

# KAPIOLANI COMMUNITY COLLEGE EXTERIOR LIGHTING STUDY

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OAHU, HAWAII



MARCH 2008

FINAL SUBMITTAL

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## SECTION 1.0 - EXECUTIVE SUMMARY

The exterior lighting at the Kapiolani Community College was built along with the majority of the campus during the 80's and early 90's. Because much of the lighting criteria has changed since its initial construction, UHCC (University of Hawaii Community Colleges) and KCC (Kapiolani Community College) initiated this study to determine the extent of work needed to improve the exterior lighting on campus. Higher exterior lighting levels would increase visual accuracy, make it easier for campus security to effectively patrol the campus, and provide people with a sense of higher security as perceptions of safety increase with higher lighting levels.

Each area of the Kapiolani Community College campus was identified, grouped, and prioritized into the following 4 areas.

1. 1st Priority Areas      Estimated cost for lighting improvements - **\$456,000**  
1st priority areas are defined as high traffic areas where the exterior lighting levels do not meet the current lighting level criteria and where the users have indicated the existing lighting conditions to be deficient. It is recommended that new lighting be provided to replace the existing lighting.
2. 2nd Priority Areas      Estimated cost for lighting improvements - **\$998,000**  
2nd priority areas are defined as high to moderate traffic areas where the exterior lighting levels do not meet the current lighting level criteria and where the existing lighting conditions could be improved. It is recommended that new lighting be provided to replace the existing lighting.
3. 3rd Priority Areas      Estimated cost for lighting improvements - **\$641,000**  
3rd priority areas are defined as light traffic areas where the exterior lighting levels do not meet current lighting level criteria and where the existing lighting conditions could be moderately improved. It is recommended that new lighting be provided to replace the existing lighting.
4. 4th Priority Areas      Estimated cost for lighting improvements - **\$183,000**  
4th priority areas are defined as areas within the interior parts of campus where users and existing lighting calculations have indicated existing lighting conditions to be adequate. It is recommended that the existing luminaires be relamped, repaired, and have the lenses cleaned or replaced as necessary and in cases where the luminaires are not repairable, replaced.

In addition to the improvement stated above, regular tree trimming is recommended to minimize the amount of shadows being produced by the trees in all areas of the campus.

An overall summary listing the estimated cost of the exterior lighting improvements and priorities of each area is listed in Figure 1.0 of Appendix A.

## SECTION 2.0 - EXISTING CONDITIONS

To determine the lighting levels of existing conditions, we ran lighting calculations based on record drawings and performed field investigations to verify the existing lighting conditions.

Field investigations verified that most of the existing luminaires on campus were the original lights installed during the 80's and early 90's. The existing inner campus exterior walkway lights were of non-cutoff type which provides good vertical illumination but increases light pollution. Existing parking lot and campus roadway lights are of the full cut-off type. Many of the exterior lights had limited light output due to yellowing or dirty lenses or were non-functional due to burnt out lamps and malfunctioning ballasts. The estimated efficiency of the existing operational lights under these conditions range from 60% to 80%.

The existing lighting calculations (as shown in Appendix B, Figure 2.1 thru Figure 2.20) are approximate and do not include contribution from building lights and street lighting, and interference from landscape vegetation. Nighttime field investigations were conducted to take actual light meter measurements of the existing conditions which were then compared against the lighting calculations that were based on the existing lighting conditions. In most cases, the existing lighting measurements corresponded well with its corresponding calculation point. However a few points were affected by nearby trees and objects. Even so, we felt that the calculations, that were based on the existing conditions, are accurate enough for the use of comparison and analysis.

The individual areas of work are defined as indicated on Figure 2.0 in Appendix B. The boundaries of the defined lighting areas were chosen to keep each area as independent as possible so as to provide separate construction phases that would have minimal impacts on each other and to minimize construction costs. The defined lighting areas are as follows and the lighting layout and calculations of the existing conditions can be found in Appendix B on the figure as indicated.

1. Parking Lot "A" Lighting Area 1 (see Figure 2.1)
2. Parking Lot "A" Lighting Area 2 (see Figure 2.1)
3. Ewa Access Road Lighting Area (see Figure 2.2)
4. Parking Lot "B" Lighting Area (see Figure 2.3)
5. Diamond Head Access Road Lighting Area (see Figure 2.3)
6. Parking Lot "C" Lighting Area 1 (see Figure 2.4)
7. Parking Lot "C" Lighting Area 2 (see Figure 2.4)



