

25/11/21

RANDWICK RACECOURSE NIGHT LIGHTING

LIGHTING RESPONSES TO SSDA SUBMISSION

The submissions to the SEARS application for night racing at Randwick Racecourse, fall in to four areas of concern.

1. Light spill to neighbouring properties
2. Light pollution, environmental effects & times of operation
3. Pole size
4. Sustainability

As per DPIE request, additional modelling has been provided for AS/NZ 4282:2019 Control of obtrusive light effects of outdoor lighting:

- Threshold Increment
- Upward Light Ratio

LIGHT SPILL

The Australian standard AS/NZ 4282:2019 Control of obtrusive light effects of outdoor lighting, was updated in 2019. The earlier version (1997) did not include lighting for television broadcasting. In consultation with professional bodies such as The Lighting Societies of Australia & NZ, Astronomical Society of Australia, planning bodies, local government & road controlling authorities, sets of limits were established.

The standard now states acceptable limits for residential areas within the vicinity of sporting venues being illuminated for TV coverage. The proposed lighting installation at Randwick Racecourse meets those criteria.

Additionally, any perceived light spill or glare will be managed by the following mitigation measures:

- Baffles, visors & shields fitted to luminaires
- Dimming between races
- Event notification
- Light level sensor/monitoring system

Included in the overall night racing lighting control system, light sensors will be placed inside the boundary of the racecourse at selected locations to rear of the Doncaster Ave & along Alison Rd. Lux levels would be taken prior to each event and data collected at each event to confirm the calculated levels have not been exceeded. The system would be designed in line with Australian Standards AS/NZ 4282:2019 and AS3827 Lighting system performance – Accuracies & tolerances.

LIGHT POLLUTION, ENVIRONMENTAL EFFECTS & TIMES OF OPERATION

IGS considered if Randwick Racecourse were simply being evaluated for obtrusive light effects of a general lighting installation, **not TV broadcasting**, according to AS4282:2019 Obtrusive effects of outdoor lighting. It would be assessed as a high brightness district Zone A4 due to the ambient light conditions and regular levels of night-time activity in the area.

Refer to Table 3.1 below.

TABLE 3.1
ENVIRONMENTAL ZONES

Zones	Description	Examples
A0	Intrinsically dark	UNESCO Starlight Reserve. IDA Dark Sky Parks. Major optical observatories No road lighting -unless specifically required by the road controlling authority
A1	Dark	Relatively uninhabited rural areas No road lighting - unless specifically required by the road controlling authority
A2	Low district brightness	Sparsely inhabited rural and semi-rural areas
A3	Medium district brightness	Suburban areas in towns and cities
A4	High district brightness	Town and city centres and other commercial areas Residential areas abutting commercial areas

Randwick Council Local Environmental Plan 2012 maps show Randwick Racecourse abuts residential zones R2 & R3 and commercial areas of zone B2.

Refer to the Land Zoning maps – Sheet LZN_001 & LZN_002 at

<https://pp.planningportal.nsw.gov.au/publications/environmental-planning-instruments/randwick-local-environmental-plan-2012>

To give an indication of the ambient lighting conditions in the immediate area, an independent assessor took lux readings on 23 June 2021 from 6.30pm to 8.00pm at existing property frontages on Alison Rd, High St Wansey Rd & Doncaster Ave. Refer to Table 1.1 below for the recorded vertical lux levels and see attached *Appendix A* plan of these locations.

