

Lands to the Ardshanavooly, Killarney, Co. Kerry

Proposed Residential Development

## Daylight and Sunlight Analysis Report

Lands at Ardshanavooly,  
Killarney,  
Co. Kerry

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# 1 Introduction

## 1.1 Report purpose

This report gives information on daylight and sunlight studies within the proposed new development and assesses the impact on daylight and sunlight to surrounding areas / existing environment. The daylight and sunlight studies are assessed under two categories, these are.

Performance of proposed development:

- Daylight reception analysis of the proposed development
- Sunlight reception analysis of the proposed development

Impact of proposed development on the existing surrounding environment:

- Impact on daylight reception analysis on existing environment
- Impact on sunlight reception analysis on existing environment

## 1.2 Instruction

DKPartnership (DKP) have been commissioned by Wrightwood Development Limited to carry out the analysis and report for the proposed development at Ardshanavooly, Killarney, Co. Kerry.

## 1.3 Standards and guidelines overview

For this report we applied the recommendations and guidelines of the following documents.

- The Building Research Establishment report, BR 209 (2022) Site Layout Planning for Daylight and Sunlight, A Guide to Good Practice. (referred to as the BRE Report).
- British European Standard BS EN 17037:2018 +A1:2021 also referred to as the UK Annex
- Irish European Standard IS EN 17037:2018

## 1.4 Brief development description

Wrightwood Development Ltd, intend to apply for planning permission for a Large Scale Residential Development (LRD) for development at a 2.23 hectare site at lands at Ardshanavooly, Killarney, Co. Kerry. The proposed development comprises of:

1. Construction of a 124 no. dwellings in a mix of duplex, maisonette and apartment typologies comprising 16 no. 1 bed apartments, 6 no. 2 bed apartments, 16 no. 1 bed duplex apartments, 16 no. 2 bed duplex maisonettes, 33 no. 2 bed duplex apartments, 33 no. 3 bed maisonettes and 4 no. 3 bed terrace houses, all in building heights ranging from 2 to 4 storeys.
2. A total of 143 no. surface car parking spaces, including 4 no. car-share parking spaces, 6 no. visitor spaces, and 5 no. assigned Part M/accessible spaces.
3. Bicycle parking comprising of 272 no spaces in total, comprising 118 no. spaces within the private open space of ground floor residential units and 102 no. spaces within secure sheltered structures and designated secure bicycle parking areas, and 52 no. short stay/visitor spaces.
4. 3,636 sq.m of public open space, including arrival pocket park, central pocket park and amenity landscape areas (including 117 sq.m of play), grass lawns, kickabout areas, picnic areas and seating areas;
5. 956 sq.m of communal external open space, including seating areas, nature trails, and amenity grass lawns.
6. Additional environmental open space of 1,790 sq.m, including landscape buffers, protection and enhancement of existing hedgerows and trees.
7. A new vehicular, pedestrian and cyclist access from the existing estate road adjoining the site to the south.
8. Infrastructure works to serve the proposed development to include the internal road and footpath network, ESB cabinets/substations/switchrooms, site and external building lighting, site drainage works, hard and soft landscaping, boundary treatments, communal bin stores, and all ancillary site services and development works above and below ground.



## 1.5 Geographical overview

Image 1.1 the (google maps) site is an overview of the site area with the proposed development approximately outlined in red.



Image 1.1: Proposed development site boundary. Imagery © Google 2025.

## 2 Executive summary

### 2.1 Analysis conducted

This report details the achieved calculated daylight and sunlight reception within the new development and the impact on neighbouring receptors. The results are compared for compliance with the recommendations of the relevant guidelines and standards. Daylight and sunlight studies are assessed under two categories, these are.

Performance of proposed development:

- Daylight reception analysis of the proposed development,
- Sunlight reception analysis of the proposed development.

Impact of proposed development on the existing surrounding environment:

- Impact on daylight reception analysis on existing environment,
- Impact on sunlight reception analysis on existing environment,

### 2.2 Performance of proposed development - Summary of results

#### Daylight reception analysis of the proposed development

For the daylight assessment, results have been analysed within these standards:

- Assessed in accordance with IS EN17037 / BS EN17307, carried out in accordance with Method 1 and Method 2 described in the methodology section.
- Assessed in accordance with BS EN 17037:2018 National Annex.

The results from table 5.1 are reviewed under each standard below. The daylight reception assessment has been targeted to habitable rooms within the proposed development on the ground floor which are perceived to be in the most daylight challenging positions or rooms positioned with close by obstacles. Apartment block: All habitable rooms within the proposed block on the ground floor and first floor have been assessed. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms.

IS EN17037 / BS EN17307: To achieve recommendations outlined in IS EN 17037:2018 / BS EN 17307:2018, a given room must achieve: a target daylight factor of 2.0% or in terms of illuminance 300 lux on over 50% of the floor area for over 50% of the available daylight hours. And a minimum target daylight factor of 0.7% or in terms of illuminance 100 lux on over 95% of the floor area for over 50% of the available daylight hours. From the calculation result table 5.1 we note all of the proposed rooms calculated daylight results achieved the minimum guidelines, and the majority of receptors achieved well in excess of the minimum guidelines.

- Overall, residential rooms achieved on average a daylight factor (DF) of 2.9% and an illuminance of 447 lux on over 50% of the floor area for over 50% of the available daylight hours. An average DF of 1.03% and an illuminance of 145 lux on over 95% of the floor area for over 50% of the available daylight hours was achieved.

In an urban environment it can more often be the case that complete fulfilment with the guidelines is not attainable. Within the BS EN 17037 it acknowledges that a rigid application of the European Standard could prove to be a difficult task as it offers only a single target for new buildings and IS EN17037 currently has no specific National Annex. The British Annex of BS EN 17037, daylight recommendations differ depending on the function of a room and offers minimum daylight provision targets for kitchens, living rooms and bedrooms. Therefore, Given the similarity of weather, light and design patterns between Ireland and the UK and the lack of specific localisation Annex details in the Irish version, the alternate minimum daylight provision targets set out in the national annex of BS EN 17037 are reviewed next.

BS EN 17037:2018 National Annex: To achieve the alternate minimum daylight recommendations for Dublin, the room in question must achieve: Kitchen 1.3% target daylight factor or in terms of illuminance 200 lux. Living room 1.0% target daylight factor or in terms of illuminance 150 lux, and bedrooms 0.7% target daylight factor or in terms of illuminance 100 lux all over 50% of the floor area for over half the daylight hours. From the calculation result table 5.1 we note that all of the rooms calculated daylight are comfortably in excess of these minimum guidelines.

- Overall compliance for proposed development = 100%

In summary, the calculation results have achieved high compliance under IS EN17037 / BS EN17307 and BS EN 17037:2018 National Annex guidelines. This indicates an overall good level of daylight for the proposed development under the guidelines. We conclude, the proposed development can provide a good level of residential daylight amenity to future occupants.



### Sunlight in amenity areas / Sun on ground reception analysis of the proposed development

Based on the BRE guidelines at least 50% of the amenity space should receive at least two hours of sunlight on the 21st of March. From the calculation results in table 5.3 we note the selected amenity spaces all achieved sunlight above the recommended guidelines, see image 5.6 for receptor/amenity space location. Summary of results are as follows:

- The average public open space amenity area calculated sunlight on at least 50% of the area on March 21<sup>st</sup> is 9.0 hours.
- The average communal open space amenity area calculated sunlight on at least 50% of the area on March 21<sup>st</sup> is 6.0 hours.
- The average environmental open space amenity area calculated sunlight on at least 50% of the area on March 21<sup>st</sup> is 7.0 hours.

This confirms the amenity areas proposed will be adequately sunlit throughout the year. We conclude that the new amenity spaces receive sunlight on 50% of the area is in line with the recommendations of the BRE Report - Site Layout and Planning for Daylight and Sunlight - and therefore deem these to be compliant to this element.

## 2.3 Impact of proposed development on the existing surrounding environment - Summary of results

### Impact on daylight reception analysis on existing environment

The BRE recommends that the effects of a new development on daylight reception should not impact any existing VSC by more than 20% or have a maximum change factor in excess of 0.80. From the calculation results we note all selected neighbouring habitable receptors are affected to some degree with regards to daylight reception due to the introduction of the proposed development in their respective habitable rooms facing the proposed development. The calculated change in daylight reception in all of the neighbouring receptors/windows achieved a change factor ranging from 0.83 to 0.98. The BRE report outlines VSC guidelines are intended for use for rooms where daylight is required, including living rooms, kitchens and bedrooms. Properties used for habitable purposes have been assessed therefore properties occupied by commercial units have not been applied to the VSC assessment. Summarized result findings are as follows (see image 6.1 for receptor locations):

- West receptors: Receptor no. 1 to 5: Neighbouring dwellings located on Dennehy's Boreen with ground floor windows were examined and resulted in a change factor range of 0.92 to 0.98. These receptors are comfortably within the guidelines and the effect is determined as negligible under BRE definitions.
- South receptors: Receptor no. 6 to 24: Dwellings and apartments located in closest proximity with ground floor windows were examined and resulted in a change factor range of 0.83 to 0.93. These receptors are also well within the guidelines and the effect is determined as negligible under BRE definitions.
- Overall, the average change ratio for VSC is 0.90.

We conclude that the new proposed development's effect on daylight reception in the neighbouring rooms are all within the constraints and recommendations of the BRE Report – Site Layout and Planning for Daylight and Sunlight BR209 2022, and we therefore deem the proposed development to be compliant with this element.

### Impact on sunlight in existing amenity areas / Sun on ground reception analysis on existing environment

Based on the BRE guidelines at least 50% of the amenity space should receive at least two hours of sunlight on the 21<sup>st</sup> of March and that any loss of sunlight should not be greater than 0.8 (20% reduction) times its former size. From the calculation results we note that all the existing amenity spaces received 2 hours of sunlight or more on at least 50% of the area before and after the introduction of the new development. Summary of results are as follows (see image 6.2 for receptor locations):

- North receptor: Receptor no. 1, Deerpark Pitch & Putt Club resulted in a change factor of 0.98. The calculation findings are comfortably within guidelines, and the effect is determined as negligible under BRE definitions
- West receptor: Receptor no. 2 to 6 are private or communal green areas on Dennehy's Boreen Road, which resulted in a change factor range of 0.88 to 0.97. The change happens in the morning hours of 07.00-10.00. The calculation findings are well within guidelines, and the effect is also determined as negligible under BRE definitions.
- South receptors: Receptor no. 7 to 10 are private or communal green areas to the units in Park Road. These amenity areas resulted in a change factor of 1.00, the new proposed development site will have no impact on these amenity areas due to its southerly location.
- Overall, the average change ratio is 0.94.

We conclude that the new proposed development's effect on sunlight reception in the neighbouring amenity areas is all within the constraints and minimum recommendations of the BRE Report – Site Layout and Planning for Daylight and Sunlight BR209 2022, and we therefore deem the proposed development to be compliant with this element.



## 3 Standards and guidelines

### 3.1 Standards and guidelines overview

For this report we applied the recommendations and guidelines of the following documents.

- The Building Research Establishment report, BR 209 (2011) Site Layout Planning for Daylight and Sunlight, A Guide to Good Practice. On June 8th, 2022, BR 209 (2011) was replaced with BR 209 (2022) Site Layout Planning for Daylight and Sunlight, A Guide to Good Practice. This report is commonly referenced as the main guide in Ireland/UK in determining the minimum standards of daylight and sunlight and for determining the impact of a development.
- European Standard EN 17037:2018 and British European Standard BS EN 17037:2018 Daylight in buildings, which replaces BS 8206-2:2008. The document contains guidance on interior day lighting and introduces some of the calculation procedures used in the BRE Report.
- IS EN 17037:2018 Daylight in buildings. Irish guidelines.

### 3.2 BR 209 (2022): Site Layout and Planning for Daylight and Sunlight, A Guide to Good Practice

This document is an updated version of BR 209 (2011) and referred to as the BRE Guidelines. The report contains guidance on how to design developments, whilst minimising the impacts on existing buildings from overshadowing and reduced levels of daylight and sunlight. The BRE guidelines recommend the use of BS EN 17037:2018 for assessing the quality of interior spaces in proposed developments. BS EN 17037 sets out assessment methods for daylight provision and access to sunlight. The advice provided within the guide is not mandatory and should not be seen as an instrument of planning policy. Its aim is to help rather than constrain the designer and should be interpreted flexibly since natural lighting is one of many factors in site layout design.

### 3.3 EN 17037:2018: Daylight in Buildings

EN 17037 is a daylighting standard published by the European Committee for Standardization (CEN) in 2018. It is applicable across all countries within the EU including Ireland with the Irish edition IS EN17037:2018EN 17037. It provides recommendations for daylight within spaces. Recommendations made in EN 17037 regarding daylight and sunlight exposure have been incorporated into the BRE Guidelines.

### 3.4 IS EN 17037:2018: Daylight in Buildings

Prior to 2018, Ireland had no standard for daylight. In 2018, the National Standards Authority of Ireland adopted EN 17037 to directly become IS EN 17037.

### 3.5 BS EN 17037:2018: Daylight in buildings

BS EN 17037:2018: Daylight in Buildings is the British version to the European Standard and also contains a national annex. The national annex (NA) attempts to align the guidance and expectations of the European standard with the now superseded BS 8206-2. Within the British Annex it acknowledges that a rigid application of the European Standard could prove to be a difficult task. Within BS EN 17037 NA, daylight recommendations differ depending on the function of a room and offers minimum daylight provision targets for kitchens, living rooms and bedrooms.

The assessment methodology in this report is built around the above-mentioned documents. The methods proposed are outlined in section 4.



## 4 Approach and methodology

### 4.1 General approach

This report assesses the daylight and sunlight reception to the proposed development and the impact on daylight and sunlight to surrounding areas. The results are then compared with the relevant guidelines and recommendations. The calculation assessment is split across two distinct parts:

Performance of proposed development

- Daylight reception analysis of the proposed development
- Sunlight reception analysis of the proposed development

Impact of proposed development on the existing surrounding environment:

- Impact on daylight reception analysis on existing environment
- Impact on sunlight reception analysis on existing environment

### 4.2 Note on the nature and effects of daylight and sunlight

When assessing the effects of proposed building projects on the potential to cause issues relating to light, it is important to recognise the distinction between daylight and sunlight. Daylight is the combination of all direct and indirect sunlight during the daytime, whereas sunlight (for the purposes of this report) comprises only the direct elements of sunlight. For example, on a cloudy or overcast day diffused daylight still comes in through windows, even when sunlight is absent. Any development within a built-up area has the potential to alter the amount of daylight received by nearby residential properties.

Care should be taken when designing new buildings in built-up areas, especially when the proposed development is relatively tall or situated to the south of existing buildings, because in the northern hemisphere the majority of the sunlight comes from the south. In Ireland (and other northern hemisphere countries) south-facing facades will in general, receive the most sunlight, while the north facing facades will receive sunlight on only a handful of occasions, specifically early mornings and late evenings during the summer months. It is therefore important to ensure that new buildings to the south of any development do not cause over shadowing to existing dwellings and therefore reduce their capacity to receive sunlight.

### 4.3 Assessment methodology

The analyses and assessments in this report are based on the guidelines recommended in the BRE guide (2022), the guide is intended to be used in conjunction with lighting recommendations in BS EN 17037 Daylight in buildings. It should also be noted that although the BRE guide gives numerical guidelines, these should be interpreted flexibly.

The BRE document sets out in its introduction that *"It is purely advisory and the numerical target values within it may be varied to meet the needs of the development and its location." "The advice given here is not mandatory and the guide should not be seen as an instrument of planning policy; its aim is to help rather than constrain the designer. Although it gives numerical guidelines, these should be interpreted flexibly since natural lighting is only one of many factors in site layout design"*.

Throughout this report an effort will be made to differentiate between metrics used to assess daylight (skylight) versus sunlight. The following sub-sections namely 'New buildings' and 'Existing buildings / existing amenity areas' outline the methodology and assessment criteria carried out.

