



January 16, 2024

City of Helena
Community Development Sector
Kyle Holland
Planner II
316 N. Park Ave., Room 445
Helena, MT 59623

RE: Carroll College Nelson Stadium, Light Pole Height Variance Information

Mr. Holland;

I am sending this letter and attachments as additional information for consideration regarding the Carroll College light pole height variance application, as submitted on November 1, 2023. For general clarification the information here pertains most importantly to the specific variance request which is the height of the light poles themselves.

Please see summary below of information associated directly with each point of decision making as well as our response to other items which the Board of Adjustments may consider. I hope you may see here that our proposal fits all criteria and is in full consideration of adjacent neighborhood impacts. We are truly looking to minimize previously assumed impacts with this specific design.

A. To approve a requested variance for a new building or portion thereof, the board of adjustment shall consider the following standards and find as follows:

1. The variance will not create a significant risk to the public health, safety, or general welfare;

- Allowing taller lights will not create any increased risk to public health or safety vs. 60'-0" poles. Either pole height option would be constructed to the same design criteria that takes in full consideration of the public health safety and welfare (60'-0" tall poles are allowed w/o variance).
- Installing the variance requested 100'-0" tall lights will *reduce* light spread and *reduce* actual lighting output vs. constructing the zoning allowed 60'-0" tall lights, thus negating the overall impact to the community.

2. The variance will not significantly reduce or impair the peaceful use of existing property or improvements in the vicinity and the zoning district in which the subject property is located;

- See the second bullet point above regarding the taller lights being able to reduce impacts to the community
- The college is surrounded on three sides by adjacent spaces that will see no impact. There's a park to the east, the city transfer station, batch field and Bill Roberts golf course to the north, a pre-cast concrete plant and cemetery to the northwest and the rest of the campus to the south. Therefore, the overall impact on the community will affect very, very few people off campus. In fact, there are more people in the adjacent student dorms, which the college must be cognizant of, than there are community members off campus

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Helena, MT 59624

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- When lights are on, do note that at the end of play they will be dimmed to 20% output for cleanup thus reducing effects to community members. This would apply the same for 100'-0" poles as it would be for the standard 60'-0" tall poles
- The amount of time the lights would be on is the same for 100'-0" poles as it would be for the standard 60'-0" tall poles so this is a non-factor in consideration of impacts with taller poles. Taller poles aim light more directly onto the field, while shorter poles are aimed more horizontally and need to be more powerful, so they are a larger impact than our proposed design with the 100'-0" poles.

3. Strict compliance with the provisions of this title would create unnecessary hardship or practical difficulty:

- Installing 60'-0" poles require the lights to be more powerful and requires them to be aimed more horizontally. The combined effect here is that lighting will be both brighter and spread farther vs. taller poles (see attached exhibits).
- Shorter lights increase glare into the stands resulting in reduced visibility for spectators and reduced television broadcast quality.
- Shorter poles will create greater hardship to the overall community vs. approving the use of these taller poles. Increase in maximum direct glare exposure off site will go up by 360%.
- Shallower aiming angles required with shorter poles reduce effectiveness of external shields resulting an increase of direct glare exposure on site (dorm students). This would also Increase direct glare exposure off site. Shorter pole heights and shallower angles will also spread light to a greater distance.
- Shorter lights increase glare on the field and will shine more "in" the eyes of players, making use of the field more dangerous than using 100'-0" poles.
- Installing the zoning allowed 60'-0" lights vs these 100'-0" lights does create unnecessary hardship as the stadium is a bit over 60'-0' to the peak of the roof. Due to this our lights need to be mounted on an existing roof system that was never intended to have such fixtures mounted to it. This will require additional structural re-design of portions of the roof as well as increasing issues with incredible glare on the bleachers and box seat area.
- Additional roof penetrations required for adding lights to the roof, increases the possibility of future roof leaks.
- Mounting lights to the roof makes maintenance more difficult and dangerous due to the steep slope of the roof

Beyond the three main standards for making a decision please see below for other information regarding additional factors to consider for making a determination.

B. In evaluating the standards in subsection C of this section, the board of adjustment *may* consider the following factors:

1. Special conditions and circumstances that are unique to the applicant's site, including the size of the property, unusual or extreme topography, or unusual shape of the property:
 - Carroll College only has one campus and one playing field to do this on. They have no other options for location
 - The current location is at the lowest elevation on the whole campus (the rest of the campus sits on a hill). The field is already depressed below adjacent grade. These combined factors make this the very best location for reducing lighting impacts to adjacent properties
2. The height, location, or dimensions of existing structures located on the site or in the vicinity of the site;
 - There are adjacent structures on campus which are taller than these lights (see attached exhibit showing adjacent bldg. heights)
 - The field is partially blocked to nearby areas by adjacent buildings. This includes on-site structures such as the stadium, the PE Center, Hunthausen Activity Center, Guadalupe Hall, Corette Library, All Saints Chapel and St. Charles Hall. Offsite structures that also contribute to blocking light to directly adjacent areas include the waste transfer station and the pre-cast concrete plant.
 - The existing lighting at batch field does not have any shielding and creates and equal or greater glare to nearby residences (see answer in item 3 below)
3. Whether there is a prevalence of nonconformities in the vicinity of the site that are similar to the variance requested;
 - There are a number of more impactful lighting scenarios in the surrounding area. This would include the lights at Batch field, which though they are not as tall, do not have light shielding and thus do have a greater impact to neighbors. The lights at Kindrick field are the same height as our proposed lights and do not have any modern shading included in their design.
4. The subsequent imposition of zoning restrictions creating nonconforming lots or parcels, and governmental actions beyond the applicant's control;
 - The applicant does not have any other options for a field location and since the field sits at the absolute lowest point on campus any other location would be a far greater impact to the overall community regardless of pole height
5. Whether a literal interpretation of the provisions of this title would deprive the property owner of rights commonly enjoyed by other properties similarly situated in the same district under the terms of this title;
 - All other colleges in this conference are allowed this level of lighting quality so denying this variance would put Carroll at a direct disadvantage to its competitors
 - Helena Middle School has modern fixtures on their 100' tall lights for serving middle and high school sports so even the local K-12 school district would have safer lighting than our local college if this is denied
6. The extent to which the hardship or difficulty results from the actions of the applicant;
 - Denying this variance would put the college into a position of designing to zoning height of 60'-0", which requires brighter lights, aimed more horizontally. This would increase glare across the field, the campus, and the

adjoining neighborhood. This is a direct hardship/difficulty for all impacted by this change (not just the college).

7. Whether granting the variance requested will confer an unreasonable special privilege to the subject property that is not available to other properties similarly located in the same zoning district;
 - This would not be a special privilege in consideration of competing colleges or even in comparison to the local K-12 school district. This design would just bring Carroll up to the minimum standards of other schools.


Regarding points above attached are specific graphic exhibits which are included as backup to these points. Descriptions of items related to each attachment are included below:

- **Exhibit 1 - Vigilante Field Before & After:** shows positive impacts of using modern cutoff style fixtures. It greatly reduces light going off the field area and Carroll would be able to take full advantage of this type of design quality if 100'-0" poles are allowed
- **Exhibit 2 – Vigilante Stadium Map:** this outlines the distance to the nearest residence from their poles which is only 55'-0". People attending games here have noted the need for flashlights to cross the street due to the sharp and short cutoff of a near identical design being proposed with the use of 100'-0" poles
- **Exhibit 3 – Nelson Stadium Map:** this map outlines the distance to nearest residences at Nelson Stadium which is about 495'-0", or nine times farther away than lights at Vigilante stadium. Considering that light decreases at a factor squared, then light that's 9x farther away is 81 times less powerful (or just 1.23% of its original strength). So, the light hitting nearby residence nearest Nelson Stadium will be 81 times less powerful than the lights hitting houses across the street from Vigilante Stadium and the people leaving Vigilante Stadium are not able to effectively see w/o use of a flashlight when they cross the street, just 55'-0" feet away.
- **Exhibit 4 - Perspective View Across Cemetery:** this shows actual visual scale of lights as looking at the campus from the neighborhood to the west of the Cemetery
- **Exhibit 5 - Perspective View Across Benton:** this shows what the lights would look like standing just across Benton. Due to size and scale of actual buildings and trees the lights are much shorter in view from this distance than other existing elements.
- **Exhibit 6 - Nelson Stadium Campus Section 1:** This shows the Litterial dimensional relationship between the nearby structures and the proposed lights. This exhibit also notes that both All Saints Chapel and Saint Charles Hall are taller than these lights. Considering the much greater visual impact of large bulky buildings vs. small skinny lights there is not much of an impact that these poles will have in relation to adjacent buildings
- **Exhibit 7 - Nelson Stadium Campus Section 2:** This shows the relationship between the current 30'-0" tall, unshielded practice lights placed 50'-0" to 60'-0" from Benton vs. using the new 100' poles placed over 400'-0" away and how each light will appear to have the same visual impact by the very closest residence. Also, with these new lights they are shielded far better so the actual impact is going to be decreased.
- **Exhibit 8 - 60'-0 Tall Lighting Scans:** this is a 16 page technical document showing various impacts of lighting levels from 60'-0" tall poles both on and off campus as well as at specific spots such as Benton Avenue & the middle and far edge of the cemetery area

- **Exhibit 9 - 100'-0" Tall Lighting Scans:** this is a 16 page technical document showing various impacts of lighting levels from 100'-0" tall poles both on and off campus as well as at specific spots such as Benton Avenue & the middle and far edge of the cemetery area

Thank you for your time here and please feel free to call our office at (406)443-2340 if you have any questions.

Sincerely,



Jason Egeline, A.I.A., NCARB, LEED GA
Crossman Whitney Griffin P.C. Architects
jason@cwg-architects.com
(406)-443-2340

CC: Carroll College and Dick Anderson Construction

Enc: Exhibit 1 - Vigilante Field Before & After
Exhibit 2 - Vigilante Stadium Map
Exhibit 3 - Nelson Stadium Map
Exhibit 4 - Perspective View Across Cemetery
Exhibit 5 - Perspective View Across Benton
Exhibit 6 - Nelson Stadium Campus Section 1
Exhibit 7 - Nelson Stadium Campus Section 2
Exhibit 8 - 60'-0 Tall Lighting Scans
Exhibit 9 - 100'-0 Tall Lighting Scans

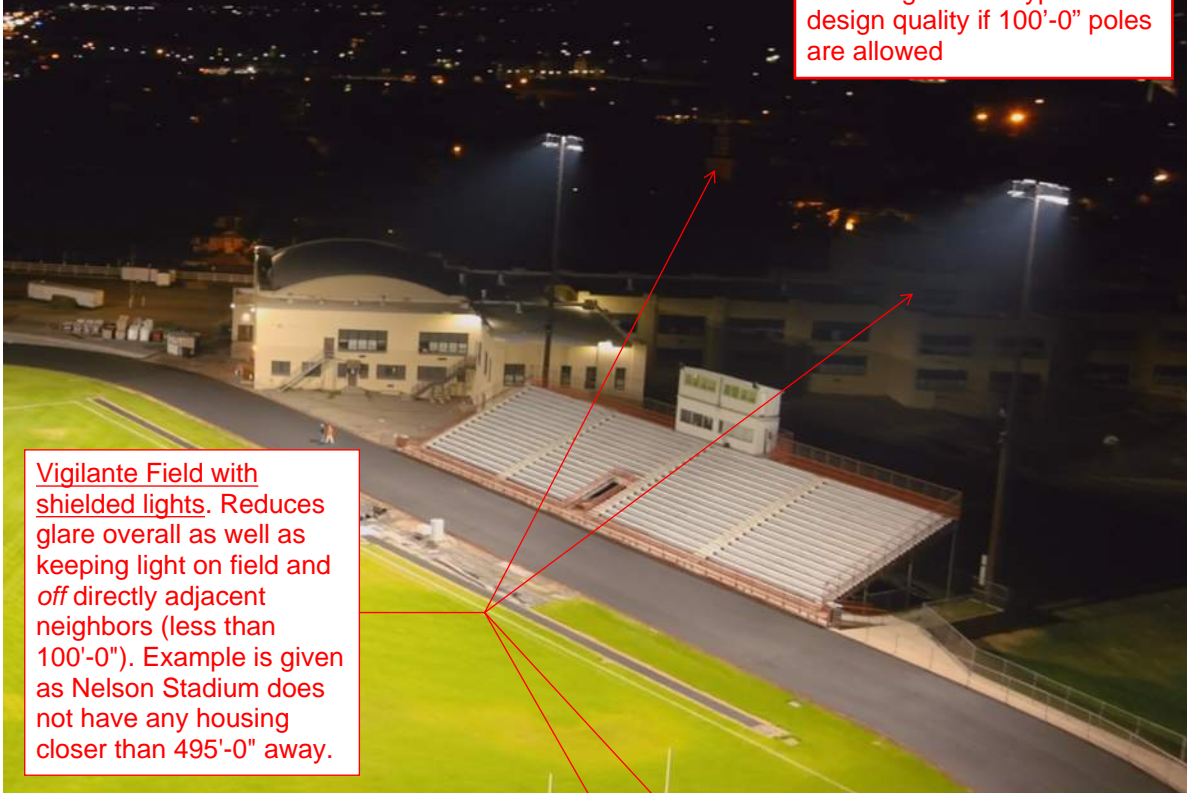
VIGILANTE FIELD - AFTER NEW FIXTURES

Exhibit 1 - Vigilante Field Before & After: shows positive impacts of using modern cutoff style fixtures. It greatly reduces light going off the field area and Carroll would be able to take full advantage of this type of design quality if 100'-0" poles are allowed

Vigilante Field with shielded lights. Reduces glare overall as well as keeping light on field and off directly adjacent neighbors (less than 100'-0"). Example is given as Nelson Stadium does not have any housing closer than 495'-0" away.