Alison Road - Northern Properties Boundary

Vertical Illuminance (Lux) readings taken at residential property boundary													
1	2	3	4	5	6	7	8	9	10	11	12	Avg	Max
11.10	9.50	13.70	9.20	8.70	16.80	17.20	12.24	8.50	12.40	16.07	22.40	13.15	22.40

High Street - Southern Properties Boundary

Vertical Illuminance (Lux) readings taken at residential property boundary													
1	2	3	4	5	6	7	8	9	10	11	12	Avg	Max
6.64	3.88	4.97	0.94	2.57	2.19	1.92	2.24	1.68	4.41	2.72	7.39	3.46	7.39

Wansey Road - Eastern Properties Boundary

Vertical Illuminance (Lux) readings taken at residential property boundary													
1	2	3	4	5	6	7	8	9	10	11	12	Avg	Max
3.14	0.43	2.70	0.30	2.10	1.15	1.04	3.15	3.90	1.70	0.90	2.30	1.90	3.90

Doncaster Avenue - Western Properties Boundary

Vertical Illuminance (Lux) readings taken at residential property boundary													
1	2	3	4	5	6	7	8	9	10	11	12	Avg	Max
1.15	0.20	3.10	3.82	1.48	0.92	0.66	2.30	0.84	1.20	0.67	1.54	1.49	3.82

TABLE 1.1

Table 3.2 below shows the complaint limits for Zone A4.

TABLE 3.2
MAXIMUM VALUES OF LIGHT TECHNICAL PARAMETERS

Zones	Vertical illuminance levels (E_v) lx		Threshold increment (TI)		Sky glow
	Non-curfew	Curfew	%	Default adaptation level (L_{ad})	Upward light ratio
A0	See Note 1	0	N/A	N/A	0
A1	2	0.1	N/A	N/A	0
A2	5	1	20%	0.2	0.01
A3	10	2	20%	1	0.02
A4	25	5	20%	5	0.03
TV	See Table 3.4	N/A	20%	10	0.08

Table 3.3 below shows intensity limits required for compliance in Zone A4 & TV zones for both Non-curfew L1 & curfew.

TABLE 3.3
MAXIMUM LUMINOUS INTENSITIES PER LUMINAIRE

Zone	Luminous intensity (<i>I</i>), cd		
	Non-curfew L1	Non-curfew L2	Curfew
A0	See Note	See Note	0
A1	2 500	5 000	500
A2	7 500	12 500	1 000
A3	12 500	25 000	2 500
A4	25 000	50 000	2 500
TV	100 000	150 000	0

Table 3.4 below shows the complaint lux level limits for TV zones. The applicable column for Randwick Racecourse is illuminance designed to >1400 lux.

TABLE 3.4
**MAXIMUM VERTICAL ILLUMINANCE NON-CURFEW LIMITS
FOR SPORTS VENUES ILLUMINATED FOR TV COVERAGE**

Zone	<i>D</i> m	Initial camera illuminance (<i>E_c</i>), lx							
		≤500	>500 ≤700	>700 ≤1000	>1000 ≤1400	>1400 ≤1900	>1900 ≤2500	>2500 ≤3200	>3200
TV1	>50 ≤100	40	55	80	110	150	200	260	330
TV2	>100 ≤200	8	10	15	20	25	35	45	55
TV3	>200 ≤300	3	4	6	8	10	14	18	22
TV4	>300	1.5	2	3	4	5	7	9	11

LEGEND:

E_c = initial (*MF* = 1) average illuminance to the camera

D = distance from the nearest part of the TPA (refer to AS 2560.1)

Table 1.2 below show the comparison the applicable limits for compliance within zone A4 versus the TV zones.

ZONE	Illuminance Lux		Max Intensity (cd)	
	Non-curfew (<11pm)	Curfew (>11pm)	Non-curfew L1 (<11pm)	Curfew (>11pm)
A4	25	5	25 000	2500
TV1	110	0	100 000	0
TV2	20	0	100 000	0
TV3	8	0	100 000	0
TV4	4	0	100 000	0

TABLE 1.2

Three of the 4 TV broadcast zones (TV zones 2-4) have a lower lux limit than a general lighting installation in zone A4.

TV broadcast zones' permitted intensity before 11pm is higher than zone A4 but nil is allowed after 11pm, whereas in zone A4 2500 cd may be permitted the entire night.

