FROM: William Holley, PhD, PE, Director of Educational Facilities

THROUGH: Tammy L. Ignacio, Chief of Staff
Alvin Crawley, Ed.D., Superintendent of Schools

TO: The Honorable Karen A. Graf, Chairman, and Members of the Alexandria City School Board

COPY: Executive Staff

TOPIC: T.C. Williams High School Parker-Gray Memorial Stadium Lighting Feasibility Study

BACKGROUND:

In preparation for the 10-year (Fiscal Year 2016-25) Capital Improvement Program in the fall, the School Board requested a feasibility study for adding lights to the Parker-Gray Memorial Stadium at T.C. Williams High School. The study is intended only to be a review of the technical feasibility of placing lights at the Stadium, including the process for any changes that would be required to the applicable Developmental Special Use Permit (DSUP). It is intended to assist the Board in making a threshold decision as to whether further to pursue that process. Decisions regarding actual installation of any lights (and related improvements) would be subject to the Board’s regular Capital Improvement Program and budgeting processes, as well as the availability of City appropriations for that purpose. In addition, operational issues that would be impacted by the potential installation of lights, including field scheduling, and maintenance of the facility, will be separately addressed by staff in connection with the Board’s discussion on September 18.

The feasibility study (Attachment 1) considers available athletic field lighting options, the required infrastructure improvements (electrical power requirements, etc.), the likely process/schedule of City of Alexandria reviews and approvals, and an opinion of probable construction cost. The details in the feasibility study consist of an existing condition photo journal and narrative, a utility investigation, a regulatory process analysis (Planning, Zoning and Development), a program requirement analysis, options for preliminary light layouts, and an opinion on probable cost.

As part of the feasibility study, Kimley-Horn provided a lighting analysis (p.20) to determine if field lighting could meet the required standard average illumination level of 50 foot-candles and not exceed the Zoning Ordinance for allowable light spill onto adjacent properties. This analysis indicates that field lighting could be constructed to meet these requirements, but that there are two adjacent properties in the southeast corner which potentially have some areas of illumination slightly greater than the 0.25 foot-candles allowed by the ordinance. The report (p.13-15) shows, however, that significant vegetative screening currently exists between the school and the adjacent properties at the southeast corner of the field. The report also states (p.8) that more protection from light spillage could be provided by the installation of fencing at the edge of the running track and by installing additional understory plant material on school property.

The cost estimates contained in the report include installation, design, and coordination of lighting for the athletic field only. These estimates assume a conceptual installation in 2015. Items excluded from the cost estimate are: accessory lighting for bleachers, concessions, walkways or other areas, legal fees, athletic field and safety equipment, turf replacement, ramp reconstruction, and other site work - fencing,
walls, grading, paving, etc. A final project cost would depend on the range and scope of these features included in the project.

A description of land use and zoning process to install permanent lighting at Parker-Gray Stadium is included for reference (Attachment 2).

CONCLUSION: Installation of lights at Parker-Gray Stadium is technically feasible. It can be accomplished consistent with applicable recreational lighting standards and Alexandria City ordinances, although in one area, some light spillover mitigation measures such as additional plantings and/or fencing may be required. In addition, the installation of lights at the Stadium would require an amendment, through the usual City process, to an existing DSUP condition which currently prohibits installation of permanent lighting there.

CONTACT PERSON: William Holley, (703) 619-8038

ATTACHMENTS: 1. T.C. Williams High School Parker-Gray Stadium Lighting Feasibility Study
2. Description of land use and zoning process
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</tr>
</tbody>
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SUMMARY

Parker Gray stadium at T.C. Williams High School is being assessed for Alexandria City Public Schools (ACPS) by Kimley-Horn to determine the feasibility of providing safe, athletic field lighting that meets state/federal guidelines and complies with local regulations for lighting the football field. The information in this report is based on field observations and coordination with Musco Lighting (the City's preferred lighting vendor).

The need to provide safe night time playing conditions while limiting the impact to adjacent neighbors is a universal one for communities across the country. In communities with urban and suburban fabrics, similar to what is found in Alexandria, the need can create conflict. In recent years several communities across the country have developed field lighting standards to help ensure the needs of players and neighbors are met in safe and reasonable ways. The standards for safe lighting and allowable light spill developed by several national organizations and local governments are presented in this study as a point of reference to help guide the discussion about what will be acceptable for the T.C. Williams High School Parker Gray Stadium Lighting project.

SITE DESCRIPTION AND OBSERVATIONS

Site Overview
T.C. Williams High School, rebuilt in 2007, is located at 3330 King Street, adjacent to the Chinquapin Park Recreation Center and Aquatics Facility. Parker Gray Stadium consists of both home and visitor bleacher sections, ramped access paths, a rubberized track, and an artificial athletic turf field. The stadium has been in use without athletic field lighting since its inception. Based on the initial concept layouts provided by Musco Lighting and Kimley-Horn's knowledge of similar projects, an Opinion of Probable Costs (OPC) is provided for preliminary athletic field lighting and utility construction costs, as well as professional design engineering fees. Kimley-Horn's photo documentation and site observations are based on site visits conducted on May 30, 2014 and June 16, 2014.