Example is given as Nelson Stadium does not have any housing closer than 495'-0" away and we have nearly identical light fixtures with very similar cutoff design

VIGILANTE FIELD - BEFORE NEW FIXTURES



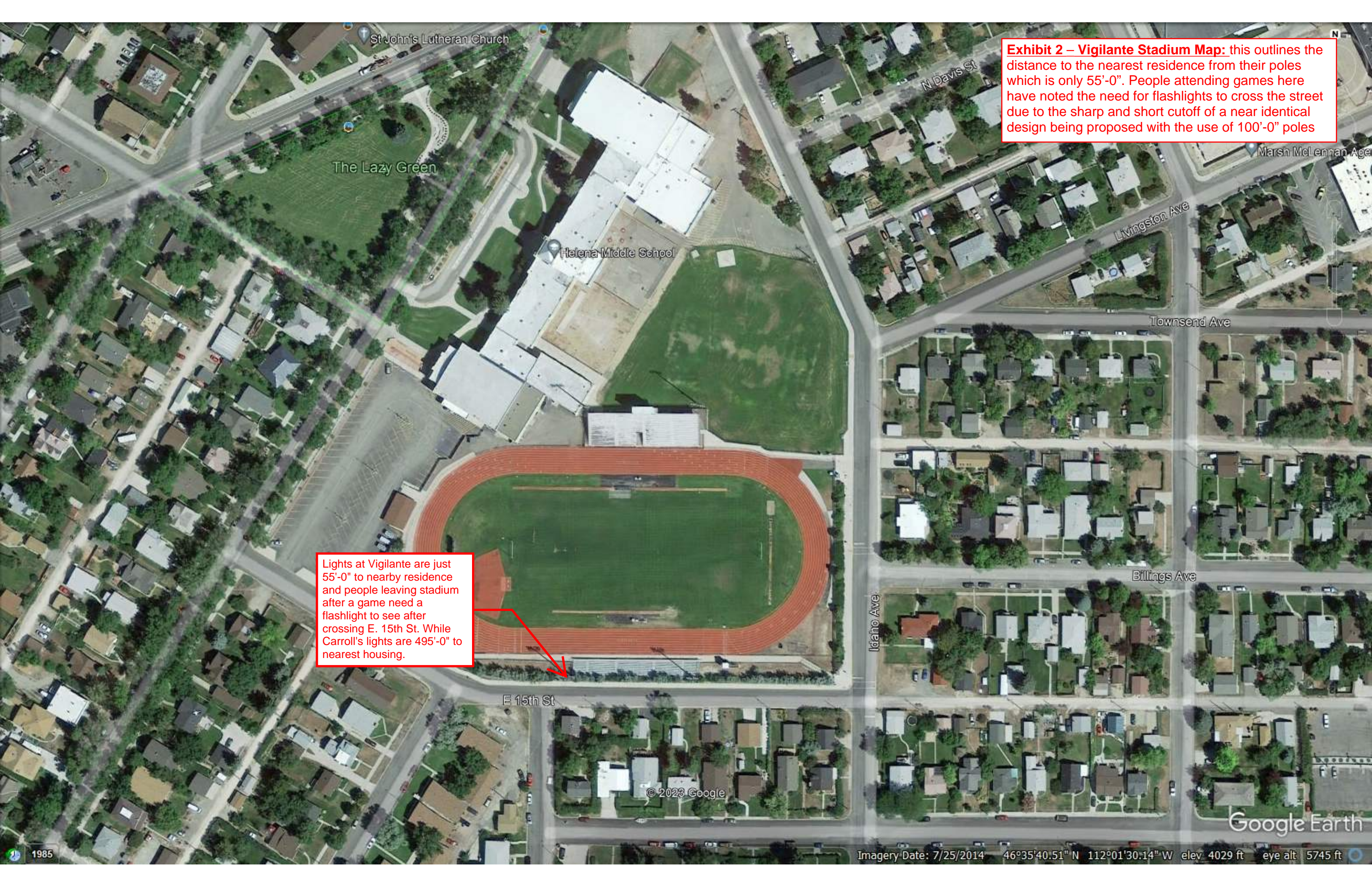


Exhibit 2 – Vigilante Stadium Map: this outlines the distance to the nearest residence from their poles which is only 55'-0". People attending games here have noted the need for flashlights to cross the street due to the sharp and short cutoff of a near identical design being proposed with the use of 100'-0" poles

Lights at Vigilante are just 55'-0" to nearby residence and people leaving stadium after a game need a flashlight to see after crossing E. 15th St. While Carroll's lights are 495'-0" to nearest housing.



St John's Lutheran Church

The Lazy Green

Helena Middle School

N Davis St

Livingston Ave

Townsend Ave

Billings Ave

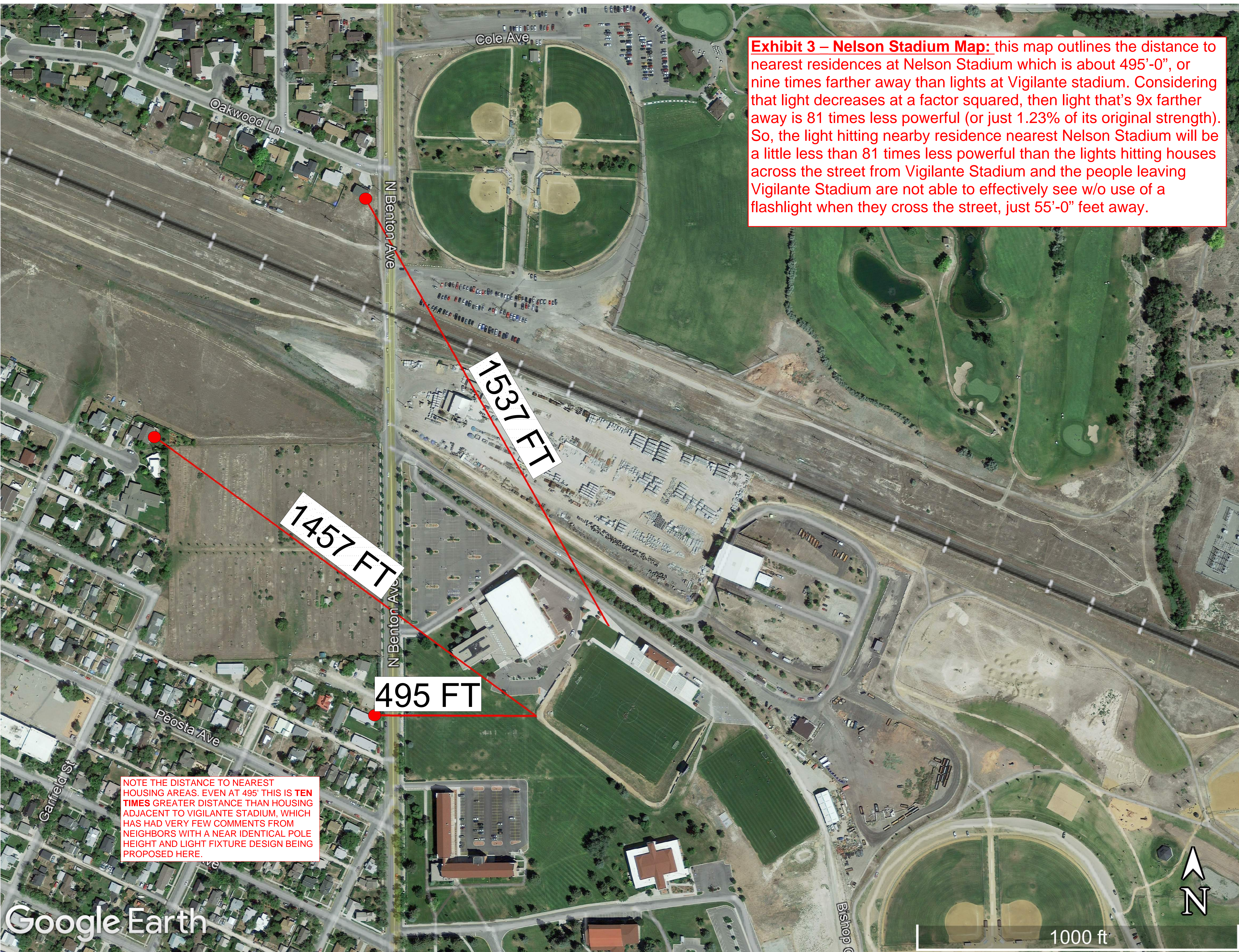
Idaho Ave

E 15th St

© 2023 Google

Google Earth

Exhibit 3 – Nelson Stadium Map: this map outlines the distance to nearest residences at Nelson Stadium which is about 495'-0", or nine times farther away than lights at Vigilante stadium. Considering that light decreases at a factor squared, then light that's 9x farther away is 81 times less powerful (or just 1.23% of its original strength). So, the light hitting nearby residence nearest Nelson Stadium will be a little less than 81 times less powerful than the lights hitting houses across the street from Vigilante Stadium and the people leaving Vigilante Stadium are not able to effectively see w/o use of a flashlight when they cross the street, just 55'-0" feet away.



NOTE THE DISTANCE TO NEAREST HOUSING AREAS. EVEN AT 495' THIS IS TEN TIMES GREATER DISTANCE THAN HOUSING ADJACENT TO VIGILANTE STADIUM, WHICH HAS HAD VERY FEW COMMENTS FROM NEIGHBORS WITH A NEAR IDENTICAL POLE HEIGHT AND LIGHT FIXTURE DESIGN BEING PROPOSED HERE.

Exhibit 4 - Perspective View Across Cemetery:
this shows actual visual scale of lights as looking at the campus from the neighborhood to the west of the Cemetery

FROM THE VIEW ACROSS THE CEMETERY NEARBY TREES AND BUILDINGS ARE TALLER FROM THIS LOCATION THAN OUR PROPOSED 100'-0" POLES.

SOME POLES ARE COMPLETELY BLOCKED FROM VIEW BY SAID EXISTING ELEMENTS.

THE MASS AND SCALE OF ACTUAL BUILDINGS IS FAR GREATER IMPACT THAN THE SIZE OF POLES.

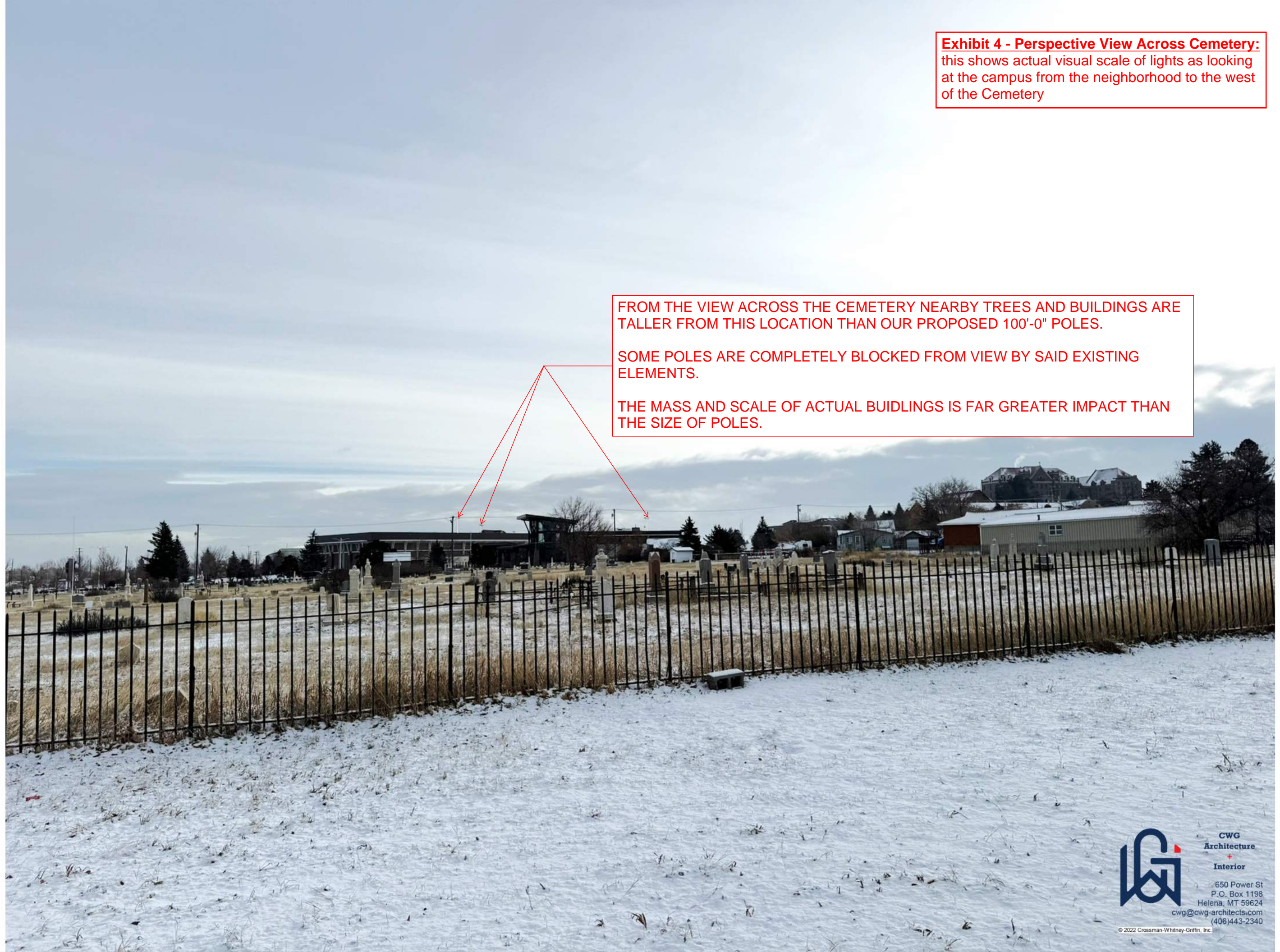


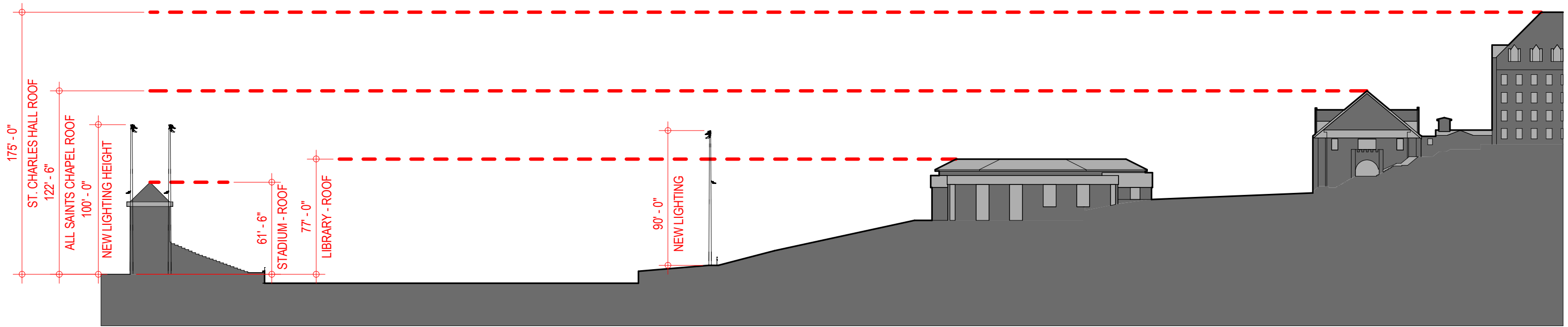
Exhibit 5 - Perspective View Across Benton: this shows what the lights would look like standing just across Benton. Due to size and scale of actual buildings and trees the lights are much shorter in view from this distance than other existing elements.



