

Appendix A
Photometric Analysis

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Freeman Stadium Field Renovation

Field Lighting Renovation

Photometric Analysis

Project Number
USS-21009117

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NARRATIVE

1 INTRODUCTION

We (exp engineering) have conducted a photometric review of the proposed renovation to California State University Monterey's (CSUMB) Freeman Stadium for use by the Monterey Bay Football Club (MBFC) with specific regard to the impact of the new high-mast sports lighting on the surrounding areas. This report details the findings of the study and provides our conclusions and recommendations if any modifications are needed to be made to the design.

2 PROJECT LOCATION

Freeman Stadium is a part of the greater Otter Sports Complex located at the south west corner of the CSUMB campus off General Jim Moore Blvd between Lightfighter Drive and Divartiy Street in the city of Seaside in Monterey County, CA. The site is approximately 1/2 mile east of Highway 1 and 4 miles north east of the city center.

See Figure 1, Project Site Location

3 PROPOSED LIGHTING RENOVATION

As part of the greater stadium renovation, the field lighting is to be upgraded with new poles and luminaires. The proposed layout consists of four (4) new 90' tall high-mast poles, one at each corner of the stadium, each containing 46 LED flood lights aimed at the field surface below. The luminaires are all aimed at various positions on the playing field with the furthest and shallowest aiming angle being roughly 65° to the center of the field to the closest and steepest aiming angle being roughly 20°. *See Figure 3, Field Lighting Proposal*

The proposed luminaires are to have glare shields on the front of the fixture to mitigate direct view of the LEDs.

Lower level, pedestrian-scale luminaires are also being added as a part of this renovation and it is proposed that portable, temporary parking lot flood light towers will be employed for evening events. While these other sources will add to the illumination surrounding the stadium at night, their contribution will not be visible to the surrounding community and therefore were not considered in any of the calculations for this report.

4 SITE CONSIDERATIONS

CSUMB is located on the site of the former military base Fort Ord with the Otter Sports Complex and

Freeman Stadium isolated in the south west corner of the campus. Most of the former base structures have been demolished leaving wide swaths of land between the stadium and community structures.

The closest building to the site is the Veteran's Administration building, a medical office complex located on a small hill above the stadium, roughly 580' from the closest light tower. However, this office complex is no longer in operation.

The closest campus residences are approximately 1,800 feet northeast of the site, and the site is not visible from this location due to topography and vegetation. The closest off-campus residential community view of the complex is located roughly .51 miles south which is bordered by large, dense canopy trees obstructing the views to the north. The same is true for Highway 1. Any view to the sports complex and the stadium from highway traffic is obscured by groves of tall trees.

The stadium itself sits several feet below grade, with the new high-mast poles mounting at that lower field level making the top of those poles roughly the same height as the existing poles around the adjacent baseball field to the south and soccer fields to the south west.

5 CODES AND REGULATIONS

This section describes regulatory plans, policies, and ordinances related to lighting on the CSUMB campus or within the surrounding City of Seaside. As indicated in the following text, the California State University (CSU) does not have specific lighting policies or guidelines directing appropriate light levels (and spillover) from sports field or stadium lighting. As a result, although CSU as a state entity is not subject to local land use regulations, the City of Seaside's General Plan, the City's Municipal Zoning Code, and the guidelines in CSU Outdoor Lighting Design Guide were reviewed to provide parameters for the analysis of light impacts resulting from the proposed outdoor lighting.

California State University Outdoor Lighting Design Guide (2018)

The Outdoor Lighting Design Guide provides CSU campuses with guidelines for outdoor lighting design to ensure a comfortable nighttime environment, maximize energy efficiency, reduce light pollution, reduce glare, and improve campus aesthetics.

The guide dictates that lighting designs follow the current State codes (Title 24/ CALGreen).

Sports field lighting is not specifically addressed in this document.

CSUMB Master Plan 2007 (Current)

CSUMB's 2007 Master Plan Campus Lighting Plan states that the "*primary goal of most exterior lighting is functional: to provide adequate light for safety and security.*" The proposed lighting plan would be reviewed by Campus Police Department to ensure it meets safety concerns.

CSUMB Master Plan 2017 (Draft)

CSUMB's lighting policy, based on the Draft 2017 Master Plan, is geared toward energy efficacy while ensuring safety and security on all walkways and parking areas. The most pertinent section to this project falls under section 9 regarding Daylighting Strategies and Lighting Technologies:

LED lighting technologies have progressed rapidly in quality, color rendering, and cost effectiveness and are now embedded in California's Title 24 energy code. LEDs are therefore a requirement for new construction, and lighting loads as a fraction of total loads will decline. New buildings should take advantage of LED lighting technologies. Existing buildings can also be retrofit for LED technologies, and this might be considered for an additional energy efficiency project. The UC CSU Energy Efficiency Partnership provides incentives for LED retrofits.