### 4.4 New buildings

**Daylight provision:**

#### Daylight provision within IS EN 17037 guidelines

The IS EN 17037 explains that *"a space is considered to provide adequate daylight if a target illuminance level is achieved across a fraction of the reference plane within a space for at least half of the daylight hours"*. These guidelines do not provide different illuminance targets for different room types. Therefore, all rooms have the same daylight provision targets. To achieve the minimum level of daylight provision as per table 4.2, the following must be achieved, taken from IS EN 17037:2018 (table ref A.1).

- A minimum target illuminance of 300 lux must be achieved on over 50% of the floor area for over 50% of the available daylight hours.
- A minimum target illuminance of 100 lux must be achieved on over 95% of the floor area for over 50% of the available daylight hours.
- Both targets above must be satisfied for a space to be deemed compliant with the requirements.



Level of recommendation for vertical and inclined daylight opening	Target illuminance ET lx	Fraction of space for target level Fplane,%	Minimum target illuminance ETM lx	Fraction of space for Minimum target level Fplane,%	Fraction of daylight hours Ftime,%
Minimum	300	50%	100	95%	50%
Medium	500	50%	300	95%	50%
High	750	50%	500	95%	50%

Table 4.2: IS EN 17037:2018 target illuminance levels.

These recommendations can also be expressed in terms of a daylight factor. IS EN 17037:2018 (table ref A.3) provides the corresponding daylight factor relative to a recommended target illuminance and target minimum illuminance depending on the location (capital city for individual countries) for daylight. The Dublin daylight factor target recommendations are replicated in table 4.3.

Nation	Capital	Geographical latitude $\phi$ [°]	Median External Diffuse Illuminance $E_{v,d,med}$	D to exceed 100 lx	D to exceed 300 lx	D to exceed 500 lx	D to exceed 750 lx
Ireland	Dublin	53,43	14 900	0.7%	2.0%	3.4%	5.0%

Table 4.3: IS EN 17037:2018 target daylight factor levels for Dublin.

Therefore, within IS EN 17037:2018, to achieve the minimum level of daylight provision for vertical openings the following must be achieved:

- A minimum target daylight factor of 2.0% must be achieved on over 50% of the floor area for over 50% of the available daylight hours.
- A minimum target daylight factor of 0.7% must be achieved on over 95% of the floor area for over 50% of the available daylight hours.
- Both targets above must be satisfied for a space to be deemed compliant with the requirements.

#### Daylight provision within BS EN 17037 National Annex

In the UK, EN 17037 was adopted to form BS EN 17037 and a national annex was also included. The national annex offers additional targets and guidance for daylight provision in residential developments and states “*it is the opinion of the UK committee that the recommendations for daylight provision in a space may not be achievable for some buildings.*” The national annex gives specific minimum recommendations for habitable rooms in dwellings in the UK. These are intended for ‘hard to light’ dwellings. The national annex therefore provides the UK guidance on minimum daylight provision in all UK dwellings, these are 100 lux in bedrooms, 150 lux in living rooms and 200 lux in kitchens, to be exceeded over at least 50% of the assessment points in the room for at least half of the daylight hours.

Habitable room types	BS EN17037 National Annex Minimum target Illuminance	BS EN17037 Corresponding minimum target daylight factor (Dublin)
Kitchen	200 lux	1.3%
Living rooms	150 lux	1.0%
Bedrooms	100 lux	0.7%
Living, Kitchen, Dining	200 lux	1.3%

Table 4.4: BS EN 17037 minimum target Illuminances and daylight factor for dwellings.



### Daylight provision within BR 209 (2022) guidelines

The BRE guide is intended to be used in conjunction with recommendations in BS EN 17037. The guide states that “Daylight provision in new rooms may be checked using either of the methods in BS EN 17037 Daylight in Buildings: direct prediction of illuminance levels using hourly climate data, or the use of the daylight factor”. The two methods to assess daylight provision to the interior which are based on target values.

- Method 1-Daylight factor method: This calculation method uses the daylight factor targets on the reference plane. The Daylight factor is the illuminance at a point on a reference plane in a space, divided by the illuminance on an unobstructed horizontal surface outdoors. The assessment is carried out on a representative day and time during the year, i.e., under standard CIE overcast sky conditions. BS EN 17037 gives the Median External Diffuse Illuminance (Ev,d,med) for the capital cities throughout Europe to account for external local illuminance levels.
- Method 2-Illuminance method: This calculation method uses the illuminance targets on the reference plane. The assessment requires the use of a suitable weather file which accounts for varying sky conditions and sun positions throughout the year and takes into account the orientation of the space

Equivalent daylight factor targets to achieve a target illuminance over at least half of the daylight hours in a year are based on the formula: Target daylight factor (DT)= target illuminance/Ev,d,med x 100 [%].

Where, Ev,d,med is the median diffuse horizontal illuminance from the sky (as recommended for Dublin, Ireland).

The daylight factor (D) addresses daylight provision as a ratio of unobstructed external illuminance under overcast sky conditions. The daylight factor is defined as  $D = E_i/E_o \times 100[\%]$ , where,  
E<sub>i</sub>=illuminance due to daylight at a point on the indoors working plane.  
E<sub>o</sub>= simultaneous outdoor illuminance on a horizontal plane from an unobstructed hemisphere of overcast sky.

Table 4.5 provides the target illuminances from daylight over at least half of the daylight hours and thus the corresponding calculated daylight factor targets for side lit rooms for Dublin.

Level of recommendation for vertical and inclined daylight opening	Target illuminance (lx) for half of assessment grid	Target illuminance ETM (lx) for 95% of assessment grid	Target daylight factor D for half of assessment grid (Dublin)	Target daylight factor D for 95% of assessment grid (Dublin)
Minimum	300	100	2.0%	0.7%
Medium	500	300	3.4%	2.0%
High	750	500	5.0%	3.4%

Table 4.5: Target illuminances and thus the corresponding calculated daylight factor targets for side lit rooms for Dublin.

The recommendations for rooms are met if both target daylight factors are achieved; the median daylight factor over 50% of the reference plane, and the minimum daylight factor over 95% of the reference plane.

### Project calculation parameters

The following values were used in the daylighting calculations.

Element	DKP metrics	Comments
Internal and external factors:		
Ceilings	0.8	Light
Walls	0.5	Medium dark
Floor	0.2	Dark
Exterior walls and obstructions	0.2	
Exterior ground	0.2	
Maintenance factors:		
Glass light diffuse transmittance	0.68	
Glazing maintenance factor	0.92	

Table 4.6: Project calculation parameters.



**Sunlight provision:**

**Sunlight to proposed amenity spaces / Sun on ground**

Acceptable criterion within the BRE guidelines for sunlight reception recommends that at least half of the amenity area should receive at least two hours of sunlight on the 21<sup>st</sup> of March. The minimum sunlight requirement in this report measured in sunlight time 2 hours (120 minutes) multiplied by 50% area m<sup>2</sup> or the minimum requirement = 120 (min) \* 0.5a (m<sup>2</sup>) = [ ] min·m<sup>2</sup>.

Analysis	BRE recommendation, criteria on March 21 <sup>st</sup>	Acceptable sunlight reception parameters
Sunlight reception	Minimum sunlight reception in amenity spaces	At least 50% of the total area to receive at least 2 hours sunshine

Table 4.7: Sunlight to proposed amenity spaces / Sun on ground assessment

The sunlight assessment is executed using a 3D model of the project with the results illustrated in tabular format showing the hourly status of the shadow / sunlight fraction in the relevant amenity spaces. Appendix A provides the 3D images. The impacts of vegetation: It is important to note that according to the BRE Report, calculations do not normally take into account vegetation. The exception is when evergreen vegetation exists that forms a continuous barrier and would be permanent throughout the seasons.

**4.5 Existing buildings**

**Impact on daylight provision:**

**Daylight provision to surrounding existing buildings**

The impact of the proposed development on the existing buildings with respect to daylight can be assessed using the following methodologies advised in the BRE guide.

- The distance test: loss of light to windows need not be analysed if the distance from the existing window to the development is three or more times its height above the centre of the existing window.
- The 25° rule: loss of light to windows need not be analysed if the angle to the horizontal subtended by the new development from the centre of the existing window is less than 25° (an angle of 25° equates to a VSC of 27%).
- Vertical Sky Component (VSC) assessment: diffuse daylight of an existing building may be adversely affected by a proposed development if either: the vertical sky component measured at the centre of an existing main window is less than 27%, and less than 0.8 times its former value; or the area of the working plane which can receive direct skylight is reduced to less than 0.8 times its former value.

The impact assessment of daylight is required for windows serving rooms in adjoining dwellings where daylight is required including living rooms, kitchens and bedrooms. Windows to bathrooms, toilets, storerooms, circulation areas and garages need not be assessed. The guidelines also apply to any room that may have a reasonable expectation of daylight, including schools, hospitals, hotels and some offices. To ensure a neighbouring property is not adversely affected, VSC is calculated and assessed in this report. This report assesses the percentage of direct sky illuminance that falls on the assessment point of neighbouring windows that could be affected by the proposed development, image 4.1 represents this.

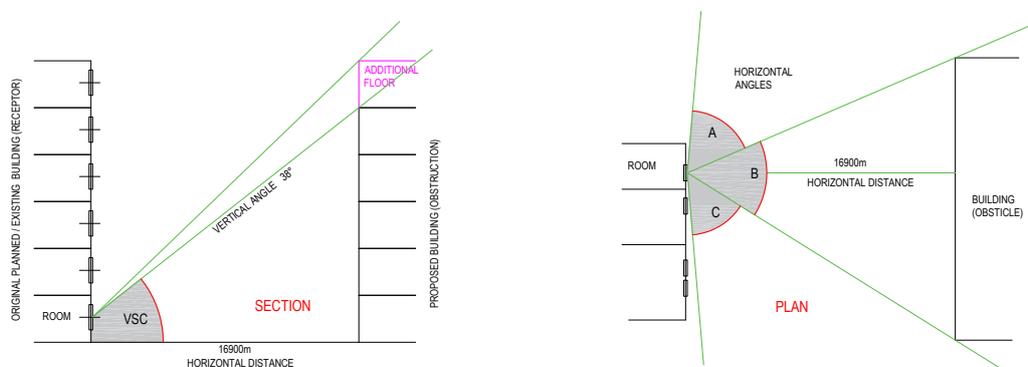


Image 4.1:

VSC gives a measure of daylight received on the outside of a window. Stated within BR 209 (2022) “if the VSC is greater than 27% then enough skylight should still be reaching the window of the existing building. Any reduction



below this level should be kept to a minimum. If the VSC, with the new development in place, is both less than 27% and less than 0.80 times its former value, occupants of the existing building will notice the reduction in the amount of skylight". Table 4.8 details the BRE assessment criteria for daylight reception for existing windows.

Analysis	Description	Acceptable parameters
Daylight reception	Existing daylight incoming angle	Existing angles should not be affected more than 0.8 time its former value or a maximum loss of 20%.

Table 4.8: VSC assessment.

In this report, the VSC of the assessment point on each of the assessed windows will be calculated, both in the baseline state and in the proposed state. The baseline state reflects the current VSC of the window, the proposed state will determine what the VSC of the window would be if the proposed development is built as planned.

## Impact on sunlight provision:

### Neighbouring Properties – Sunlight on the Ground (Shadow) Gardens and Open spaces

Sunlight provision in existing amenity areas: BRE (2022), recommendations are given as to the quantity of sunlight in amenity areas that is required to produce a well sunlit space throughout the year. "It is recommended that for it to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least two hours of sunlight on 21<sup>st</sup> of March. If as a result of new development, an existing garden or amenity area does not meet the above, and the area which can receive two hours of sun on 21<sup>st</sup> of March is less than 0.80 times its former value, then the loss of sunlight is likely to be noticeable". Calculations were conducted in accordance with the BRE guidelines to determine the extent to which the proposed development could affect the shadow / sunlight reception in the selected existing neighbouring amenity spaces. For existing amenity spaces any loss of sunlight should not be greater than 0.8 times its former size on March 21<sup>st</sup>.

Analysis	Criteria on March 21 <sup>st</sup>	Acceptable sunlight reception parameters
Sunlight reception	Minimum sunlight reception in amenity spaces	At least 80% or 0.8 x its former sunlight reception.

Table 4.9: Sunlight in existing amenity areas.

Sunlight provision in existing amenity areas is recommended to be checked for all open spaces where it is required. BRE recommends spaces such as, gardens, such as the main back garden of a house or communal gardens including courtyards and roof terraces, parks and playing fields, children's playgrounds, outdoor swimming pools and paddling pools, and other areas of recreational water such as marinas and boating lakes, sitting out areas such as those between non-domestic buildings and in public squares, nature reserves (which may have special requirements for sunlight if rare plants are growing there).

**Design Model:** A 3D model of the proposed development and the surrounding neighbouring properties was provided by the Architect. SketchUp Pro 2023 design model was used to examine potential impacts. The model was geo-referenced to its correct location and an accurate solar daylight system was introduced. The 3D model of the project with the results illustrated in tabular format showing the hourly status of the shadow/sunlight fraction in the relevant amenity spaces is used to undertake the sun light assessment. Appendix A provides the illustrations in hourly sections.



#### 4.6 Summary of analysis

The table below summarises the assessments carried out in this report.

Element	Guidelines	
Performance of proposed development		
Daylight	Daylight – IS EN 17037 / BS EN 17307	To achieve the daylight provision outlined in IS / BS EN 17037:2018 a given room is recommended to achieve: Using method 1: <ul style="list-style-type: none"> <li>• A target daylight factor of 2.0% must be achieved on over 50% of the floor area for over 50% of the available daylight hours.</li> <li>• A target daylight factor of 0.7% must be achieved on over 95% of the floor area for over 50% of the available daylight hours.</li> </ul> Or using method 2: <ul style="list-style-type: none"> <li>• A target illuminance of 300 lux must be achieved on over 50% of the floor area for over 50% of the available daylight hours.</li> <li>• A target illuminance of 100 lux must be achieved on over 95% of the floor area for over 50% of the available daylight hours.</li> </ul>
	Daylight - National annex BS EN 17037	To achieve the alternate minimum daylight provision outlined in the national annex of BS EN 17037:2018, the room is recommended to achieve: <ul style="list-style-type: none"> <li>• Kitchens, 1.3% target daylight factor or 200 lux over 50% of the floor area for over half the daylight hours.</li> <li>• Living rooms, 1.0% target daylight factor or 150 lux over 50% of the floor area for over half the daylight hours.</li> <li>• Bedrooms, 0.7% target daylight factor or 100 lux over 50% of the floor area for over half the daylight hours.</li> </ul>
Sunlight	Sunlight in amenity areas / Sun on ground	To meet the minimum recommendations given in BR 209 (2022), a new amenity space should experience two hours sunlight on March 21st for at least 50% of its area.
Impact of the proposed development on the existing surrounding environment		
Daylight	Vertical Sky Component (VSC)	To meet the recommendations in BR 209 (2022), the VSC with the new development in place, should be greater than 27% or greater than 0.80 times its former value.
Sunlight	Sunlight in existing amenity areas / Sun on ground	To meet the recommendations in BR 209 (2022), an existing amenity space, with the new development in place should experience in excess of two hours sunlight on March 21st for at least 50% of its area and should be greater than 0.80 times the previous value.

Table 4.10: Summary of assessments.



#### 4.7 Note on receptors

The BRE guide states that when assessing the potential effects of a proposed development on existing buildings, only those windows and rooms that have a reasonable expectation of daylight and sunlight need to be considered. Windows and rooms which meet this criterion are considered to be sensitive receptors. The BRE guide clarifies what are considered sensitive receptors with respect to sunlight and daylight as follows: "The guidelines given here are intended for use for rooms in adjoining dwellings where daylight is required, including living rooms, kitchens and bedrooms. Windows to bathrooms, toilets, storerooms, circulation areas and garages need not be analysed."

The guidelines may also be applied to any existing non-domestic building where the occupants have a reasonable expectation of daylight; this would normally include schools, hospitals, hotels and hostels, small workshops and some offices. Outdoor amenity spaces which have a reasonable expectation of sunlight, whether they are private gardens, communal open spaces or outdoor public amenity areas, are also considered sensitive receptors. Receptors that may be affected by the proposed development are highlighted in the calculation section of each appropriate analysis.

