRENALD WALDRON ASSOCIATES
ARCHITECTURAL LIGHTING CONSULTANTS
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NARBERTH PA
19072 0525
TEL 610 667 6330
FAX 610 667 7658

University of Virginia
Exterior Lighting Study

Charlottesville, Virginia

30103

Type
RL1

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Type
RL1

Fixture Specification Sheets

Description
LED Primary Path Fixture

Mounting
Fixture head to accept a 3 1/2" diameter x 3" high tenon on campus standard pole

Fixture head to be mounted to 12' octagonal cast aluminum pole and base with UVA logo

Housing
Nominally 20" diameter x 34" tall cast aluminum housings

Remarks / Accessories / Location

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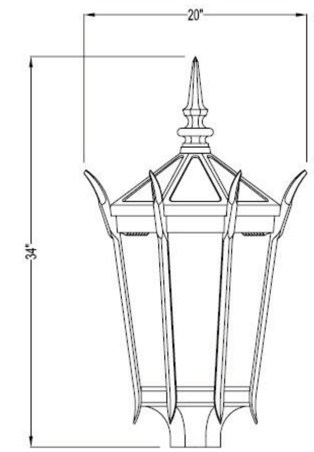
Type
RL2



PERFORMANCE INFORMATION

Reflector / Lens / Louver
Diffuse pebbled acrylic lens

ELECTRICAL INFORMATION

Lamp Quantity
LED array

Max Wattage
99

Lamp
Integral Neutral White LED, 4500K

Volts
120

Control Gear
Integral power supply

ORDERING INFORMATION

Manufacturer
Spring City

Manufacturer Contact

Catalog #
Edgewater- ALMEDM-LE099/EV1/4500-Diffuse pebble acrylic-(Type II)-RSG
Pole - 12' high Edgewater, 1 piece Ductile Iron DPSEDG-20-12-TN7.00/0.75-323/1NW-CW

Alternate Manufacturer
King Luminaire -K56-S-R-FAAR-II-CF011P-75W-5000-120-RD-XPG-Quick Disc.-4500K-RSG, King/ELA Pole - P3059-12'-RSG

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Type
RL2

Fixture Specification Sheets

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Grenald Waldron Associates Architectural Lighting Consultants PO Box 525 260 Haverford Avenue Narberth PA 19072 0525 Tel 610 667 6330 Fax 610 667 7658	University of Virginia Exterior Lighting Study Charlottesville, Virginia 30103	Type RM1

FIXTURE SPECIFICATION SHEETS

Description

LED Secondary Path and Residential Areas Fixture

Mounting

Fixture head slip fits onto a 3" outside diameter round pole

Fixture head to be mounted 14' above grade

Housing

Nominally 12" wide x 4" tall x 24" long die-cast aluminum housing, bronze finish

Remarks / Accessories / Location

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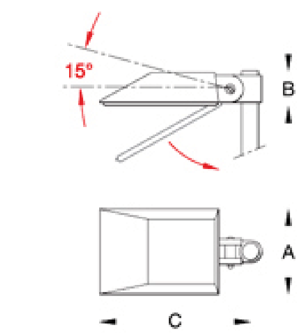
Type

RL3



	Lamp	Lumen	A	B	C
7928LED	26W LED	2700	11½	4¼	23⅞

PERFORMANCE INFORMATION

Reflector / Lens / Louver

Clear tempered glass lens

ELECTRICAL INFORMATION

Lamp Quantity

Max Wattage

26

Lamp

Integral White LED, 4000K

Volts

120

Control Gear

Integral power supply

ORDERING INFORMATION

Manufacturer

BEGA

Manufacturer Contact

Catalog #

7928LED-BRZ

Alternate Manufacturer

None

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Type

RL3

Fixture Specification Sheets

Description
LED Plaza Fixture

Mounting
Slip fit optical housing on 3" outside diameter round pole

Fixture head to be mounted at 12' above grade

Housing
Nominally 32" diameter x 21" tall one piece die-cast aluminum optical housing, silver finish

Remarks / Accessories / Location

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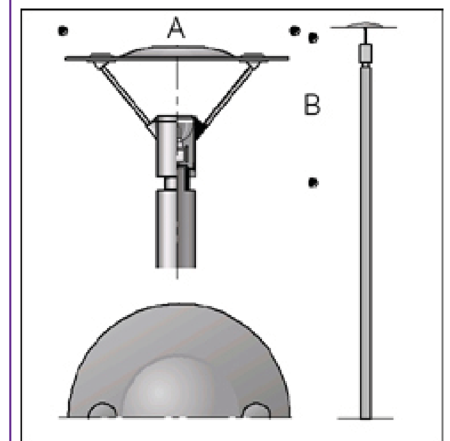
Type
RL4



	Lamp			Lumen	A	B
8304 MH	1	70W	T6 G12 MH	6600	31½	21

PERFORMANCE INFORMATION

Reflector / Lens / Louver
Stippled pure aluminum, narrow beam reflector
3/4" this, machined tempered crystal clear optical glass
Reflective disk is 31.5" diameter x 0.25" thick aluminum plate with aluminum parabolic dome section in the center of the disk

ELECTRICAL INFORMATION

Lamp Quantity
1

Max Wattage
40

Lamp
Integral Neutral White LED, 4000K

Volts

Control Gear
Integral power supply

ORDERING INFORMATION

Manufacturer
Bega

Manufacturer Contact

Catalog #
8309LED SLV
Pole - 906HR 5" straight round SLV

Alternate Manufacturer
None

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Type
RL4

Fixture Specification Sheets

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Type

RM2

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FAX 610 667 7658

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Type

RM2

FIXTURE SPECIFICATION SHEETS

Description

Metal Halide Historic Path Fixture

Mounting

Globe mount to cast aluminum fitter which mounts to pole using self locking set screws to attached to cast aluminum decagon tapered pole

Bottom of fitter to me 8' above grade

Housing

Nominally 14" diameter acrylic opal globe

Remarks / Accessories / Location

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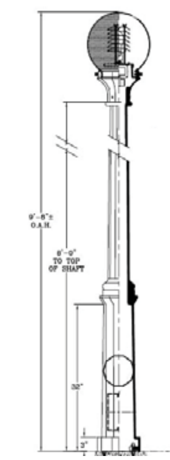
Type

RM3



PERFORMANCE INFORMATION

Reflector / Lens / Louver

Acrylic opal globe with internal type 5 stacked reflector

ELECTRICAL INFORMATION

Lamp Quantity	Max Wattage
1	110

Lamp	Volts
100W ED17 Medium Base Ceramic Metal Halide, 3000K 85CRI	120/277

Control Gear

Integral magnetic ballast

ORDERING INFORMATION

Manufacturer

ELA (Environmental Lighting for Architecture, Inc.)

Manufacturer Contact

Catalog #

L9720/P3029 SHUTTER GREEN-METAL HALIDE-MEDIUM BASE-100-120/277-V-ACRYLIC-OPAL

Alternate Manufacturer

None

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Charlottesville, Virginia

30103

Type

RM3

Fixture Specification Sheets

Description
LED Building Mounted Sconce

Mounting
Surface mounted to building facade

Coordinate mounting requirements with facade materials

Housing
Nominally 15" wide x 9 1/2" deep x 5 1/2" tall die-cast aluminum housing

Remarks / Accessories / Location

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Charlottesville, Virginia

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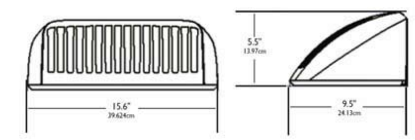
Type
SL1



PERFORMANCE INFORMATION

Reflector / Lens / Louver
Diffusing lens

ELECTRICAL INFORMATION

Lamp Quantity
LED array

Max Wattage
36-57

Lamp
Integral Neutral White LED, 4300K 75CRI

Volts
120/277

Control Gear
Integral power supply

ORDERING INFORMATION

Manufacturer
Gardco

Manufacturer Contact

Catalog #
121-MT-50LA-NW-UNIV-BRP-PCB

Alternate Manufacturer
None

GRENALD WALDRON ASSOCIATES
ARCHITECTURAL LIGHTING CONSULTANTS
PO BOX 525
260 HAVERFORD AVENUE
NARBERTH PA 19072 0525
TEL 610 667 6330
FAX 610 667 7658

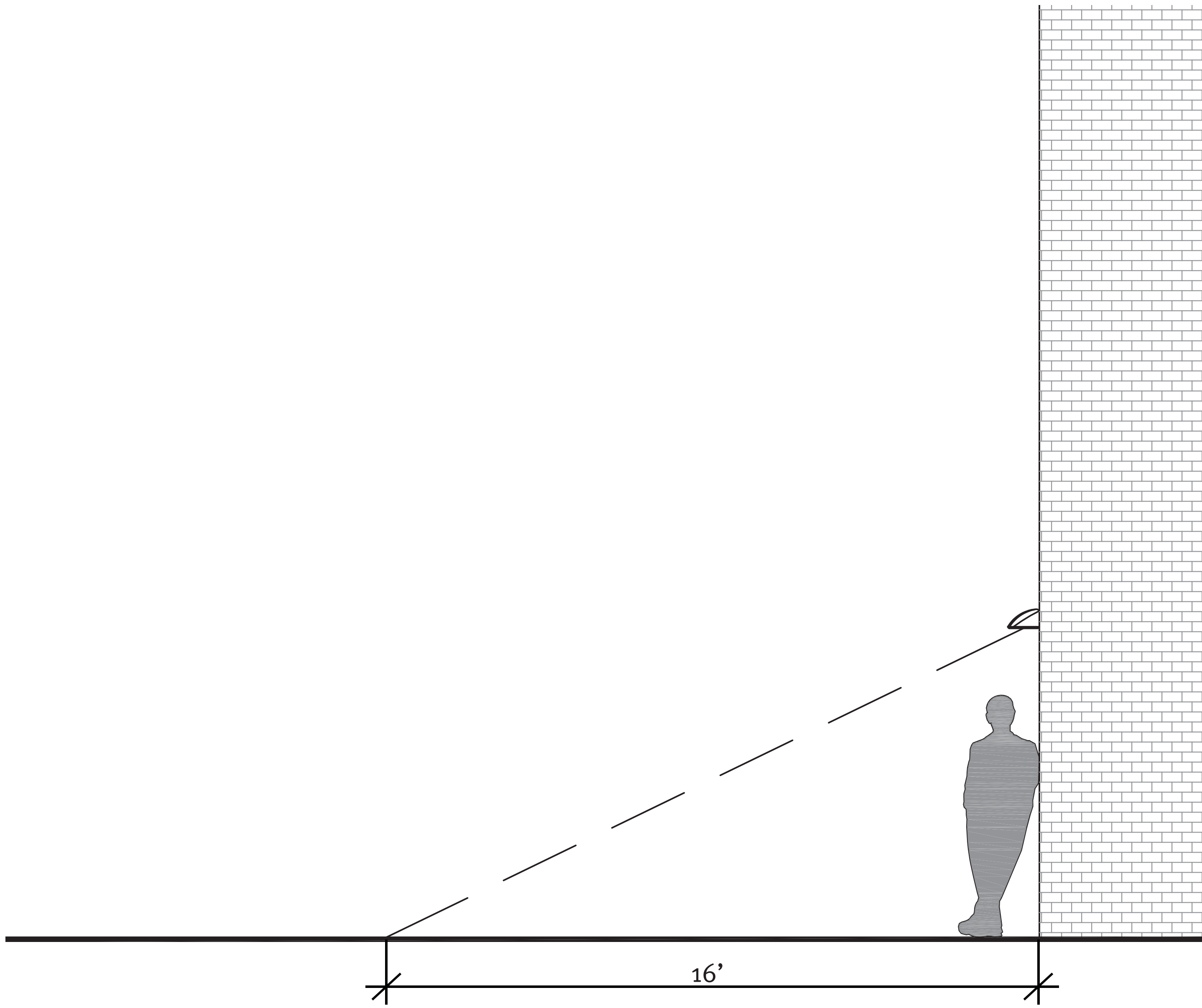
University of Virginia Exterior Lighting Study

