

**Lighting Design Report and Specifications for**

**Clonburris, K1**  
**REV B**

|                |   |
|----------------|---|
| Client         | Kelland Homes Ltd.                                |
| Project number | 22047   |
| Designed by    | Patrick Redmond <i>MILP, MSLL, IEng, Tech IEI</i> |
| Date submitted | 15 <sup>th</sup> November 2022                    |



Redmond Analytical Management Services Ltd.  
8 Peare Campus, Moyne Park, Old Dublin Road, Enniscorthy, Co. Wexford. Y21 TD68  
Tel: 053 9231112 | Email: [info@redmondams.ie](mailto:info@redmondams.ie) | Web: [www.redmondams.ie](http://www.redmondams.ie)  
Company registration number: 557316  
Directors: P Redmond, M Redmond.

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**Accompanying Documents**

- 22047 Lighting class selection Clonburris, K1.
- 22047 Luminaire selection calculation Clonburris, K1.
- 22047 Luminaire selection report Clonburris, K1.
- 22047 Lighting level calculation full output Clonburris, K1 REV B.
- 22047 Lighting level report full output Clonburris, K1 REV B.
- 22047 Lighting level calculation dimmed by 25% Clonburris, K1 REV B.
- 22047 Lighting level report dimmed by 25% Clonburris, K1 REV B.
- 22047 Electrical calculations Clonburris, K1 REV B.
- 22047 Energy consumption calculation Clonburris, K1 REV A.
- 22047 Lighting layout drawing Clonburris, K1 REV B.
- 22047 Lighting layout drawing Clonburris, K1 REV B ~ PDF version.

## 1 General Information

The Safety, Health and Welfare at Work (Construction) Regulations 2013 clearly defines certain duties for Designers and for Project Supervisors, Design Stage. In order to meet these duties and to assist other designers and supervisors involved in this project to meet their duties we provide the following information. It must be noted that this information is based on our observations and there may be other risks that are beyond our knowledge on this project.

### 1.1 Client & Project

|                  |                      |
|------------------|----------------------|
| Project Name     | Clonburris, K1 REV B |
| Project Location | Clonburris, D22      |
| Client           | Kelland Homes Ltd.   |
| Contact          | Brian Cummins        |

### 1.2 Our Design Role

We have completed a lighting design for the above project to comply with relevant EU Norms, National Standards, and best guidance documents as appropriate.

|                                 |   |
|---------------------------------|---|
| European lighting standards     | <i>I.S. EN 13201-2:2015</i><br><i>I.S. EN 13201-5:2015</i><br><i>I.S. EN 12464-2:2007</i>   |
| Code of practise                | <i>BS 5489-1: 2020</i><br><i>ESN Networks National Code of Practice for the Customer Interface Version No. 5 April 2021</i>                         |
| Professional guidance documents | <i>ILP PLG03 (2012)</i><br><i>Technical Report 12. ILP (2007)</i><br><i>Guidance Note 01/20. ILP (2020)</i><br><i>Lighting Guide 21. SLL (2021)</i> |
| Electrical standard             | <i>I.S. 10101:2020</i>  |
| Lantern standard                | <i>EN 60598</i>   |
| Column standard                 | <i>EN 40</i>  |
| Column calculation method       | <i>BD94/07</i>  |
| Steelwork protection            | <i>EN 1461</i>  |

The design has been completed based on the drawings provided to us.

Our design covers the physical area defined by the calculation grids marked in the lighting design booklet accompanying this report.

It is not possible to incorporate the blocking and shadowing effect of trees, or other obstructions into the lighting level calculations.

## 2 Safety

We are committed to safe working practises and have done all in our power to identify and 'design out' hazards. If there is any detail within this design that requires clarification or



if you need further information, please contact us and we will endeavour to co-operate fully.

## **2.1 Particular Risks**

Using Schedule 1 *Non-exhaustive List of Work Involving Particular Risks to the Safety, Health and Welfare of Persons at Work* as a template, we have identified the following risks that affect the design process:

*None that we could identify.*

## **2.2 Other Risks**

In addition to the risks described in **2 Particular Risks** above, we have identified the following risks that affect the design process:

*None that we could identify.*

## **2.3 Construction and Risk Control**

It is the contractor's responsibility to ensure that their method of work meets their duty of care and requirements under the Safety, Health and Welfare at Work (Construction) Regulations 2013 and any other national or local requirements.

## **2.4 Electrical Safety Tests**

It is the electrical contractor's duty to calculate the appropriate fuse size for the electrical infrastructure.

It is the contractor's duty to ensure that all his electrical work meets relevant national and local standards. The contractor must ensure that all electrical safety testing is completed by a competent member of staff and that all test results are recorded and signed, and a copy given to the client and to us.

The maximum fuse size permitted by ESB Networks for unmetered public lighting is 6Amps per circuit. For discrimination, a 2Amp fuse should be used in the column cut out. However, this is subject to the required electrical testing undertaken by a competent electrician.

## **2.5 Lighting Columns as a Hazard**

Public lighting columns are defined in *BS 5489-1:2020 6.13* as a potential hazard to road users and defines minimal setbacks to the column face from the edge of the carriageway. In general, the edge of the carriageway is defined by the raised kerb in residential developments.

In this project we have located the columns at the back of the footpath or set back by at least 800mm from the kerb edge.

## **3 Lighting Design**

Using *S.R. CEN/TR 13201-1:2014 Table 4* we have determined that designing the lighting within the residential area to comply with *I.S. EN 13201-2:2015 P4* is appropriate for this project given its size, location, and usage.



### **3.1 Dimming**

We have designed the lighting to dim by 25% from 00:00 to 06:00 in line with dimming profile *U14*.

### **3.2 Constant Lumen Output**

The luminaires shall utilise constant lumen output.

### **3.3 Switching**

The luminaires will be operated by PECUs switching at 35/18<sub>lux</sub> levels.

### **3.4 Lighting Impact**

We select the luminaire that uses the lowest energy consumption for the specific application. We utilise the most appropriate lumen package (lumen output and distribution optics) to ensure efficient lighting of the target area and to minimise light spill outside of the area. Our energy consumption calculations are based on the requirements of *IS EN 13201-5:2015*.

We design using full cut off luminaires to ensure there is no direct upward light. We ensure that *threshold increment* is included in our calculations so that the luminaires are not a glare source.

We believe our lighting designs utilise the most energy efficient, sustainable luminaires currently available on the market and reflect practises laid out in relevant standards and in guidance notes from the professional bodies of which we are members, the Institution of Lighting Professionals and the Society of Light and Lighting.

## **4 Lighting Performance**

The lighting design has been carried out based on the performance of the selected luminaire. Any changes to the selected luminaire will make our design obsolete. This includes variation of specification of the luminaire by any member of the supply chain, including the original equipment manufacturer. Once this design has been approved by the local authority, any changes to the design will also require approval.

### **4.1 Maintenance Factor**

The luminaire manufacturer's stated *lumen depreciation factor* is 0.9 at 100,000 hours at 25<sup>o</sup> C for drive current selected. The *lamp survival factor* is 1. The mounting height, environmental zone and cleaning cycle derives a *luminaire maintenance factor* of 0.92 from *table C.1, BS 5489-1:2020*. This results in a *combined maintenance factor* of 0.83 which has been applied to the calculations.

### **4.2 Correlated Colour Temperature**

The light source shall have a correlated colour temperature (CCT) of 4,000 Kelvin.

### **4.3 Luminaire Selection**

We have selected a luminaire based on energy consumption, photometric performance, and general quality.

### **4.4 Luminaire Variation**

While we endeavour to use the smallest number of luminaire variations on our projects, our primary aim is to comply with relevant European lighting standards while minimising energy consumption, minimising light pollution and light spill.

We achieve this by selecting an appropriate lumen package to suit the geometry of the area to be illuminated.

#### **4.5 Design Luminaire**

In this instance, we have selected a design based on the stated photometric performance and energy consumption of the ASD Lighting Highway Diamond range.

### **5 Columns**

We have used 6m columns throughout the development. To allow for future maintenance access, we have utilised a number of hinged columns. The hinged columns are identified on the accompanying drawing.

#### **5.1 Trees and Landscaping**

Trees and tall growth should be pruned back so that they do not cause shadowing. No trees or tall shrubs can be planted within 6m of the column.

### **6 Cable and Ducting**

Ducting must be laid in accordance with the *National Rules for Electrical Installations I.S. 10101: Latest version*.

No cable joints are permitted. Cables can share ducts, but they must not be jointed in any manner.

No element of public lighting can stand on, or pass under, private property.

#### **6.1 Midi Pillars**

The project will require thirteen midi pillars, three of which will not be taken in charge.

Midi pillars must be located in places that afford ease of identification and access for future maintenance crews. They must be located logically so as not to cause any risk to maintenance crews in the future.

#### **6.2 Circuits**

Each midi pillar will supply three circuits each, except *MP 4*, *MP 10*, *MMP 12*, and *MMP 13* which will provide two circuits each. *MMP 11* will supply a single circuit.

### **7 Energy Consumption**

The total energy consumption for this project will be 4,697 kW/h per annum, including dimming.



## Appendix A Luminaire Quantities

| Luminaire Quantities |  |
|----------------------|--|
| Quantity             | Item   |
| 60                   | ASD Lighting HWD2-#4K12 300-S4-CLO Gen 5 1.81klm in neutral white (4000K) with 7 pin NEMA socket, DALI registered driver, and CLO. Programmed to dim by 25% from 00:00 to 06:00. Prewired to suit 6m column. Luminaire to comply with Appendix B attached. |
| 33                   | ASD Lighting HWD2-#4K04 400-N3-CLO Gen 5 0.74klm in neutral white (4000K) with 7 pin NEMA socket, DALI registered driver, and CLO. Programmed to dim by 25% from 00:00 to 06:00. Prewired to suit 6m column. Luminaire to comply with Appendix B attached. |
| 11                   | ASD Lighting HWD2-#4K12 300-S8-CLO Gen 5 1.73klm in neutral white (4000K) with 7 pin NEMA socket, DALI registered driver, and CLO. Programmed to dim by 25% from 00:00 to 06:00. Prewired to suit 6m column. Luminaire to comply with Appendix B attached. |
| 5                    | ASD Lighting HWD2-#4K08 350-S0-CLO Gen 5 1.38klm in neutral white (4000K) with 7 pin NEMA socket, DALI registered driver, and CLO. Programmed to dim by 25% from 00:00 to 06:00. Prewired to suit 6m column. Luminaire to comply with Appendix B attached. |
| 3                    | ASD Lighting HWD2-#4K16 700-M2-CLO Gen 5 3.95klm in neutral white (4000K) with 7 pin NEMA socket, DALI registered driver, and CLO. Programmed to dim by 25% from 00:00 to 06:00. Prewired to suit 6m column. Luminaire to comply with Appendix B attached. |
| 6                    | ASD Lighting HWD2-#4K12 400-S4-CLO Gen 5 2.29klm in neutral white (4000K) with 7 pin NEMA socket, DALI registered driver, and CLO. Programmed to dim by 25% from 00:00 to 06:00. Prewired to suit 6m column. Luminaire to comply with Appendix B attached. |
| 1                    | ASD Lighting HWD2-#4K04 200-N3-CLO Gen 5 0.40klm in neutral white (4000K) with 7 pin NEMA socket, DALI registered driver, and CLO. Programmed to dim by 25% from 00:00 to 06:00. Prewired to suit 6m column. Luminaire to comply with Appendix B attached. |
| 76                   | 6m column to comply with Appendix C attached.  |
| 38                   | 6m hinged column to comply with Appendix C attached.   |
| 3                    | Minimum outreach stub TEE bracket with zero inclination inclination to suit 6m column and to comply with Appendix C attached   |
| 119                  | 18/35 PECU.  |
| 117                  | Cut outs.  |
| 2                    | Twin cut out.  |
| 13                   | Midi pillar  |
| 36                   | Cable access chamber   |
| 3495                 | Metres (approximately) 2 core 6mm <sup>2</sup> NYCY cable to link columns.   |
| 3800                 | Metres (approximately) Rigid duct to comply with Appendix D attached.  |
| 130                  | Metres (approximately) flexi duct to comply with Appendix D attached.  |



## Appendix B Luminaire Specification

1. Luminaires shall be fully compliant with the *Single Light Regulation ~ Commission Regulation (EU) 2019/2020 of 5<sup>th</sup> December 2019*. The luminaire shall be registered on the EPREL website and labelled in accordance with the regulation requirements.
2. Luminaires shall be registered on SEAI's Triple E and ACA registers.
3. Luminaires shall be CE marked in line with *Directive 2014/35/EU* or later. Note that *UK Equivalent Certification* is not valid in the Republic of Ireland.
4. Luminaires shall be manufactured in compliance with *IEC 62504:2014 + A1:2018* or later.
5. Luminaires shall be compliant with the following electrical safety standards:
  - *EN 60598-1:2015 + A1:2018*
  - *EN 60598-2-3:2003 + A1:2011*
  - *EN 6038-1:2017 + A1:2017*
  - *EN 62031:2008 + A2:2015*
  - *IEC 61347-2-13:2014 + A1:2017*
6. Luminaires shall be compliant with *EN 62471:2008*.
7. Luminaires shall be compliant with *EN 55015:2013+A1:2015*, and with *EN 61547:2009 COR 2015*.
8. Luminaires shall be compliant with the following performance standards:
  - *EN 62384:2006 + A1:2009*
  - *EN 62386 101:2014/AMD1:2018*
  - *EN 62386 102:2014/AMD1:2018*
  - *EN 62386 103:2014/AMD1:2018*
  - *EN 62386-207:2018*
  - *EN 62707-1:2013 + A1:2018*
  - *EN 62717:2017 + A2:2019*
  - *EN 62722-2-1:2016*
  - *EN 61643-11:2012 + A11:2018*
  - *IEC 62262:2002*
  - *IEC TR 62696:2011*
9. Luminaires shall be manufactured in accordance with the European Directive on Waste Electrical and Electronic Equipment (*WEEE*).
10. The luminaire shall be designed specifically to be used with LED light sources.
11. The correlated colour temperature (*CCT*) of the source shall be as described in *Section 4.2* of this design report.
12. The binning of the LED chips shall be within a five step MacAdam ellipse.
13. The luminaire shall be rated to operate at 230V ± 10% at 50 Hertz.
14. Power factor correction shall not exceed 0.9 at 100% lumen output, or 0.8 when dimmed.
15. The luminaire shall utilise constant lumen output (*CLO*), unless the lumen depreciation factor (*LDF*) is less than 98% at 100,000 hours operation, in which case the additional complexity may make *CLO* obsolete.

