

Port Road Killarney

Proposed Residential Development

DAYLIGHT and SUNLIGHT ANALYSIS REPORT

Port Road,
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 Portal Asset Holdings Ltd, to carry out the analysis and report for the proposed development at Port Road, 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

Portal Asset Holdings Ltd. intend to apply for planning permission for a Large-Scale Residential Development (LRD) at Port Road and St Margaret's Road, Coollegrean, Inch, Knockreer, Ardnamweely, Derreen (townlands), Killarney, Co. Kerry. The proposed development will consist of 224 no. units comprising 76 no. two storey houses (8 no. 2 bed units, 38 no. 3 bed units and 30 no 4 bed units), 52 no. duplexes over 3 no. storeys (14 no. 1 bed units, 26 no. 2 bed units and 12 no. 3 bed units) and 96 no. apartments in 3 no. 4 no. storey buildings (16 no. 1 bed units and 80 no. 2 bed units), and a 2 no. storey creche (334 sq. m). Ancillary site works include public and communal open spaces, hard and soft landscaping, the relocation/undergrounding of ESB powerlines, wastewater infrastructure including foul pumping station, surface water attenuation, water utility services, public lighting, bin stores, bicycle stores, ESB substation, and all associated site development works. Vehicular access to the development will be via a new entrance from Port Road. The proposed development includes upgrade works to Port Road, a pedestrian connection to Millwood Estate, and improvements to the stormwater network on St. Margaret's Road, as part of enabling infrastructure for the project.



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. Note: the area of proposed infrastructure upgrade works in St Margaret's Road is not included in Image 1.1 as the works are below ground and not considered relevant to the analysis in this report.



Image 1.1: Proposed development site boundary. Imagery © Google 2024.



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 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.

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% on over 50% of the floor area for over 50% of the available daylight hours. And a minimum target daylight factor of 0.7% 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 rooms calculated daylight factors (DF) achieved minimum guidelines or above.

- Selected residential rooms achieved an average DF of 2.64% on over 50% of the floor area for over 50% of the available daylight hours. An average DF of 2.21% on over 95% of the floor area for over 50% of the available daylight hours was achieved.
- Overall compliance for proposed development = 100%

In the BS EN 17037 it acknowledges that a rigid application of the European Standard could prove to be a difficult task. Within 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, 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. Living room 1.0% target daylight factor, and bedrooms 0.7% target daylight factor each 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 DF's are well in excess of these minimum guidelines.

- Overall compliance for proposed development = 100%

In summary, the calculation results have achieved full 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 we note that all selected amenity spaces received more than 2 hours of sunlight on at least 50% of the area on March 21st (see image 5.7 for receptor/amenity space locations).

Overall the calculated average sunlight on at least 50% of the area on March 21st for the selected areas is 6.80 hours.

The results confirm 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 0.82 to 0.99. 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 ref no. A to J are residential dwellings with ground floor windows on Port Road. These dwellings were examined and resulted in a change factor range of 0.96-0.98. These receptors are comfortably within the guidelines and the effect is determined as negligible under BRE definitions.
- North receptors: Receptor ref no. K to O are private residential dwellings. These dwellings were examined and resulted in a change factor range of 0.88-0.99. These receptors are also comfortably within the guidelines. BRE guidelines consider VSC calculations for residential rooms. Although not strictly residential we have treated receptor P (MS Ireland Regional Office) and receptor Q (Killarney Community Hospital) as such. These receptors are both well within the guidelines with a change factor of 0.89 and 0.91.
- East receptors: Receptor ref no. R (Holy cross gardens) and S (Killarney nursing home) are dwellings with ground floor windows. These dwellings were examined and resulted in a change factor range of 0.82-0.91. These receptors are also well within the guidelines and the effect is determined as negligible.
- Overall the average change ratio for VSC is 0.92.

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 21st 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):

- West receptors: Receptor no. A to F are residential dwellings with private back gardens / amenity spaces. These dwellings on Port Road resulted in a change factor range of 0.89-0.96. The change happens in the early morning hours of 07.00-09.00. The calculation findings are comfortably within BRE guidelines, and the effect is determined as negligible under BRE recommendations.
- North receptors: Receptor no. G and H are residential dwellings with private back gardens. These spaces resulted in a change factor of 0.96 and 0.87. The change happens in the morning hours between 08.00-12.00. The results are well within BRE guidelines. Receptor no. I (Millwood communal green space) resulted in a change factor of 0.97. The change happens in the morning and afternoon hours between 08.00-10.00 and 14.00-17.00. The result is comfortably within BRE guidelines. Receptor J is a private residential garden with a calculated change factor of 0.91, the change happens in the afternoon hours between 13.00-18.00. The result is also well within BRE guidelines. Receptor no. K (MS Ireland Regional Office) and L (Killarney Community Hospital) are private amenity areas. These resulted in a change factor of 0.82 and 0.84. This effect happens in the morning/afternoon hours between 10.00-18.00. The results are within BRE guidelines. All selected receptors located North are well within BRE guidelines, and the effect is determined as negligible under BRE recommendations.
- East receptors: Receptor no. M (Holy cross gardens) has a change factor of 0.83, the change happens in the afternoon hours between 14.00-18.00. The result is within BRE guidelines. Receptor no. N (Killarney nursing home, garden space) has a change factor of 1.00 meaning the proposed development will have no impact on this amenity space.
- Overall the average change ratio for the tested amenity spaces is 0.91.

We conclude that the new proposed development's effect on sunlight reception in the neighbouring amenity areas are within the 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 EN 17037:2018. 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 ϕ [°]	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 ($E_{v,d,med}$) 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

Based on the above criteria, for this report the daylight provision to the proposed development has been assessed using method 1 to calculate the daylight factor (D). 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/ $E_{v,d,med}$ x 100 [%]. Where,

$E_{v,d,med}$ 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_i = illuminance due to daylight at a point on the indoors working plane.

E_o = 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 21st of March. The minimum sunlight requirement in this report measured in sunlight time 2 hours (120 minutes) multiplied by 50% area m^2 or the minimum requirement = 120 (min) * 0.5a (m^2) = [] min· m^2 .



Analysis	BRE recommendation, criteria on March 21 st	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 / existing amenity areas

Impact on daylight provision:

Neighbouring Properties - Light from the Sky impact on neighbouring properties

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.

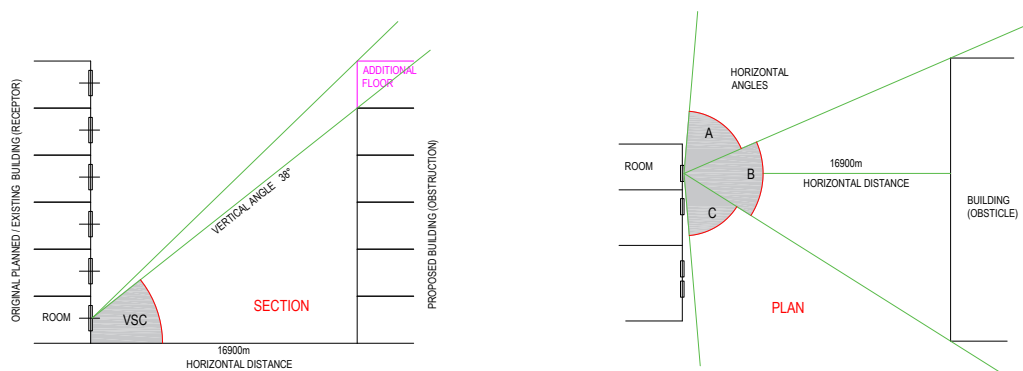


Image 4.1:

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 21st 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 21st 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 21st.

Analysis	Criteria on March 21 st	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 factor (D) – 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: <ul style="list-style-type: none"> • 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. • 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.
	Daylight factor (D) - 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"> • Kitchens, 1.3% target daylight factor over 50% of the floor area for over half the daylight hours. • Living rooms, 1.0% target daylight factor over 50% of the floor area for over half the daylight hours. • Bedrooms, 0.7% target daylight factor over 50% of the floor area for over half the daylight hours.
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:

Daylight factor assessment:

5.1 Receptor selection – Rooms within the proposed development

Receptors / rooms within the proposed development are indicated in image 5.1 to 5.6 below. All rooms on the ground floor were analysed for Apartment blocks J, K and L. Duplex and houses receptors were targeted to habitable rooms which are perceived to be in the most challenging locations or rooms positioned with close by obstacles. 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.



Image 5.1: Level 00 (ground floor). Showing all receptors.