Figure 1.0 below shows TV zone 1, that is 100m zone beyond the racecourse boundary.



FIGURE 1.0

Some residential properties fall within this zone. The rear of some properties on Doncaster Ave face the racecourse. Sections of dense evergreen trees along Alison Rd, Wansey Rd & High St offer screening to reduce light spill, view of the luminaires and the visual impact of the poles.

AS4282 calculations for all the specified distances for TV zones 1-4 at 1.5m above ground level are shown on *Appendix B*. The Relevant information was extracted and provided in the DA submission.

For additional information sample vertical calculation points were taken at the rear of the buildings along Doncaster Ave at 1.5m above ground level at 5m intervals. Vertical (V) illuminance (lux) levels are taken when the light meter is tilted to 90 degrees from the horizontal & facing towards the centre of the racecourse. Topography, trees, fences, or buildings were not included in the modelling. Therefore, these figures are the worst-case scenario as the path of light is not obstructed.

Table 1.3 below is a summary of the calculations in *Appendix B*.

Reference name	Addresses	Max V lux
Houses 1	86-124 Doncaster Ave	21.48
Houses 2	68 -84 Doncaster Ave	0.24
Houses 3	20 - 66 Doncaster Ave	0.07

Vertical Illuminance (Lux) points at Locations "Houses 1"									
1	2	3	4	5	6	7	8	9	10
21.48	19.26	9.54	9.03	8.76	9.39	12.24	13.50	14.41	15.48
11	12	13	14	15	16	17	18	19	20
16.14	16.67	17.12	17.40	17.40	15.63	13.33	11.76	9.55	7.50
21	22	23	24	25	26	27	28	29	30
5.99	4.72	3.63	3.02	2.74	2.33	1.77	1.61	1.62	1.26
31	32	33	34	35	36				
0.97	0.84	0.68	0.60	0.53	0.46				

Vertical Illuminance (Lux) points at Locations "Houses 2"									
1	2	3	4	5	6	7	8	9	10
0.21	0.18	0.16	0.15	0.13	0.11	0.10	0.10	0.09	0.09
11	12	13	14	15	16				
0.09	0.09	0.10	0.10	0.10	0.10				

Vertical Illuminance (Lux) readings at Locations "Houses 3"									
1	2	3	4	5	6	7	8	9	10
0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.03	0.03	0.02
11	12	13	14	15	16	17	18	19	20
0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01
21	22	23	24	25	26	27	28	29	30
0.01	0.01	0.01	0.01	0.01	0.0	0.0	0.0	0.0	0.0

TABLE 1.3

The highest level of 21.48 lux is found at the rear of the property of 124 Doncaster Ave which is closest to the racecourse boundary. The level is significantly less than the maximum 110 lux permitted in the 50m to 100m zone (TV1). The levels continue to drop & diminish to imperceptible 200m along Doncaster Ave.

Considering obstructions were not included and as night racing events are only to be held on 16 nights per year, the levels at these properties will not cause adverse impact and are acceptable.

TIMES OF OPERATION

We have taken into consideration that the number of events each year is limited to 16 and exclusive to the summer season when daylight saving is in place in NSW.

Night racing meetings will be scheduled between 6pm & 10pm This is 64 hours per season but as the lights will not be noticeable till the dusk, between 7.20pm & 8.30pm as the season changes, this is approx 34 hours per season. Races are every 30 minutes for 5 to 7 minutes. The lights will be slowly dimmed over 5mins to 20% between races so the full brightness will be for only for 20 minutes per hour or 11.5 hours per season annually.

On this basis, the frequency and extent of proposed lighting for night racing events is minimal and unlikely to cause adverse impacts. Any potential impacts are further minimised as the extent of light spill from the proposal is also minimal and well below the required illuminance levels (Lux) for adjoining residential development.

Dimming of the proposed lights provides secondary benefits, in terms of less light pollution to the night sky and less energy being consumed.

