Michael Baker INTERNATIONAL

We Make a Difference

MEMO

To: Amie Ashton, David J. Powers & Associates, Inc.

From: Neil Hinckley, Michael Baker International

Date: June 25, 2018

Re: Shamrock Seed Project – Lighting Technical Memorandum

David J. Powers & Associates, Inc., on behalf of Santa Clara County, contracted Michael Baker International (Michael Baker) to prepare an environmental impact lighting study of the Shamrock Seed Project as required by the County of Santa Clara and the California Environmental Quality Act (CEQA). Michael Baker evaluated the environmental impact of the illumination from the proposed lighting to be installed as part of the project. We used AGi32 lighting analysis software to evaluate the effects of glare and trespass lighting across property lines. For this project, we developed a custom software solution based on the model presented by Garstang (1986) to calculate sky glow. We also visited the site on April 5, 2018, to measure the illumination levels from the existing greenhouses.

ENVIRONMENTAL IMPACTS

The proposed project being evaluated includes construction of two new greenhouse structures (measuring approximately 100 feet by 130 feet and 85 feet by 300 feet). These two greenhouses would be up to 22 feet tall, and composed of a translucent material to allow sunlight to enter during daylight hours. The greenhouses would be internally illuminated at night to provide a total of 16 hours of both natural and artificial lighting for the plants inside. The 16 hours of lighting would be continuous by supplementing natural day light with the artificial lighting in the morning or evening hours; hence, the duration of artificial lighting would vary depending upon the time of year.

The relevant significance criteria from Appendix G of the CEQA Guidelines for evaluating the potential lighting impacts of this project are as follows:

> *Would the project create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?*

This report evaluates three aspects of this impact:

- **Light Trespass.** Light trespass occurs when spill light is cast past the property line.
- **Glare.** Glare is described as difficulty seeing in the presence of bright light. It is a visual sensation caused by excessive and uncontrolled brightness.
- **Light Pollution (Uplight and Sky Glow).** The International Dark Sky Association describes this type as “brightening of the night sky caused by streetlights and other man-

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> made sources, which has a disruptive effect on natural cycles and inhibits the observation of stars and planets."

The amount of uplight and glare from each fixture can be limited by locating the lamp/light source deep enough inside the body of the fixture that the lamp cannot be seen unless a person is standing directly underneath it. Light trespass is limited by using low lumen output fixtures that are low to the ground or fixtures which control the amount of light that extends beyond the property line. Sky glow is proportional to the total intensity of the lighting on the site, the total reflectivity of the ground (or the area under the lights), and the amount of light directed above the horizon. Sky glow can be limited by lowering the intensity of lights, eliminating light that is directed above the horizon, and covering illuminated areas.

POLICIES

Santa Clara County does not currently have any specific policies, ordinances, or codes with regard to lighting that would apply to this situation; however other counties in California do have some applicable codes that can be looked to as examples. The strictest example is Humboldt County Ordinance No. 2559, "Ordinance Making Clarifying and Corrective Amendments to Title III of the Humboldt County Code Relating to the Commercial Cultivation, Processing, Manufacturing and Distribution of Cannabis for Medical Use." While this ordinance is specific to cannabis cultivation, it includes language that could be applied to greenhouses in general, specifically 55.4.11(v), which states:

> Those cultivators using artificial lighting for mixed-light cultivation shall shield greenhouses so that little to no light escapes. Light shall not escape at a level that is visible from neighboring properties between sunset and sunrise.

The term "mixed-light" is defined as follows:

> "Mixed-Light" means cultivation using a combination of natural and supplemental artificial lighting at a maximum threshold as set forth in performance standards in Section 55.4.11(v), et seq. of this ordinance, or as to be determined by the Department of Food and Agriculture, whichever is less.

EXISTING LIGHTING

On April 5, 2018, Michael Baker documented and evaluated the existing lighting on the site using a light meter at least one hour after sunset. The existing on-site lighting emanated from two existing greenhouses illuminated with high pressure sodium and compact fluorescent lights.

Greenhouse 1 is about 3,000 square feet and currently has twelve 400-watt high pressure sodium lights mounted at approximately 9 feet above the ground, for a total of 4,800 watts and about 1.6 watts per square foot.

Greenhouse 2 is about 2,000 square feet and currently has approximately nine 32-watt compact fluorescent lights mounted at 9 feet above the ground, for a total of 288 watts and about 0.14 watts per square foot.

The total existing lighting is about 5,088 watts and 507,000 lumens.

The complete collection of existing lighting conditions can be found in *Appendix 1: Existing Light Measurements*. A photometric analysis can be found in *Appendix 2: Existing Site Photometrics*. We compare the existing and proposed lighting conditions below.

PROPOSED GREENHOUSES

The proposed greenhouses will be approximately 13,000 and 25,000 square feet, covering a total of approximately 38,000 square feet, or 7.6 times more area than the existing illuminated greenhouses.

The smaller proposed greenhouse will have 120 400-watt high pressure sodium lights mounted at approximately 9.5 feet, for a total of 48,000 watts and about 3.7 watts per square foot.

The larger proposed greenhouse will have 243 400-watt high pressure sodium lights mounted at approximately 9.5 feet, for a total of 97,200 watts and about 3.9 watts per square foot.

The proposed lighting is about 145,200 watts of high pressure sodium lighting, or about 28.5 times the existing lighting wattage, and about 14.5×10^6 lumens, or about 28.5 times the existing light output.

The complete photometric analysis of the proposed greenhouses can be found in *Appendix 3: Proposed Site Photometrics.*

TRESPASS

Light trespass occurs when spill light is cast past the property line. We used AGi32 to evaluate the amount of light from the existing greenhouses and from the proposed project that would fall on areas beyond the project's property line. Standards for light trespass vary, but typically should not be over 0.1 foot-candle (fc) 10 to 20 feet past the property line.[1] Light trespass is categorized as horizontal trespass and vertical illuminance.

The existing greenhouse lighting does not have any significant (>0.05 fc) horizontal trespass lighting. The full horizontal trespass can be found on page 7 of Appendix 2.

For the proposed project, as shown on pages 15-17 of Appendix 3, there would be some horizontal light trespass onto adjacent properties. The most significant area of trespass would be on the northwest side of the property near the larger of the two proposed greenhouses. The maximum light trespass value would be 0.3 fc right at the edge of the property, which quickly falls off to 0.1 fc within 10 feet of the property line. The full horizontal trespass calculation can be found on pages 15–17 of Appendix 3. Obtrusive light, or light that falls on a vertical plane at the property line, was measured by vertical illuminance at the northwest property line, where the proposed greenhouses would be closest to the property line. The applicable standard for obtrusive light is IDA/IES MLO-2011, which establishes a limit for a rural setting of about 0.1 fc at the property line.

The existing greenhouse lighting had a maximum vertical illuminance at the northwest property edge of 0.2 fc at the limit of the calculation grid 30 feet in the air. The average value was 0.02 fc

[1] A foot-candle is a unit of illumination equal to that given by a source of one candela at a distance of 1 foot (equivalent to one lumen per square foot or 10.764 lux).

over the entire northwest edge of the site. The full vertical illuminance calculation can be found on pages 3–6 of Appendix 2.

The vertical illuminance for the proposed project was measured using a grid that extended from the ground to 30 feet in the air (just over the height of the proposed greenhouses), with calculation points spaced 5 feet apart. The maximum calculated value of vertical illuminance would be 7.9 fc. The average for the entire northwest edge of the site would be 2.7 fc. The maximum value from the proposed project is 79 times higher than the limit set in IDA/IES MLO-2011, while the average is 27 times higher. The full vertical illuminance calculation can be found on pages 10–14 of Appendix 3.

GLARE

Glare is described as difficulty seeing in the presence of bright light. It is a visual sensation caused by excessive and uncontrolled brightness. Its effect can be disabling or simply uncomfortable. Glare is subjective, and sensitivity to glare can vary widely depending on the individual. Older people are usually more sensitive to glare due to the aging characteristics of the eye. Disability glare is the reduction in visibility caused by intense light sources in the field of view. This is the glare on a glossy magazine that makes it hard to read outside in bright sunlight.

The Glare Rating (GR) is a numerical evaluation of the amount of glare experienced by an observer. Veiling Luminance is the light reflected off a surface that obscures an object, making it difficult to see. It is used by AGi to calculate the Glare Rating, as shown below. GR runs from 10, which is unnoticeable, to 90, which is unbearable, actually causing pain. The level of GR that is acceptable depends on the application and task being performed. If a person is doing fine work, repairing a watch for example, the maximum desired GR is 45. If a ditch is being dug, a GR of 55 is acceptable. For the purposes of this report, the effect on the low light nature of the area is the primary concern, and the maximum acceptable GR is 20, which amounts to “barely noticeable.”[2] Each GR value is tied to one observer position.

The observer positions for this study are shown in the attached lighting summary and are labeled sequentially as Obs #1, Obs #2, etc. For example, a grid labeled Obs #1 has one observer position and would have a Glare Rating grid associated with it. AGi32 was used to evaluate the glare at seven points around the perimeter of the property as shown on page 2 of Appendix 3, with the locations chosen to reflect typical viewpoints of the property.

Evaluation Point	Glare Rating		
	Avg.	Max.	Min.
Glare Evaluation Point # 1	10.00	10	10
Glare Evaluation Point # 2	10.00	10	10
Glare Evaluation Point # 3	10.00	10	10
Glare Evaluation Point # 4	10.00	10	10
Glare Evaluation Point # 5	10.00	10	10

[2] Lighting Analysts, Inc., “Calculations Glare Rating Concepts” https://docs.agi32.com/AGi32/Content/adding_calculation_points/Calculations_Glare_Rating_Concepts.htm, 2018.

Glare Evaluation Point # 6	10.03	12	10
Glare Evaluation Point # 7	10.41	16	10

As summarized in the table and shown on pages 3–9 of Appendix 3, the glare from the proposed project would be barely discernable at its worst case and unnoticeable on average.

A glare evaluation was not done for the existing lighting as its results would be insignificant.

LIGHT POLLUTION (SKY GLOW)

Light pollution is defined by the International Dark Sky Association, and their definition is accepted by the Illuminating Engineering Society of North America, as "brightening of the night sky caused by streetlights and other man-made sources, which has a disruptive effect on natural cycles and inhibits the observation of stars and planets."

All of the fixtures evaluated for this report had no uplight, as they are full cutoff fixtures. Full cutoff is defined as a fixture having zero light emitted at or above horizontal. For a typical lighting application, this would be sufficient to ensure dark sky compliance. However, in this case, the downward-facing light is much more intense than typical and so requires a more detailed look.

Initial lighting calculations for light reflected upward were done in AGi32, using equivalent lights for the greenhouse lighting because the photometric files for specified lights were not available. The lights selected as equivalents are Lithonia KAD 400S, which are also 400W high pressure sodium lights with a wide distribution. Because AGi32 doesn't have the ability to calculate sky glow, a calculation grid was placed at cloud level (6,000 feet), facing down, and used to calculate what the illuminance on the clouds would be. The maximum illuminance value at cloud level was approximately 0.03 fc. For reference, the illuminance on the ground during a full moon is approximately 0.01 fc, or one-third the illumination that the greenhouses are putting on clouds at a height of 6,000 feet. The illumination at this altitude is >0.01 fc to a radius of approximately 1 mile from the center of the site. This analysis shows that the amount of reflected light from the greenhouses is substantial, but does not provide enough data to conclude whether the new lighting would negatively affect sky brightness.

A grid was also placed at the same height above the simulation of the existing lighting, but no measurable (>0.001 fc) cloud level illumination was present.

Following this initial analysis, a more detailed analysis was done using the model described by Garstang.[3] His model was used to create a computer program that can calculate how a light source affects the brightness of the sky, and the values for the greenhouses were used to calculate a set of values for the sky for an observer on the edge of the property, as well as 5 km away. All calculations were done for zenith distances of 0–80 degrees, and for 30 degrees to the side of the center of the site. The calculations to the side of the site are symmetrical, so only one side was calculated. The results have the brightness listed in nanolamberts (nL), and the factor of the natural sky brightness (factor) has been included for the maximum and minimum values as shown below. These and other units used for measuring the brightness of the sky are shown in Figure 1. The natural sky has a brightness of approximately 59.2 nL.

[3] Garstang, R. H., "Model for Artificial Night-Sky Illumination," 1986.

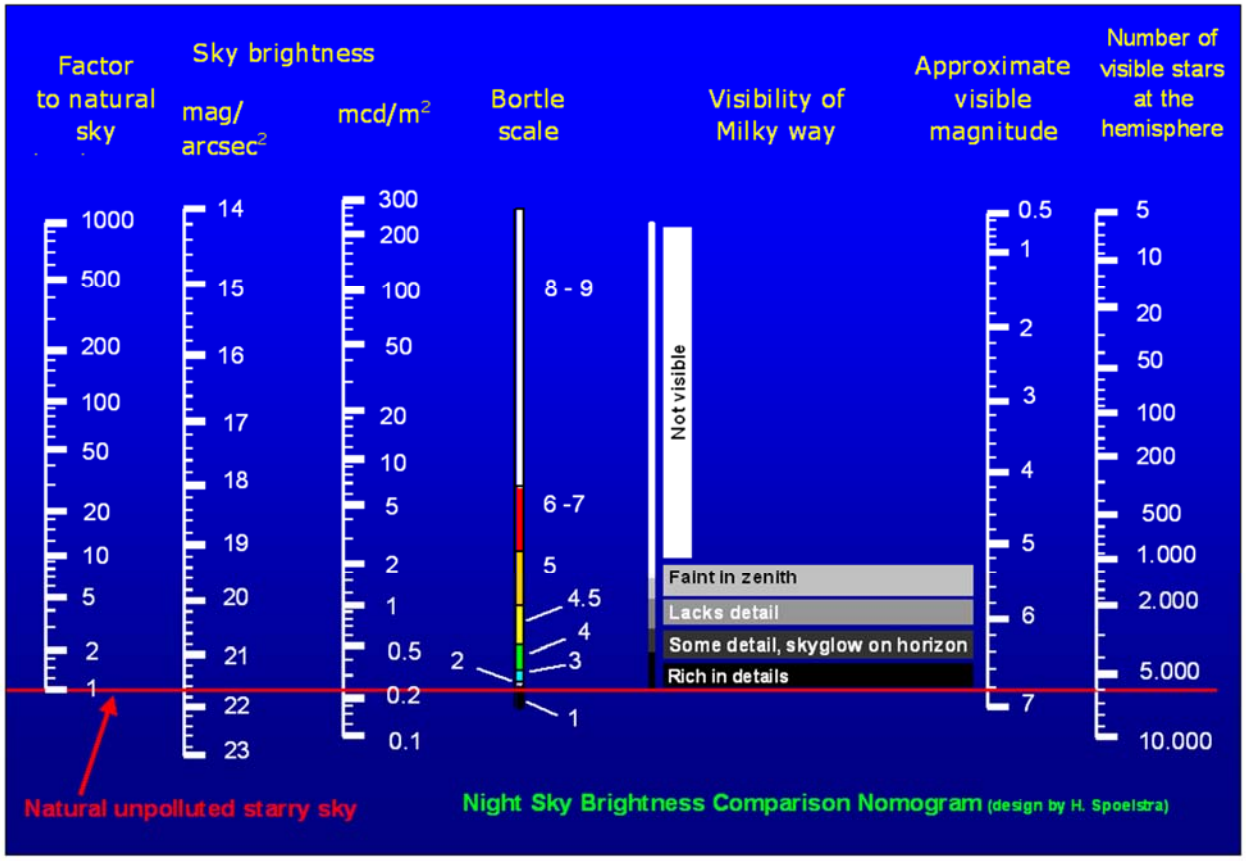


Figure 1: Night Sky Brightness Comparison Nomogram from www.darkskiesawareness.org

To calculate the sky glow caused by the greenhouse, a total lumen output of about 14.5 mega lumens (Ml) was calculated (40,000 lumens per fixture, 363 fixtures). This value was reduced to 80%, or 11.6 Ml, to account for losses through the glass. An additional light loss factor for the age and condition of the bulbs was not used since the environmental impact should account for the worst case. A ground reflectivity of 0.15 was used, which is the typical value used by Garstang. The site diameter was set to 400 meters, and an aerosol density of around 4/cm^3 (which is about an Air Quality Index of 150) was used as a worst-case scenario.