16. The luminaire shall be fitted with surge protection in accordance with *EN 61643-11:2012 + A11:2018* rated 10kA/1010kV. Surge protection shall be the first component encountered in the circuit to ensure protection for all components within the luminaire.
17. The luminaire, and mounting arrangement, shall be constructed in a robust manner and suitable for Irish climatic conditions in an ambient temperature of -35°C to +55°C. The luminaire shall have a minimum impact resistance of *IK08*.
18. The luminaire body shall be protected against ingress to *IP 66*.
19. The luminaire shall be protected to a level of 1,000 hour salt fog test as a minimum in accordance with *EN ISO 9227*.
20. Except for blanking covers to permit detection, communications, or other such functionality, the luminaire shall be manufactured from die cast corrosion resistant marine grade aluminium alloy in accordance with either: *EN AC 44100*, or *EN AC 44200*, or *EN AC 44300*.
21. The luminaire, and mounting arrangement, shall be powder coated in accordance with relevant industry norms, or EU standard. All externally visible components of the luminaire shall be of the same colour, except for decorative applications.
22. The light source shall be modular and replaceable on site. The module shall be fixed in a manner that maximises heat transfer from the chip and board.
23. The light source shall be protected by an appropriate material and shall be protected against ingress to *IP 66* and have a minimum impact resistance to *IK08*.
24. The original equipment manufacturer (*OEM*) shall ensure that all components within the luminaire are compatible in both performance and thermal management to ensure that lumen depreciation factor (*LDF*) or any other life prediction methodology is not shortened or compromised. This shall include any component, or accessory.
25. The driver shall be *DALI* registered and capable of two-way communication and interaction with a *control and management system (CMS)* or shall be capable of being controlled by 1 to 10.
26. The driver shall have over temperature protection.
27. The ingress protection rating of the entire luminaire shall be maintained over the operational life of the product.
28. The luminaire shall be provided by the original equipment manufacturer (*OEM*) prewired with a minimum 1.5mm<sup>2</sup> artic flex for mounting heights up to 6m, and a minimum 2.5mm<sup>2</sup> artic flex for mounting heights above 6m. The cable shall be suitable for the application and comply with *BS 6004*. The cable shall be of sufficient length to permit an adequate drip loop to be provided on luminaire installation. The cable shall have sufficient cores to allow for the safe electrical connection, and for data transmission from ground level to the luminaire. Colour codes of the conductor insulating shall be in accordance with *I.S. 10101:2020*, or later.

The requirement for ground level data transfer excludes the following local authorities:

- Wexford County Council.
- Laois County Council.
- South Dublin County Council.
- Dun Laoghaire Rathdown County Council.
- Fingal County Council.
- Dublin City Council.



29. All fixtures, bolts, screws all other mechanical fixtures shall be captive and constructed from noncorrosive materials.
30. All covers, or openings, required to be opened during installation or maintenance shall be captive when open.
31. All wiring shall be heat resistant and comply with *I.S. EN 60598*.
32. Electrical connection terminals shall be indelibly marked to indicate all wiring connections and use shrouded screws. Control equipment shall bear a clear circuit diagram to indicate all component connections in a clear and concise manner. Operating voltages shall be clearly marked within the luminaire enclosure.
33. Electrical terminals shall be capable of terminating three core 2.5mm<sup>2</sup> flexible cable.
34. *LDF* shall not exceed 0.1 at 100,000 operating hours in Irish climatic conditions and ambient temperatures.
35. *Lamp survival factor* (LSF) shall be equal to, or less than 1 at 100,000 operating hours in Irish climatic conditions and ambient temperatures.
36. The temperature that photometric data is measured shall be stated and shall not be less than 15°C.
37. The weight of the entire luminaire assembly shall not exceed 18kg and shall be stated.
38. The maximum projected side area (*windage*) of the luminaire shall not exceed 0.18m<sup>2</sup> and shall be stated.
39. A comprehensive written warranty shall be provided for the entire luminaire covering a minimum period of ten years from date of installation. Full details will be provided in how the local authority can access this warranty if they are taking the luminaire in charge rather than procuring directly.



## Appendix C Column & Bracket Specification

The column, column door, bracket and any adaptors shall be designed to comply with all sections of *I.S. EN 40* and in accordance with *BD 94/07*. The column, bracket and any adaptors shall be of suitable size to bear the specified lantern and to achieve a nominal height to light source as called for by the lighting design.

Columns, column doors, brackets, and any adaptors shall have a fatigue design life of a minimum 30 years in Irish coastal environment in accordance with *I.S. EN 40-3-3*. All columns, column doors, brackets, and any adaptors shall have a written warranty for ten years. Written details shall be provided on how a local authority shall access this warranty where they are not part of the supply chain, such as when taking in charge.

The column, column door, bracket, and any adaptor manufacturer shall be registered with and certified by either NSAI, British Standards Institute of Quality Assurance Services or Lloyds Register Quality Assurance Register for the design, manufacture, supply and verification of road lighting columns and brackets under their quality assessment schedule to ISO 9001 latest version.

The quality assurance certification shall relate to the specific lighting column material being proposed. The local authority reserves the right to request proof of certification from the proposed column manufacturer.

Aluminium columns can be considered for use, especially as they can be more environmentally favourable than steel columns.

Brackets will be manufactured from the same material as the column.

Columns shall be located to provide sufficient set back from the kerb edge so as not to present a hazard to road users. Where cycle lanes are present, sufficient set back shall be provided so as not to endanger cyclists.

On shared surfaces such as *Homezones* provision shall be made so that columns can be positioned safely. Often it will fall to the project architect to provide appropriate space for the column and associated infrastructure, including ducting and section pillars.

Public lighting columns cannot stand in private property.

The column will comply with the following specifications:

- 1 The column, column door, bracket and/or adaptor shall be of functional design and suitable for the location and intended loading.
- 2 The column, column door, bracket and/or adaptor shall be protected against the ingress of moisture at the top and at the door entry.
- 3 Steel column, column door, bracket and/or adaptor shall be galvanised to *BS EN 1461* latest version.
- 4 Column roots shall be protected with bitumen or other appropriate material. This protection should extend 100mm above ground level.

Column roots shall have a cable slot at an appropriate depth to allow electrical cable ingress and egress. The cable slot shall be formed so as to prevent damage to draw rope or electrical cable.

- 5 Doors shall be fitted in such a way as to minimise the risk of being pried off. Twin locks shall be fitted. Column and door should have earth terminals of suitable mechanical type.

- 6 A suitable non-hygroscopic backboard will be fitted in line with the door and be large enough to take local authority approved termination units.
- 7 The space between the door and the backboard will be sufficient to enable the fitment of termination units as required by the County Council.
- 8 Each lantern shall be individually protected with a suitable fuse unit in the column base.
- 9 Neutral blocks, or looping-in blocks, shall be of an approved grooved bore 63A type, fully insulated and solidly mounted on the backboard.
- 10 Columns shall be wired with a minimum 2.5mm<sup>2</sup> PVC/PVC stranded copper cable.
- 11 All columns shall comply with *I.S. 10101:2020* and regulations with regard to minimum door height.
- 12 Columns shall be installed so that their doors are aligned at 90° to the curb edge to enable maintenance personnel face towards oncoming traffic.
- 13 Close protection of street lighting lanterns to be provided by a 25A rated cut-out loaded with a 6A fuse incorporating a *cam lever* single pole disconnection. The cut-out will use a separate neutral and earth. The cut-out must provide ingress protection to *IP21* as defined by *EN 60529*. This fuse type is colloquially identified as conforming to *BS 88*.
- 14 The cut-out shall be constructed to conform to the requirements laid out in *BS 7654* for example: *MC040SLF 25A SLCO TYPE 1 (SNE)* by Lucy Zodion. Note that other cut-outs that meet this specification will be acceptable so long as they are an established and recognised, quality brand and do not have a negative impact on maintenance stock requirements of the local authority or their agents.
- 15 Where three phase supply is required, then separate link boxes will be installed in the column below the cut-out to allow for interconnecting. Link boxes must comply with the requirements laid out in *BS 7657:2010*. Link boxes will be supplied for live 1, live 2, live 3, neutral and finally earth. The link box must provide ingress protection to *IP21* as defined by *EN 60529*.
- 16 All terminals shall be formed from solid brass and be electroplated for temperature rise stability. Terminals shall have a serrated bore to ensure good contact with all types of conductors. The incoming terminals shall have additional protection, provided by a red safety shield to guard against accidental contact with live metal.
- 17 All components required will be firmly fixed to the backboard of the column in a tidy professional manner. All conductors will be stripped to the appropriate length to allow for connection. No exposed conductors shall be allowed.
- 18 The column shall be earthed from the incoming cable via a 6mm<sup>2</sup> PVC cable which will be connected to the column by a crimped lug.
- 19 The column shall carry a unique, permanent, and weather resistant identification label. The label shall durably legible. It shall be mounted in the column base and be visible after electrical fit out has been completed.

The label shall carry the following information:

- The manufacturer.
- Product model.
- Year of manufacture.



- Standard to which the product has been designed and manufactured to comply with.
- 20 Where future access by maintenance contractors *MEWP* is difficult, or require reversing over significant distances, then hinged columns shall be used.



## Appendix D Ducting Specification

- 1 Ducting shall comply with *I.S. EN 61386-1-22-23-24* and shall be single wall, coloured red and manufactured from high density polyethylene. The nominal external diameter of the duct shall be 107mm with a minimal wall thickness of 5mm. Each length of duct shall be stamped with the legend 'Public Lighting' or 'Street Lighting', in 18mm black lettering repeated at 1000mm intervals. Ducts shall be laid with the legend facing upwards.
- 2 The duct shall withstand a 750 Newton load rating for 5% deflection.
- 3 Ducting shall be laid in fully coupled, unbroken lengths and shall be installed to achieve the minimum depths of armoured cable required by *I.S. 10101* latest version, and local authority requirements. Typical depths for the cable are 750mm at road crossings, 450mm under footpaths, and 600mm under grass or other softer materials.
- 4 Ducting shall be laid in a straight line, close to the line of columns and shall contain a continuous, knot free, draw line of minimum 8kN.
- 5 Ducting shall be laid on a bed of sand and surrounded with sand. After compacting, the sand bed shall be a minimum of 50mm deep at the bottom of the duct, 25mm at either side of the duct, and 150mm above the duct.

An electrical hazard warning tape shall be laid on top of the sand along the entire length of the ducting at approximately 300mm below finished ground level. The tape shall be made of plastic, coloured yellow, with the legend 'Caution Electric Cable Below'.

The remainder of the trench shall be backfilled to ground to ground level using material free of sharp stones, or stones greater in size than 50mm.

Road crossing ducts shall be adequately protected by a cover of lean mix concrete and at a depth consistent with road construction requirements but shall not be less than 750mm deep.

- 6 Duct ends shall be protected from the ingress of rubble or any other material. All ducts shall be installed so that no undue stress is placed on cables when pulled. Ducts shall be aligned as straight as possible horizontally and vertically. Sweeps shall be as gradual as possible.
- 7 Where ducts must be cut, it shall be with an appropriate tool and cuts shall be such that they do not affect the sealing of joints. The duct shall be completely deburred before installation.
- 8 The interior of the duct shall be cleaned with an appropriate brush, in both directions, following installation.
- 9 Following installation, and prior to backfilling, the duct shall be tested by drawing a cylindrical mandrel through. The mandrel shall be 300mm long and have a diameter that is 10% smaller than the internal diameter of the duct, or 10mm smaller, whichever is smaller.
- 10 Immediately after cleaning and testing, each shall be fitted with a continuous draw rope of 10mm diameter, free of knots, and with a minimum 8kN breaking strength.

A surplus of 2m of draw rope shall be left neatly coiled at each end of the duct. The ends of the draw rope shall be secured in a manner that prevents accidental withdrawal of the rope.

The ends of the duct shall then be closed off with purpose made caps or bungs to prevent ingress of water or foreign material.

- 11 Flexible duct is not acceptable as a substitute to rigid duct and is only appropriate in the following instances:
  - When linking columns to rigid duct.
  - For runs less than 2m in length.
  - Where tight turns are required and there is insufficient space for cable access chambers.
- 12 Cable access chambers shall be provided at the following locations:
  - At the intersection of duct runs.
  - At the divergence of duct runs.
  - At both sides of road crossings.
  - At both ends of ducting under shared surfaces, with a single access chamber in front of each column.
  - At any location where bends are equal to, or greater than 90 degrees.
  - At any location where proprietary 'duct bends' cannot be used due to constricted space.
  - At either side of any substantial change in installation, at either side of a bridge for example.
  - At substantial changes in height.
- 13 Prefabricated chambers of plastic, or similar material shall not be used.
- 14 Public lighting ducting cannot pass under private property.



## Appendix E Electrical Cable Specification

All electrical cables shall comply with the requirements of *I.S. 10101* latest version, and with local authority specifications.

All cables to be installed in ducting shall be armoured. Cable loading will be derived by appropriate calculation methods by a competent designer but will have a minimum conductor size of 0.6mm<sup>2</sup>.

Cable can be either: 2 core NYCY, 3 core PVC/SWA/PVC, or 3 core XPLE/SWA/PVC. Cable type and size will be detailed in *Appendix A* of this design report.

Electrical cable specifications are to be as follows as a minimum:

- 1 Only armoured cable can be installed underground.
- 2 SWA cable to *BS 6346 (0.6 / 1kV)*.
- 3 SWA cable to *BS 5477 / I.S. 273 (0.6 / 1kV)*.
- 4 NYCY cable to *DIN VDE 0276 - 603 (0.6 / 1kV)*.
- 5 The steel sheath of SWA shall not be used as an earth conductor.
- 6 Glands shall be used in accordance with manufacturer's instruction to provide an earth with when using NYCY.
- 7 Cable joints are not permitted.
- 8 Only one cable incoming, and one cable outgoing shall be used, maximum of two, shall be installed in a column. This means that a supply circuit cannot normally be split to provide a spur, except in limited circumstances as designed by a competent person.
- 9 The bending radius of the cable shall never be less than the manufacturer's specified limit. The minimum bending radius is normally 8 x total diameter of the cable.
- 10 Underground cables shall be protected for the entire run by ducting, column foundation sleeves and cable access chambers. No section of cable shall be in contact with the soil or ground.

## Appendix F Public Lighting Midi (Section) Pillar

Public lighting midi pillars, also known as section pillars, must not be located within two metres of an ESBN customer service pillar.

Public lighting section pillars shall not be located on private property. They shall be in logical locations that are easily accessible by maintenance crews. When the pillar is not located on a footpath, then a concrete plinth shall be constructed, longer and wider than the pillar by 100mm in each direction.

For unmetered connections, the supply shall be single phase. The total electrical load shall not exceed 2kVA per section pillar.