POLE SIZE

Poles are made from galvanised steel, which is recyclable. Pole heights are selected to effectively enable the required illumination for television coverage of the horse racing events. The least number of poles required is the optimum solution for various reasons.

Higher poles mean less poles as the luminaires can be more controlled in their aiming to the required plane. However, higher poles may be more conspicuous during the day. Less poles means the visual impact is reduced & less infrastructure & cabling throughout the site. Additionally, locations are co-ordinated with tree protection zones.

Randwick Racecourse is bounded by many mature trees on Alison Rd, Wansey Rd & High St. These substantially reduce the view of the poles from these directions.

SUSTAINABILITY

Due to the lack of available mains power on the site, the relatively few events per year and operational hours per year, the diesel generator solution was considered most viable.

While mains electricity would be preferred to diesel generation of energy in relation to sustainability, we considered the inclusion of additional kiosk substations to the electricity supply grid. However, it is anticipated that a new HV feeder would be required from the zone substation which would require intrusive and destructive works for cable laying relatively long distances. In addition, the diesel generator solution would save the embedded carbon footprint associated with the cables, conduits, cable insulation as well as the electromagnetic radiation and noise associated with any new HV infrastructure.

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The diesel generators were also selected due to the low amount of use required, their low visual impact and to avoid impact on the local grid network at peak periods of energy demand (in evenings in summer).

As such we believed the diesel generator supply strategy was the best outcome overall, regardless of the cost, as it represents a more 'time and place of use' system without the disadvantages of the HV feeder works.