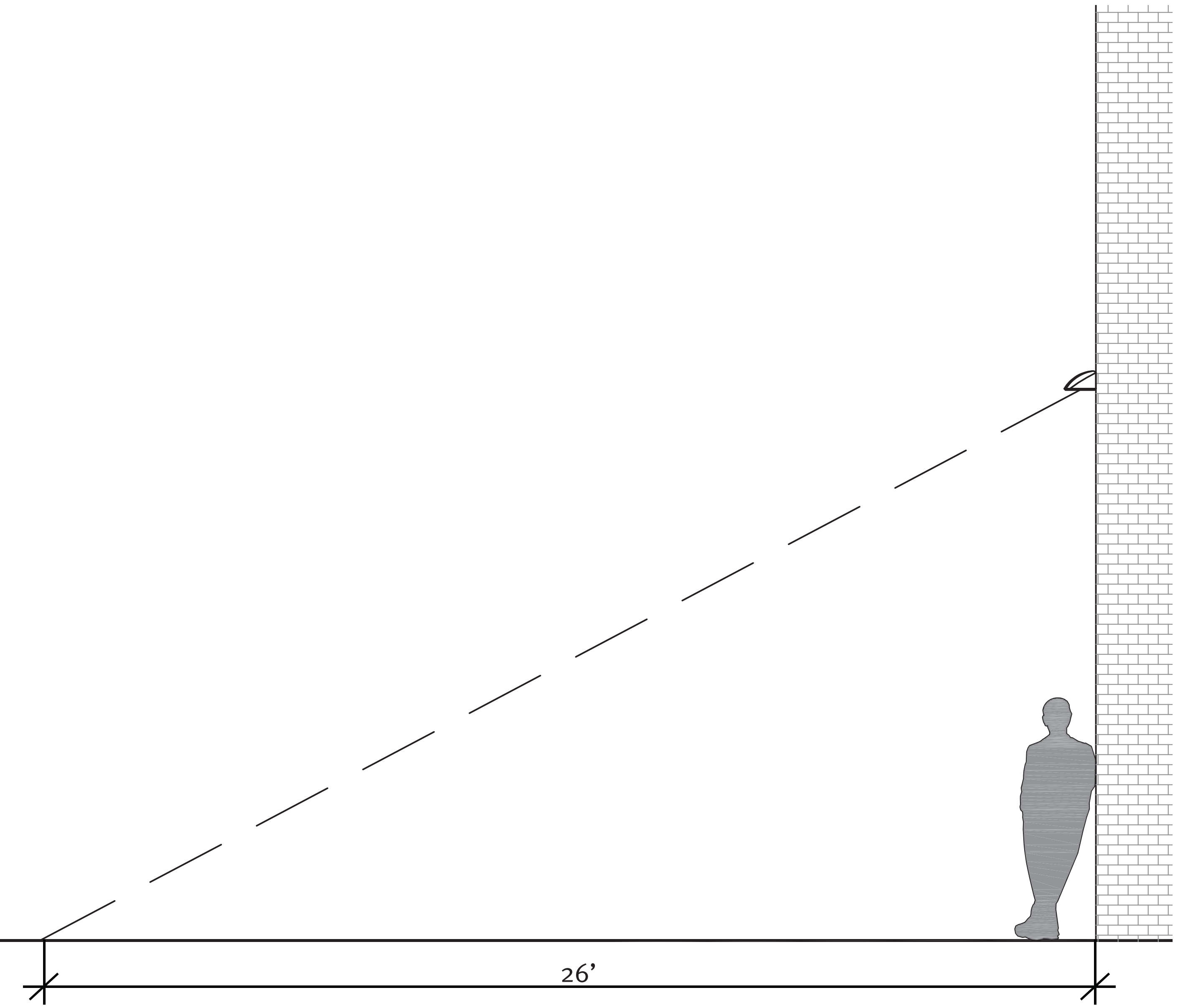
Charlottesville, Virginia

30103

Type
SL1

Fixture Specification Sheets





MOUNTING HEIGHT: 6-12' ABOVE FINISHED GRADE

LAMP: INTEGRAL 38W NEUTRAL WHITE LED, 4300K 75CRI

OPTICAL DISTRIBUTION: WIDE THROW

CATALOG NUMBER: 121-MRM-WT-35LA-NW-UNIV-BLP-MHS-D-15-DL

REMARKS: IF LIGHT IS REQUIRED BEYOND 16' FROM THE BUILDING, CHANGE OPTICAL DISTRIBUTION TO FORWARD THROW

MOUNTING HEIGHT: 12-25' ABOVE FINISHED GRADE

LAMP: INTEGRAL 57W NEUTRAL WHITE LED, 4300K 75CRI

OPTICAL DISTRIBUTION: WIDE THROW

CATALOG NUMBER: 121-MRM-WT-50LA-NW-UNIV-BLP-MHS-D-15-DL

REMARKS: IF LIGHT IS REQUIRED BEYOND 26' FROM THE BUILDING, CHANGE OPTICAL DISTRIBUTION TO FORWARD THROW

Fixture Specification Sheets

Description
LED Surface Step Light for retrofits

Mounting
Surface mounted to buildings, railings and or retaining walls

Coordinate mounting requirements with surface materials

Housing
Nominally 7" wide x 4 3/4" tall x 2 1/3" deep extruded aluminum housing modified with wet location back box for surface mount

Remarks / Accessories / Location
Smaller 5" wide version is available if rrequired.

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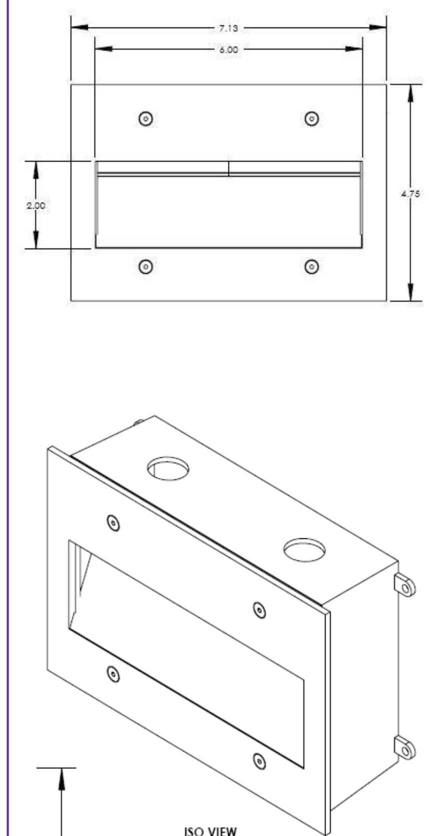
Charlottesville, Virginia
30103

Type
SL2



PERFORMANCE INFORMATION

Reflector / Lens / Louver
Concealed optics with long distribution: for large area illumination

ELECTRICAL INFORMATION

Lamp Quantity
LED Module

Max Wattage
12

Lamp
Integral Warm White LED, 3000K

Volts
90V - 250V

Control Gear
Integral power supply

ORDERING INFORMATION

Manufacturer
Winona Lighting

Manufacturer Contact

Catalog #
LED-STEP03-6-L-001/HO-ND120V-XXX-WL-MOD
Finish to be selected, brushed stainless steel for contemporary and black for traditional settings

Alternate Manufacturer

GRENALD WALDRON ASSOCIATES
ARCHITECTURAL LIGHTING CONSULTANTS
PO BOX 525
260 HAVERFORD AVENUE
NARBERTH PA 19072 0525
TEL 610 667 6330
FAX 610 667 7658

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Charlottesville, Virginia
30103

Type
SL2

Fixture Specification Sheets

Description
LED Recessed Steplight

Mounting
Recess mounted in buildings, railings and or retaining walls

Coordinate mounting requirements with surface materials

Housing
Nominally 3 -12" wide x 5" tall x 2" deep extruded aluminum housing

Remarks / Accessories / Location
Various sizes available from 3" to 12" wide depending on location and usage. Standard module specified is 8 1/2" wide.