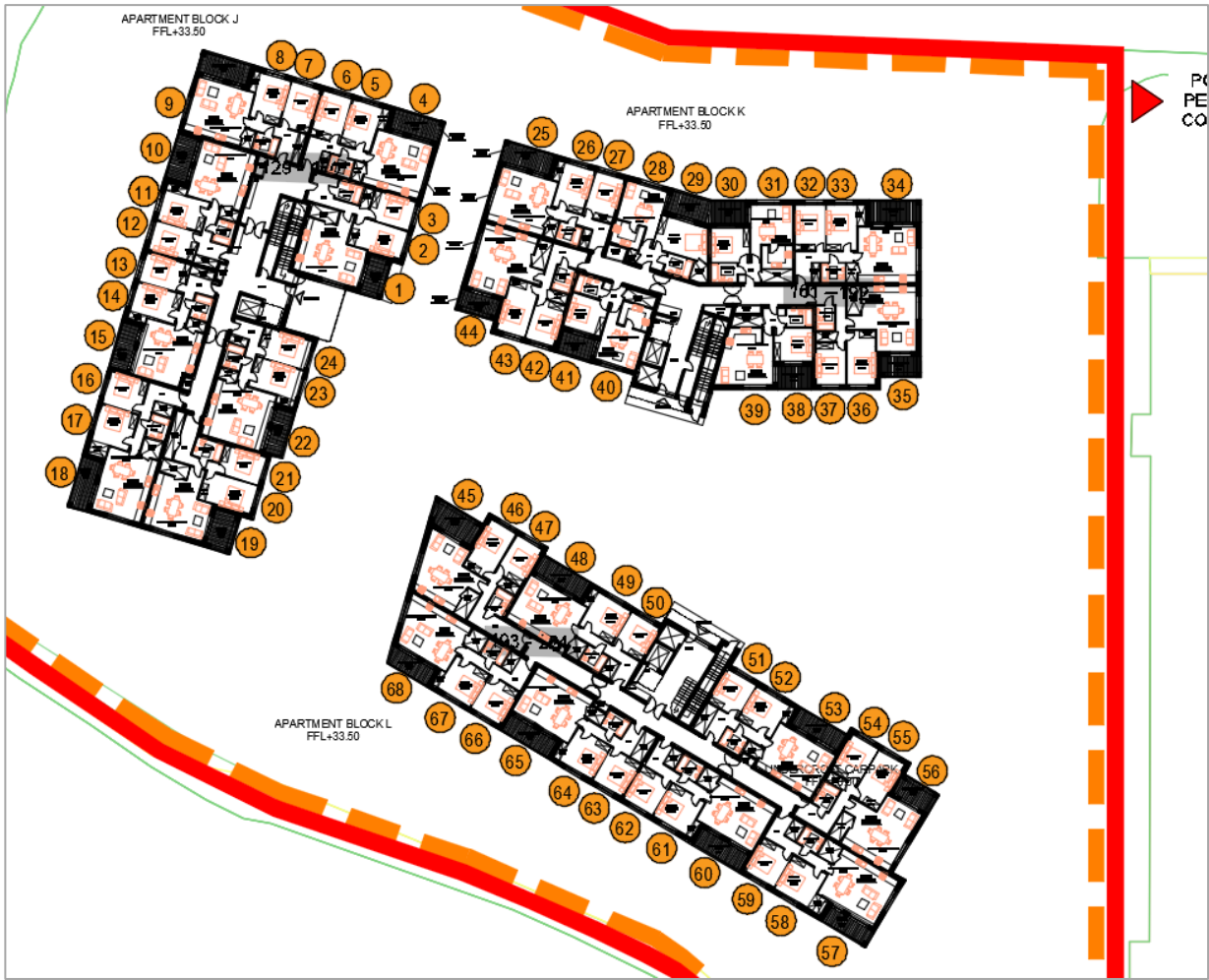


Image 5.2: Level 00 (ground floor). Receptors labelled 1 - 68. Apartment blocks J, K and L.

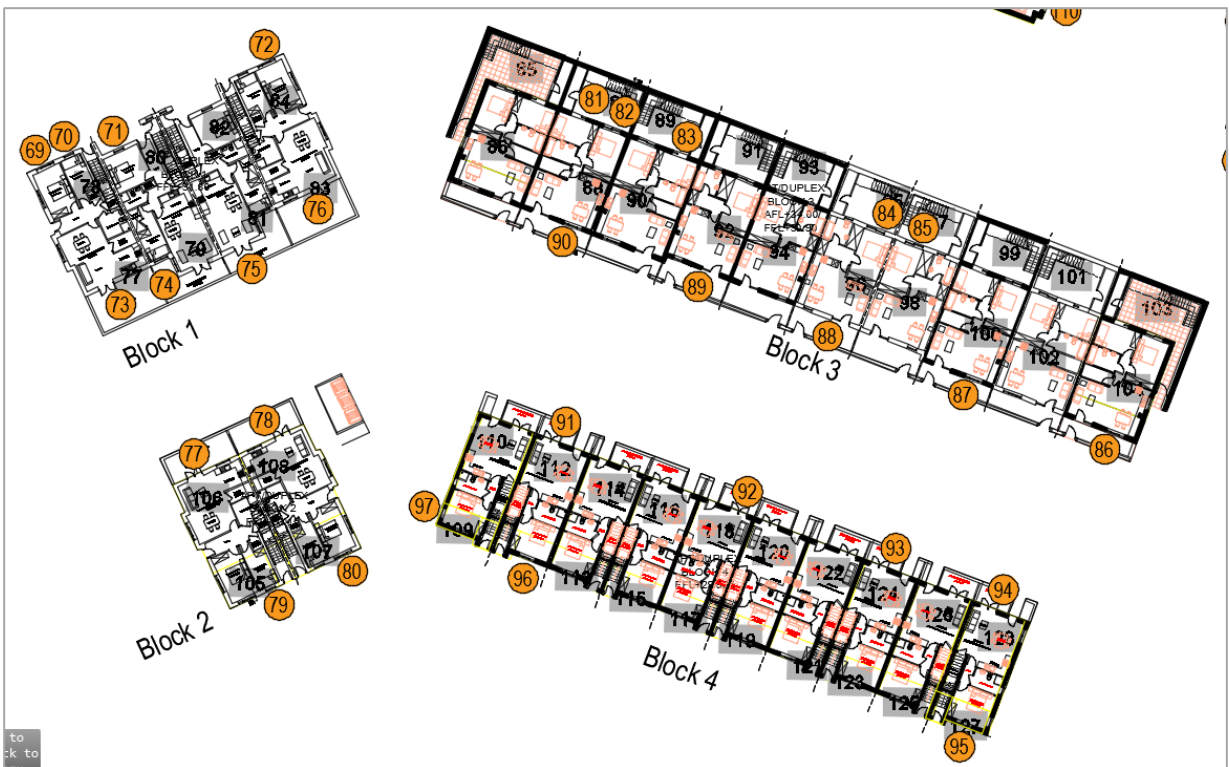


Image 5.3: Level 00 (ground floor). Receptors labelled 69 - 97. Duplex Apartment blocks 1, 2, 3 & 4.





Image 5.4: Level 00 (ground floor). Receptors labelled 98 - 121. Houses.

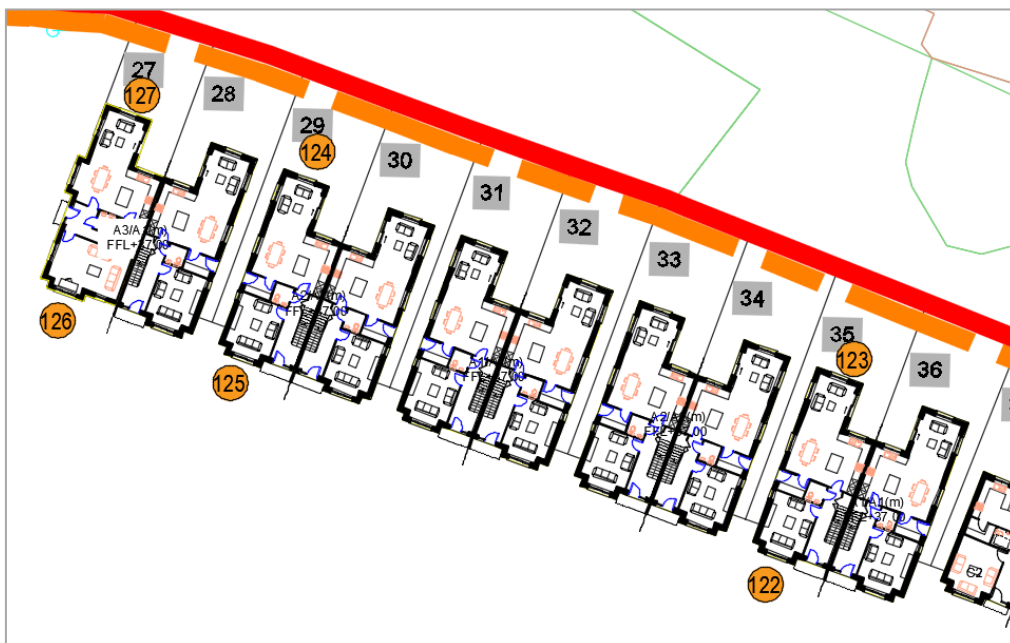


Image 5.5: Level 00 (ground floor). Receptors labelled 122 - 127. Houses.