◀ N. BENTON AVE

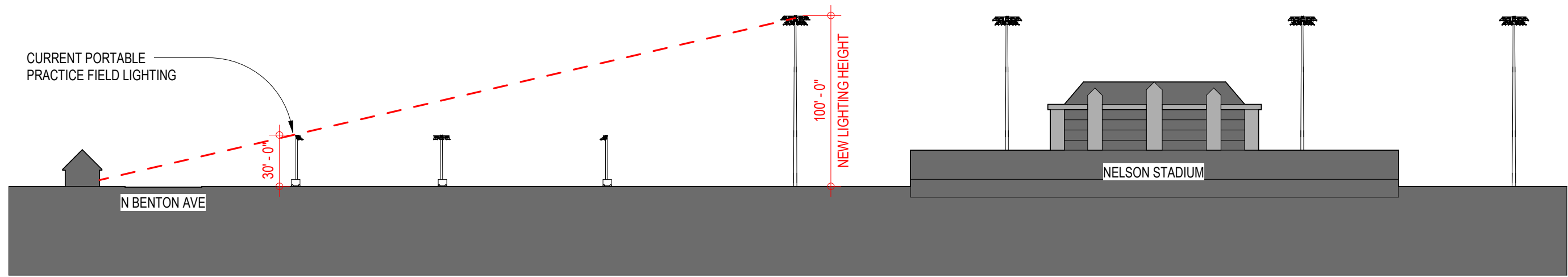
LIIGHT POLE ACTUAL HEIGHTS ARE LESS IMPACTFUL AT BENTON THAN NEARBY BUILDINGS
TRESS SHOW UP LARGER THAN THE PROPSOED LIHGTS FROM THIS LOCATION.
POLES ARE VERY SKINNY IN RELATION TO ACTAUL BUIDLINGS AND TREES

Exhibit 6 - Nelson Stadium Campus Section 1:
 This shows the Litterial dimensional relationship between the nearby structures and the proposed lights. This exhibit also notes that both All Saints Chapel and Saint Charles Hall are taller than these lights. Considering the much greater visual impact of large bulky buildings vs. small skinny lights there is not much of an impact that these poles will have in relation to adjacent buildings



1 CAMPUS SECTION - LOOKING EAST
 1/64" = 1'-0"

Exhibit 7 - Nelson Stadium Campus Section 2:
 This shows the relationship between the current 30'-0" tall, unshielded practice lights placed 50'-0" to 60'-0" from Benton vs. using the new 100' poles placed over 490'-0" away and how each light will appear to have the same visual impact by the very closest residence. Also, with these new lights they are shielded far better so the actual impact is going to be decreased.



① CAMPUS SECTION ACROSS BENTON LOOKING NORTH
 1/64" = 1'-0"

Lighting System

| Pole/Fixture Summary | | | | | | |
|----------------------|-------------|------------|-------------|----------------|------------------|---------|
| Pole ID | Pole Height | Mtg Height | Fixture Qty | Luminaire Type | Load | Circuit |
| N1 | 60' | 62' | 2 | TLC-LED-1500 | 2.82 kW | B |
| | | 62' | 7 | TLC-LED-1500 | 9.87 kW | A |
| | | 55' | 2 | TLC-LED-600-A | 1.16 kW | C |
| N2-N3 | 60' | 62' | 1 | TLC-LED-1500 | 1.41 kW | B |
| | | 62' | 9 | TLC-LED-1500 | 12.69 kW | A |
| | | 55' | 1 | TLC-LED-600-A | 0.58 kW | C |
| N4 | 60' | 60' | 2 | TLC-LED-1500 | 2.82 kW | B |
| | | 60' | 7 | TLC-LED-1500 | 9.87 kW | A |
| | | 55' | 2 | TLC-LED-600-A | 1.16 kW | C |
| S1 | 60' | 60' | 2 | TLC-LED-1500 | 2.82 kW | B |
| | | 60' | 7 | TLC-LED-1500 | 9.87 kW | A |
| | | 55' | 2 | TLC-LED-600-A | 1.16 kW | C |
| S2 | 60' | 60' | 2 | TLC-LED-1500 | 2.82 kW | B |
| | | 60' | 12 | TLC-LED-1500 | 16.92 kW | A |
| | | 55' | 2 | TLC-LED-600-A | 1.16 kW | C |
| S3 | 60' | 60' | 2 | TLC-LED-1500 | 2.82 kW | B |
| | | 60' | 7 | TLC-LED-1500 | 9.87 kW | A |
| | | 55' | 2 | TLC-LED-600-A | 1.16 kW | C |
| 7 | | | 82 | | 105.66 kW | |

| Circuit Summary | | | |
|-----------------|--------------------|----------|-------------|
| Circuit | Description | Load | Fixture Qty |
| A | Field-Normal Power | 81.78 kW | 58 |
| B | Field-EM. Power | 16.92 kW | 12 |
| C | Egress-EM. Power | 6.96 kW | 12 |

| Fixture Type Summary | | | | | | | |
|----------------------|--------------------|---------|---------|----------|----------|----------|----------|
| Type | Source | Wattage | Lumens | L90 | L80 | L70 | Quantity |
| TLC-LED-1500 | LED 5700K - 75 CRI | 1410W | 181,000 | >120,000 | >120,000 | >120,000 | 70 |
| TLC-LED-600-A | LED 5700K - 75 CRI | 580W | 65,600 | -- | -- | -- | 12 |

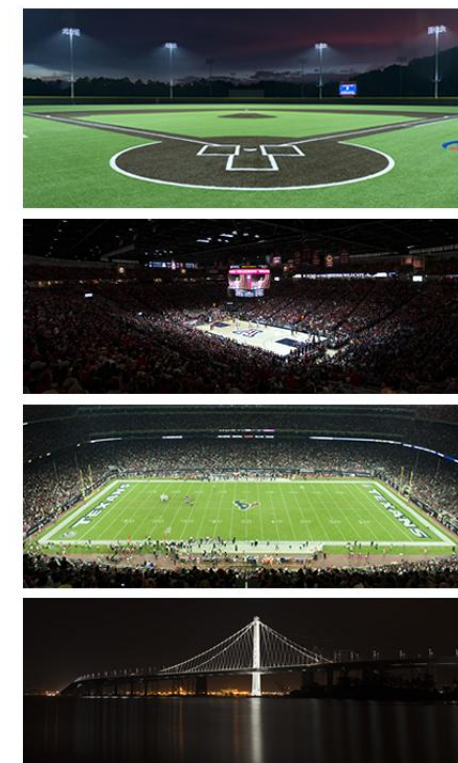
| Single Luminaire Amperage Draw Chart | | | | | | | | |
|---|---|-------------|-------------|-------------|-------------|-------------|-------------|--|
| Driver Specifications (.90 min power factor) | Line Amperage Per Luminaire (max draw) | | | | | | | |
| | 208 (60) | 220 (60) | 240 (60) | 277 (60) | 347 (60) | 380 (60) | 480 (60) | |
| Single Phase Voltage | 208 (60) | 220 (60) | 240 (60) | 277 (60) | 347 (60) | 380 (60) | 480 (60) | |
| TLC-LED-1500 | 8.4 | 7.9 | 7.3 | 6.3 | 5.0 | 4.6 | 3.6 | |
| TLC-LED-600 | 3.4 | 3.2 | 3.0 | 2.6 | 2.0 | 1.9 | 1.5 | |

Light Level Summary

| Calculation Grid Summary | | | | | | | | |
|--------------------------|---------------------------------|--------------|------|---------|----------|---------|----------|-------------|
| Grid Name | Calculation Metric | Illumination | | | | | Circuits | Fixture Qty |
| | | Ave | Min | Max | Max/Min | Ave/Min | | |
| 0.0fc-Spill | Horizontal | 1.90 | 0 | 114 | 0.00 | | A,B | 70 |
| 1fc-Spill | Horizontal | 1.90 | 0 | 117 | 0.00 | | A,B | 70 |
| Spill Line | Glare Rating | 68.3 | 26 | 90 | 3.49 | 2.63 | A,B | 70 |
| Spill Line | Horizontal | 0 | 0 | 0 | 0.00 | | A,B | 70 |
| Spill Line | Max Candela (by Fixture) | 213419 | 547 | 603716 | 1103.40 | 390.16 | A,B | 70 |
| Spill Line | Max Candela (by Light Bank) | 424462 | 1154 | 1127652 | 977.59 | 367.82 | A,B | 70 |
| Spill Line | Max Vertical Illuminance Metric | 0.90 | 0 | 2 | 1735.03 | | A,B | 70 |
| Spill Line 2 | Glare Rating | 65.6 | 10 | 90 | 9.00 | 6.56 | A,B | 70 |
| Spill Line 2 | Horizontal | 0 | 0 | 0 | 0.00 | | A,B | 70 |
| Spill Line 2 | Max Candela (by Light Bank) | 269585 | 48 | 880057 | 18242.00 | 5616.35 | A,B | 70 |
| Spill Line 2 | Max Vertical Illuminance Metric | 0.20 | 0 | 1 | 0.00 | | A,B | 70 |
| Spill Line 3 | Glare Rating | 70 | 15 | 90 | 5.90 | 4.67 | A,B | 70 |
| Spill Line 3 | Horizontal | 0 | 0 | 0 | 0.00 | | A,B | 70 |
| Spill Line 3 | Max Candela (by Light Bank) | 160305 | 149 | 764741 | 5121.30 | 1075.87 | A,B | 70 |
| Spill Line 3 | Max Vertical Illuminance Metric | 0.10 | 0 | 0 | 0.00 | | A,B | 70 |

Exhibit 8 - 60'-0 Tall Lighting Scans: this is a 16 page technical document showing various impacts of lighting levels from 60'-0" tall poles both on and off campus as well as at specific spots such as Benton Avenue & the middle and far edge of the cemetery area

From Hometown to Professional



We Make It Happen.

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Carrol College Nelson Stadium

Helena, MT

| Grid Summary | |
|--------------|------------------|
| Name | 0.0fc-Spill |
| Size | 360' x 160' |
| Spacing | 30.0' x 30.0' |
| Height | 3.0' above grade |