- 1 All columns shall be supplied from a dedicated public lighting midi pillar located adjacent to the ESBN customer service pillar. Total electrical loading shall be calculated for each circuit. The electrical characteristics shall be provided, along with a single line electrical schematic.
- 2 The pillar shall consist of a rectangular box of approximate dimensions above ground of 150mm deep, 250mm width, and 600mm high. The root section shall be 320mm long and turned out at the bottom by 50mm. This root section will be protected by bitumen or other suitable material.
- 3 After fabrication the pillar, and root section shall be hot dipped galvanized both inside and outside in accordance with *BS EN 1461*.
- 4 The pillar shall be fitted with a recessed, lift-out, door with a weather strip all round. The door shall be fixed with an M8 triangular headed locking screw at the top onto a suitably tapped fixing plate and secured at the bottom by a fixed catch onto the weather strip.
- 5 The door shall be equipped with a suitable unobtrusive finger grip to facilitate easy removal of the door.
- 6 The minimum opening size shall be 220mm wide by 510mm high.
- 7 The pillar shell, door and extension plates shall be of 3mm thick mild steel. The pillar, when fabricated, shall be suitable for free standing or recessing into a wall.
- 8 A suitable non-hygroscopic backboard shall be fitted in each pillar which shall be easily removable.
- 9 A main earth terminal shall also be provided with an insulated earth lead to the door.
- 11 The pillar shall have a smooth exterior finish and be free of all sharp and rough edges, both outside and inside.
- 12 All electrical components shall be securely mounted on the baseboard.
- 13 All outgoing circuits shall be individually fused by means of a 20A HRC fuse unit, capable of accommodating cable sizes up to 25mm<sup>2</sup>. The fuse shall be rated 16kA minimum rupturing capacity and shall comply with *BS 1361*. The terminals of the fuse unit shall be of the grooved bore type. Unless appropriate calculations call for a different size fuse.
- 14 RCDs must not be used.
- 15 Where there is more than one outgoing circuit, a main fuse shall also be provided. The main fuse shall be rated 25A and shall otherwise be identical with individual circuit fuses.
- 16 The electrical contractor shall consult with the local ESB Networks office on ESB interface requirements at the Customer Service Pillar.



- 17 The installed pillar shall be embedded in concrete, *Class E, Clause 1502*, Specification for Road-works, published by the Department of the Environment.
- 18 The front of all public lighting section pillars shall display a permanent rigid danger warning sign (black lettering on a yellow background), 100mm wide by 120mm deep, securely fixed, as per the local authority specification.

All public lighting midi pillars shall be earthed, using an earth electrode and the supply neutralised. The electrode shall consist of a bare copper, or hot dipped galvanised steel rod/pipe of at least 16mm diameter, driven vertically into the soil for a length of at least 1,200mm. If difficulties arise in driving the vertical rod, due to underground services, a horizontal earth electrode may be installed as follows:

- A straight length of at least 4.5m of either:
    - 16mm diameter bare copper.
    - 16mm diameter hot dipped galvanised steel rod.
    - 25mm<sup>2</sup> cross-section bare copper.
    - 25mm<sup>2</sup> cross-section hot dipped galvanised steel rod.
  - They shall be buried in the soil to a depth of at least 500mm. The earthing lead shall exit the pillar through the services cable entry opening.
- 19 The connection at the earth electrode shall be accessible for inspection and shall be protected against corrosion by a suitable waterproof tape. The connection shall be enclosed in a galvanised steel box, with an inspection cover. After inspection, the connection shall be buried underground.
  - 20 A main earth terminal shall be mounted on the pillar baseboard, with the following connections:
    - 10mm<sup>2</sup> PVC cable from the earth terminal on the pillar, with a crimped lug connection to the pillar,
    - 10mm<sup>2</sup> PVC cable from the earth electrode,
    - 10mm<sup>2</sup> PVC cable from the neutral link.
  - 21 A main earth terminal shall be mounted on the baseboard in each lighting column, with the following connections:
    - 6mm<sup>2</sup> PVC cable from the earth terminal to the column, with a crimped lug connection to the column,
    - 2.5mm<sup>2</sup> PVC cable from the lantern earth terminal.
  - 22 The outer sheath of the incoming and/or outgoing service cable shall be connected to the main earth terminal, in the case of both the lighting column and the public lighting customer service pillar.
  - 23 Earth continuity cables shall be coloured yellow/green, in accordance with *I.S. 10101* latest version, wiring rules. In the case of NYCY cables, appropriate yellow/green sleeving shall be used.

## P Classification Selection

Project Name Clonburris, K1

Project Number 22047

From Table 4 - Parameters for the selection of lighting class P CEN/TR 13201-1:2014

| Parameter           | Options                                     | Description  | Weighting Value $V_w^a$              | Designer Selection |
|---------------------|---|--|--------------------------------------|--------------------|
| Travel speed        | Low   | $v \leq 40\text{km/h}$   | 1                                    | 1                  |
|                     | Very low (walking speed)                    | Very low, walking speed  | 0                                    |                    |
| Use intensity       | Busy  |  | 1                                    |                    |
|                     | Normal                                      |  | 0                                    | 0                  |
|                     | Quiet                                       |  | -1                                   |                    |
| Traffic composition | Pedestrians, cyclists and motorised traffic |  | 2                                    |                    |
|                     | Pedestrians and motorised traffic           |  | 1                                    | 1                  |
|                     | Pedestrians and cyclists only               |  | 1                                    |                    |
|                     | Pedestrians only                            |  | 0                                    |                    |
| Parked vehicles     | Cyclists only                               |  | 0                                    |                    |
|                     | Present                                     |  | 1                                    |                    |
|                     | Not present                                 |  | 0                                    | 0                  |
| Ambient luminosity  | High  | Shopping windows, advertisement expressions, sports fields, station areas, storage areas | 1                                    |                    |
|                     | Moderate                                    | Normal situation   | 0                                    | 0                  |
|                     | Low   |  | -1                                   |                    |
| Facial recognition  | Necessary                                   |  | Additional requirements <sup>b</sup> |                    |
|                     | Not necessary                               |  | No additional requirements           |                    |

<sup>a</sup> The values stated in the column are an example. Any adaption of the method or more appropriate weighting values can be used instead, on the national level.

<sup>b</sup> Specific guidelines on use of facial recognition parameter are defined at national level for each country.

**Number of lighting classes** 6

**Weighting value  $V_w$**  2

**Lighting class selected** 4



**DATE:** 15 November 2022  
**DESIGNER:** Patrick Redmond  
**PROJECT No:** 22047  
**PROJECT NAME:** Clonburris, K1 REV B



Lighting designed to comply with I.S. EN 13201-2:2015 P4, with a neutral (4,000K) source, due to the nature of the development.  
Energy consumption assessed in accordance with I.S. EN 13201-5:2015.

LMF 0.92 x LDF 0.9 x LSF 1 = MF 0.83 at 100,000 hours at 25 degrees ambient. Photometry measured at minimum 15 degree ambient.

Luminaire A, B, & D = 12W. Luminaire C = 6W.  
Luminaire E = 10W. Luminaire F = 33W. Luminaire G = 15W.  
Luminaire H = 4W. Connected load, averaged for CLO.

## Light Level ~ Full Output

**PREPARED BY:** Patrick Redmond MILP, MSLI, IEng, Tech IEI  
Redmond Analytical Management Services Ltd.  
M~ 086 2356356  
O~ 053 9231112  
patrick@redmondams.ie  
8 Peare Campus, Moyne Park, Old Dublin Road,  
Enniscorthy, Co. Wexford. Y21 TD68  
www.redmondams.ie  
Document control: TD 01 Version: 1.0

## Layout Report

### General Data

Dimensions in Metres Angles in Degrees

### Calculation Grids

| ID | Grid Name | X          | Y         | X' Length | Y' Length | X' Spacing | Y' Spacing |
|----|-----------|------------|-----------|-----------|-----------|------------|------------|
| 1  | Phase 1   | 2404333.18 | 732467.63 | 170.92    | 204.87    | 1.50       | 1.50       |
| 2  | Phase 1A  | 2404310.64 | 732384.35 | 229.68    | 82.51     | 1.49       | 1.47       |
| 3  | Phase 2   | 2404464.91 | 732487.26 | 239.30    | 194.77    | 1.50       | 1.50       |
| 4  | Phase 2A  | 2404527.51 | 732445.22 | 193.81    | 49.15     | 1.49       | 1.49       |

### Luminaires

#### Luminaire A Data

|                      |                                 |
|----------------------|---------------------------------|
| Supplier             | ASD Lighting                    |
| Type                 | HWD2-#4K12 300-S4-CLO Gen 5     |
| Lamp(s)              | LED                             |
| LampFlux(klm)/Colour | 1.81 4000/72                    |
| File Name            | HWD2-#4K12 300-S4-CLO (12W).ldt |
| Maintenance Factor   | 0.83                            |
| Imax70,80,90(cd/klm) | 536.0, 29.5, 0.6                |
| No. in Project       | 51                              |

#### Luminaire B Data

|                      |                                 |
|----------------------|---------------------------------|
| Supplier             | ASD Lighting                    |
| Type                 | HWD2-#4K12 300-S4-CLO Gen 5     |
| Lamp(s)              | LED                             |
| LampFlux(klm)/Colour | 1.81 4000/72                    |
| File Name            | HWD2-#4K12 300-S4-CLO (12W).ldt |
| Maintenance Factor   | 0.83                            |
| Imax70,80,90(cd/klm) | 536.0, 29.5, 0.6                |
| No. in Project       | 9                               |

#### Luminaire C Data

|                      |                                |
|----------------------|--------------------------------|
| Supplier             | ASD Lighting                   |
| Type                 | HWD2-#4K04 400-N3-CLO Gen 5    |
| Lamp(s)              | LED                            |
| LampFlux(klm)/Colour | 0.74 4000/72                   |
| File Name            | HWD2-#4K04 400-N3-CLO (6W).ldt |
| Maintenance Factor   | 0.83                           |
| Imax70,80,90(cd/klm) | 1101.0, 90.2, 1.0              |
| No. in Project       | 33                             |

#### Luminaire D Data

|                      |                                 |
|----------------------|---------------------------------|
| Supplier             | ASD Lighting                    |
| Type                 | HWD2-#4K12 300-S8-CLO Gen 5     |
| Lamp(s)              | LED                             |
| LampFlux(klm)/Colour | 1.73 4000/72                    |
| File Name            | HWD2-#4K12 300-S8-CLO (12W).ldt |
| Maintenance Factor   | 0.83                            |
| Imax70,80,90(cd/klm) | 513.1, 38.5, 0.3                |
| No. in Project       | 11                              |

#### Luminaire E Data

|                      |                                 |
|----------------------|---------------------------------|
| Supplier             | ASD Lighting                    |
| Type                 | HWD2-#4K08 350-S0-CLO Gen 5     |
| Lamp(s)              | LED                             |
| LampFlux(klm)/Colour | 1.38 4000/72                    |
| File Name            | HWD2-#4K08 350-S0-CLO (10W).ldt |
| Maintenance Factor   | 0.83                            |
| Imax70,80,90(cd/klm) | 455.1, 52.5, 0.5                |
| No. in Project       | 5                               |

#### Luminaire F Data

|                      |                                 |
|----------------------|---------------------------------|
| Supplier             | ASD Lighting                    |
| Type                 | HWD2-#4K16 700-M2-CLO Gen 5     |
| Lamp(s)              | LED                             |
| LampFlux(klm)/Colour | 3.95 4000/72                    |
| File Name            | HWD2-#4K16 700-M2-CLO (33W).ldt |
| Maintenance Factor   | 0.83                            |
| Imax70,80,90(cd/klm) | 846.5, 206.8, 2.0               |
| No. in Project       | 3                               |



**Luminaires**

**Luminaire G Data**

|                      |                                 |
|----------------------|---------------------------------|
| Supplier             | ASD Lighting                    |
| Type                 | HWD2-#4K12 400-S4-CLO Gen 5     |
| Lamp(s)              | LED                             |
| LampFlux(klm)/Colour | 2.29 4000/72                    |
| File Name            | HWD2-#4K12 400-S4-CLO (15W).ldt |
| Maintenance Factor   | 0.83                            |
| Imax70,80,90(cd/klm) | 537.8, 29.1, 0.6                |
| No. in Project       | 6                               |

**Luminaire H Data**

|                      |                                |
|----------------------|--------------------------------|
| Supplier             | ASD Lighting                   |
| Type                 | HWD2-#4K04 200-N3-CLO Gen 5    |
| Lamp(s)              | LED                            |
| LampFlux(klm)/Colour | 0.40 4000/72                   |
| File Name            | HWD2-#4K04 200-N3-CLO (4W).ldt |
| Maintenance Factor   | 0.83                           |
| Imax70,80,90(cd/klm) | 1080.3, 101.3, 1.1             |
| No. in Project       | 1                              |

**Layout**

| ID    | Type | X          | Y         | Height | Angle  | Tilt | Cant | Out-reach | Target X | Target Y | Target Z |
|-------|------|------------|-----------|--------|--------|------|------|-----------|----------|----------|----------|
| PL 1  | A    | 2404392.44 | 732495.21 | 6.00   | 0.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 2  | A    | 2404386.75 | 732528.02 | 6.00   | 0.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 3  | A    | 2404399.95 | 732535.48 | 6.00   | 181.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 4  | A    | 2404383.60 | 732552.49 | 6.00   | 1.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 5  | A    | 2404399.17 | 732556.06 | 6.00   | 184.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 6  | A    | 2404375.43 | 732580.33 | 6.00   | 23.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 7  | A    | 2404389.34 | 732585.15 | 6.00   | 198.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 8  | A    | 2404365.59 | 732607.64 | 6.00   | 17.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 9  | A    | 2404380.79 | 732608.76 | 6.00   | 198.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 10 | A    | 2404376.56 | 732634.28 | 6.00   | 203.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 11 | A    | 2404363.62 | 732637.89 | 6.00   | 341.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 12 | A    | 2404380.17 | 732647.41 | 6.00   | 292.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 13 | A    | 2404406.91 | 732657.15 | 6.00   | 293.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 14 | A    | 2404436.93 | 732657.37 | 6.00   | 224.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 15 | A    | 2404427.52 | 732649.95 | 6.00   | 356.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 16 | D    | 2404411.90 | 732526.02 | 6.00   | 277.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 17 | D    | 2404431.83 | 732526.69 | 6.00   | 276.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 18 | A    | 2404470.70 | 732521.56 | 6.00   | 135.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 19 | A    | 2404463.87 | 732541.04 | 6.00   | 2.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 20 | A    | 2404455.64 | 732570.69 | 6.00   | 23.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 21 | A    | 2404445.21 | 732599.58 | 6.00   | 19.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 22 | A    | 2404434.61 | 732628.34 | 6.00   | 22.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 23 | A    | 2404340.35 | 732489.93 | 6.00   | 0.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 24 | A    | 2404349.91 | 732502.07 | 6.00   | 188.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 25 | C    | 2404465.70 | 732500.09 | 6.00   | 4.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 26 | C    | 2404478.27 | 732537.46 | 6.00   | 213.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 27 | C    | 2404484.96 | 732519.44 | 6.00   | 214.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 28 | C    | 2404496.45 | 732504.04 | 6.00   | 203.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 29 | D    | 2404333.41 | 732413.11 | 6.00   | 284.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 30 | D    | 2404352.29 | 732419.23 | 6.00   | 284.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 31 | D    | 2404327.81 | 732392.32 | 6.00   | 105.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 32 | D    | 2404358.25 | 732400.48 | 6.00   | 105.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 33 | A    | 2404372.54 | 732419.54 | 6.00   | 187.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 34 | A    | 2404357.55 | 732431.21 | 6.00   | 0.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 35 | A    | 2404359.31 | 732452.72 | 6.00   | 0.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 36 | A    | 2404376.12 | 732454.81 | 6.00   | 181.00 | 0.00 | 0.00 | 0.40      |          |          |          |