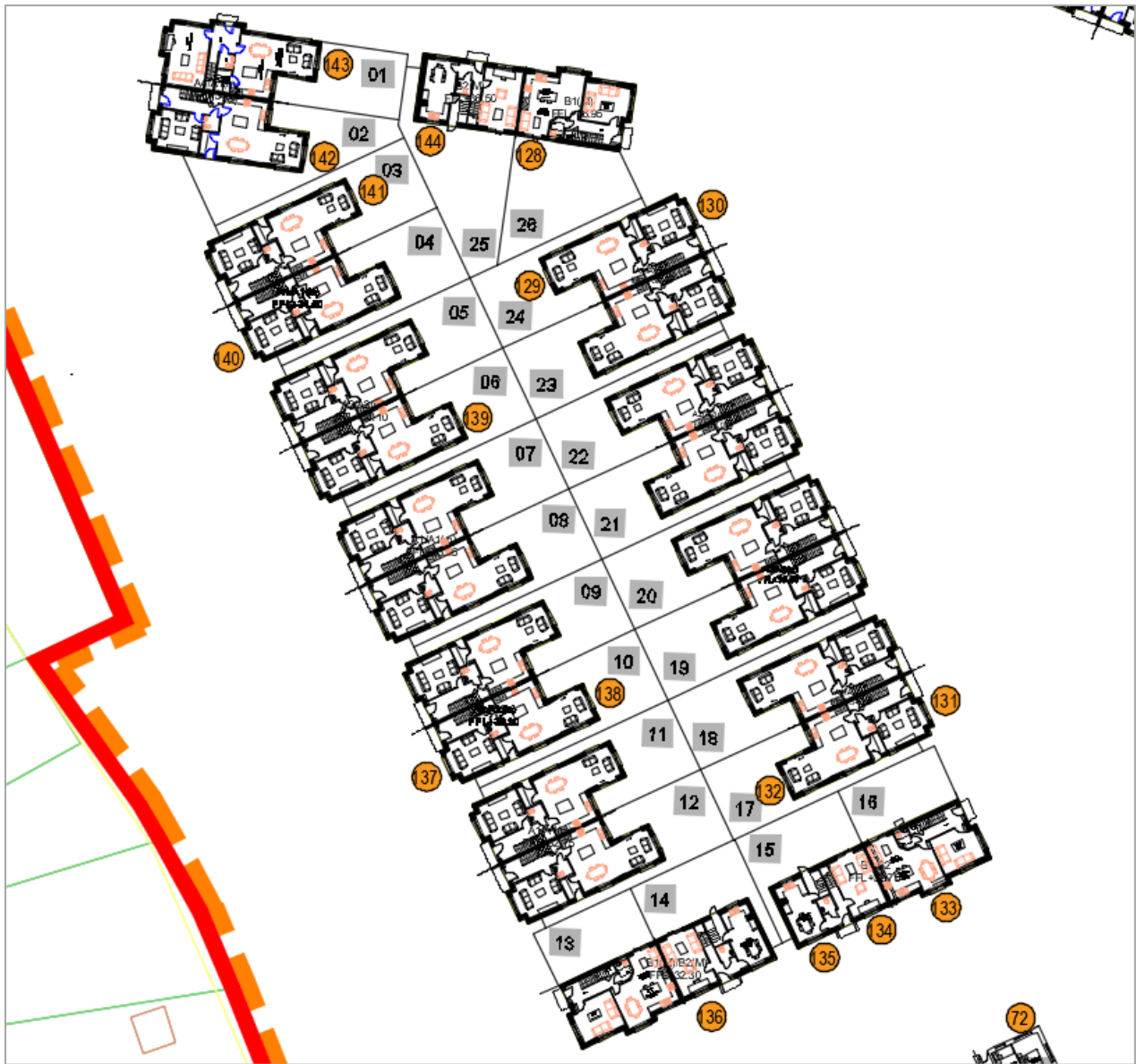


Image 5.6: Level 00 (ground floor). Receptors labelled 128 - 144. Houses.

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 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 guide

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

Receptor	Level/Floor	Block / Unit ID	Room / type	glass area m2	room area m2	glass ratio %	v volume m3	Dept/Width	Calculations		Guidelines		
									calculated DF at 95% area	calculated DF at 50% area	IS/BS EN17037 DF at 95%	IS/BS EN17037 DF at 50%	NA BS EN17037 DF at 50%
1	00	Apt Block J	Living - Kitchen	7.42	28.98	25.6	78.25	1.29	1.38	2.15	0.7	2.0	1.3
2	00	Apt Block J	Bed room	3.52	12.04	29.2	32.51	1.45	1.45	2.00	0.7	2.0	0.7
3	00	Apt Block J	Bed room	3.52	10.92	32.2	29.48	1.60	1.68	2.10	0.7	2.0	0.7
4	00	Apt Block J	Living - Kitchen	9.64	29.15	33.1	78.71	1.55	2.79	3.60	0.7	2.0	1.3
5	00	Apt Block J	Bed room	3.52	12.76	27.6	34.45	1.44	2.31	3.20	0.7	2.0	0.7
6	00	Apt Block J	Bed room	3.52	12.32	28.6	33.26	1.42	2.34	3.30	0.7	2.0	0.7
7	00	Apt Block J	Bed room	3.52	12.32	28.6	33.26	1.42	2.34	3.30	0.7	2.0	0.7
8	00	Apt Block J	Bed room	3.52	13.20	26.7	35.64	1.47	2.31	3.15	0.7	2.0	0.7
9	00	Apt Block J	Living - Kitchen	9.64	29.15	33.1	78.71	1.55	3.06	3.95	0.7	2.0	1.3
10	00	Apt Block J	Living - Kitchen	5.72	25.85	22.1	69.80	1.79	1.84	2.05	0.7	2.0	1.3
11	00	Apt Block J	Bed room	3.52	12.76	27.6	34.45	1.44	2.35	3.25	0.7	2.0	0.7
12	00	Apt Block J	Bed room	3.52	12.32	28.6	33.26	1.42	2.38	3.35	0.7	2.0	0.7
13	00	Apt Block J	Bed room	3.52	12.32	28.6	33.26	1.42	2.38	3.35	0.7	2.0	0.7
14	00	Apt Block J	Bed room	3.52	12.76	27.6	34.45	1.44	2.35	3.25	0.7	2.0	0.7
15	00	Apt Block J	Living - Kitchen	5.72	26.50	21.6	71.55	1.66	1.83	2.20	0.7	2.0	1.3
16	00	Apt Block J	Bed room	3.36	11.16	30.1	30.13	1.82	3.05	3.35	0.7	2.0	0.7
17	00	Apt Block J	Bed room	3.52	12.96	27.2	34.99	1.95	3.02	3.10	0.7	2.0	0.7
18	00	Apt Block J	Living - Kitchen	9.64	29.76	32.4	80.35	1.87	3.64	3.90	0.7	2.0	1.3
19	00	Apt Block J	Living - Kitchen	7.12	30.68	23.2	82.84	1.70	1.91	2.25	0.7	2.0	1.3
20	00	Apt Block J	Bed room	3.52	14.56	24.2	39.31	1.20	1.53	2.55	0.7	2.0	0.7
21	00	Apt Block J	Bed room	3.52	11.48	30.7	31.00	1.52	2.25	2.95	0.7	2.0	0.7
22	00	Apt Block J	Living - Kitchen	5.72	29.15	19.6	78.71	1.59	1.59	2.00	0.7	2.0	1.3
23	00	Apt Block J	Bed room	3.52	13.63	25.8	36.80	1.35	1.76	2.60	0.7	2.0	0.7
24	00	Apt Block J	Bed room	3.52	13.16	26.7	35.53	1.33	1.76	2.65	0.7	2.0	0.7
25	00	Apt Block K	Living - Kitchen	9.64	29.15	33.1	78.71	1.63	2.93	3.60	0.7	2.0	1.3
26	00	Apt Block K	Bed room	3.52	12.76	27.6	34.45	1.44	2.17	3.00	0.7	2.0	0.7
27	00	Apt Block K	Bed room	3.52	12.32	28.6	33.26	1.42	2.20	3.10	0.7	2.0	0.7
28	00	Apt Block K	Living - Kitchen	7.00	24.40	28.7	65.88	2.18	3.92	3.60	0.7	2.0	1.3
29	00	Apt Block K	Bed room	3.52	14.08	25.0	38.02	2.38	2.44	2.05	0.7	2.0	0.7
30	00	Apt Block K	Bed room	3.52	12.21	28.8	32.97	2.15	2.42	2.25	0.7	2.0	0.7
31	00	Apt Block K	Living - Kitchen	7.00	24.40	28.7	65.88	1.23	2.24	3.65	0.7	2.0	1.3
32	00	Apt Block K	Bed room	3.52	12.32	28.6	33.26	1.42	2.06	2.90	0.7	2.0	0.7
33	00	Apt Block K	Bed room	3.52	12.76	27.6	34.45	1.44	2.02	2.80	0.7	2.0	0.7
34	00	Apt Block K	Living - Kitchen	9.45	29.15	32.4	78.71	1.63	2.60	3.20	0.7	2.0	1.3