Signed on behalf of IGS Pty Ltd

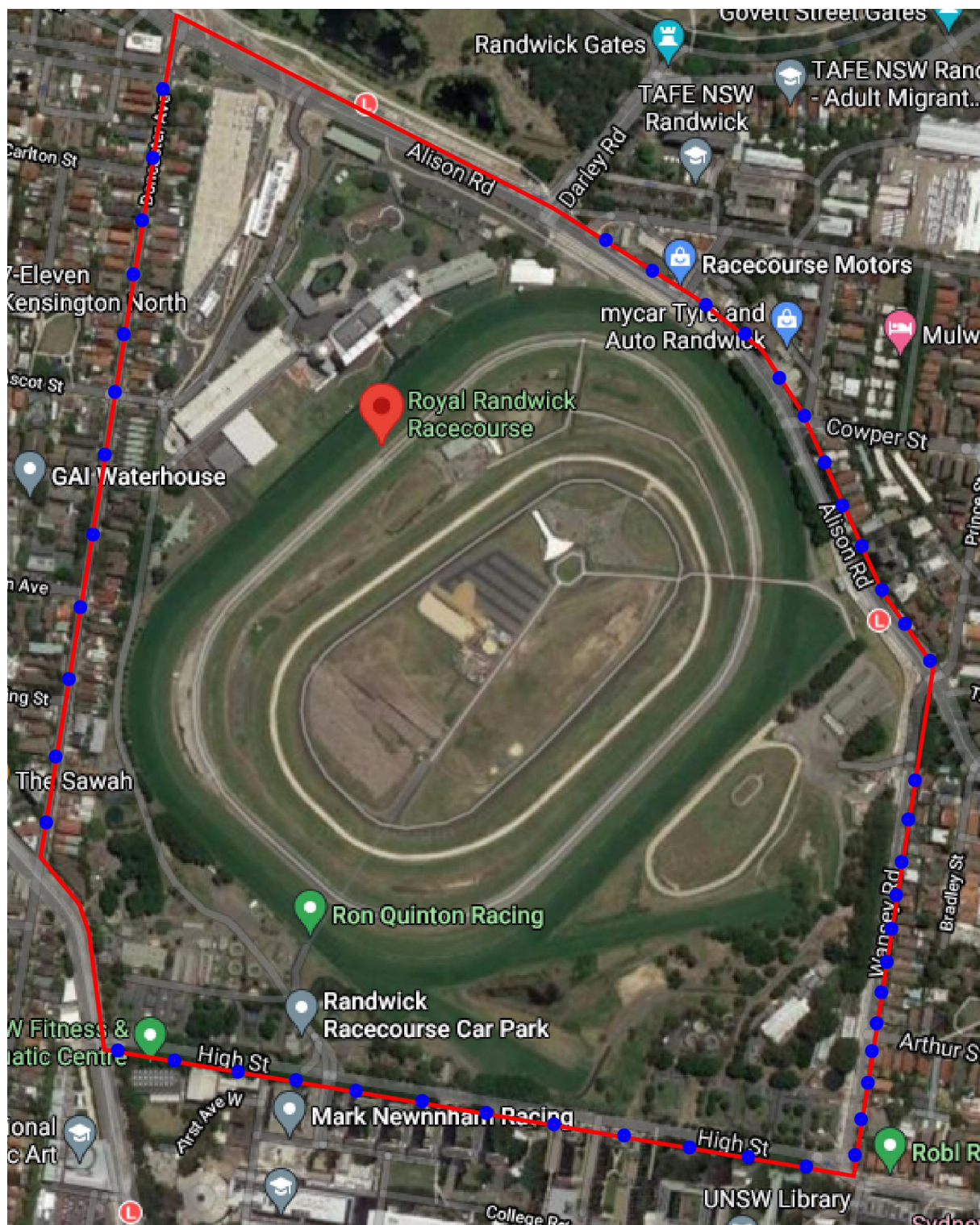
Regards

A handwritten signature in black ink, appearing to read "Julie Van Der Ley".

Julie Van Der Ley
Senior Lighting Designer
Grad Dip Des Sc Illum, MIES
Integrated Group Services

Vince Nigro
DIRECTOR
BE (Elec) MIEAust CPEng NER BDC (C8) RBPV RPEQ
Integrated Group Services

A handwritten signature in black ink, appearing to read "V. Nigro".



● INDICATES EACH LOCATION OF VERTICAL ILLUMINANCE MEASUREMENT RECORDING

GRID SUMMARY

Name: Houses 1
Spacing: 5.0m
Height: 1.5m above grade

ILLUMINATION SUMMARY

TV LLUX: Center of Track: vertical towards centre of racecourse
Entire Grid
Scan Average: 8.3652
Maximum: 21.4786
Minimum: 0.4597
No. of Points: 44