**Layout Continued**

| ID    | Type | X          | Y         | Height | Angle  | Tilt | Cant | Out-reach | Target X | Target Y | Target Z |
|-------|------|------------|-----------|--------|--------|------|------|-----------|----------|----------|----------|
| PL 37 | C    | 2404389.72 | 732442.77 | 6.00   | 96.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 38 | C    | 2404419.31 | 732444.67 | 6.00   | 95.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 39 | E    | 2404441.53 | 732423.57 | 6.00   | 95.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 40 | E    | 2404437.31 | 732447.31 | 6.00   | 276.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 41 | E    | 2404436.08 | 732462.32 | 6.00   | 7.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 42 | C    | 2404453.74 | 732450.19 | 6.00   | 106.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 43 | C    | 2404476.67 | 732453.52 | 6.00   | 102.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 44 | C    | 2404498.66 | 732456.98 | 6.00   | 102.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 45 | A    | 2404504.37 | 732471.28 | 6.00   | 11.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 46 | A    | 2404517.93 | 732472.36 | 6.00   | 190.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 47 | A    | 2404511.33 | 732446.35 | 6.00   | 14.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 48 | E    | 2404527.30 | 732456.66 | 6.00   | 274.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 49 | G    | 2404524.10 | 732513.51 | 6.00   | 188.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 50 | A    | 2404509.00 | 732536.63 | 6.00   | 20.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 51 | A    | 2404500.36 | 732562.38 | 6.00   | 20.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 52 | A    | 2404490.79 | 732591.09 | 6.00   | 20.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 53 | A    | 2404481.46 | 732620.43 | 6.00   | 16.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 54 | A    | 2404494.62 | 732641.03 | 6.00   | 179.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 55 | A    | 2404485.02 | 732654.25 | 6.00   | 317.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 56 | A    | 2404502.46 | 732656.74 | 6.00   | 269.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 57 | A    | 2404533.01 | 732655.32 | 6.00   | 270.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 58 | F    | 2404558.96 | 732654.20 | 6.00   | 269.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 59 | F    | 2404590.90 | 732652.85 | 6.00   | 269.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 60 | A    | 2404613.16 | 732649.63 | 6.00   | 221.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 61 | A    | 2404606.39 | 732636.10 | 6.00   | 26.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 62 | A    | 2404629.58 | 732622.15 | 6.00   | 207.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 63 | A    | 2404645.68 | 732594.46 | 6.00   | 208.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 64 | F    | 2404658.73 | 732568.06 | 6.00   | 179.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 65 | A    | 2404539.43 | 732526.60 | 6.00   | 100.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 66 | A    | 2404535.24 | 732540.39 | 6.00   | 283.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 67 | A    | 2404574.14 | 732535.43 | 6.00   | 117.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 68 | A    | 2404567.20 | 732547.98 | 6.00   | 297.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 69 | A    | 2404612.83 | 732537.29 | 6.00   | 102.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 70 | A    | 2404610.34 | 732551.38 | 6.00   | 281.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 71 | A    | 2404642.88 | 732546.26 | 6.00   | 122.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 72 | A    | 2404635.82 | 732558.73 | 6.00   | 304.00 | 0.00 | 0.00 | 0.40      |          |          |          |



**Layout Continued**

| ID     | Type | X          | Y         | Height | Angle  | Tilt | Cant | Out-reach | Target X | Target Y | Target Z |
|--------|------|------------|-----------|--------|--------|------|------|-----------|----------|----------|----------|
| PL 73  | C    | 2404556.03 | 732515.65 | 6.00   | 9.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 74  | C    | 2404629.30 | 732527.60 | 6.00   | 5.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 75  | C    | 2404661.07 | 732537.81 | 6.00   | 11.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 76  | C    | 2404663.97 | 732525.37 | 6.00   | 169.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 77  | C    | 2404671.03 | 732553.67 | 6.00   | 207.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 78  | C    | 2404671.81 | 732535.79 | 6.00   | 20.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 79  | C    | 2404685.34 | 732524.99 | 6.00   | 226.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 80  | G    | 2404586.11 | 732536.91 | 6.00   | 9.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 81  | E    | 2404598.40 | 732520.71 | 6.00   | 194.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 82  | G    | 2404586.73 | 732558.39 | 6.00   | 207.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 83  | G    | 2404571.57 | 732569.37 | 6.00   | 24.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 84  | G    | 2404560.63 | 732592.09 | 6.00   | 24.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 85  | G    | 2404553.00 | 732615.33 | 6.00   | 1.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 86  | A    | 2404549.13 | 732638.56 | 6.00   | 0.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 87  | A    | 2404563.02 | 732633.89 | 6.00   | 181.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 88  | C    | 2404489.26 | 732576.45 | 6.00   | 24.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 89  | C    | 2404481.77 | 732594.24 | 6.00   | 234.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 90  | C    | 2404476.60 | 732606.23 | 6.00   | 166.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 91  | C    | 2404467.09 | 732596.82 | 6.00   | 295.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 92  | C    | 2404472.17 | 732626.54 | 6.00   | 23.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 93  | C    | 2404472.62 | 732641.90 | 6.00   | 347.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 94  | H    | 2404643.18 | 732545.75 | 6.00   | 301.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 95  | B    | 2404624.47 | 732485.44 | 6.00   | 5.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 96  | C    | 2404617.66 | 732476.83 | 6.00   | 104.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 97  | C    | 2404590.80 | 732472.71 | 6.00   | 100.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 98  | C    | 2404580.27 | 732482.04 | 6.00   | 194.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 99  | C    | 2404565.51 | 732468.95 | 6.00   | 100.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 100 | C    | 2404545.34 | 732465.75 | 6.00   | 100.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 101 | C    | 2404533.15 | 732478.24 | 6.00   | 206.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| ML 102 | B    | 2404361.17 | 732584.24 | 6.00   | 119.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| ML 103 | C    | 2404366.51 | 732582.60 | 6.00   | 110.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 104 | D    | 2404451.82 | 732527.50 | 6.00   | 275.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| ML 105 | D    | 2404407.86 | 732506.83 | 6.00   | 189.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| ML 106 | D    | 2404408.52 | 732491.35 | 6.00   | 182.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| ML 107 | D    | 2404422.22 | 732509.98 | 6.00   | 94.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| ML 108 | D    | 2404453.82 | 732511.50 | 6.00   | 93.00  | 0.00 | 0.00 | 0.40      |          |          |          |



**Layout Continued**

| ID     | Type | X          | Y         | Height | Angle  | Tilt | Cant | Out-reach | Target X | Target Y | Target Z |
|--------|------|------------|-----------|--------|--------|------|------|-----------|----------|----------|----------|
| ML 109 | B    | 2404424.00 | 732501.52 | 6.00   | 2.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| ML 110 | C    | 2404426.08 | 732549.04 | 6.00   | 81.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| ML 111 | C    | 2404407.71 | 732550.15 | 6.00   | 290.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| ML 112 | C    | 2404434.24 | 732545.19 | 6.00   | 184.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 113 | B    | 2404372.20 | 732527.28 | 6.00   | 275.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 114 | B    | 2404373.97 | 732508.46 | 6.00   | 271.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 115 | B    | 2404373.05 | 732487.12 | 6.00   | 272.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 116 | B    | 2404373.03 | 732487.53 | 6.00   | 91.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 117 | B    | 2404373.95 | 732509.04 | 6.00   | 89.00  | 0.00 | 0.00 | 0.40      |          |          |          |
| PL 118 | B    | 2404356.61 | 732519.07 | 6.00   | 5.00   | 0.00 | 0.00 | 0.40      |          |          |          |
| ML 119 | C    | 2404427.86 | 732497.17 | 6.00   | 275.00 | 0.00 | 0.00 | 0.40      |          |          |          |

# Horizontal Illuminance (lux)

Phase 1



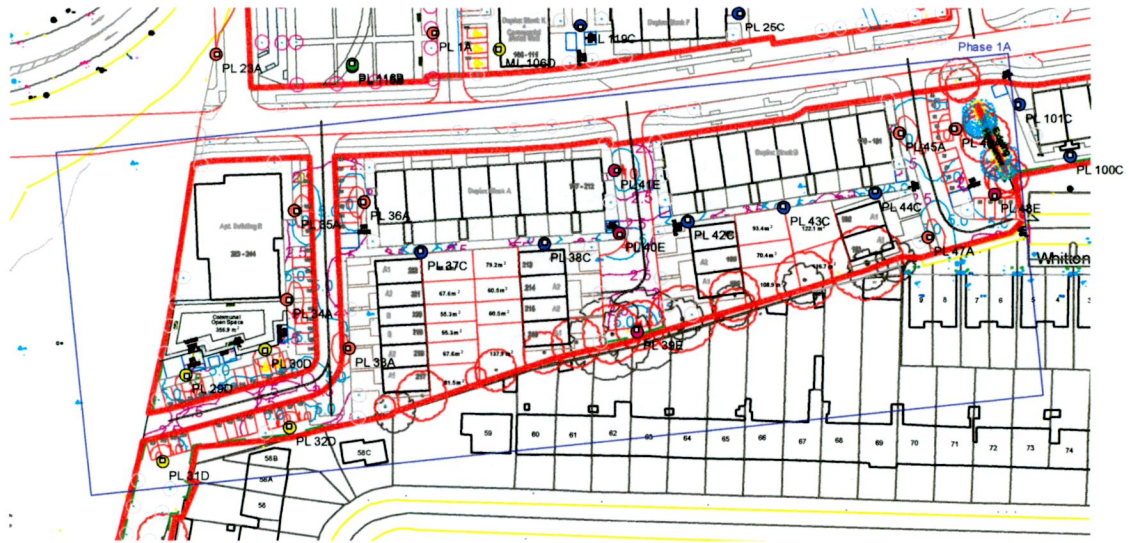
## Results

|           |       |
|-----------|-------|
| Eav       | 5.88  |
| Emin      | 1.15  |
| Emax      | 17.26 |
| Emin/Emax | 0.07  |
| Emin/Eav  | 0.20  |
|           |       |



# Horizontal Illuminance (lux)

Phase 1A

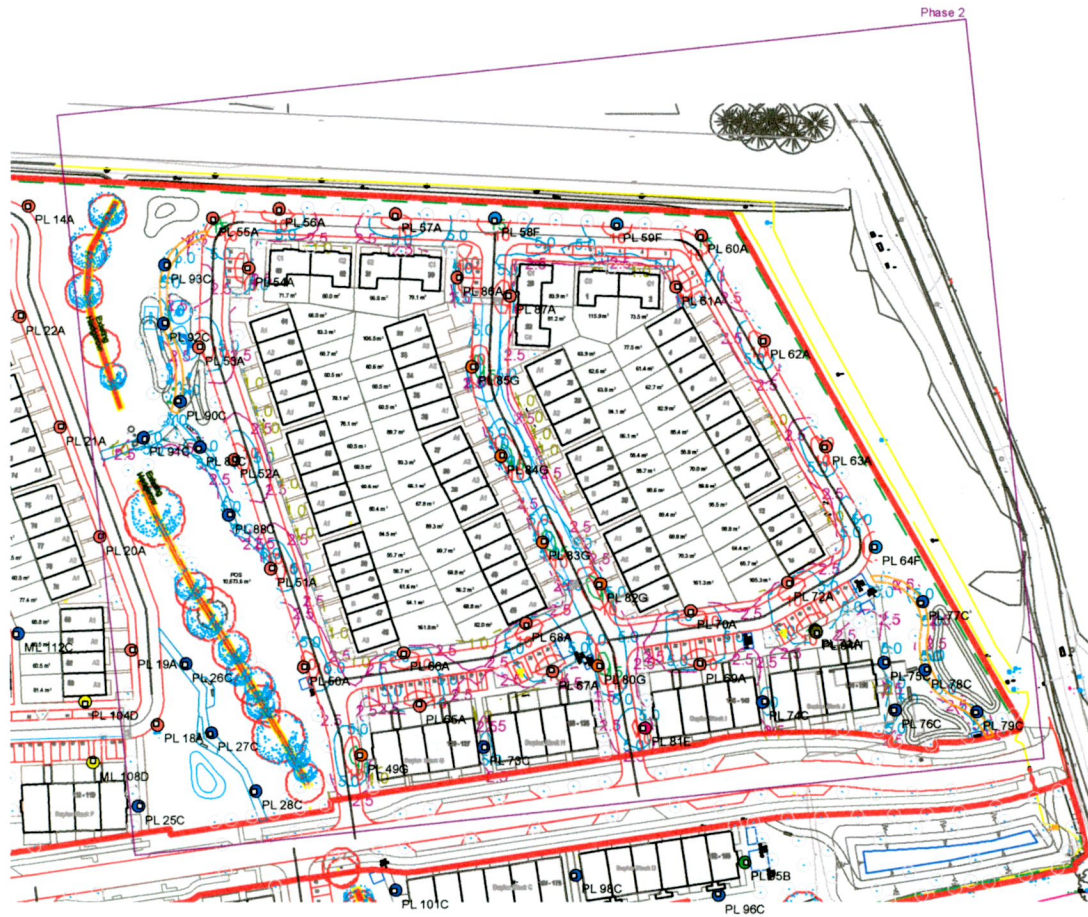


## Results

|           |       |
|-----------|-------|
| Eav       | 5.15  |
| Emin      | 1.09  |
| Emax      | 15.12 |
| Emin/Emax | 0.07  |
| Emin/Eav  | 0.21  |
|           |       |

## Horizontal Illuminance (lux)

Phase 2



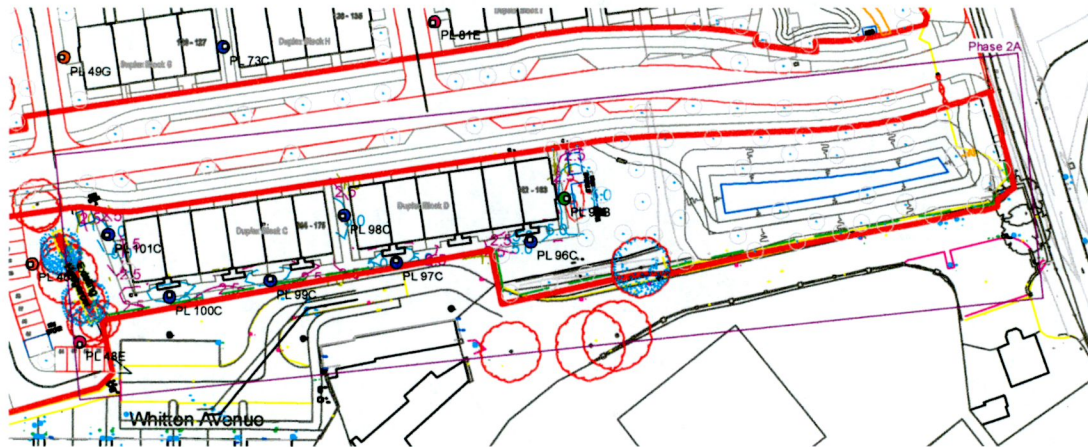
### Results

|           |       |
|-----------|-------|
| Eav       | 5.85  |
| Emin      | 1.16  |
| Emax      | 19.38 |
| Emin/Emax | 0.06  |
| Emin/Eav  | 0.20  |
|           |       |



## Horizontal Illuminance (lux)

Phase 2A



### Results

|                                    |       |
|------------------------------------|-------|
| Eav                                | 5.14  |
| Emin                               | 1.16  |
| E <sub>max</sub>                   | 13.99 |
| E <sub>min</sub> /E <sub>max</sub> | 0.08  |
| E <sub>min</sub> /E <sub>av</sub>  | 0.23  |

DATE: 15 November 2022  
DESIGNER: Patrick Redmond  
PROJECT No: 22047  
PROJECT NAME: Clonburris, K1 REV B



Lighting designed to comply with I.S. EN 13201-2:2015 P4, prior to dimming by 25%, with a neutral (4,000K) source, due to the nature of the development. Energy consumption assessed in accordance with I.S. EN 13201-5:2015.