California Title 24

The California Lighting Technology Center's 2019 Outdoor Lighting Guide for Title 24, Part 6, compliance is designed to help builders, lighting industry professionals, and others navigate the nonresidential outdoor lighting portion of the California's Building Energy Efficiency Standards (CLTC 2016). The new standards, which took effect January 1, 2020, include updated requirements for retrofit standards, lighting controls, and uplight and glare limits. The guide includes an overview of updates to the 2019 standards, information about current lighting technologies, and energy-efficient lighting strategies and principles. Explanations of critical code requirements for outdoor lighting and controls accompany best practice recommendations are also included.

California Green Building Standards Code (CALGreen)

The California Green Buildings Standards (2019), a subsection of California's Title 24 code (Part 11) includes regulations for backlight, uplight, and glare. If the nearest property line is less than or equal to two mounting heights from the front hemisphere of the luminaire distribution, the applicable reduced glare rating and reduced backlight rating regulations outlined within these standards shall be met. These ratings are defined by Lighting Zones within the California Energy Code and California Administrative Code.

Seaside General Plan

The current General Plan (2003) provides the direction for current and future development within the city. A major theme throughout the plan involves the protection of the natural environment, including the night sky. The plan includes the following directives specifically pertaining to lighting:

Implementation Plan UD-2.2.1 Restrict Light and Noise Impacts

Continue to impose and enforce mitigation measures and operation requirements on new development to

restrict construction and operation lighting and noise levels to regular work hours during the week and to acceptable times during the weekends.

Implementation Plan COS-8.1.2 Design Guidelines for Exterior Light Sources.

The City shall develop design guidelines that re-quire wherever possible that exterior light sources be controlled and/or shielded to the downward direction so as not to glare or be directly visible beyond the limits of the parcel.

Additionally, the plan emphasizes the desire to protect the night sky environment for the continued success of the nearby Monterey Institute for Research in Astronomy (MIRA).

Seaside Municipal Code

Chapter 17 of the city's Municipal Code identifies lighting regulations for outdoor development. Specifically, Section 17.30.070 *Outdoor Lighting* states that lighting on the site of a multi-family or nonresidential structure or use shall comply with the following requirements:

Maximum height. A freestanding outdoor light fixture shall be limited to a maximum height of 16 feet, measured from adjacent normal grade to the top of the fixture(s). The fixture shall be considered to be the highest portion of the light structure. When not located adjacent to a single-family residential zone, the Board of Architectural Review may grant exceptions to the maximum height of freestanding outdoor light fixture(s) with the finding that the proposed height is consistent with surrounding land uses and is compatible with the existing or proposed surrounding structures.

Energy efficiency. Outdoor lighting shall utilize energy-efficient (high pressure sodium, low pressure sodium, hard-wired compact fluorescent, LED, or other lighting technology that is of equal or greater energy efficiency) fixtures and lamps.

Position of light fixtures. All lighting fixtures shall be properly directed, recessed, and fully shielded (e.g., downward and away from adjoining properties) to reduce light bleed and glare onto adjacent properties or public rights-of-way, by:

1. Ensuring that the light source (e.g., bulb, etc.) is not visible from off the site; and
2. Confining glare and reflections within the boundaries of the subject site to the maximum extent feasible.

Maximum illumination. No lighting on private property shall produce an illumination level greater than one foot-candle on any property within a residential zone except on the site of the light source.

Backlighting, Uplighting and Glare (BUG) rating. All outdoor light fixtures are subject to the BUG rating limits established by the California Energy Code (CALGreen 5.106.8) prior to the issuance of an electrical permit.

No blinking, flashing, or high intensity. No permanently installed lighting shall blink, flash, flutter, or be of unusually high intensity or brightness, or change light brightness, color, or intensity, as determined by the Zoning Administrator.

New light fixtures on commercial buildings. Installation of new light fixtures on commercial buildings shall be

subject to review and approval by the Board of Architectural Review.

6 ANALYSIS

The proposed project site, while isolated from the majority of other public buildings, is currently exposed to urban nighttime lighting. Artificial light sources found on site and in the surrounding area include existing interior and exterior lighting at the Field House, high-mast sports lighting at the baseball and soccer fields and outdoor aquatic center adjacent to the site, parking lot lighting, light along the adjacent walkways and streets, and illuminated automobile headlights. The site itself previously contained high-mast field lighting that is being upgraded to the new locations with improved luminaires.

The proposed project includes the installation of four energy-efficient lighting poles, with a mounting height of 90 feet and 46 luminaires on each pole, to facilitate nighttime use of the field. These poles would be the primary sources of light for the field while other new lighting is associated with the proposed project. The lighting poles would be implemented with Dark Sky-compliant LED fixtures with a fixed tilt based upon their calculated aiming angles. The poles would be mounted at the corners at the perimeters of the field to focus light directly on the field and away from neighboring receptors. Field lighting for the proposed project would be turned on at full output at dusk when needed for practice or games and would be switch off after the events with exact times being determined by the duration of the usage.