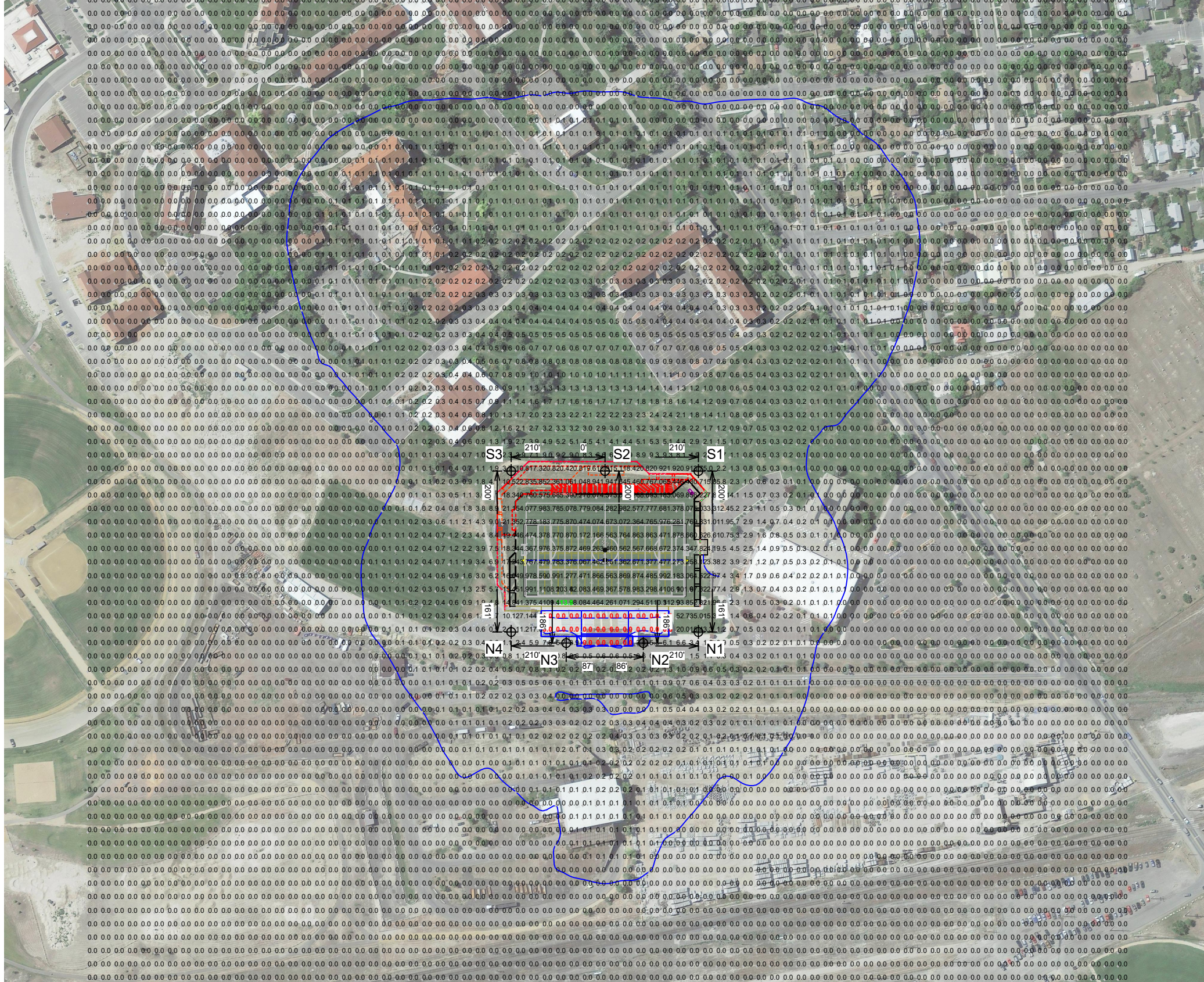
| Illumination Summary | |
|-----------------------------------|-------------|
| MAINTAINED HORIZONTAL FOOTCANDLES | |
| | Entire Grid |
| Scan Average | 1.9 |
| Maximum | 114 |
| Minimum | 0 |
| Avg/Min | - |
| Max/Min | - |
| UG (adjacent pts) | 92.00 |
| CU | 0.90 |
| No. of Points | 6318 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

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 driver and structures located within 3 feet (1m) of design locations.



Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗



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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

| Grid Summary | |
|--------------|------------------|
| Name | 1fc-Spill |
| Size | 360' x 160' |
| Spacing | 30.0' x 30.0' |
| Height | 3.0' above grade |

| Illumination Summary | |
|-----------------------------------|----------|
| MAINTAINED HORIZONTAL FOOTCANDLES | |
| Scan Average | 1.9 |
| Maximum | 117 |
| Minimum | 0 |
| Avg/Min | - |
| Max/Min | - |
| UG (adjacent pts) | 80.04 |
| CU | 0.93 |
| No. of Points | 6478 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

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

Installation Requirements: Results assume $\pm 3\%$ nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.



SCALE IN FEET 1 : 250
0' 250' 500'
ENGINEERED DESIGN By: A.Boersma • File #151917D-PROD-60'-R1 • 10-Jan-24

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗



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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

Grid Summary

Name **Spill Line**
 Size 360' x 160'
 Spacing 30.0' x 10.0'
 Height 3.0' above grade

Illumination Summary

| MAINTAINED HORIZONTAL FOOTCANDLES | |
|-----------------------------------|----------|
| Entire Grid | |
| Scan Average | 0.0 |
| Maximum | 0 |
| Minimum | 0 |
| Avg/Min | - |
| Max/Min | - |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 48 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

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 driver and structures located within 3 feet (1m) of design locations.



SCALE IN FEET 1 : 200
 0' 200' 400'
 ENGINEERED DESIGN By: A.Boersma • File #151917D-PROD-60'-R1 • 10-Jan-24

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗



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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

Grid Summary

Name Spill Line
Size 360' x 160'
Spacing 30.0' x 10.0'
Height 3.0' above grade

Illumination Summary

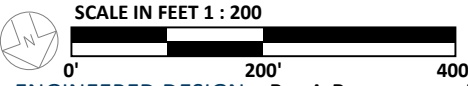
| MAINTAINED MAX VERTICAL FOOTCANDLES | |
|-------------------------------------|----------------|
| Entire Grid | |
| Scan Average | 0.9 |
| Maximum | 2 |
| Minimum | 0 |
| Avg/Min | 660.72 |
| Max/Min | 1735.03 |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 48 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

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 driver and structures located within 3 feet (1m) of design locations.



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Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗



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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

Grid Summary

Name Spill Line
Size 360' x 160'
Spacing 30.0' x 10.0'
Height 3.0' above grade

Illumination Summary

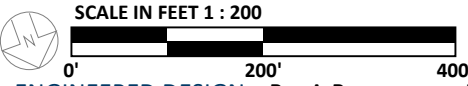
| | Max Candela (by lightbank) |
|------------------------------|----------------------------|
| Entire Grid | |
| Scan Average | 424461.7 |
| Maximum | 1127652 |
| Minimum | 1154 |
| Avg/Min | 367.98 |
| Max/Min | 977.59 |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 48 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

Grid Summary

Name **Spill Line**
 Size 360' x 160'
 Spacing 30.0' x 10.0'
 Height 3.0' above grade

Illumination Summary

| MAINTAINED GLARE RATING: Max Reading | |
|--------------------------------------|-------------|
| Entire Grid | |
| Scan Average | 68.3 |
| Maximum | 90 |
| Minimum | 26 |
| Avg/Min | 2.65 |
| Max/Min | 3.49 |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 48 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

Grid Summary

Name **Spill Line 2**
 Size 360' x 160'
 Spacing 30.0' x 10.0'
 Height 3.0' above grade

Illumination Summary

| MAINTAINED HORIZONTAL FOOTCANDLES | |
|-----------------------------------|-------------|
| | Entire Grid |
| Scan Average | 0.0 |
| Maximum | 0 |
| Minimum | 0 |
| Avg/Min | - |
| Max/Min | - |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 45 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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SCALE IN FEET 1 : 200
 0' 200' 400'
 ENGINEERED DESIGN By: A.Boersma • File #151917D-PROD-60'-R1 • 10-Jan-24

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

Grid Summary

Name **Spill Line 2**
 Size 360' x 160'
 Spacing 30.0' x 10.0'
 Height 3.0' above grade

Illumination Summary

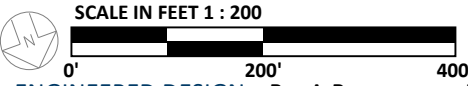
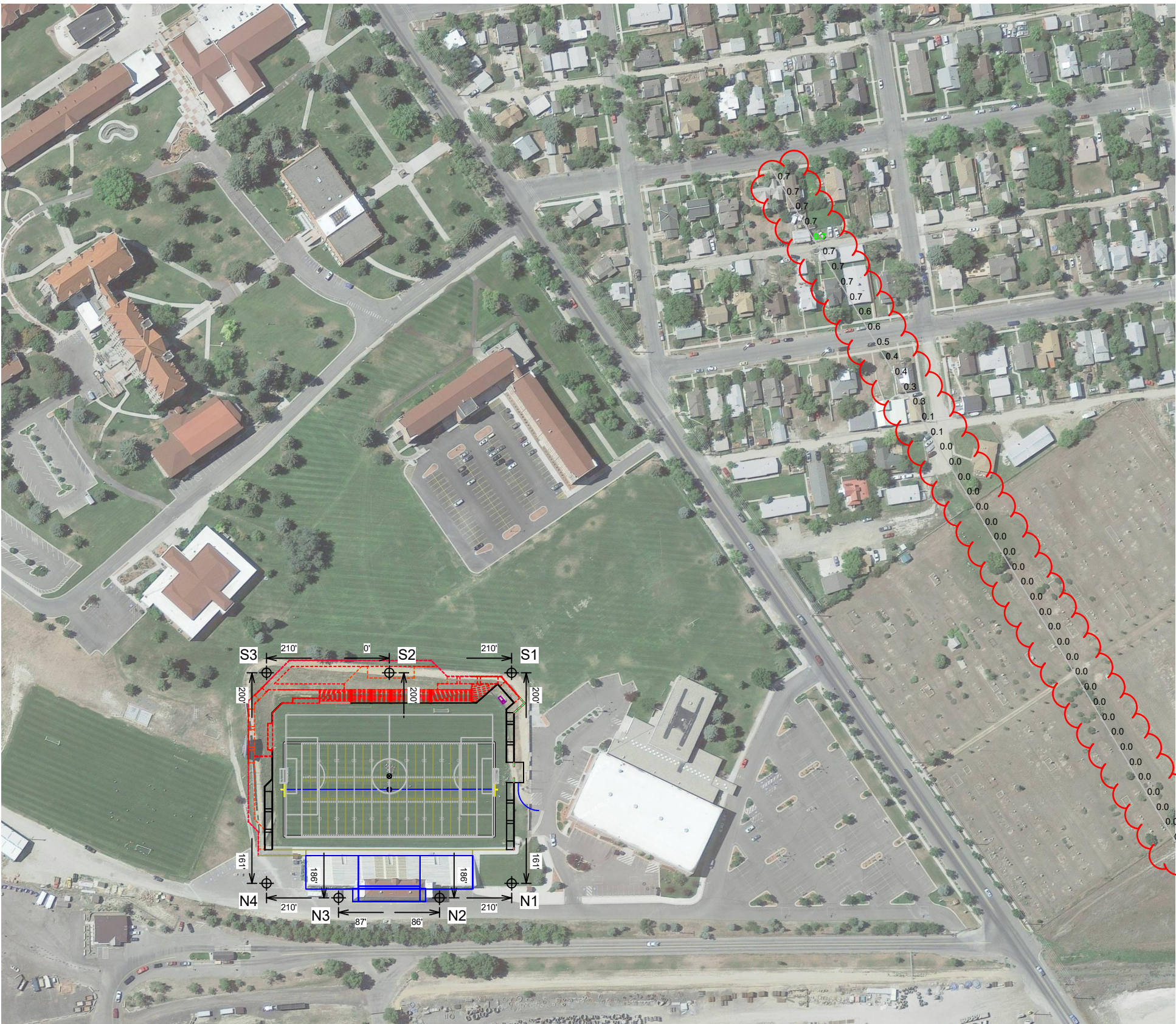
| MAINTAINED MAX VERTICAL FOOTCANDLES | |
|-------------------------------------|------------|
| Entire Grid | |
| Scan Average | 0.2 |
| Maximum | 1 |
| Minimum | 0 |
| Avg/Min | - |
| Max/Min | - |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 45 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

| Grid Summary | |
|--------------|------------------|
| Name | Spill Line 2 |
| Size | 360' x 160' |
| Spacing | 30.0' x 10.0' |
| Height | 3.0' above grade |

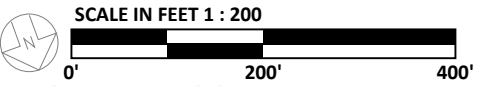
| Illumination Summary | |
|------------------------------|----------------------------|
| | Max Candela (by lightbank) |
| | Entire Grid |
| Scan Average | 269585.0 |
| Maximum | 880057 |
| Minimum | 48 |
| Avg/Min | 5588.02 |
| Max/Min | 18242.00 |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 45 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

| Grid Summary | |
|--------------|------------------|
| Name | Spill Line 2 |
| Size | 360' x 160' |
| Spacing | 30.0' x 10.0' |
| Height | 3.0' above grade |

| Illumination Summary | |
|------------------------------|--------------------------------------|
| | MAINTAINED GLARE RATING: Max Reading |
| | Entire Grid |
| Scan Average | 65.6 |
| Maximum | 90 |
| Minimum | 10 |
| Avg/Min | 6.56 |
| Max/Min | 9.00 |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 45 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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SCALE IN FEET 1 : 200
 0' 200' 400'
 ENGINEERED DESIGN By: A.Boersma • File #151917D-PROD-60'-R1 • 10-Jan-24

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

| Grid Summary | |
|--------------|------------------|
| Name | Spill Line 3 |
| Size | 360' x 160' |
| Spacing | 30.0' x 10.0' |
| Height | 3.0' above grade |