Existing Conditions and Program
Weekday use of the artificial turf field by the school consists of activities throughout the day with practices continuing after school hours. Football games as well as other sporting events are held on Saturdays. When not in use by the school system, the athletic field is used by youth and adult recreational leagues through various RP&CA programs. The absence of field lighting requires ACPS to schedule uses around light requirements and availability.

Parker Gray Stadium is located directly behind the high school and parking structure. The entire school campus is in zoning district R-20. Access is provided by an entrance on King Street. A service drive separates the school from the stadium. It serves as access to the high school's maintenance areas. Detached concession structures exist to the west of the track situated adjacent to the elevated scoreboard.

A ramp and stair entrance are provided to gain entry into the athletic field and track area. A 4’ chain link fence surrounds the perimeter of the track. Both home and visitor bleachers are located outside of the fence. There is no site lighting provided for the athletic fields or stadium areas. Pedestrian and access road lighting exists on sidewalks, entrance roads, and parking areas outside of the athletic field area. Security lighting exists on the high school and parking structure exterior walls. Pole lighting, with an approximate height of 25’ exists on the second level of the parking structure.

The athletic field layout is approximately parallel to King Street in an east-west alignment and is situated in the south corner of the parcel. The southern boundary consists of wooded residential lots (zoned R-20) accessed by Bishop Lane, while smaller residential lots make up the western boundary (zoned R-20) accessed by Woods Place. The residential lots along the southern end of the field are approximately 4 ft. lower in elevation than the adjacent track and field. The eastern residential lots are at approximately the same elevation as the field. An area for track and field events exists between the visitor’s bleachers and the southern corner of the property.
The southern boundary of the property, adjacent to the residential lots accessed by Bishop Lane, is comprised of large deciduous trees and significant understory plants. When these trees and shrubs are in leaf, the adjacent properties are obscured. The graphic below is a schematic drawing depicting the approximate location and type of plant material that is currently in place along the property line of the school. The plant material depicted on adjacent properties is approximate.
PLANNING AND ZONING PROCESS ANALYSIS

T.C. Williams is subject to two existing Development Special Use Permits (DSUP) that regulate the allowable uses. Condition #85 of DSUP#2002-0044 for T.C. Williams High School prohibits stadium lighting as well as other athletic field lighting:

No permanent stadium lighting shall be installed at the School stadium or any other athletic fields, including the proposed new practice field...

DSUP#2013-0014 modified condition #85 to allow only tennis court lighting on the site. Comment #85 of DSUP#2013-0014 reads:

No permanent stadium lighting shall be installed at the School stadium or any other athletic fields, except as to allow for the lighted tennis courts proposed under the DSUP2013-0014 submission...P&Z (DSUP2002-0044)

A new DSUP application will be required to amend condition #85 to allow athletic field lighting at the stadium. This process will introduce an athletic field lighting plan, engage the community through public input sessions, be subject to city staff review, and ultimately be considered for approval by the Planning Commission and City Council.

Proposed lighting concepts must comply with the Alexandria Zoning Ordinance. Consideration of adjacent properties’ existing light levels will be critical in any implementation of athletic field lighting. While no lighting guidance exists for institutional properties, the ordinance does provide guidance for commercial and residential properties. Although T.C. Williams High School is an institutional use, it lies within a residential zone (R-20).

Article 13 - 1 - 3, Commercial properties and residential properties - Night Illumination, of Alexandria Zoning Ordinance states

(a) It shall be unlawful for the owner or operator of any commercial property or the owner or occupant of any residential property when located adjacent to property used for residential purposes, to use for the outdoor lighting of the commercial property or residential property lights which are so arranged that the illumination and glare therefrom is thrown upon the side yard or rear yard of the adjacent property occupied for residential purposes in an amount of illumination which measures more than point twenty-five hundredths footcandles measured at any point seven feet beyond the property line of the adjacent property used for residential purposes.

(b) All lights used by an owner or operator of a commercial property or an owner or occupant of residential property shall be shielded or directed so as to confine the area of diffusion to the property which it is intended to illuminate. (Code 1963, Sec. 23-6)
ATHLETIC FIELD LIGHTING STANDARDS

The Illuminating Engineering Society of Northern America (IESNA) recommends a level of lighting for social or recreational sports ranging between 20 and 50 footcandles; professional sports field lighting where events are televised and played before large groups of spectators may reach 300 footcandles.

The NCAA best lighting practice to ensure the quality of light needed for safe play and spectator enjoyment states that the minimum light level for standard intercollegiate football with less than 5000 spectators is 50 footcandles.¹

The Virginia High School League does not currently provide detailed guidance for the lighting of athletic fields however there are several published examples of athletic field lighting standards. The North Carolina High School standards² for football, soccer, lacrosse, field hockey and rugby are 50 foot candles for events with up to 5000 spectators and 100 foot candles for events with more than 5000 spectators.