The International Astronomical Union (IAU) has suggested that man-made light not increase the brightness of the night sky by more than 10% (or a factor of 0.1) at a zenith distance of 45 degrees for a location to be considered a dark site.[4] This area is not a dark site, and so a higher value might be considered. However, it is also only one property, so a value of over 10% would seem to be an excessive allowance. Based on these arguments, it was decided that a value of 10% would be used as an acceptable cutoff. The detailed results are found in *Appendix 4: Compiled Sky Brightness*, which also contains a complete list of the settings used for each of the calculations.

[4] Smith, F. G., “Report and Recommendations of IAU Commission 50,” 1979.

Sky Brightness Due to Proposed Greenhouses

	Maximum @ 45° zenith distance (nL)	Maximum @ 45° zenith distance (factor)	Maximum @ zenith (nL)	Maximum @ zenith (factor)
Edge of Property	1.52	0.026	0.473	0.008
5 km from Property	0.058	0.001	0.013	2.2×10^{-4}

As can be seen, our simulation shows that the sky brightness due to the proposed greenhouses would be well below the 10% (0.1 factor) recommendation both at the property edge and at a distance of 5 km. The complete sky brightness results can be found on pages 6–7 of Appendix 4.

Sky Brightness Due to Existing Greenhouses

	Maximum @ 45° zenith distance (nL)	Maximum @ 45° zenith distance (factor)	Maximum @ zenith (nL)	Maximum @ zenith (factor)
Edge of Property	0.152	0.0026	0.016	2.7×10^{-4}
5 km from Property	0.041	6.9×10^{-4}	4.7×10^{-4}	7.9×10^{-6}

The proposed lighting would increase the current sky glow caused by the greenhouses and seen from the edge of the property by about 10 times at a 45 degree zenith distance and by about 30 times at zenith. From a distance of 5 km, the increase is only 1.4 times at a 45 degree zenith distance and about 28 times at zenith. The complete sky brightness results can be found on pages 4–5 of Appendix 4.

We also ran simulations to determine the approximate sky brightness in the site vicinity due to nearby cities to evaluate the effect of the additional light from the proposed greenhouses. Detailed results can be found on pages 1–3 of Appendix 4.

Sky Brightness Due to Adjacent Cities

	Maximum @ 45° zenith distance (nL)	Maximum @ 45° distance source (factor)	Maximum at zenith (nL)	Maximum at zenith (factor)
San Jose	50.6	0.85	13.55	0.23
Salinas	4.47	0.075	1.08	0.018
Gilroy	23.8	0.40	6.20	0.10

The sky glow of nearby cities is significantly brighter than the sky glow that will be caused by the new greenhouses. If the observer was near the greenhouse and facing San Jose, the sky glow from San Jose at a 45 degree zenith distance would be 33 times brighter than that from the proposed greenhouses, while the brightness at zenith from these three cities combined would be 44 times brighter than the sky glow at zenith from the proposed greenhouses.

Existing vs Proposed Sky Brightness

The total existing sky brightness can be calculated by adding the sky brightness caused by each source at zenith together. Below is a comparison of the current sky brightness with the brightness change caused by the proposed greenhouses.

	Existing @ zenith (factor)	Proposed @ zenith (factor)	% Change
Edge of Property	0.348	0.356	2.2%
5 km from Property	0.348	0.348	0%

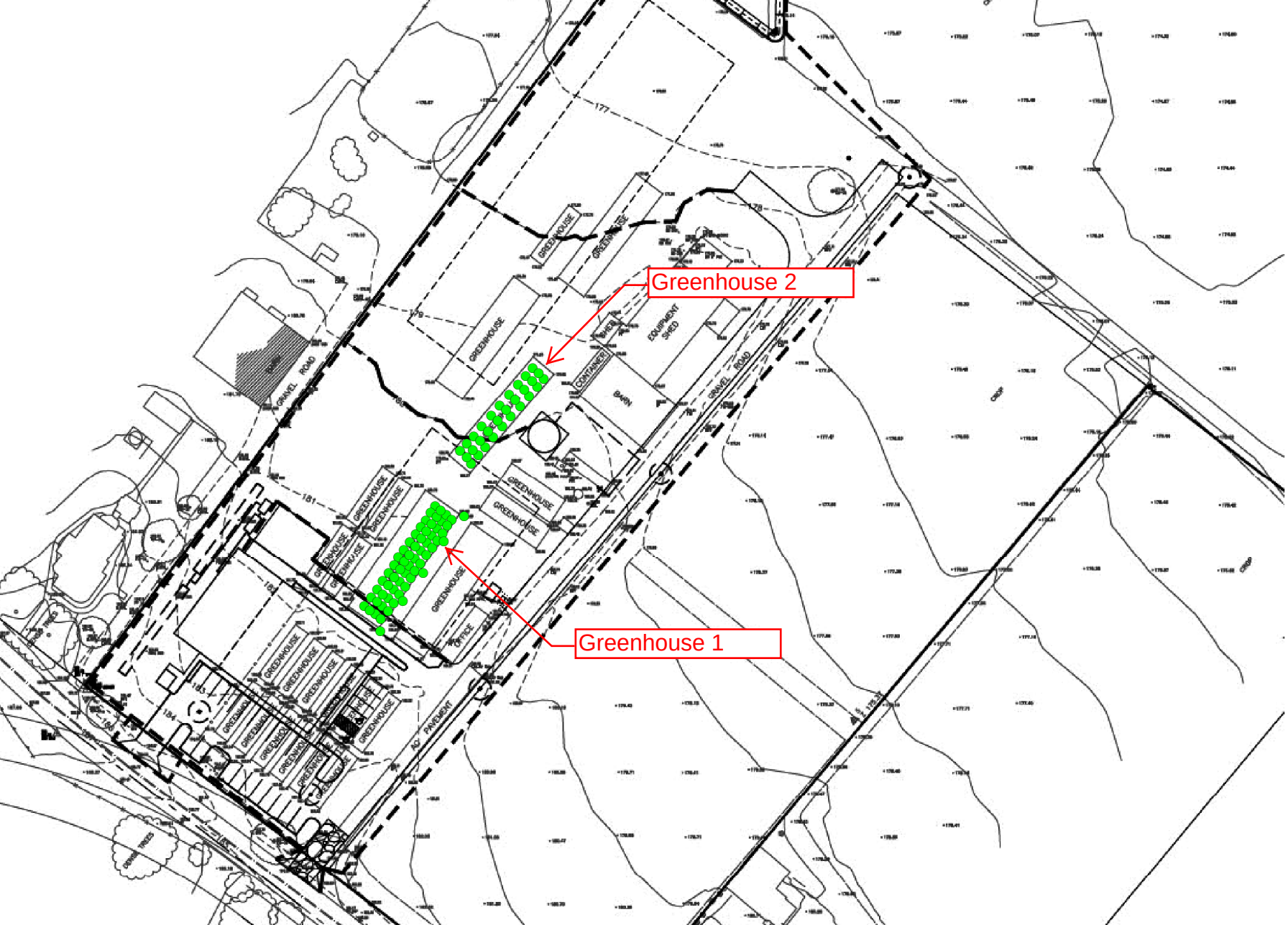
The difference threshold for light, or how much of a difference in brightness is noticeable by humans, is about 8%. The increase in night sky brightness caused by the proposed greenhouses is only about 2% at zenith, and would not be noticeable.

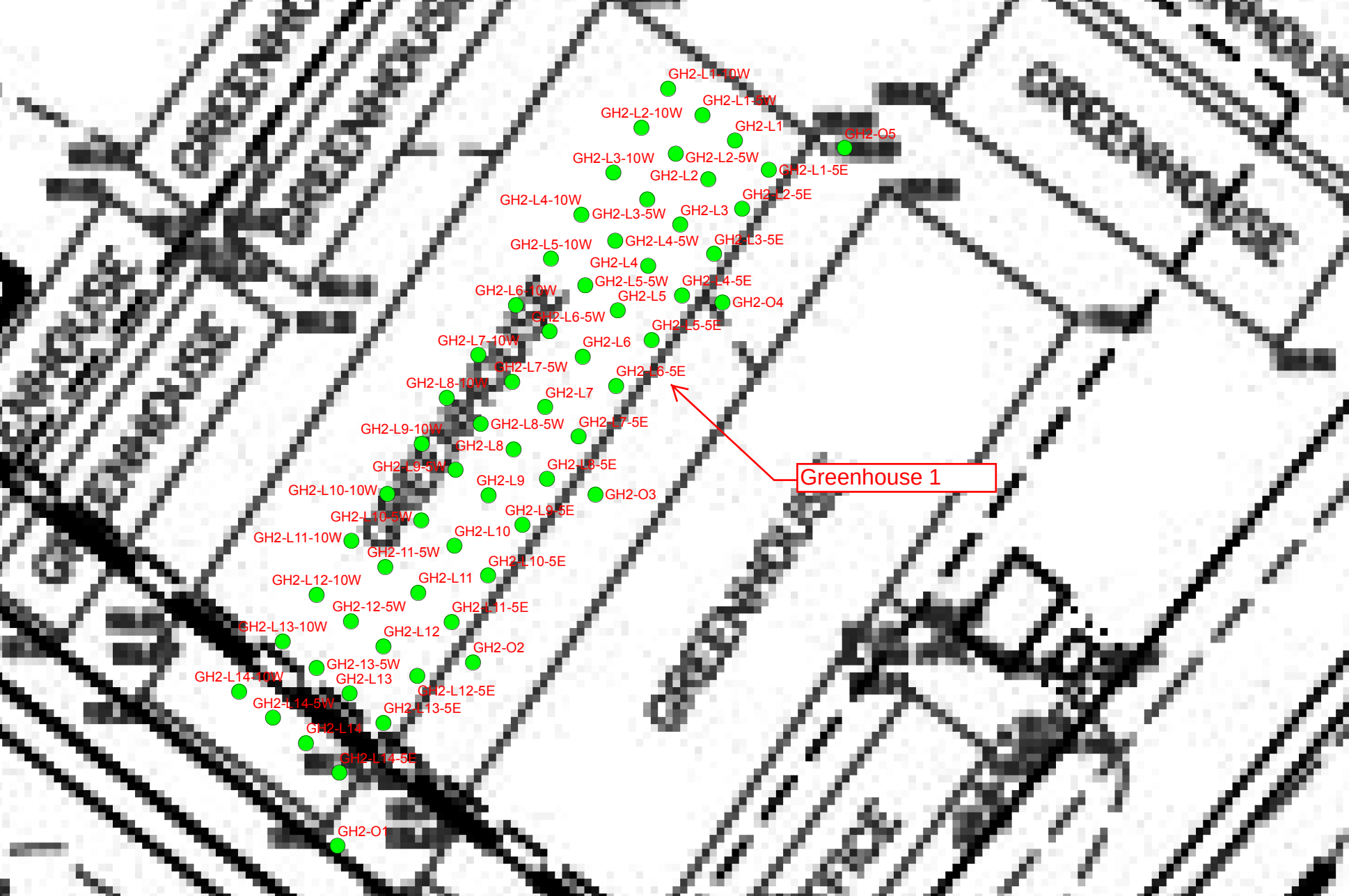
CONCLUSION

The proposed greenhouses will cause minimal glare, trespass, and sky glow, all close to or well within any established standard. However, they will have a significant impact on vertical illuminance that requires mitigation. The projected vertical illuminance at the northwest property line would be very high; at approximately 79 times the maximum allowed by IDA/IES MLO-2011.

Our recommendation is that the County require the applicant to install a solid barrier on the northwest side of the proposed greenhouses to reduce the vertical illuminance at the northwest property line to levels below those specified in IDA/IES MLO-2011. The barrier is required to have an opacity of at least 80% and be at least as tall as the greenhouses. The most appropriate solution is a shade or other similar barrier that is attached or placed adjacent to the greenhouses.

Appendix 1


Greenhouse 2
Greenhouse 1
GREENHOUSE
EQUIPMENT SHED
BARN
CONTAINER
GRAVEL ROAD
OFFICE
40' PAVEMENT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GH2-O5
GH2-L3-10W
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GH2-L1-5E
GH2-L2
GH2-L4-10W
GH2-L2-5E
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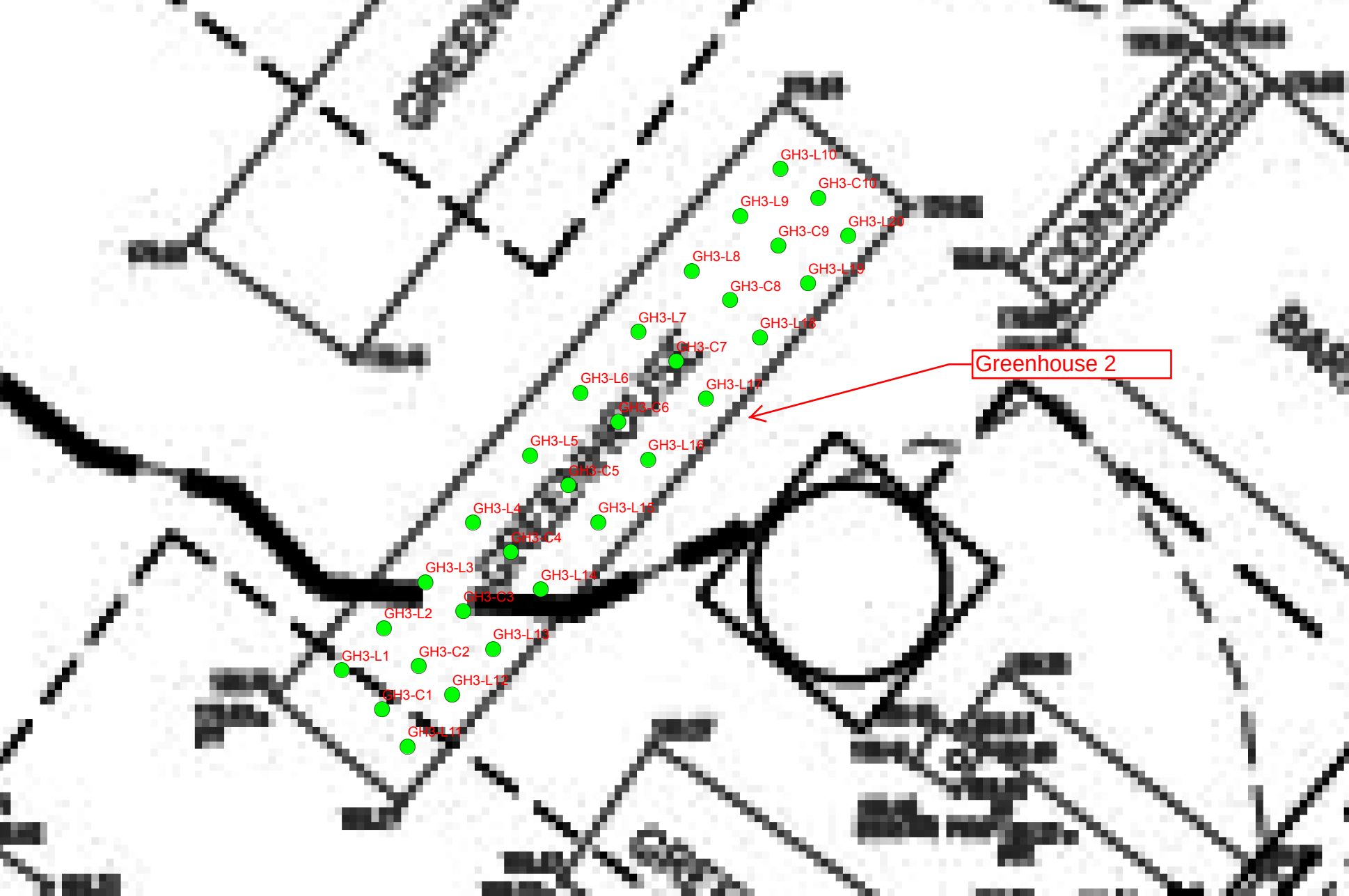
GH2-O1
Greenhouse 1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GH3-L20
GH3-L8
GH3-L19
GH3-C8
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GH3-L18
GH3-C7
Greenhouse 2
GH3-L6
GH3-L17
GH3-C6
GH3-L5
GH3-L16
GH3-C5
GH3-L4
GH3-L15
GH3-C4
GH3-L3
GH3-L14
GH3-C3
GH3-L2
GH3-L13
GH3-L1
GH3-C2
GH3-L12
GH3-C1
GH3-L11