#### 4.8 Note on the definition of effects

Guidelines from Appendix H in the BRE guidelines is used to categorise the varying degrees of compliance when assessing the impact, a proposed development might have on the daylight and sunlight of an existing environment. The table of definitions given below is used in the results section of this report, for the purposes of categorising the impact on sunlight and daylight.

Effect	Definition of effect
Negligible	Where any loss of daylight / sunlight is well within the guidelines, or only a small number of windows or area of space lose daylight / sunlight but still within the guidelines, then the impact is assessed as negligible.
Minor Adverse	If the level of effect is marginally outside of the criteria as stated in the relevant guidelines, a minor adverse level of effect will be applied if the level of daylight / sunlight is within 5% of the target guideline.
Moderate Adverse	If the level of effect is outside of the criteria as stated in the relevant guidelines, a moderate adverse level of effect will be applied if the level of daylight / sunlight is within 5-10% of the target guideline.
Major Adverse	If the level of effect is outside of the criteria as stated in the relevant guidelines, a moderate adverse level of effect will be applied if the level of daylight / sunlight is in excess of 10% of the target value.
Beneficial Impact	If the ratio of change is > 1.10 (an improvement of 10%), then the impact is assessed as a beneficial impact. Should less significant improvements occur a negligible level of effect will be stated.

Table 4.11: Definition of effects used in the impact assessments.



## 5 Performance of proposed development – Calculation results and conclusion

The performance of the proposed development calculations is broken into two sections, daylight reception and sunlight reception.

### Daylight Reception:

#### 5.1 Receptor selection – Rooms within the proposed development

The daylight reception assessment has been targeted to habitable rooms within the proposed development on the ground floor which are observed to be in the most daylight challenging positions or rooms positioned with close by obstacles. Apartment block: All habitable rooms within the proposed block on the ground floor and first floor have been assessed. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms. Receptors / rooms within the proposed development are indicated in image 5.1 to 5.5 below.

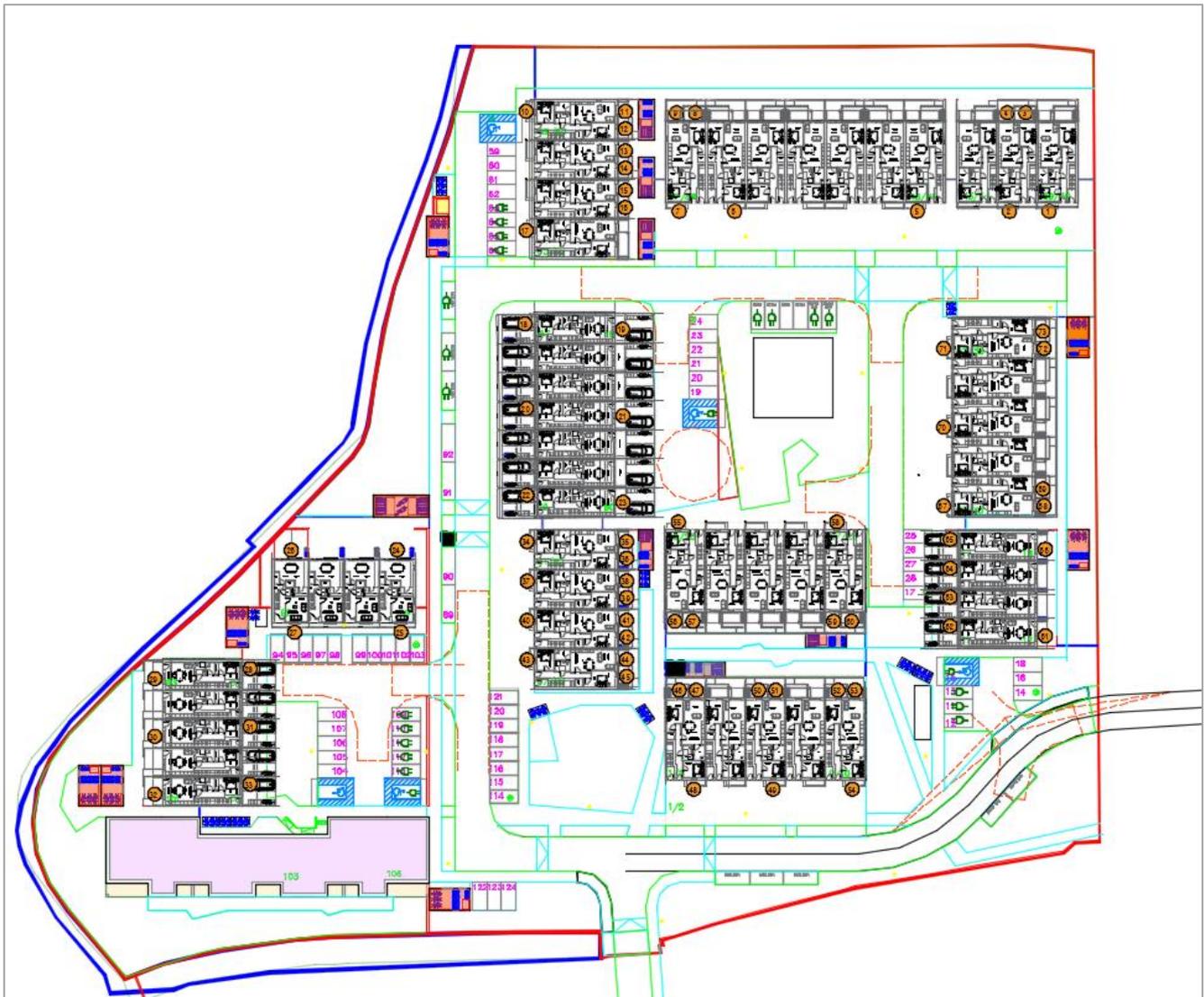


Image 5.1: Level 00 (ground floor). Overall view.

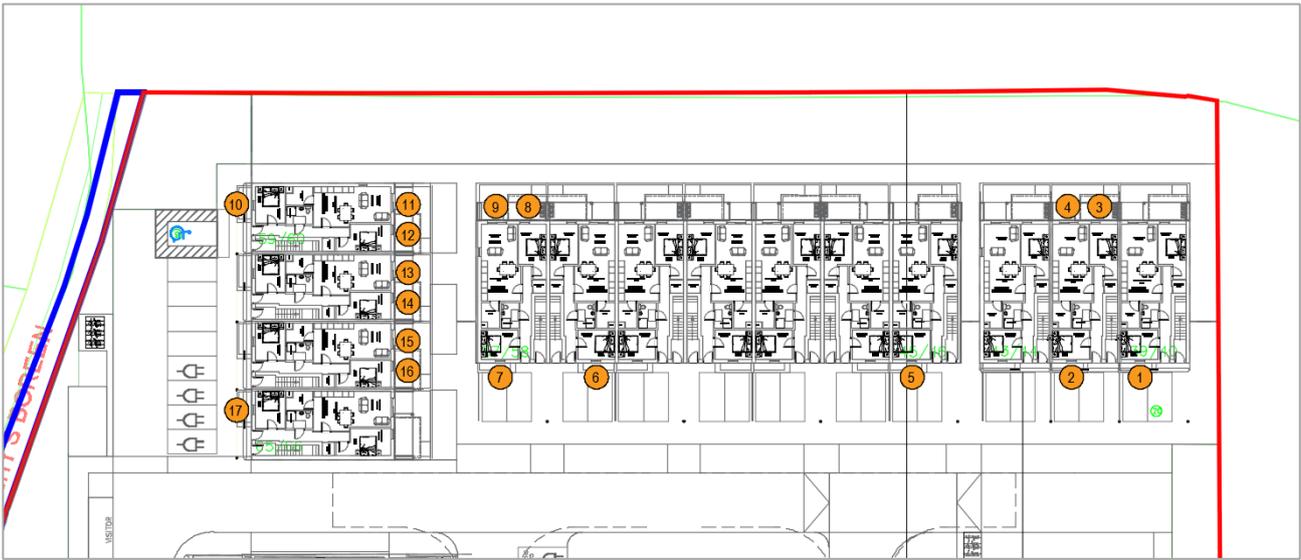


Image 5.2: Level 00 (ground floor). Receptor no. 1 to 17.



Image 5.3: Level 00 (ground floor). Receptor no. 18 to 60.



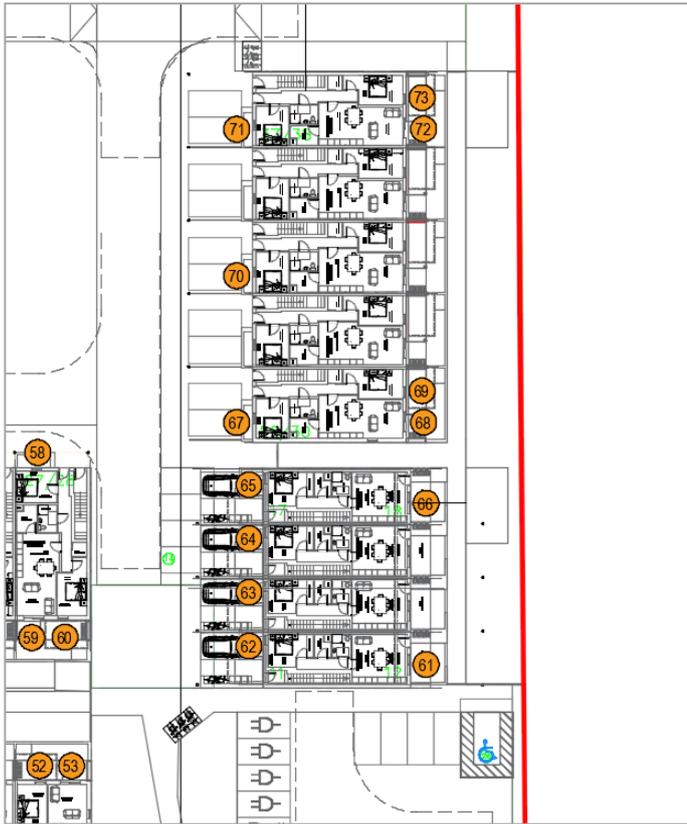


Image 5.4: Level 00 (ground floor). Receptor no. 61 to 73.

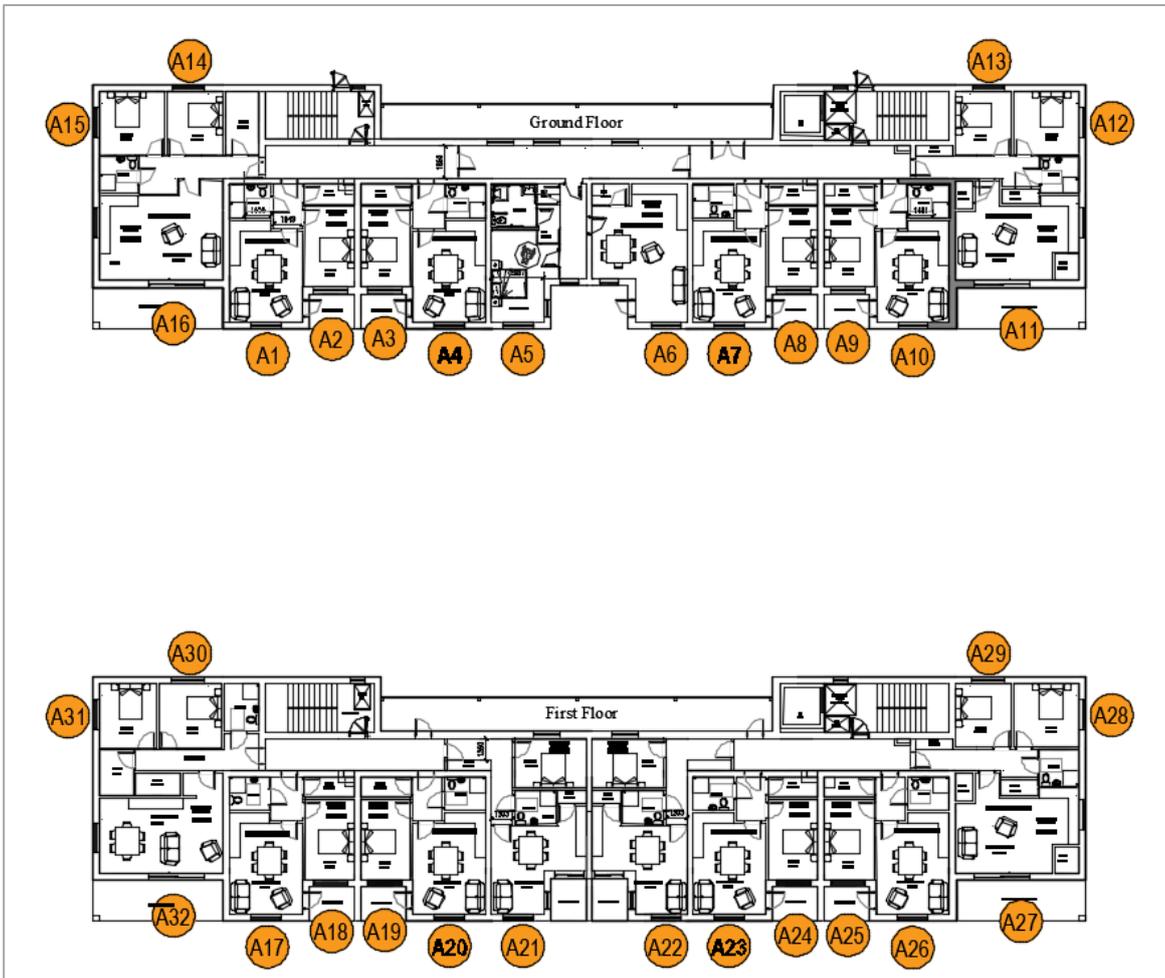


Image 5.5: Level 00 & 01 (ground floor & first floor). Apartment block. Receptor no. A1 to A32.



### 5.2 Calculation result table

The results table below provide the full calculation results of the selected receptors / rooms. IS EN17037 / BS EN17037 daylight factor and illuminance levels are provided and the National Annex (NA) target values in BS EN17037. The calculation results have been given the following colour code guide depending on its level of resulting compliance within each guideline.