Spill Light Standards
IESNA has also defined four (4) Environmental Zones to provide guidance in establishing maximum levels of light spill onto adjacent properties. The zone definitions are as follows:

<table>
<thead>
<tr>
<th>Environmental Zones:</th>
<th>Initial/Maintained</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1 Areas with intrinsically dark landscapes such as parks and areas of outstanding beauty.</td>
<td>0.14 fc / 0.1 fc</td>
</tr>
<tr>
<td>E2 Areas of low ambient lighting such as suburban or rural residential areas.</td>
<td>0.42 fc / 0.3 fc</td>
</tr>
<tr>
<td>E3 Areas of medium ambient brightness such as urban residential areas.</td>
<td>1.1 fc / 0.8 fc</td>
</tr>
<tr>
<td>E4 Areas of high ambient brightness such as dense urban areas with mixed residential and commercial uses.</td>
<td>2.1 fc / 1.5 fc</td>
</tr>
</tbody>
</table>


The T.C. Williams campus falls between Environmental Zones E3 and E4. The frontage of the campus along King Street is consistent with the E4 description and the area adjacent to the Parker Gray Stadium is consistent with the E3 description.

For the purpose of comparison, the IESNA points out that a 30 foot street lamp located 10 feet from a residential property line would likely produce 1.3 fc at the residential property line.

In July 2010, the Fairfax County Park Authority released a white paper titled Athletic Field Lighting and Control of Obtrusive Light Pollution. The document was prepared in cooperation with the Fairfax County Environmental Quality Council (EQAC); the Fairfax County Department of Planning and Zoning (DPZ); along with input from several consulting engineers and scientists. The discussions in the white paper cover two subjects; “The Response of the Human Eye to Light” and “Issues and Problems with Controlling Light Pollution”.

The paper points out that “light trespass” and “glare” are the most problematic issues in the design of athletic field lighting in close proximity to residential uses. In an effort to address these two areas of concern, the Park Authority identified a maximum of 0.5 footcandles as an acceptable maximum limit for illumination at the property lines of their facilities and follows this guideline today.

² Lighting Standards, North Carolina High School Athletic Association, 2008
In 2003, Fairfax County created and adopted Zoning Ordinance Outdoor Lighting Standards. These standards are considered by many to be the best example of regulations that take modern lighting technology into account. These standards seek to control glare and reduce spill by incorporating appropriate shielding and luminaire aiming. Among the new standards is the requirement to prepare and submit a Sports Illumination Plan (SIP). This plan must indicate whether or not on-field and near-field lighting will be maintained at appropriate levels and that all proposed luminaires are either full cut-off or directionally shielded. The white paper identifies several best practices to ensure the least amount of impact to neighboring properties:

1. Utilize tall poles to increase the angle of illumination in order to increase the light quality on the play field and reduce glare
2. Utilize, full cut-off luminaires to control the light from the source
3. Employ screening where possible to block glare and/or spill near property boundaries

**T.C. WILLIAMS HIGH SCHOOL PARKER GRAY STADIUM LIGHTING CONCEPTS**

The existing layout and orientation of the athletic field and stadium facilities limit the placement of site lighting. The close proximity of the track and field to the adjacent properties creates constraints for pole placement, most noticeably in the southeast corner of the track and field. Consistent with current design methodology, the athletic field lighting at Parker Gray Stadium should utilize luminaires that are full cut-off and directional (aimable) and that are mounted at an elevation that will create the steepest angle possible to minimize glare onto adjacent properties.

To achieve these results, six poles will be needed to ensure the least amount of light spill from the targeted athletic field. Pole heights of 80’ and 90’ will be needed to accommodate the elevation change from the north and south bleachers and maximize light spill control.

An attachment included in this report shows the preliminary lighting layout provided by Musco Lighting (Appendix A). This option utilizes six poles, and provides a light uniformity ratio of 2:1 and an average illumination level of 50 foot candles, but exceeds the Zoning Ordinance for allowable light spill onto adjacent properties.

Option A conforms with the Zoning Ordinance for illumination levels on adjacent property along all property boundaries except the southeast corner. The highest light level at the southeast property boundary is .78 foot candles.

**Mitigation Opportunities**

While significant vegetative screening currently exists between the adjacent properties in the southern end of the project area, it is possible to increase the amount of screening to provide more protection from light spill than the existing plant material already provides. A fence could be installed at the track edge and additional understory plant material could be added to the T.C. Williams property.

**Electrical Service Observations and Investigation**

The proposed athletic field lighting will require the extension of electrical service capable of handling the luminaire power requirements. A utility / maintenance room exists at the rear of the high school with access available from an asphalt service drive. Kimley-Horn observed that one of the large distribution panels in the east utility room appeared to have available spaces capable of taking a three pin breaker of 150 A which would be required for the installation of the athletic field lighting system. In review of the school’s previous utility records, it appears that enough capacity exists to handle the power requirement needed for additional Parker-Gray field lighting (based on the attached proposed Musco Lighting concepts).
PROPOSED ATHLETIC FIELD LIGHTING EQUIPMENT AND ELECTRICAL REQUIREMENTS:

RP&CA’s Park Facility Standards Manual lists Musco Light-Structure Green, as the standard lighting system for athletic fields. The Musco proposed light systems included in this report meet RP&CA’s 25 year warranty standard, and are compatible with the existing Musco remote power control system currently in use throughout the City.