Greenhouse 1 = ID Key GH2 and Greenhouse 2 = ID Key GH3

Recorded Location	ID Key	Place	Date	Time	Value	Unit
P1	GH2-O1	P1	4/5/2018	7:54:11 PM	48	Ft cd
P2	GH2-O2	P2	4/5/2018	7:55:05 PM	77.4	Ft cd
P3	GH2-O3	P3	4/5/2018	7:55:40 PM	77.6	Ft cd
P4	GH2-O4	P4	4/5/2018	7:56:50 PM	65.9	Ft cd
P5	GH2-O5	P5	4/5/2018	7:57:25 PM	54.4	Ft cd
P1	GH2-L1	P1	4/5/2018	8:02:41 PM	138.6	Ft cd
P2	GH2-L2	P2	4/5/2018	8:03:15 PM	220.4	Ft cd
P3	GH2-L3	P3	4/5/2018	8:04:01 PM	219.4	Ft cd
P4	GH2-L4	P4	4/5/2018	8:05:12 PM	221.3	Ft cd
P5	GH2-L5	P5	4/5/2018	8:06:12 PM	224.1	Ft cd
P6	GH2-L6	P6	4/5/2018	8:07:15 PM	222.2	Ft cd
P7	GH2-L7	P7	4/5/2018	8:08:21 PM	232.5	Ft cd
P8	GH2-L8	P8	4/5/2018	8:09:18 PM	236.2	Ft cd
P9	GH2-L9	P9	4/5/2018	8:10:17 PM	230.6	Ft cd
P10	GH2-L10	P10	4/5/2018	8:11:09 PM	243.6	Ft cd
P11	GH2-L11	P11	4/5/2018	8:12:20 PM	237.1	Ft cd
P12	GH2-L12	P12	4/5/2018	8:13:10 PM	219.9	Ft cd
P13	GH2-L13	P13	4/5/2018	8:14:11 PM	212	Ft cd
P14	GH2-L14	P14	4/5/2018	8:15:19 PM	154.8	Ft cd
5-L14	GH2-L14-5W	P1	4/5/2018	8:23:33 PM	142.2	Ft cd
5-L12	GH2-12-5W	P2	4/5/2018	8:24:30 PM	202.7	Ft cd
5-L10	GH2-L10-5W	P3	4/5/2018	8:25:49 PM	202.7	Ft cd
5-L8	GH2-L8-5W	P4	4/5/2018	8:26:36 PM	218.5	Ft cd
5-L6	GH2-L6-5W	P5	4/5/2018	8:27:46 PM	209.2	Ft cd
5-L4	GH2-L4-5W	P6	4/5/2018	8:28:55 PM	216.6	Ft cd
5-L2	GH2-L2-5W	P7	4/5/2018	8:29:57 PM	180.2	Ft cd
5-L1	GH2-L1-5W	P8	4/5/2018	8:30:51 PM	162.3	Ft cd
10-L1	GH2-L1-10W	P1	4/5/2018	8:31:56 PM	93.8	Ft cd
10-L2	GH2-L2-10W	P2	4/5/2018	8:32:54 PM	126.7	Ft cd
10-L4	GH2-L4-10W	P3	4/5/2018	8:34:02 PM	125.8	Ft cd
10-L6	GH2-L6-10W	P4	4/5/2018	8:34:43 PM	140.1	Ft cd
10-L8	GH2-L8-10W	P5	4/5/2018	8:36:16 PM	145.4	Ft cd
10-L10	GH2-L10-10W	P6	4/5/2018	8:37:20 PM	128.5	Ft cd
10-L12	GH2-L12-10W	P7	4/5/2018	8:38:39 PM	121.8	Ft cd
10-L14	GH2-L14-10W	P8	4/5/2018	8:39:54 PM	52.4	Ft cd
5-L14	GH2-L14-5E	P1	4/5/2018	8:43:16 PM	147.8	Ft cd
5-L12	GH2-L12-5E	P2	4/5/2018	8:44:18 PM	226.9	Ft cd
5-L10	GH2-L10-5E	P3	4/5/2018	8:45:09 PM	224.1	Ft cd
5-L8	GH2-L8-5E	P4	4/5/2018	8:46:52 PM	222.2	Ft cd
5-L6	GH2-L6-5E	P5	4/5/2018	8:48:33 PM	240.8	Ft cd
5-L4	GH2-L4-5E	P6	4/5/2018	8:49:50 PM	225.9	Ft cd
5-L2	GH2-L2-5E	P7	4/5/2018	8:50:57 PM	217.1	Ft cd
5-L1	GH2-L1-5E	P8	4/5/2018	8:52:14 PM	162.1	Ft cd

L1	GH3-L1	P1	4/5/2018	9:01:20 PM	6.9	Ft cd
L2	GH3-L2	P2	4/5/2018	9:03:10 PM	6.5	Ft cd
L3	GH3-L3	P3	4/5/2018	9:03:42 PM	5.3	Ft cd
L4	GH3-L4	P4	4/5/2018	9:04:12 PM	4.6	Ft cd
L5	GH3-L6	P5	4/5/2018	9:05:41 PM	2.1	Ft cd
L6	GH3-L8	P6	4/5/2018	9:06:21 PM	0.2	Ft cd
R10	GH3-L20	P1	4/5/2018	9:07:30 PM	0.1	Ft cd
R9	GH3-L19	P2	4/5/2018	9:08:01 PM	3.9	Ft cd
R8	GH3-L18	P3	4/5/2018	9:08:41 PM	2.5	Ft cd
R7	GH3-L17	P4	4/5/2018	9:09:23 PM	2.1	Ft cd
R6	GH3-L16	P5	4/5/2018	9:10:36 PM	2.1	Ft cd
R5	GH3-L15	P6	4/5/2018	9:14:13 PM	2.9	Ft cd
R4	GH3-L14	P7	4/5/2018	9:14:48 PM	3.7	Ft cd
R3	GH3-L13	P8	4/5/2018	9:15:17 PM	5.3	Ft cd
R2	GH3-L12	P9	4/5/2018	9:15:49 PM	6.2	Ft cd
R1	GH3-L11	P10	4/5/2018	9:18:15 PM	6.1	Ft cd
C2	GH3-C2	P1	4/5/2018	9:20:31 PM	6.5	Ft cd
C3	GH3-C3	P2	4/5/2018	9:21:09 PM	6.2	Ft cd
C4	GH3-C4	P3	4/5/2018	9:21:46 PM	3.9	Ft cd
C5	GH3-C5	P4	4/5/2018	9:22:11 PM	3.5	Ft cd
C6	GH3-C6	P5	4/5/2018	9:23:07 PM	2.3	Ft cd
C7	GH3-C7	P6	4/5/2018	9:23:49 PM	1.7	Ft cd
C8	GH3-C8	P7	4/5/2018	9:24:43 PM	2.3	Ft cd
C9	GH3-C9	P8	4/5/2018	9:25:40 PM	3	Ft cd
C10	GH3-C10	P9	4/5/2018	9:26:23 PM	0	Ft cd

Appendix 2

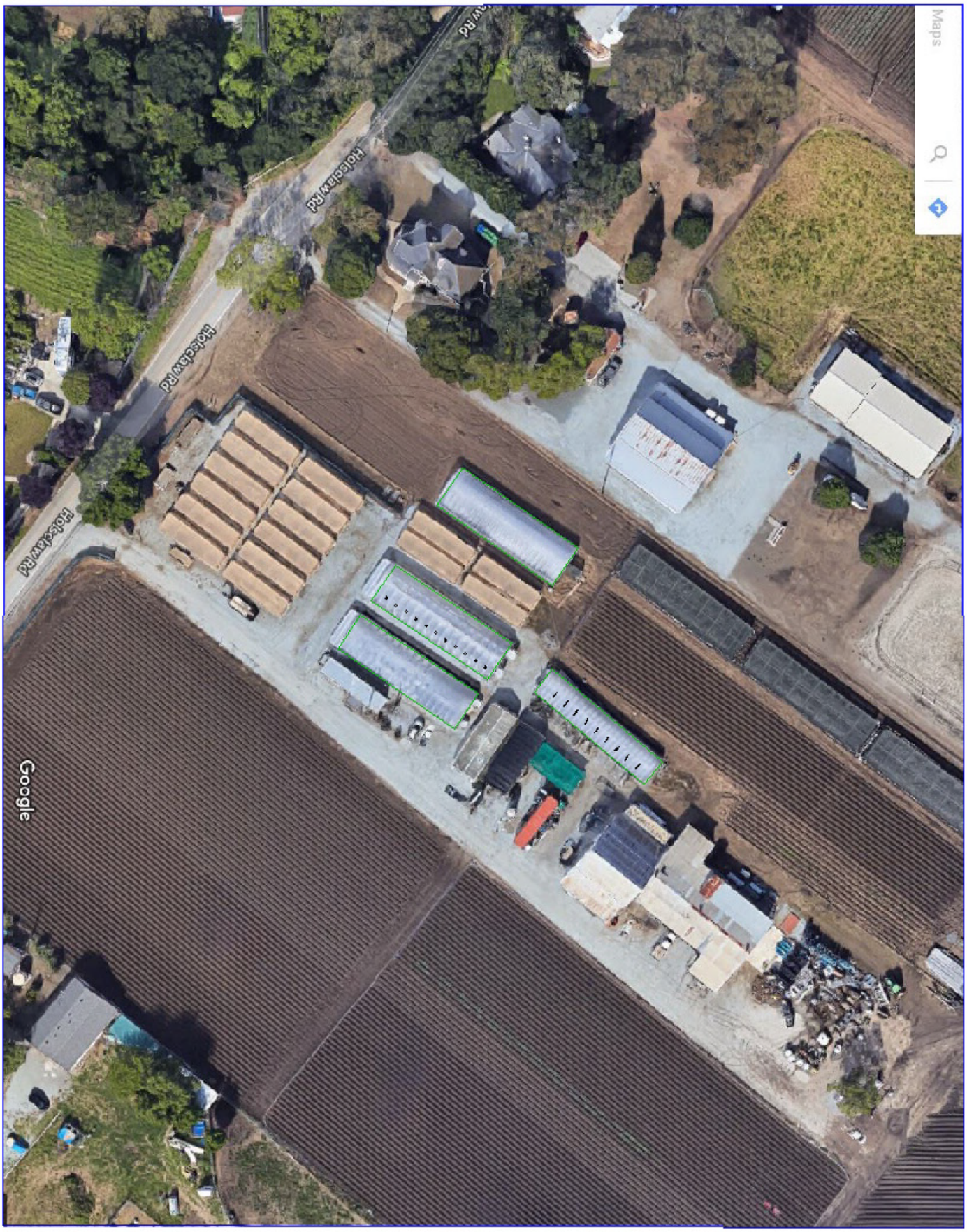
Page 1 of 8

Shamrock Seeds Greenhouse	
Cloud Level Illuminance	

Drawn By: Neil Hinckley	
Checked By: Lance Mackie	
Date:4/19/2018	
Scale: N/A	

Revisions	#	Date	Comments

Michael Baker INTERNATIONAL



Shamrock Seeds Greenhouse	
Existing Site	

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Revisions	#	Date	Comments

Michael Baker INTERNATIONAL

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.
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0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.