LMF 0.92 x LDF 0.9 x LSF 1 = MF 0.83 at 100,000 hours at 25 degrees ambient. Photometry measured at minimum 15 degree ambient.

Luminaire A, B, & D = 9W. Luminaire C = 5W.  
Luminaire E = 8W. Luminaire F = 25W. Luminaire G = 11W.  
Luminaire H = 3W. Dimmed load, averaged for CLO.

## Light Level ~ Dimmed By 25%

PREPARED BY: Patrick Redmond MILP, MSL, IEng, Tech IEI  
Redmond Analytical Management Services Ltd.  
M~ 086 2356356  
O~ 053 9231112  
patrick@redmondams.ie  
8 Peare Campus, Moyne Park, Old Dublin Road,  
Enniscorthy, Co. Wexford. Y21 TD68  
www.redmondams.ie  
Document control: TD 01 Version: 1.0



## Layout Report

### General Data

Dimensions in Metres Angles in Degrees

### Calculation Grids

| ID | Grid Name | X          | Y         | X' Length | Y' Length | X' Spacing | Y' Spacing |
|----|-----------|------------|-----------|-----------|-----------|------------|------------|
| 1  | Phase 1   | 2404333.18 | 732467.63 | 170.92    | 204.87    | 1.50       | 1.50       |
| 2  | Phase 1A  | 2404310.64 | 732384.35 | 229.68    | 82.51     | 1.49       | 1.47       |
| 3  | Phase 2   | 2404464.91 | 732487.26 | 239.30    | 194.77    | 1.50       | 1.50       |
| 4  | Phase 2A  | 2404527.51 | 732445.22 | 193.81    | 49.15     | 1.49       | 1.49       |

### Luminaires

#### Luminaire A Data

|                      |                                 |
|----------------------|---------------------------------|
| Supplier             | ASD Lighting                    |
| Type                 | HWD2-#4K12 300-S4-CLO Gen 5     |
| Lamp(s)              | LED                             |
| LampFlux(klm)/Colour | 1.81 4000/72                    |
| File Name            | HWD2-#4K12 300-S4-CLO (12W).ldt |
| Maintenance Factor   | 0.83                            |
| Imax70,80,90(cd/klm) | 536.0, 29.5, 0.6                |
| No. in Project       | 51                              |

#### Luminaire B Data

|                      |                                 |
|----------------------|---------------------------------|
| Supplier             | ASD Lighting                    |
| Type                 | HWD2-#4K12 300-S4-CLO Gen 5     |
| Lamp(s)              | LED                             |
| LampFlux(klm)/Colour | 1.81 4000/72                    |
| File Name            | HWD2-#4K12 300-S4-CLO (12W).ldt |
| Maintenance Factor   | 0.83                            |
| Imax70,80,90(cd/klm) | 536.0, 29.5, 0.6                |
| No. in Project       | 9                               |

#### Luminaire C Data

|                      |                                |
|----------------------|--------------------------------|
| Supplier             | ASD Lighting                   |
| Type                 | HWD2-#4K04 400-N3-CLO Gen 5    |
| Lamp(s)              | LED                            |
| LampFlux(klm)/Colour | 0.74 4000/72                   |
| File Name            | HWD2-#4K04 400-N3-CLO (6W).ldt |
| Maintenance Factor   | 0.83                           |
| Imax70,80,90(cd/klm) | 1101.0, 90.2, 1.0              |
| No. in Project       | 33                             |

#### Luminaire D Data

|                      |                                 |
|----------------------|---------------------------------|
| Supplier             | ASD Lighting                    |
| Type                 | HWD2-#4K12 300-S8-CLO Gen 5     |
| Lamp(s)              | LED                             |
| LampFlux(klm)/Colour | 1.73 4000/72                    |
| File Name            | HWD2-#4K12 300-S8-CLO (12W).ldt |
| Maintenance Factor   | 0.83                            |
| Imax70,80,90(cd/klm) | 513.1, 38.5, 0.3                |
| No. in Project       | 11                              |

#### Luminaire E Data

|                      |                                 |
|----------------------|---------------------------------|
| Supplier             | ASD Lighting                    |
| Type                 | HWD2-#4K08 350-S0-CLO Gen 5     |
| Lamp(s)              | LED                             |
| LampFlux(klm)/Colour | 1.38 4000/72                    |
| File Name            | HWD2-#4K08 350-S0-CLO (10W).ldt |
| Maintenance Factor   | 0.83                            |
| Imax70,80,90(cd/klm) | 455.1, 52.5, 0.5                |
| No. in Project       | 5                               |

#### Luminaire F Data

|                      |                                 |
|----------------------|---------------------------------|
| Supplier             | ASD Lighting                    |
| Type                 | HWD2-#4K16 700-M2-CLO Gen 5     |
| Lamp(s)              | LED                             |
| LampFlux(klm)/Colour | 3.95 4000/72                    |
| File Name            | HWD2-#4K16 700-M2-CLO (33W).ldt |
| Maintenance Factor   | 0.83                            |
| Imax70,80,90(cd/klm) | 846.5, 206.8, 2.0               |
| No. in Project       | 3                               |

## Luminaires

### Luminaire G Data

|                      |                                 |
|----------------------|---------------------------------|
| Supplier             | ASD Lighting                    |
| Type                 | HWD2-#4K12 400-S4-CLO Gen 5     |
| Lamp(s)              | LED                             |
| LampFlux(klm)/Colour | 2.29 4000/72                    |
| File Name            | HWD2-#4K12 400-S4-CLO (15W).ldt |
| Maintenance Factor   | 0.83                            |
| Imax70,80,90(cd/klm) | 537.8, 29.1, 0.6                |
| No. in Project       | 6                               |

### Luminaire H Data

|                      |                                |
|----------------------|--------------------------------|
| Supplier             | ASD Lighting                   |
| Type                 | HWD2-#4K04 200-N3-CLO Gen 5    |
| Lamp(s)              | LED                            |
| LampFlux(klm)/Colour | 0.40 4000/72                   |
| File Name            | HWD2-#4K04 200-N3-CLO (4W).ldt |
| Maintenance Factor   | 0.83                           |
| Imax70,80,90(cd/klm) | 1080.3, 101.3, 1.1             |
| No. in Project       | 1                              |



**Layout**

| ID    | Type | X          | Y         | Height | Angle  | Tilt | Cant | Out-reach | Dimmed to | Target X | Target Y | Target Z |
|-------|------|------------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| PL 1  | A    | 2404392.44 | 732495.21 | 6.00   | 0.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 2  | A    | 2404386.75 | 732528.02 | 6.00   | 0.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 3  | A    | 2404399.95 | 732535.48 | 6.00   | 181.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 4  | A    | 2404383.60 | 732552.49 | 6.00   | 1.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 5  | A    | 2404399.17 | 732556.06 | 6.00   | 184.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 6  | A    | 2404375.43 | 732580.33 | 6.00   | 23.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 7  | A    | 2404389.34 | 732585.15 | 6.00   | 198.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 8  | A    | 2404365.59 | 732607.64 | 6.00   | 17.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 9  | A    | 2404380.79 | 732608.76 | 6.00   | 198.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 10 | A    | 2404376.56 | 732634.28 | 6.00   | 203.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 11 | A    | 2404363.62 | 732637.89 | 6.00   | 341.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 12 | A    | 2404380.17 | 732647.41 | 6.00   | 292.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 13 | A    | 2404406.91 | 732657.15 | 6.00   | 293.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 14 | A    | 2404436.93 | 732657.37 | 6.00   | 224.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 15 | A    | 2404427.52 | 732649.95 | 6.00   | 356.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 16 | D    | 2404411.90 | 732526.02 | 6.00   | 277.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 17 | D    | 2404431.83 | 732526.69 | 6.00   | 276.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 18 | A    | 2404470.70 | 732521.56 | 6.00   | 135.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 19 | A    | 2404463.87 | 732541.04 | 6.00   | 2.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 20 | A    | 2404455.64 | 732570.69 | 6.00   | 23.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 21 | A    | 2404445.21 | 732599.58 | 6.00   | 19.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 22 | A    | 2404434.61 | 732628.34 | 6.00   | 22.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 23 | A    | 2404340.35 | 732489.93 | 6.00   | 0.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 24 | A    | 2404349.91 | 732502.07 | 6.00   | 188.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 25 | C    | 2404465.70 | 732500.09 | 6.00   | 4.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 26 | C    | 2404478.27 | 732537.46 | 6.00   | 213.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 27 | C    | 2404484.96 | 732519.44 | 6.00   | 214.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 28 | C    | 2404496.45 | 732504.04 | 6.00   | 203.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 29 | D    | 2404333.41 | 732413.11 | 6.00   | 284.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 30 | D    | 2404352.29 | 732419.23 | 6.00   | 284.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 31 | D    | 2404327.81 | 732392.32 | 6.00   | 105.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 32 | D    | 2404358.25 | 732400.48 | 6.00   | 105.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 33 | A    | 2404372.54 | 732419.54 | 6.00   | 187.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 34 | A    | 2404357.55 | 732431.21 | 6.00   | 0.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 35 | A    | 2404359.31 | 732452.72 | 6.00   | 0.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 36 | A    | 2404376.12 | 732454.81 | 6.00   | 181.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |



**Layout Continued**

| ID    | Type | X          | Y         | Height | Angle  | Tilt | Cant | Out-reach | Dimmed to | Target X | Target Y | Target Z |
|-------|------|------------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| PL 37 | C    | 2404389.72 | 732442.77 | 6.00   | 96.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 38 | C    | 2404419.31 | 732444.67 | 6.00   | 95.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 39 | E    | 2404441.53 | 732423.57 | 6.00   | 95.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 40 | E    | 2404437.31 | 732447.31 | 6.00   | 276.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 41 | E    | 2404436.08 | 732462.32 | 6.00   | 7.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 42 | C    | 2404453.74 | 732450.19 | 6.00   | 106.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 43 | C    | 2404476.67 | 732453.52 | 6.00   | 102.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 44 | C    | 2404498.66 | 732456.98 | 6.00   | 102.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 45 | A    | 2404504.37 | 732471.28 | 6.00   | 11.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 46 | A    | 2404517.93 | 732472.36 | 6.00   | 190.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 47 | A    | 2404511.33 | 732446.35 | 6.00   | 14.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 48 | E    | 2404527.30 | 732456.66 | 6.00   | 274.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 49 | G    | 2404524.10 | 732513.51 | 6.00   | 188.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 50 | A    | 2404509.00 | 732536.63 | 6.00   | 20.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 51 | A    | 2404500.36 | 732562.38 | 6.00   | 20.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 52 | A    | 2404490.79 | 732591.09 | 6.00   | 20.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 53 | A    | 2404481.46 | 732620.43 | 6.00   | 16.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 54 | A    | 2404494.62 | 732641.03 | 6.00   | 179.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 55 | A    | 2404485.02 | 732654.25 | 6.00   | 317.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 56 | A    | 2404502.46 | 732656.74 | 6.00   | 269.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 57 | A    | 2404533.01 | 732655.32 | 6.00   | 270.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 58 | F    | 2404558.96 | 732654.20 | 6.00   | 269.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 59 | F    | 2404590.90 | 732652.85 | 6.00   | 269.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 60 | A    | 2404613.16 | 732649.63 | 6.00   | 221.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 61 | A    | 2404606.39 | 732636.10 | 6.00   | 26.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 62 | A    | 2404629.58 | 732622.15 | 6.00   | 207.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 63 | A    | 2404645.68 | 732594.46 | 6.00   | 208.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 64 | F    | 2404658.73 | 732568.06 | 6.00   | 179.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 65 | A    | 2404539.43 | 732526.60 | 6.00   | 100.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 66 | A    | 2404535.24 | 732540.39 | 6.00   | 283.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 67 | A    | 2404574.14 | 732535.43 | 6.00   | 117.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 68 | A    | 2404567.20 | 732547.98 | 6.00   | 297.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 69 | A    | 2404612.83 | 732537.29 | 6.00   | 102.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 70 | A    | 2404610.34 | 732551.38 | 6.00   | 281.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 71 | A    | 2404642.88 | 732546.26 | 6.00   | 122.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 72 | A    | 2404635.82 | 732558.73 | 6.00   | 304.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |



**Layout Continued**

| ID     | Type | X          | Y         | Height | Angle  | Tilt | Cant | Out-reach | Dimmed to | Target X | Target Y | Target Z |
|--------|------|------------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| PL 73  | C    | 2404556.03 | 732515.65 | 6.00   | 9.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 74  | C    | 2404629.30 | 732527.60 | 6.00   | 5.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 75  | C    | 2404661.07 | 732537.81 | 6.00   | 11.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 76  | C    | 2404663.97 | 732525.37 | 6.00   | 169.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 77  | C    | 2404671.03 | 732553.67 | 6.00   | 207.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 78  | C    | 2404671.81 | 732535.79 | 6.00   | 20.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 79  | C    | 2404685.34 | 732524.99 | 6.00   | 226.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 80  | G    | 2404586.11 | 732536.91 | 6.00   | 9.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 81  | E    | 2404598.40 | 732520.71 | 6.00   | 194.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 82  | G    | 2404586.73 | 732558.39 | 6.00   | 207.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 83  | G    | 2404571.57 | 732569.37 | 6.00   | 24.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 84  | G    | 2404560.63 | 732592.09 | 6.00   | 24.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 85  | G    | 2404553.00 | 732615.33 | 6.00   | 1.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 86  | A    | 2404549.13 | 732638.56 | 6.00   | 0.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 87  | A    | 2404563.02 | 732633.89 | 6.00   | 181.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 88  | C    | 2404489.26 | 732576.45 | 6.00   | 24.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 89  | C    | 2404481.77 | 732594.24 | 6.00   | 234.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 90  | C    | 2404476.60 | 732606.23 | 6.00   | 166.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 91  | C    | 2404467.09 | 732596.82 | 6.00   | 295.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 92  | C    | 2404472.17 | 732626.54 | 6.00   | 23.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 93  | C    | 2404472.62 | 732641.90 | 6.00   | 347.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 94  | H    | 2404643.18 | 732545.75 | 6.00   | 301.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 95  | B    | 2404624.47 | 732485.44 | 6.00   | 5.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 96  | C    | 2404617.66 | 732476.83 | 6.00   | 104.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 97  | C    | 2404590.80 | 732472.71 | 6.00   | 100.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 98  | C    | 2404580.27 | 732482.04 | 6.00   | 194.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 99  | C    | 2404565.51 | 732468.95 | 6.00   | 100.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 100 | C    | 2404545.34 | 732465.75 | 6.00   | 100.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 101 | C    | 2404533.15 | 732478.24 | 6.00   | 206.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| ML 102 | B    | 2404361.17 | 732584.24 | 6.00   | 119.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| ML 103 | C    | 2404366.51 | 732582.60 | 6.00   | 110.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 104 | D    | 2404451.82 | 732527.50 | 6.00   | 275.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| ML 105 | D    | 2404407.86 | 732506.83 | 6.00   | 189.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| ML 106 | D    | 2404408.52 | 732491.35 | 6.00   | 182.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| ML 107 | D    | 2404422.22 | 732509.98 | 6.00   | 94.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| ML 108 | D    | 2404453.82 | 732511.50 | 6.00   | 93.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |

**Layout Continued**

| ID     | Type | X          | Y         | Height | Angle  | Tilt | Cant | Out-reach | Dimmed to | Target X | Target Y | Target Z |
|--------|------|------------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| ML 109 | B    | 2404424.00 | 732501.52 | 6.00   | 2.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| ML 110 | C    | 2404426.08 | 732549.04 | 6.00   | 81.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| ML 111 | C    | 2404407.71 | 732550.15 | 6.00   | 290.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| ML 112 | C    | 2404434.24 | 732545.19 | 6.00   | 184.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 113 | B    | 2404372.20 | 732527.28 | 6.00   | 275.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 114 | B    | 2404373.97 | 732508.46 | 6.00   | 271.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 115 | B    | 2404373.05 | 732487.12 | 6.00   | 272.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 116 | B    | 2404373.03 | 732487.53 | 6.00   | 91.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 117 | B    | 2404373.95 | 732509.04 | 6.00   | 89.00  | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| PL 118 | B    | 2404356.61 | 732519.07 | 6.00   | 5.00   | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |
| ML 119 | C    | 2404427.86 | 732497.17 | 6.00   | 275.00 | 0.00 | 0.00 | 0.40      | 75%       |          |          |          |



# Horizontal Illuminance (lux)

Phase 1

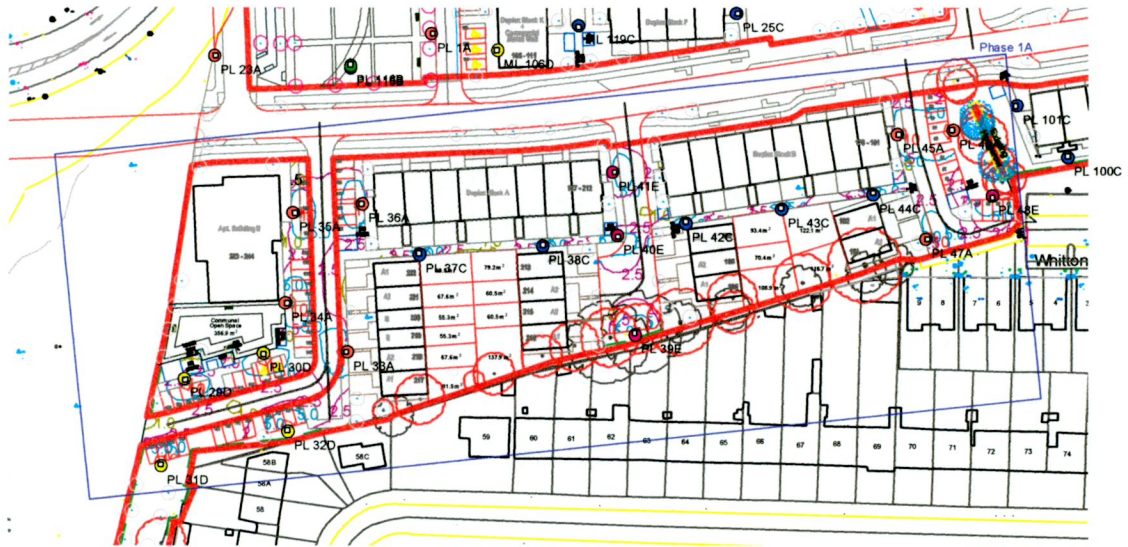


## Results

|           |       |
|-----------|-------|
| Eav       | 4.41  |
| Emin      | 0.86  |
| Emax      | 12.95 |
| Emin/Emax | 0.07  |
| Emin/Eav  | 0.20  |
|           |       |

# Horizontal Illuminance (lux)

Phase 1A



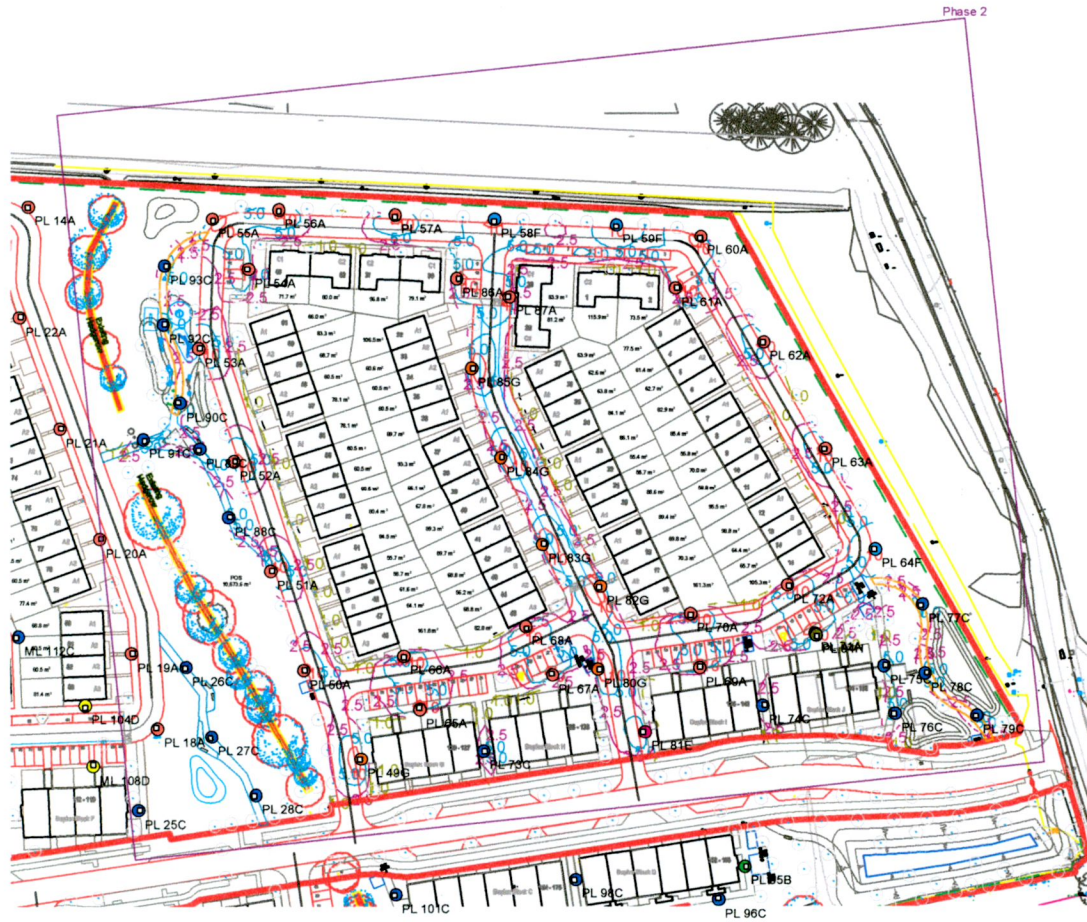
## Results

|           |       |
|-----------|-------|
| Eav       | 3.86  |
| Emin      | 0.82  |
| Emax      | 11.34 |
| Emin/Emax | 0.07  |
| Emin/Eav  | 0.21  |



# Horizontal Illuminance (lux)

Phase 2

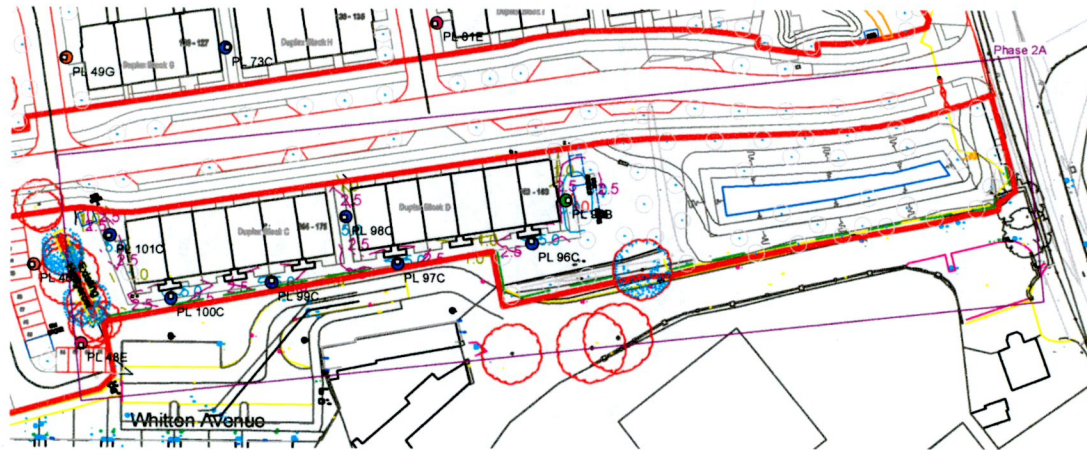


## Results

|                                    |       |
|------------------------------------|-------|
| Eav                                | 4.39  |
| Emin                               | 0.87  |
| E <sub>max</sub>                   | 14.53 |
| E <sub>min</sub> /E <sub>max</sub> | 0.06  |
| E <sub>min</sub> /E <sub>av</sub>  | 0.20  |

## Horizontal Illuminance (lux)

Phase 2A



### Results

|                                    |       |
|------------------------------------|-------|
| Eav                                | 3.85  |
| Emin                               | 0.87  |
| E <sub>max</sub>                   | 10.49 |
| E <sub>min</sub> /E <sub>max</sub> | 0.08  |
| E <sub>min</sub> /E <sub>av</sub>  | 0.23  |



**DATE:** 29 May 2022  
**DESIGNER:** Patrick Redmond  
**PROJECT No:** 22047  
**PROJECT NAME:** Clonburris, K1



Luminaire selected based on a balance of visual comfort and low energy consumption whilst achieving compliance with I.S. EN 13201-2:2015 P4, with a neutral (4,000K) source, on a typical section of the development. Energy consumption assessed in accordance with I.S. EN 13201-5:2015.

LMF 0.92 x LDF 0.9 x LSF 1 = MF 0.83 at 100,000 hours at 25 degrees ambient. Photometry measured at minimum 15 degree ambient.

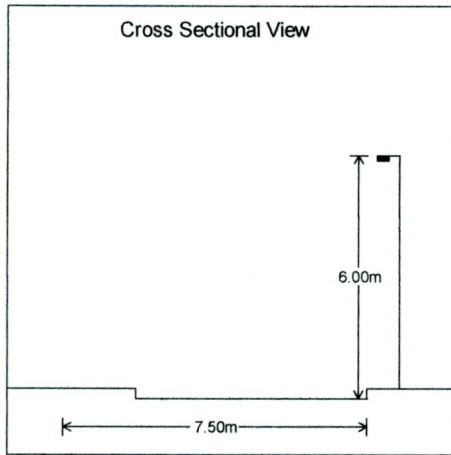
Of the comparable products assessed, the ASD luminaire offers excellent U0, comfortable TI, and high energy efficacy. Product specification may vary with detailed design.