LUMINAIRE INFORMATION

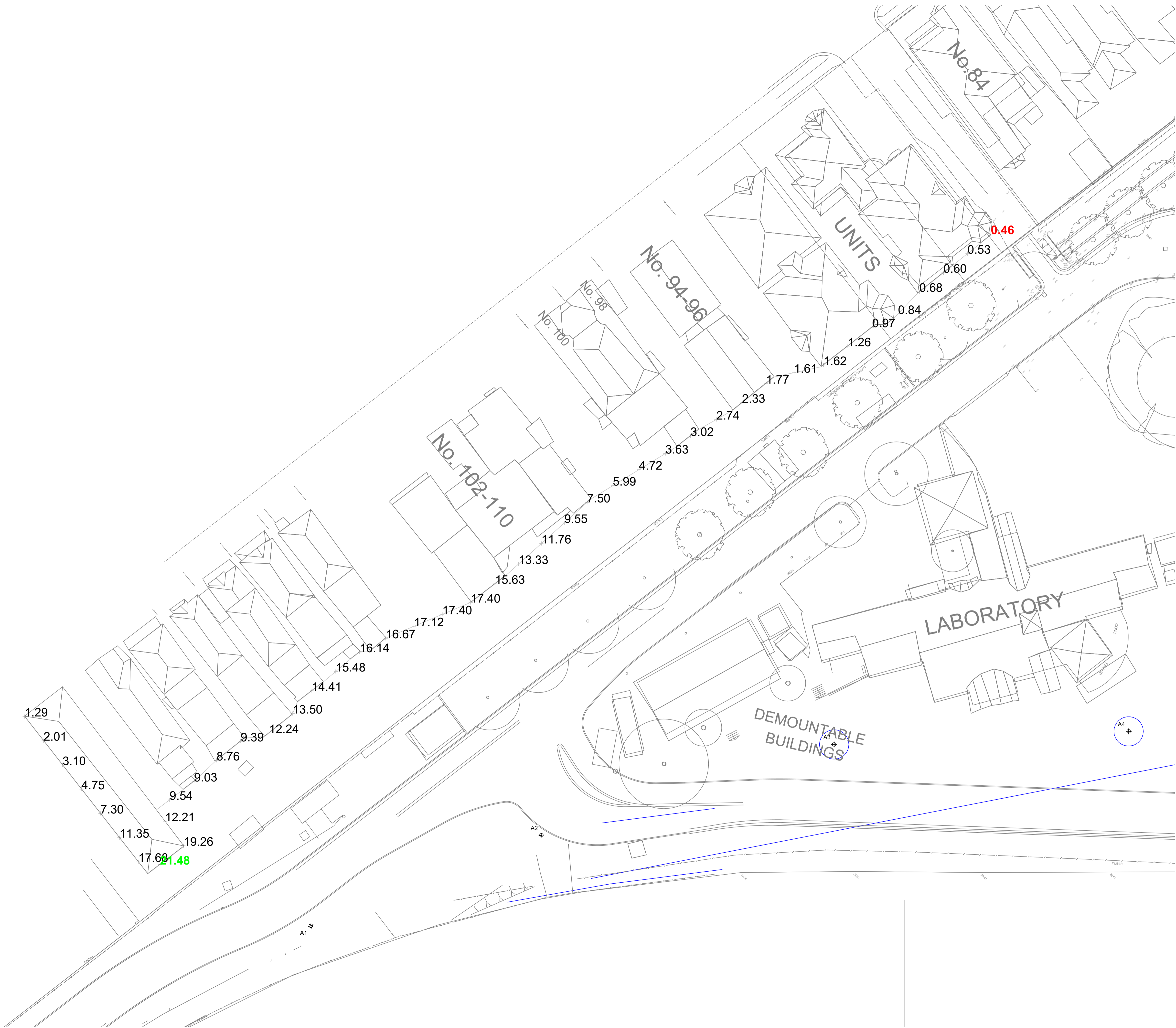
Applied Circuits: A, B, C
No. of Luminaires: 1894
Avg Load: 2708.42 kW
Max Load: 2568.29 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

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.