0.00

Michael Baker INTERNATIONAL

Revisions

#	Date	Comments

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Shamrock Seeds Greenhouse

Obtrusive Lighting Illuminance

0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
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0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Michael Baker INTERNATIONAL

#	Date	Comments

Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Shamrock Seeds Greenhouse

Obtrusive Lighting Illuminance

Michael Baker INTERNATIONAL

#	Date	Comments

Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Shamrock Seeds Greenhouse

Obtrusive Lighting Illuminance

0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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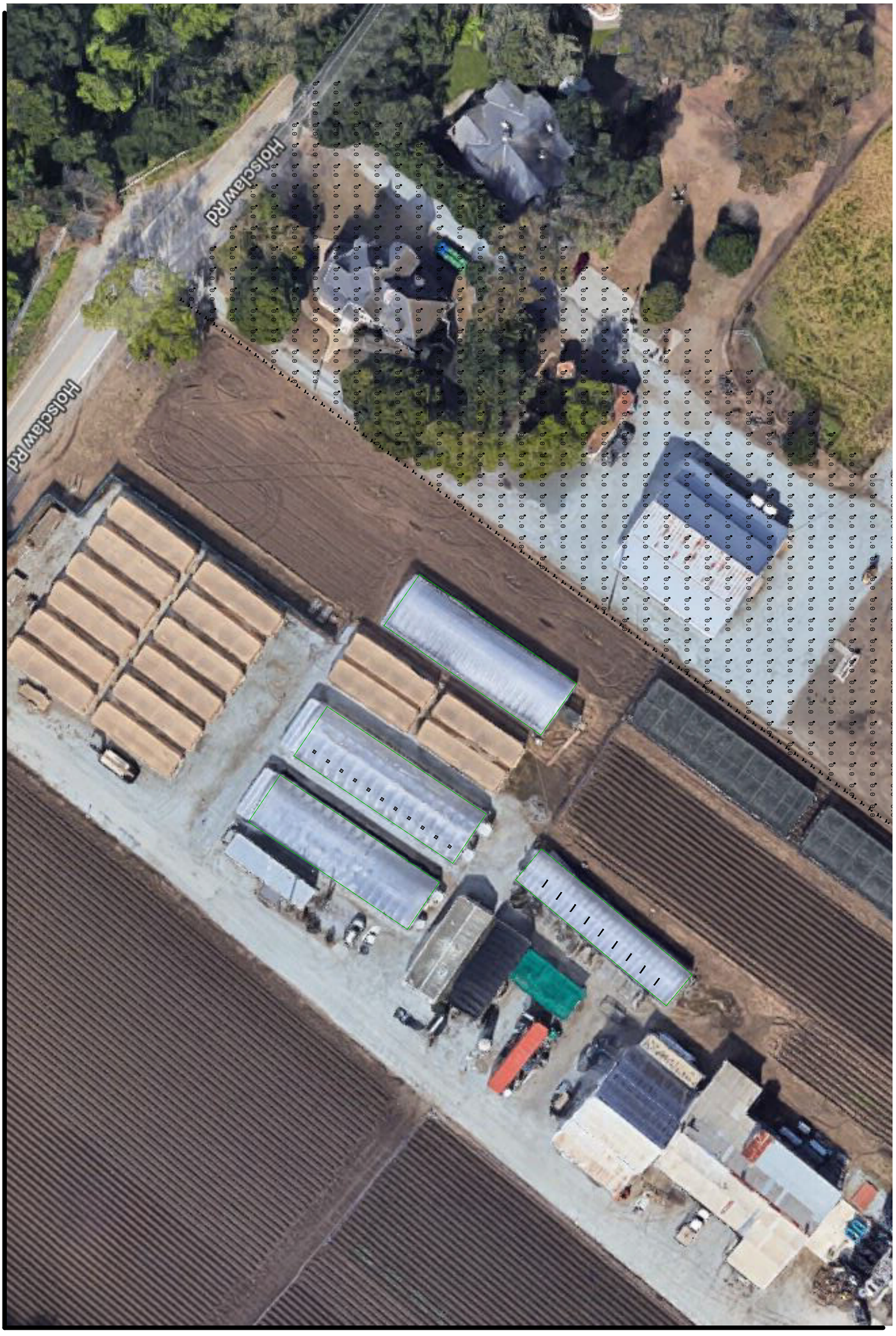
#	Date	Comments

Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Shamrock Seeds Greenhouse

Obtrusive Lighting Illuminance



Shamrock Seeds Greenhouse	
Lighting Trespass Illuminance	

Drawn By: Neil Hinckley	
Checked By: Lance Mackie	
Date:4/19/2018	
Scale: N/A	

Revisions	#	Date	Comments

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Luminaire Schedule						
Symbol	Qty	Label	Arrangement	Total Lamp Lumens	LLF	Description
	11	KAD_400S_R5S	SINGLE	50000	0.700	KAD 400S R5S
	9	C_1_32	SINGLE	3050	0.800	C 1 32

Calculation Summary							
Label	CalcType	Units	Avg	Max	Min	Avg/Min	Max/Min
Clouds	Illuminance	Fc	0.00	0.000	0.000	N.A.	N.A.
Existing Greenhouse_2_Floor	Illuminance	Fc	5.41	9.4	0.7	7.73	13.43
Existing Greenhouse_Floor	Illuminance	Fc	87.10	240.3	4.0	21.78	60.08
ObtrusiveLight_1_III_Seg1	Obtrusive Light - III	Fc	0.02	0.2	0.0	N.A.	N.A.
Trespass	Illuminance	Fc	0.00	0.0	0.0	N.A.	N.A.

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#	Date	Comments

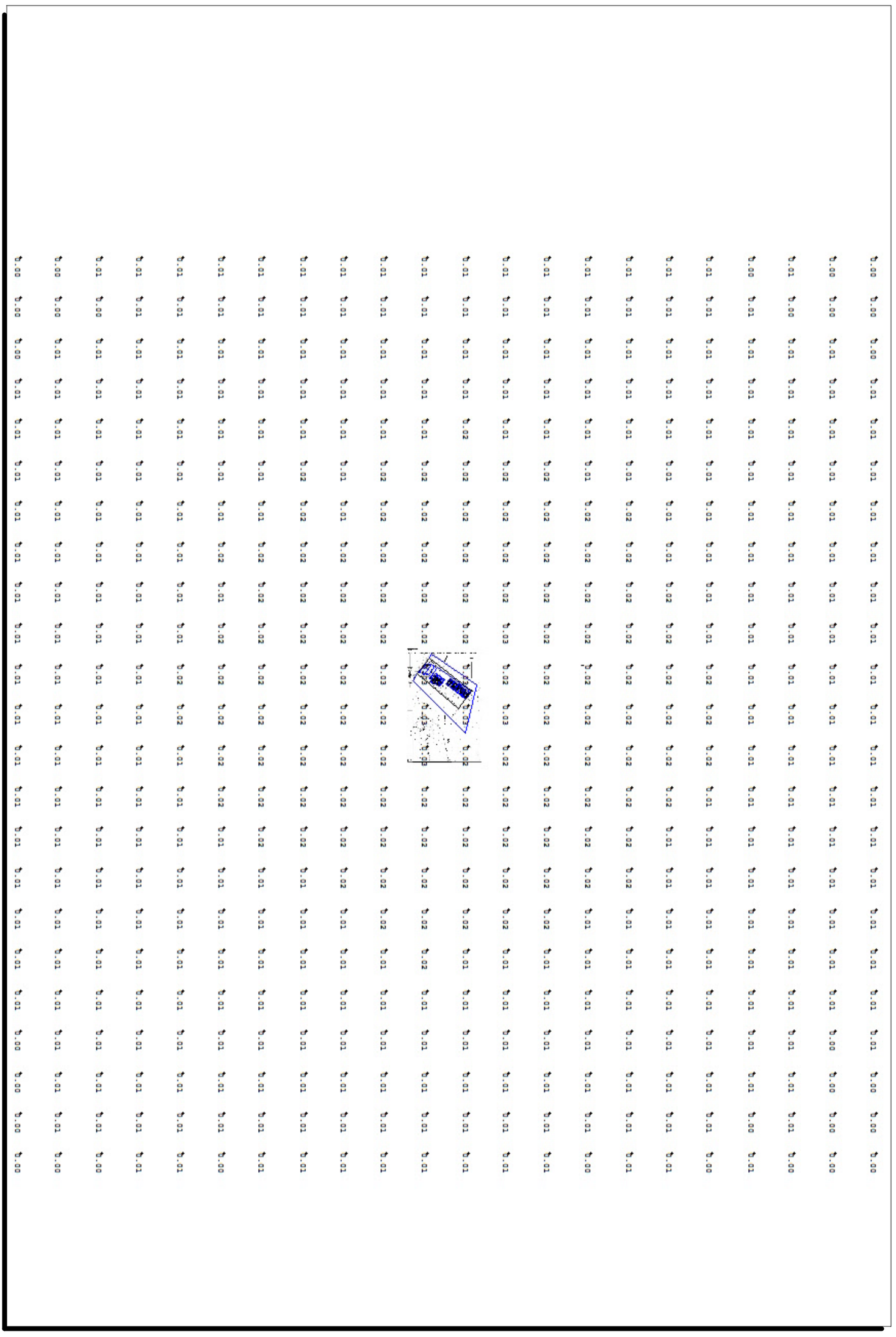
Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Shamrock Seeds Greenhouse

Photometrics Summary

Appendix 3



Page 1 of 21	Shamrock Seeds Greenhouse	Drawn By: Neil Hinckley	Revisions	#	Date	Comments
		Checked By: Lance Mackie				
	Cloud Level Illuminance	Date:4/19/2018				
		Scale: N/A				

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(IN FEET)
1 inch = 40 ft.

FUTURE GREENHOUSES

Obs 7

Obs 6

SEPTIC TANK AND PUMP TANK

LEACHFIELD

45.0'

43.9'

FUTURE GREENHOUSES

Obs 5

RESEARCH BUILDING

EXISTING BUILDING TO REMAIN

Obs 4

TRASH ENCLOSURE

23.0'

2 SPACES

71.3'

Obs 3

Obs 2

Obs 1

EXISTING BUILDING TO REMAIN AS USE NOT FOR RESEARCH

WATER TANK

FIRE HYDRANT

2X WELLS

70.0'

FIRE TURNAROUND AREA

20.0'

FD 3/4" IP OPEN

APN 841-49-018
PATANE

FD 1" IP
LS 2560

APN 84

PARCEL TWO
PER DOC. NO. 22488301

APN 841-49-0
PEREZ

OVERALL SITE PLAN
SCALE: 1"=120'

REVISIONS:		
DATE	DESCRIPTION	BY:

HANNA BRUNETTI

REFERENCES

Site Pl

OF

Michael Baker INTERNATIONAL

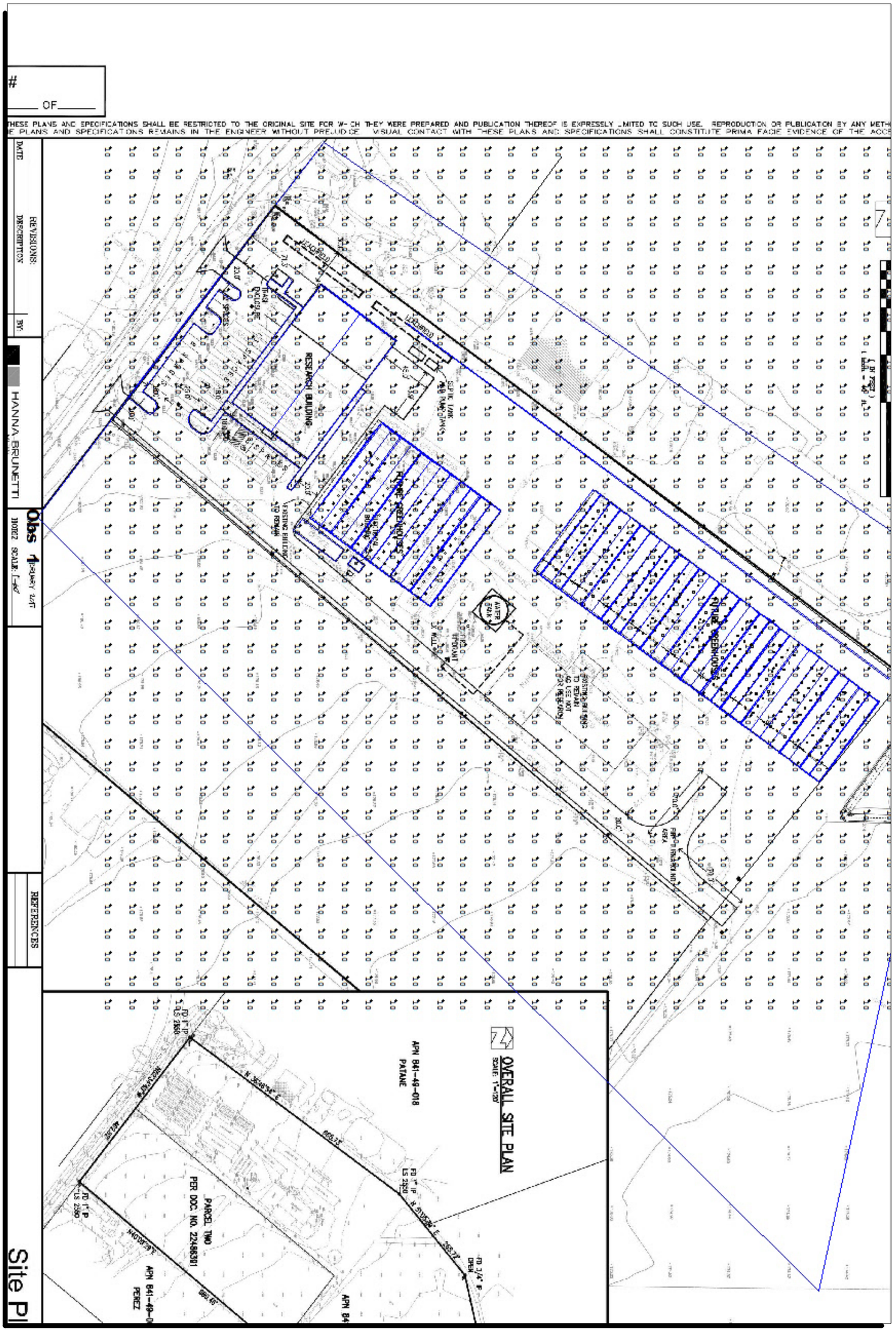
#	Date	Comments

Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Shamrock Seeds Greenhouse

Glare Observer Locations



Page 3 of 21

Shamrock Seeds Greenhouse	
Glare for Observer 1	

Drawn By: Neil Hinckley	
Checked By: Lance Mackie	
Date:4/19/2018	
Scale: N/A	

Revisions	#	Date	Comments

Michael Baker
INTERNATIONAL

REVISIONS:

DATE	DESCRIPTION	BY:

HANNA BRUNETTI

DATE: FEBRUARY 2017

SCALE: 1"=60'

REFERENCES

Site Pl

OF

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#	Date	Comments

Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Shamrock Seeds Greenhouse

Glare For Observer 2

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#	Date	Comments

Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Shamrock Seeds Greenhouse

Glare for Observer 3

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#	Date	Comments

Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Shamrock Seeds Greenhouse

Glare for Observer 4

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OF

REVISIONS:

DATE	DESCRIPTION	BY:

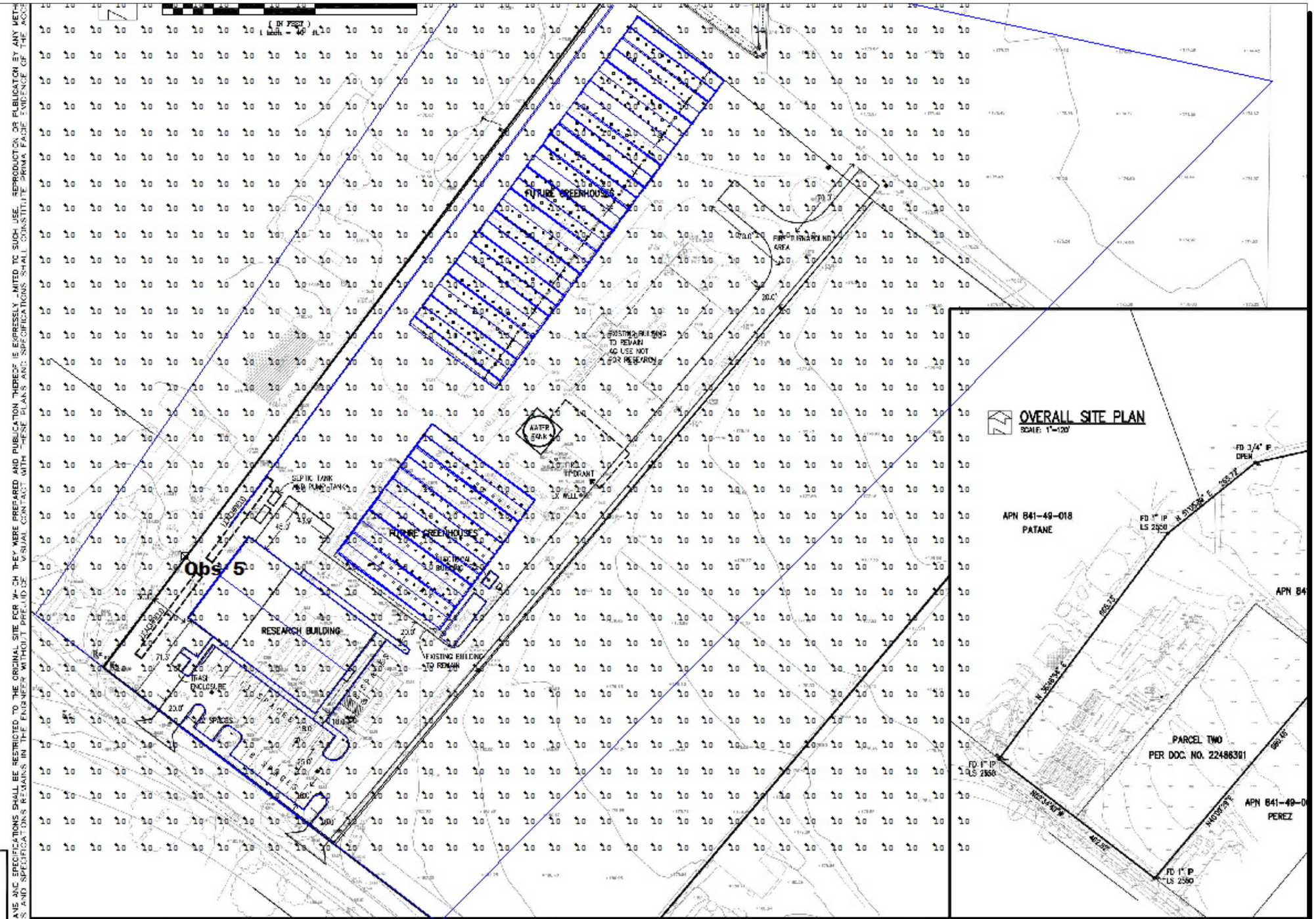
HANNA BRUNETTI

DATE: FEBRUARY 2017

HORIZ SCALE: 1"=60'

REFERENCES

Site Pl



Michael Baker INTERNATIONAL

#	Date	Comments

Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Shamrock Seeds Greenhouse

Glare for Observer 5

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OF

REVISIONS:		
DATE	DESCRIPTION	BY:

HANNA BRUNETTI

DATE: FEBRUARY 2017
HORIZ SCALE: 1"=60'

REFERENCES

Site Pl

Michael Baker INTERNATIONAL

#	Date	Comments

Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Shamrock Seeds Greenhouse

Glare for Observer 6

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OF

REVISIONS:		
DATE	DESCRIPTION	BY:

HANNA BRUNETTI

DATE: FEBRUARY 2017
HORIZ SCALE: 1"=60'

REFERENCES

Michael Baker INTERNATIONAL

#	Date	Comments

Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Shamrock Seeds Greenhouse

Glare for Observer 7

Michael Baker INTERNATIONAL

#	Date	Comments

Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Shamrock Seeds Greenhouse

Obtrusive Lighting Illuminance

Michael Baker INTERNATIONAL

#	Date	Comments

Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Shamrock Seeds Greenhouse

Obtrusive Lighting Illuminance

Michael Baker INTERNATIONAL

#	Date	Comments

Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Shamrock Seeds Greenhouse

Obtrusive Lighting Illuminance

Michael Baker INTERNATIONAL

Revisions			
#			
Date			
Comments			

Drawn By: Neil Hinckley	Checked By: Lance Mackie	Date:4/19/2018	Scale: N/A

Shamrock Seeds Greenhouse

Obtrusive Lighting Illuminance

Michael Baker INTERNATIONAL

#	Date	Comments

Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Shamrock Seeds Greenhouse

Obtrusive Lighting Illuminance

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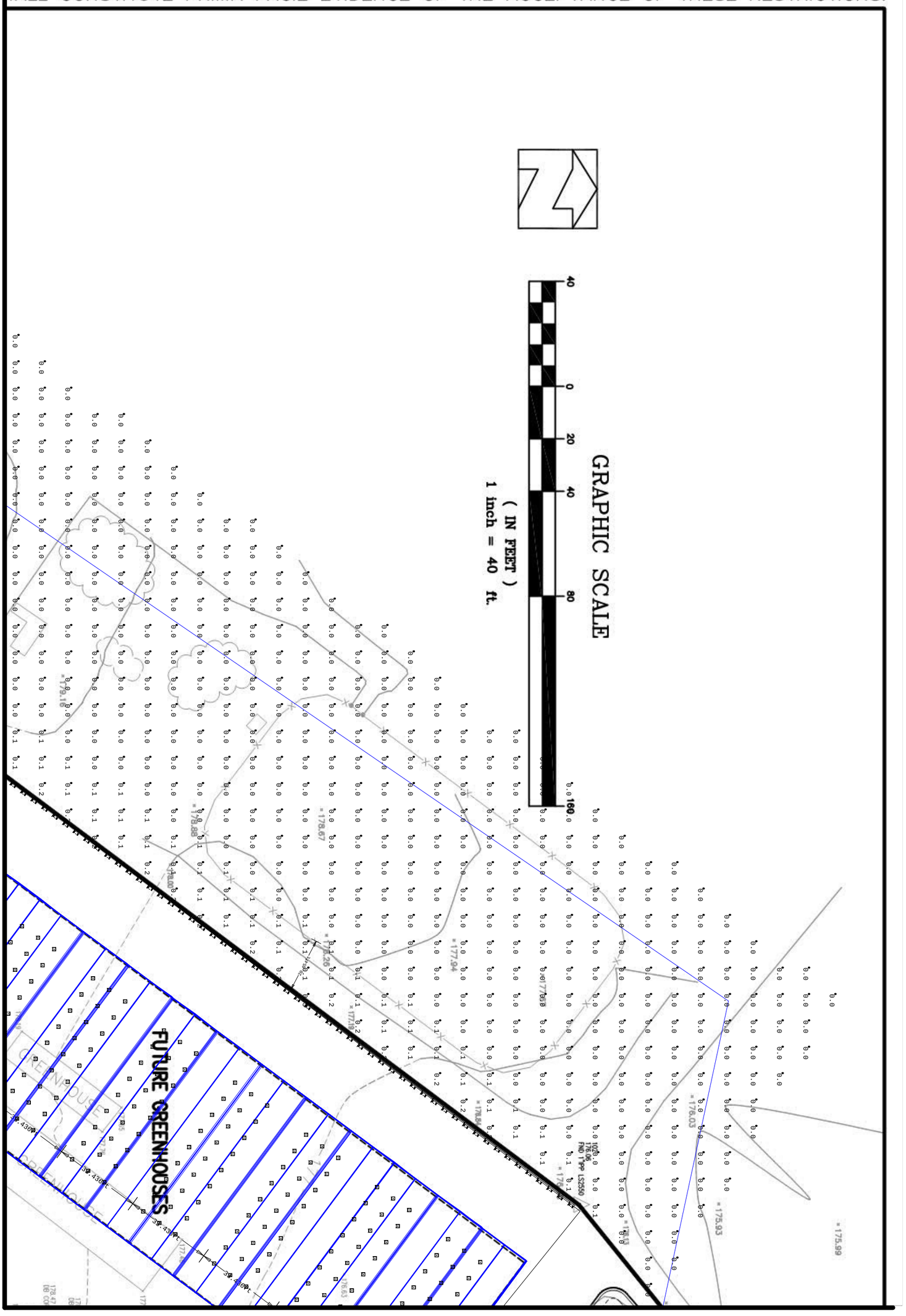

Page 15 of 21

Shamrock Seeds Greenhouse	
Lighting Trespass Illuminance	

Drawn By: Neil Hinckley	
Checked By: Lance Mackie	
Date:4/19/2018	
Scale: N/A	

Revisions	#	Date	Comments

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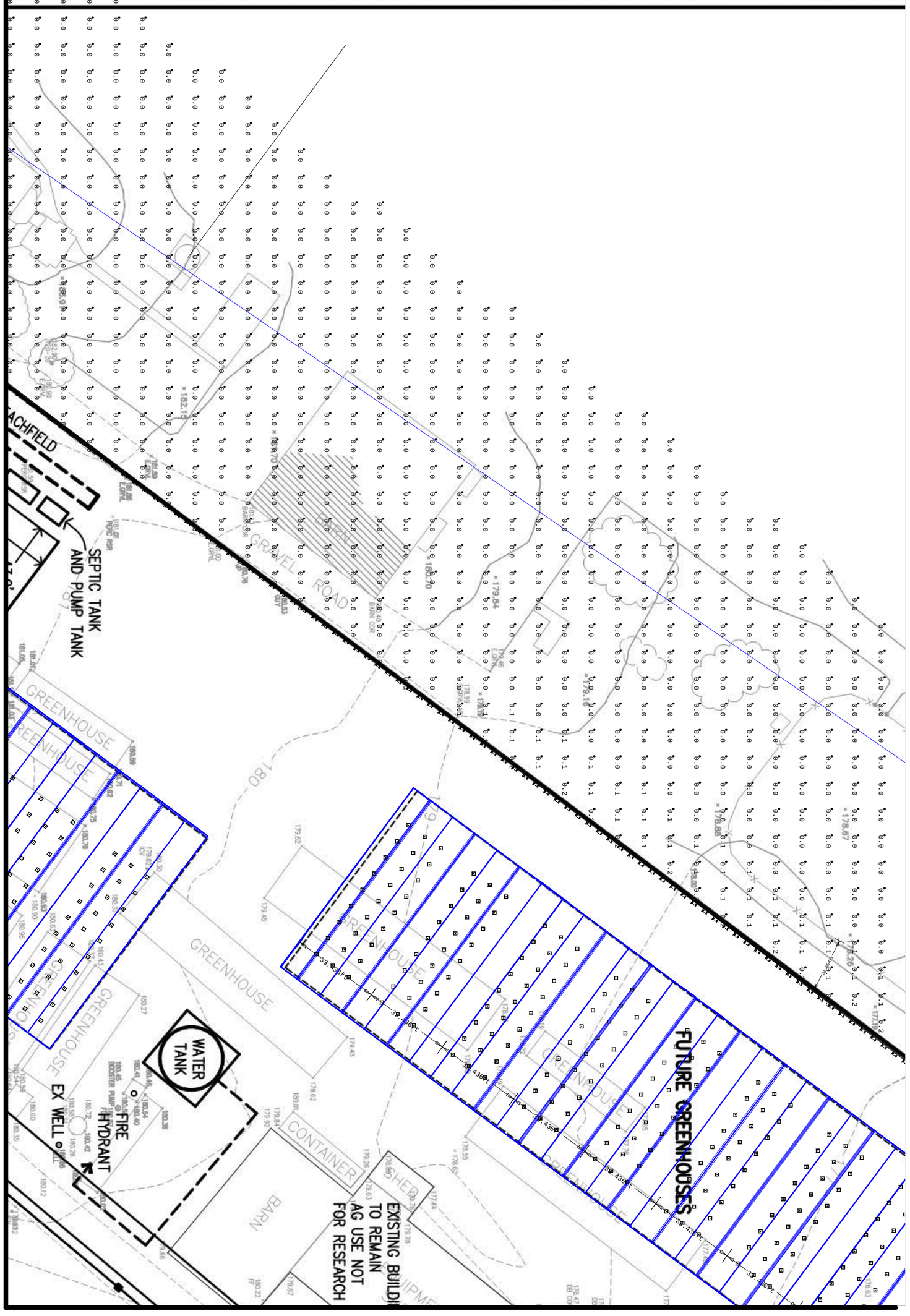

Page 16 of 21	Shamrock Seeds Greenhouse	Drawn By: Neil Hinckley	Revisions	#	Date	Comments
		Checked By: Lance Mackie				
	Lighting Trespass Illuminance	Date:4/19/2018				
		Scale: N/A				