- Musco “Light-Structure Green” System - 6 poles (3 @ 90’ Height and 3 @ 80’ Height) (Musco Equipment)
- Lamp Type - 1500W MZ (Musco Equipment)
- “Control-Link” / Monitoring Cabinet, Surge Protection Device (Musco Equipment)
- Control Transformer, Panelboard, Circuit Breaker at Existing Switchboard, Conduit, Conductors (non-Musco Equipment)
- Design Voltage - 480 V, Three Phase
- Control Power Consumption - 120 V, Single Phase

OPINION OF PROBABLE COST (OPC)

The following cost estimates include installation, design, and coordination of lighting for the athletic field only. This OPC assumes a conceptual installation in 2015.

<table>
<thead>
<tr>
<th>ITEM DESCRIPTION</th>
<th>LOW COST</th>
<th>HIGH COST</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. ATHLETIC FIELD LIGHTING AT PARKER-GRAY STADIUM</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installed Athletic Field Lighting furnished by Musco Lighting installed by a contractor. Includes installation of pre-cast bases, steel poles, light fixtures and visors, electrical switch gear, and remote electrical component enclosure</td>
<td>355,000</td>
<td>385,000</td>
</tr>
<tr>
<td><strong>B. POWER SUPPLY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New electrical conduit, conductors, junction boxes, circuit breaker, panelboard, control transformer, and excavation from existing utility room extending to proposed Athletic Field Lighting</td>
<td>60,000</td>
<td>65,000</td>
</tr>
<tr>
<td><strong>C. DESIGN</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City DSUP &amp; FSP entitlement process, Civil and Electrical design for the extension of electrical services and new lighting systems</td>
<td>155,000</td>
<td>195,000</td>
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</table>

Sub Totals: 570,000 645,000
20% Contingency: 114,000 129,000
Totals: 684,000 774,000

ITEMS EXCLUDED FROM THIS OPC:
- Accessory Lighting for Bleachers, Concessions, Walkways or other areas
- Legal Fees
- Athletic Field and Safety Equipment
- Turf Replacement
- Ramp Reconstruction
- Other Site Work - Fencing, Walls, Grading, Paving, etc.
*The attached lighting concept does not include lighting for stadium bleachers, visitor bleachers, concession stand areas, or any other areas.

*The Consultant has no control over the cost of labor, materials, equipment, or over the Contractor’s methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Consultant at this time and represent only the Consultant’s judgment as a design professional familiar with the construction industry. The Consultant cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

### SCHEDULE AND AGENDA

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration of Project</th>
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<tbody>
<tr>
<td>Community Outreach</td>
<td></td>
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<tr>
<td>DSUP Application</td>
<td>12 - 19 months</td>
</tr>
<tr>
<td>Final Site Plan (FSP)</td>
<td>12-19 months</td>
</tr>
<tr>
<td>Construction</td>
<td>1-3 months</td>
</tr>
</tbody>
</table>
PHOTOGRAPHIC JOURNAL OF EXISTING CONDITIONS