GRENALD WALDRON ASSOCIATES
ARCHITECTURAL LIGHITNG CONSULTANTS
PO BOX 525 260 HAVERFORD AVENUE NARBERTH PA 19072 0525
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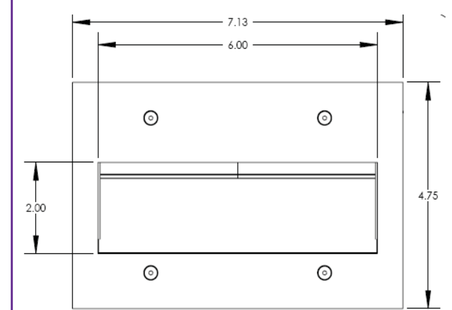
University of Virginia Exterior Lighting Study

Charlottesville, Virginia

30103

Type

KL1



PERFORMANCE INFORMATION

Reflector / Lens / Louver
Concealed opticwith long distribution: for large area illumination

ELECTRICAL INFORMATION

Lamp Quantity
LED Module

Max Wattage
12

Lamp
Integral Warm White LED, 3000K

Volts
90V - 250VAC

Control Gear
Integra; power supply

ORDERING INFORMATION

Manufacturer
Winona Lighting

Manufacturer Contact

Catalog #
LED-STEP03-6--001/HO-ND120V-XXX-WL-STD
Finish to be selected, brushed stainless steel for contemporary and black for traditional settings

Alternate Manufacturer
None

GRENALD WALDRON ASSOCIATES
ARCHITECTURAL LIGHITNG CONSULTANTS
PO BOX 525 260 HAVERFORD AVENUE NARBERTH PA 19072 0525
TEL 610 667 6330 FAX 610 667 7658

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Type

KL1

Fixture Specification Sheets

Description
LED Bollard

Mounting
Anchor bolt fixture to concrete foundation

Housing
Nominally 8” diameter x 42” tall extruded aluminum housing with cast aluminum base. Finish to be Dark bronze for locations with traditional architecture and natural aluminum in contemporary settings.

Remarks / Accessories / Location
Provide with integral motion response to maintain LEDs at low level, 8 watts, until motion is detected and then raise to full light output, 41 watts.

GRENALD WALDRON ASSOCIATES
ARCHITECTURAL LIGHTING CONSULTANTS
PO BOX 525
260 HAVERFORD AVENUE
NARBERTH PA
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TEL 610 667 6330
FAX 610 667 7658

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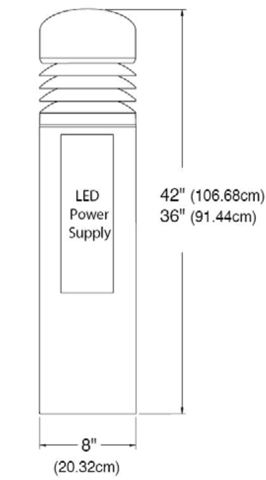
Charlottesville, Virginia

30103

Type
ML1



PERFORMANCE INFORMATION

Reflector / Lens / Louver
180 or 360 degree stacked louver system

ELECTRICAL INFORMATION

Lamp Quantity
LED array

Max Wattage
41

Lamp
Integral Neutral White LED, 4300K 75CRI

Volts
120/277

Control Gear
Integral power supply

ORDERING INFORMATION

Manufacturer
Gardco

Manufacturer Contact

Catalog #
BRM834-42-MR-NW-(Lighted Coverage, 360 or 180 deg.)-UNIV-XXX

Alternate Manufacturer
None

GRENALD WALDRON ASSOCIATES
ARCHITECTURAL LIGHTING CONSULTANTS
PO BOX 525
260 HAVERFORD AVENUE
NARBERTH PA
19072 0525
TEL 610 667 6330
FAX 610 667 7658

University of Virginia Exterior Lighting Study

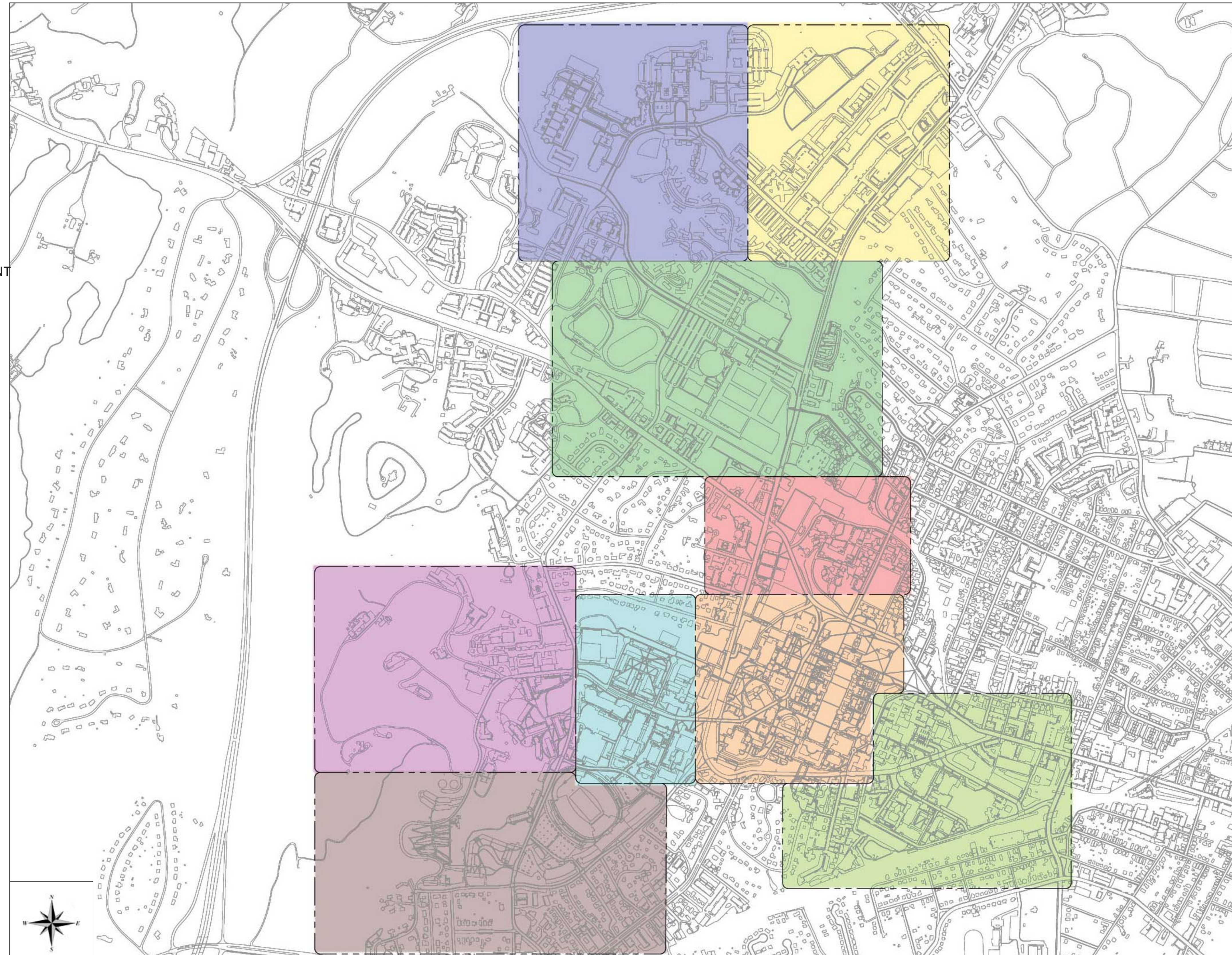
Charlottesville, Virginia

30103

Type
ML1

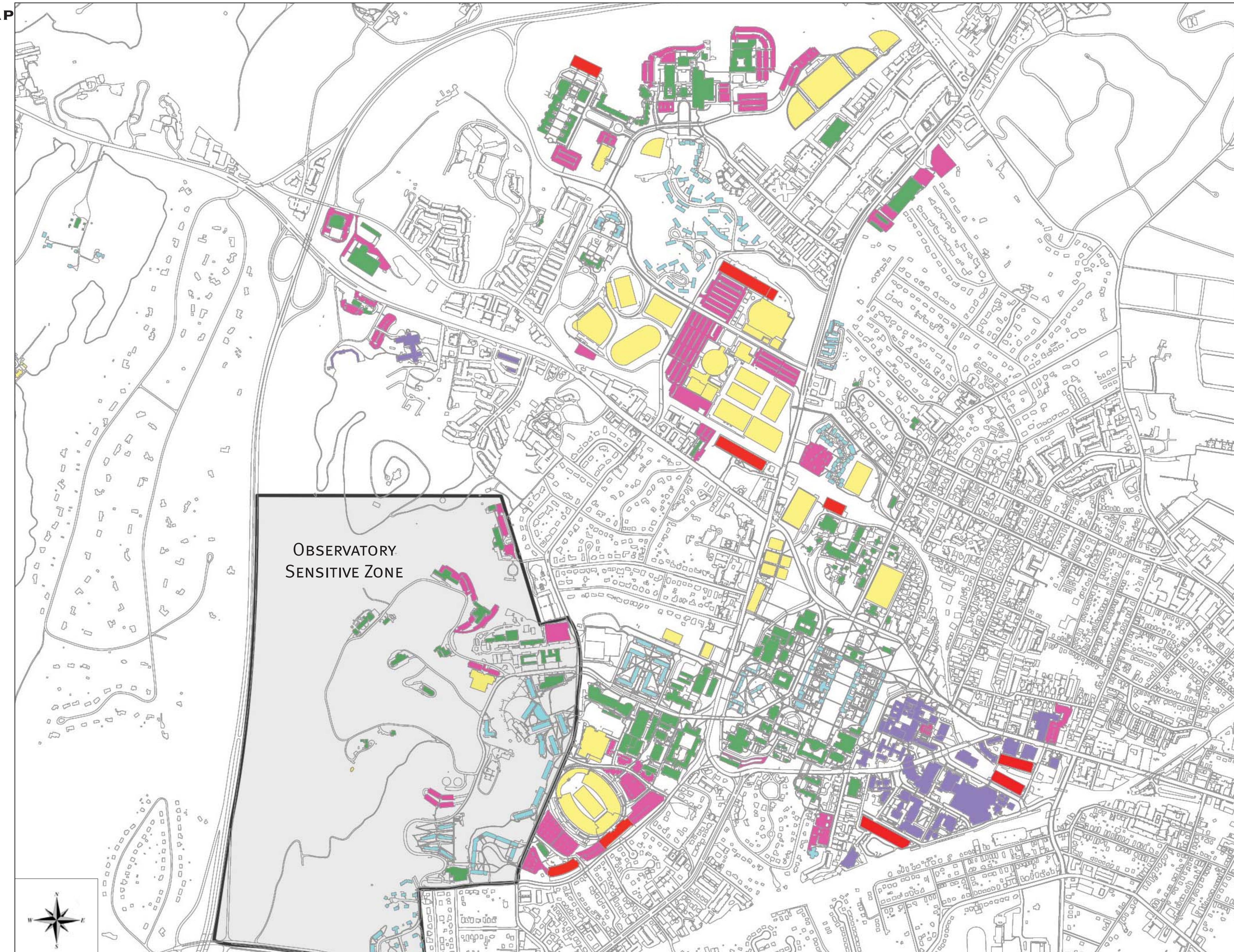
University Area Designation Map

- North Grounds
- U.S. 29 North
- University Hall & Athletic Fields
- Arts & Architecture
- Observatory Hill & Facilities Management
- McCormick Road Area
- Central Grounds
- Health System
- Hereford College & Carl Smith Center