35	00	Apt Block K	Living - Kitchen	6.93	33.39	20.8	90.15	1.35	1.39	2.05	0.7	2.0	1.3
36	00	Apt Block K	Bed room	3.52	14.56	24.2	39.31	1.20	1.56	2.60	0.7	2.0	0.7
37	00	Apt Block K	Bed room	3.52	11.48	30.7	31.00	1.52	2.29	3.00	0.7	2.0	0.7
38	00	Apt Block K	Bed room	3.52	11.10	31.7	29.97	2.37	2.42	2.05	0.7	2.0	0.7
39	00	Apt Block K	Living - Kitchen	5.60	26.79	20.9	72.33	1.81	2.22	2.45	0.7	2.0	1.3
40	00	Apt Block K	Living - Kitchen	5.60	24.40	23.0	65.88	1.23	1.38	2.25	0.7	2.0	1.3
41	00	Apt Block K	Bed room	3.52	10.73	32.8	28.97	2.45	2.45	2.00	0.7	2.0	0.7
42	00	Apt Block K	Bed room	3.52	11.48	30.7	31.00	1.52	2.02	2.65	0.7	2.0	0.7
43	00	Apt Block K	Bed room	3.52	14.56	24.2	39.31	1.20	1.35	2.25	0.7	2.0	0.7
44	00	Apt Block K	Living - Kitchen	6.93	33.39	20.8	90.15	1.35	1.39	2.05	0.7	2.0	1.3
45	00	Apt Block L	Living - Kitchen	6.93	26.55	26.1	71.69	1.33	1.43	2.15	0.7	2.0	1.3
46	00	Apt Block L	Bed room	3.52	14.56	24.2	39.31	1.20	1.35	2.25	0.7	2.0	0.7
47	00	Apt Block L	Bed room	3.52	11.48	30.7	31.00	1.52	2.02	2.65	0.7	2.0	0.7
48	00	Apt Block L	Living - Kitchen	5.72	25.20	22.7	68.04	2.06	2.06	2.00	0.7	2.0	1.3
49	00	Apt Block L	Bed room	3.52	12.60	27.9	34.02	1.92	2.55	2.65	0.7	2.0	0.7
50	00	Apt Block L	Bed room	3.52	11.16	31.5	30.13	1.82	2.64	2.90	0.7	2.0	0.7
51	00	Apt Block L	Bed room	3.52	11.16	31.5	30.13	1.82	2.46	2.70	0.7	2.0	0.7
52	00	Apt Block L	Bed room	3.52	12.96	27.2	34.99	1.95	2.34	2.40	0.7	2.0	0.7
53	00	Apt Block L	Living - Kitchen	5.72	25.20	22.7	68.04	2.06	2.06	2.00	0.7	2.0	1.3
54	00	Apt Block L	Bed room	3.52	11.48	30.7	31.00	1.52	2.36	3.10	0.7	2.0	0.7
55	00	Apt Block L	Bed room	3.52	14.56	24.2	39.31	1.20	1.59	2.65	0.7	2.0	0.7
56	00	Apt Block L	Living - Kitchen	6.93	32.86	21.1	88.72	1.37	1.48	2.15	0.7	2.0	1.3
57	00	Apt Block L	Living - Kitchen	9.45	31.00	30.5	83.70	1.35	2.66	3.95	0.7	2.0	1.3
58	00	Apt Block L	Bed room	3.52	12.96	27.2	34.99	1.95	3.07	3.15	0.7	2.0	0.7
59	00	Apt Block L	Bed room	3.52	11.52	30.6	31.10	1.85	3.19	3.45	0.7	2.0	0.7
60	00	Apt Block L	Living - Kitchen	5.72	25.62	22.3	69.17	2.07	2.33	2.25	0.7	2.0	1.3
61	00	Apt Block L	Bed room	3.52	12.96	27.2	34.99	1.95	3.07	3.15	0.7	2.0	0.7
62	00	Apt Block L	Bed room	3.52	11.16	31.5	30.13	1.82	3.23	3.55	0.7	2.0	0.7
63	00	Apt Block L	Bed room	3.52	11.16	31.5	30.13	1.82	3.23	3.55	0.7	2.0	0.7
64	00	Apt Block L	Bed room	3.52	11.16	31.5	30.13	2.26	3.85	3.40	0.7	2.0	0.7
65	00	Apt Block L	Living - Kitchen	5.72	26.04	22.0	70.31	2.08	2.29	2.20	0.7	2.0	1.3
66	00	Apt Block L	Bed room	3.52	11.16	31.5	30.13	1.82	3.23	3.55	0.7	2.0	0.7
67	00	Apt Block L	Bed room	3.52	12.96	27.2	34.99	1.95	3.07	3.15	0.7	2.0	0.7
68	00	Apt Block L	Living - Kitchen	9.45	27.93	33.8	75.41	1.78	3.52	3.95	0.7	2.0	1.3
69	00	Duplex block 1	Bed room	4.32	13.16	32.8	35.53	1.33	2.39	3.60	0.7	2.0	0.7
70	00	Duplex block 1	Bed room	1.62	6.30	25.7	17.01	1.75	1.88	2.15	0.7	2.0	0.7
71	00	Duplex block 1	Bed room	2.47	12.96	19.1	34.99	1.95	1.95	2.00	0.7	2.0	0.7
72	00	Duplex block 1	Bed room	4.32	13.16	32.8	35.53	1.33	2.39	3.60	0.7	2.0	0.7
73	00	Duplex block 1	Living - Kitchen	6.03	29.00	20.8	78.30	1.41	2.11	3.00	0.7	2.0	1.3
74	00	Duplex block 1	Bed room	1.56	5.67	27.5	15.31	1.94	1.94	2.00	0.7	2.0	0.7
75	00	Duplex block 1	Living - Kitchen	4.17	28.00	14.9	75.60	1.07	1.07	2.00	0.7	2.0	1.3
76	00	Duplex block 1	Living - Kitchen	6.03	29.00	20.8	78.30	1.41	1.69	2.40	0.7	2.0	1.3
77	00	Duplex block 2	Living - Kitchen	6.03	29.00	20.8	78.30	1.41	1.97	2.80	0.7	2.0	1.3
78	00	Duplex block 2	Living - Kitchen	6.03	29.00	20.8	78.30	1.41	1.90	2.70	0.7	2.0	1.3
79	00	Duplex block 2	Bed room	1.62	7.56	21.4	20.41	1.46	1.46	2.00	0.7	2.0	0.7
80	00	Duplex block 2	Bed room	4.32	13.16	32.8	35.53	1.33	2.43	3.65	0.7	2.0	0.7
81	00	Duplex block 3	Bed room	2.28	9.25	24.6	24.98	2.78	2.78	2.00	0.7	2.0	0.7



82	00	Duplex block 3	Bed room	3.15	13.16	23.9	35.53	1.33	1.63	2.45	0.7	2.0	0.7
83	00	Duplex block 3	Bed room	2.28	9.25	24.6	24.98	2.78	2.78	2.00	0.7	2.0	0.7
84	00	Duplex block 3	Bed room	3.15	13.16	23.9	35.53	1.33	1.63	2.45	0.7	2.0	0.7
85	00	Duplex block 3	Bed room	3.15	13.16	23.9	35.53	1.33	1.63	2.45	0.7	2.0	0.7
86	00	Duplex block 3	Living - Kitchen	4.79	29.67	16.1	80.11	2.10	2.26	2.15	0.7	2.0	1.3
87	00	Duplex block 3	Living - Kitchen	4.25	28.29	15.0	76.38	2.20	2.20	2.00	0.7	2.0	1.3
88	00	Duplex block 3	Living - Kitchen	4.25	28.29	15.0	76.38	2.20	2.20	2.00	0.7	2.0	1.3
89	00	Duplex block 3	Living - Kitchen	4.25	28.29	15.0	76.38	2.20	2.20	2.00	0.7	2.0	1.3
90	00	Duplex block 3	Living - Kitchen	4.25	28.29	15.0	76.38	2.20	2.20	2.00	0.7	2.0	1.3
91	00	Duplex block 4	Living - Kitchen	3.68	24.44	15.0	65.99	1.76	1.76	2.00	0.7	2.0	1.3
92	00	Duplex block 4	Living - Kitchen	3.68	24.44	15.0	65.99	1.76	1.76	2.00	0.7	2.0	1.3
93	00	Duplex block 4	Living - Kitchen	3.68	24.44	15.0	65.99	1.76	1.76	2.00	0.7	2.0	1.3
94	00	Duplex block 4	Living - Kitchen	4.67	24.44	19.1	65.99	1.76	2.20	2.50	0.7	2.0	1.3
95	00	Duplex block 4	Bed room	2.79	13.26	21.0	35.80	2.13	2.45	2.30	0.7	2.0	0.7
96	00	Duplex block 4	Bed room	2.09	12.24	17.1	33.05	2.06	2.06	2.00	0.7	2.0	0.7
97	00	Duplex block 4	Bed room	3.08	13.26	23.2	35.80	2.13	2.45	2.30	0.7	2.0	0.7
98	00	House	Living	4.86	17.86	27.2	48.22	1.56	2.46	3.15	0.7	2.0	1.0
99	00	House	Living	3.06	12.21	25.1	32.97	1.82	2.10	2.30	0.7	2.0	1.0
100	00	House	Living	3.06	14.44	21.2	38.99	1.89	2.03	2.15	0.7	2.0	1.0
101	00	House	Living - Kitchen	4.24	18.56	22.8	50.11	2.68	3.41	2.55	0.7	2.0	1.3
102	00	House	Living - Kitchen	6.14	26.10	23.5	70.47	0.76	1.14	3.00	0.7	2.0	1.3
103	00	House	Living	3.06	12.21	25.1	32.97	1.82	2.19	2.40	0.7	2.0	1.0
104	00	House	Living - Kitchen	4.24	18.56	22.8	50.11	2.68	3.28	2.45	0.7	2.0	1.3
105	00	House	Living	3.06	14.44	21.2	38.99	1.89	2.03	2.15	0.7	2.0	1.0
106	00	House	Living - Kitchen	4.24	18.56	22.8	50.11	2.68	3.15	2.35	0.7	2.0	1.3
107	00	House	Living - Kitchen	4.24	18.56	22.8	50.11	2.68	3.21	2.40	0.7	2.0	1.3
108	00	House	Living - Kitchen	6.14	26.10	23.5	70.47	0.76	1.16	3.05	0.7	2.0	1.3
109	00	House	Living - Kitchen	4.24	18.56	22.8	50.11	2.68	3.15	2.35	0.7	2.0	1.3
110	00	House	Living	3.06	14.44	21.2	38.99	1.89	2.03	2.15	0.7	2.0	1.0
111	00	House	Living	4.56	22.20	20.5	59.94	1.21	1.39	2.30	0.7	2.0	1.0
112	00	House	Living - Kitchen	6.06	29.50	20.5	79.65	1.72	2.07	2.40	0.7	2.0	1.3
113	00	House	Living - Kitchen	4.24	18.56	22.8	50.11	2.68	3.01	2.25	0.7	2.0	1.3
114	00	House	Living - Kitchen	4.24	18.56	22.8	50.11	2.68	3.01	2.25	0.7	2.0	1.3
115	00	House	Living	3.06	14.44	21.2	38.99	1.89	2.41	2.55	0.7	2.0	1.0
116	00	House	Living - Kitchen	6.06	16.80	36.1	45.36	1.04	1.54	2.95	0.7	2.0	1.3
117	00	House	Living - Kitchen	4.74	29.50	16.1	79.65	1.72	1.77	2.05	0.7	2.0	1.3
118	00	House	Living	3.06	12.21	25.1	32.97	1.82	2.19	2.40	0.7	2.0	1.0
119	00	House	Living - Kitchen	4.24	18.56	22.8	50.11	2.68	3.41	2.55	0.7	2.0	1.3
120	00	House	Living - Kitchen	4.24	18.56	22.8	50.11	2.68	3.41	2.55	0.7	2.0	1.3
121	00	House	Living	3.06	12.21	25.1	32.97	1.82	2.19	2.40	0.7	2.0	1.0
122	00	House	Living	3.96	15.96	24.8	43.09	1.71	2.56	3.00	0.7	2.0	1.0
123	00	House	Living - Kitchen	7.60	39.00	19.5	105.30	1.36	2.11	3.10	0.7	2.0	1.3
124	00	House	Living - Kitchen	7.60	39.00	19.5	105.30	1.36	2.11	3.10	0.7	2.0	1.3
125	00	House	Living	3.96	15.96	24.8	43.09	1.71	2.52	2.95	0.7	2.0	1.0
126	00	House	Living	4.50	22.80	19.7	61.56	1.22	1.68	2.75	0.7	2.0	1.0
127	00	House	Living - Kitchen	7.60	39.00	19.5	105.30	1.36	2.05	3.00	0.7	2.0	1.3
128	00	House	Living - Kitchen	6.06	29.50	20.5	79.65	1.72	1.94	2.25	0.7	2.0	1.3