The CSU *Outdoor Lighting Design Guide* provides the CSU campuses with guidelines for outdoor lighting design to ensure a comfortable nighttime environment, maximize energy efficiency, reduce light pollution, reduce glare, and improve campus aesthetics. The guide contains CSU lighting design goals and strategies, lighting control strategies and methods throughout the campuses, and the mandated use of LED sources on new luminaires for energy efficiency and ease of maintenance. The guide includes goals pertaining to compliance with local codes, assurance of good nighttime visibility, low maintenance of lighting, energy efficiency, reduced light pollution, and integration into the overall campus aesthetic. As previously noted, sports field lighting is not specifically addressed in this document. Lighting design strategies are provided in the guide to aid in implementation of established lighting goals. Lighting design strategies are oriented toward creating vertical surface brightness, enhancing navigation, minimizing glare, maintaining lighting uniformity, and providing appropriate lighting levels (CSU 2018). The proposed lighting and operational schedule would ensure that the field is illuminated as efficiently as possible and that campus uniformity is maintained in the project vicinity.

Regulations and restrictions with respect to lighting on the CSUMB campus are not strictly defined within campus development and planning documents. The 2007 Master Plan and 2017 Draft Master Plan focus on better efficiency of all lighting throughout the university and should meet safety and security standards. When

possible, outdoor light should be controlled by automatic timers, and the use of LED sources mandatory. The documents do not identify strict lighting restrictions or regulations and does not have any specific lighting requirements for CSUMB sports fields. The proposed LED source and shielding treatment and proposed operational schedule would ensure that the field is being illuminated as efficiently as possible and that public safety is maintained during nighttime hours, respectively..

Due to the lack of specific guidance for sports field lighting from the applicable CSU and Master Plan lighting guidelines, the City of Seaside's Outdoor Lighting ordinance was reviewed (City of Seaside Municipal Code Section 17.30.070). Although CSUMB is not subject to the City's ordinances or regulations, the City's Municipal Code and Master Plan guidelines were reviewed to provide parameters for the analysis of light impacts. Although neither the City's Municipal Code, nor the City's Mater Plan provide numeric regulations specifically for sports field lighting, there are several regulations and restrictions for development of outdoor lighting that can be useful in the evaluation of the lighting impacts associated with the proposed project.

The City's Municipal Code (2020) states that outdoor lighting shall utilize energy-efficient (high pressure sodium, low pressure sodium, hard-wired compact fluorescent, LED, or other lighting technology that is of equal or greater energy efficiency) fixtures and lamps. It further states that all lighting fixtures shall be properly directed, recessed, and fully shielded (e.g., downward and away from adjoining properties) to reduce light bleed and glare onto adjacent properties by ensuring that the light source is not visible from off the site and confining glare and reflections within the site to the maximum extent feasible. The design of the field lighting for the proposed project takes into account all available methods for reducing lighting spillover and glare. The field lighting poles would be arranged to focus the light directly on the field. The energy-efficient luminaires would be at a mounting height of 90 feet, mitigating the direct glare in the pedestrian views within the immediate vicinity. The luminaires in this system will have a fixed downward angel to prohibit upward spill of the light and the fixtures faces are shielded with a 20" long shield making the system Dark-Sky compliant.

See Figure 3, Field Lighting Proposal

The City's Municipal Code (2020) also states that, to the extent applicable, outdoor lighting should be in compliance with the California Energy Code and Green Building Regulations (CALGreen0. CALGreen stipulates that all luminaires must meet the mandated BUG (Backlight/Uplight/Glare) ratings per their designated lighting zone unless otherwise exempt by Section 140.7 of the California Energy Code (Title 24) of which *Lighting for sports and athletic fields* is exemption number 4. However, despite being exempt, as shown in *Figure 5, Sky Glow Study*, the calculations show that the design does not produce any direct illumination at 120' or above the ground.

The City's Municipal Code (2020) states that all lighting shall direct, shield, and control light to keep it from falling onto surrounding properties, and no direct-beam illumination shall leave the premises. As shown in *Figure 2, Distance to Nearest Sensitive Receptors*, the closest campus residences are more than 1,800 feet

(.34 miles) northeast of the site, while the closest private residential neighborhood is located approximately ½ mile south of the site. In addition, the proposed residential areas within the approved Campus Town Specific Plan Project, located south of Lightfighter Drive in the City of Seaside, are located over 950 feet from the nearest lighting pole. And as shown in Figure 4, *Light Spill Summary*, at 250' from the stadium (pole locations), there would be little to no spillover light. Therefore, the gross majority of the light would be directed to the field and would be shielded from all surrounding sensitive receptors.

Since this project would be in compliance with applicable outdoor lighting guidelines and policies and would result in minimal spillover, the increased light and glare would not be substantial for and public viewers at night. Because the proposed project would not create a new source of substantial light or glare in the area, impacts would be less than significant.