APPENDIX B

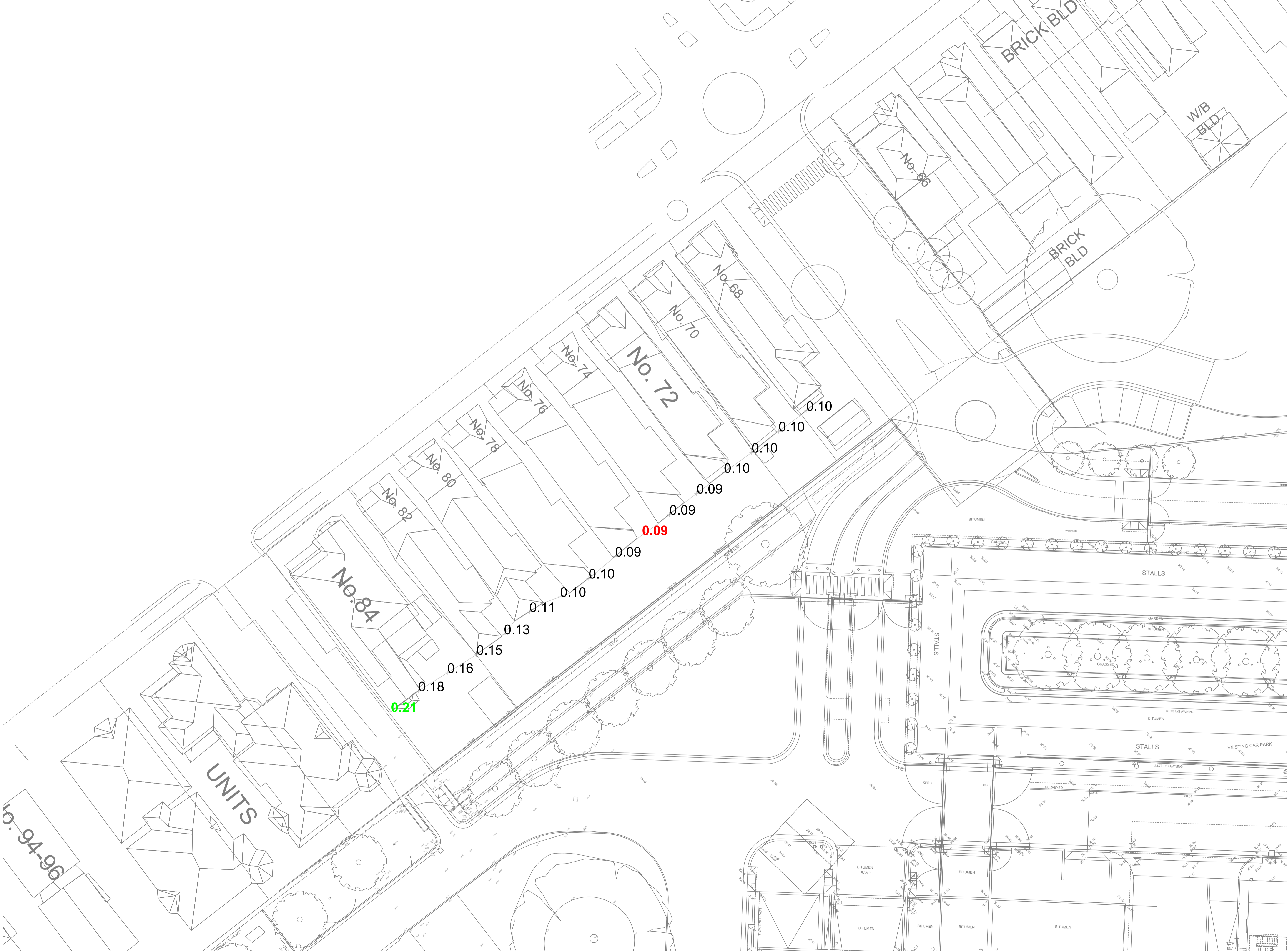
GRID SUMMARY	
Name:	Houses 2
Spacing:	5.0m
Height:	1.5m above grade
ILLUMINATION SUMMARY	
TV LUX: Center of Track:	vertical towards centre of racecourse
Entire Grid	
Scan Average:	0.1192
Maximum:	0.2100
Minimum:	0.0920
No. of Points:	16
LUMINAIRE INFORMATION	
Applied Circuits:	A, B, C
No. of Luminaires:	1894
Avg Load:	2708.42 kW
Max Load:	2568.29 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

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.



GRID SUMMARY

Name: Houses 3
Spacing: 5.0m
Height: 1.5m above grade

ILLUMINATION SUMMARY

TV LLUX: Center of Track: vertical towards centre of racecourse
Entire Grid
Scan Average: 0.0333
Maximum: 0.0707
Minimum: 0.0000
No. of Points: 51