129	00	House	Living - Kitchen	7.60	39.00	19.5	105.30	1.36	1.71	2.50	0.7	2.0	1.3
130	00	House	Living	3.96	15.96	24.8	43.09	1.71	2.52	2.95	0.7	2.0	1.0
131	00	House	Living	3.96	15.96	24.8	43.09	1.71	2.52	2.95	0.7	2.0	1.0
132	00	House	Living - Kitchen	7.60	39.00	19.5	105.30	1.36	1.64	2.40	0.7	2.0	1.3
133	00	House	Living - Kitchen	6.06	29.50	20.5	79.65	1.72	2.24	2.60	0.7	2.0	1.3
134	00	House	Living	4.56	22.20	20.5	59.94	1.21	1.51	2.50	0.7	2.0	1.0
135	00	House	Living - Kitchen	4.06	16.80	24.2	45.36	1.04	1.38	2.65	0.7	2.0	1.3
136	00	House	Living	4.56	22.20	20.5	59.94	1.21	1.51	2.50	0.7	2.0	1.0
137	00	House	Living	3.96	15.96	24.8	43.09	1.71	2.61	3.05	0.7	2.0	1.0
138	00	House	Living - Kitchen	7.60	39.00	19.5	105.30	1.36	1.71	2.50	0.7	2.0	1.3
139	00	House	Living - Kitchen	7.60	39.00	19.5	105.30	1.36	1.71	2.50	0.7	2.0	1.3
140	00	House	Living	3.96	15.96	24.8	43.09	1.71	2.61	3.05	0.7	2.0	1.0
141	00	House	Living - Kitchen	7.60	39.00	19.5	105.30	1.36	1.50	2.20	0.7	2.0	1.3
142	00	House	Living - Kitchen	7.60	39.00	19.5	105.30	1.36	1.50	2.20	0.7	2.0	1.3
143	00	House	Living - Kitchen	7.60	39.00	19.5	105.30	1.36	1.60	2.35	0.7	2.0	1.3
144	00	House	Living - Kitchen	4.06	16.80	24.2	45.36	1.04	1.12	2.15	0.7	2.0	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 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.

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% on over 50% of the floor area for over 50% of the available daylight hours. And a minimum target daylight factor of 0.7% 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 rooms calculated daylight factors (DF) achieved minimum guidelines or above.

- Selected residential rooms achieved an average DF of 2.64% on over 50% of the floor area for over 50% of the available daylight hours. An average DF of 2.21% on over 95% of the floor area for over 50% of the available daylight hours was achieved.
- Overall compliance for proposed development = 100%

In the BS EN 17037 it acknowledges that a rigid application of the European Standard could prove to be a difficult task. Within 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, 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. Living room 1.0% target daylight factor, and bedrooms 0.7% target daylight factor each 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 DF's are well in excess of these minimum guidelines.

- Overall compliance for proposed development = 100%

In summary, the calculation results have achieved full 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 5.7 below indicates the open space and supporting GI amenity areas that have been selected and analysed on the basis that the shadow casted from the proposed GI development 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 5.7: New proposed amenity spaces within the development.

Receptor	Amenity Description	Amenity area (m ²)
1	Open space	488
2	Open space	2,292
3	Open space	540
4	Open space	2,315
5	Open space	525
6	Supporting GI	915
7	Supporting GI	70
8	Supporting GI	80
9	Supporting GI	2,047
10	Supporting GI	1,520
11	Supporting GI	4,992
12	Supporting GI	70

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 21st 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

<input checked="" type="checkbox"/>	0% Over /equal to
<input checked="" type="checkbox"/>	5% Within
!!	10% Within
x	10% In excess of

Amenity space ID ref	Amenity space area (m ²)	Achieved daily sun time * area	Achieved total sun time (hrs)	Required sun hours @ 50% area	Achieved sun hours on @ 50% area
1	488.0	188270.4	6.43	2.0	7.0
2	2292.0	1119412.8	8.14	2.0	9.0
3	540.0	285768.0	8.82	2.0	9.0
4	2315.0	686166.0	4.94	2.0	4.0
5	525.0	168840.0	5.36	2.0	6.0
6	915.0	404613.0	7.37	2.0	9.0
7	70.0	29358.0	6.99	2.0	7.0
8	80.0	23664.0	4.93	2.0	5.0
9	2047.0	880619.4	7.17	2.0	9.0
10	1520.0	782496.0	8.58	2.0	8.0
11	4992.0	1755187.2	5.86	2.0	6.0
12	70.0	14532.0	3.46	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 21st of March. From the calculation results we note that all selected amenity spaces received more than 2 hours of sunlight on at least 50% of the area on March 21st (see image 5.7 for receptor/amenity space locations).

Overall the calculated average sunlight on at least 50% of the area on March 21st for the selected areas is 6.80 hours.

The results confirm 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 close 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.