7 Conclusion

EXP has reviewed all of the University, State, and local outdoor lighting codes, ordinances, and recommendations as they pertain to the proposed upgrade to the Freeman Stadium field lighting upgrade. We find that neither the pedestrian scale luminaires nor any of the temporary parking towers will emit light beyond the immediate site and if properly shielded will not contribute to any upward light pollution. As for the new stadium towers, the update to well-shielded LED luminaires with fixed downward aiming to only illuminate the field below, we find that there will be no significant visual impact on the surrounding community and that the system being proposed meets the environmental goals of mitigating sky glow from light shining above 90° nadir, into the night sky.

*This report, prepared by **exp** Services Inc., is intended for the exclusive use of the California State University Monterey Bay, Monterey FC, and Denise Duffy & Associates. Neither **exp** Services Inc the California State University Monterey Bay, Monterey FC, and Denise Duffy & Associates assume any liability for the use of this report, or for the use of any information disclosed in the report, or for damages resulting from the use of this report, by other parties.*

Figure 1, Project Site Location

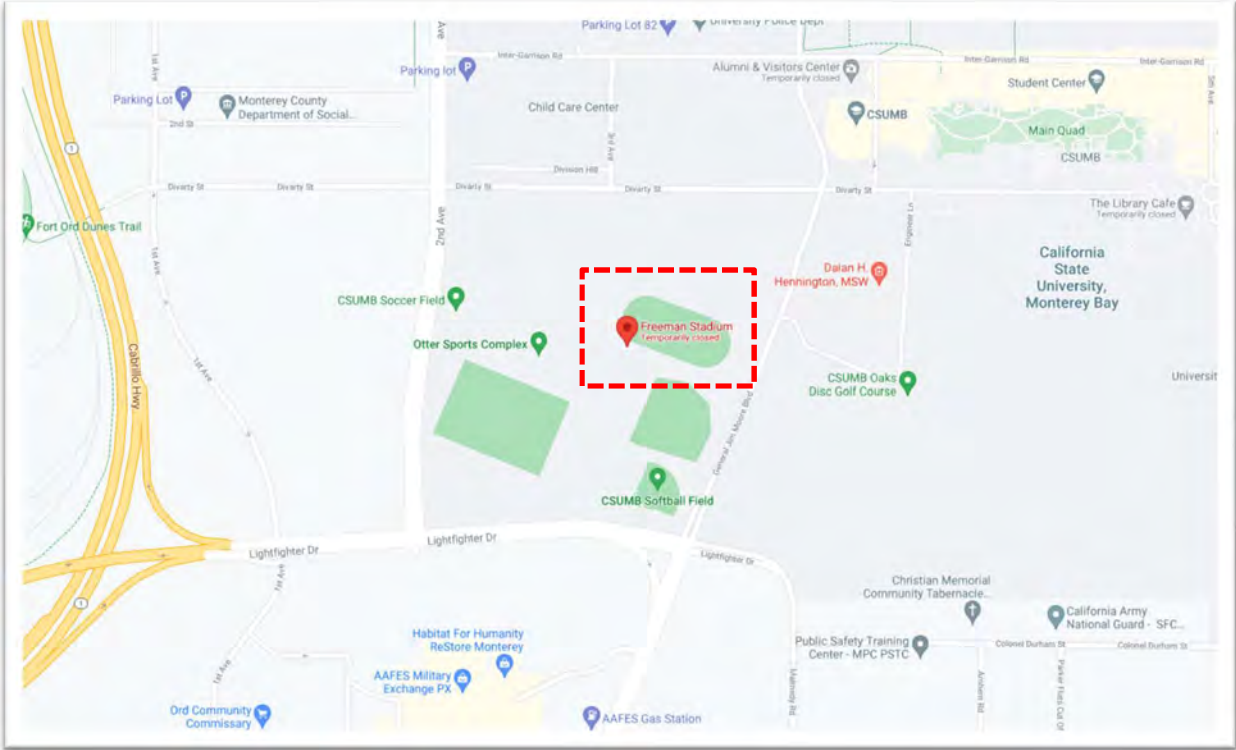
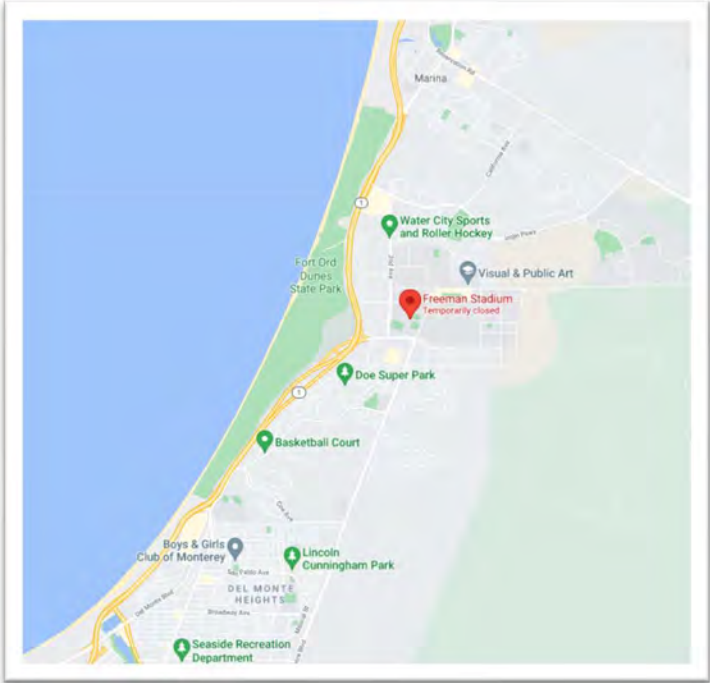