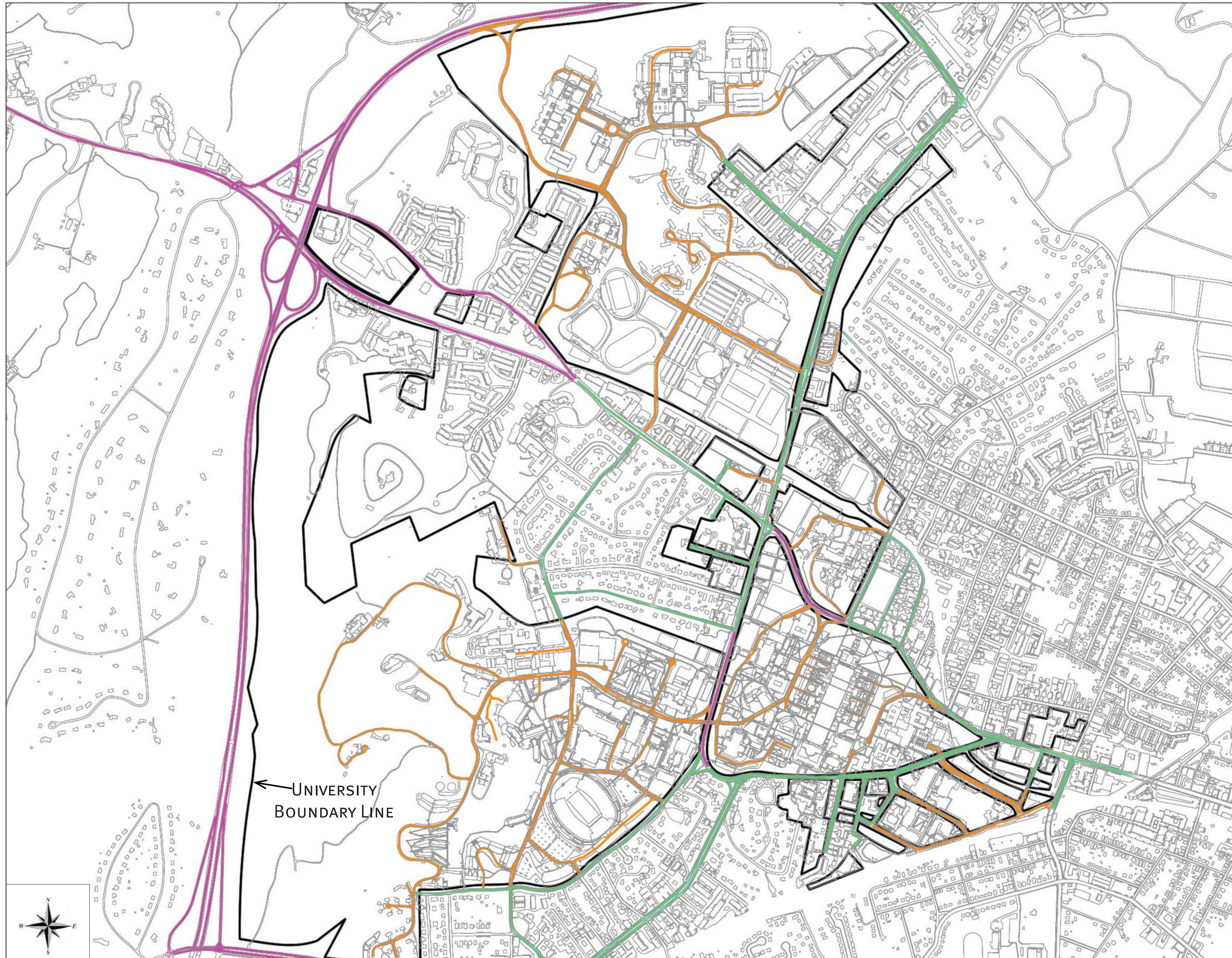
University Facility Designation Map

- Academic / Auxilary Facility
- Residential
- Health System
- Parking Garage
- Athletic Field / Facility
- Parking Lot



UNIVERSITY ROADWAY MAP

- City Roads
- University Roads
- County Roads



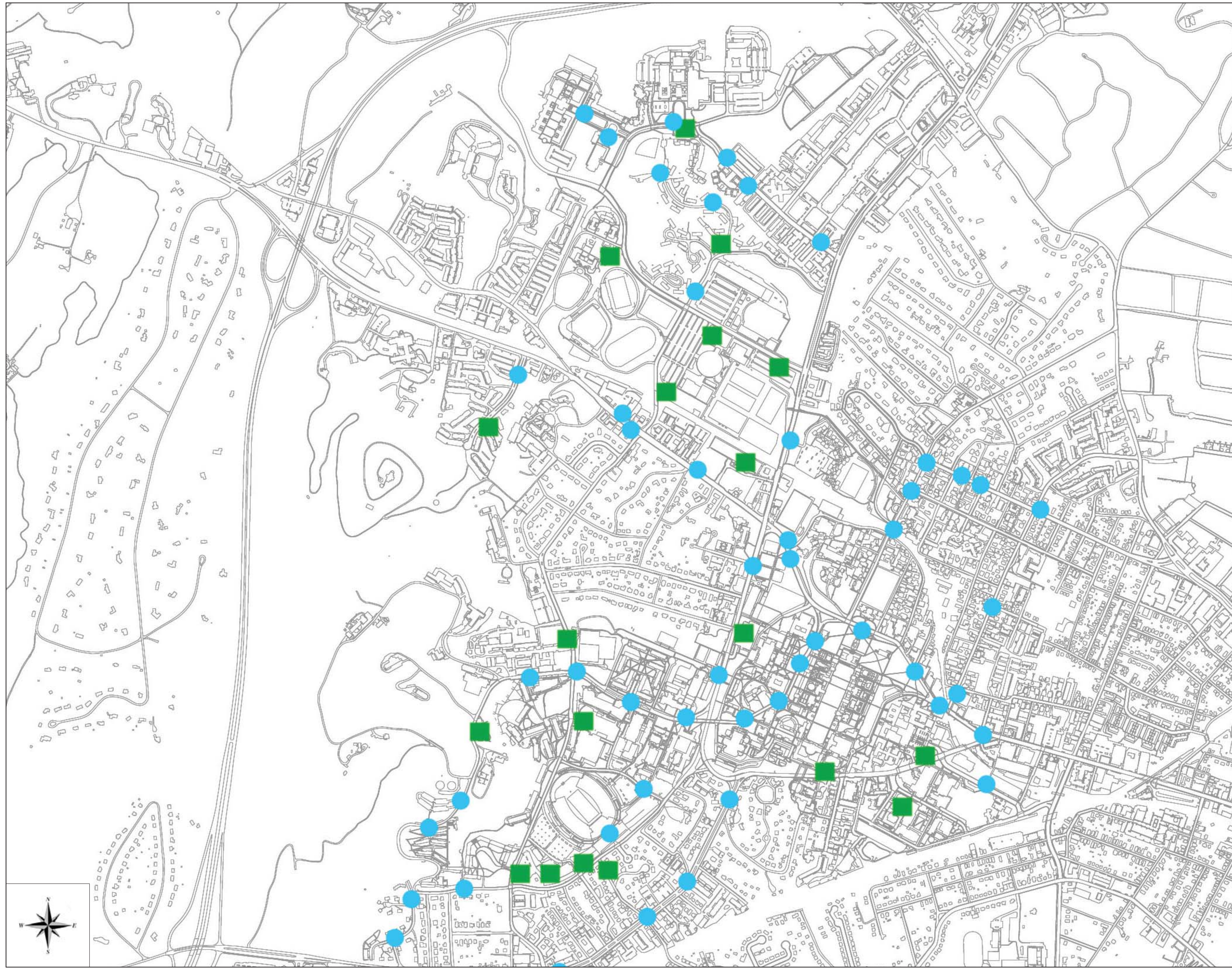
University Entry Point Map

Monumental Entry Points
(presence of structural elements, existing or proposed)

Vehicular Entry Points
(awareness of passing into university grounds)