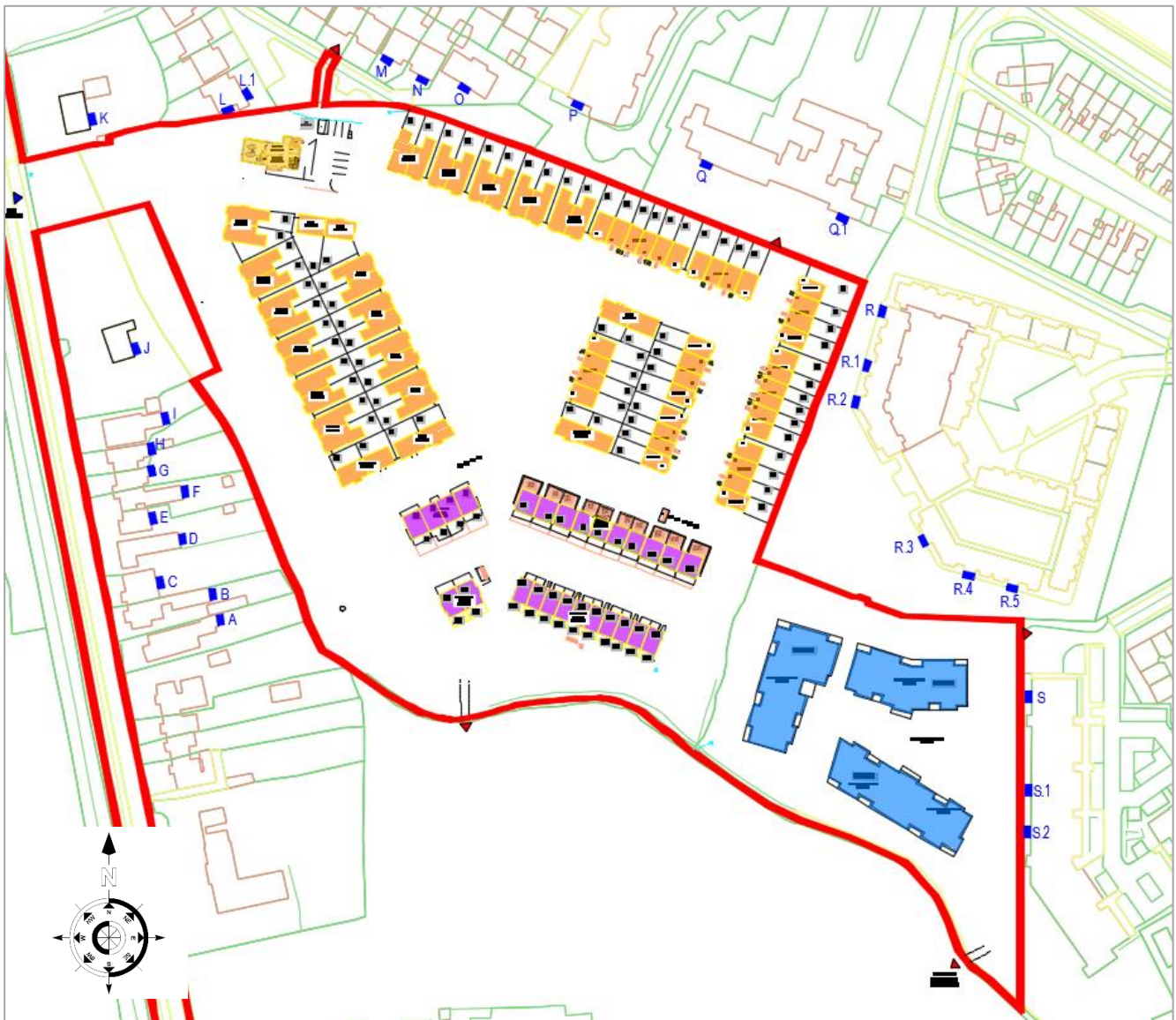


Image 6.1: Daylight impact: Neighbouring receptors – Overall view (showing all receptors no. A to S).

Receptor/ window	Level	Location / Address	Dwelling description
A	00	2 Port Road, Coollegrean, Killarney	Residential
B	00	3 Port Road, Coollegrean, Killarney	Residential
C	00	4 Port Road, Coollegrean, Killarney	Residential
D	00	Port Ville, Port Road, Coollegrean, Killarney	Residential
E	00	5 Port Road, Coollegrean, Killarney	Residential
F	00	8 Port Road, Coollegrean, Killarney	Residential
G	00	9 Port Road, Coollegrean, Killarney	Residential
H	00	10 Port Road, Coollegrean, Killarney	Residential
I	00	11 Port Road, Coollegrean, Killarney	Residential
J	00	Santa Rosa, Port Road, Coollegrean, Killarney	Residential
K	00	Deenagh house, Port Road, Coollegrean, Killarney	Residential
L, L.1	00	36 Millwood, Coollegrean, Killarney	Residential
M	00	33 Millwood, Coollegrean, Killarney	Residential
N	00	34 Millwood, Coollegrean, Killarney	Residential
O	00	35 Millwood, Coollegrean, Killarney	Residential
P	00	MS Ireland Regional Office, 2 St.Margaret's Road, Coollegrean, Killarney	Residential
Q, Q.1	00	Killarney Community Hospital, St.Margaret's Road, Coollegrean, Killarney	Residential
R, R.1, R.2, R.3, R.4, R.5	00	Holy Cross Gardens, Rock Road, Coollegrean, Killarney	Residential
S, S.1, S.2	00	Killarney nursing home, Oakwood Retirement Village, Rock Road, Kilcoolaght, Killarney	Residential

Table 6.1: List of receptors selected for analysis.



6.2 Calculation result table

The VSC has been calculated for potentially affected windows within the neighbouring/adjacent properties. 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
x	10% In excess of

Receptor ID	Existing baseline VSC value [%]	Proposed VSC value [%]	Change factor	Comment / Effect of proposed development
Receptor A	36%	35%	0.98	Negligible
Receptor B	36%	35%	0.98	Negligible
Receptor C	36%	35%	0.98	Negligible
Receptor D	36%	35%	0.98	Negligible
Receptor E	36%	35%	0.98	Negligible
Receptor F	36%	34%	0.96	Negligible
Receptor G	36%	34%	0.97	Negligible
Receptor H	36%	34%	0.97	Negligible
Receptor I	36%	34%	0.97	Negligible
Receptor J	36%	34%	0.97	Negligible
Receptor K	35%	35%	0.99	Negligible
Receptor L	36%	33%	0.91	Negligible
Receptor L.1	35%	34%	0.97	Negligible
Receptor M	36%	33%	0.91	Negligible
Receptor N	36%	32%	0.91	Negligible
Receptor O	36%	31%	0.88	Negligible
Receptor P	36%	32%	0.89	Negligible
Receptor Q	36%	32%	0.89	Negligible
Receptor Q.1	35%	32%	0.91	Negligible
Receptor R	35%	32%	0.91	Negligible
Receptor R.1	36%	31%	0.89	Negligible
Receptor R.2	36%	31%	0.89	Negligible
Receptor R.3	36%	32%	0.90	Negligible
Receptor R.4	35%	31%	0.89	Negligible
Receptor R.5	35%	31%	0.89	Negligible
Receptor S	36%	29%	0.83	Negligible
Receptor S.1	36%	29%	0.82	Negligible
Receptor S.2	36%	30%	0.86	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 0.82 to 0.99. 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 ref no. A to J are residential dwellings with ground floor windows on Port Road. These dwellings were examined and resulted in a change factor range of 0.96-0.98. These receptors are comfortably within the guidelines and the effect is determined as negligible under BRE definitions.
- North receptors: Receptor ref no. K to O are private residential dwellings. These dwellings were examined and resulted in a change factor range of 0.88-0.99. These receptors are also comfortably within the guidelines. BRE guidelines consider VSC calculations for residential rooms. Although not strictly residential we have treated receptor P (MS Ireland Regional Office) and receptor Q (Killarney Community Hospital) as such. These receptors are both well within the guidelines with a change factor of 0.89 and 0.91.
- East receptors: Receptor ref no. R (Holy cross gardens) and S (Killarney nursing home) are dwellings with ground floor windows. These dwellings were examined and resulted in a change factor range of 0.82-0.91. These receptors are also well within the guidelines and the effect is determined as negligible.
- Overall the average change ratio for VSC is 0.92.

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 Reception:

Sunlight in existing amenity areas:

6.4 Receptor selection – Existing amenity spaces

The sunlight reception assessment has been targeted to neighbouring amenity spaces that might be affected by the introduction of the new proposed development. 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.

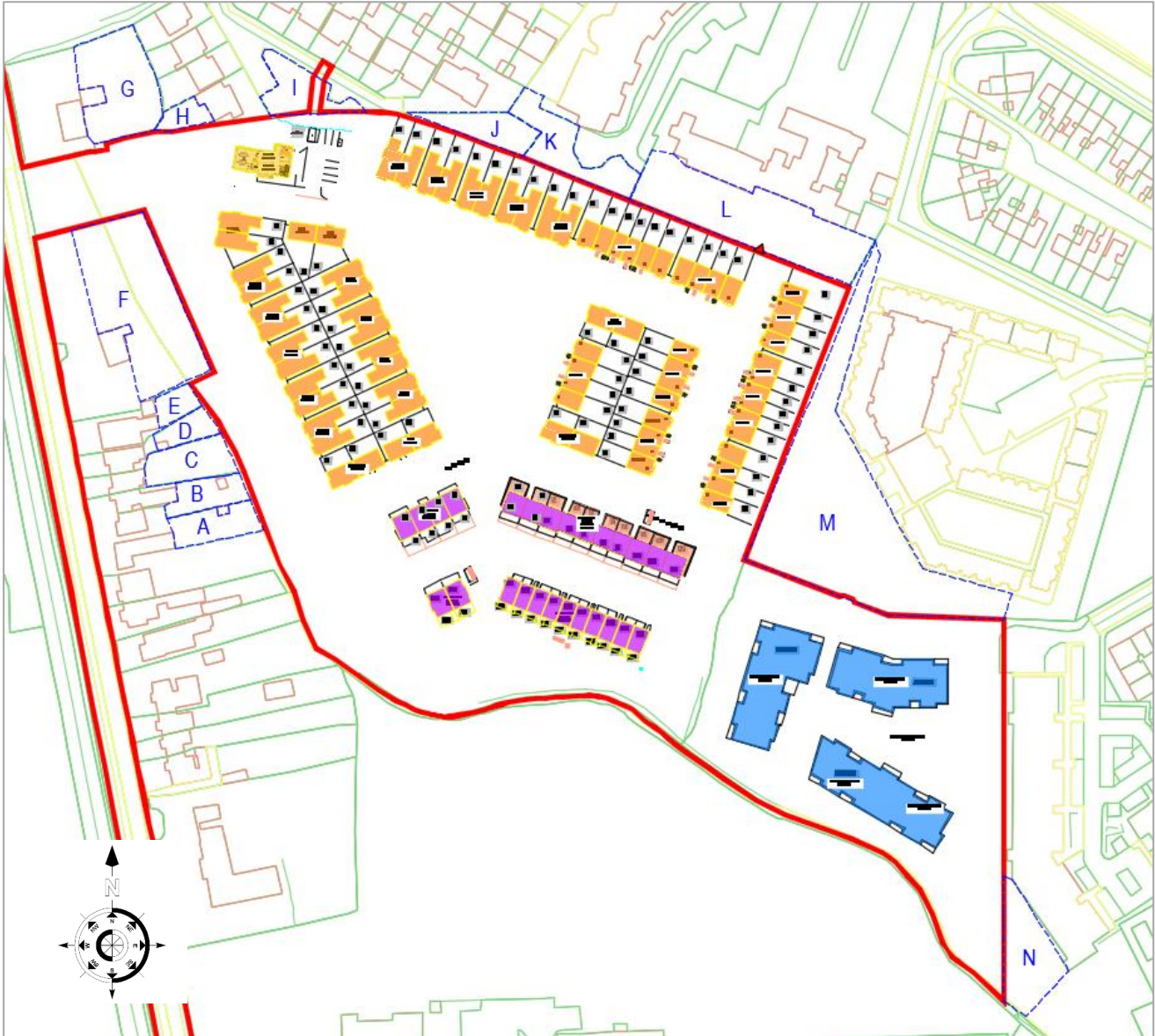


Image 6.2: Sunlight impact: Existing neighbouring amenity spaces labelled 'A to N' for reference.