VIEW OF PARKING GARAGE AND ACCESS DRIVE LIGHTING FROM FIELD

PARKER GRAY STADIUM HOME BLEACHERS WITH REAR ACCESS DRIVE LIGHTING

TRACK AND FIELD RETAINING WALL AND UPPER PEDESTRIAN LIGHTING
PHOTOGRAPHIC JOURNAL OF EXISTING CONDITIONS

EXISTING PEDESTRIAN LIGHTING AT HOME BLEACHERS

EXISTING SITE LIGHTING AT ACCESS LOOP AND DROP-OFF

EXISTING REAR ACCESS ROAD LIGHTING

EXISTING PARKING LIGHTING ON UPPER DECK OF PARKING STRUCTURE
PHOTOGRAPHIC JOURNAL OF EXISTING CONDITIONS

EXISTING VEGETATION AT THE SOUTHERN BUFFER

EXISTING VEGETATION AT THE SOUTHERN BUFFER
PHOTOGRAPHIC JOURNAL OF EXISTING CONDITIONS

SOUTHEAST CORNER OF TRACK AND FIELD. AREA MOST AFFECTED BY PROPOSED CONCEPTS’ LIGHT SPILL

EXISTING REAR ACCESS ROAD LIGHTING

EXISTING UPPER LEVEL PEDESTRIAN LIGHTING AT TRACK

PARKER GRAY STADIUM HOME BLEACHERS WITH UPPER PEDESTRIAN LIGHTING
PHOTOGRAPHIC JOURNAL OF EXISTING CONDITIONS

SOUTHERN VIEW OF ATHLETIC FIELD, ADJACENT PROPERTIES, AND VISITOR BLEACHERS

WESTERN VIEW OF ADJACENT PROPERTIES, SCOREBOARD, AND CONCESSION AREAS
PHOTOGRAPHIC JOURNAL OF EXISTING CONDITIONS

SOUTH EASTERN PROPERTY EDGE AND TRACK AND FIELD FACILITIES BEHIND VISITOR BLEACHERS

RAISED TRACK AND FIELD AREA BEHIND VISITOR BLEACHERS

VISITOR BLEACHERS. NO EXISTING LIGHTING
PHOTOGRAPHIC JOURNAL OF EXISTING CONDITIONS

RAISED BERM AND VEGETATIVE SCREENING AT WESTERN BOUNDARY

VIEW NORTH FROM SOUTHERN CORNER OF Parcel

SCOREBOARD AND VEGETATIVE SCREENING
PHOTOGRAPHIC JOURNAL OF EXISTING CONDITIONS

EXISTING SWITCHBOARD DISTRIBUTION PANEL IN MAIN ELECTRICAL ROOM WITH AVAILABLE BREAKER SPACES

ENTRANCE TO MAIN ELECTRICAL ROOM AT REAR OF SCHOOL

SWITCHBOARD MODEL / TYPE
APPENDIX A

CONCEPTUAL ATHLETIC FIELD LIGHT DESIGN

Provided by Musco Lighting

The attached plans contain preliminary layout, concept photometric information, equipment layout, control systems summary, and manufacturer’s cost estimate.
EQUIPMENT LIST FOR AREAS SHOWN

<table>
<thead>
<tr>
<th>Pole Location</th>
<th>Size</th>
<th>Elevation</th>
<th>Height</th>
<th>Lamp Type</th>
<th>QTY</th>
<th>Pole</th>
<th>THRD</th>
<th>GRD</th>
<th>OTHER GRD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 F1, F3</td>
<td>90°</td>
<td>-</td>
<td>90°</td>
<td>1500W MZ</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1 F2</td>
<td>90°</td>
<td>-</td>
<td>90°</td>
<td>1500W MZ</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2 F4, F6</td>
<td>80°</td>
<td>-</td>
<td>80°</td>
<td>1500W MZ</td>
<td>8</td>
<td>8</td>
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</tr>
<tr>
<td>1 F5</td>
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<td>-</td>
<td>80°</td>
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<td>9</td>
<td>9</td>
<td>9</td>
<td>0</td>
<td></td>
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<tr>
<td>TOTALS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>0</td>
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</tbody>
</table>

ATTACHMENT 1
School Board Meeting 9-4-2014

MY PROJECT
Name: TC Williams High School Football
Location: Alexandria, VA

GRID SUMMARY
Name: Spill @ PL
Spacing: 30.9'
Height: 3.0' above grade

CONSTANT ILLUMINATION

<table>
<thead>
<tr>
<th>Summary</th>
<th>Horizontal Footcandles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scan Average</td>
<td>0.089</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.778</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.000</td>
</tr>
<tr>
<td>No. of Points</td>
<td>81</td>
</tr>
</tbody>
</table>

LUMINAIRE INFORMATION
Luminaire Type: Green Generation
Rated Lamp Life: 5,000 hours
Design Lumens: 134,000
Avg Lamp Tilt Factor: 1.000
No. of Luminaires: 50
Avg KW: 78.2 (85.0 max)

Guaranteed Performance: The CONSTANT ILLUMINATION described above is guaranteed for the rated life of the lamp.

Field Measurements: Illumination measured in accordance with IESNA LM 5-06 and C79.51A. Individual values may vary. See the Warranty document for details.

Electrical System Requirements: Refer to Armpenage Draw Chart and/or the "Musco Control System Summary" for electrical sizing.

Installation Requirements: Results assume +/- 3% nominal voltage at line side of the ballast and structures located within 3 feet (1m) of design locations.

ENGINEERED DESIGN
By: Brad Vonk
File # / Date: 169318 / 29-May-2014

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APPENDIX - A_OPTION A
ILLUMINATION SUMMARY
ATTACHMENT 1
School Board Meeting 9-4-2014

MY PROJECT
Name: TC Williams High School Football
Location: Alexandria, VA

EQUIPMENT LAYOUT
INCLUDES: Football

Electrical System Requirements: Refer to Amperage Draw Chart and/or the "Musco Control System Summary" for electrical sizing.

Installation Requirements: Results assume +/- 3% nominal voltage at line side of the ballast and structures located within 3 feet (1m) of design locations.