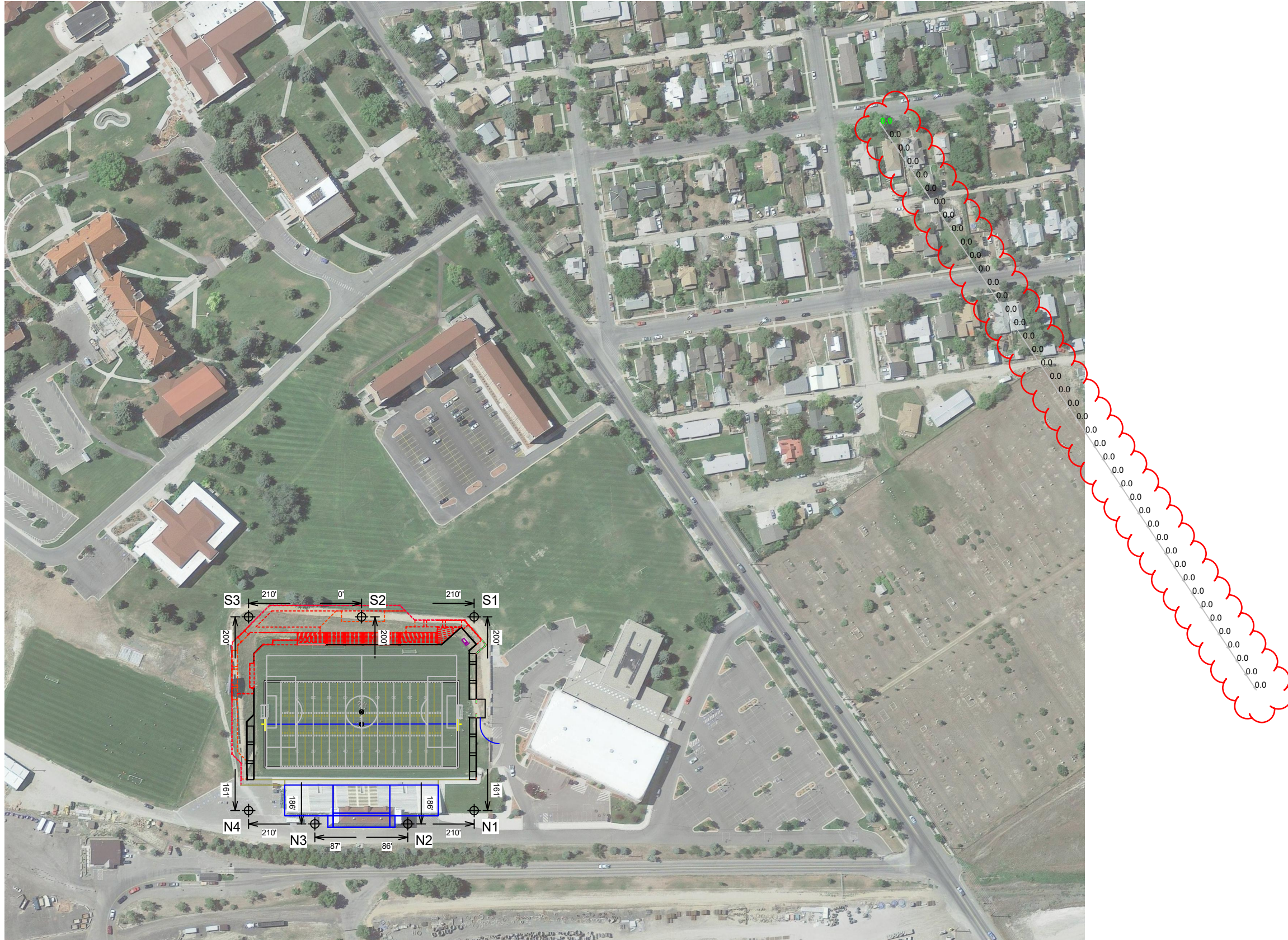
| Illumination Summary | |
|-----------------------------------|----------|
| MAINTAINED HORIZONTAL FOOTCANDLES | |
| Entire Grid | |
| Scan Average | 0.0 |
| Maximum | 0 |
| Minimum | 0 |
| Avg/Min | - |
| Max/Min | - |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 43 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

| Grid Summary | |
|--------------|------------------|
| Name | Spill Line 3 |
| Size | 360' x 160' |
| Spacing | 30.0' x 10.0' |
| Height | 3.0' above grade |

| Illumination Summary | |
|------------------------------|-------------------------------------|
| | MAINTAINED MAX VERTICAL FOOTCANDLES |
| | Entire Grid |
| Scan Average | 0.1 |
| Maximum | 0 |
| Minimum | 0 |
| Avg/Min | - |
| Max/Min | - |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 43 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

| Grid Summary | |
|--------------|------------------|
| Name | Spill Line 3 |
| Size | 360' x 160' |
| Spacing | 30.0' x 10.0' |
| Height | 3.0' above grade |

| Illumination Summary | |
|------------------------------|----------------------------|
| | Max Candela (by lightbank) |
| | Entire Grid |
| Scan Average | 160304.6 |
| Maximum | 764741 |
| Minimum | 149 |
| Avg/Min | 1073.53 |
| Max/Min | 5121.30 |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 43 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

| Grid Summary | |
|--------------|------------------|
| Name | Spill Line 3 |
| Size | 360' x 160' |
| Spacing | 30.0' x 10.0' |
| Height | 3.0' above grade |

| Illumination Summary | |
|------------------------------|--------------------------------------|
| | MAINTAINED GLARE RATING: Max Reading |
| Entire Grid | |
| Scan Average | 70.0 |
| Maximum | 90 |
| Minimum | 15 |
| Avg/Min | 4.59 |
| Max/Min | 5.90 |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 43 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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 0' 200' 400'
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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

Equipment Layout

INCLUDES:

- Football
- Soccer

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

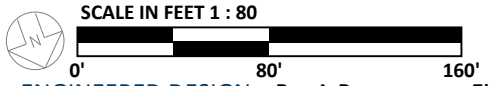
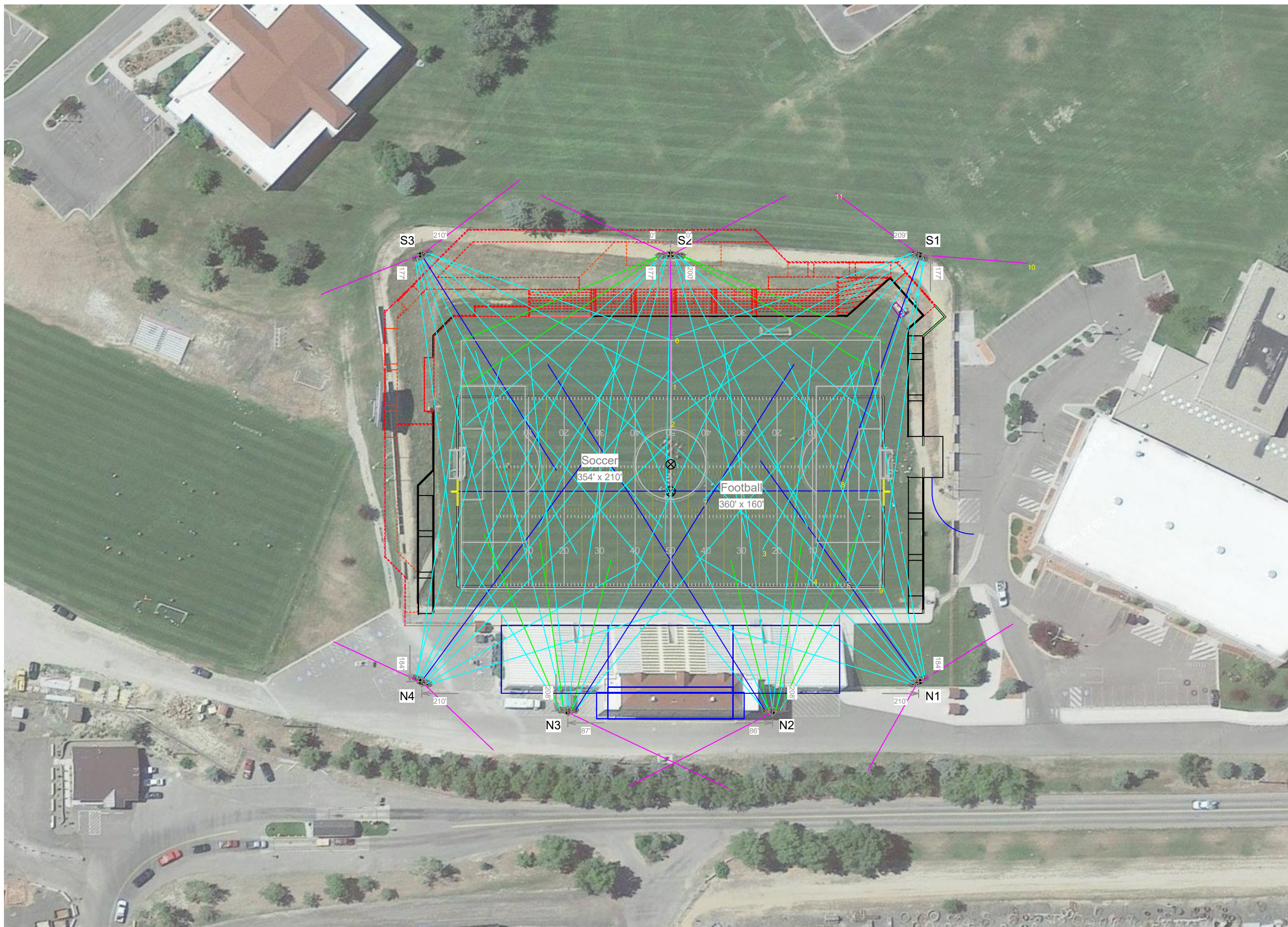
Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

Equipment List For Areas Shown

| QTY | Pole | | | Luminaires | | | |
|-----|----------|------|-----------------|-------------------|-----------------------------|----------|----|
| | LOCATION | SIZE | GRADE ELEVATION | ABOVE GRADE LEVEL | LUMINAIRE TYPE | QTY/POLE | |
| 1 | N1 | 60' | 2' | 61.7' 56.7' | TLC-LED-1500 TLC-LED-600 | 9 2 | |
| 2 | N2-N3 | 60' | 2' | 61.7' 56.7' | TLC-LED-1500 TLC-LED-600 | 10 1 | |
| 1 | N4 | 60' | 4' | 64.2' 59.2' | TLC-LED-1500 TLC-LED-600 | 9 2 | |
| 1 | S1 | 60' | 10' | 69.7' 64.7' | TLC-LED-1500 TLC-LED-600 | 9 2 | |
| 1 | S2 | 60' | 16' | 76.5' 71.5' | TLC-LED-1500 TLC-LED-600 | 14 2 | |
| 1 | S3 | 60' | 17' | 76.7' 71.7' | TLC-LED-1500 TLC-LED-600 | 9 2 | |
| 7 | Totals | | | | | | 82 |

Single Luminaire Amperage Draw Chart

| Driver Specifications (.90 min power factor) | Line Amperage Per Luminaire (max draw) | | | | | | |
|---|---|-------------|-------------|-------------|-------------|-------------|-------------|
| Single Phase Voltage | 208 (60) | 220 (60) | 240 (60) | 277 (60) | 347 (60) | 380 (60) | 480 (60) |
| TLC-LED-1500 | 8.4 | 7.9 | 7.3 | 6.3 | 5.0 | 4.6 | 3.6 |
| TLC-LED-600 | 3.4 | 3.2 | 3.0 | 2.6 | 2.0 | 1.9 | 1.5 |



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Lighting System

| Pole/Fixture Summary | | | | | | |
|----------------------|-------------|------------|-------------|----------------|------------------|---------|
| Pole ID | Pole Height | Mtg Height | Fixture Qty | Luminaire Type | Load | Circuit |
| N1 | 100' | 102' | 2 | TLC-LED-1500 | 2.82 kW | B |
| | | 102' | 7 | TLC-LED-1500 | 9.87 kW | A |
| | | 55' | 2 | TLC-LED-600-A | 1.16 kW | C |
| N2-N3 | 100' | 102' | 1 | TLC-LED-1500 | 1.41 kW | B |
| | | 102' | 9 | TLC-LED-1500 | 12.69 kW | A |
| | | 55' | 1 | TLC-LED-600-A | 0.58 kW | C |
| N4 | 100' | 100' | 2 | TLC-LED-1500 | 2.82 kW | B |
| | | 100' | 7 | TLC-LED-1500 | 9.87 kW | A |
| | | 55' | 2 | TLC-LED-600-A | 1.16 kW | C |
| S1 | 100' | 100' | 2 | TLC-LED-1500 | 2.82 kW | B |
| | | 100' | 7 | TLC-LED-1500 | 9.87 kW | A |
| | | 55' | 2 | TLC-LED-600-A | 1.16 kW | C |
| S2 | 60' | 60' | 2 | TLC-LED-1500 | 2.82 kW | B |
| | | 60' | 12 | TLC-LED-1500 | 16.92 kW | A |
| | | 55' | 2 | TLC-LED-600-A | 1.16 kW | C |
| S3 | 100' | 100' | 2 | TLC-LED-1500 | 2.82 kW | B |
| | | 100' | 7 | TLC-LED-1500 | 9.87 kW | A |
| | | 55' | 2 | TLC-LED-600-A | 1.16 kW | C |
| 7 | | | 82 | | 105.66 kW | |

| Circuit Summary | | | |
|-----------------|--------------------|----------|-------------|
| Circuit | Description | Load | Fixture Qty |
| A | Field-Normal Power | 81.78 kW | 58 |
| B | Field-EM. Power | 16.92 kW | 12 |
| C | Egress-EM. Power | 6.96 kW | 12 |

| Fixture Type Summary | | | | | | | |
|----------------------|--------------------|---------|---------|----------|----------|----------|----------|
| Type | Source | Wattage | Lumens | L90 | L80 | L70 | Quantity |
| TLC-LED-1500 | LED 5700K - 75 CRI | 1410W | 181,000 | >120,000 | >120,000 | >120,000 | 70 |
| TLC-LED-600-A | LED 5700K - 75 CRI | 580W | 65,600 | -- | -- | -- | 12 |

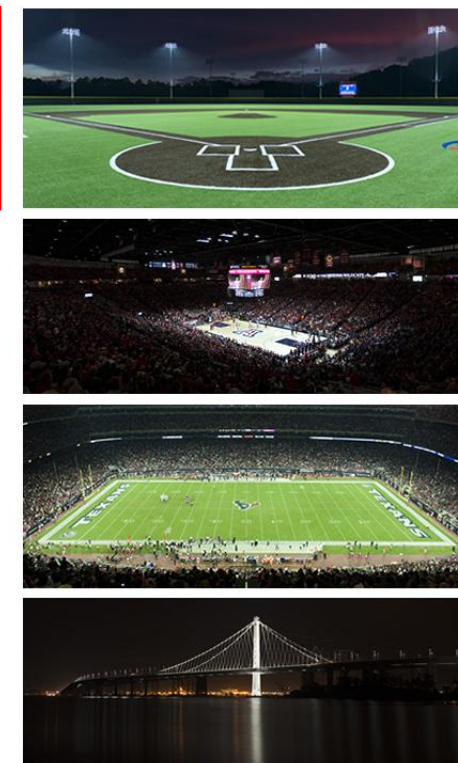
| Single Luminaire Amperage Draw Chart | | | | | | | |
|---|---|-------------|-------------|-------------|-------------|-------------|-------------|
| Driver Specifications (.90 min power factor) | Line Amperage Per Luminaire (max draw) | | | | | | |
| | 208 (60) | 220 (60) | 240 (60) | 277 (60) | 347 (60) | 380 (60) | 480 (60) |
| Single Phase Voltage | | | | | | | |
| TLC-LED-1500 | 8.4 | 7.9 | 7.3 | 6.3 | 5.0 | 4.6 | 3.6 |
| TLC-LED-600 | 3.4 | 3.2 | 3.0 | 2.6 | 2.0 | 1.9 | 1.5 |