Receptor	Location / Address	Amenity description	Approx. area (m ²)
A	Port Ville, Port Road, Coollegrean, Killarney	Private back garden	350
B	8 Port Road, Coollegrean, Killarney	Private front garden	280
C	9 Port Road, Coollegrean, Killarney	Private front garden	410
D	10 Port Road, Coollegrean, Killarney	Private back garden	180
E	11 Port Road, Coollegrean, Killarney	Private back garden	170
F	Santa Rosa, Port Road, Coollegrean, Killarney	Private back garden	1,500
G	Deenagh house, Port Road, Coollegrean, Killarney	Private back garden	800
H	36 Millwood, Coollegrean, Killarney	Private back garden	140
I	Millwood, Coollegrean, Killarney	Communal space	420
J	35 Millwood, Coollegrean, Killarney	Green amenity area	540
K	MS Ireland Regional Office, 2 St.Margaret's Rd, Coollegrean, Killarney	Green amenity area	600
L	Killarney Community Hospital, St.Margaret's Rd, Coollegrean, Killarney	Green amenity area	1,400
M	Holy Cross Gardens, Rock Road, Coollegrean, Killarney	Green amenity area	3,500
N	Killarney nursing home, Oakwood Retirement Village, Rock Rd, Kilcoolaght, Killarney	Green amenity area	650

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 0.8 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 ²)	EXISTING STATUS			NEW STATUS			Change factor	Comment / effect of proposed development
		sun hours * amenity space area (Sun Hr*m ²)	total sun hours (Sun Hr)	sun hours on 50% of the area	sun hours * amenity space area (Sun Hr*m ²)	total sun hours (Sun Hr)	sun hours on 50% of the area		
A	350	152040	7.24	8	146370	6.97	8	0.96	Negligible
B	280	121632	7.24	8	116256	6.92	8	0.96	Negligible
C	410	178104	7.24	8	168510	6.85	8	0.95	Negligible
D	180	78192	7.24	8	73872	6.84	8	0.95	Negligible
E	170	77724	7.62	8	73134	7.17	8	0.94	Negligible
F	1,500	824400	9.16	10	734400	8.16	9	0.89	Negligible
G	800	371520	7.74	8	356160	7.42	8	0.96	Negligible
H	140	76188	9.07	10	65520	7.8	9	0.86	Negligible
I	420	210420	8.35	9	204372	8.11	9	0.97	Negligible
J	540	261792	8.08	10	238464	7.36	9	0.91	Negligible
K	600	295560	8.21	10	241920	6.72	8	0.82	Negligible
L	1,400	677040	8.06	10	567000	6.75	8	0.84	Negligible
M	3,500	1698900	8.09	10	1402800	6.68	8	0.83	Negligible
N	650	313560	8.04	9	313560	8.04	9	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 21st 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):

- West receptors: Receptor no. A to F are residential dwellings with private back gardens / amenity spaces. These dwellings on Port Road resulted in a change factor range of 0.89-0.96. The change happens in the early morning hours of 07.00-09.00. The calculation findings are comfortably within BRE guidelines, and the effect is determined as negligible under BRE recommendations.
- North receptors: Receptor no. G and H are residential dwellings with private back gardens. These spaces resulted in a change factor of 0.96 and 0.87. The change happens in the morning hours between 08.00-12.00. The results are well within BRE guidelines. Receptor no. I (Millwood communal green space) resulted in a change factor of 0.97. The change happens in the morning and afternoon hours between 08.00-10.00 and 14.00-17.00. The result is comfortably within BRE guidelines. Receptor J is a private residential garden with a calculated change factor of 0.91, the change happens in the afternoon hours between 13.00-18.00. The result is also well within BRE guidelines. Receptor no. K (MS Ireland Regional Office) and L (Killarney Community Hospital) are private amenity areas. These resulted in a change factor of 0.82 and 0.84. This effect happens in the morning/afternoon hours between 10.00-18.00. The results are within BRE guidelines. All selected receptors located North are well within BRE guidelines, and the effect is determined as negligible under BRE recommendations.
- East receptors: Receptor no. M (Holy cross gardens) has a change factor of 0.83, the change happens in the afternoon hours between 14.00-18.00. The result is within BRE guidelines. Receptor no. N (Killarney nursing home, garden space) has a change factor of 1.00 meaning the proposed development will have no impact on this amenity space.
- Overall the average change ratio for the tested amenity spaces is 0.91.

We conclude that the new proposed development's effect on sunlight reception in the neighbouring amenity areas are within the 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.