EQUIPMENT LIST FOR AREAS SHOWN

<table>
<thead>
<tr>
<th>Pole</th>
<th>Luminaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1, F3</td>
<td>90'</td>
</tr>
<tr>
<td>F2</td>
<td>90'</td>
</tr>
<tr>
<td>F4, F6</td>
<td>80'</td>
</tr>
<tr>
<td>F5</td>
<td>80'</td>
</tr>
</tbody>
</table>

TOTALS: 50

SINGLE LUMINAIRE AMPERAGE DRAW CHART
Ballast Specifications (30 min power factor) Line Amperage Per Luminaire

<table>
<thead>
<tr>
<th>Single Phase Voltage</th>
<th>208 (40)</th>
<th>220 (40)</th>
<th>240 (60)</th>
<th>277 (60)</th>
<th>347 (60)</th>
<th>380 (60)</th>
<th>480 (60)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500 watt M7</td>
<td>8.6</td>
<td>4.3</td>
<td>3.7</td>
<td>6.5</td>
<td>4.7</td>
<td>4.8</td>
<td></td>
</tr>
</tbody>
</table>

ENGINEERED DESIGN
By: Brad Vonk
File # / Date: 169318 29-May-14

TC Williams High School Football
Alexandria, VA
May 29, 2014

The following is a turnkey estimate based on Design #169318 to light the football field at TC Williams High School in Alexandria, VA.

**Turnkey Estimate:**

**Football Field:**

$310,000 – $340,000

**Adder for Climbing Gear:**

$7,500 per pole

-Pricing per pole to add steps, cables, and platforms

**Equipment List:**

- Light Structure Green™ System delivered to your site in Five Easy Pieces™ which includes precast concrete bases, galvanized steel poles, UL listed remote electrical component enclosures, pole length wire harness, and factory-aimed and assembled luminaires.

**Budget Estimate Criteria**

- **Installation Criteria:**
  - Offloading, assembly and installation of the Musco equipment, installation of branch circuits from main disconnect panel to each pole location and installation of the main disconnect panel by a licensed electrical contractor will be provided by others
  - Musco is a lighting manufacturer and not an electrical contractor. Installation estimates are based upon projects similar in scope.
  - Getting electrical power to the site, coordination with the utility, and any power company fees are responsibility of the owner.
  - Standard soil conditions. Rock, bottomless, wet or unsuitable soil may require additional engineering, special installation methods and additional cost.

- **Warranty:**
  - Musco Constant 25™ product assurance and warranty program that eliminates 100% of your maintenance costs for 25 years, including labor and materials
  - Guaranteed light levels of 50fc for 25 years:
  - (1) Group re-lamp at the end of the ramps rated life, 5,000 hours

- **Controls:**
  - Control Link®, Control & Monitoring System for flexible control and solid management of your lighting system
  - Lighting Contactors sized for voltage and phasing at site

**Notes**

- Estimate is based on:
  - Shipment of entire project together to one location
  - Confirmation of pole locations prior to production
  - Field size of 360’x160’
  - Structural code and wind speed = 2009 IBC, 90 MPH 1.0.
  - (2) LED fixtures per pole for emergency egress lighting are included in pricing above

Thank you for considering Musco for your sports-lighting needs. We look forward to helping you make your project a success.

**Steve Wiley**
Sales Representative
Musco Sports Lighting, LLC
Phone: 804.836.6785
E-mail: steve.wiley@musco.com
Fax: 800.374.6402
ATTACHMENT 1
School Board Meeting 9-4-2014

Control System Summary

Project Specific Notes:
Assuming a 480V 3P system is at the site.

Materials Checklist
Contractor/Customer Supplied:

☐ A single control circuit must be supplied per distribution panel location.
   If the control voltage is NOT available, a control transformer is required.
☐ Electrical distribution panel to provide overcurrent protection for circuits
   — Thermal/Magnetic circuit breaker sized per full load amps on Circuit
   Summary by Zone Chart
☐ Wiring:
   — Dedicated control power circuit
   — Power circuit to and from lighting contactors
   — Monitoring circuit from surge protection device to Control and Monitoring cabinet 1
   — Harnesses for cabinets at remote locations
   — Means of grounding, including lightning ground protection
☐ Electrical conduit wireway system
   — Entrance hubs rated NEMA 4: must be die-cast zinc, PVC, or copper-free die-cast aluminum
☐ Mounting hardware for cabinets
☐ Control circuit lock-on device to prevent unauthorized power interruption to control power
☐ Anti-corrosion compound to apply to ends of wire, if necessary

Call Control-Link Central(TM) operations center at 877/347-3319 to schedule activation of the control system upon completion of the installation. Note: Activation may take up to 1 1/2 hours

Project Information

Project #: 169318
Project Name: TC Williams High School Football
Date: 05/29/14
Project Engineer: BVonk
Sales Representative: Steve Wiley
Control System Type: Control and Monitoring
Communication Type: Digital Cellular
Scan: 169318
Document ID: 169318P1V1-0529093615
Distribution Panel Location or ID: FB
Total # of Distribution Panel Locations for Project: 1
Design Voltage/Hertz/Phase: 480/60/3
Control Voltage: 120

Equipment Listing

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>APPROXIMATE SIZE</th>
<th>QTY</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Control and Monitoring Cabinet</td>
<td>24 X 48</td>
<td>6</td>
<td>30 AMP</td>
</tr>
<tr>
<td>2. Surge Protection Device</td>
<td>6 X 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Off/On/Auto Switches:</td>
<td></td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Preliminary Plant: Contain all Details - voltage, # of distribution panels, etc.