#### Compliance hierarchy

- ☑☑ >=100%
- ☑ <100% , >95%
- ☑ <95% , >90%
- !! <90% , >80%
- x <80%

Receptor	Level/Floor	Block /Unit ID	Room / type	glass area m2	room area m2	glass ratio %	Depth/Width	Σ VSC L (total)	ISEN17037				ISEN17037				BSEN17037	
									DAY LIGHT FACTOR				ILLUMINANCE				ANNEX	
									50% area		95% area		50% area		95% area		illuminance lx	day light factor %
									50% sun hrs	min	50% sun hrs	min	50% sun hrs	min	50% sun hrs	min		
%	%	%	%	lx	lx	lx	lx	lx	lx									
1	00	Unit no. 39	Bed room	1.65	11.1	14.9	3.87	34%	2.48	2.00	0.87	0.70	375	300	124	100	100	0.7
2	00	Unit no. 41	Bed room	1.65	11.1	14.9	3.87	34%	2.48	2.00	0.87	0.70	375	300	124	100	100	0.7
3	00	Unit no. 41	Bed room	2.04	11.2	18.2	2.57	32%	2.88	2.00	1.01	0.70	436	300	144	100	100	0.7
4	00	Unit no. 41	Living-Kitchen	3.99	27.4	14.6	1.54	32%	2.88	2.00	1.01	0.70	436	300	144	100	200	1.3
5	00	Unit no. 45	Bed room	1.65	11.1	14.9	3.87	31%	2.21	2.00	0.77	0.70	334	300	110	100	100	0.7
6	00	Unit no. 55	Bed room	1.65	11.1	14.9	3.87	30%	2.14	2.00	0.75	0.70	324	300	107	100	100	0.7
7	00	Unit no. 57	Bed room	1.65	11.1	14.9	3.87	30%	2.14	2.00	0.75	0.70	324	300	107	100	100	0.7
8	00	Unit no. 57	Bed room	2.04	11.2	18.2	2.57	32%	2.88	2.00	1.01	0.70	436	300	144	100	100	0.7
9	00	Unit no. 57	Living-Kitchen	5.80	27.4	21.2	1.54	27%	3.42	2.00	1.20	0.70	517	300	171	100	200	1.3
10	00	Unit no. 59	Bed room	1.65	11.1	14.9	3.87	36%	2.61	2.00	0.91	0.70	395	300	130	100	100	0.7
11	00	Unit no. 59	Living-Kitchen	5.80	27.4	21.2	1.54	24%	3.02	2.00	1.05	0.70	456	300	150	100	200	1.3
12	00	Unit no. 59	Bed room	2.04	11.2	18.2	2.57	24%	2.08	2.00	0.73	0.70	314	300	104	100	100	0.7
13	00	Unit no. 61	Living-Kitchen	3.99	27.4	14.6	1.54	23%	2.01	2.00	0.70	0.70	304	300	100	100	200	1.3
14	00	Unit no. 61	Bed room	2.04	11.2	18.2	2.57	23%	2.01	2.00	0.70	0.70	304	300	100	100	100	0.7
15	00	Unit no. 63	Living-Kitchen	3.99	27.4	14.6	1.54	25%	2.21	2.00	0.77	0.70	334	300	110	100	200	1.3
16	00	Unit no. 63	Bed room	2.04	11.2	18.2	2.57	25%	2.21	2.00	0.77	0.70	334	300	110	100	100	0.7
17	00	Unit no. 65	Bed room	1.65	11.1	14.9	3.87	36%	2.61	2.00	0.91	0.70	395	300	130	100	100	0.7
18	00	Unit no. 67	Bed room	1.44	10.9	13.2	2.96	31%	1.94	2.00	0.68	0.70	294	300	97	100	100	0.7
19	00	Unit no. 67	Living-Kitchen	6.22	24.0	26.0	2.49	31%	4.76	2.00	1.66	0.70	719	300	237	100	200	1.3
20	00	Unit no. 73	Bed room	1.44	10.9	13.2	2.96	31%	1.94	2.00	0.68	0.70	294	300	97	100	100	0.7
21	00	Unit no. 73	Living-Kitchen	6.22	24.0	26.0	2.49	31%	4.76	2.00	1.66	0.70	719	300	237	100	200	1.3
22	00	Unit no. 79	Bed room	1.44	10.9	13.2	2.96	31%	1.94	2.00	0.68	0.70	294	300	97	100	100	0.7
23	00	Unit no. 79	Living-Kitchen	6.22	24.0	26.0	2.49	28%	4.36	2.00	1.52	0.70	659	300	217	100	200	1.3
24	00	Unit no. 89	Living-Kitchen	6.99	23.5	29.7	3.21	30%	5.29	2.00	1.85	0.70	800	300	264	100	200	1.3
25	00	Unit no. 89	Living	5.75	16.0	36.0	2.79	27%	5.29	2.00	1.85	0.70	800	300	264	100	150	1.0
26	00	Unit no. 92	Living-Kitchen	6.11	23.5	26.0	3.21	32%	4.96	2.00	1.73	0.70	750	300	247	100	200	1.3
27	00	Unit no. 92	Living	3.99	16.0	25.0	2.79	26%	3.48	2.00	1.22	0.70	527	300	174	100	150	1.0
28	00	Unit no. 93	Bed room	1.69	11.0	15.3	3.03	29%	2.14	2.00	0.75	0.70	324	300	107	100	100	0.7
29	00	Unit no. 93	Living-Kitchen	6.22	24.0	26.0	2.49	34%	5.29	2.00	1.85	0.70	800	300	264	100	200	1.3
30	00	Unit no. 97	Living-Kitchen	6.22	24.0	26.0	2.49	34%	5.29	2.00	1.85	0.70	800	300	264	100	200	1.3
31	00	Unit no. 97	Bed room	1.69	11.0	15.3	3.03	29%	2.14	2.00	0.75	0.70	324	300	107	100	100	0.7
32	00	Unit no. 101	Living-Kitchen	6.22	24.0	26.0	2.49	26%	4.09	2.00	1.43	0.70	618	300	204	100	200	1.3
33	00	Unit no. 101	Bed room	1.69	11.0	15.3	3.03	26%	1.94	2.00	0.68	0.70	294	300	97	100	100	0.7
34	00	Unit no. 81	Bed room	1.65	11.1	14.9	3.87	34%	2.48	2.00	0.87	0.70	375	300	124	100	100	0.7
35	00	Unit no. 81	Living-Kitchen	5.80	27.0	21.5	1.53	22%	2.75	2.00	0.96	0.70	415	300	137	100	200	1.3
36	00	Unit no. 81	Bed room	2.63	11.5	22.9	2.50	22%	2.35	2.00	0.82	0.70	355	300	117	100	100	0.7



37	00	Unit no. 83	Bed room	1.65	11.1	14.9	3.87	33%	2.41	2.00	0.84	0.70	365	300	120	100	100	0.7
38	00	Unit no. 83	Living-Kitchen	3.99	27.0	14.8	1.53	22%	2.01	2.00	0.70	0.70	304	300	100	100	200	1.3
39	00	Unit no. 83	Bed room	2.04	11.5	17.7	2.50	22%	1.94	2.00	0.68	0.70	294	300	97	100	100	0.7
40	00	Unit no. 85	Bed room	1.65	11.1	14.9	3.87	34%	2.48	2.00	0.87	0.70	375	300	124	100	100	0.7
41	00	Unit no. 85	Living-Kitchen	3.99	27.0	14.8	1.53	24%	2.14	2.00	0.75	0.70	324	300	107	100	200	1.3
42	00	Unit no. 85	Bed room	2.04	11.5	17.7	2.50	24%	2.08	2.00	0.73	0.70	314	300	104	100	100	0.7
43	00	Unit no. 87	Bed room	1.65	11.1	14.9	3.87	33%	2.41	2.00	0.84	0.70	365	300	120	100	100	0.7
44	00	Unit no. 87	Living-Kitchen	4.41	27.0	16.3	1.53	21%	2.08	2.00	0.73	0.70	314	300	104	100	200	1.3
45	00	Unit no. 87	Bed room	2.63	11.5	22.9	2.50	21%	2.35	2.00	0.82	0.70	355	300	117	100	100	0.7
46	00	Unit no. 1	Bed room	2.04	11.5	17.7	2.50	23%	2.01	2.00	0.70	0.70	304	300	100	100	100	0.7
47	00	Unit no. 1	Living-Kitchen	3.99	27.0	14.8	1.53	23%	2.01	2.00	0.70	0.70	304	300	100	100	200	1.3
48	00	Unit no. 1	Bed room	1.65	11.1	14.9	3.87	34%	2.48	2.00	0.87	0.70	375	300	124	100	100	0.7
49	00	Unit no. 5	Bed room	1.65	11.1	14.9	3.87	34%	2.48	2.00	0.87	0.70	375	300	124	100	100	0.7
50	00	Unit no. 5	Bed room	2.04	11.5	17.7	2.50	23%	2.01	2.00	0.70	0.70	304	300	100	100	100	0.7
51	00	Unit no. 5	Living-Kitchen	3.99	27.0	14.8	1.53	23%	2.01	2.00	0.70	0.70	304	300	100	100	200	1.3
52	00	Unit no. 9	Bed room	2.04	11.5	17.7	2.50	23%	2.01	2.00	0.70	0.70	304	300	100	100	100	0.7
53	00	Unit no. 9	Living-Kitchen	5.80	27.0	21.5	1.53	23%	2.95	2.00	1.03	0.70	446	300	147	100	200	1.3
54	00	Unit no. 9	Bed room	1.65	11.1	14.9	3.87	34%	2.48	2.00	0.87	0.70	375	300	124	100	100	0.7
55	00	Unit no. 19	Bed room	1.65	11.1	14.9	3.87	29%	2.08	2.00	0.73	0.70	314	300	104	100	100	0.7
56	00	Unit no. 19	Living-Kitchen	5.80	27.0	21.5	1.53	23%	2.95	2.00	1.03	0.70	446	300	147	100	200	1.3
57	00	Unit no. 19	Bed room	2.04	11.5	17.7	2.50	23%	2.01	2.00	0.70	0.70	304	300	100	100	100	0.7
58	00	Unit no. 27	Bed room	1.65	11.1	14.9	3.87	30%	2.21	2.00	0.77	0.70	334	300	110	100	100	0.7
59	00	Unit no. 27	Living-Kitchen	3.99	27.0	14.8	1.53	23%	2.01	2.00	0.70	0.70	304	300	100	100	200	1.3
60	00	Unit no. 27	Bed room	2.04	11.5	17.7	2.50	23%	2.01	2.00	0.70	0.70	304	300	100	100	100	0.7
61	00	Unit no. 11	Living-Kitchen	6.22	24.0	26.0	2.49	34%	5.23	2.00	1.83	0.70	790	300	261	100	200	1.3
62	00	Unit no. 11	Bed room	2.03	11.0	18.4	3.03	25%	2.28	2.00	0.80	0.70	344	300	114	100	100	0.7
63	00	Unit no. 13	Bed room	2.03	11.0	18.4	3.03	25%	2.21	2.00	0.77	0.70	334	300	110	100	100	0.7
64	00	Unit no. 15	Bed room	2.03	11.0	18.4	3.03	25%	2.21	2.00	0.77	0.70	334	300	110	100	100	0.7
65	00	Unit no. 17	Bed room	2.03	11.0	18.4	3.03	25%	2.21	2.00	0.77	0.70	334	300	110	100	100	0.7
66	00	Unit no. 17	Living-Kitchen	6.22	24.0	26.0	2.49	31%	4.76	2.00	1.66	0.70	719	300	237	100	200	1.3
67	00	Unit no. 29	Bed room	1.65	11.1	14.9	3.87	31%	2.28	2.00	0.80	0.70	344	300	114	100	100	0.7
68	00	Unit no. 29	Living-Kitchen	3.99	27.0	14.8	1.53	34%	3.02	2.00	1.05	0.70	456	300	150	100	200	1.3
69	00	Unit no. 29	Bed room	2.04	11.5	17.7	2.50	34%	2.88	2.00	1.01	0.70	436	300	144	100	100	0.7
70	00	Unit no. 33	Bed room	1.65	11.1	14.9	3.87	32%	2.28	2.00	0.80	0.70	344	300	114	100	100	0.7
71	00	Unit no. 37	Bed room	1.65	11.1	14.9	3.87	32%	2.28	2.00	0.80	0.70	344	300	114	100	100	0.7
72	00	Unit no. 37	Living-Kitchen	3.99	27.0	14.8	1.53	32%	2.81	2.00	0.98	0.70	426	300	140	100	200	1.3
73	00	Unit no. 37	Bed room	2.04	11.5	17.7	2.50	32%	2.75	2.00	0.96	0.70	415	300	137	100	100	0.7
A1	00	Apt.	Living-Kitchen	4.57	23.8	19.2	2.30	32%	3.35	2.00	1.17	0.70	507	300	167	100	200	1.3
A2	00	Apt.	Bed room	3.99	12.9	31.0	2.33	18%	2.41	2.00	0.84	0.70	365	300	120	100	100	0.7
A3	00	Apt.	Bed room	3.99	12.9	31.0	2.33	18%	2.41	2.00	0.84	0.70	365	300	120	100	100	0.7
A4	00	Apt.	Living-Kitchen	4.57	23.8	19.2	2.30	32%	3.35	2.00	1.17	0.70	507	300	167	100	200	1.3
A5	00	Apt.	Bed room	5.67	18.2	31.2	4.18	23%	3.69	2.00	1.29	0.70	557	300	184	100	100	0.7
A6	00	Apt.	Living-Kitchen	5.67	33.5	16.9	2.88	23%	2.41	2.00	0.84	0.70	365	300	120	100	200	1.3
A7	00	Apt.	Living-Kitchen	4.57	23.8	19.2	2.30	28%	2.95	2.00	1.03	0.70	446	300	147	100	200	1.3
A8	00	Apt.	Bed room	3.99	12.9	31.0	2.33	17%	2.21	2.00	0.77	0.70	334	300	110	100	100	0.7
A9	00	Apt.	Bed room	3.99	12.9	31.0	2.33	17%	2.21	2.00	0.77	0.70	334	300	110	100	100	0.7
A10	00	Apt.	Living-Kitchen	4.57	23.8	19.2	2.30	28%	2.95	2.00	1.03	0.70	446	300	147	100	200	1.3
A11	00	Apt.	Living-Kitchen	9.87	30.2	32.7	3.54	25%	4.76	2.00	1.66	0.70	719	300	237	100	200	1.3
A12	00	Apt.	Bed room	3.57	13.0	27.6	3.23	31%	3.89	2.00	1.36	0.70	588	300	194	100	100	0.7
A13	00	Apt.	Bed room	3.57	11.2	31.9	3.28	29%	3.95	2.00	1.38	0.70	598	300	197	100	100	0.7
A14	00	Apt.	Bed room	3.57	11.2	31.9	3.28	25%	3.35	2.00	1.17	0.70	507	300	167	100	100	0.7
A15	00	Apt.	Bed room	3.57	13.0	27.6	3.23	32%	3.95	2.00	1.38	0.70	598	300	197	100	100	0.7
A16	00	Apt.	Living-Kitchen	9.87	33.6	29.4	3.37	22%	3.82	2.00	1.34	0.70	578	300	191	100	200	1.3
A17	01	Apt.	Living-Kitchen	4.57	23.8	19.2	2.30	33%	3.48	2.00	1.22	0.70	527	300	174	100	200	1.3



A18	01	Apt.	Bed room	3.99	12.9	31.0	2.33	19%	2.61	2.00	0.91	0.70	395	300	130	100	100	0.7
A19	01	Apt.	Bed room	3.99	12.9	31.0	2.33	19%	2.61	2.00	0.91	0.70	395	300	130	100	100	0.7
A20	01	Apt.	Living-Kitchen	4.57	23.8	19.2	2.30	33%	3.48	2.00	1.22	0.70	527	300	174	100	200	1.3
A21	01	Apt.	Living-Kitchen	9.03	22.5	40.1	2.77	25%	5.29	2.00	1.85	0.70	800	300	264	100	200	1.3
A22	01	Apt.	Living-Kitchen	9.03	22.5	40.1	2.77	25%	5.29	2.00	1.85	0.70	800	300	264	100	200	1.3
A23	01	Apt.	Living-Kitchen	4.57	23.8	19.2	2.30	29%	3.08	2.00	1.08	0.70	466	300	154	100	200	1.3
A24	01	Apt.	Bed room	3.99	12.9	31.0	2.33	18%	2.41	2.00	0.84	0.70	365	300	120	100	100	0.7
A25	01	Apt.	Bed room	3.99	12.9	31.0	2.33	18%	2.41	2.00	0.84	0.70	365	300	120	100	100	0.7
A26	01	Apt.	Living-Kitchen	4.57	23.8	19.2	2.30	29%	3.08	2.00	1.08	0.70	466	300	154	100	200	1.3
A27	01	Apt.	Living-Kitchen	9.87	30.2	32.7	3.54	27%	5.03	2.00	1.76	0.70	760	300	251	100	200	1.3
A28	01	Apt.	Bed room	3.57	13.0	27.6	3.23	33%	4.02	2.00	1.41	0.70	608	300	201	100	100	0.7
A29	01	Apt.	Bed room	3.57	11.2	31.9	3.28	31%	4.15	2.00	1.45	0.70	628	300	207	100	100	0.7
A30	01	Apt.	Bed room	3.57	11.2	31.9	3.28	26%	3.48	2.00	1.22	0.70	527	300	174	100	100	0.7
A31	01	Apt.	Bed room	3.57	13.0	27.6	3.23	34%	4.15	2.00	1.45	0.70	628	300	207	100	100	0.7
A32	01	Apt.	Living-Kitchen	9.87	33.6	29.4	3.37	23%	4.02	2.00	1.41	0.70	608	300	201	100	200	1.3

Table 5.1: Calculation results: Daylight performance of proposed development.



### 5.3 Daylight reception of proposed development conclusion

For the daylight assessment, results have been analysed within these standards:

- Assessed in accordance with IS EN17037 / BS EN17307, carried out in accordance with Method 1 and Method 2 described in the methodology section.
- Assessed in accordance with BS EN 17037:2018 National Annex.