Light Level Summary

| Calculation Grid Summary | | | | | | | | |
|--------------------------|---------------------------------|--------------|-----|--------|----------|----------|----------|-------------|
| Grid Name | Calculation Metric | Illumination | | | | | Circuits | Fixture Qty |
| | | Ave | Min | Max | Max/Min | Ave/Min | | |
| 0.0fc-Spill | Horizontal | 2 | 0 | 105 | 0.00 | | A,B | 70 |
| 1fc-Spill | Horizontal | 2 | 0 | 107 | 0.00 | | A,B | 70 |
| Spill Line | Glare Rating | 66.9 | 13 | 90 | 6.67 | 5.15 | A,B | 70 |
| Spill Line | Horizontal | 0 | 0 | 0 | 0.00 | | A,B | 70 |
| Spill Line | Max Candela (by Fixture) | 87915 | 145 | 255017 | 1752.87 | 606.31 | A,B | 70 |
| Spill Line | Max Candela (by Light Bank) | 137965 | 210 | 406951 | 1935.23 | 656.98 | A,B | 70 |
| Spill Line | Max Vertical Illuminance Metric | 0.20 | 0 | 1 | 2125.04 | | A,B | 70 |
| Spill Line 2 | Glare Rating | 67 | 10 | 90 | 9.00 | 6.70 | A,B | 70 |
| Spill Line 2 | Horizontal | 0 | 0 | 0 | 0.00 | | A,B | 70 |
| Spill Line 2 | Max Candela (by Light Bank) | 59839 | 2 | 174973 | 87244.05 | 29919.50 | A,B | 70 |
| Spill Line 2 | Max Vertical Illuminance Metric | 0 | 0 | 0 | 0.00 | | A,B | 70 |
| Spill Line 3 | Glare Rating | 69.5 | 10 | 90 | 9.00 | 6.95 | A,B | 70 |
| Spill Line 3 | Horizontal | 0 | 0 | 0 | 0.00 | | A,B | 70 |
| Spill Line 3 | Max Candela (by Light Bank) | 25816 | 6 | 102552 | 18406.53 | 4302.58 | A,B | 70 |
| Spill Line 3 | Max Vertical Illuminance Metric | 0 | 0 | 0 | 0.00 | | A,B | 70 |

Exhibit 9 - 100'-0" Tall Lighting Scans: this is a 16 page technical document showing various impacts of lighting levels from 100'-0" tall poles both on and off campus as well as at specific spots such as Benton Avenue & the middle and far edge of the cemetery area

From Hometown to Professional



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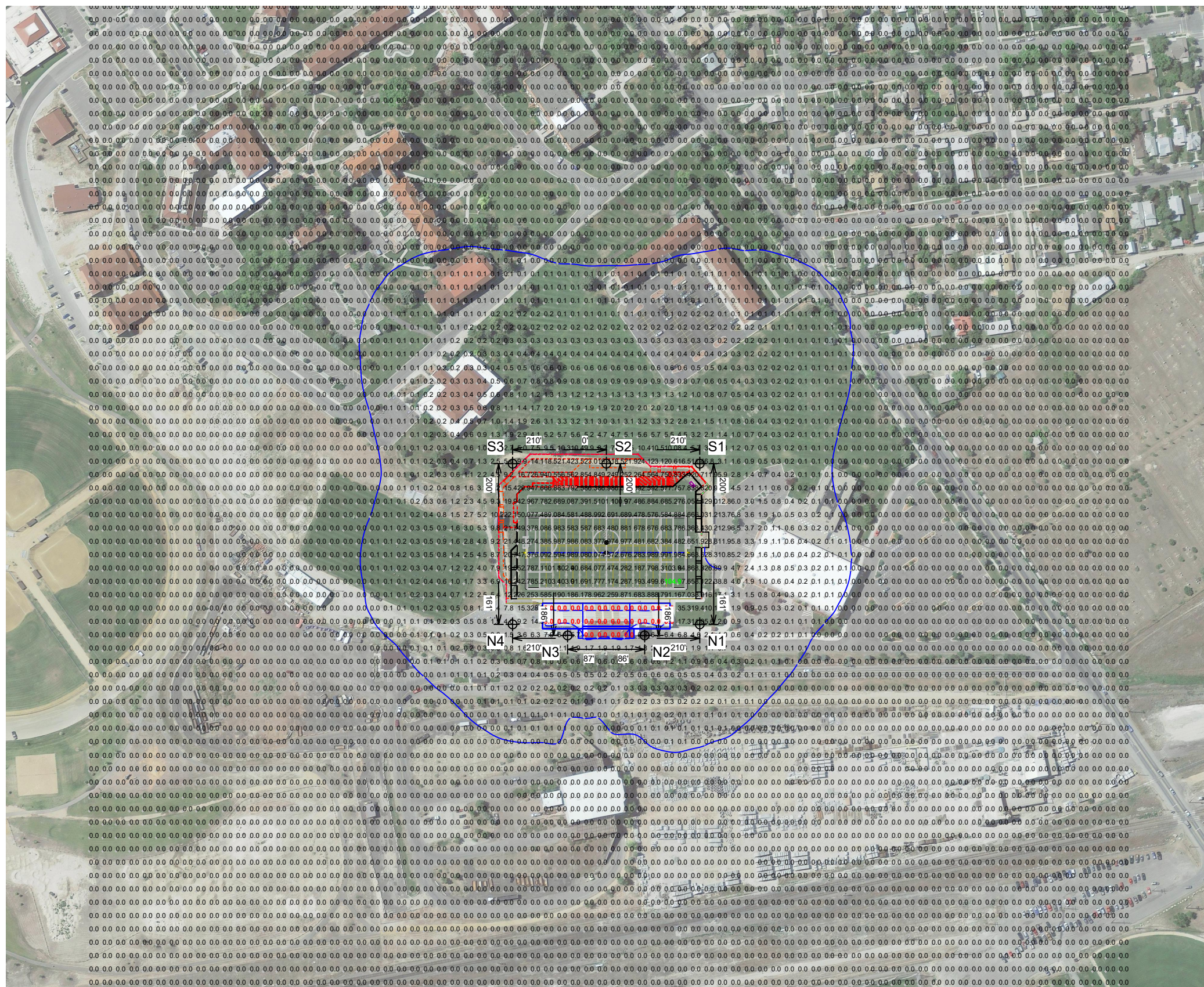
Carrol College Nelson Stadium

Helena, MT

| Grid Summary | |
|--------------|------------------|
| Name | 0.0fc-Spill |
| Size | 360' x 160' |
| Spacing | 30.0' x 30.0' |
| Height | 3.0' above grade |

| Illumination Summary | |
|-----------------------------------|----------|
| MAINTAINED HORIZONTAL FOOTCANDLES | |
| Entire Grid | |
| Scan Average | 2.0 |
| Maximum | 105 |
| Minimum | 0 |
| Avg/Min | - |
| Max/Min | - |
| UG (adjacent pts) | 69.48 |
| CU | 0.93 |
| No. of Points | 6318 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

Map shows that 100'-0" poles keep the light spread limited to campus property vs same design with 60'-0" pole which spreads light across Benton and onto many nearby residences



Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

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 driver and structures located within 3 feet (1m) of design locations.



Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗



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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

| Grid Summary | |
|--------------|------------------|
| Name | 1fc-Spill |
| Size | 360' x 160' |
| Spacing | 30.0' x 30.0' |
| Height | 3.0' above grade |

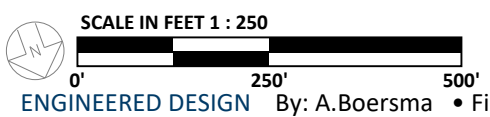
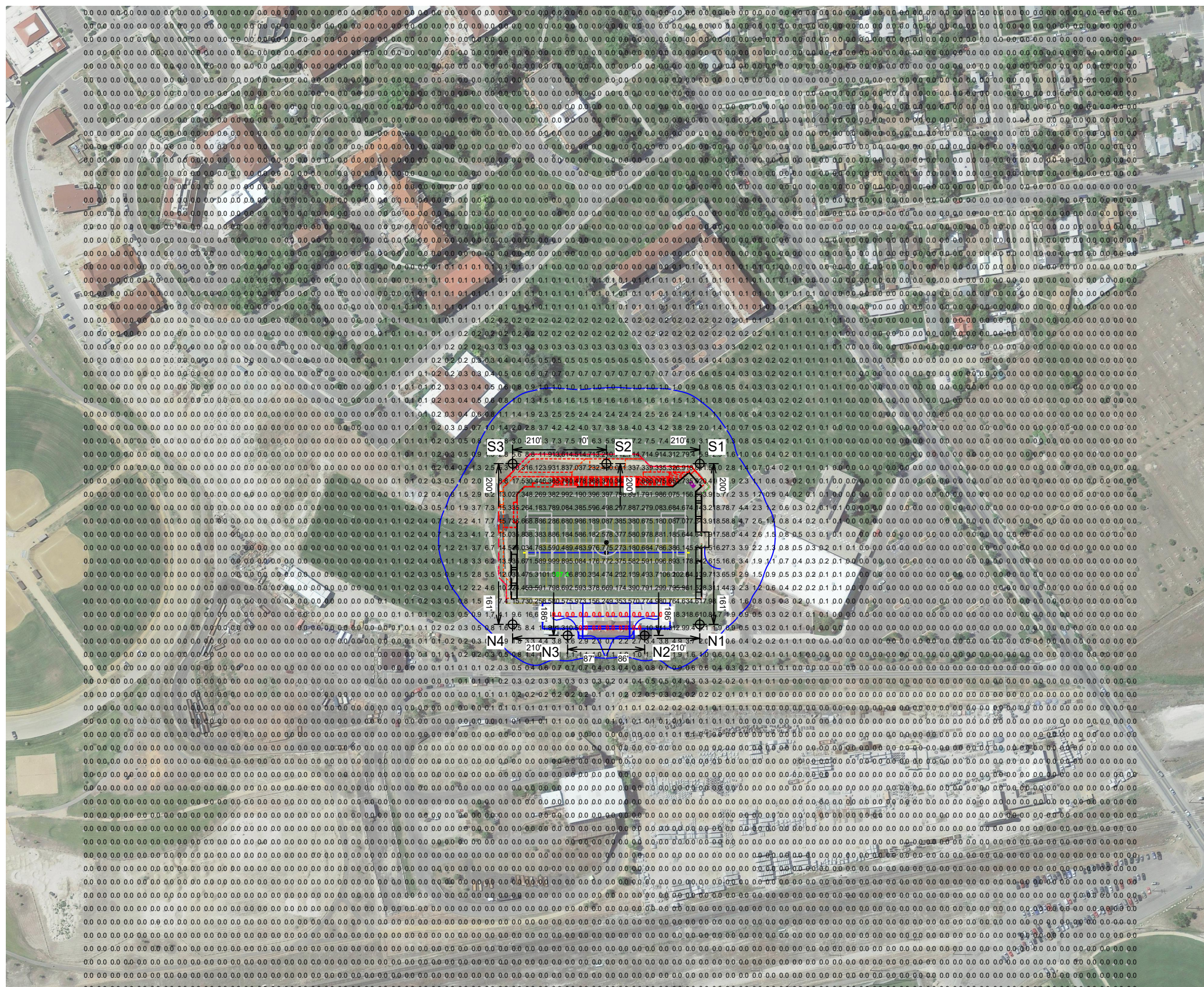
| Illumination Summary | |
|-----------------------------------|----------|
| MAINTAINED HORIZONTAL FOOTCANDLES | |
| Entire Grid | |
| Scan Average | 2.0 |
| Maximum | 107 |
| Minimum | 0 |
| Avg/Min | - |
| Max/Min | - |
| UG (adjacent pts) | 76.92 |
| CU | 0.95 |
| No. of Points | 6478 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

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

Installation Requirements: Results assume $\pm 3\%$ nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.