 IMPORTANT NOTES

1. Please confirm that the design voltage listed above is accurate for this facility. Design voltage/phase is defined as the voltage/phase being connected and utilized at each lighting pole's ballast enclosure disconnect. Inaccurate design voltage/phase can result in additional costs and delays. Contact your Musco sales representative to confirm this item.
2. In a 3 phase design, all 3 phases are to be run to each pole. When a 3 phase design is used Musco's single phase luminaires come pre-wired to utilize all 3 phases across the entire facility.
3. One contactor is required for each pole. When a pole has multiple circuits, one contactor is required for each circuit. All contactors are UL 100% rated for the published continuous load. All contactors are 3 pole.
4. If the lighting system will be fed from more than one distribution location, additional equipment may be required. Contact your Musco sales representative.
5. A single control circuit must be supplied per control system.
6. Size overcurrent devices using the full load amps column of the Circuit Summary By Zone chart. Minimum power factor is 0.9.

NOTE: Refer to Installation Instructions for more details on equipment information and the installation requirements
## Control-Link Control and Monitoring System

- Transformer (provided by customer for control voltage supply if not available)
- Electrical distribution panel (provided by customer for overcurrent protection)
- Surge protection device
- Digital cellular antenna
- Off-on-auto keyed switches
- Equipment ground
- To lighting circuits
- Control and monitoring cabinet

### Wire Summary

<table>
<thead>
<tr>
<th>Wire</th>
<th>Description</th>
<th># of Wires</th>
<th>Typ. Wire Size (AWG)</th>
<th>Max. Wire Length (FT)</th>
<th>Wire from Musco</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Line power to contactors, and equipment grounding conductor</td>
<td>Note A</td>
<td>Note B</td>
<td>27</td>
<td>No</td>
<td>A – E</td>
</tr>
<tr>
<td>2</td>
<td>Load power to lighting circuits</td>
<td>Note A</td>
<td>Note B</td>
<td>N/A</td>
<td>No</td>
<td>A – D</td>
</tr>
<tr>
<td>3</td>
<td>Control power (dedicated, 20A)</td>
<td>3</td>
<td>12</td>
<td>N/A</td>
<td>No</td>
<td>C, D</td>
</tr>
<tr>
<td>4</td>
<td>Surge protection device to distribution panel</td>
<td>--</td>
<td>--</td>
<td>N/A</td>
<td>Yes</td>
<td>F</td>
</tr>
<tr>
<td>5</td>
<td>Surge protection device monitoring</td>
<td>3</td>
<td>14</td>
<td>N/A</td>
<td>Yes</td>
<td>C, D, F</td>
</tr>
</tbody>
</table>

**Notes:**
- A. Voltage and phasing per the notes on cover page.
- B. Calculate per load and voltage drop.
- C. All conduit diameters should be per code.
- D. Refer to control and monitoring system installation instructions for more details on equipment information and the installation requirements.
- E. Contact Musco if maximum wire length from circuit breaker to contactor exceeds value in chart.
- F. Refer to surge protection device installation Instructions for more details on equipment information and the installation requirements.

**IMPORTANT:** Control (3) and monitoring (5) wires must be in separate conduit from line and load power wiring (1, 2).
# Control System Summary

## SWITCHING SCHEDULE

<table>
<thead>
<tr>
<th>Field/Zone Description</th>
<th>Zones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Football</td>
<td>1</td>
</tr>
</tbody>
</table>

## CONTROL POWER CONSUMPTION

<table>
<thead>
<tr>
<th>120V Single Phase</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>VA loading of Musco Supplied Equipment</td>
<td>INRUSH: 2058.0</td>
</tr>
<tr>
<td></td>
<td>SEALED: 246.8</td>
</tr>
</tbody>
</table>

## BALLAST SPECIFICATIONS

<table>
<thead>
<tr>
<th>90 Minimum Power Factor</th>
<th>Voltage: 480V</th>
</tr>
</thead>
</table>

### BALLAST OPERATING VOLTAGE

<table>
<thead>
<tr>
<th>Watt Metal Halide Lamp</th>
<th>208</th>
<th>220</th>
<th>240</th>
<th>277</th>
<th>347</th>
<th>380</th>
<th>480</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating line amperage per fixture- maximum</td>
<td>8.6</td>
<td>8.3</td>
<td>7.5</td>
<td>6.5</td>
<td>5.1</td>
<td>4.7</td>
<td>3.7</td>
</tr>
<tr>
<td>1000 Watt Metal Halide Lamp</td>
<td>6.5</td>
<td>6.4</td>
<td>5.8</td>
<td>4.9</td>
<td>4.0</td>
<td>3.6</td>
<td>2.9</td>
</tr>
</tbody>
</table>