The results from table 5.1 are reviewed under each standard below. The daylight reception assessment has been targeted to habitable rooms within the proposed development on the ground floor which are perceived to be in the most daylight challenging positions or rooms positioned with close by obstacles. Apartment block: All habitable rooms within the proposed block on the ground floor and first floor have been assessed. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms.

IS EN17037 / BS EN17307: To achieve recommendations outlined in IS EN 17037:2018 / BS EN 17307:2018, a given room must achieve: a target daylight factor of 2.0% or in terms of illuminance 300 lux on over 50% of the floor area for over 50% of the available daylight hours. And a minimum target daylight factor of 0.7% or in terms of illuminance 100 lux on over 95% of the floor area for over 50% of the available daylight hours. From the calculation result table 5.1 we note all of the proposed rooms calculated daylight results achieved the minimum guidelines, and the majority of receptors achieved well in excess of the minimum guidelines.

- Overall, residential rooms achieved on average a daylight factor (DF) of 2.9% and an illuminance of 447 lux on over 50% of the floor area for over 50% of the available daylight hours. An average DF of 1.03% and an illuminance of 145 lux on over 95% of the floor area for over 50% of the available daylight hours was achieved.

In an urban environment it can more often be the case that complete fulfilment with the guidelines is not attainable. Within the BS EN 17037 it acknowledges that a rigid application of the European Standard could prove to be a difficult task as it offers only a single target for new buildings and IS EN17037 currently has no specific National Annex. The British Annex of BS EN 17037, daylight recommendations differ depending on the function of a room and offers minimum daylight provision targets for kitchens, living rooms and bedrooms. Therefore, Given the similarity of weather, light and design patterns between Ireland and the UK and the lack of specific localisation Annex details in the Irish version, the alternate minimum daylight provision targets set out in the national annex of BS EN 17037 are reviewed next.

BS EN 17037:2018 National Annex: To achieve the alternate minimum daylight recommendations for Dublin, the room in question must achieve: Kitchen 1.3% target daylight factor or in terms of illuminance 200 lux. Living room 1.0% target daylight factor or in terms of illuminance 150 lux, and bedrooms 0.7% target daylight factor or in terms of illuminance 100 lux all over 50% of the floor area for over half the daylight hours. From the calculation result table 5.1 we note that all of the rooms calculated daylight are comfortably in excess of these minimum guidelines.

- Overall compliance for proposed development = 100%

In summary, the calculation results have achieved high compliance under IS EN17037 / BS EN17307 and BS EN 17037:2018 National Annex guidelines. This indicates an overall good level of daylight for the proposed development under the guidelines. We conclude, the proposed development can provide a good level of residential daylight amenity to future occupants.



## Sunlight Reception

### Sunlight in the new proposed amenity areas:

#### 5.4 Receptor selection - Amenity spaces within the proposed development

Image 5.6 below indicates the open space and public open space amenity areas that have been selected and analysed on the basis that the shadow casted from the proposed development areas may affect the amenity areas given its geographical location in relation to the development. These areas are identified below and labelled for reference in the results.

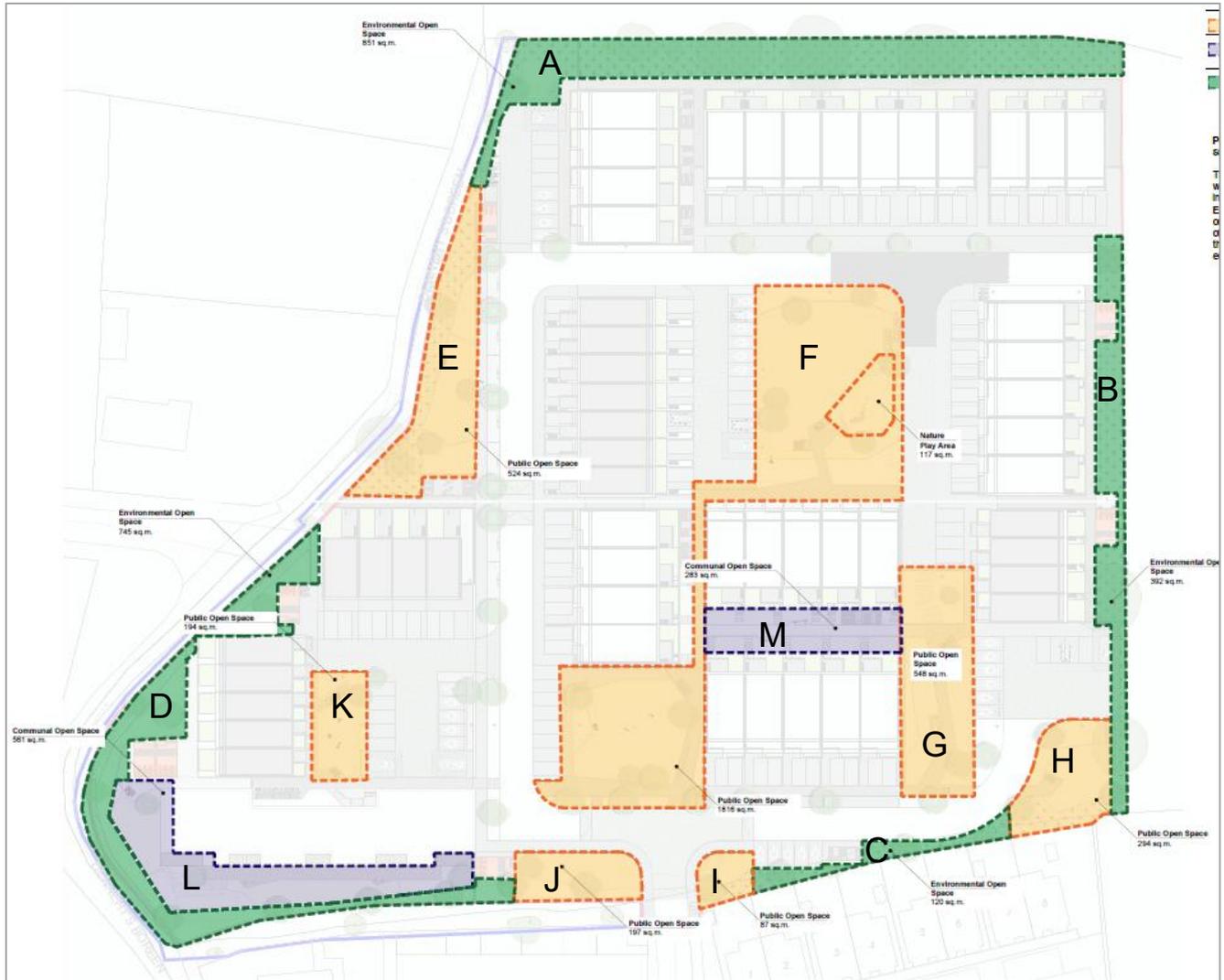


Image 5.6: New proposed amenity spaces within the development.

Receptor	Amenity Description	Amenity area (m²)
A	Environmental open space	851
B	Environmental open space	392
C	Environmental open space	120
D	Environmental open space	745
E	Public open space	524
F	Public open space	1,816
G	Public open space	548
H	Public open space	294
I	Public open space	87



J		Public open space	197
K		Public open space	194
L		Communal open space	561
M		Communal open space	283

Table 5.2: List of new proposed amenity spaces.

### 5.5 Calculation result table

The result table below provides a summary of the calculation results of the proposed amenity areas. It shows the overall hours of sunlight on March 21<sup>st</sup> together with the 'to-be-achieved' BRE minimum sunlight standards. Appendix B provides the full calculation results of the proposed amenity areas. The calculation results have been given the following colour code guide depending on its level of resulting compliance.

#### Compliance guide

☑	0% Over /equal to
☑	5% Within
!!	10% Within
x	10% In excess of

Amenity space ID ref	Amenity space area (m <sup>2</sup> )	Achieved daily sun time * area	Achieved total sun time (hrs)	Required sun hours @ 50% area	Achieved sun hours on @ 50% area
A	851.0	239982.0	4.70	2.0	4.0
B	392.0	160876.8	6.84	2.0	6.0
C	120.0	61632.0	8.56	2.0	10.0
D	745.0	321840.0	7.20	2.0	8.0
E	524.0	239887.2	7.63	2.0	9.0
F	1816.0	758361.6	6.96	2.0	8.0
G	548.0	256135.2	7.79	2.0	9.0
H	294.0	153468.0	8.70	2.0	10.0
I	87.0	44683.2	8.56	2.0	10.0
J	197.0	104488.8	8.84	2.0	10.0
K	194.0	56337.6	4.84	2.0	7.0
L	561.0	313711.2	9.32	2.0	10.0
M	283.0	44317.8	2.61	2.0	2.0

Table 5.3: Calculation results: Summary table of sunlight analysis of proposed amenity spaces.

### 5.6 Sunlight reception – amenity areas of the proposed development conclusion

Based on the BRE guidelines at least 50% of the amenity space should receive at least two hours of sunlight on the 21<sup>st</sup> of March. From the calculation results in table 5.3 we note the selected amenity spaces all achieved sunlight above the recommended guidelines, see image 5.6 for receptor/amenity space location. Summary of results are as follows:

- The average public open space amenity area calculated sunlight on at least 50% of the area on March 21<sup>st</sup> is 9.0 hours.
- The average communal open space amenity area calculated sunlight on at least 50% of the area on March 21<sup>st</sup> is 6.0 hours.
- The average environmental open space amenity area calculated sunlight on at least 50% of the area on March 21<sup>st</sup> is 7.0 hours.

This confirms the amenity areas proposed will be adequately sunlit throughout the year. We conclude that the new amenity spaces receive sunlight on 50% of the area is in line with the recommendations of the BRE Report - Site Layout and Planning for Daylight and Sunlight - and therefore deem these to be compliant to this element.



## 6 Impact of proposed development – Calculation results and conclusion

The impact of the proposed development calculations and assessments is broken into two sections, impact on daylight reception and impact on sunlight reception.

### Impact on Daylight Reception:

#### Vertical sky component (VSC):

##### 6.1 Receptor selection – Buildings / windows neighbouring the proposed development

The VSC assessment has been targeted to habitable neighbouring windows / rooms / dwellings that are perceived to be in challenging locations i.e., ground floor rooms and dwellings/rooms in the vicinity of the new proposed development on the basis that if these habitable rooms pass the minimum requirements all rooms at higher levels will definitely pass the minimum recommendations as a result of the improving vertical sky view angle. Image 6.1 below indicates the windows that have been selected and analysed. The windows are identified and labelled for reference in the results.

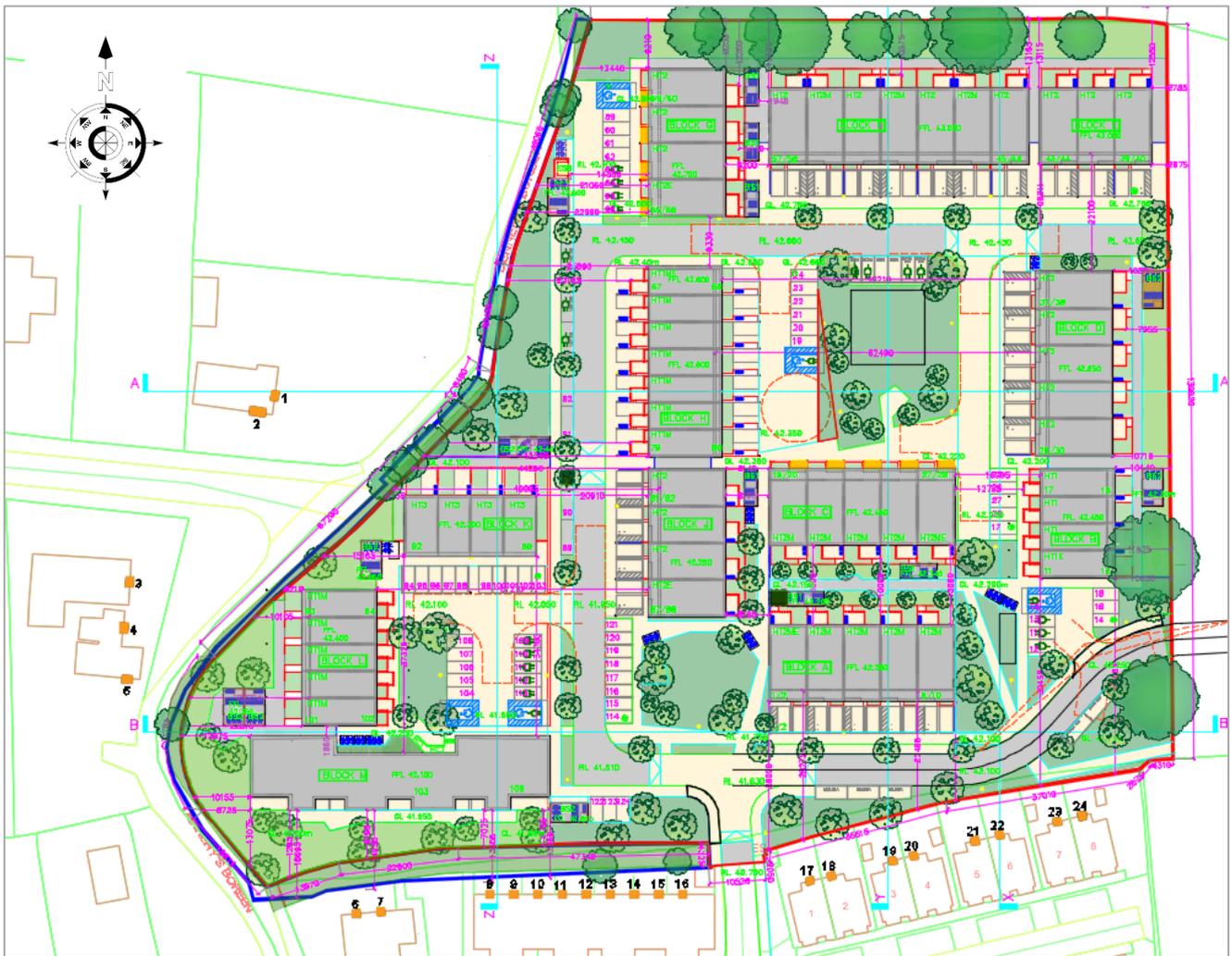


Image 6.1: Daylight impact: Neighbouring receptors – Overall view (receptor no. 1 - 24).



Receptor / window *	Level	Location / address	Dwelling description
1, 2	00	Dennehy's Boreen, Killarney, Co. Kerry	Residential
3	00	Dennehy's Boreen, Killarney, Co. Kerry	Residential
4, 5	00	The Lyne's little lodge, Dennehy's Boreen, Killarney, Co. Kerry	Residential
6, 7	00	Block B, Garrai Glas, Park Road, Killarney, Co. Kerry	Residential
8, 9, 10, 11, 12, 13, 14, 15, 16	00	Block A, Garrai Glas, Park Road, Killarney, Co. Kerry	Residential
17	00	1 Park Rd, Ardshanavooly, Killarney, Co. Kerry	Residential
18	00	2 Park Rd, Ardshanavooly, Killarney, Co. Kerry	Residential
19	00	3 Park Rd, Ardshanavooly, Killarney, Co. Kerry	Residential
20	00	4 Park Rd, Ardshanavooly, Killarney, Co. Kerry	Residential
21	00	5 Park Rd, Ardshanavooly, Killarney, Co. Kerry	Residential
22	00	6 Park Rd, Ardshanavooly, Killarney, Co. Kerry	Residential
23	00	7 Park Rd, Ardshanavooly, Killarney, Co. Kerry	Residential
24	00	8 Park Rd, Ardshanavooly, Killarney, Co. Kerry	Residential

Table 6.1: List of receptors selected for analysis.

\* The BRE report outlines VSC guidelines are intended for use for rooms where daylight is required, including living rooms, kitchens and bedrooms. Windows to bathrooms, toilets, storerooms, circulation areas and garages need not be analysed or commercial premises.