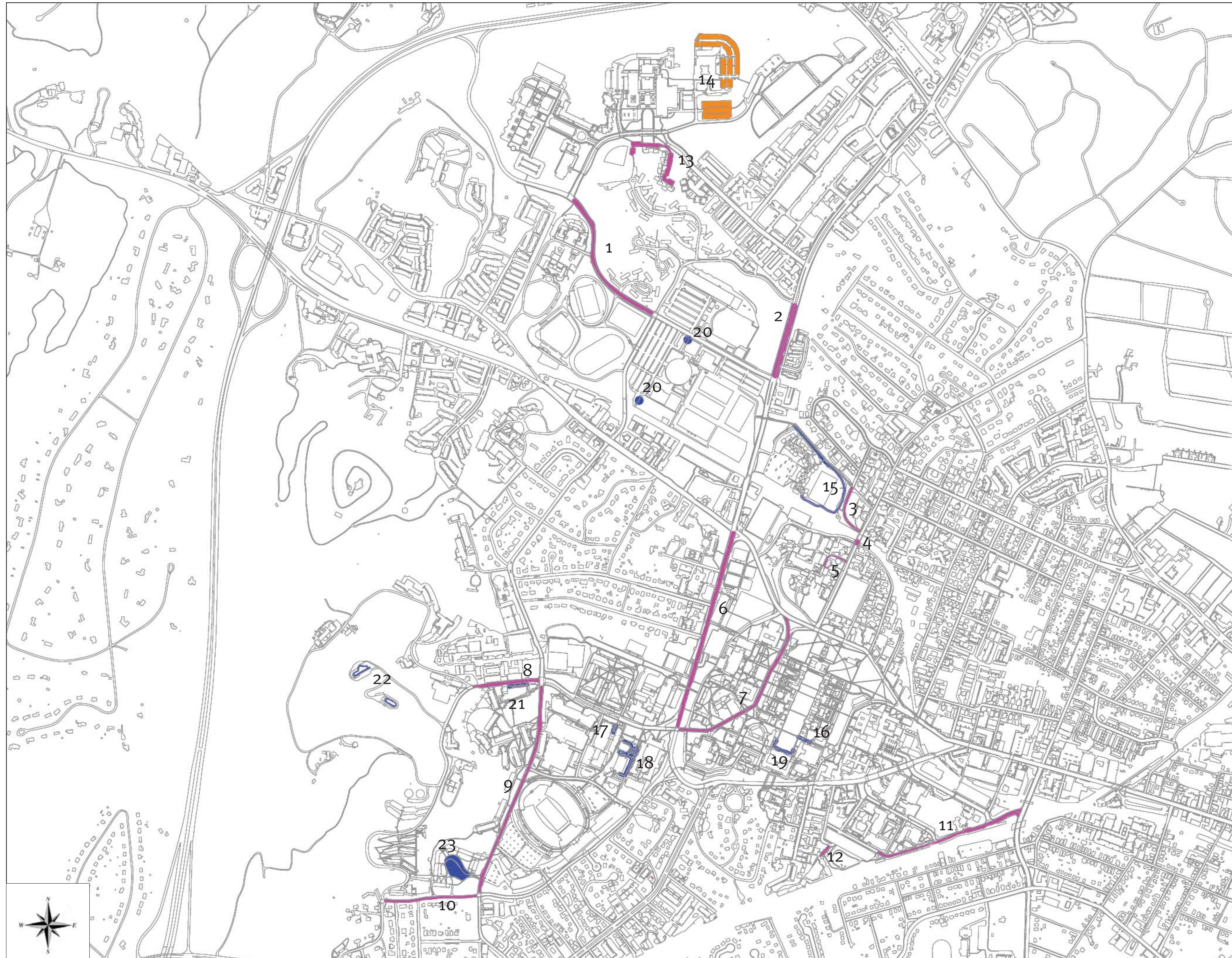
University Bus Stop Map

- Bus Shelter
- Bus Stop



Areas of Lighting Concerns Cited by Stakeholders

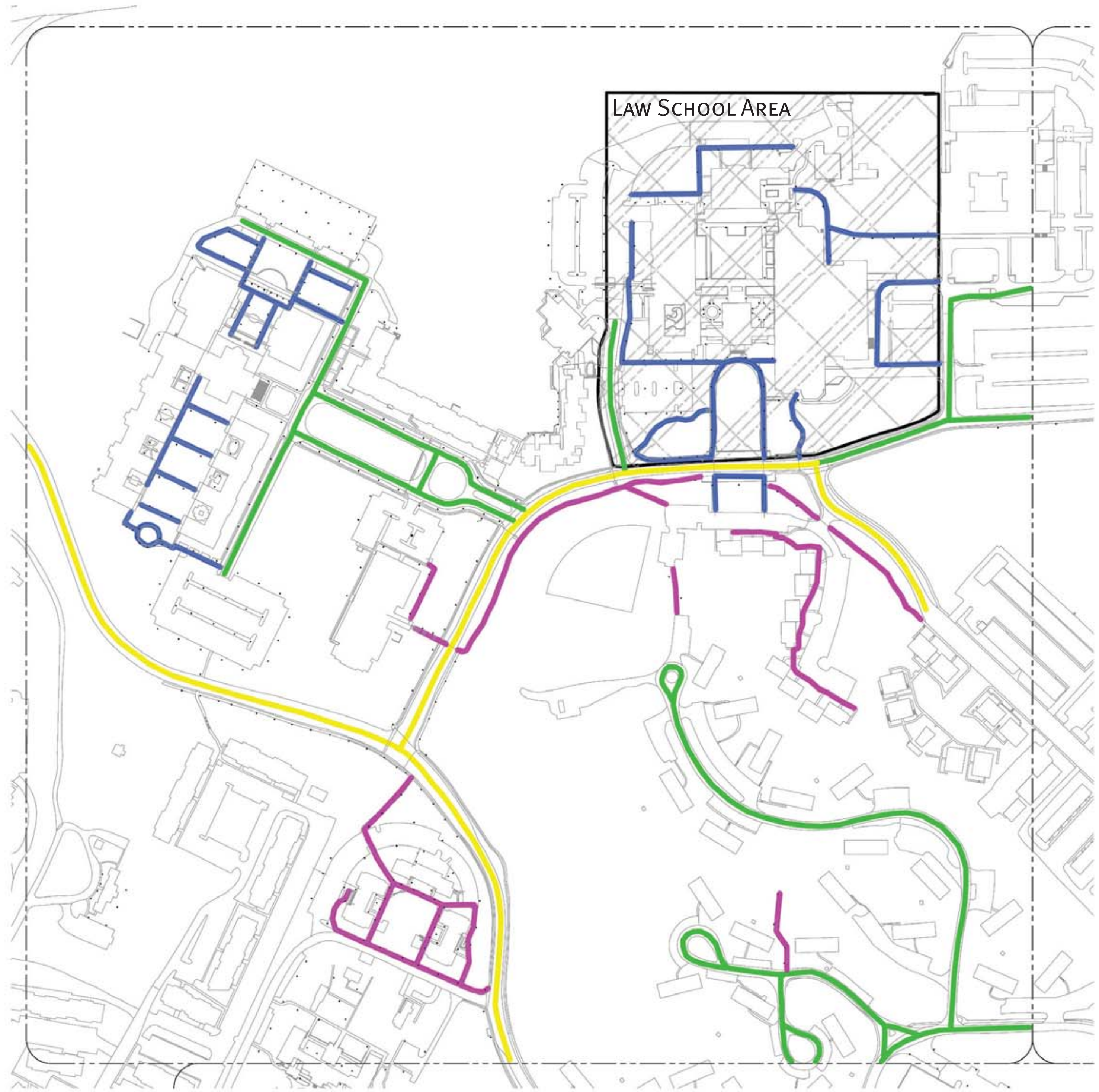
- Roadways
- Parking Lots
- Walkways and Plazas



North Grounds Circulation Hierarchy Map

- Primary Path
- Secondary Path
- Historical Path

- Primary Roadway/Path
- Secondary Roadway/Path



Recommended Fixture Key

Edgewater
Primary Paths and Primary Roadway Paths (12' mounting height)

Roadway Pole
Crosswalks (20' mounting height)

Pedestrian Pole
Secondary paths (14' mounting height)

U.S. 29 North Circulation Hierarchy Map

- Primary Path
- Secondary Path
- Historical Path

- Primary Roadway/Path
- Secondary Roadway/Path

Recommended Fixture Key

Edgewater
Primary Paths and Primary Roadway Paths (12' mounting height)

Roadway Pole
Crosswalks (20' mounting height)

Pedestrian Pole
Secondary paths (14' mounting height)

University Hall & Athletic Fields Circulation Map

Primary Path

Secondary Path

Historical Path

Primary Roadway/Path

Secondary Roadway/Path

Recommended Fixture Key

Edgewater
Primary Paths and Primary Roadway Paths (12' mounting height)

Roadway Pole
Crosswalks (20' mounting height)

Pedestrian Pole
Secondary paths (14' mounting height)

Arts & Architecture Circulation Hierarchy Map

- Primary Path
- Secondary Path
- Historical Path

- Primary Roadway/Path
- Secondary Roadway/Path

Recommended Fixture Key

Edgewater
Primary Paths and Primary Roadway Paths (12' mounting height)

Roadway Pole
Crosswalks (20' mounting height)

Pedestrian Pole
Secondary paths (14' mounting height)

Observatory Hill & Facilities Management Circulation Hierarchy Map

- Primary Path
- Secondary Path
- Historical Path

- Primary Roadway/Path
- Secondary Roadway/Path

Recommended Fixture Key

Edgewater
Primary Paths and Primary Roadway Paths (12' mounting height)

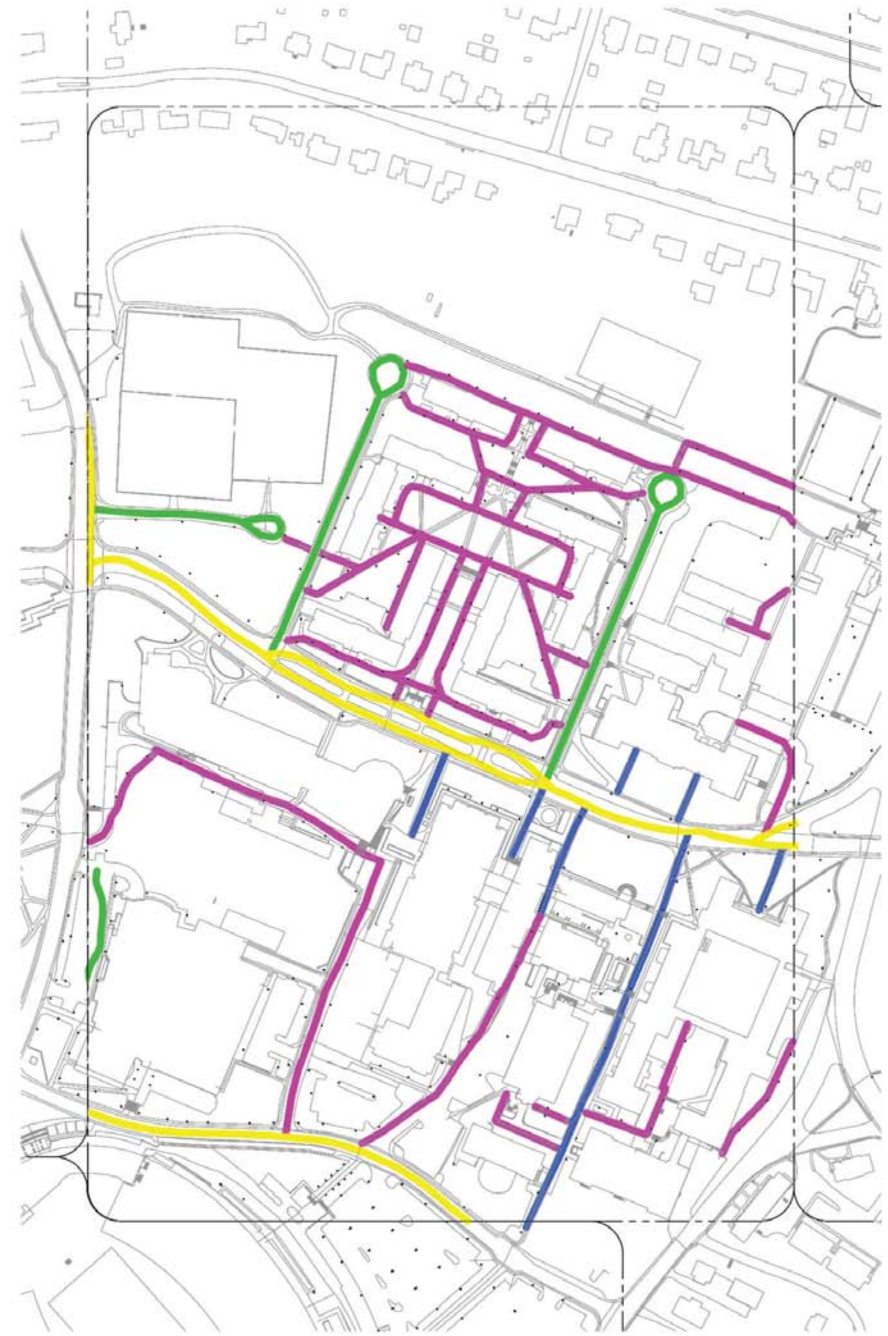
Roadway Pole
Crosswalks (20' mounting height)