### CIRCUIT SUMMARY BY ZONE

<table>
<thead>
<tr>
<th>POLE</th>
<th>CIRCUIT DESCRIPTION</th>
<th># OF FIXTURES</th>
<th>FULL LOAD AMPs</th>
<th>CONTACOER SIZE (AMPS)</th>
<th>CONTACOER ID</th>
<th>ZONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Football</td>
<td>8</td>
<td>22.2</td>
<td>30</td>
<td>C1</td>
<td>1</td>
</tr>
<tr>
<td>F2</td>
<td>Football</td>
<td>9</td>
<td>22.2</td>
<td>30</td>
<td>C2</td>
<td>1</td>
</tr>
<tr>
<td>F3</td>
<td>Football</td>
<td>8</td>
<td>22.2</td>
<td>30</td>
<td>C3</td>
<td>1</td>
</tr>
<tr>
<td>F4</td>
<td>Football</td>
<td>8</td>
<td>22.2</td>
<td>30</td>
<td>C4</td>
<td>1</td>
</tr>
<tr>
<td>F5</td>
<td>Football</td>
<td>9</td>
<td>22.2</td>
<td>30</td>
<td>C5</td>
<td>1</td>
</tr>
<tr>
<td>F6</td>
<td>Football</td>
<td>8</td>
<td>22.2</td>
<td>30</td>
<td>C6</td>
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</table>
### PANEL SUMMARY

<table>
<thead>
<tr>
<th>CABINET #</th>
<th>CONTROL MODULE LOCATION</th>
<th>CONTACTOR ID</th>
<th>CIRCUIT DESCRIPTION</th>
<th>FULL LOAD AMPS</th>
<th>DISTRIBUTION PANEL ID (BY OTHERS)</th>
<th>CIRCUIT BREAKER POSITION (BY OTHERS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>C1</td>
<td>Pole F1</td>
<td>22.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>C2</td>
<td>Pole F2</td>
<td>22.20</td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>C3</td>
<td>Pole F3</td>
<td>22.20</td>
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<tr>
<td>1</td>
<td>1</td>
<td>C4</td>
<td>Pole F4</td>
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<tr>
<td>1</td>
<td>1</td>
<td>C5</td>
<td>Pole F5</td>
<td>22.20</td>
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<tr>
<td>1</td>
<td>1</td>
<td>C6</td>
<td>Pole F6</td>
<td>22.20</td>
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</tbody>
</table>

### ZONE SCHEDULE

<table>
<thead>
<tr>
<th>ZONE</th>
<th>SELECTOR SWITCH</th>
<th>ZONE DESCRIPTION</th>
<th>POLE ID</th>
<th>CONTROLLER ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td>1</td>
<td>Football</td>
<td>F1</td>
<td>C1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>F2</td>
<td>C2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>F3</td>
<td>C3</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>F4</td>
<td>C4</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>F5</td>
<td>C5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>F6</td>
<td>C6</td>
</tr>
</tbody>
</table>
PROCESS TO AMEND DEVELOPMENT SPECIAL USE PERMIT #2013-0014 T. C. WILLIAMS HIGH SCHOOL TO PERMIT THE INSTALLATION OF PERMANENT LIGHTING FOR PARKER-GRAY STADIUM

The use and development of the T. C. Williams property and facilities are governed by the terms and conditions of Development Special Use Permit with Site Plan #2013-0014 granted by the Alexandria City Council on December 14, 2013 (the “DSUP”). The DSUP superseded Development Special Use Permit #2003-0044 granted in 2004 authorizing the construction of the new T. C. Williams High School. The DSUP amended condition 85 of the 2004 DSUP that prohibited “No permanent stadium lighting shall be installed at the School stadium or on any other athletic fields, including the proposed new practice field”. The purpose of the DSUP was to allow the installation of lighting for new tennis courts at the high school. As amended by the DSUP, condition was revised to read: “No permanent stadium lighting shall be installed at the School stadium or on any other athletic fields, except as to allow for lighted tennis courts proposed under the DSUP2013-0014 submission. For the Courts, the number of poles, mounting heights and the light types shall be consistent with the Preliminary Plan dated 10/01/13 for SSUP 2013-0014.

In order to install permanent lighting for Parker-Gray Stadium an application to amend the DSUP is required to further amend condition 85 to eliminate the prohibition of the installation of permanent lighting at the “School stadium.” As with the 2013 amendment, the request would be reviewed by the all City of Alexandria Departments with the Department of Planning and Zoning being the lead department. A Staff Report will be prepared by City Staff which will contain a recommendation of approval or denial of the application and, most likely, will include conditions to regulate the installation and use of the stadium lighting if approved. It is anticipated that extensive public outreach will be an important part of the process to amend the DSUP. Public Hearings will be held by both the Alexandria Planning Commission and the Alexandria City Council on the application. The Planning Commission’s action is a recommendation to the City Council. The City Council’s is the vote that grants or denies the requested amend to the DSUP to approve the stadium lighting.