Figure 2, Distance to Nearest Sensitive Receptors



Figure 3, Field Lighting Proposal

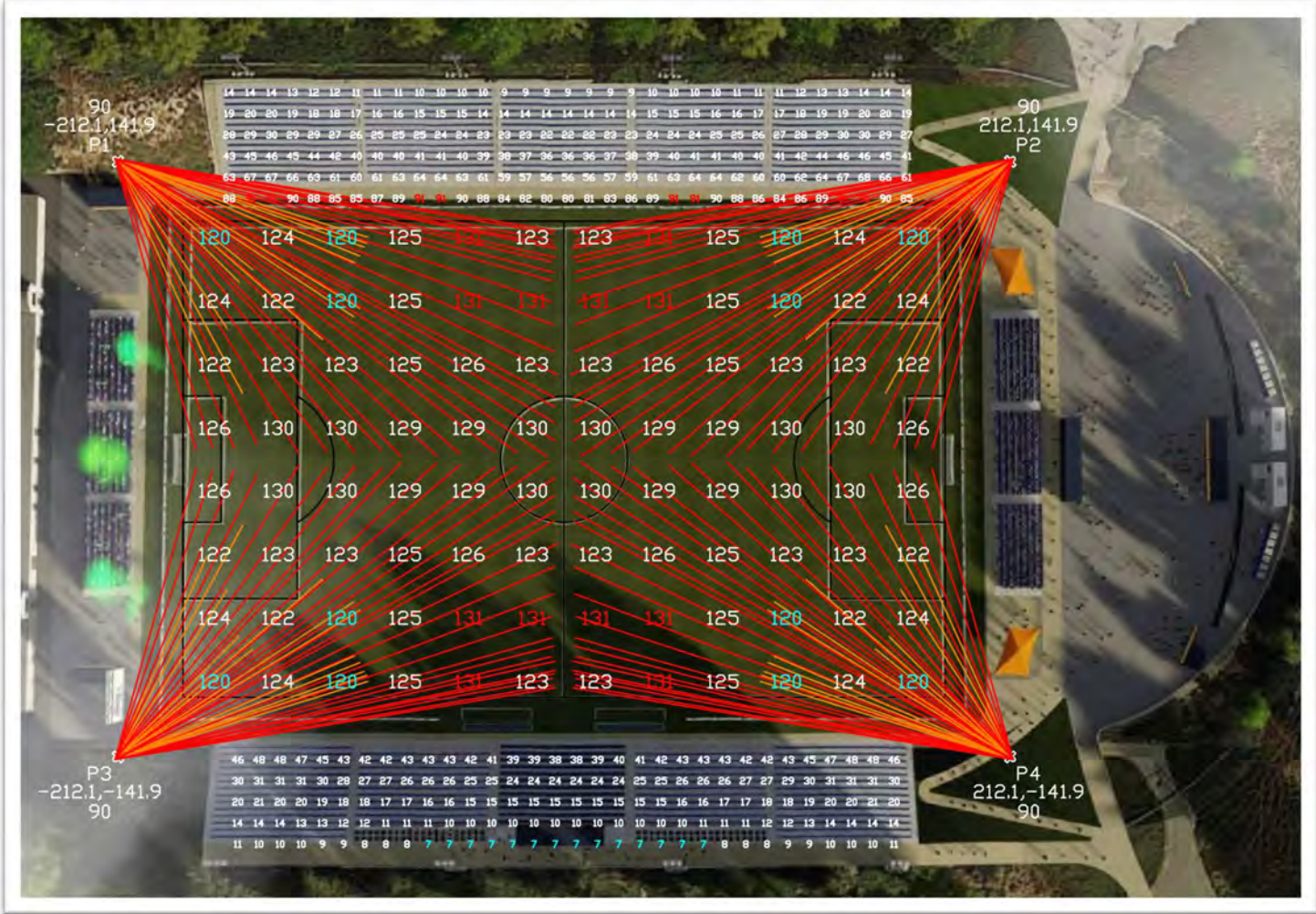
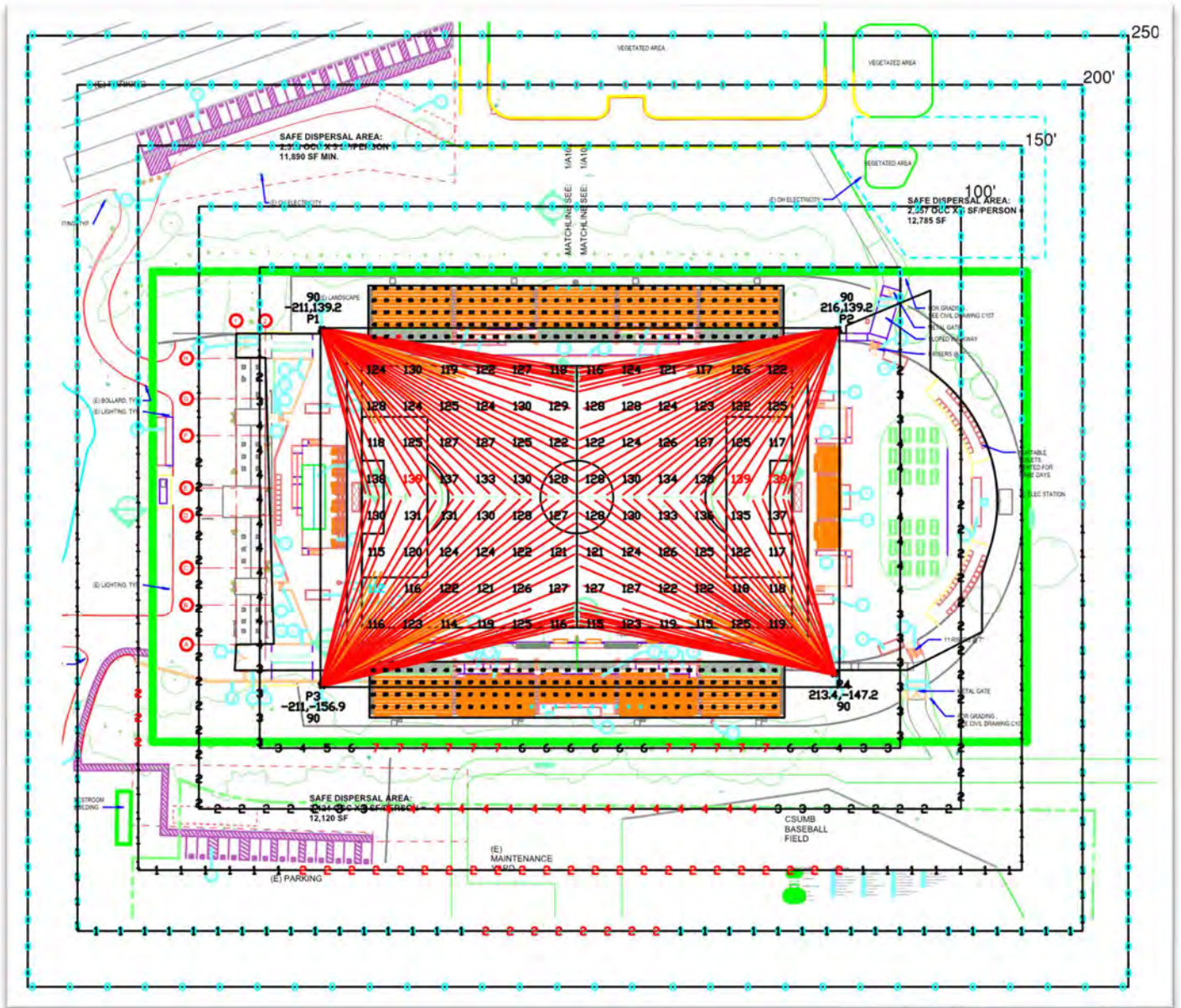