Pedestrian Pole
Secondary paths (14' mounting height)

McCormick Road Area Circulation Hierarchy Map

- Primary Path
- Secondary Path
- Historical Path

- Primary Roadway/Path
- Secondary Roadway/Path



Recommended Fixture Key

Edgewater
Primary Paths and Primary Roadway Paths (12' mounting height)

Roadway Pole
Crosswalks (20' mounting height)

Pedestrian Pole
Secondary paths (14' mounting height)

Central Grounds Circulation Hierarchy Map

Primary Path

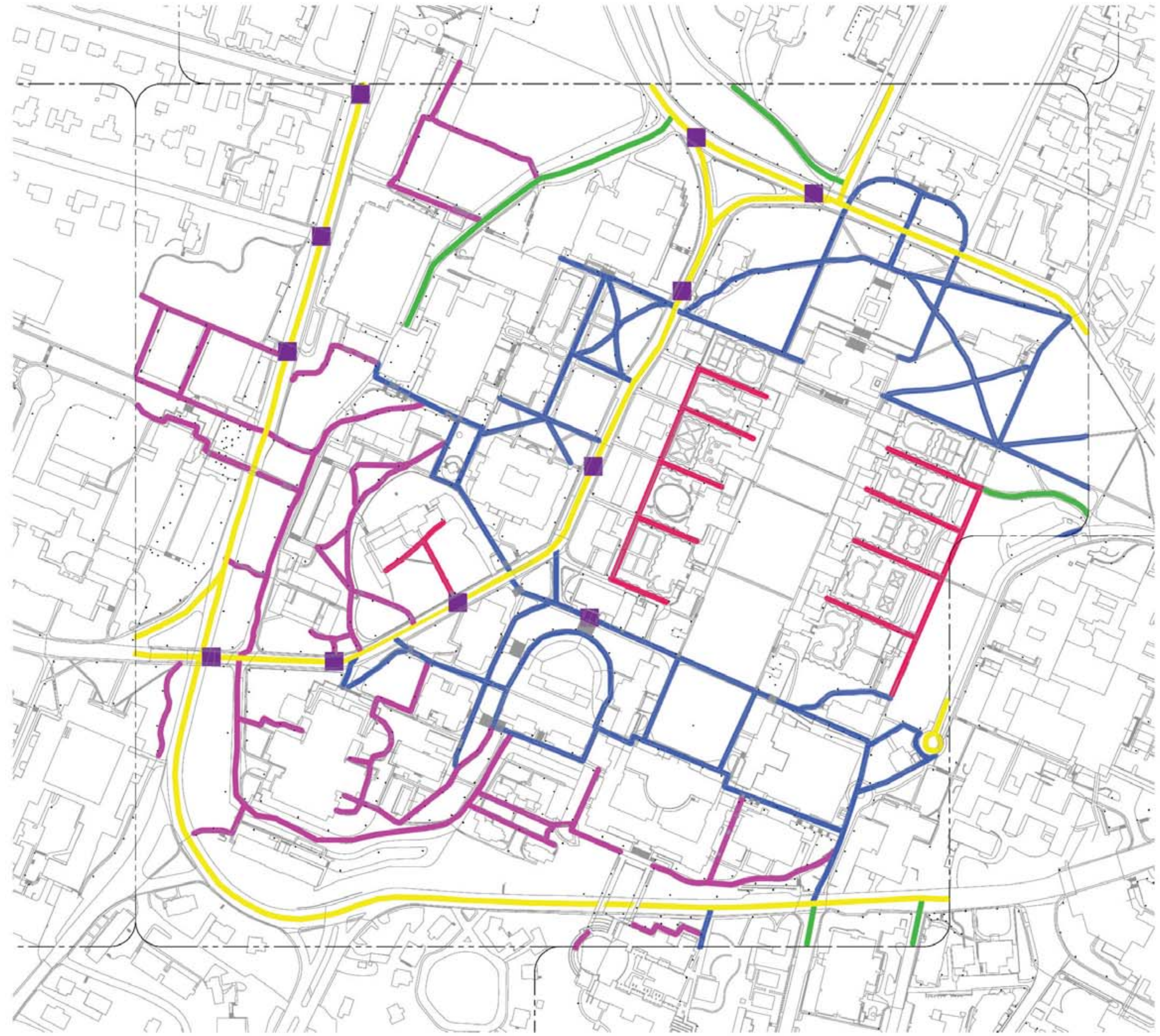
Secondary Path

Historical Path

Primary Roadway/Path

Secondary Roadway/Path

Crosswalk



Recommended Fixture Key

Edgewater
Primary Paths and Primary Roadway Paths (12' mounting height)

Roadway Pole
Crosswalks (20' mounting height)

Pedestrian Pole
Secondary paths (14' mounting height)

Health System Circulation Hierarchy Map

- Primary Path
- Secondary Path
- Historical Path

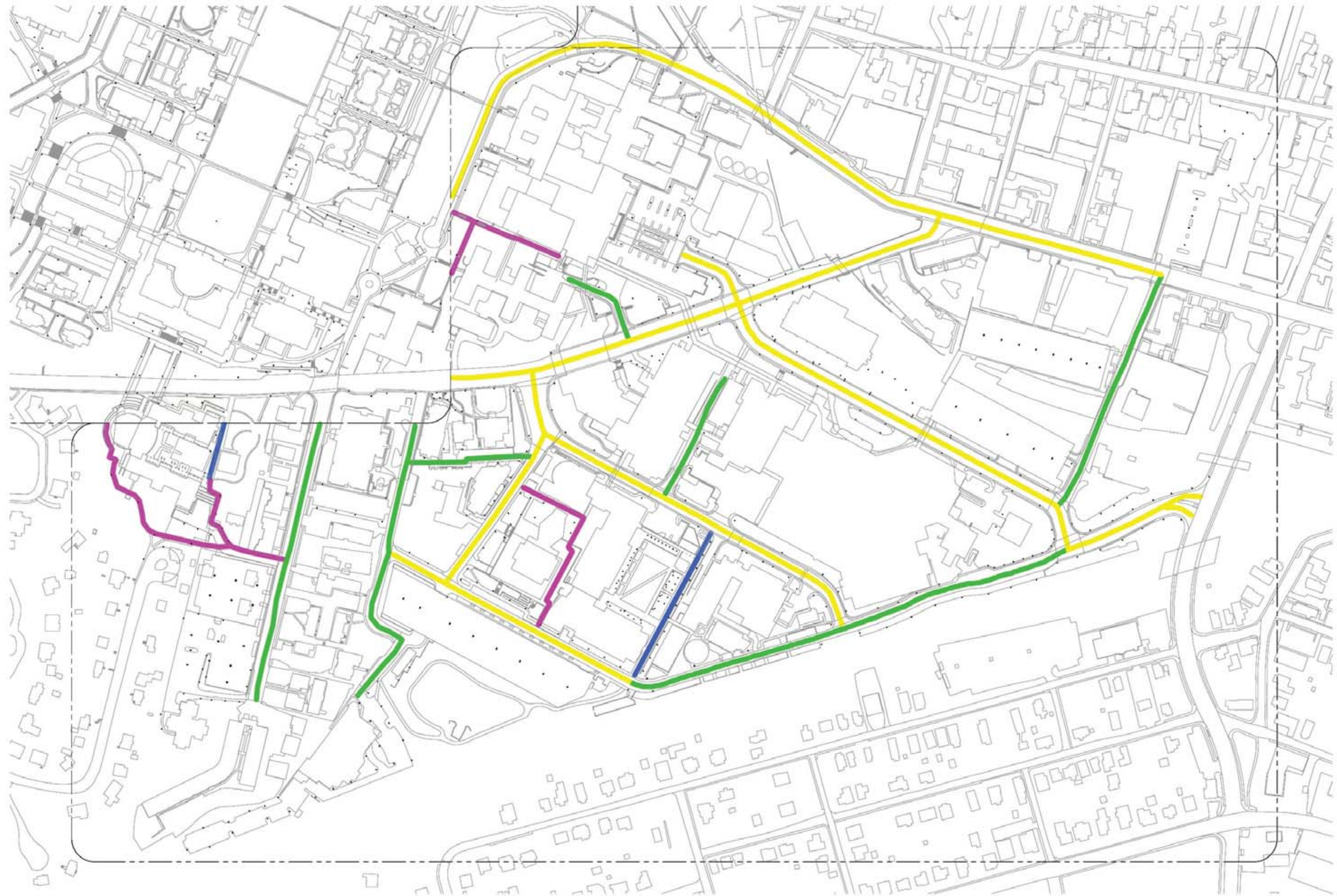
- Primary Roadway/Path
- Secondary Roadway/Path

Recommended Fixture Key

Edgewater
Primary Paths and Primary Roadway Paths (12' mounting height)

Roadway Pole
Crosswalks (20' mounting height)