8. Olopuu Lighting Area (see Figure 2.5)
9. Parking Lot "D" Lighting Area (see Figure 2.6)
10. Parking Lot "E" Lighting Area (see Figure 2.7)
11. Manolo and Manele Lighting Area (see Figure 2.8)
12. Mauka Access Road Lighting Area (see Figure 2.8)
13. Mamane, Mokihana, and Maile Lighting Area (see Figure 2.9)
14. Library Parking Lot Lighting Area (see Figure 2.9)
15. Iliahi Lighting Area 1 (see Figure 2.10)
16. Kauila, Kokio, and Koa Lighting Area (see Figure 2.11)
17. Kopiko Lighting Area (see Figure 2.12)
18. Iliahi Lighting Area 2 (see Figure 2.13)
19. Great Lawn and Kalia Lighting Area (see Figure 2.14)
20. Ilima Lighting Area (see Figure 2.15)
21. Ohia Lighting Area (see Figure 2.16)
22. Naio Lighting Area (see Figure 2.17)
23. Ohelo and Olana Lighting Area (Walkways) (see Figure 2.18)
24. Ohelo and Olana Lighting Area (Roadways) (see Figure 2.18)
25. Lama Lighting Area (see Figure 2.19)
26. Bikepath Lighting Area (see Figure 2.20)

### SECTION 3.0 - ANALYSIS

The target lighting levels recommended by the IESNA (Illuminating Engineering Society of North America) for parking lots, pedestrian walkways, and similar areas varies from 0.2 to 0.5 horizontal footcandles minimum with a 5:1 average/minimum uniformity ratio. However, the illumination calculations will aim for slightly higher footcandle ranges of 0.5 to 1.0 minimum footcandles to compensate for the ubiquitous trees at the campus which tend to block much of the light and create many shadows.

The lighting calculations for the existing conditions indicate that the parking lots and campus roadways do not meet the target lighting level. A new lighting layout was developed to meet the target lighting level for these areas (see Appendix C). The new luminaires are to be of the full cut-off type to minimize the amount of light pollution and light trespass. The new luminaires will also be more efficient than the existing luminaires some of which are approaching 20+ years in age. (see Appendix E for new luminaires catalog cut sheets).

KCC users have indicated the exterior lighting within the interior parts of the campus is adequate and the existing lighting calculations confirm this with the exception of a few small remote areas. However it is the recommendation of this study that all luminaires to remain should be relamped and/or re-ballasted, have the lenses cleaned or replaced, and in some instances where the luminaires are beyond repair, replaced. (see Appendix C)

Regular tree trimming is recommended to minimize the amounts of shadows being produced by the trees. Because this is an environmentally sensitive subject, care should be taken during any tree trimming work.

Previous KCC personnel had concerns about resetting all the lighting circuit timers after power outages. The existing lighting control scheme will be retained with lighting timers and contactors controlling each individual area. However, new lighting timers will be provided with 24 hour mechanical spring backups for continuous operation during power outages.

The construction cost for the exterior lighting improvements in each of the defined lighting areas can be found in Appendix D.

The lighting areas were prioritized into the following 4 groups taking into account pedestrian and vehicular traffic usage, user input, IESNA recommended lighting levels, and level of improvement to meet the current lighting criteria. The recommended work can be found in Appendix C on the figure as indicated.

1. **1ST PRIORITY** – High traffic areas where the exterior lighting levels do not meet the current lighting level criteria and where users have indicated the existing lighting conditions to be deficient. It is recommended that new lighting be provided to replace the existing lighting in the following areas:

- a. Parking Lot "A" Exterior Lighting Area 1 (see Figure 3.1)
  - b. Ewa Access Road Exterior Lighting Area (see Figure 3.2)
  - c. Diamond Head Access Road Exterior Lighting Area (see Figure 3.3)
  - d. Parking Lot "C" Exterior Lighting Area 1(see Figure 3.4)
  - e. Library Parking Lot Exterior Lighting Area (see Figure 3.9)
  - f. Ohelo and Olana Exterior Lighting Area (Roadways) (see Figure 3.18)
2. **2ND PRIORITY** – High to moderate traffic areas where the exterior lighting levels do not meet the current lighting level and where the existing lighting conditions could be greatly improved. It is recommended that new lighting be provided to replace the existing lighting in the following areas:
- a. Parking Lot "A" Exterior Lighting Area 2 (see Figure 3.1)
  - b. Parking Lot "B" Exterior Lighting Area (see Figure 3.3)
  - c. Parking Lot "C" Exterior Lighting Area 2 (see Figure 3.4)
3. **3RD PRIORITY** – Light traffic areas where the exterior lighting levels do not meet current lighting level criteria and where the existing lighting conditions could be moderately improved. It is recommended that new lighting be provided to replace the existing lighting in the following areas:
- a. Olopuu Exterior Lighting Area (see Figure 3.5)
  - b. Parking Lot "D" Exterior Lighting Area (see Figure 3.6)
  - c. Parking Lot "E" Exterior Lighting Area (see Figure 3.7)
  - d. Makai Access Road Exterior Lighting Area (see Figure 3.8)
4. **4TH PRIORITY** – Areas within the interior parts of campus where users and existing lighting calculations have indicated existing lighting conditions to be adequate. The existing luminaires to remain are recommended to be relamped, repaired/replaced, and have the lenses cleaned as necessary. 4th priority areas include the following areas:
- a. Manolo and Manele Exterior Lighting Area (see Figure 3.8)
  - b. Mamane, Mokihana, and Maile Exterior Lighting Area (see Figure 3.9)