Figure 4, Light Spill Summary



CACL @50'
 92 points
VERTICAL FOOTCANDLES
 Average 3
 Maximum 7
 Minimum 0

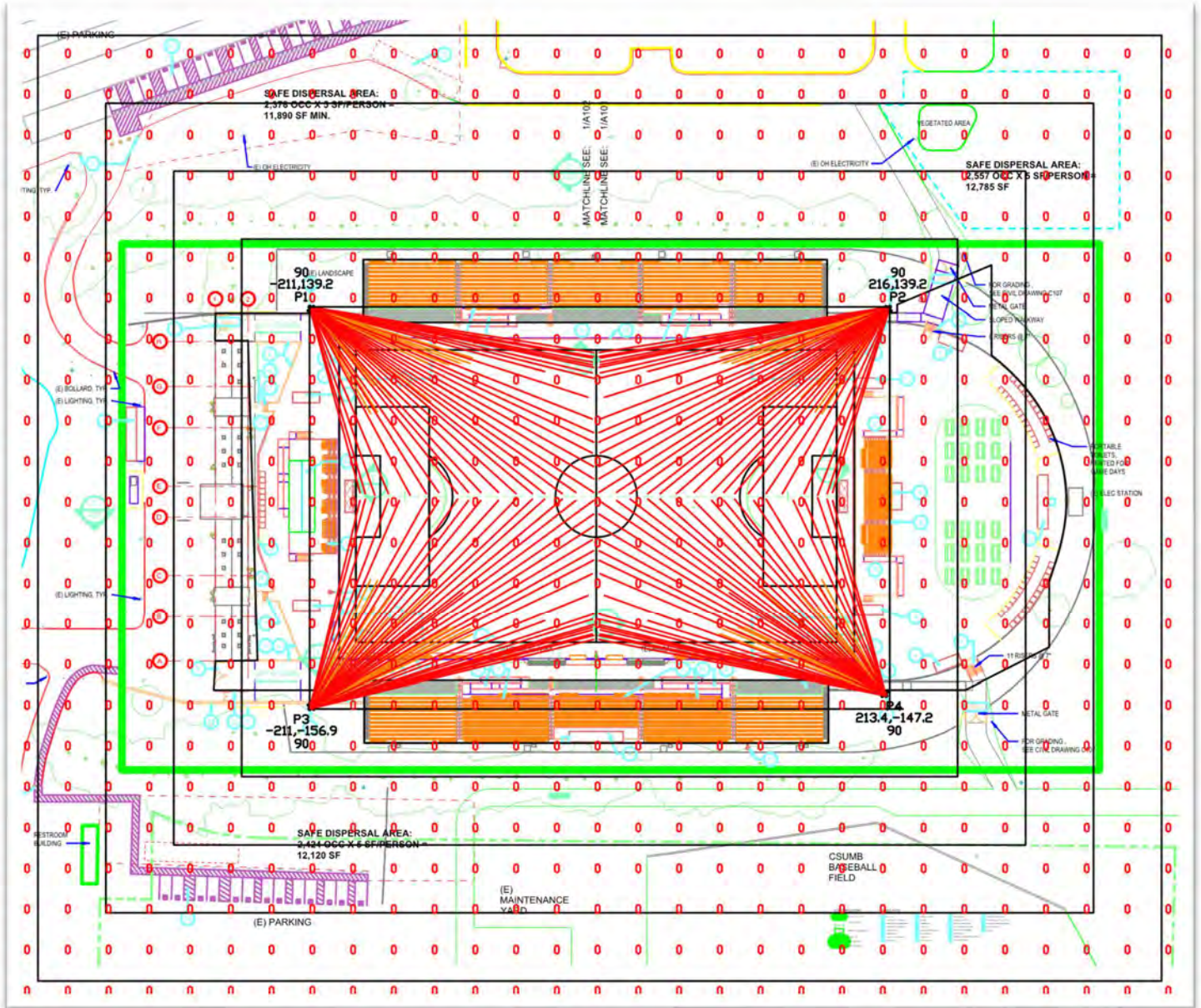
CALC @100'
 112 points
VERTICAL FOOTCANDLES
 Average 1
 Maximum 4
 Minimum 0

CALC @150'
 132 points
VERTICAL FOOTCANDLES
 Average 1
 Maximum 2
 Minimum 0

CALC @200'
 152 points

Average	A	B	
Maximum	0	1	A HORIZONTAL FOOTCANDLES
Minimum	1	2	B VERTICAL FOOTCANDLES.
	0	0	