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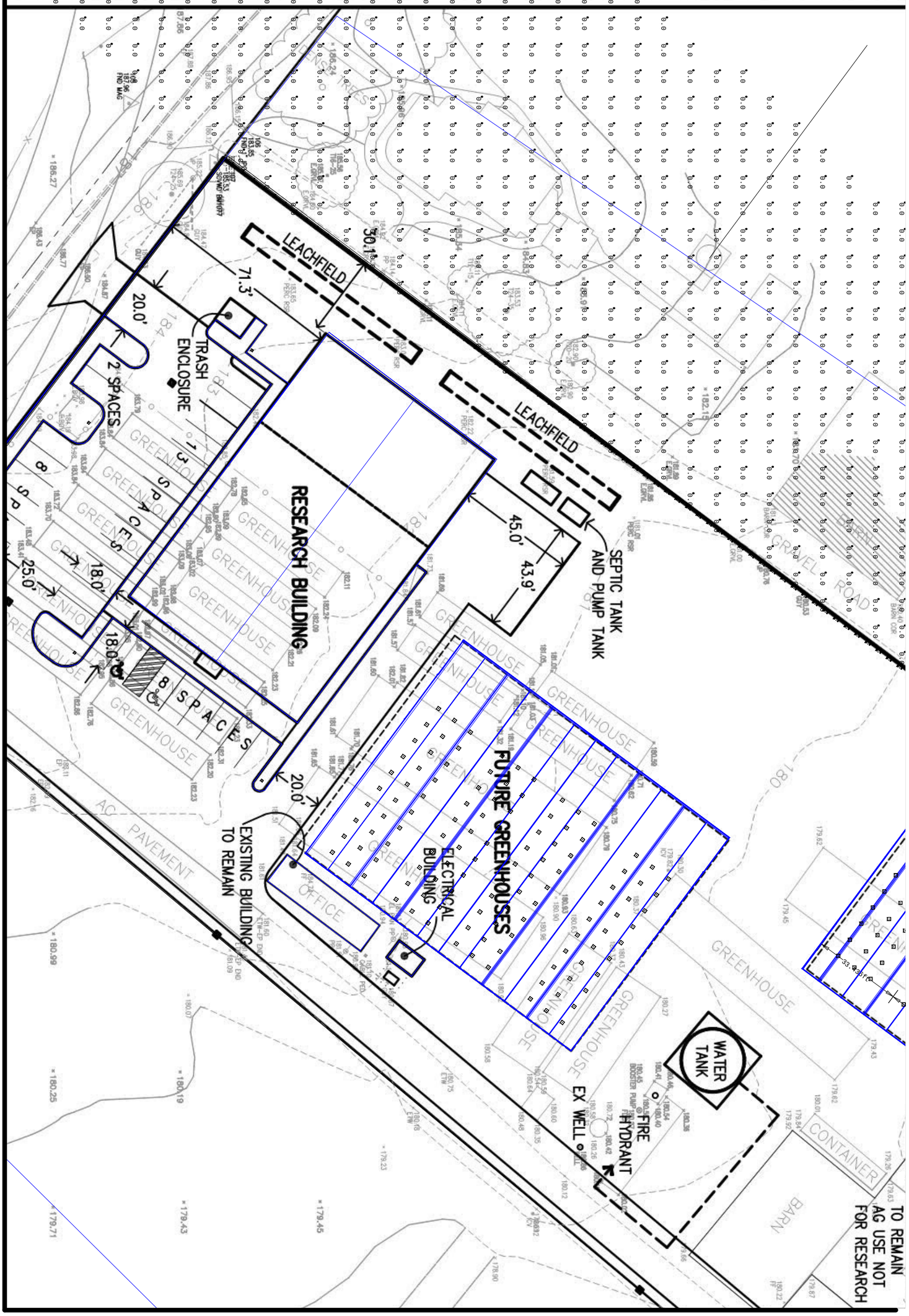
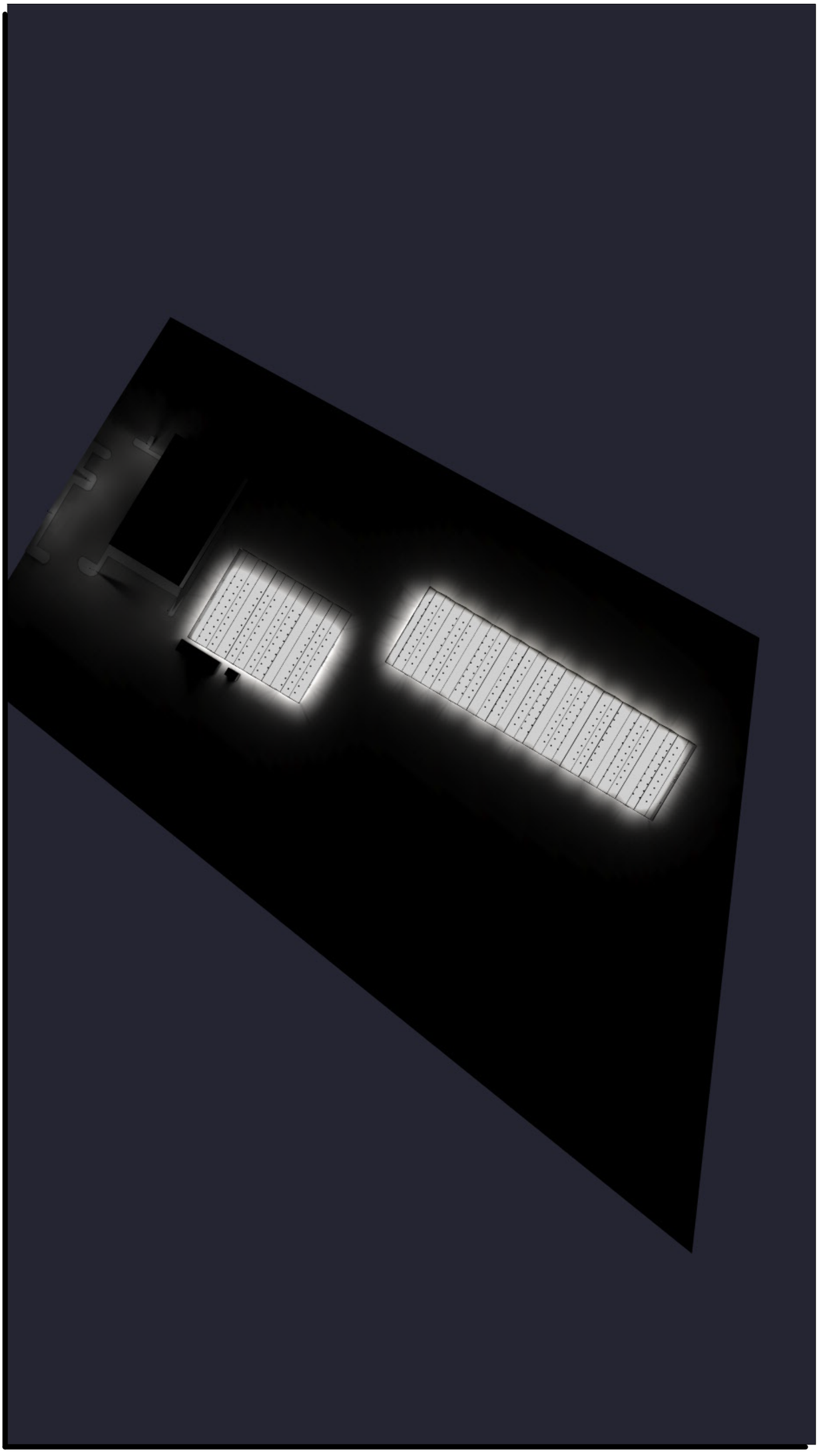


Shamrock Seeds Greenhouse	Drawn By: Neil Hinckley	Revisions	#	Date	Comments
	Checked By: Lance Mackie				
Lighting Trespass Illuminance	Date:4/19/2018				
	Scale: N/A				

Michael Baker INTERNATIONAL



Shamrock Seeds Greenhouse

Sky View Render

Drawn By:	Neil Hinckley
Checked By:	Lance Mackie
Date:	4/19/2018
Scale:	N/A

Revisions

#	Date	Comments

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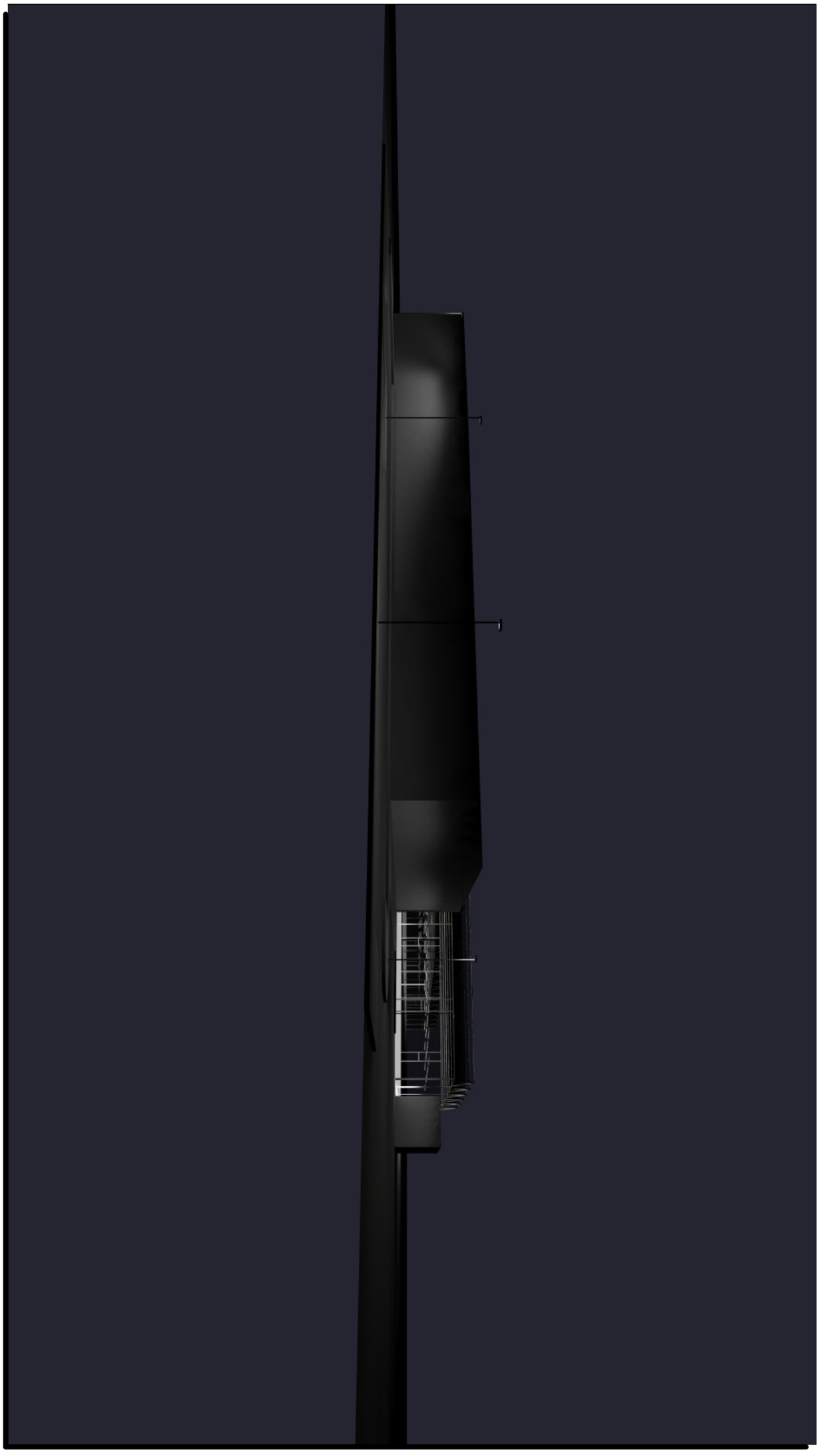


Shamrock Seeds Greenhouse

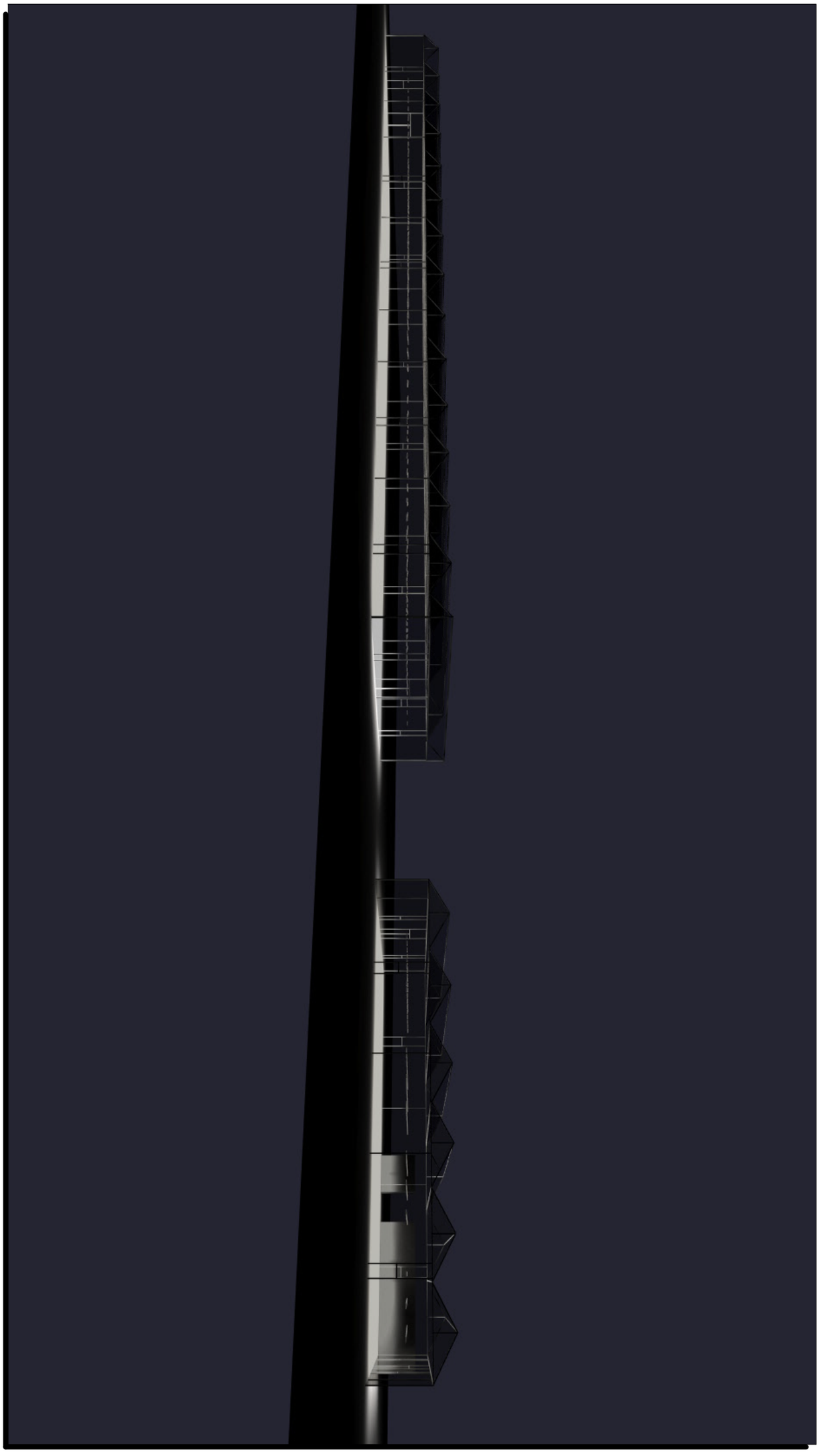
Street View Render

Drawn By:	Neil Hinckley
Checked By:	Lance Mackie
Date:	4/19/2018
Scale:	N/A

Revisions

#	Date	Comments

Michael Baker INTERNATIONAL



Shamrock Seeds Greenhouse

North-West View Render

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date:4/19/2018
Scale: N/A

Revisions	#	Date	Comments

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Luminaire Schedule						
Symbol	Qty	Label	Arrangement	Total Lamp Lumens	LLF	Description
	9	Short Greenhouse	GROUP	N.A.	0.800	KAD 400S R5S x 27
	4	Long Greenhouse	GROUP	N.A.	0.800	KAD 400S R5S x 30
	2	DSX1_LED_P1_30K	SINGLE	N.A.	0.800	DSX1 LED P1 30K T5W MVOLT
	1	DSX1_LED_P1_30K	SINGLE	N.A.	0.800	DSX1 LED P1 30K T3M MVOLT
	2	DSX1_LED_P1_30K	SINGLE	N.A.	0.800	DSX1 LED P1 30K T4M MVOLT

Calculation Summary								
Label	Obs Label	CalcType	Units	Avg	Max	Min	Avg/Min	Max/Min
Clouds	N.A.	Illuminance	Fc	0.01	0.03	0.00	N.A.	N.A.
GR_1	N.A.	Illuminance	Fc	22.67	533	0	N.A.	N.A.
GR_1	Obs 1	Glare Rating	N.A.	10.00	10	10	1.00	1.00
GR_1	Obs 2	Glare Rating	N.A.	10.00	10	10	1.00	1.00
GR_1	Obs 3	Glare Rating	N.A.	10.00	10	10	1.00	1.00
GR_1	Obs 4	Glare Rating	N.A.	10.00	10	10	1.00	1.00
GR_1	Obs 5	Glare Rating	N.A.	10.00	10	10	1.00	1.00
GR_1	Obs 6	Glare Rating	N.A.	10.03	12	10	1.00	1.20
GR_1	Obs 7	Glare Rating	N.A.	10.41	16	10	1.04	1.60
ObtrusiveLight_1_Cd_Seg1	N.A.	Obtrusive Light - Cd	N.A.	30.35	276	0	N.A.	N.A.
ObtrusiveLight_1_III_Seg1	N.A.	Obtrusive Light - III	Fc	2.71	8.0	0.0	N.A.	N.A.
Trespass	N.A.	Illuminance	Fc	0.01	0.3	0.0	N.A.	N.A.