## Luminaire Selection

**PREPARED BY:** Patrick Redmond MILP, MSL, IEng, Tech IEI  
Redmond Analytical Management Services Ltd.  
M~ 086 2356356  
O~ 053 9231112  
patrick@redmondams.ie  
8 Peare Campus, Moyne Park, Old Dublin Road,  
Enniscorthy, Co. Wexford. Y21 TD68  
www.redmondams.ie  
Document control: TD 01 Version: 1.0

## Roadway Report Summary

### Layout



### Road Data

|                   |                          |
|-------------------|--------------------------|
| Calculation Grid  | 2015:EN13201 Illuminance |
| Width (m)         | 7.50                     |
| No. of Lanes      | 2                        |
| Road Surface      | C2                       |
| Q0                | 0.07                     |
| Left Footpath(m)  | 1.80                     |
| Right Footpath(m) | 0.00                     |

### Main Lighting

#### Column Data

|               |                    |
|---------------|--------------------|
| Configuration | Single Sided Right |
| Spacing (m)   | 32.00              |
| Height (m)    | 6.00               |
| Tilt (deg)    | 0.00               |
| Setback (m)   | 0.80               |
| Outreach (m)  | 0.40               |
| Overhang (m)  | -0.40              |

#### Luminaire Data

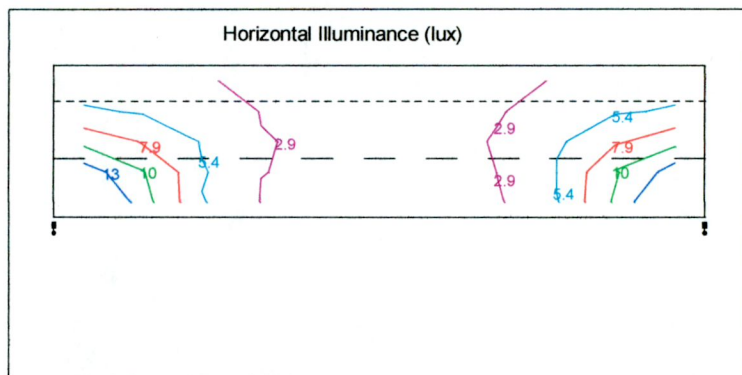
|                      |                                 |
|----------------------|---------------------------------|
| Supplier             | ASD Lighting                    |
| Type                 | HWD2-#4K12 400-S4-CLO Gen 5     |
| Lamp(s)              | LED                             |
| LampFlux(klm)/Colour | 2.29 4000/72                    |
| File Name            | HWD2-#4K12 400-S4-CLO (15W).ldt |
| Maintenance Factor   | 0.83                            |
| Lum. Int. Class      | G3                              |

### Results

#### Main

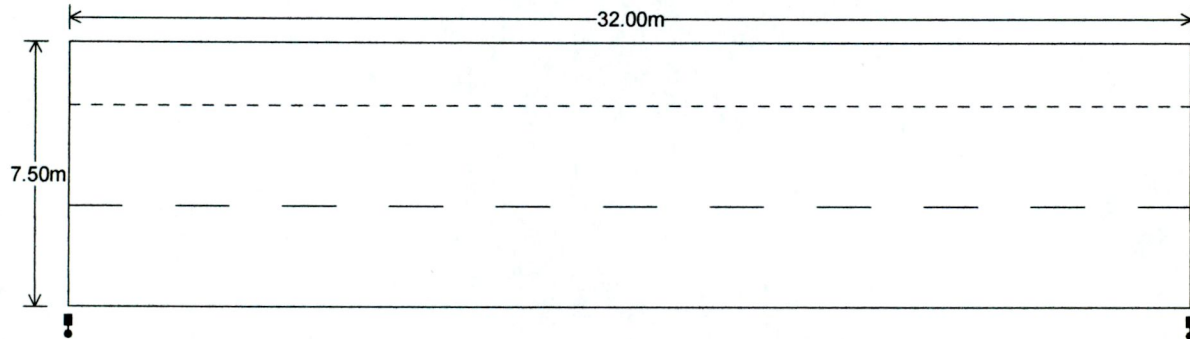
Complies with P4

|           |       |
|-----------|-------|
| Eav       | 5.13  |
| Emin      | 1.64  |
| Emax      | 16.70 |
| Emin/Emax | 0.10  |
| Emin/Eav  | 0.32  |
| TI(%)     | 14.42 |



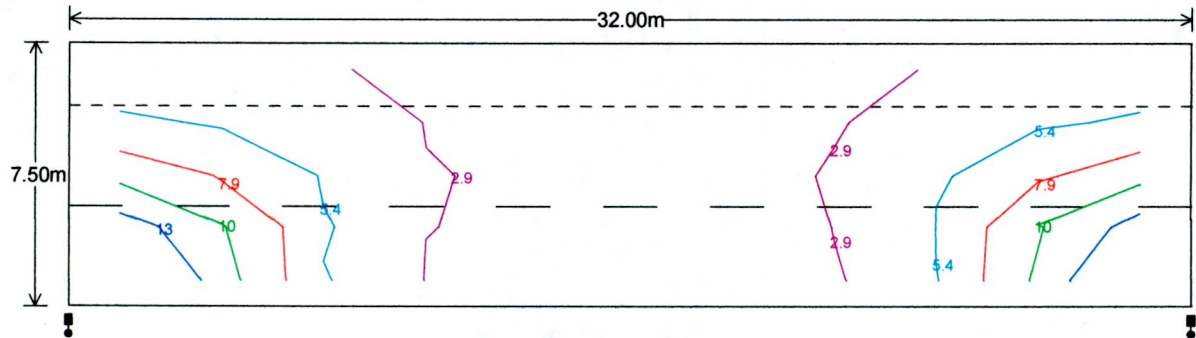


## Energy performance indicators



|                                      |       |
|--------------------------------------|-------|
| Power Main Luminaire(W)              | 15.00 |
| Parasitic Power(W)                   | 0.00  |
| Area(m <sup>2</sup> )                | 240   |
| Hours per Year                       | 4100  |
| Power Density(mW/lx/m <sup>2</sup> ) | 12.19 |
| AECI(kWh/m <sup>2</sup> )            | 0.26  |

## Horizontal Illuminance (lux)



### Main Results

|           |       |
|-----------|-------|
| Eav       | 5.13  |
| Emin      | 1.64  |
| Emax      | 16.70 |
| Emin/Emax | 0.10  |
| Emin/Eav  | 0.32  |
| TI(%)     | 14.42 |



DATE: 29 May 2022  
PROJECT No: 22047

DESIGNER: Patrick Redmond  
PROJECT NAME: Clonburris, K1



## Comparison Table

EN13201 Class: P4    Calculation Grid: 2015:EN13201 Illuminance    Road Surface: C2    Q0: 0.07    No. of Lanes: 2    Total Width: 7.50  
Configuration: Single Sided Right

| No. | Luminaire         | Lamp      | Flux | MF   | Spacing | Overhang | Height | Tilt | Eav  | Emin | Emax  | Emin/Emax | Emin/Eav | TI    | Power Density | AECI |
|-----|-------------------|-----------|------|------|---------|----------|--------|------|------|------|-------|-----------|----------|-------|---------------|------|
| 1   | HWD2-#4K12 400    | LED       | 2.29 | 0.83 | 32.00   | -0.40    | 6.00   | 0.00 | 5.13 | 1.64 | 16.70 | 0.10      | 0.32     | 14.42 | 0.00          | 0.00 |
| 2   | P852K-12-R2B-N    | 740C NW   | 2.28 | 0.83 | 32.00   | -0.40    | 6.00   | 0.00 | 5.11 | 1.97 | 15.37 | 0.13      | 0.39     | 16.12 | 0.00          | 0.00 |
| 3   | BGP291 DM12       | LED-HB 5  | 2.60 | 0.83 | 32.00   | -0.40    | 6.00   | 0.00 | 5.13 | 1.21 | 13.55 | 0.09      | 0.24     | 21.14 | 0.00          | 0.00 |
| 4   | ISARO PRO S - 1   | LED_4000K | 2.71 | 0.83 | 32.00   | -0.40    | 6.00   | 0.00 | 5.13 | 1.56 | 13.49 | 0.12      | 0.30     | 14.62 | 0.00          | 0.00 |
| 5   | AXIA 3.1 5295 Int | 16 OSLON  | 2.57 | 0.83 | 32.00   | -0.40    | 6.00   | 0.00 | 5.02 | 1.74 | 11.01 | 0.16      | 0.35     | 13.67 | 0.00          | 0.00 |

## Cable Calculations

Project Name Clonburris, K1 REV B  
Project Number 22047

### Midi Pillar Number 1

| Circuit | Tabulated Voltage drop (cable) | Total columns on circuit          | Total luminaire Current ( $I_b$ ) | Total circuit length  | kVA for pillar    | Voltage drop               | Voltage drop percentage      |
|---------|--------------------------------|-----------------------------------|-----------------------------------|-----------------------|-------------------|----------------------------|------------------------------|
| 1       | 7.3                            | 5                                 | 0.32                              | 167                   |                   | 0.11                       | 0.05%                        |
| 2       | 7.3                            | 3                                 | 0.21                              | 101                   | 0.16              | 0.04                       | 0.02%                        |
| 3       | 7.3                            | 3                                 | 0.16                              | 116                   |                   | 0.04                       | 0.02%                        |
| Circuit | $Z_E$                          | Conductor Resistance $\Omega$ /km | $Z_s$                             | Circuit Impedance Ohm | Fault Current Amp | Circuit Fuse ( $I_N$ ) Amp | Cable CSA (mm <sup>2</sup> ) |
| 1       | 0.35                           | 3.95                              | 0.66                              | 1.0                   | 227.8             | 6                          | 6                            |
| 2       | 0.35                           | 3.95                              | 0.40                              | 0.7                   | 307.1             | 6                          | 6                            |
| 3       | 0.35                           | 3.95                              | 0.46                              | 0.8                   | 284.6             | 6                          | 6                            |

*Note that circuit length includes an extra 10m per column to allow for turns, access and other potential issues. PF taken as 0.8  
The maximum circuit fuse size permitted by ESBN for unmetred public lighting circuits is 6Amp.*

*It is the duty of the electrical contractor to undertake appropriate electrical safety tests and to certify the electrical installation.*

The voltage drop on each circuit is below the allowed maximum.

The minimum sized cable permissible under I.S. 10101:2020 is 6mm SQ.

It is the duty of the electrical contractor to calculate the appropriate fuse size.

Approximate Total Cable (m) = 3495



### Midi Pillar Number 2

| Circuit | Tabulated Voltage drop (cable) | Total columns on circuit          | Total luminaire Current ( $I_b$ ) | Total circuit length  | kVA for pillar    | Voltage drop               | Voltage drop percentage      |
|---------|--------------------------------|-----------------------------------|-----------------------------------|-----------------------|-------------------|----------------------------|------------------------------|
| 1       | 7.3                            | 3                                 | 0.16                              | 82                    |                   | 0.03                       | 0.01%                        |
| 2       | 7.3                            | 1                                 | 0.03                              | 41                    | 0.08              | 0.00                       | 0.00%                        |
| 3       | 7.3                            | 4                                 | 0.14                              | 116                   |                   | 0.03                       | 0.01%                        |
| Circuit | $Z_E$                          | Conductor Resistance $\Omega$ /km | $Z_s$                             | Circuit Impedance Ohm | Fault Current Amp | Circuit Fuse ( $I_w$ ) Amp | Cable CSA (mm <sup>2</sup> ) |
| 1       | 0.35                           | 3.95                              | 0.32                              | 0.7                   | 341.3             | 6                          | 6                            |
| 2       | 0.35                           | 3.95                              | 0.16                              | 0.5                   | 449.3             | 6                          | 6                            |
| 3       | 0.35                           | 3.95                              | 0.46                              | 0.8                   | 284.6             | 6                          | 6                            |

Note that circuit length includes an extra 10m per column to allow for turns, access and other potential issues. **PF** taken as 0.8

The maximum circuit fuse size permitted by ESBN for unmetered public lighting circuits is 6Amp.

It is the duty of the electrical contractor to undertake appropriate electrical safety tests and to certify the electrical installation.

### Midi Pillar Number 3

| Circuit | Tabulated Voltage drop (cable) | Total columns on circuit          | Total luminaire Current ( $I_b$ ) | Total circuit length  | kVA for pillar    | Voltage drop               | Voltage drop percentage      |
|---------|--------------------------------|-----------------------------------|-----------------------------------|-----------------------|-------------------|----------------------------|------------------------------|
| 1       | 7.3                            | 5                                 | 0.27                              | 207                   |                   | 0.11                       | 0.05%                        |
| 2       | 7.3                            | 4                                 | 0.21                              | 148                   | 0.17              | 0.06                       | 0.03%                        |
| 3       | 7.3                            | 5                                 | 0.27                              | 178                   |                   | 0.10                       | 0.04%                        |
| Circuit | $Z_E$                          | Conductor Resistance $\Omega$ /km | $Z_s$                             | Circuit Impedance Ohm | Fault Current Amp | Circuit Fuse ( $I_w$ ) Amp | Cable CSA (mm <sup>2</sup> ) |
| 1       | 0.35                           | 3.95                              | 0.82                              | 1.2                   | 197.0             | 6                          | 6                            |
| 2       | 0.35                           | 3.95                              | 0.58                              | 0.9                   | 246.1             | 6                          | 6                            |
| 3       | 0.35                           | 3.95                              | 0.70                              | 1.1                   | 218.4             | 6                          | 6                            |

Note that circuit length includes an extra 10m per column to allow for turns, access and other potential issues. **PF** taken as 0.8

The maximum circuit fuse size permitted by ESBN for unmetered public lighting circuits is 6Amp.

It is the duty of the electrical contractor to undertake appropriate electrical safety tests and to certify the electrical installation.



#### Midi Pillar Number 4

| Circuit | Tabulated Voltage drop (cable) | Total columns on circuit          | Total luminaire Current ( $I_b$ ) | Total circuit length  | kVA for pillar    | Voltage drop               | Voltage drop percentage      |
|---------|--------------------------------|-----------------------------------|-----------------------------------|-----------------------|-------------------|----------------------------|------------------------------|
| 1       | 7.3                            | 7                                 | 0.37                              | 230                   | 0.13              | 0.17                       | 0.08%                        |
| 2       | 7.3                            | 5                                 | 0.20                              | 170                   |                   | 0.07                       | 0.03%                        |
| Circuit | $Z_E$                          | Conductor Resistance $\Omega$ /km | $Z_S$                             | Circuit Impedance Ohm | Fault Current Amp | Circuit Fuse ( $I_N$ ) Amp | Cable CSA (mm <sup>2</sup> ) |
| 1       | 0.35                           | 3.95                              | 0.91                              | 1.3                   | 182.8             | 6                          | 6                            |
| 2       | 0.35                           | 3.95                              | 0.67                              | 1.0                   | 225.2             | 6                          | 6                            |

Note that circuit length includes an extra 10m per column to allow for turns, access and other potential issues. **PF** taken as 0.8  
The maximum circuit fuse size permitted by ESBN for unmetered public lighting circuits is 6Amp.

It is the duty of the electrical contractor to undertake appropriate electrical safety tests and to certify the electrical installation.

#### Midi Pillar Number 5

| Circuit | Tabulated Voltage drop (cable) | Total columns on circuit          | Total luminaire Current ( $I_b$ ) | Total circuit length  | kVA for pillar    | Voltage drop               | Voltage drop percentage      |
|---------|--------------------------------|-----------------------------------|-----------------------------------|-----------------------|-------------------|----------------------------|------------------------------|
| 1       | 7.3                            | 1                                 | 0.06                              | 28                    |                   | 0.00                       | 0.00%                        |
| 2       | 7.3                            | 4                                 | 0.13                              | 138                   | 0.08              | 0.04                       | 0.02%                        |
| 3       | 7.3                            | 3                                 | 0.15                              | 79                    |                   | 0.02                       | 0.01%                        |
| Circuit | $Z_E$                          | Conductor Resistance $\Omega$ /km | $Z_S$                             | Circuit Impedance Ohm | Fault Current Amp | Circuit Fuse ( $I_N$ ) Amp | Cable CSA (mm <sup>2</sup> ) |
| 1       | 0.35                           | 3.95                              | 0.11                              | 0.5                   | 499.3             | 6                          | 6                            |
| 2       | 0.35                           | 3.95                              | 0.55                              | 0.9                   | 257.0             | 6                          | 6                            |
| 3       | 0.35                           | 3.95                              | 0.31                              | 0.7                   | 347.4             | 6                          | 6                            |

Note that circuit length includes an extra 10m per column to allow for turns, access and other potential issues. **PF** taken as 0.8  
The maximum circuit fuse size permitted by ESBN for unmetered public lighting circuits is 6Amp.