\* Some of the windows selected here could potentially be windows to a bathroom, WC, storeroom or circulation area and the room may not need to be examined. However, for the purpose of this report they have all been presumed as habitable.

\* The windows have been calculated as ground floor receptors. On the basis that if these habitable rooms pass the minimum requirements all rooms at higher levels will definitely pass the minimum recommendations as a result of the improving vertical sky view angle.



## 6.2 Calculation result table

The VSC has been calculated for potentially affected windows within the neighbouring/adjacent properties. Locations of receptors are based on guideline recommendations for the closest facades which have windows with potential for impact. The change factor or effect on daylight reception in an existing habitable room should not be affected by more than 20% i.e., a maximum change factor of 0.8. The column named comment/effect describes the level of change an assessed window will experience, based on its compliance with the BRE target. A list of definitions can be found in section 4.8 of this report. To identify the status of the change factor in the tables below we use the following colour code guide depending on its level of resulting compliance status. The summary result table below provides the VSC calculation results. Appendix C provides the full calculation result table.

### Compliance guide

	0% Over /equal to
	5% Within
	10% Within
	10% In excess of

Receptor ID	Existing baseline VSC value [%]	Proposed VSC value [%]	Change factor	Comment / Effect of proposed development
Receptor 1	37%	34%	0.92	Negligible
Receptor 2	36%	34%	0.95	Negligible
Receptor 3	36%	33%	0.94	Negligible
Receptor 4	34%	31%	0.93	Negligible
Receptor 5	35%	34%	0.98	Negligible
Receptor 6	36%	31%	0.86	Negligible
Receptor 7	36%	31%	0.86	Negligible
Receptor 8	36%	30%	0.83	Negligible
Receptor 9	36%	31%	0.85	Negligible
Receptor 10	36%	31%	0.86	Negligible
Receptor 11	36%	31%	0.86	Negligible
Receptor 12	37%	32%	0.87	Negligible
Receptor 13	37%	32%	0.87	Negligible
Receptor 14	37%	32%	0.87	Negligible
Receptor 15	37%	32%	0.88	Negligible
Receptor 16	37%	32%	0.88	Negligible
Receptor 17	37%	34%	0.92	Negligible
Receptor 18	37%	34%	0.92	Negligible
Receptor 19	37%	33%	0.91	Negligible
Receptor 20	37%	33%	0.91	Negligible
Receptor 21	37%	33%	0.91	Negligible
Receptor 22	37%	33%	0.91	Negligible
Receptor 23	37%	34%	0.93	Negligible
Receptor 24	37%	34%	0.93	Negligible

Table 6.2: Calculation results: Summary table of VSC results.



### 6.3 Impact on daylight reception conclusion

The BRE recommends that the effects of a new development on daylight reception should not impact any existing VSC by more than 20% or have a maximum change factor in excess of 0.80. From the calculation results we note all selected neighbouring habitable receptors are affected to some degree with regards to daylight reception due to the introduction of the proposed development in their respective habitable rooms facing the proposed development. The calculated change in daylight reception in all of the neighbouring receptors/windows achieved a change factor ranging from 0.83 to 0.98. The BRE report outlines VSC guidelines are intended for use for rooms where daylight is required, including living rooms, kitchens and bedrooms. Properties used for habitable purposes have been assessed therefore properties occupied by commercial units have not been applied to the VSC assessment. Summarized result findings are as follows (see image 6.1 for receptor locations):

- West receptors: Receptor no. 1 to 5: Neighbouring dwellings located on Dennehy's Boreen with ground floor windows were examined and resulted in a change factor range of 0.92 to 0.98. These receptors are comfortably within the guidelines and the effect is determined as negligible under BRE definitions.
- South receptors: Receptor no. 6 to 24: Dwellings and apartments located in closest proximity with ground floor windows were examined and resulted in a change factor range of 0.83 to 0.93. These receptors are also well within the guidelines and the effect is determined as negligible under BRE definitions.
- Overall, the average change ratio for VSC is 0.90.

We conclude that the new proposed development's effect on daylight reception in the neighbouring rooms is all within the constraints and recommendations of the BRE Report – Site Layout and Planning for Daylight and Sunlight BR209 2022, and we therefore deem the proposed development to be compliant with this element.



## Impact on Sunlight Reception:

### Sunlight in existing amenity areas:

#### 6.4 Receptor selection – Existing amenity spaces

The sunlight reception assessment is targeted to neighbouring amenity spaces that might be affected by the introduction of the new proposed development. BR 209 (2022) outlines sunlight checks should include gardens, parks, playing fields, playgrounds, swimming pools, areas of recreational water, moorings, sitting out areas and nature reserves. Image 6.2 below indicates the neighbouring amenity areas selected and analysed on the basis that the shadow casted from the new development may impact these amenity areas given its geographical location in relation to the proposed development. These areas are identified below and labelled for reference in the results.



Image 6.2: Sunlight impact: Existing neighbouring amenity spaces (labelled 1-10).

Receptor	Location / address	Amenity description	Approx. area (m <sup>2</sup> )
1	Deerpark Pitch & Putt Club, Moyeightragh, Killarney, Co. Kerry	Pitch & Putt amenity area	38,000
2, 3	Dennehy's Boreen, Killarney, Co. Kerry	Private garden amenity area	1,700 & 1,100
4	Dennehy's Boreen, Killarney, Co. Kerry	Private garden amenity area	350
5	Dennehy's Boreen, Killarney, Co. Kerry	Communal green area	300
6	The Lyne's little lodge, Dennehy's Boreen, Killarney, Co. Kerry	Private garden amenity area	630
7	Dennehy's Boreen, Killarney, Co. Kerry	Private garden amenity area	450
8	Garrai Glas, Park Road, Killarney, Co. Kerry	Communal amenity area	120
9	1 Park Rd, Ardshanavooly, Killarney, Co. Kerry	Private garden amenity area	60
10	8 Park Rd, Ardshanavooly, Killarney, Co. Kerry	Private garden amenity area	170

Table 6.3: Sunlight impact: List of existing neighbouring amenity spaces.

### 6.5 Calculation result table

The table below provides a summary of the calculation results of the selected amenity space before and after the introduction of the new proposed development. Under the BRE guidelines any loss of sunlight in existing neighbouring amenity spaces as a result of the new development should not be greater than 0.80 times (maximum 20% reduction) its former size. The column named comment/effect describes the level of effect an assessed window will experience, based on its compliance with the BRE target. A list of definitions can be found in the section 4.8 of this report. Appendix D provides the full calculation results of the amenity areas. To identify the status of the change factor the following colour code guide is used depending on its level of resulting compliance status.

#### Compliance guide

	0% Over /equal to
	5% Within
	10% Within
	10% In excess of

Amenity space ID	Amenity space area (m <sup>2</sup> )	EXISTING STATUS			NEW STATUS			Change factor	Comment / effect of proposed development
		sun hours * amenity space area (Sun Hr*m <sup>2</sup> )	total sun hours (Sun Hr)	sun hours on 50% of the area	sun hours * amenity space area (Sun Hr*m <sup>2</sup> )	total sun hours (Sun Hr)	sun hours on 50% of the area		
1	38,000	20998800	9.21	11.0	20497200	8.99	11.0	0.98	Negligible
2	1,700	904740	8.87	11.0	872100	8.55	11.0	0.97	Negligible
3	1,100	544500	8.25	11.0	502920	7.62	10.0	0.93	Negligible
4	350	127680	6.08	9.0	115920	5.52	8.0	0.91	Negligible
5	300	148500	8.25	9.0	130500	7.25	7.0	0.88	Negligible
6	630	359856	9.52	11.0	344736	9.12	10.0	0.96	Negligible
7	450	175500	6.50	8.0	175500	6.50	8.0	1.00	Negligible
8	120	38448	5.34	5.0	38448	5.34	5.0	1.00	Negligible
9	60	13860	3.85	3.0	13860	3.85	3.0	1.00	Negligible
10	170	40800	4.00	3.0	40800	4.00	3.0	1.00	Negligible

Table 6.4: Calculation results: summary table of sunlight impact of existing neighbouring amenity spaces.



## 6.6 Impact on sunlight reception conclusion

Based on the BRE guidelines at least 50% of the amenity space should receive at least two hours of sunlight on the 21<sup>st</sup> of March and that any loss of sunlight should not be greater than 0.8 (20% reduction) times its former size. From the calculation results we note that all the existing amenity spaces received 2 hours of sunlight or more on at least 50% of the area before and after the introduction of the new development. Summary of results are as follows (see image 6.2 for receptor locations):

- North receptor: Receptor no. 1, Deerpark Pitch & Putt Club resulted in a change factor of 0.98. The calculation findings are comfortably within guidelines, and the effect is determined as negligible under BRE definitions
- West receptor: Receptor no. 2 to 6 are private or communal green areas on Dennehy's Boreen Road, which resulted in a change factor range of 0.88 to 0.97. The change happens in the morning hours of 07.00-10.00. The calculation findings are well within guidelines, and the effect is also determined as negligible under BRE definitions.
- South receptors: Receptor no. 7 to 10 are private or communal green areas to the units in Park Road. These amenity areas resulted in a change factor of 1.00, the new proposed development site will have no impact on these amenity areas due to its southerly location.
- Overall, the average change ratio is 0.94.

We conclude that the new proposed development's effect on sunlight reception in the neighbouring amenity areas is all within the constraints and minimum recommendations of the BRE Report – Site Layout and Planning for Daylight and Sunlight BR209 2022, and we therefore deem the proposed development to be compliant with this element.



## Appendix A

Sunlight analysis illustrations: plotted in one hourly illustration time frames for March 21<sup>st</sup> (Spring equinox).

Proposed status: 06:00 to 19:00 hours.

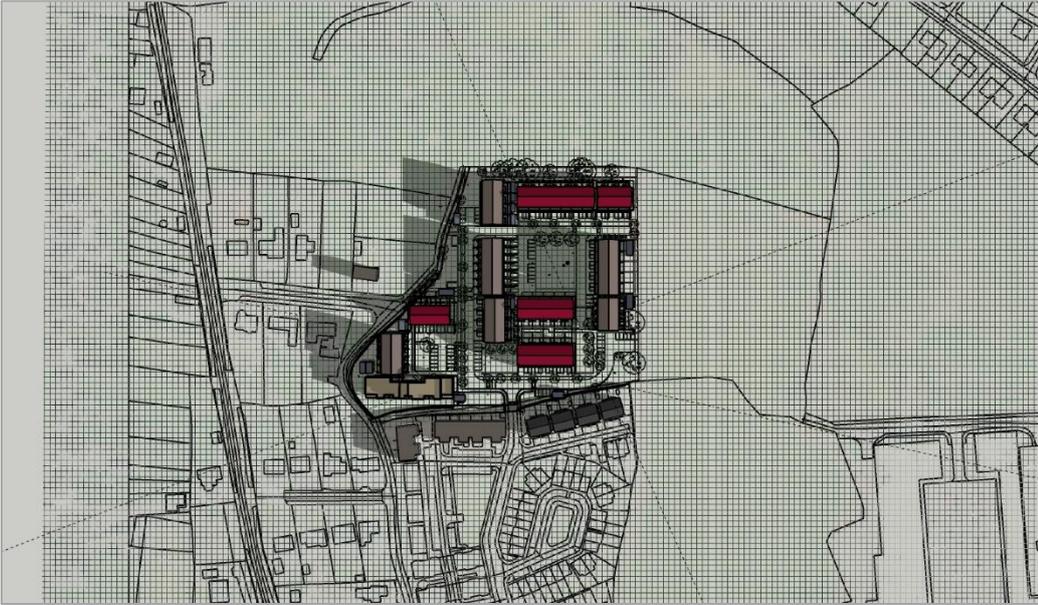
06.00 March 21st



07.00 March 21st



08.00 March 21<sup>st</sup>



09.00 March 21<sup>st</sup>



10.00 March 21<sup>st</sup>



11.00 March 21st



12.00 March 21st



13.00 March 21st



14.00 March 21st



15.00 March 21st



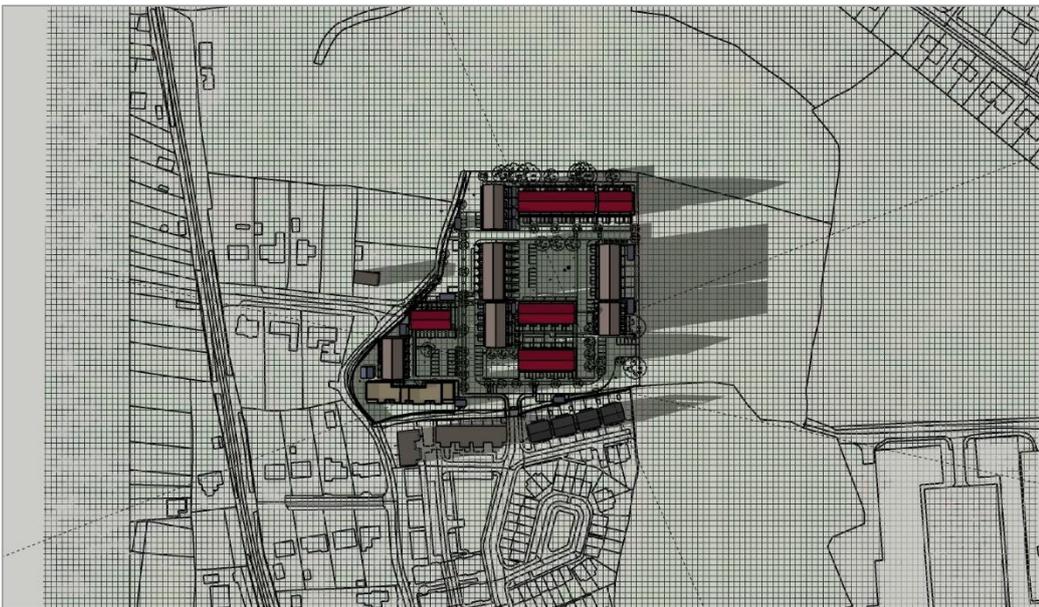
16.00 March 21st



17.00 March 21st



18.00 March 21st



19.00 March 21st



## Appendix B

Sunlight calculation results of the developments proposed amenity areas providing the overall hours of sunlight on March 21<sup>st</sup> together with the recommended BRE sunlight standards.