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#	Date	Comments

Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
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Scale: N/A

Shamrock Seeds Greenhouse

Photometrics Summary

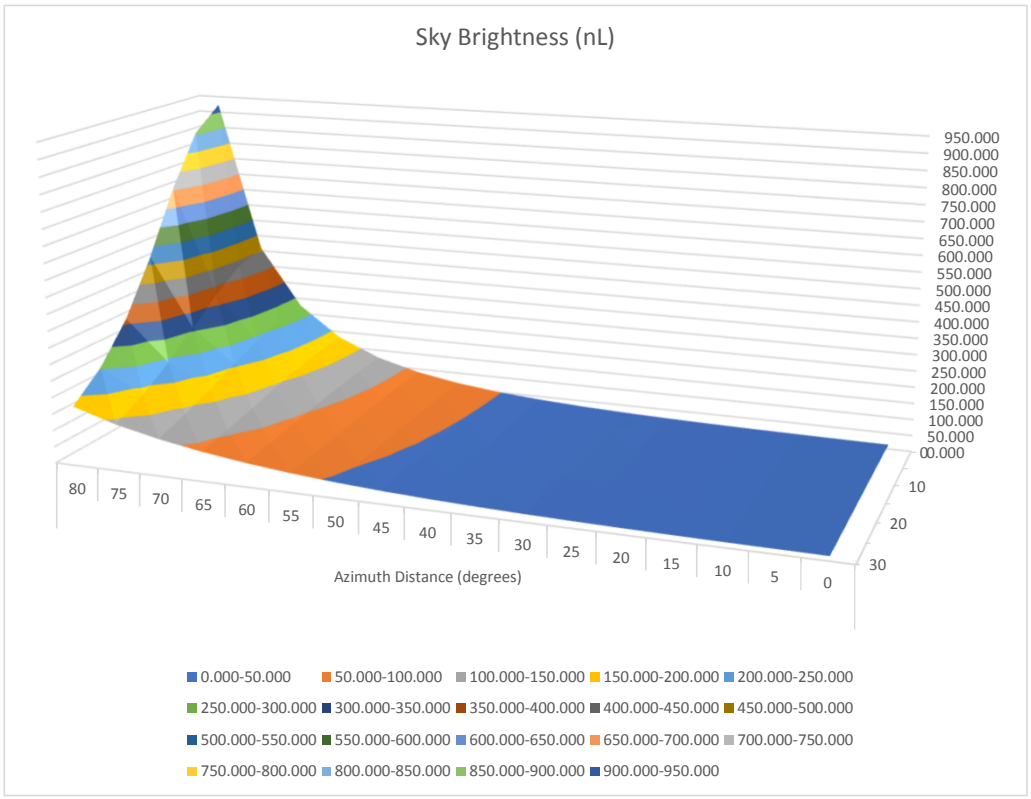
Appendix 4

Sky Glow Calculations- San Jose as seen in Gilroy

Azimuth Distance (degrees)	Degrees from Center of Source						
	0	5	10	15	20	25	30
0	13.555	13.555	13.555	13.555	13.555	13.555	13.555
5	14.245	14.240	14.229	14.212	14.188	14.159	14.125
10	15.399	15.385	15.353	15.304	15.238	15.157	15.062
15	17.027	17.000	16.935	16.836	16.704	16.543	16.356
20	19.255	19.206	19.091	18.913	18.680	18.397	18.074
25	22.280	22.197	22.002	21.704	21.314	20.847	20.319
30	26.387	26.249	25.929	25.443	24.814	24.068	23.237
35	31.995	31.771	31.253	30.472	29.471	28.302	27.018
40	39.742	39.377	38.538	37.286	35.701	33.879	31.916
45	50.620	50.020	48.650	46.625	44.105	41.262	38.267
50	66.232	65.224	62.941	59.617	55.559	51.093	46.511
55	89.257	87.514	83.605	78.016	71.363	64.257	57.208
60	124.398	121.265	114.327	104.631	93.453	81.967	71.036
65	180.454	174.554	161.668	144.162	124.795	105.862	88.773
70	275.819	264.038	238.635	205.258	170.273	138.287	111.328
75	458.724	433.068	377.897	307.937	239.970	183.574	140.269
80	923.533	856.380	706.500	521.238	363.688	253.416	179.897

Results are in nano-Lamberts (nL).

Observer Height	0	Meters
Observer Distance	48000	Meters
Source Diameter	20000	Meters
Population	1050001	
Lumens Per Person	1000	
Ground Reflectivity	0.15	Ratio
% Light Above Horizontal	0	%
Sky Clarity	1	Clear night
Altitude	100	Meters
Source Granularity	10	
Angular Granularity	5	Degrees
Atmosphere Granularity	1	Meters
Atmosphere Limit	40000	Meters
Aerosol Density	4	per cm^3

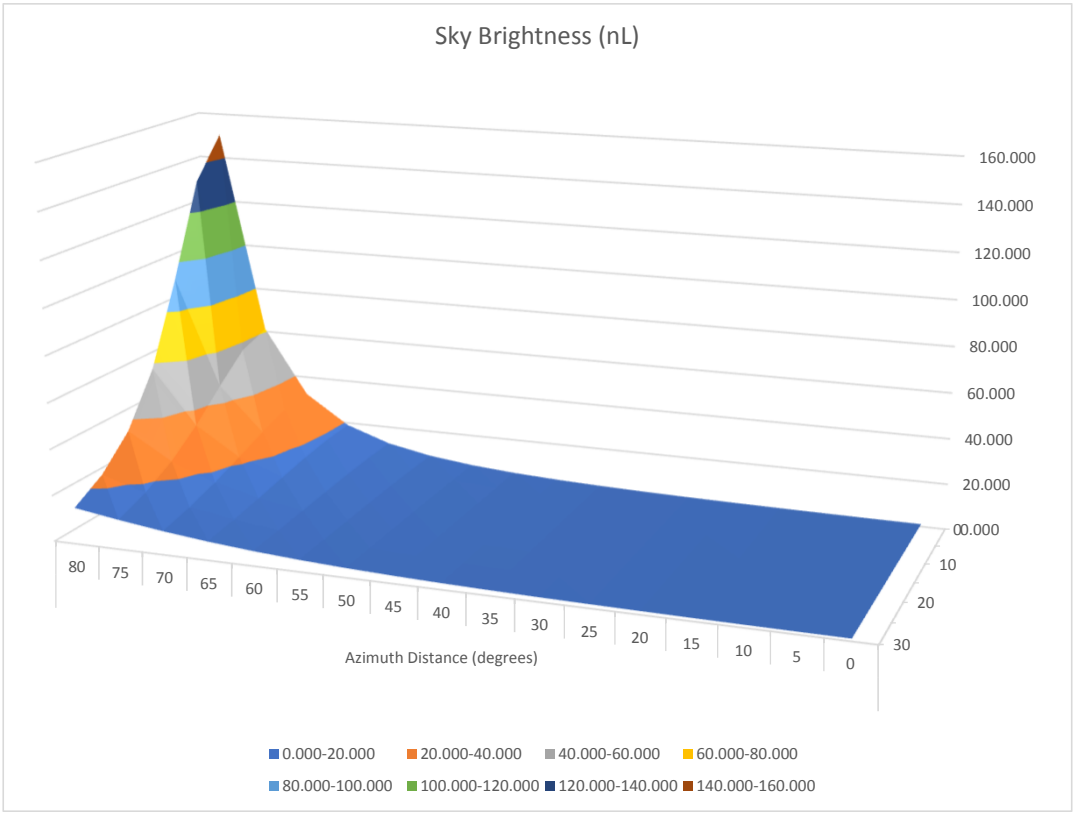


Sky Glow Calculations- Salinas as seen in Gilroy

Azimuth Distance (degrees)	Degrees from Center of Source						
	0	5	10	15	20	25	30
0	1.078	1.078	1.078	1.078	1.078	1.078	1.078
5	1.142	1.142	1.141	1.140	1.138	1.135	1.132
10	1.245	1.244	1.242	1.238	1.232	1.225	1.216
15	1.389	1.387	1.382	1.374	1.363	1.349	1.332
20	1.586	1.583	1.573	1.558	1.538	1.513	1.485
25	1.853	1.848	1.832	1.807	1.773	1.731	1.684
30	2.219	2.210	2.184	2.142	2.086	2.019	1.944
35	2.726	2.711	2.668	2.599	2.508	2.401	2.284
40	3.441	3.416	3.343	3.229	3.082	2.911	2.727
45	4.471	4.428	4.305	4.113	3.870	3.596	3.309
50	6.003	5.927	5.710	5.379	4.971	4.525	4.074
55	8.372	8.231	7.831	7.238	6.534	5.795	5.078
60	12.227	11.945	11.164	10.049	8.788	7.537	6.391
65	18.948	18.333	16.682	14.447	12.094	9.928	8.082
70	31.896	30.381	26.486	21.628	17.010	13.181	10.206
75	61.203	56.736	45.944	34.080	24.447	17.546	12.780
80	150.513	132.888	93.079	57.824	35.945	23.271	15.717

Results are in nano-Lamberts (nL).

Observer Height	0	Meters
Observer Distance	35000	Meters
Source Diameter	8000	Meters
Population	175001	
Lumens Per Person	1000	
Ground Reflectivity	0.15	Ratio
% Light Above Horizontal	0	%
Sky Clarity	1	Clear night
Altitude	100	Meters
Source Granularity	10	
Angular Granularity	5	Degrees
Atmosphere Granularity	1	Meters
Atmosphere Limit	40000	Meters
Aerosol Density	4	per cm^3

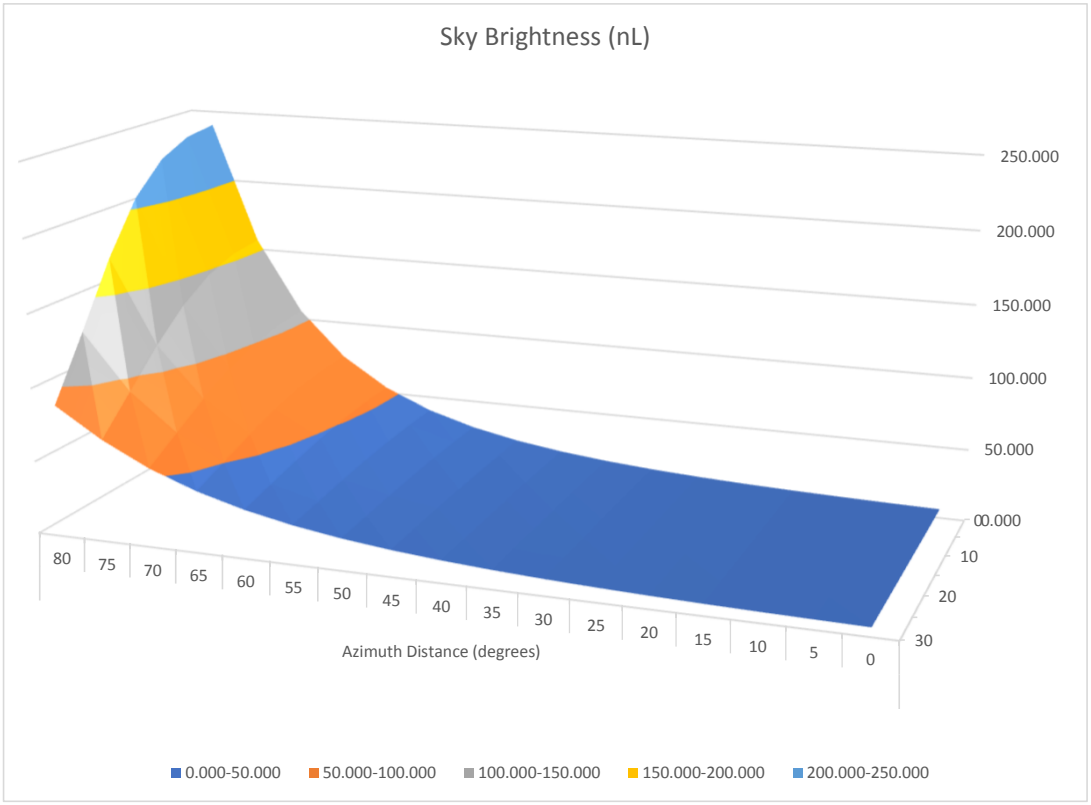


Sky Glow Calculations- Gilroy from Greenhouses

Azimuth Distance (degrees)	Degrees from Center of Source						
	0	5	10	15	20	25	30
0	6.196	6.196	6.196	6.196	6.196	6.196	6.196
5	6.749	6.747	6.740	6.728	6.712	6.692	6.668
10	7.439	7.433	7.415	7.386	7.347	7.297	7.238
15	8.321	8.309	8.276	8.221	8.146	8.052	7.942
20	9.462	9.443	9.385	9.291	9.162	9.004	8.820
25	10.952	10.920	10.826	10.672	10.466	10.212	9.921
30	12.911	12.861	12.712	12.470	12.147	11.755	11.309
35	15.515	15.436	15.204	14.831	14.334	13.737	13.066
40	19.019	18.897	18.540	17.967	17.209	16.308	15.308
45	23.810	23.623	23.072	22.193	21.040	19.681	18.193
50	30.479	30.189	29.340	27.988	26.224	24.164	21.940
55	39.962	39.514	38.197	36.101	33.377	30.222	26.862
60	53.777	53.080	51.027	47.747	43.478	38.563	33.402
65	74.445	73.365	70.156	64.965	58.145	50.297	42.178
70	106.275	104.633	99.660	91.364	80.179	67.210	54.001
75	156.865	154.518	147.082	133.777	114.752	92.242	69.767
80	240.172	237.323	227.440	206.630	172.321	130.267	89.828

Results are in nano-Lamberts (nL).