- c. Iliahi Exterior Lighting Area 1 (see Figure 3.10)
- d. Kauila, Kokio, and Koa Exterior Lighting Area (see Figure 3.11)
- e. Kopiko Exterior Lighting Area (see Figure 3.12)
- f. Iliahi Exterior Lighting Area 2 (see Figure 3.13)
- g. Great Lawn and Kalia Exterior Lighting Area (see Figure 3.14)
- h. Ilima Exterior Lighting Area (see Figure 3.15)
- i. Ohia Exterior Lighting Area (see Figure 3.16)
- j. Naio Exterior Lighting Area (see Figure 3.17)
- k. Ohelo and Olana Exterior Lighting Area (Walkways) (see Figure 3.18)
- l. Lama Exterior Lighting Area (see Figure 2.19)
- m. Bikepath Exterior Lighting Area (see Figure 2.20)

**SECTION 4.0 - CONCLUSION**

The total estimated construction cost to improve all the exterior lighting on campus is \$2,278,000. The areas of construction, to improve the exterior lighting, were prioritized based on pedestrian and vehicular traffic usage, user input from KCC, IESNA recommended lighting levels, and existing lighting conditions.

The area were prioritized into the following 4 groups with the recommended lighting improvements are as follows.

1. **1ST PRIORITY** – High traffic areas where the exterior lighting levels do not meet the current lighting level criteria and where users have indicated the existing lighting conditions to be deficient. It is recommended that new lighting be provided to replace the existing lighting.
2. **2ND PRIORITY** – High to moderate traffic areas where the exterior lighting levels do not meet the current lighting level and where the existing lighting conditions could be greatly improved. It is recommended that new lighting be provided to replace the existing lighting.
3. **3RD PRIORITY** – Light traffic areas where the exterior lighting levels do not meet current lighting level criteria and where the existing lighting conditions could be moderately improved. It is recommended that new lighting be provided to replace the existing lighting.
4. **4TH PRIORITY** – Areas within the interior parts of campus where users and existing lighting calculations have indicated existing lighting conditions to be adequate. The existing luminaires to remain are recommended to be relamped, repaired/replaced, and have the lenses cleaned as necessary.

The costs for the recommended lighting improvements are as follows.

<b>1st Priority Areas – Total Estimated cost for lighting improvements</b>	<b>\$456,000</b>
1. Parking Lot “A” Exterior Lighting Area 1	\$22,000
2. Ewa Access Road Exterior Lighting Area	\$113,000
3. Diamond Head Access Road Exterior Lighting Area	\$81,000
4. Parking Lot “C” Exterior Lighting Area 1	\$120,000
5. Library Parking Lot Exterior Lighting Area	\$33,000
6. Ohelo and Olana Exterior Lighting Area (Roadways)	\$55,000
<b>2nd Priority Areas – Total Estimated cost for lighting improvements</b>	<b>\$998,000</b>
7. Parking Lot “A” Exterior Lighting Area 2	\$181,000
8. Parking Lot “B” Exterior Lighting Area	\$310,000
9. Parking Lot “C” Exterior Lighting Area 2	\$507,000



<b>3rd Priority Areas – Total Estimated cost for lighting improvements</b>	<b>\$641,000</b>
10. Olopuia Exterior Lighting Area	\$88,000
11. Parking Lot “D” Exterior Lighting Area	\$252,000
12. Parking Lot “E” Exterior Lighting Area	\$211,000
13. Makai Access Road Exterior Lighting Area	\$90,000
<b>4th Priority Areas – Total Estimated cost for lighting improvements</b>	<b>\$183,000</b>
14. Manolo and Manele Exterior Lighting Area	\$14,000
15. Mamane, Mokihana, and Maile Exterior Lighting Area	\$9,000
16. Iliahi Exterior Lighting Area 1	\$9,000
17. Kauila, Kokio, and Koa Exterior Lighting Area	\$22,000
18. Kopiko Exterior Lighting Area	\$9,000
19. Iliahi Exterior Lighting Area 2	\$9,000
20. Great Lawn and Kalia Exterior Lighting Area	\$16,000
21. Ilima Exterior Lighting Area	\$17,000
22. Ohia Exterior Lighting Area	\$3,000
23. Naio Exterior Lighting Area	\$9,000
24. Ohelo and Olana Exterior Lighting Area (Walkways)	\$16,000
25. Lama Exterior Lighting Area	\$19,000
26. Bikepath Exterior Lighting Area	\$18,000

In addition to the improvements listed above, regular tree trimming is recommended in all areas of campus. Because this is an environmentally sensitive subject, care should be taken during any tree trimming work.

An overall summary of the estimated cost of the exterior lighting improvements and priorities of each area is listed in Figure 1.0 of Appendix A.