Pedestrian Pole
Secondary paths (14' mounting height)



Hereford College & Carl Smith Center Circulation Hierarchy Map

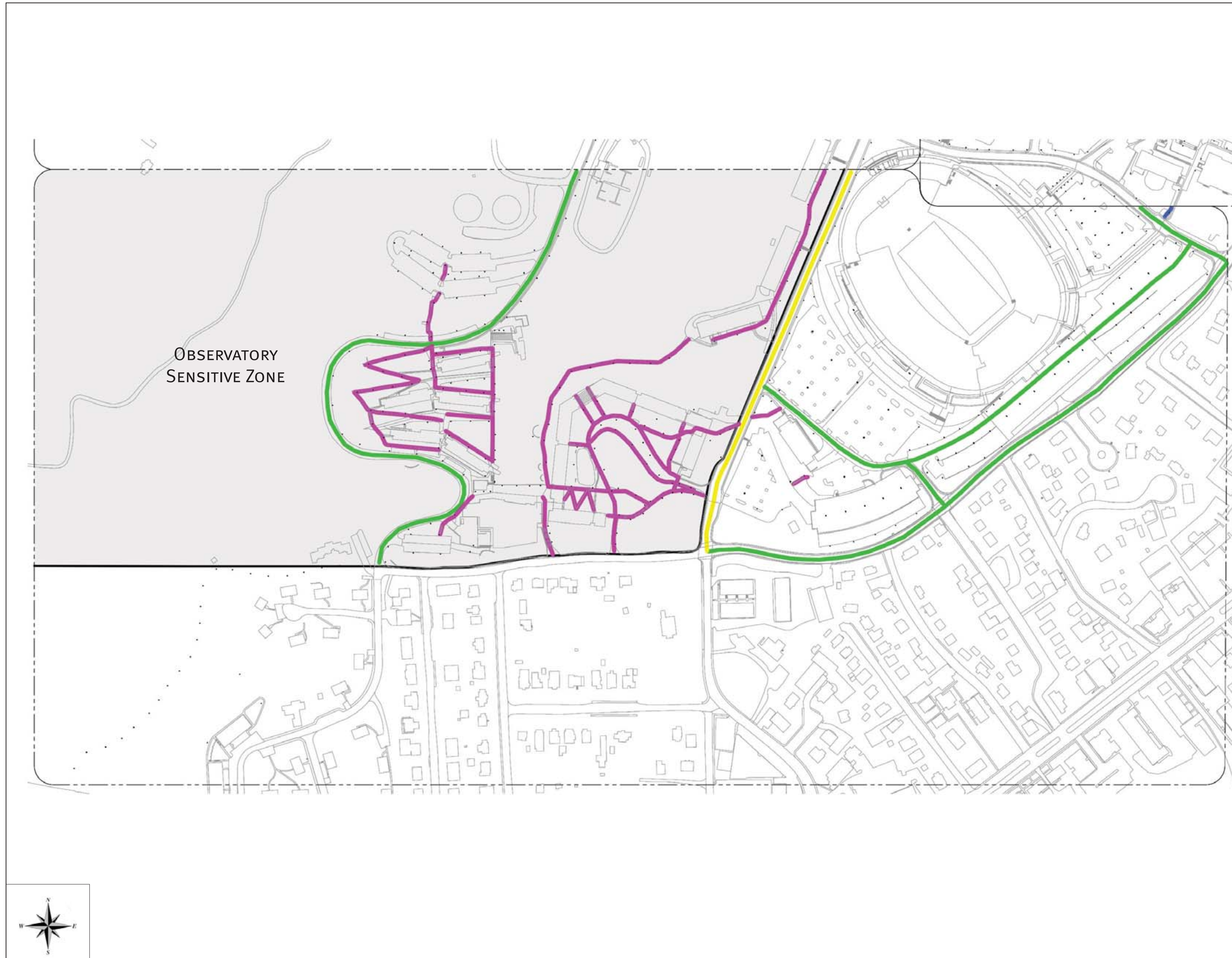
Primary Path

Secondary Path

Historical Path

Primary Roadway/Path

Secondary Roadway/Path



Recommended Fixture Key

Edgewater
Primary Paths and Primary Roadway Paths (12' mounting height)

Roadway Pole
Crosswalks (20' mounting height)

Pedestrian Pole
Secondary paths (14' mounting height)

North Grounds Existing Fixture Style Map

- Edgewater
- Shoe Box
- Cobra Head
- Bega Indirect
- Globe
- Field
- Holophane
- Bollard

U.S. 29 North Existing Fixture Style Map

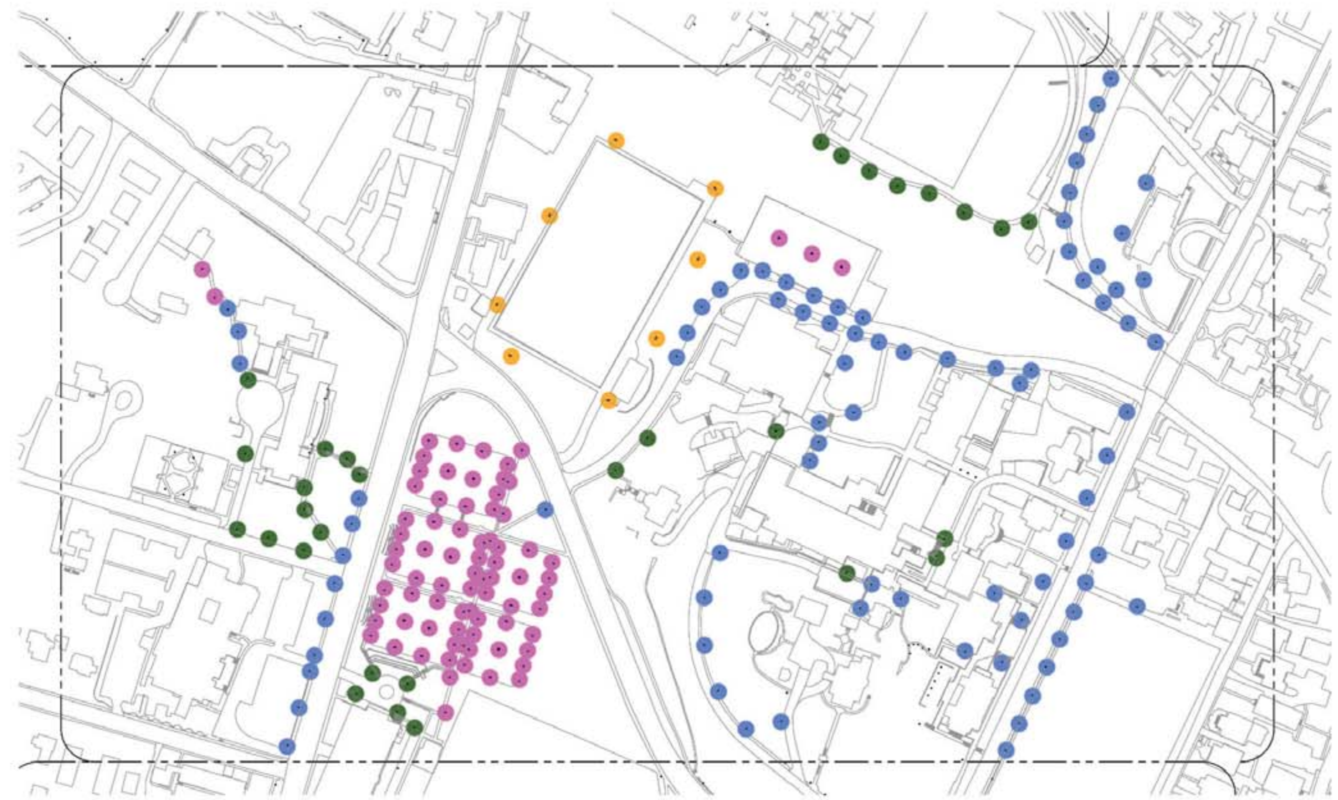
- Edgewater
- Shoe Box
- Cobra Head
- Bega Indirect
- Globe
- Field
- Holophane
- Bollard

University Hall & Athletic Fields Existing Fixture Style Map

- Edgewater
- Shoe Box
- Cobra Head
- Bega Indirect
- Globe
- Field
- Holophane
- Bollard

Arts & Architecture Existing Fixture Style Map

- Edgewater
- Shoe Box
- Cobra Head
- Bega Indirect
- Globe
- Field
- Holophane
- Bollard



Observatory Hill & Facilities Management Existing Fixture Style Map

- Edgewater
- Shoe Box
- Cobra Head
- Bega Indirect
- Globe
- Field
- Holophane
- Bollard

McCormick Road Area Existing Fixture Style Map

- Edgewater
- Shoe Box
- Cobra Head
- Bega Indirect
- Globe
- Field
- Holophane
- Bollard