Observer Height	0	Meters
Observer Distance	4200	Meters
Source Diameter	3200	Meters
Population	50000.99	
Lumens Per Person	1000	
Ground Reflectivity	0.15	Ratio
% Light Above Horizontal	0	%
Sky Clarity	1	Clear night
Altitude	100	Meters
Source Granularity	10	
Angular Granularity	5	Degrees
Atmosphere Granularity	1	Meters
Atmosphere Limit	40000	Meters
Aerosol Density	4	per cm^3

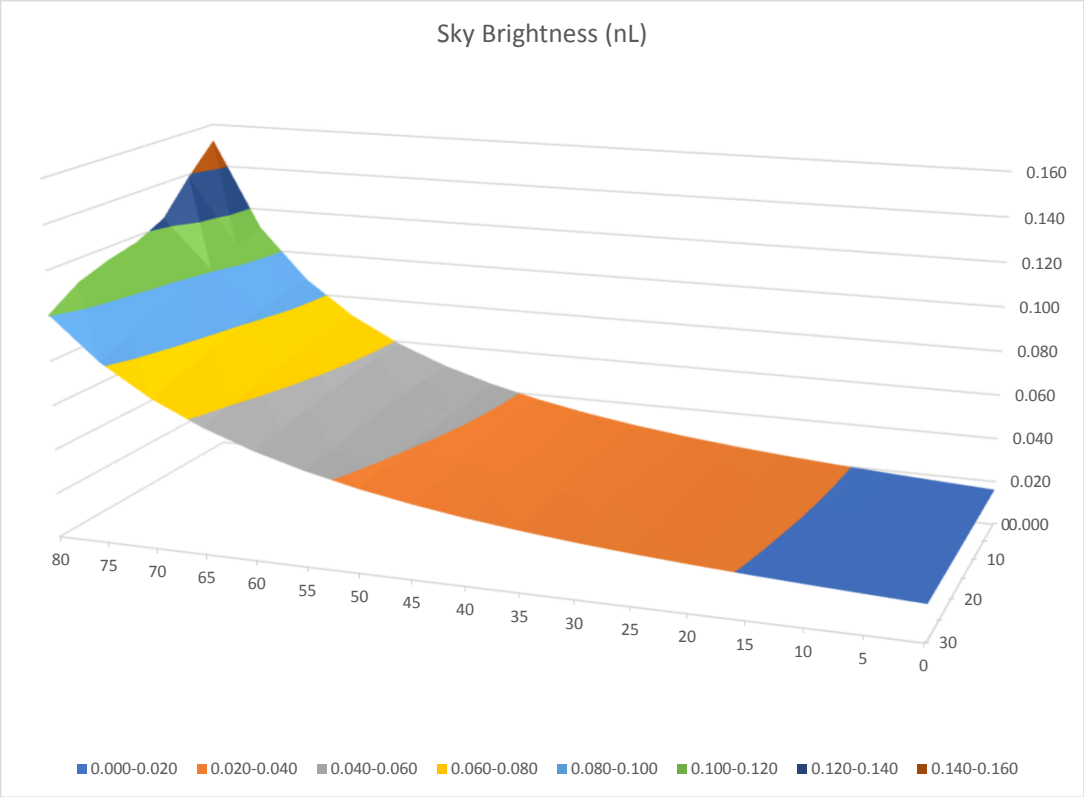


Sky Glow Calculations- Near Existing Greenhouses

Azimuth Distance (degrees)	Degrees from Center of Source						
	0	5	10	15	20	25	30
0	0.016	0.016	0.016	0.016	0.016	0.016	0.016
5	0.017	0.017	0.017	0.017	0.017	0.017	0.017
10	0.019	0.019	0.019	0.019	0.019	0.019	0.018
15	0.020	0.020	0.020	0.020	0.020	0.020	0.020
20	0.022	0.022	0.022	0.022	0.022	0.021	0.021
25	0.024	0.024	0.024	0.024	0.023	0.023	0.023
30	0.027	0.027	0.026	0.026	0.026	0.025	0.025
35	0.030	0.029	0.029	0.029	0.028	0.028	0.027
40	0.033	0.033	0.033	0.032	0.032	0.031	0.030
45	0.038	0.037	0.037	0.036	0.035	0.034	0.033
50	0.043	0.043	0.042	0.041	0.040	0.039	0.037
55	0.050	0.050	0.049	0.047	0.046	0.044	0.043
60	0.059	0.058	0.057	0.055	0.053	0.051	0.049
65	0.071	0.070	0.068	0.066	0.063	0.060	0.057
70	0.087	0.085	0.082	0.079	0.075	0.071	0.068
75	0.111	0.107	0.101	0.095	0.091	0.087	0.081
80	0.152	0.139	0.124	0.117	0.114	0.109	0.100

Results are in nano-Lamberts (nL).

Observer Height	0	Meters
Observer Distance	600	Meters
Source Diameter	1200	Meters
Population	50000.99	
Lumens Per Person	1	
Ground Reflectivity	0.15	Ratio
% Light Above Horizontal	0	%
Sky Clarity	1	Clear night
Altitude	100	Meters
Source Granularity	10	
Angular Granularity	5	Degrees
Atmosphere Granularity	1	Meters
Atmosphere Limit	40000	Meters
Aerosol Density	4	per cm^3

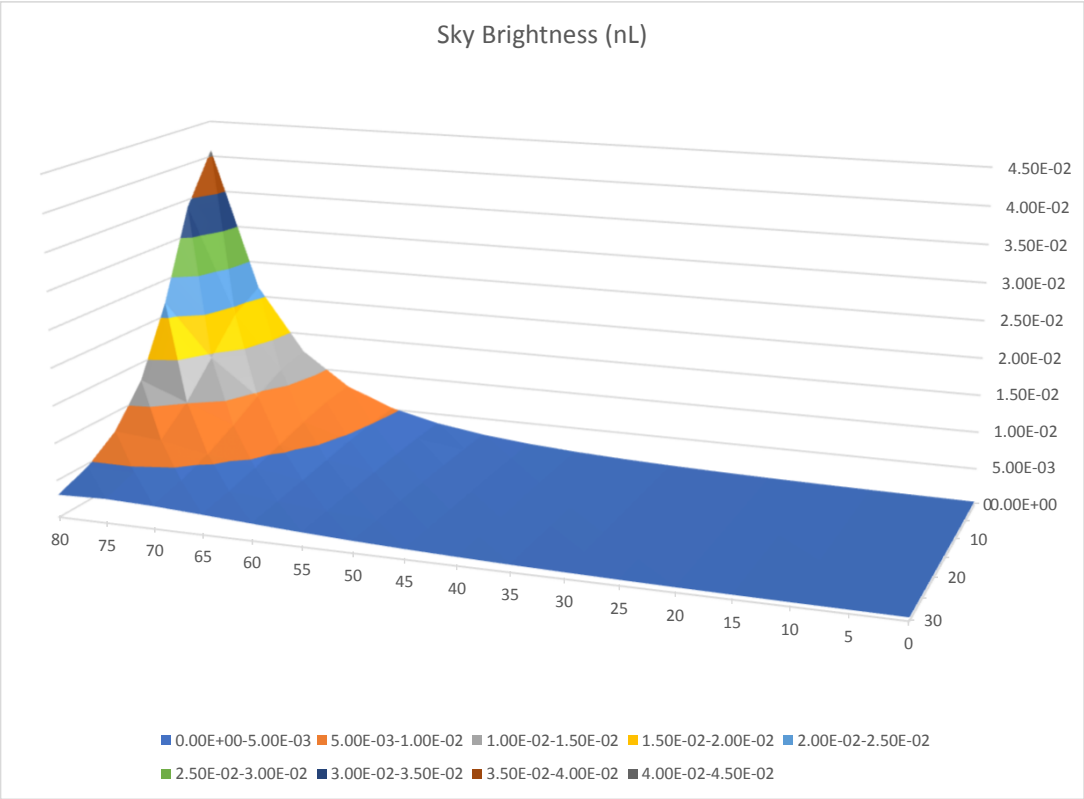


Sky Glow Calculations- 5km From Existing Greenhouses

Azimuth Distance (degrees)	Degrees from Center of Source						
	0	5	10	15	20	25	30
0	4.69E-04	4.69E-04	4.69E-04	4.69E-04	4.69E-04	4.69E-04	4.69E-04
5	5.11E-04	5.11E-04	5.10E-04	5.10E-04	5.08E-04	5.07E-04	5.05E-04
10	5.66E-04	5.65E-04	5.63E-04	5.61E-04	5.58E-04	5.54E-04	5.49E-04
15	6.37E-04	6.36E-04	6.33E-04	6.28E-04	6.21E-04	6.13E-04	6.04E-04
20	7.31E-04	7.29E-04	7.23E-04	7.14E-04	7.03E-04	6.89E-04	6.73E-04
25	8.56E-04	8.53E-04	8.43E-04	8.28E-04	8.09E-04	7.85E-04	7.59E-04
30	0.001025	0.001018	0.001002	9.78E-04	9.46E-04	9.09E-04	8.67E-04
35	0.001254	0.001243	0.001217	0.001177	0.001125	0.001066	0.001002
40	0.00157	0.001553	0.001509	0.001443	0.001361	0.001268	0.001171
45	0.002019	0.001989	0.001915	0.001806	0.001673	0.001527	0.001379
50	0.002672	0.002619	0.002492	0.002307	0.002089	0.00186	0.001636
55	0.003657	0.00356	0.003331	0.003011	0.002648	0.002283	0.001945
60	0.005209	0.005023	0.004591	0.004013	0.003395	0.002812	0.002305
65	0.00779	0.007403	0.006537	0.00545	0.004375	0.003443	0.002694
70	0.012384	0.011496	0.00962	0.007476	0.005583	0.004119	0.003053
75	0.021316	0.019016	0.014533	0.010114	0.006829	0.00465	0.003246
80	0.040867	0.03395	0.021834	0.012608	0.007416	0.004612	0.003034

Results are in nano-Lamberts (nL).

Observer Height	0	Meters
Observer Distance	5000	Meters
Source Diameter	1200	Meters
Population	50000.99	
Lumens Per Person	1	
Ground Reflectivity	0.15	Ratio
% Light Above Horizontal	0	%
Sky Clarity	1	Clear night
Altitude	100	Meters
Source Granularity	10	
Angular Granularity	5	Degrees
Atmosphere Granularity	1	Meters
Atmosphere Limit	40000	Meters
Aerosol Density	4	per cm^3

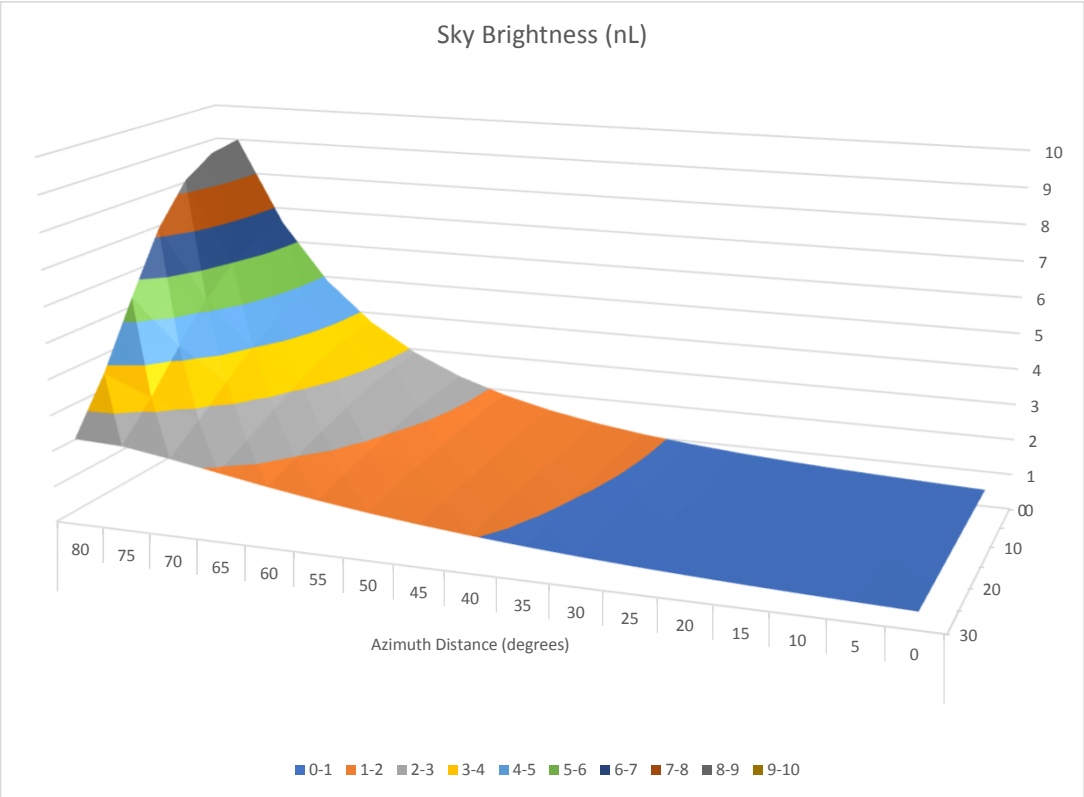


Sky Glow Calculations- Near Greenhouses

Azimuth Distance (degrees)	Degrees from Center of Source						
	0	5	10	15	20	25	30
0	0.47324	0.47324	0.47324	0.47324	0.47324	0.47324	0.47324
5	0.518866	0.518671	0.518091	0.517131	0.515805	0.514125	0.512114
10	0.572039	0.571565	0.570149	0.567818	0.564609	0.560578	0.555791
15	0.635394	0.63451	0.63188	0.627565	0.621666	0.614313	0.605665
20	0.712272	0.710788	0.706385	0.699194	0.68943	0.677368	0.663341
25	0.807019	0.804655	0.797649	0.786273	0.770943	0.752203	0.730669
30	0.925414	0.921743	0.910917	0.893429	0.870067	0.841817	0.809803
35	1.075295	1.069693	1.053203	1.026741	0.99172	0.9499	0.903215
40	1.267507	1.259014	1.234101	1.194373	1.142328	1.081016	1.01372
45	1.517289	1.504445	1.466885	1.407414	1.330321	1.24082	1.144406
50	1.846407	1.826978	1.770324	1.681192	1.566879	1.436225	1.298383
55	2.286613	2.257186	2.171542	2.037449	1.867127	1.675607	1.478228
60	2.88506	2.840536	2.710848	2.50801	2.252098	1.968918	1.684786
65	3.712813	3.64603	3.450177	3.141423	2.751872	2.32709	1.914255
70	4.879092	4.78151	4.489584	4.016919	3.411978	2.759984	2.151454
75	6.553052	6.419861	6.001693	5.276835	4.306995	3.268785	2.353639
80	9.002073	8.849751	8.315428	7.216985	5.57174	3.82028	2.408563

Results are in nano-Lamberts (nL).

Observer Height	0	Meters
Observer Distance	600	Meters
Source Diameter	400	Meters
Population	25000.99	
Lumens Per Person	450	
Ground Reflectivity	0.15	Ratio
% Light Above Horizontal	0	%
Sky Clarity	1	Clear night
Altitude	100	Meters
Source Granularity	10	
Angular Granularity	5	Degrees
Atmosphere Granularity	1	Meters
Atmosphere Limit	40000	Meters
Aerosol Density	4	per cm^3



Sky Glow Calculations- 5km from Greenhouses

Azimuth Distance (degrees)	Degrees from Center of Source						
	0	5	10	15	20	25	30
0	0.0134	0.0134	0.0134	0.0134	0.0134	0.0134	0.0134
5	0.0146	0.0146	0.0146	0.0145	0.0145	0.0145	0.0144
10	0.0161	0.0161	0.0161	0.0160	0.0159	0.0158	0.0157
15	0.0182	0.0182	0.0181	0.0179	0.0178	0.0175	0.0173
20	0.0209	0.0208	0.0207	0.0204	0.0201	0.0197	0.0193
25	0.0245	0.0244	0.0241	0.0237	0.0232	0.0225	0.0218
30	0.0293	0.0292	0.0288	0.0281	0.0272	0.0261	0.0249
35	0.0359	0.0357	0.0350	0.0339	0.0324	0.0307	0.0289
40	0.0451	0.0447	0.0435	0.0417	0.0393	0.0367	0.0338
45	0.0581	0.0574	0.0554	0.0523	0.0485	0.0443	0.0400
50	0.0771	0.0759	0.0723	0.0671	0.0608	0.0541	0.0475
55	0.1060	0.1036	0.0972	0.0879	0.0773	0.0666	0.0566
60	0.1518	0.1472	0.1348	0.1177	0.0994	0.0822	0.0672
65	0.2291	0.2192	0.1934	0.1606	0.1284	0.1007	0.0786
70	0.3699	0.3456	0.2870	0.2208	0.1637	0.1203	0.0890
75	0.6557	0.5843	0.4347	0.2966	0.1988	0.1352	0.0944
80	1.3438	1.0672	0.6351	0.3594	0.2123	0.1330	0.0880

Results are in nano-Lamberts (nL).

Observer Height	0	Meters
Observer Distance	5200	Meters
Source Diameter	400	Meters
Population	25000.99	
Lumens Per Person	450	
Ground Reflectivity	0.15	Ratio
% Light Above Horizontal	0	%
Sky Clarity	1	Clear night
Altitude	100	Meters
Source Granularity	10	
Angular Granularity	5	Degrees
Atmosphere Granularity	1	Meters
Atmosphere Limit	40000	Meters
Aerosol Density	4	per cm^3