Pole location(s) ⊗ dimensions are relative to 0,0 reference point(s) ⊗



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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

Grid Summary

Name **Spill Line**
 Size 360' x 160'
 Spacing 30.0' x 10.0'
 Height 3.0' above grade

Illumination Summary

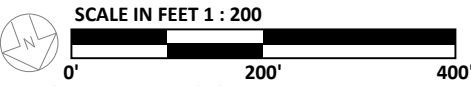
| MAINTAINED HORIZONTAL FOOTCANDLES | |
|-----------------------------------|-------------|
| | Entire Grid |
| Scan Average | 0.0 |
| Maximum | 0 |
| Minimum | 0 |
| Avg/Min | - |
| Max/Min | - |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 48 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

Grid Summary

Name **Spill Line**
 Size 360' x 160'
 Spacing 30.0' x 10.0'
 Height 3.0' above grade

Illumination Summary

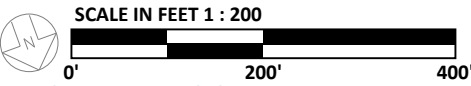
| MAINTAINED MAX VERTICAL FOOTCANDLES | |
|-------------------------------------|----------------|
| Entire Grid | |
| Scan Average | 0.2 |
| Maximum | 1 |
| Minimum | 0 |
| Avg/Min | 676.00 |
| Max/Min | 2125.04 |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 48 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

Grid Summary

Name Spill Line
Size 360' x 160'
Spacing 30.0' x 10.0'
Height 3.0' above grade

Illumination Summary

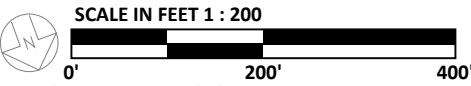
| | Max Candela (by lightbank) |
|------------------------------|----------------------------|
| Entire Grid | |
| Scan Average | 137965.2 |
| Maximum | 406951 |
| Minimum | 210 |
| Avg/Min | 656.08 |
| Max/Min | 1935.23 |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 48 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

Grid Summary

Name Spill Line
Size 360' x 160'
Spacing 30.0' x 10.0'
Height 3.0' above grade

Illumination Summary

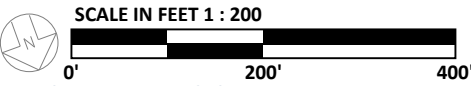
| MAINTAINED GLARE RATING: Max Reading | |
|--------------------------------------|-------------|
| Entire Grid | |
| Scan Average | 66.9 |
| Maximum | 90 |
| Minimum | 13 |
| Avg/Min | 4.96 |
| Max/Min | 6.67 |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 48 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

Grid Summary

Name **Spill Line 2**
 Size 360' x 160'
 Spacing 30.0' x 10.0'
 Height 3.0' above grade

Illumination Summary

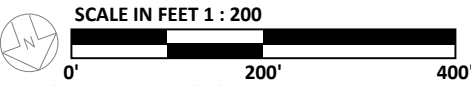
| MAINTAINED HORIZONTAL FOOTCANDLES | |
|-----------------------------------|-------------|
| | Entire Grid |
| Scan Average | 0.0 |
| Maximum | 0 |
| Minimum | 0 |
| Avg/Min | - |
| Max/Min | - |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 45 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

Grid Summary

Name **Spill Line 2**
 Size 360' x 160'
 Spacing 30.0' x 10.0'
 Height 3.0' above grade

Illumination Summary

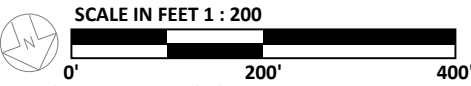
| MAINTAINED MAX VERTICAL FOOTCANDLES | |
|-------------------------------------|----------|
| Entire Grid | |
| Scan Average | 0.0 |
| Maximum | 0 |
| Minimum | 0 |
| Avg/Min | - |
| Max/Min | - |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 45 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

| Grid Summary | |
|--------------|------------------|
| Name | Spill Line 2 |
| Size | 360' x 160' |
| Spacing | 30.0' x 10.0' |
| Height | 3.0' above grade |

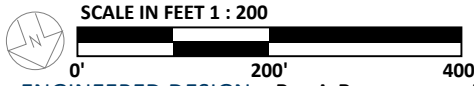
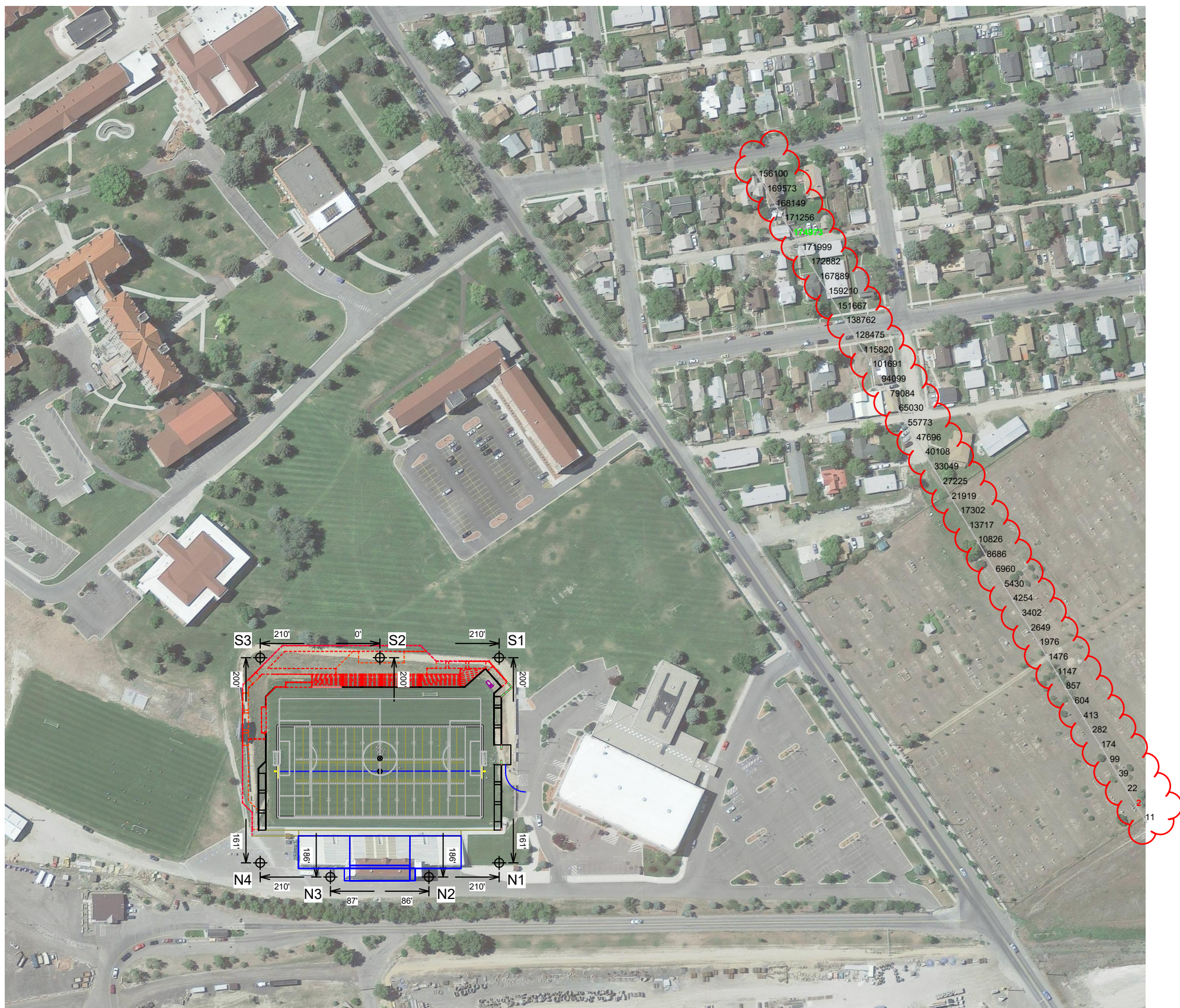
| Illumination Summary | |
|------------------------------|----------------------------|
| | Max Candela (by lightbank) |
| | Entire Grid |
| Scan Average | 59839.0 |
| Maximum | 174973 |
| Minimum | 2 |
| Avg/Min | 29836.51 |
| Max/Min | 87244.05 |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 45 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗



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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

Grid Summary

Name **Spill Line 2**
 Size 360' x 160'
 Spacing 30.0' x 10.0'
 Height 3.0' above grade

Illumination Summary

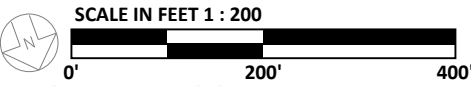
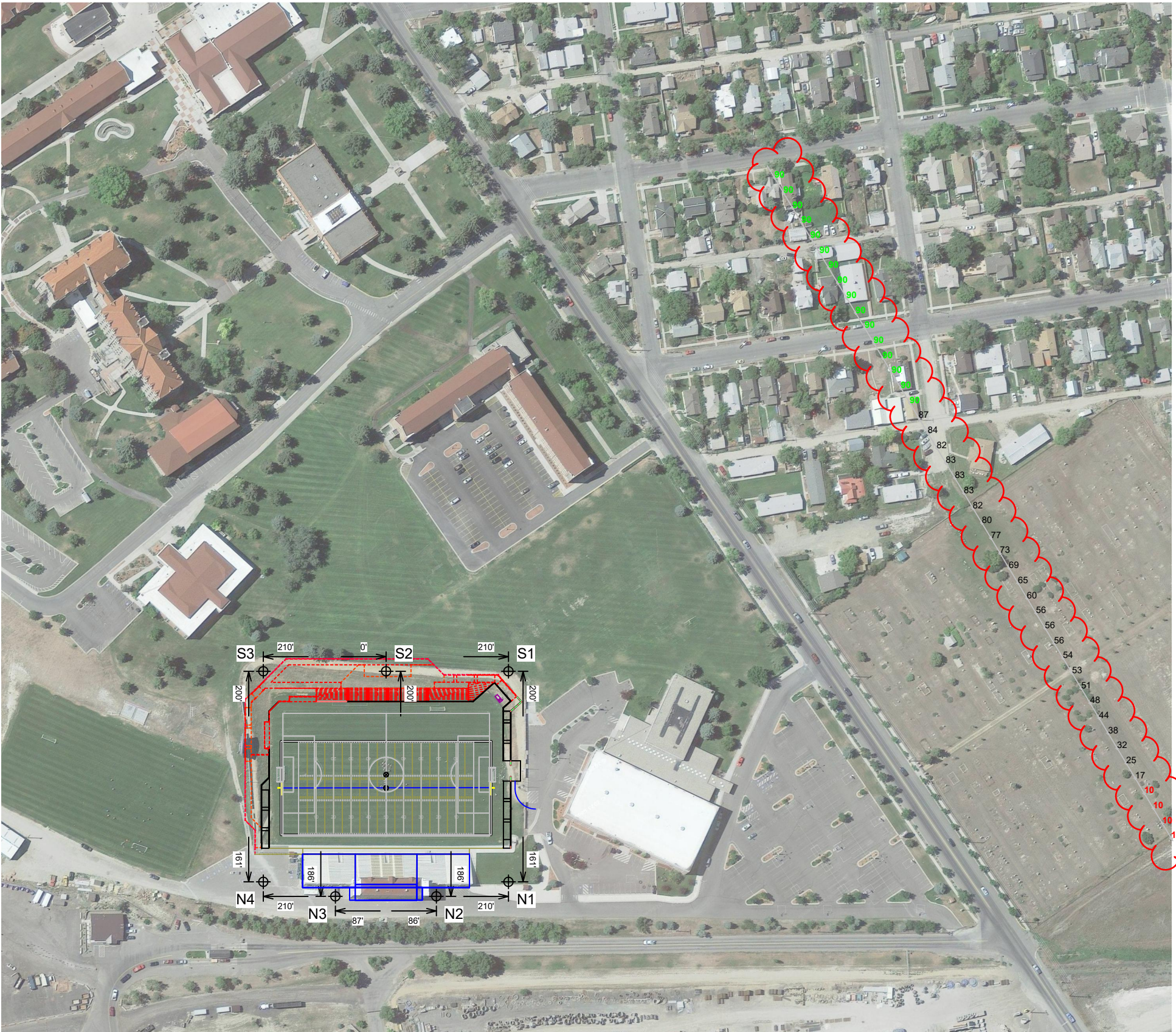
| MAINTAINED GLARE RATING: Max Reading | |
|--------------------------------------|-------------|
| Entire Grid | |
| Scan Average | 67.0 |
| Maximum | 90 |
| Minimum | 10 |
| Avg/Min | 6.70 |
| Max/Min | 9.00 |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 45 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗



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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

Grid Summary

Name **Spill Line 3**
 Size 360' x 160'
 Spacing 30.0' x 10.0'
 Height 3.0' above grade

Illumination Summary

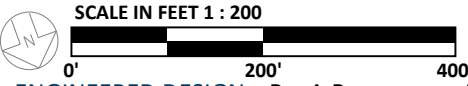
| MAINTAINED HORIZONTAL FOOTCANDLES | |
|-----------------------------------|-------------|
| | Entire Grid |
| Scan Average | 0.0 |
| Maximum | 0 |
| Minimum | 0 |
| Avg/Min | - |
| Max/Min | - |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 43 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

| Grid Summary | |
|--------------|------------------|
| Name | Spill Line 3 |
| Size | 360' x 160' |
| Spacing | 30.0' x 10.0' |
| Height | 3.0' above grade |