It is the duty of the electrical contractor to undertake appropriate electrical safety tests and to certify the electrical installation.



### Midi Pillar Number 6

| Circuit | Tabulated Voltage drop (cable) | Total columns on circuit          | Total luminaire Current ( $I_b$ ) | Total circuit length  | kVA for pillar    | Voltage drop               | Voltage drop percentage      |
|---------|--------------------------------|-----------------------------------|-----------------------------------|-----------------------|-------------------|----------------------------|------------------------------|
| 1       | 7.3                            | 5                                 | 0.28                              | 198                   |                   | 0.11                       | 0.05%                        |
| 2       | 7.3                            | 6                                 | 0.36                              | 216                   | 0.19              | 0.16                       | 0.07%                        |
| 3       | 7.3                            | 4                                 | 0.20                              | 123                   |                   | 0.05                       | 0.02%                        |
| Circuit | $Z_E$                          | Conductor Resistance $\Omega$ /km | $Z_S$                             | Circuit Impedance Ohm | Fault Current Amp | Circuit Fuse ( $I_N$ ) Amp | Cable CSA (mm <sup>2</sup> ) |
| 1       | 0.35                           | 3.95                              | 0.78                              | 1.1                   | 203.2             | 6                          | 6                            |
| 2       | 0.35                           | 3.95                              | 0.85                              | 1.2                   | 191.2             | 6                          | 6                            |
| 3       | 0.35                           | 3.95                              | 0.49                              | 0.8                   | 275.2             | 6                          | 6                            |

Note that circuit length includes an extra 10m per column to allow for turns, access and other potential issues. **PF** taken as 0.8  
The maximum circuit fuse size permitted by ESBN for unmetred public lighting circuits is 6Amp.

It is the duty of the electrical contractor to undertake appropriate electrical safety tests and to certify the electrical installation.

### Midi Pillar Number 7

| Circuit | Tabulated Voltage drop (cable) | Total columns on circuit          | Total luminaire Current ( $I_b$ ) | Total circuit length  | kVA for pillar    | Voltage drop               | Voltage drop percentage      |
|---------|--------------------------------|-----------------------------------|-----------------------------------|-----------------------|-------------------|----------------------------|------------------------------|
| 1       | 7.3                            | 1                                 | 0.06                              | 21                    |                   | 0.00                       | 0.00%                        |
| 2       | 7.3                            | 7                                 | 0.21                              | 192                   | 0.12              | 0.08                       | 0.04%                        |
| 3       | 7.3                            | 3                                 | 0.25                              | 99                    |                   | 0.05                       | 0.02%                        |
| Circuit | $Z_E$                          | Conductor Resistance $\Omega$ /km | $Z_S$                             | Circuit Impedance Ohm | Fault Current Amp | Circuit Fuse ( $I_N$ ) Amp | Cable CSA (mm <sup>2</sup> ) |
| 1       | 0.35                           | 3.95                              | 0.08                              | 0.4                   | 531.2             | 6                          | 6                            |
| 2       | 0.35                           | 3.95                              | 0.76                              | 1.1                   | 207.5             | 6                          | 6                            |
| 3       | 0.35                           | 3.95                              | 0.39                              | 0.7                   | 310.4             | 6                          | 6                            |

Note that circuit length includes an extra 10m per column to allow for turns, access and other potential issues. **PF** taken as 0.8  
The maximum circuit fuse size permitted by ESBN for unmetred public lighting circuits is 6Amp.

It is the duty of the electrical contractor to undertake appropriate electrical safety tests and to certify the electrical installation.



### Midi Pillar Number 8

| Circuit | Tabulated Voltage drop (cable) | Total columns on circuit          | Total luminaire Current ( $I_b$ ) | Total circuit length  | kVA for pillar    | Voltage drop               | Voltage drop percentage      |
|---------|--------------------------------|-----------------------------------|-----------------------------------|-----------------------|-------------------|----------------------------|------------------------------|
| 1       | 7.3                            | 5                                 | 0.20                              | 190                   |                   | 0.08                       | 0.03%                        |
| 2       | 7.3                            | 5                                 | 0.14                              | 153                   | 0.12              | 0.04                       | 0.02%                        |
| 3       | 7.3                            | 3                                 | 0.17                              | 123                   |                   | 0.04                       | 0.02%                        |
| Circuit | $Z_E$                          | Conductor Resistance $\Omega$ /km | $Z_s$                             | Circuit Impedance Ohm | Fault Current Amp | Circuit Fuse ( $I_N$ ) Amp | Cable CSA (mm <sup>2</sup> ) |
| 1       | 0.35                           | 3.95                              | 0.75                              | 1.1                   | 209.0             | 6                          | 6                            |
| 2       | 0.35                           | 3.95                              | 0.60                              | 1.0                   | 241.0             | 6                          | 6                            |
| 3       | 0.35                           | 3.95                              | 0.49                              | 0.8                   | 275.2             | 6                          | 6                            |

Note that circuit length includes an extra 10m per column to allow for turns, access and other potential issues. **PF** taken as 0.8  
The maximum circuit fuse size permitted by ESBN for unmetered public lighting circuits is 6Amp.

It is the duty of the electrical contractor to undertake appropriate electrical safety tests and to certify the electrical installation.

### Midi Pillar Number 9

| Circuit | Tabulated Voltage drop (cable) | Total columns on circuit          | Total luminaire Current ( $I_b$ ) | Total circuit length  | kVA for pillar    | Voltage drop               | Voltage drop percentage      |
|---------|--------------------------------|-----------------------------------|-----------------------------------|-----------------------|-------------------|----------------------------|------------------------------|
| 1       | 7.3                            | 1                                 | 0.06                              | 51                    |                   | 0.01                       | 0.00%                        |
| 2       | 7.3                            | 5                                 | 0.45                              | 181                   | 0.13              | 0.17                       | 0.07%                        |
| 3       | 7.3                            | 1                                 | 0.06                              | 30                    |                   | 0.00                       | 0.00%                        |
| Circuit | $Z_E$                          | Conductor Resistance $\Omega$ /km | $Z_s$                             | Circuit Impedance Ohm | Fault Current Amp | Circuit Fuse ( $I_N$ ) Amp | Cable CSA (mm <sup>2</sup> ) |
| 1       | 0.35                           | 3.95                              | 0.20                              | 0.6                   | 417.1             | 6                          | 6                            |
| 2       | 0.35                           | 3.95                              | 0.71                              | 1.1                   | 216.0             | 6                          | 6                            |
| 3       | 0.35                           | 3.95                              | 0.12                              | 0.5                   | 490.9             | 6                          | 6                            |

Note that circuit length includes an extra 10m per column to allow for turns, access and other potential issues. **PF** taken as 0.8  
The maximum circuit fuse size permitted by ESBN for unmetered public lighting circuits is 6Amp.

It is the duty of the electrical contractor to undertake appropriate electrical safety tests and to certify the electrical installation.



### Midi Pillar Number 10

| Circuit | Tabulated Voltage drop (cable) | Total columns on circuit  | Total luminaire Current (I <sub>b</sub> ) | Total circuit length  | kVA for pillar    | Voltage drop                       | Voltage drop percentage      |
|---------|--------------------------------|---------------------------|---|-----------------------|-------------------|------------------------------------|------------------------------|
| 1       | 7.3                            | 6                         | 0.16                                      | 207                   | 0.05              | 0.07                               | 0.03%                        |
| 2       | 7.3                            | 1                         | 0.06                                      | 13                    |                   | 0.00                               | 0.00%                        |
| Circuit | Z <sub>E</sub>                 | Conductor Resistance Ω/km | Z <sub>S</sub>                            | Circuit Impedance Ohm | Fault Current Amp | Circuit Fuse (I <sub>N</sub> ) Amp | Cable CSA (mm <sup>2</sup> ) |
| 1       | 0.35                           | 3.95                      | 0.82                                      | 1.2                   | 197.0             | 6                                  | 6                            |
| 2       | 0.35                           | 3.95                      | 0.05                                      | 0.4                   | 573.1             | 6                                  | 6                            |

*Note that circuit length includes an extra 10m per column to allow for turns, access and other potential issues. PF taken as 0.8  
The maximum circuit fuse size permitted by ESNB for unmetered public lighting circuits is 6Amp.*

*It is the duty of the electrical contractor to undertake appropriate electrical safety tests and to certify the electrical installation.*

### Management Midi Pillar Number 11

| Circuit | Tabulated Voltage drop (cable) | Total columns on circuit  | Total luminaire Current (I <sub>b</sub> ) | Total circuit length  | kVA for pillar    | Voltage drop                       | Voltage drop percentage      |
|---------|--------------------------------|---------------------------|---|-----------------------|-------------------|------------------------------------|------------------------------|
| 1       | 7.3                            | 3                         | 0.08                                      | 63                    | 0.02              | 0.01                               | 0.00%                        |
| Circuit | Z <sub>E</sub>                 | Conductor Resistance Ω/km | Z <sub>S</sub>                            | Circuit Impedance Ohm | Fault Current Amp | Circuit Fuse (I <sub>N</sub> ) Amp | Cable CSA (mm <sup>2</sup> ) |
| 1       | 0.35                           | 3.95                      | 0.25                                      | 0.6                   | 384.1             | 6                                  | 6                            |

*Note that circuit length includes an extra 10m per column to allow for turns, access and other potential issues. PF taken as 0.8  
The maximum circuit fuse size permitted by ESNB for unmetered public lighting circuits is 6Amp.*

*It is the duty of the electrical contractor to undertake appropriate electrical safety tests and to certify the electrical installation.*



### Management Midi Pillar Number 12

| Circuit | Tabulated Voltage drop (cable) | Total columns on circuit          | Total luminaire Current ( $I_B$ ) | Total circuit length  | kVA for pillar    | Voltage drop               | Voltage drop percentage      |
|---------|--------------------------------|-----------------------------------|-----------------------------------|-----------------------|-------------------|----------------------------|------------------------------|
| 1       | 7.3                            | 1                                 | 0.03                              | 15                    | 0.02              | 0.00                       | 0.00%                        |
| 2       | 7.3                            | 1                                 | 0.06                              | 24                    |                   | 0.00                       | 0.00%                        |
| Circuit | $Z_E$                          | Conductor Resistance $\Omega$ /km | $Z_S$                             | Circuit Impedance Ohm | Fault Current Amp | Circuit Fuse ( $I_N$ ) Amp | Cable CSA (mm <sup>2</sup> ) |
| 1       | 0.35                           | 3.95                              | 0.06                              | 0.4                   | 562.0             | 6                          | 6                            |
| 2       | 0.35                           | 3.95                              | 0.09                              | 0.4                   | 517.1             | 6                          | 6                            |

Note that circuit length includes an extra 10m per column to allow for turns, access and other potential issues. **PF** taken as 0.8  
The maximum circuit fuse size permitted by ESBN for unmetred public lighting circuits is 6Amp.

It is the duty of the electrical contractor to undertake appropriate electrical safety tests and to certify the electrical installation.

### Management Midi Pillar Number 13

| Circuit | Tabulated Voltage drop (cable) | Total columns on circuit          | Total luminaire Current ( $I_B$ ) | Total circuit length  | kVA for pillar    | Voltage drop               | Voltage drop percentage      |
|---------|--------------------------------|-----------------------------------|-----------------------------------|-----------------------|-------------------|----------------------------|------------------------------|
| 1       | 7.3                            | 1                                 | 0.06                              | 24                    | 0.07              | 0.00                       | 0.00%                        |
| 2       | 7.3                            | 5                                 | 0.24                              | 127                   |                   | 0.06                       | 0.03%                        |
| Circuit | $Z_E$                          | Conductor Resistance $\Omega$ /km | $Z_S$                             | Circuit Impedance Ohm | Fault Current Amp | Circuit Fuse ( $I_N$ ) Amp | Cable CSA (mm <sup>2</sup> ) |
| 1       | 0.35                           | 3.95                              | 0.09                              | 0.4                   | 517.1             | 6                          | 6                            |
| 2       | 0.35                           | 3.95                              | 0.50                              | 0.9                   | 270.1             | 6                          | 6                            |

Note that circuit length includes an extra 10m per column to allow for turns, access and other potential issues. **PF** taken as 0.8  
The maximum circuit fuse size permitted by ESBN for unmetred public lighting circuits is 6Amp.

It is the duty of the electrical contractor to undertake appropriate electrical safety tests and to certify the electrical installation.



## Energy Consumption

Project Name Clonburris, K1 REV A  
Project Number 22047  
Dimming Profile U14

| Proposed Installation |                       |          |                     |                   |                  |             |
|-----------------------|-----------------------|----------|---------------------|-------------------|------------------|-------------|
| Lantern               | Connected Load<br>~ W | Quantity | Burn Hours<br>Annum | kW/h per<br>Annum | Cost per<br>kW/h | Annual Cost |
| 1.81 klm luminaire    | 12                    | 60       | 2350                | 1692              | € 0.300          | €507.60     |
|                       | 9                     | 60       | 1710                | 923               | € 0.300          | €277.02     |
| 0.74 klm luminaire    | 6                     | 33       | 2350                | 465               | € 0.300          | €139.59     |
|                       | 5                     | 33       | 1710                | 254               | € 0.300          | €76.18      |
| 1.73 klm luminaire    | 12                    | 11       | 2350                | 310               | € 0.300          | €93.06      |
|                       | 9                     | 11       | 1710                | 169               | € 0.300          | €50.79      |
| 1.38 klm luminaire    | 10                    | 5        | 2350                | 118               | € 0.300          | €35.25      |
|                       | 8                     | 5        | 1710                | 64                | € 0.300          | €19.24      |
| 3.95 klm luminaire    | 33                    | 3        | 2350                | 233               | € 0.300          | €69.80      |
|                       | 25                    | 3        | 1710                | 127               | € 0.300          | €38.09      |
| 2.29 klm luminaire    | 15                    | 6        | 2350                | 212               | € 0.300          | €63.45      |
|                       | 11                    | 6        | 1710                | 115               | € 0.300          | €34.63      |
| 0.40 klm luminaire    | 4                     | 1        | 2350                | 9                 | € 0.300          | €2.82       |
|                       | 3                     | 1        | 1710                | 5                 | € 0.300          | €1.54       |

**Total Annual Energy Cost** €1,409.05

**Total Annual Energy Consumption (kW/h)** 4696.82