Central Grounds Existing Fixture Style Map

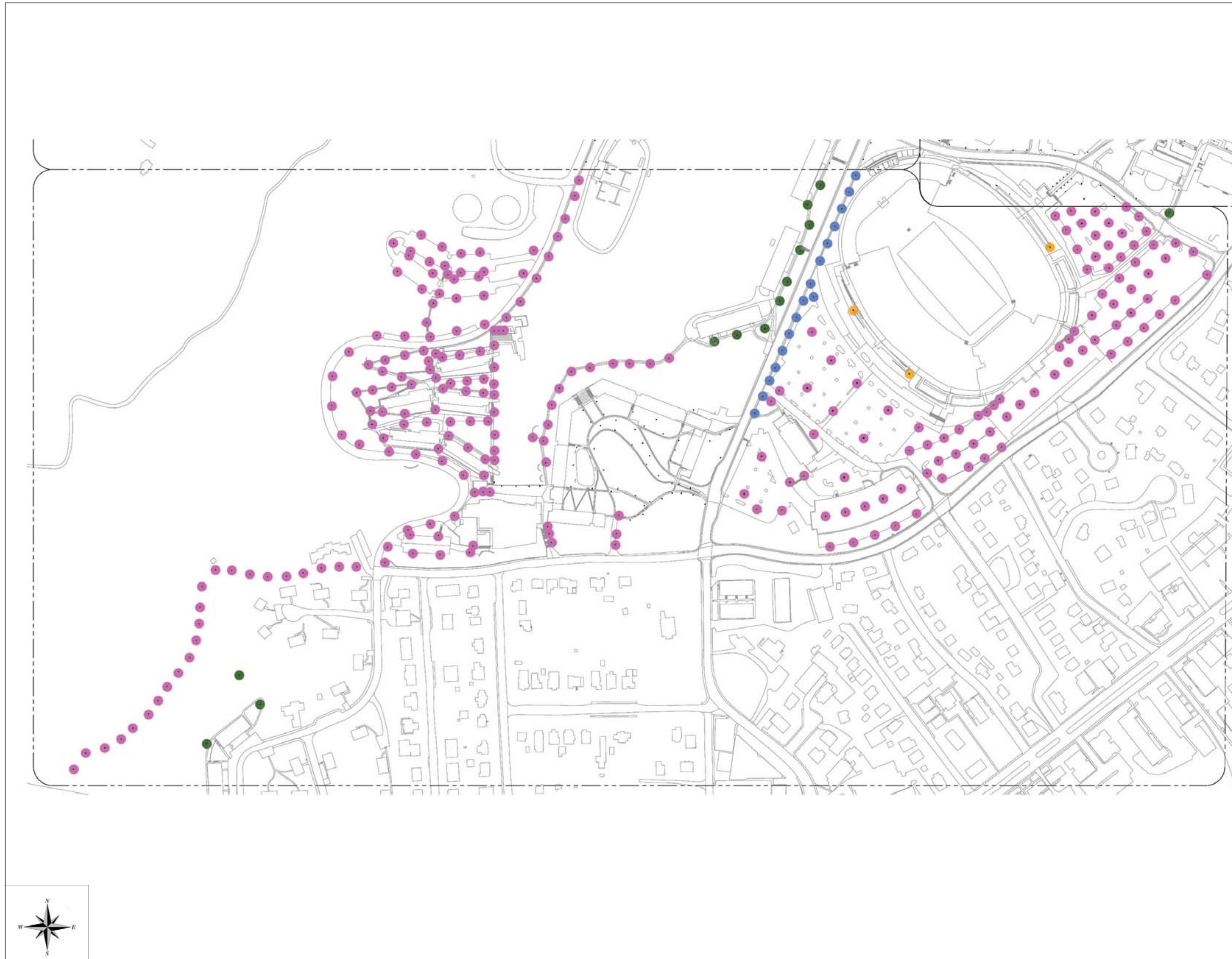
- Edgewater
- Shoe Box
- Cobra Head
- Bega Indirect
- Globe
- Field
- Holophane
- Bollard

Health System Existing Fixture Style Map

- Edgewater
- Shoe Box
- Cobra Head
- Bega Indirect
- Globe
- Field
- Holophane
- Bollard

Hereford College & Carl Smith Center Existing Fixture Style Map

- Edgewater
- Shoe Box
- Cobra Head
- Bega Indirect
- Globe
- Field
- Holophane
- Bollard



University Survey Lighting Measurements

Location	Maximum Illuminance Reading (footcandles)	Minimum Illuminance Reading (footcandles)	Average Illuminance (footcandles)	IESNA Recommended Level (footcandles)	Uniformity (Ave:Min)
Roadway & Sidewalks					
Massie Road between Copeley Road & Leonard Sandridge Road	1.20	0.03	0.36	0.9	12:1
Bayly Drive	0.13	0.02	0.05	0.7	2.7:1
Crispell Drive Between South Hospital Parking Garage & Roosevelt Brown Boulevard	4.60	0.03	0.84	0.9	27:1
Sidewalk at Leonard Sandridge Road	1.60	0.60	1.10	0.5	1.8:1
McCormick Road Between University Avenue & Emmet Street	0.70	0.10	0.43	0.9	4.3:1
Sidewalk at McCormick Road Between University Avenue & Emmet Street	1.82	0.08	0.26	0.6	3.3:1
Parking Lots					
Judge Advocate South Parking Lot	4.60	0.10	1.00	1.0	10:1
Judge Advocate East Parking Lot	5.70	0.70	2.10	1.0	3:1
Walkways, Stairs & Plazas					
Stairs between Rouss hall & Pavilion	0.02	0.01	0.01	1.0	1.3:1
Walkway at Engineering School	1.60	0.10	0.85	0.5	8.5:1
Plaza between Chemistry & Gilmer Hall	0.53	0.09	0.25	0.5	2.9:1
Plaza between Chemistry & Wilsdorf	0.33	0.18	0.59	0.5	1.8:1
Walkway Between Cocke Hall & Rouss Hall	0.24	0.01	0.24	0.5	24:1
Stairs between Randall Hall & rouss/Robertson Hall	1.20	0.26	0.78	1.0	3:1
Walkway between Cabell Hall & Wilson Hall	1.40	0.20	0.70	0.5	3.5:1
Walkway between Brooks Hall & rotunda	0.50	0.01	0.14	0.5	14:1
Lambeth Lane between Goodwin Bridge & University Way	1.80	0.05	0.55	0.5	11:1
Stairs at Lambeth Field Residence	22.0	6.00	14.0	3.0	2.3:1
Walkway at Lambeth Field Residence	3.00	-	-	0.5	-
Stairs at Faulkner Residence	30.0	10.0	20.0	3.0	2:1
Walkway at Faulkner Residence	2.0	1.00	1.50	0.5	3:1
Bus Stops					
McCormick Road	1.82	-	-	3.0	-

IESNA Recommended Illuminance Values

Location		IESNA Recommended Average Illuminance (Footcandles)	Uniformity (Avg:Min)
Roadways R2 & R3 Pavement Classification			
Collector	Commercial: Heavy Pedestrian Activity	1.2	4:1
	Intermediate: Moderately heavy Pedestrian Activity	0.9	4:1
	Residential	0.6	4:1
Local	Commercial: Heavy Pedestrian Activity	0.9	6:1
	Intermediate: Moderately heavy Pedestrian Activity	0.7	6:1
	Residential	0.4	6:1
Other Locations			
Roadside Sidewalks & Designated Bike Lanes on Road	Commercial: Heavy Pedestrian Activity	1.0	4:1
	Intermediate: Moderately heavy Pedestrian Activity	0.6	4:1
	Residential	0.2	4:1
Walkways, Bike Paths & Stairways - Distant From Roadway		0.5 to 1.0	5:1
Pedestrian Tunnels		4.3	4:1
Parks, Plazas and Pedestrian Malls		0.5 to 2.0	10:1
Parking Lots		0.5	5:1
Parking Garages		1.0	10:1
Exterior Residential Stairways		3.0	-
Bus Stops (city/intercity at city stop and intercity bus at country stop)		3.0	-

Lighting Glossary

Term	Definition
Accommodation	The process by which the eye changes focus from one distance to another.
Adaptation	The process by which the visual system becomes accustomed to more or less light than it was exposed to during an immediately preceding period. It results in a change in the sensitivity of the eye to light.
Amperes (amps or A)	The unit of measurement of electric current.
Ballast	An auxiliary device consisting of induction windings wound around a metal core and sometimes includes a capacitor for power correction. It is used with fluorescent and HID lamps to provide the necessary starting voltage and to limit the current during operation.
Color Rendering Index (CRI)	Measure of the degree of color shift objects undergo when illuminated by the light source as compared with the color of those same objects when illuminated by a reference source of comparable color temperature.
Color Temperature	The absolute temperature of a blackbody radiator having a chromaticity equal to that of the light source.
Cutoff Luminaires	Outdoor luminaires that restrict all light output to below 85° from vertical.
Direct Glare	Glare resulting from high luminances or insufficiently shielded light sources in the field of view It usually is associated with bright areas, such as luminaires, ceilings and windows which are outside the visual tasks or region being viewed.
Discomfort Glare	Glare producing discomfort. It does not necessarily interfere with visual performance or visibility.
Emergency Lighting	Lighting system designed to provide minimum illumination required for safety, during power failures.
Footcandle (fc)	The unit of illuminance when the foot is taken as the unit of length. It is the illuminance on a surface one square foot in area on which there is a uniformly distributed flux of one lumen.
Glare	The sensation produced by luminance within the visual field that is sufficiently greater than the luminance to which the eyes are adapted to cause annoyance, discomfort, or loss in visual performance and visibility.
High Intensity Discharge (HID) Lamp	A discharge lamp in which the light producing arc is stabilized by wall temperature, and the arc tube has a bulb wall loading in excess of three watts per square centimeter. HID lamps include groups of lamps known as mercury, metal halide, and high pressure sodium.

Term	Definition
Kelvin	Unit of measurement for color temperature. The Kelvin scale starts from absolute zero, which is -273° Celsius.
Kilowatt-Hour (KWH)	Unit of electrical power consumed over a period of time. KWH = watts/1000 x hours used.
Lamp	An artificial source of light (also portable luminaire equipped with a cord and plug).
Lamp Efficacy	The ratio of lumens produced by a lamp to the watts consumed. Expressed as lumens per watt (LPW).
Lamp Lumen Depreciation (LLD)	Multiplier factor in illumination calculations for reduction in the light output of a lamp over a period of time.
Lumen	The unit of luminous flux. It is the luminous flux emitted within a unit solid angle (one steradian) by a point source having a uniform luminous intensity of one candela.
Luminaire	A complete lighting unit consisting of a lamp or lamps together with the parts designed to distribute the light, to position and protect the lamps and to connect the lamps to the power supply.
Luminaire Direct Depreciation (LDD)	The multiplier to be used in illuminance provided by clean, new luminaires to the reduced illuminance that they will provide due to direct collection on the luminaires at the time at which it is anticipated that cleaning procedures will be instituted.
Luminaire Efficiency	The ratio of luminous flux (lumens) emitted by a luminaire to that emitted by the lamp or lamps used.
Luminance	The amount of light reflected or transmitted by an object.
Maintenance Factor (MF)	A factor used in calculating illuminance after a given period of time and under given conditions. It takes into account temperature and voltage variations, dirt accumulation on luminaire and room surfaces, lamp depreciation, maintenance procedures and atmosphere conditions.
Metal Halide Lamp	A high intensity discharge (HID) lamp in which the major portion of the light is produced by radiation of metal halides and their products of dissociation-possible in combination with metallic vapors such as mercury. Includes clear and phosphor coated lamps.
Watt (W)	The unit for measuring electric power. It defines the power or energy consumed by an electrical device. The cost of operating an electrical device is determined by the watts it consumes times the hours or use.