<b>A</b>						851.00 m <sup>2</sup>
<b>NEW STATUS</b>						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area	
24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	
6.00	100%	0%	60	0	0	
7.00	89%	11%	60	94	5,617	
8.00	77%	23%	60	196	11,744	
9.00	77%	23%	60	196	11,744	
10.00	61%	39%	60	332	19,913	
11.00	52%	48%	60	408	24,509	
12.00	52%	48%	60	408	24,509	
13.00	48%	52%	60	443	26,551	
14.00	48%	52%	60	443	26,551	
15.00	48%	52%	60	443	26,551	
16.00	49%	51%	60	434	26,041	
17.00	60%	40%	60	340	20,424	
18.00	69%	31%	60	264	15,829	
19.00	100%	0%	60	0	0	
Required sun hours @ 50% area						2
Achieved sun hours on @ 50% area						4.00
Achieved total sun time (hrs)						4.70
Achieved daily sun time * area						239982

<b>B</b>						392.00 m <sup>2</sup>
<b>NEW STATUS</b>						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area	
24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	
6.00	100%	0%	60	0	0	
7.00	78%	24%	60	94	5,645	
8.00	53%	47%	60	184	11,054	
9.00	15%	85%	60	333	19,992	
10.00	15%	85%	60	333	19,992	
11.00	15%	85%	60	333	19,992	
12.00	17%	83%	60	325	19,522	
13.00	17%	83%	60	325	19,522	
14.00	17%	83%	60	325	19,522	
15.00	55%	45%	60	176	10,584	
16.00	68%	32%	60	125	7,526	
17.00	78%	22%	60	86	5,174	
18.00	90%	10%	60	39	2,352	
19.00	100%	0%	60	0	0	
Required sun hours @ 50% area						2
Achieved sun hours on @ 50% area						6.00
Achieved total sun time (hrs)						6.84
Achieved daily sun time * area						160877

<b>C</b>						120.00 m <sup>2</sup>
<b>NEW STATUS</b>						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area	
24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	
6.00	100%	0%	60	0	0	
7.00	100%	0%	60	0	0	
8.00	64%	36%	60	43	2,592	
9.00	14%	86%	60	103	6,192	
10.00	14%	86%	60	103	6,192	
11.00	14%	86%	60	103	6,192	
12.00	14%	86%	60	103	6,192	
13.00	14%	86%	60	103	6,192	
14.00	14%	86%	60	103	6,192	
15.00	14%	86%	60	103	6,192	
16.00	14%	86%	60	103	6,192	
17.00	23%	77%	60	92	5,544	
18.00	45%	55%	60	66	3,960	
19.00	100%	0%	60	0	0	
Required sun hours @ 50% area						2
Achieved sun hours on @ 50% area						10.00
Achieved total sun time (hrs)						8.56
Achieved daily sun time * area						61632

<b>D</b>						745.00 m <sup>2</sup>
<b>NEW STATUS</b>						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area	
24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	
6.00	100%	0%	60	0	0	
7.00	100%	0%	60	0	0	
8.00	67%	33%	60	246	14,751	
9.00	63%	37%	60	276	16,539	
10.00	53%	47%	60	350	21,009	
11.00	26%	74%	60	551	33,078	
12.00	21%	79%	60	589	35,313	
13.00	21%	79%	60	589	35,313	
14.00	21%	79%	60	589	35,313	
15.00	18%	82%	60	611	36,654	
16.00	18%	82%	60	611	36,654	
17.00	26%	74%	60	551	33,078	
18.00	46%	54%	60	402	24,138	
19.00	100%	0%	60	0	0	
Required sun hours @ 50% area						2
Achieved sun hours on @ 50% area						8.00
Achieved total sun time (hrs)						7.20
Achieved daily sun time * area						321840

<b>E</b>						524.00 m <sup>2</sup>
<b>NEW STATUS</b>						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area	
24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	
6.00	100%	0%	60	0	0	
7.00	100%	0%	60	0	0	
8.00	100%	0%	60	0	0	
9.00	59%	41%	60	215	12,890	
10.00	16%	84%	60	440	26,410	
11.00	15%	85%	60	445	26,724	
12.00	15%	85%	60	445	26,724	
13.00	15%	85%	60	445	26,724	
14.00	15%	85%	60	445	26,724	
15.00	15%	85%	60	445	26,724	
16.00	17%	83%	60	435	26,095	
17.00	26%	74%	60	388	23,266	
18.00	44%	56%	60	293	17,606	
19.00	100%	0%	60	0	0	
Required sun hours @ 50% area						2
Achieved sun hours on @ 50% area						9.00
Achieved total sun time (hrs)						7.63
Achieved daily sun time * area						239887

<b>F</b>						1816.00 m <sup>2</sup>
<b>NEW STATUS</b>						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area	
24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	
6.00	100%	0%	60	0	0	
7.00	95%	5%	60	91	5,448	
8.00	76%	24%	60	436	26,150	
9.00	35%	65%	60	1180	70,824	
10.00	27%	73%	60	1326	79,541	
11.00	19%	81%	60	1471	88,258	
12.00	18%	82%	60	1489	89,347	
13.00	18%	82%	60	1489	89,347	
14.00	18%	82%	60	1489	89,347	
15.00	18%	82%	60	1489	89,347	
16.00	18%	82%	60	1489	89,347	
17.00	69%	31%	60	563	33,778	
18.00	93%	7%	60	127	7,627	
19.00	100%	0%	60	0	0	
Required sun hours @ 50% area						2
Achieved sun hours on @ 50% area						8.00
Achieved total sun time (hrs)						6.96
Achieved daily sun time * area						758362



**G** **548.00** m2

**NEW STATUS** March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %	% / %	min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	91%	9%	60	49	2,959
8.00	27%	73%	60	400	24,002
9.00	25%	75%	60	411	24,660
10.00	19%	81%	60	444	26,633
11.00	17%	83%	60	455	27,290
12.00	0%	100%	60	548	32,880
13.00	0%	100%	60	548	32,880
14.00	18%	82%	60	449	26,962
15.00	35%	65%	60	356	21,372
16.00	46%	54%	60	296	17,755
17.00	56%	44%	60	241	14,467
18.00	87%	13%	60	71	4,274
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2  
 Achieved sun hours on @ 50% area **9.00**  
 Achieved total sun time (hrs) 7.79  
 Achieved daily sun time \* area 256135

**H** **294.00** m2

**NEW STATUS** March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %	% / %	min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	86%	14%	60	41	2,470
8.00	64%	36%	60	106	6,350
9.00	14%	86%	60	253	15,170
10.00	14%	86%	60	253	15,170
11.00	14%	86%	60	253	15,170
12.00	14%	86%	60	253	15,170
13.00	14%	86%	60	253	15,170
14.00	14%	86%	60	253	15,170
15.00	14%	86%	60	253	15,170
16.00	14%	86%	60	253	15,170
17.00	23%	77%	60	226	13,583
18.00	45%	55%	60	162	9,702
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2  
 Achieved sun hours on @ 50% area **10.00**  
 Achieved total sun time (hrs) 8.70  
 Achieved daily sun time \* area 153468

**I** **87.00** m2

**NEW STATUS** March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %	% / %	min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	100%	0%	60	0	0
8.00	64%	36%	60	31	1,879
9.00	14%	86%	60	75	4,489
10.00	14%	86%	60	75	4,489
11.00	14%	86%	60	75	4,489
12.00	14%	86%	60	75	4,489
13.00	14%	86%	60	75	4,489
14.00	14%	86%	60	75	4,489
15.00	14%	86%	60	75	4,489
16.00	14%	86%	60	75	4,489
17.00	23%	77%	60	67	4,019
18.00	45%	55%	60	48	2,871
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2  
 Achieved sun hours on @ 50% area **10.00**  
 Achieved total sun time (hrs) 8.56  
 Achieved daily sun time \* area 44683

**J** **197.00** m2

**NEW STATUS** March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %	% / %	min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	100%	0%	60	0	0
8.00	26%	74%	60	146	8,747
9.00	14%	86%	60	169	10,165
10.00	14%	86%	60	169	10,165
11.00	14%	86%	60	169	10,165
12.00	14%	86%	60	169	10,165
13.00	14%	86%	60	169	10,165
14.00	14%	86%	60	169	10,165
15.00	16%	84%	60	165	9,929
16.00	17%	83%	60	164	9,811
17.00	20%	80%	60	158	9,456
18.00	53%	47%	60	93	5,555
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2  
 Achieved sun hours on @ 50% area **10.00**  
 Achieved total sun time (hrs) 8.84  
 Achieved daily sun time \* area 104489

**K** **194.00** m2

**NEW STATUS** March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %	% / %	min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	93%	7%	60	14	815
8.00	23%	77%	60	149	8,963
9.00	44%	56%	60	109	6,518
10.00	49%	51%	60	99	5,936
11.00	43%	57%	60	111	6,635
12.00	39%	61%	60	118	7,100
13.00	39%	61%	60	118	7,100
14.00	39%	61%	60	118	7,100
15.00	53%	47%	60	91	5,471
16.00	94%	6%	60	12	698
17.00	100%	0%	60	0	0
18.00	100%	0%	60	0	0
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2  
 Achieved sun hours on @ 50% area **7.00**  
 Achieved total sun time (hrs) 4.84  
 Achieved daily sun time \* area 56338

**L** **561.00** m2

**NEW STATUS** March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %	% / %	min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	77%	23%	60	129	7,742
8.00	36%	64%	60	359	21,542
9.00	31%	69%	60	387	23,225
10.00	21%	79%	60	443	26,591
11.00	18%	82%	60	460	27,601
12.00	0%	100%	60	561	33,660
13.00	0%	100%	60	561	33,660
14.00	0%	100%	60	561	33,660
15.00	0%	100%	60	561	33,660
16.00	0%	100%	60	561	33,660
17.00	34%	66%	60	370	22,216
18.00	51%	49%	60	275	16,493
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2  
 Achieved sun hours on @ 50% area **10.00**  
 Achieved total sun time (hrs) 9.32  
 Achieved daily sun time \* area 313711

**M** **283.00** m2

**NEW STATUS** March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %	% / %	min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	88%	12%	60	34	2,038
8.00	48%	52%	60	147	8,830
9.00	49%	51%	60	144	8,660
10.00	80%	20%	60	57	3,396
11.00	85%	15%	60	42	2,547
12.00	90%	10%	60	28	1,698
13.00	100%	0%	60	0	0
14.00	90%	10%	60	28	1,698
15.00	85%	15%	60	42	2,547
16.00	70%	30%	60	85	5,094
17.00	66%	34%	60	96	5,773
18.00	88%	12%	60	34	2,038
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2  
 Achieved sun hours on @ 50% area **2.00**  
 Achieved total sun time (hrs) 2.61  
 Achieved daily sun time \* area 44318



## Appendix C

Daylight calculation results of existing VSC and the VSC after the introduction of the new proposed development.

Receptor	EXISTING								NEW								change			
	Section 1	Section 2	Section 3	Section 4	Hor <sup>o</sup>	Ver <sup>o</sup>	Σ	VSC	Section 1	Section 2	Section 3	Section 4	Hor <sup>o</sup>	Ver <sup>o</sup>	Σ	VSC				
<b>Receptor 1</b>																				
VSC test distance 24 m																				
Target distance 27m	99	1	81	1			180	37%	40	1	59	8	37	17	44	12	180	34%		
																	0.92			
<b>Receptor 2</b>																				
VSC test distance 24 m																				
Target distance 35m	71	7	109	1			180	36%	71	8	25	1	84	12			180	34%		
																	0.95			
<b>Receptor 3</b>																				
VSC test distance 24 m																				
Target distance 31m	35	8	66	1	79	6	180	36%	35	8	80	15	31	8	34	6	180	33%		
																	0.94			
<b>Receptor 4</b>																				
VSC test distance 24 m																				
Target distance 33m	30	7	68	1	40	6	42	25	180	34%	30	7	80	15	28	7	42	25	180	31%
																	0.93			
<b>Receptor 5</b>																				
VSC test distance 24 m																				
Target distance 27m	52	6	128	7			180	35%	36	16	16	6	128	7			180	34%		
																	0.98			
<b>Receptor 6</b>																				
VSC test distance 24 m																				
Target distance 19m	92	1	88	6			180	36%	56	6	100	24	24	8			180	31%		
																	0.86			
<b>Receptor 7</b>																				
VSC test distance 24 m																				
Target distance 19m	85	6	95	1			180	36%	48	6	105	24	27	8			180	31%		
																	0.86			
<b>Receptor 8</b>																				
VSC test distance 24 m																				
Target distance 16m	70	5	110	1			180	36%	23	5	103	27	54	7			180	30%		
																	0.83			
<b>Receptor 9</b>																				
VSC test distance 24 m																				
Target distance 15m	66	5	114	1			180	36%	21	5	89	27	70	7			180	31%		
																	0.85			
<b>Receptor 10</b>																				
VSC test distance 24 m																				
Target distance 16m	64	4	116	1			180	36%	19	4	78	27	60	9	23	1	180	31%		
																	0.86			
<b>Receptor 11</b>																				
VSC test distance 24 m																				
Target distance 18m	64	4	116	1			180	36%	19	4	78	27	60	9	23	1	180	31%		
																	0.86			
<b>Receptor 12</b>																				
VSC test distance 24 m																				
Target distance 19m	60	3	120	1			180	37%	17	3	59	27	77	10	27	1	180	32%		
																	0.87			
<b>Receptor 13</b>																				
VSC test distance 24 m																				
Target distance 21m	59	3	121	1			180	37%	15	3	53	27	85	10	27	1	180	32%		
																	0.87			



Receptor	EXISTING								NEW								change		
	Section 1	Section 2	Section 3	Section 4	Hor°	Ver°	Σ	VSC	Section 1	Section 2	Section 3	Section 4	Hor°	Ver°	Σ	VSC			
<b>Receptor 14</b>																			
VSC test distance	24 m																		
Target distance	23m																		
	57	3	123	1			180	37%	15	3	53	27	85	10	27	1	180	32%	0.87
<b>Receptor 15</b>																			
VSC test distance	24 m																		
Target distance	25m																		
	55	3	125	1			180	37%	13	3	41	26	94	12	32	1	180	32%	0.88
<b>Receptor 16</b>																			
VSC test distance	24 m																		
Target distance	27m																		
	53	3	127	1			180	37%	13	3	41	26	94	12	32	1	180	32%	0.88
<b>Receptor 17</b>																			
VSC test distance	24 m																		
Target distance	33m																		
	59	4	121	1			180	37%	22	4	49	9	78	15	31	1	180	34%	0.92
<b>Receptor 18</b>																			
VSC test distance	24 m																		
Target distance	32m																		
	59	4	121	1			180	37%	22	4	49	9	78	15	31	1	180	34%	0.92
<b>Receptor 19</b>																			
VSC test distance	24 m																		
Target distance	30m																		
	53	4	127	1			180	37%	19	4	40	8	83	17	38	1	180	33%	0.91
<b>Receptor 20</b>																			
VSC test distance	24 m																		
Target distance	28m																		
	53	4	127	1			180	37%	19	4	40	8	83	17	38	1	180	33%	0.91
<b>Receptor 21</b>																			
VSC test distance	24 m																		
Target distance	26m																		
	48	3	132	1			180	37%	17	3	29	7	84	18	50	1	180	33%	0.91
<b>Receptor 22</b>																			
VSC test distance	24 m																		
Target distance	27m																		
	48	3	132	1			180	37%	17	3	29	7	84	18	50	1	180	33%	0.91
<b>Receptor 23</b>																			
VSC test distance	24 m																		
Target distance	29m																		
	44	3	136	1			180	37%	15	3	20	6	80	17	65	1	180	34%	0.93
<b>Receptor 24</b>																			
VSC test distance	24 m																		
Target distance	31m																		
	44	3	136	1			180	37%	15	3	20	6	80	17	65	1	180	34%	0.93



# Appendix D

Sunlight calculation results of existing amenity spaces before and after the introduction of the new proposed development.