LUMINAIRE INFORMATION

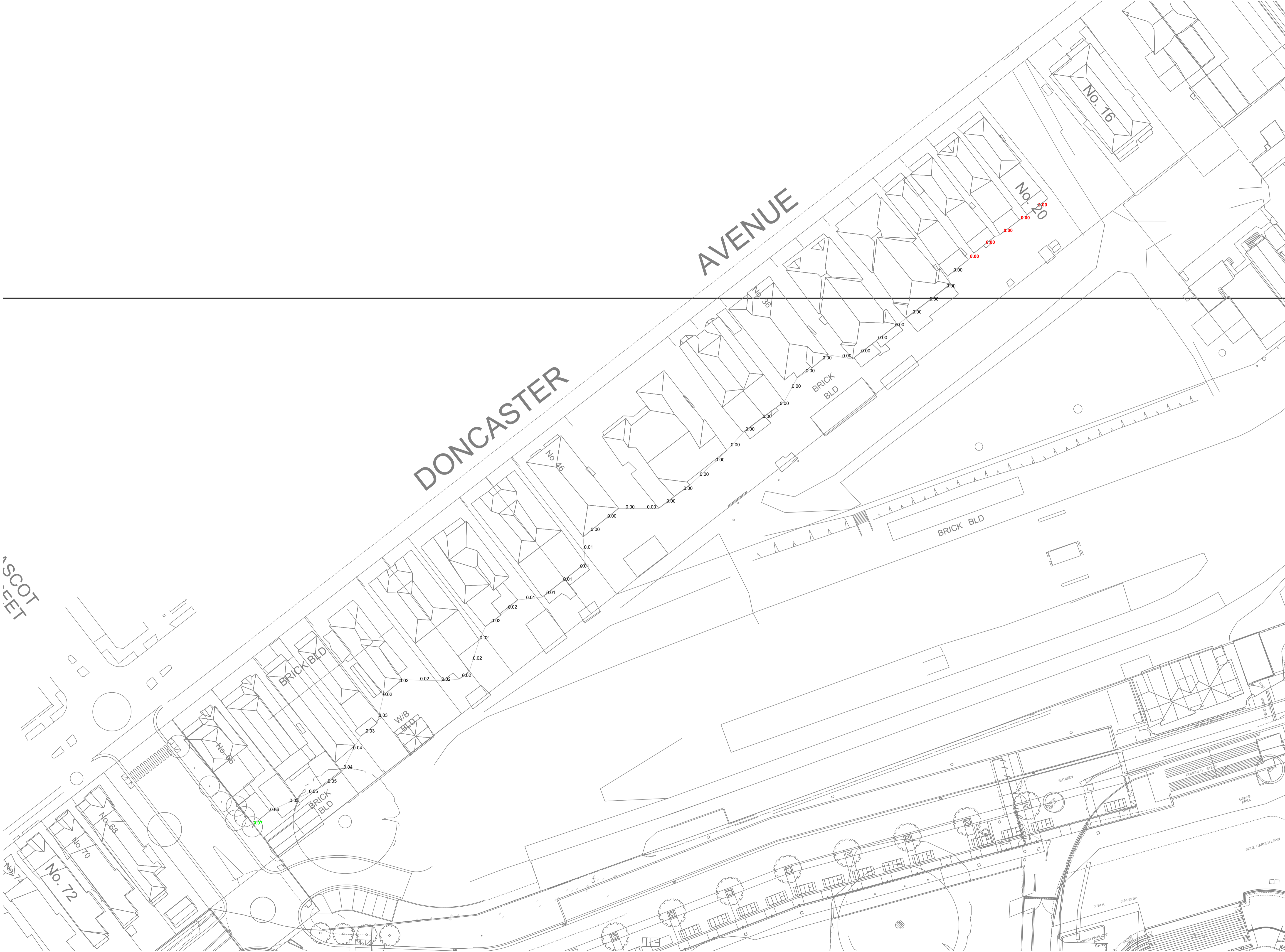
Applied Circuits: A, B, C
No. of Luminaires: 1894
Avg Load: 2708.42 kW
Max Load: 2568.29 kW

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SCALE 1:400

0 10m 20m

Pole location(s) Ⓢ dimensions are relative to 0.0 reference point(s) Ⓢ