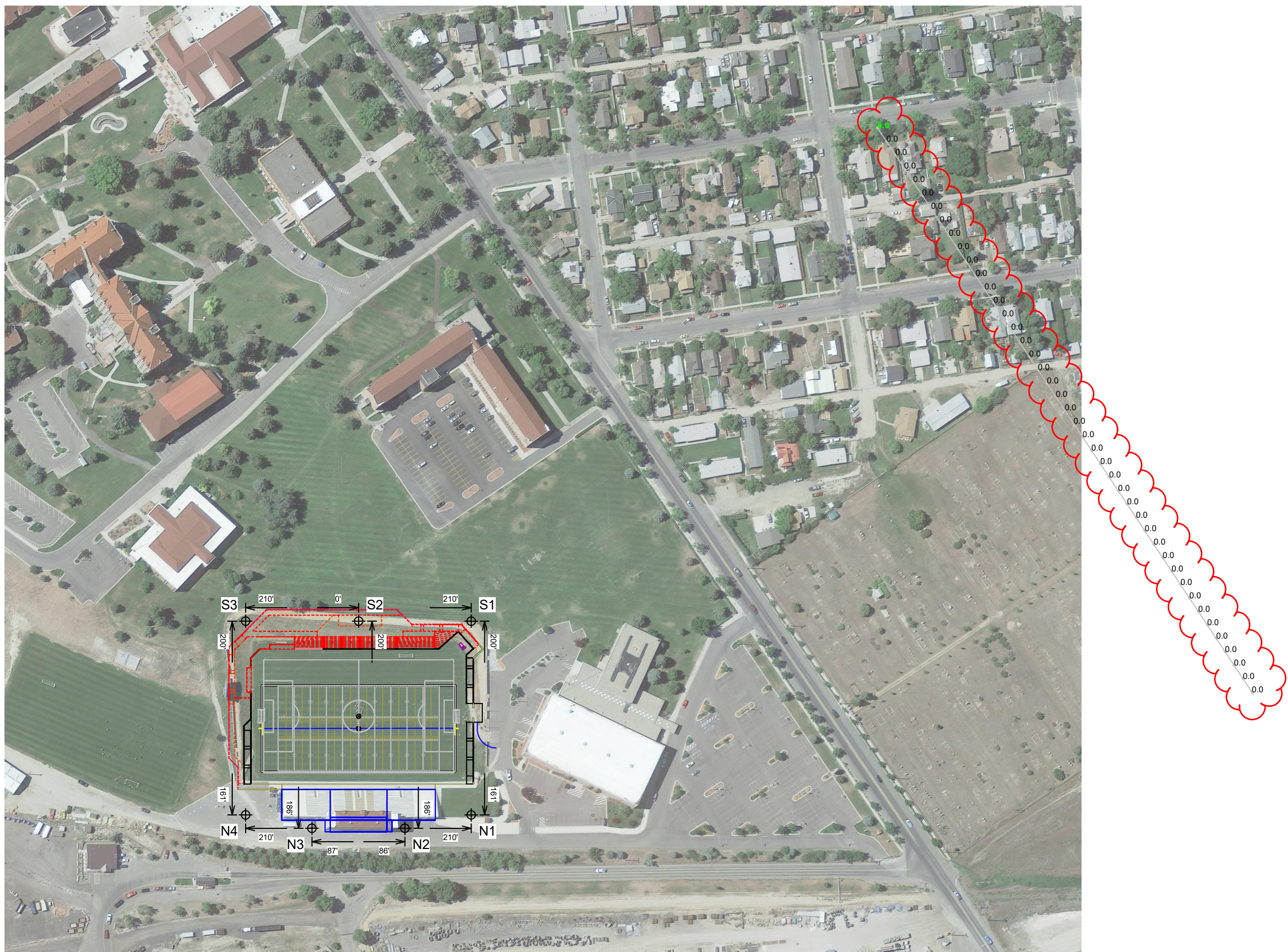
| Illumination Summary | |
|-------------------------------------|----------|
| MAINTAINED MAX VERTICAL FOOTCANDLES | |
| Entire Grid | |
| Scan Average | 0.0 |
| Maximum | 0 |
| Minimum | 0 |
| Avg/Min | - |
| Max/Min | - |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 43 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

| Grid Summary | |
|--------------|------------------|
| Name | Spill Line 3 |
| Size | 360' x 160' |
| Spacing | 30.0' x 10.0' |
| Height | 3.0' above grade |

| Illumination Summary | |
|-----------------------|----------------------------|
| | Max Candela (by lightbank) |
| | Entire Grid |
| Scan Average | 25815.5 |
| Maximum | 102552 |
| Minimum | 6 |
| Avg/Min | 4633.51 |
| Max/Min | 18406.53 |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 43 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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SCALE IN FEET 1 : 200
 0' 200' 400'
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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

| Grid Summary | |
|--------------|------------------|
| Name | Spill Line 3 |
| Size | 360' x 160' |
| Spacing | 30.0' x 10.0' |
| Height | 3.0' above grade |

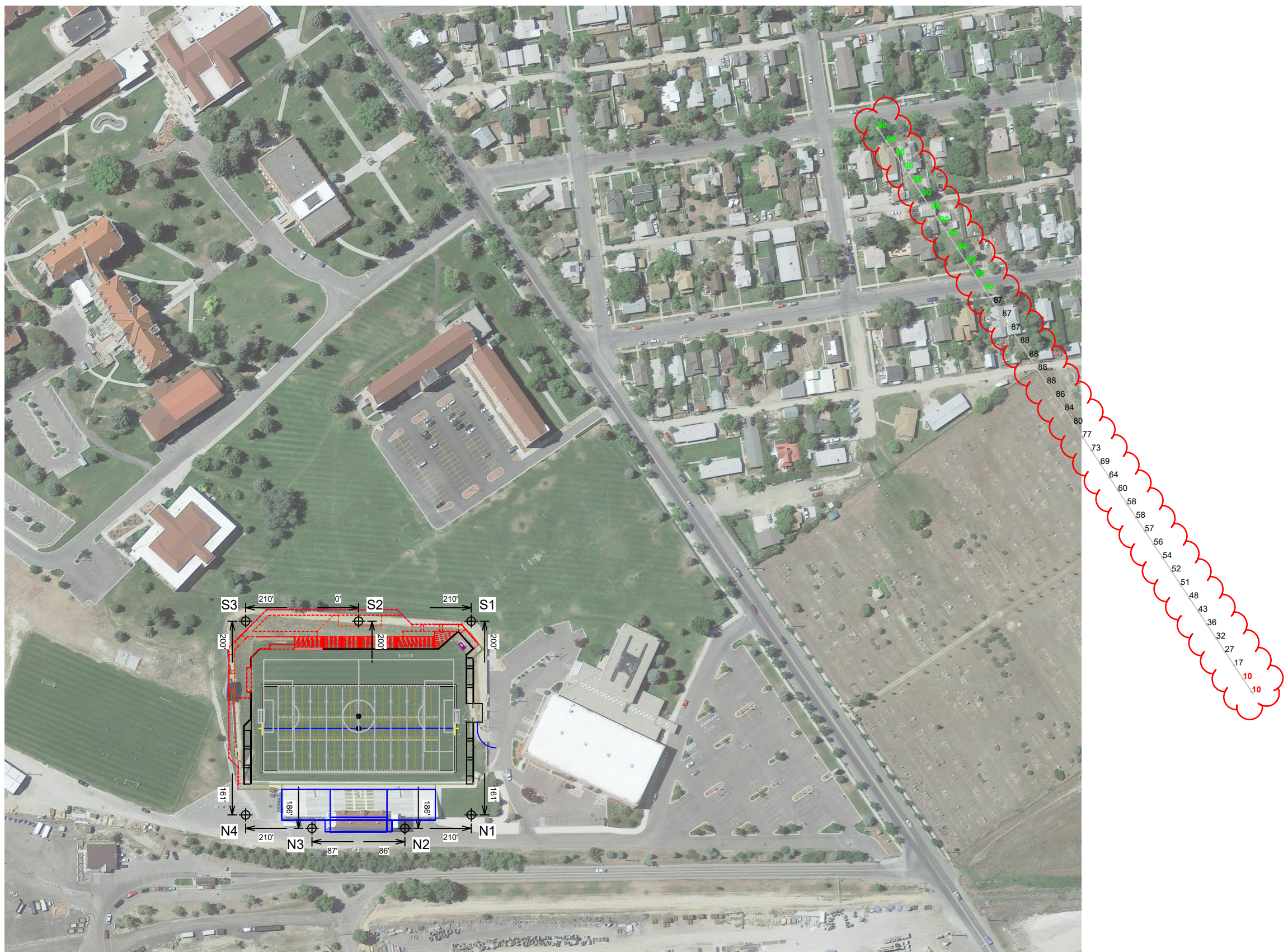
| Illumination Summary | |
|--------------------------------------|----------|
| MAINTAINED GLARE RATING: Max Reading | |
| Entire Grid | |
| Scan Average | 69.5 |
| Maximum | 90 |
| Minimum | 10 |
| Avg/Min | 6.95 |
| Max/Min | 9.00 |
| UG (adjacent pts) | 0.00 |
| CU | 0.00 |
| No. of Points | 43 |
| LUMINAIRE INFORMATION | |
| Applied Circuits | A,B |
| No. of Luminaires | 70 |
| Total Load | 98.70 kW |

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SCALE IN FEET 1 : 200
 0' 200' 400'
 ENGINEERED DESIGN By: A.Boersma • File #151917D-PROD-100'-R1 • 10-Jan-24

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ILLUMINATION SUMMARY

Carrol College Nelson Stadium

Helena, MT

Equipment Layout

INCLUDES:

- Football
- Soccer

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

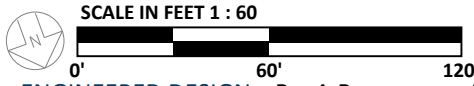
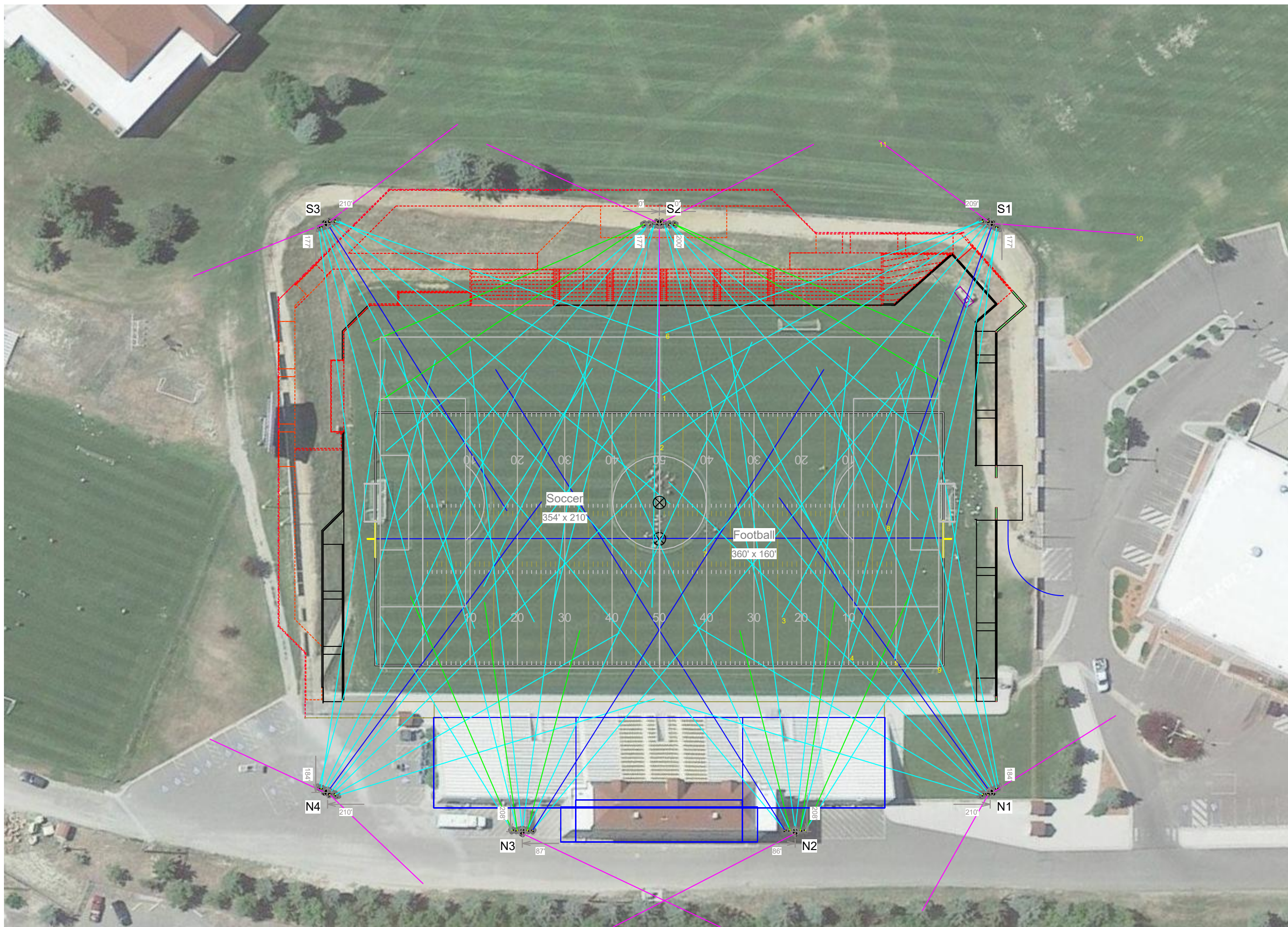
Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

Equipment List For Areas Shown

| QTY | Pole | | | Luminaires | | |
|-----|----------|------|-----------------|-------------------|----------------|----------|
| | LOCATION | SIZE | GRADE ELEVATION | ABOVE GRADE LEVEL | LUMINAIRE TYPE | QTY/POLE |
| 1 | N1 | 100' | 2' | 101.7' | TLC-LED-1500 | 9 |
| | | | | 56.7' | TLC-LED-600 | 2 |
| 2 | N2-N3 | 100' | 2' | 101.7' | TLC-LED-1500 | 10 |
| | | | | 56.7' | TLC-LED-600 | 1 |
| 1 | N4 | 100' | 4' | 104.2' | TLC-LED-1500 | 9 |
| | | | | 59.2' | TLC-LED-600 | 2 |
| 1 | S1 | 100' | 10' | 109.7' | TLC-LED-1500 | 9 |
| | | | | 64.7' | TLC-LED-600 | 2 |
| 1 | S2 | 60' | 16' | 76.5' | TLC-LED-1500 | 14 |
| | | | | 71.5' | TLC-LED-600 | 2 |
| 1 | S3 | 100' | 17' | 116.7' | TLC-LED-1500 | 9 |
| | | | | 71.7' | TLC-LED-600 | 2 |
| 7 | Totals | | | | | 82 |

Single Luminaire Amperage Draw Chart

| Driver Specifications (.90 min power factor) | Line Amperage Per Luminaire (max draw) | | | | | | |
|---|---|-------------|-------------|-------------|-------------|-------------|-------------|
| | 208 (60) | 220 (60) | 240 (60) | 277 (60) | 347 (60) | 380 (60) | 480 (60) |
| Single Phase Voltage | 8.4 | 7.9 | 7.3 | 6.3 | 5.0 | 4.6 | 3.6 |
| TLC-LED-1500 | 8.4 | 7.9 | 7.3 | 6.3 | 5.0 | 4.6 | 3.6 |
| TLC-LED-600 | 3.4 | 3.2 | 3.0 | 2.6 | 2.0 | 1.9 | 1.5 |



ENGINEERED DESIGN By: A.Boersma • File #151917D-PROD-100'-R1 • 10-Jan-24

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗



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EQUIPMENT LAYOUT