1							38,000 m <sup>2</sup>						
EXISTING STATUS							NEW STATUS						
March 21st							March 21st						
Time	Shadow	Sunlight	Sun time	Sun area	time * area	change	Time	Shadow	Sunlight	Sun time	Sun area	time * area	change
24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	min*m <sup>2</sup>	24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	min*m <sup>2</sup>
6.00	100%	0%	60	0	0	0	6.00	100%	0%	60	0	0	0
7.00	75%	25%	60	9500	570,000	-114,000	7.00	80%	20%	60	7600	456,000	-114,000
8.00	28%	72%	60	27360	1,641,600	-159,600	8.00	35%	65%	60	24700	1,482,000	-159,600
9.00	17%	83%	60	31540	1,892,400	-68,400	9.00	20%	80%	60	30400	1,824,000	-68,400
10.00	17%	83%	60	31540	1,892,400	-11,400	10.00	18%	83%	60	31350	1,881,000	-11,400
11.00	17%	83%	60	31540	1,892,400	-11,400	11.00	18%	83%	60	31350	1,881,000	-11,400
12.00	17%	83%	60	31540	1,892,400	-11,400	12.00	18%	83%	60	31350	1,881,000	-11,400
13.00	17%	83%	60	31540	1,892,400	-11,400	13.00	18%	83%	60	31350	1,881,000	-11,400
14.00	17%	83%	60	31540	1,892,400	-11,400	14.00	18%	83%	60	31350	1,881,000	-11,400
15.00	17%	83%	60	31540	1,892,400	-11,400	15.00	18%	83%	60	31350	1,881,000	-11,400
16.00	17%	83%	60	31540	1,892,400	-11,400	16.00	18%	83%	60	31350	1,881,000	-11,400
17.00	17%	83%	60	31540	1,892,400	-11,400	17.00	18%	83%	60	31350	1,881,000	-11,400
18.00	23%	77%	60	29260	1,755,600	-68,400	18.00	26%	74%	60	28120	1,687,200	-68,400
19.00	100%	0%	60	0	0	0	19.00	100%	0%	60	0	0	0
Required sun hours @ 50% area (hr)	2						Required sun hours @ 50% area (hr)	2					
Achieved sun hours on (hrs) @ 50% area	11.00						Achieved sun hours on (hrs) @ 50% area	11.00					
Achieved total sun time (hrs)	9.21						Achieved total sun time (hrs)	8.99					
Achieved daily sun time * area	20998800						Achieved daily sun time * area	20497200					

2							1,700 m <sup>2</sup>						
EXISTING STATUS							NEW STATUS						
March 21st							March 21st						
Time	Shadow	Sunlight	Sun time	Sun area	time * area	change	Time	Shadow	Sunlight	Sun time	Sun area	time * area	change
24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	min*m <sup>2</sup>	24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	min*m <sup>2</sup>
6.00	100%	0%	60	0	0	0	6.00	100%	0%	60	0	0	0
7.00	77%	23%	60	391	23,460	-12,240	7.00	89%	11%	60	187	11,220	-12,240
8.00	25%	75%	60	1275	76,500	-20,400	8.00	45%	55%	60	935	56,100	-20,400
9.00	15%	85%	60	1445	86,700	0	9.00	15%	85%	60	1445	86,700	0
10.00	15%	85%	60	1445	86,700	0	10.00	15%	85%	60	1445	86,700	0
11.00	15%	85%	60	1445	86,700	0	11.00	15%	85%	60	1445	86,700	0
12.00	15%	85%	60	1445	86,700	0	12.00	15%	85%	60	1445	86,700	0
13.00	15%	85%	60	1445	86,700	0	13.00	15%	85%	60	1445	86,700	0
14.00	15%	85%	60	1445	86,700	0	14.00	15%	85%	60	1445	86,700	0
15.00	19%	81%	60	1377	82,620	0	15.00	19%	81%	60	1377	82,620	0
16.00	26%	74%	60	1258	75,480	0	16.00	26%	74%	60	1258	75,480	0
17.00	36%	64%	60	1088	65,280	0	17.00	36%	64%	60	1088	65,280	0
18.00	40%	60%	60	1020	61,200	0	18.00	40%	60%	60	1020	61,200	0
19.00	100%	0%	60	0	0	0	19.00	100%	0%	60	0	0	0
Required sun hours @ 50% area (hr)	2						Required sun hours @ 50% area (hr)	2					
Achieved sun hours on (hrs) @ 50% area	11.00						Achieved sun hours on (hrs) @ 50% area	11.00					
Achieved total sun time (hrs)	8.87						Achieved total sun time (hrs)	8.55					
Achieved daily sun time * area	904740						Achieved daily sun time * area	872100					

3							1,100 m <sup>2</sup>						
EXISTING STATUS							NEW STATUS						
March 21st							March 21st						
Time	Shadow	Sunlight	Sun time	Sun area	time * area	change	Time	Shadow	Sunlight	Sun time	Sun area	time * area	change
24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	min*m <sup>2</sup>	24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	min*m <sup>2</sup>
6.00	100%	0%	60	0	0	0	6.00	100%	0%	60	0	0	0
7.00	70%	30%	60	330	19,800	-19,800	7.00	100%	0%	60	0	0	-19,800
8.00	25%	75%	60	825	49,500	-20,460	8.00	56%	44%	60	484	29,040	-20,460
9.00	26%	74%	60	814	48,840	-660	9.00	27%	73%	60	803	48,180	-660
10.00	26%	74%	60	814	48,840	-660	10.00	27%	73%	60	803	48,180	-660
11.00	18%	82%	60	902	54,120	0	11.00	18%	82%	60	902	54,120	0
12.00	18%	82%	60	902	54,120	0	12.00	18%	82%	60	902	54,120	0
13.00	18%	82%	60	902	54,120	0	13.00	18%	82%	60	902	54,120	0
14.00	22%	78%	60	858	51,480	0	14.00	22%	78%	60	858	51,480	0
15.00	26%	74%	60	814	48,840	0	15.00	26%	74%	60	814	48,840	0
16.00	31%	69%	60	759	45,540	0	16.00	31%	69%	60	759	45,540	0
17.00	46%	54%	60	594	35,640	0	17.00	46%	54%	60	594	35,640	0
18.00	49%	51%	60	561	33,660	0	18.00	49%	51%	60	561	33,660	0
19.00	100%	0%	60	0	0	0	19.00	100%	0%	60	0	0	0
Required sun hours @ 50% area (hr)	2						Required sun hours @ 50% area (hr)	2					
Achieved sun hours on (hrs) @ 50% area	11.00						Achieved sun hours on (hrs) @ 50% area	10.00					
Achieved total sun time (hrs)	8.25						Achieved total sun time (hrs)	7.62					
Achieved daily sun time * area	544500						Achieved daily sun time * area	502920					



4						350 m <sup>2</sup>						
EXISTING STATUS						NEW STATUS						
						March 21st						
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	change
24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	min*m <sup>2</sup>
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	75%	25%	60	88	5,250	7.00	100%	0%	60	0	0	-5,250
8.00	39%	61%	60	214	12,810	8.00	69%	31%	60	109	6,510	-6,300
9.00	48%	52%	60	182	10,920	9.00	49%	51%	60	179	10,710	-210
10.00	46%	54%	60	189	11,340	10.00	46%	54%	60	189	11,340	0
11.00	46%	54%	60	189	11,340	11.00	46%	54%	60	189	11,340	0
12.00	42%	58%	60	203	12,180	12.00	42%	58%	60	203	12,180	0
13.00	42%	58%	60	203	12,180	13.00	42%	58%	60	203	12,180	0
14.00	44%	56%	60	196	11,760	14.00	44%	56%	60	196	11,760	0
15.00	46%	54%	60	189	11,340	15.00	46%	54%	60	189	11,340	0
16.00	49%	51%	60	179	10,710	16.00	49%	51%	60	179	10,710	0
17.00	57%	43%	60	151	9,030	17.00	57%	43%	60	151	9,030	0
18.00	58%	42%	60	147	8,820	18.00	58%	42%	60	147	8,820	0
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	9.00	Achieved sun hours on (hrs) @ 50% area	8.00
Achieved total sun time (hrs)	6.08	Achieved total sun time (hrs)	5.52
Achieved daily sun time * area	127680	Achieved daily sun time * area	115920

5						300 m <sup>2</sup>						
EXISTING STATUS						NEW STATUS						
						March 21st						
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	change
24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	min*m <sup>2</sup>
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	75%	25%	60	75	4,500	7.00	100%	0%	60	0	0	-4,500
8.00	43%	57%	60	171	10,260	8.00	77%	23%	60	69	4,140	-6,120
9.00	25%	75%	60	225	13,500	9.00	61%	39%	60	117	7,020	-6,480
10.00	10%	90%	60	270	16,200	10.00	15%	85%	60	255	15,300	-900
11.00	10%	90%	60	270	16,200	11.00	10%	90%	60	270	16,200	0
12.00	10%	90%	60	270	16,200	12.00	10%	90%	60	270	16,200	0
13.00	10%	90%	60	270	16,200	13.00	10%	90%	60	270	16,200	0
14.00	10%	90%	60	270	16,200	14.00	10%	90%	60	270	16,200	0
15.00	16%	84%	60	252	15,120	15.00	16%	84%	60	252	15,120	0
16.00	29%	71%	60	213	12,780	16.00	29%	71%	60	213	12,780	0
17.00	59%	41%	60	123	7,380	17.00	59%	41%	60	123	7,380	0
18.00	78%	22%	60	66	3,960	18.00	78%	22%	60	66	3,960	0
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	9.00	Achieved sun hours on (hrs) @ 50% area	7.00
Achieved total sun time (hrs)	8.25	Achieved total sun time (hrs)	7.25
Achieved daily sun time * area	148500	Achieved daily sun time * area	130500

6						630 m <sup>2</sup>						
EXISTING STATUS						NEW STATUS						
						March 21st						
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	change
24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	min*m <sup>2</sup>
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	74%	26%	60	164	9,828	7.00	95%	5%	60	32	1,890	-7,938
8.00	32%	68%	60	428	25,704	8.00	51%	49%	60	309	18,522	-7,182
9.00	19%	81%	60	510	30,618	9.00	19%	81%	60	510	30,618	0
10.00	10%	90%	60	567	34,020	10.00	10%	90%	60	567	34,020	0
11.00	10%	90%	60	567	34,020	11.00	10%	90%	60	567	34,020	0
12.00	10%	90%	60	567	34,020	12.00	10%	90%	60	567	34,020	0
13.00	10%	90%	60	567	34,020	13.00	10%	90%	60	567	34,020	0
14.00	10%	90%	60	567	34,020	14.00	10%	90%	60	567	34,020	0
15.00	10%	90%	60	567	34,020	15.00	10%	90%	60	567	34,020	0
16.00	15%	85%	60	536	32,130	16.00	15%	85%	60	536	32,130	0
17.00	19%	81%	60	510	30,618	17.00	19%	81%	60	510	30,618	0
18.00	29%	71%	60	447	26,838	18.00	29%	71%	60	447	26,838	0
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	11.00	Achieved sun hours on (hrs) @ 50% area	10.00
Achieved total sun time (hrs)	9.52	Achieved total sun time (hrs)	9.12
Achieved daily sun time * area	359856	Achieved daily sun time * area	344736

7						450 m <sup>2</sup>						
EXISTING STATUS						NEW STATUS						
						March 21st						
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	change
24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	24 Hr	% / %	% / %	min	m <sup>2</sup>	min*m <sup>2</sup>	min*m <sup>2</sup>
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	100%	0%	60	0	0	7.00	100%	0%	60	0	0	0
8.00	76%	24%	60	108	6,480	8.00	76%	24%	60	108	6,480	0
9.00	49%	51%	60	230	13,770	9.00	49%	51%	60	230	13,770	0
10.00	29%	71%	60	320	19,170	10.00	29%	71%	60	320	19,170	0
11.00	24%	76%	60	342	20,520	11.00	24%	76%	60	342	20,520	0
12.00	17%	83%	60	374	22,410	12.00	17%	83%	60	374	22,410	0
13.00	17%	83%	60	374	22,410	13.00	17%	83%	60	374	22,410	0
14.00	18%	82%	60	369	22,140	14.00	18%	82%	60	369	22,140	0
15.00	23%	77%	60	347	20,790	15.00	23%	77%	60	347	20,790	0
16.00	44%	56%	60	252	15,120	16.00	44%	56%	60	252	15,120	0
17.00	67%	33%	60	149	8,910	17.00	67%	33%	60	149	8,910	0
18.00	86%	14%	60	63	3,780	18.00	86%	14%	60	63	3,780	0
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	8.00	Achieved sun hours on (hrs) @ 50% area	8.00
Achieved total sun time (hrs)	6.5	Achieved total sun time (hrs)	6.5
Achieved daily sun time * area	175500	Achieved daily sun time * area	175500



8							120 m2						
EXISTING STATUS							NEW STATUS						
							March 21st						
Time	Shadow	Sunlight	Sun time	Sun area	time * area	change	Time	Shadow	Sunlight	Sun time	Sun area	time * area	change
24 Hr	% / %	%	min	m2	min*m2	min*m2	24 Hr	% / %	%	min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0	6.00	100%	0%	60	0	0	0
7.00	100%	0%	60	0	0	0	7.00	100%	0%	60	0	0	0
8.00	80%	20%	60	24	1,440	0	8.00	80%	20%	60	24	1,440	0
9.00	67%	33%	60	40	2,376	0	9.00	67%	33%	60	40	2,376	0
10.00	41%	59%	60	71	4,248	0	10.00	41%	59%	60	71	4,248	0
11.00	26%	74%	60	89	5,328	0	11.00	26%	74%	60	89	5,328	0
12.00	0%	100%	60	120	7,200	0	12.00	0%	100%	60	120	7,200	0
13.00	0%	100%	60	120	7,200	0	13.00	0%	100%	60	120	7,200	0
14.00	24%	76%	60	91	5,472	0	14.00	24%	76%	60	91	5,472	0
15.00	53%	47%	60	56	3,384	0	15.00	53%	47%	60	56	3,384	0
16.00	75%	25%	60	30	1,800	0	16.00	75%	25%	60	30	1,800	0
17.00	100%	0%	60	0	0	0	17.00	100%	0%	60	0	0	0
18.00	100%	0%	60	0	0	0	18.00	100%	0%	60	0	0	0
19.00	100%	0%	60	0	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	5.00	Achieved sun hours on (hrs) @ 50% area	5.00
Achieved total sun time (hrs)	5.34	Achieved total sun time (hrs)	5.34
Achieved daily sun time * area	38448	Achieved daily sun time * area	38448

9							60 m2						
EXISTING STATUS							NEW STATUS						
							March 21st						
Time	Shadow	Sunlight	Sun time	Sun area	time * area	change	Time	Shadow	Sunlight	Sun time	Sun area	time * area	change
24 Hr	% / %	%	min	m2	min*m2	min*m2	24 Hr	% / %	%	min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0	6.00	100%	0%	60	0	0	0
7.00	90%	10%	60	6	360	0	7.00	90%	10%	60	6	360	0
8.00	90%	10%	60	6	360	0	8.00	90%	10%	60	6	360	0
9.00	77%	23%	60	14	828	0	9.00	77%	23%	60	14	828	0
10.00	60%	40%	60	24	1,440	0	10.00	60%	40%	60	24	1,440	0
11.00	65%	35%	60	21	1,260	0	11.00	65%	35%	60	21	1,260	0
12.00	49%	51%	60	31	1,836	0	12.00	49%	51%	60	31	1,836	0
13.00	49%	51%	60	31	1,836	0	13.00	49%	51%	60	31	1,836	0
14.00	49%	51%	60	31	1,836	0	14.00	49%	51%	60	31	1,836	0
15.00	58%	42%	60	25	1,512	0	15.00	58%	42%	60	25	1,512	0
16.00	58%	42%	60	25	1,512	0	16.00	58%	42%	60	25	1,512	0
17.00	70%	30%	60	18	1,080	0	17.00	70%	30%	60	18	1,080	0
18.00	100%	0%	60	0	0	0	18.00	100%	0%	60	0	0	0
19.00	100%	0%	60	0	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	3.00	Achieved sun hours on (hrs) @ 50% area	3.00
Achieved total sun time (hrs)	3.85	Achieved total sun time (hrs)	3.85
Achieved daily sun time * area	13860	Achieved daily sun time * area	13860

10							170 m2						
EXISTING STATUS							NEW STATUS						
							March 21st						
Time	Shadow	Sunlight	Sun time	Sun area	time * area	change	Time	Shadow	Sunlight	Sun time	Sun area	time * area	change
24 Hr	% / %	%	min	m2	min*m2	min*m2	24 Hr	% / %	%	min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0	6.00	100%	0%	60	0	0	0
7.00	90%	10%	60	17	1,020	0	7.00	90%	10%	60	17	1,020	0
8.00	80%	20%	60	34	2,040	0	8.00	80%	20%	60	34	2,040	0
9.00	67%	33%	60	56	3,366	0	9.00	67%	33%	60	56	3,366	0
10.00	65%	35%	60	60	3,570	0	10.00	65%	35%	60	60	3,570	0
11.00	65%	35%	60	60	3,570	0	11.00	65%	35%	60	60	3,570	0
12.00	49%	51%	60	87	5,202	0	12.00	49%	51%	60	87	5,202	0
13.00	49%	51%	60	87	5,202	0	13.00	49%	51%	60	87	5,202	0
14.00	49%	51%	60	87	5,202	0	14.00	49%	51%	60	87	5,202	0
15.00	58%	42%	60	71	4,284	0	15.00	58%	42%	60	71	4,284	0
16.00	58%	42%	60	71	4,284	0	16.00	58%	42%	60	71	4,284	0
17.00	70%	30%	60	51	3,060	0	17.00	70%	30%	60	51	3,060	0
18.00	100%	0%	60	0	0	0	18.00	100%	0%	60	0	0	0
19.00	100%	0%	60	0	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	3.00	Achieved sun hours on (hrs) @ 50% area	3.00
Achieved total sun time (hrs)	4	Achieved total sun time (hrs)	4
Achieved daily sun time * area	40800	Achieved daily sun time * area	40800



End of Report