Figure 5, Sky Glow Study

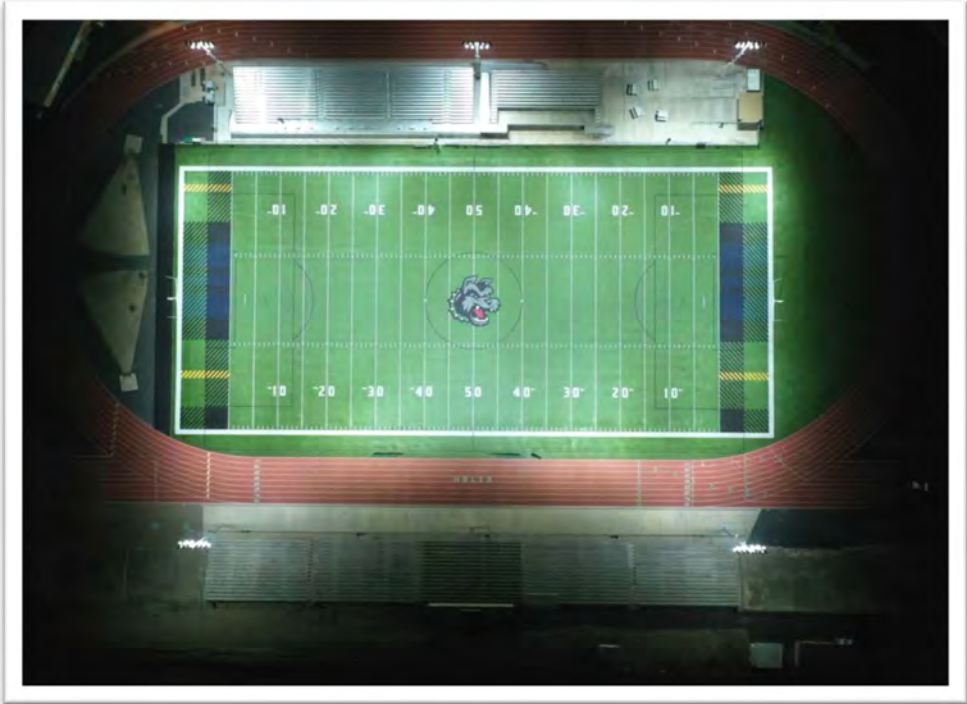


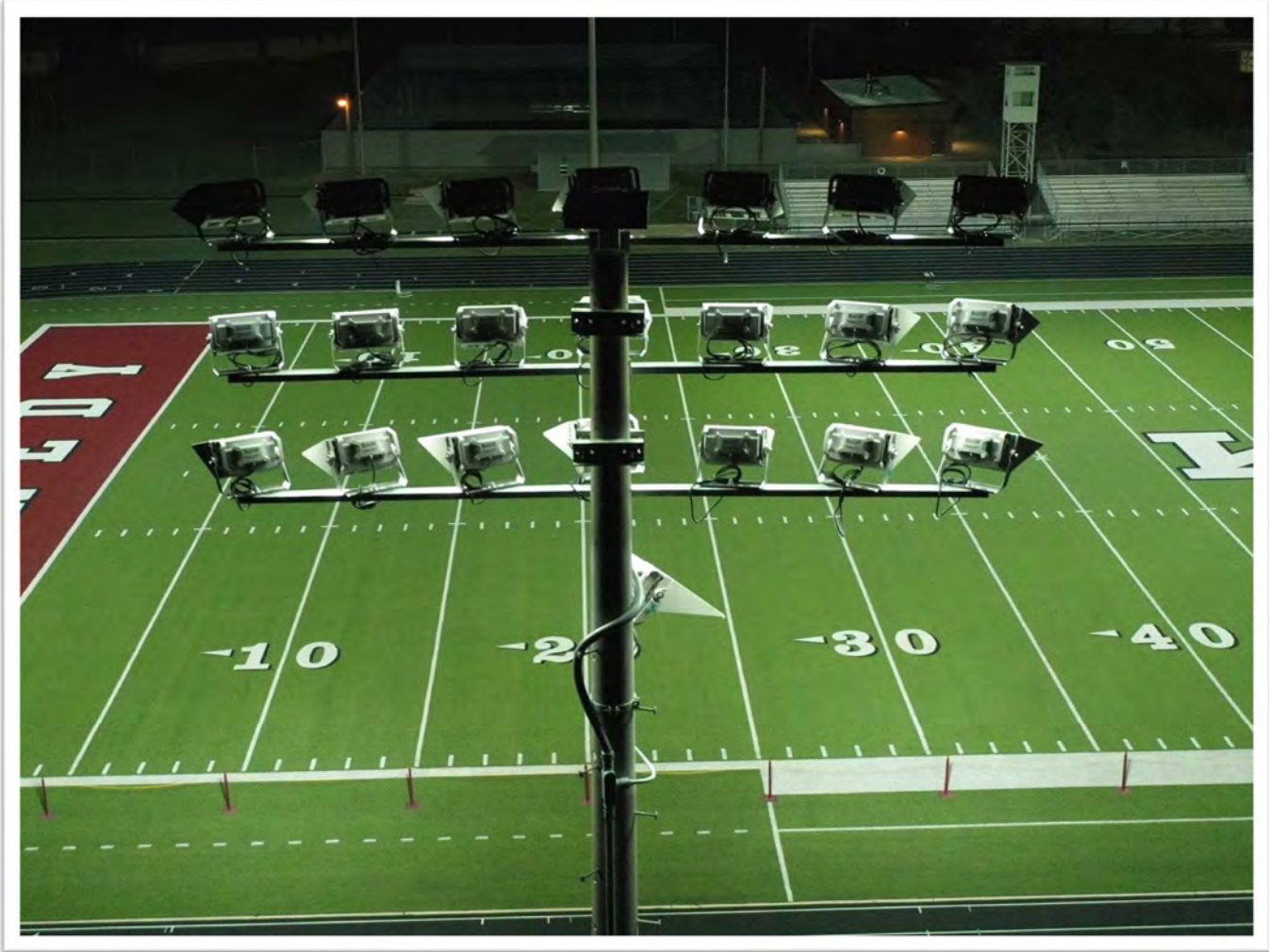
SKY GLOW @120'
 696 points at z=120, sp 30ft by 30ft
 FOOTCANDLES perpendicular to surface
 Average 0
 Maximum 0
 Minimum 0

Figure 6, Proposed Filed Lighting Luminaire



Figure 7, Similar Installed Examples of Proposed High-Mast Lighting System by Techline





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