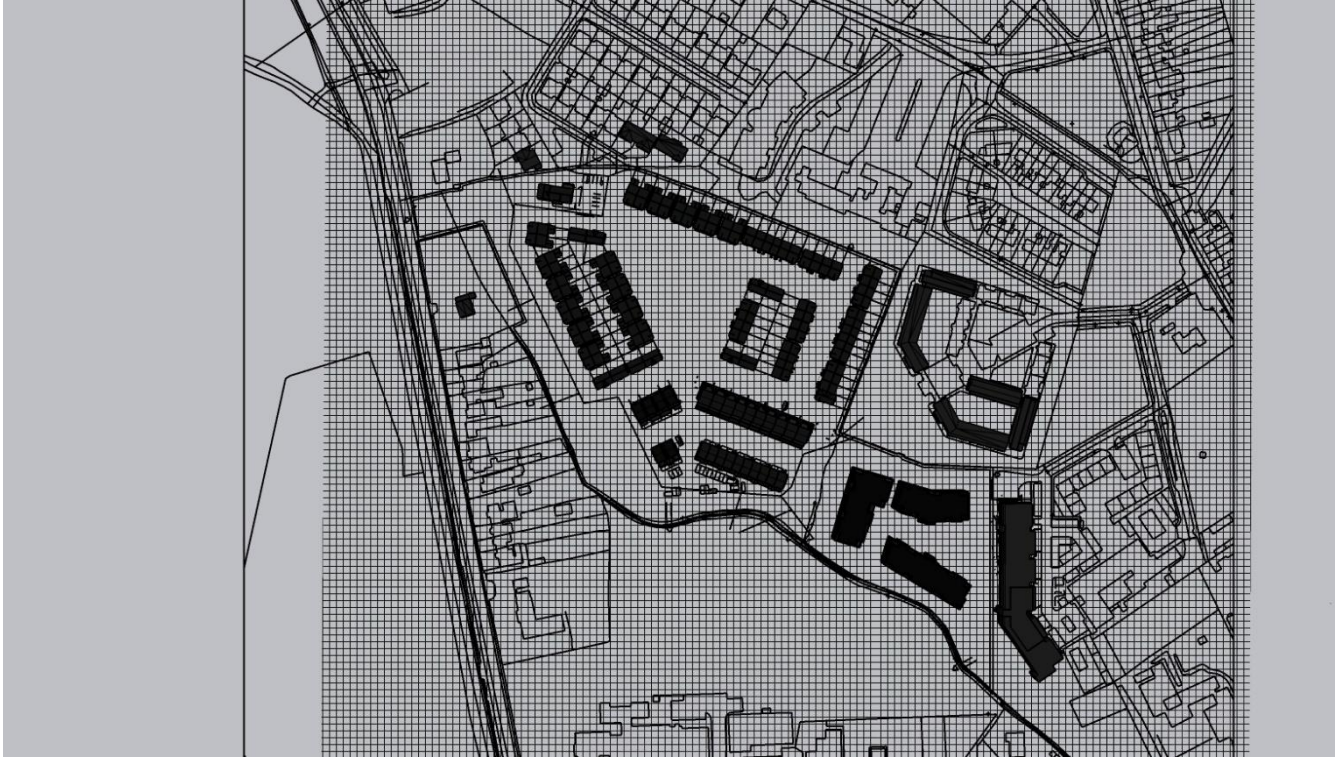


Appendix A

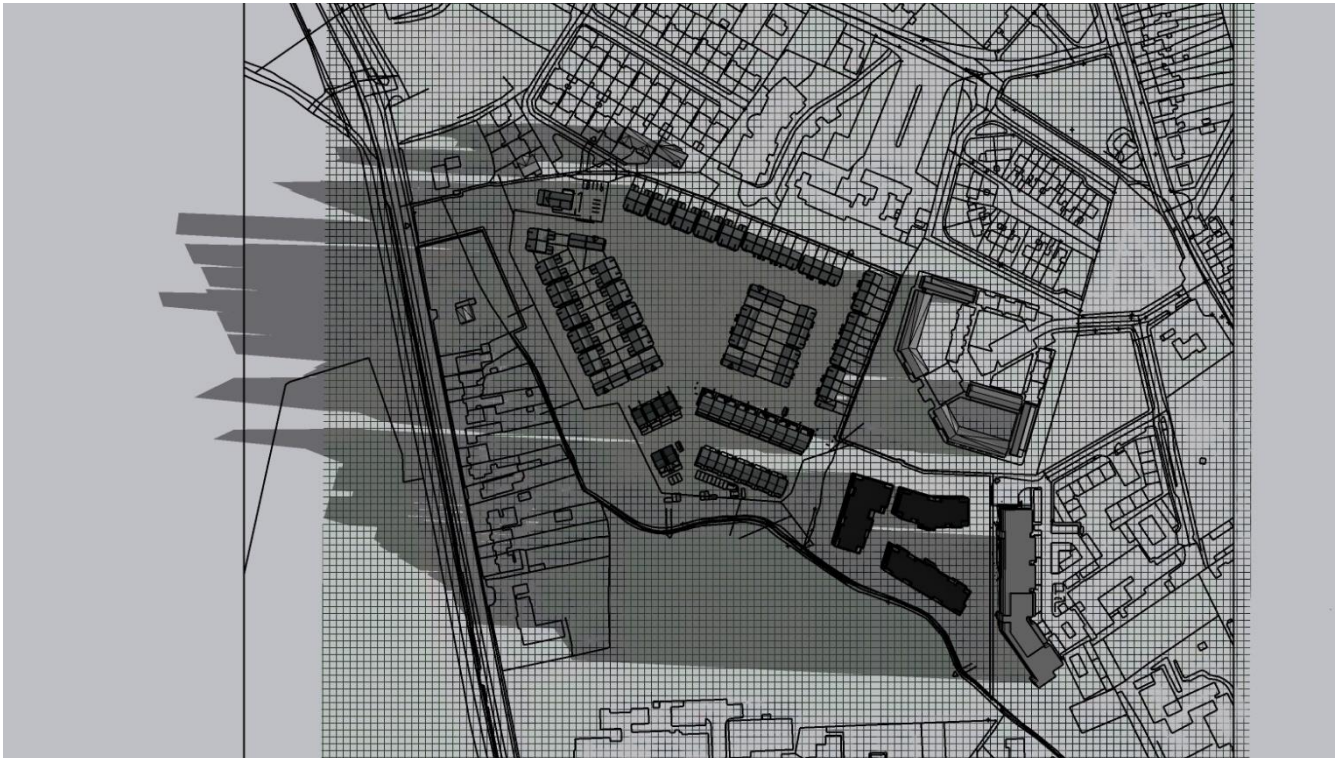
Sunlight analysis illustrations: plotted in one hourly illustration time frames for March 21st (Spring equinox).

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

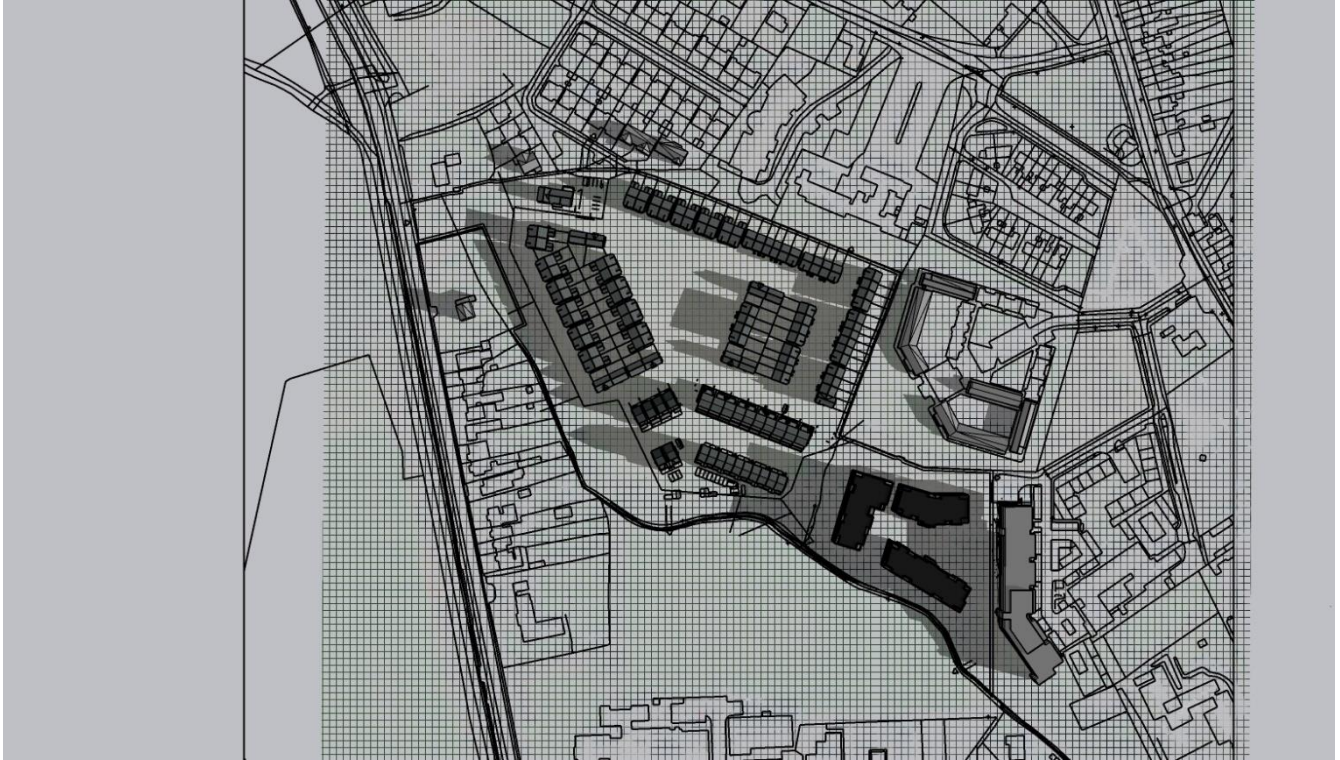
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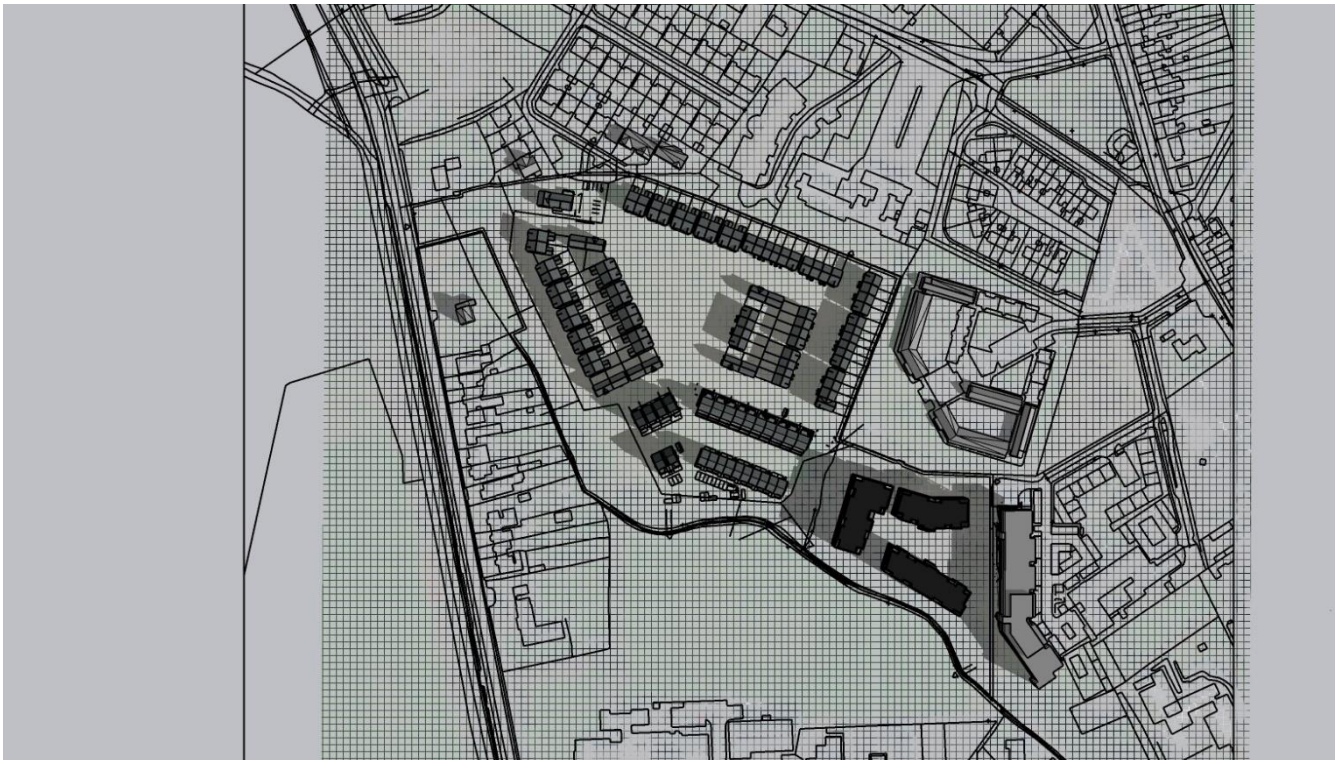
07.00 March 21st



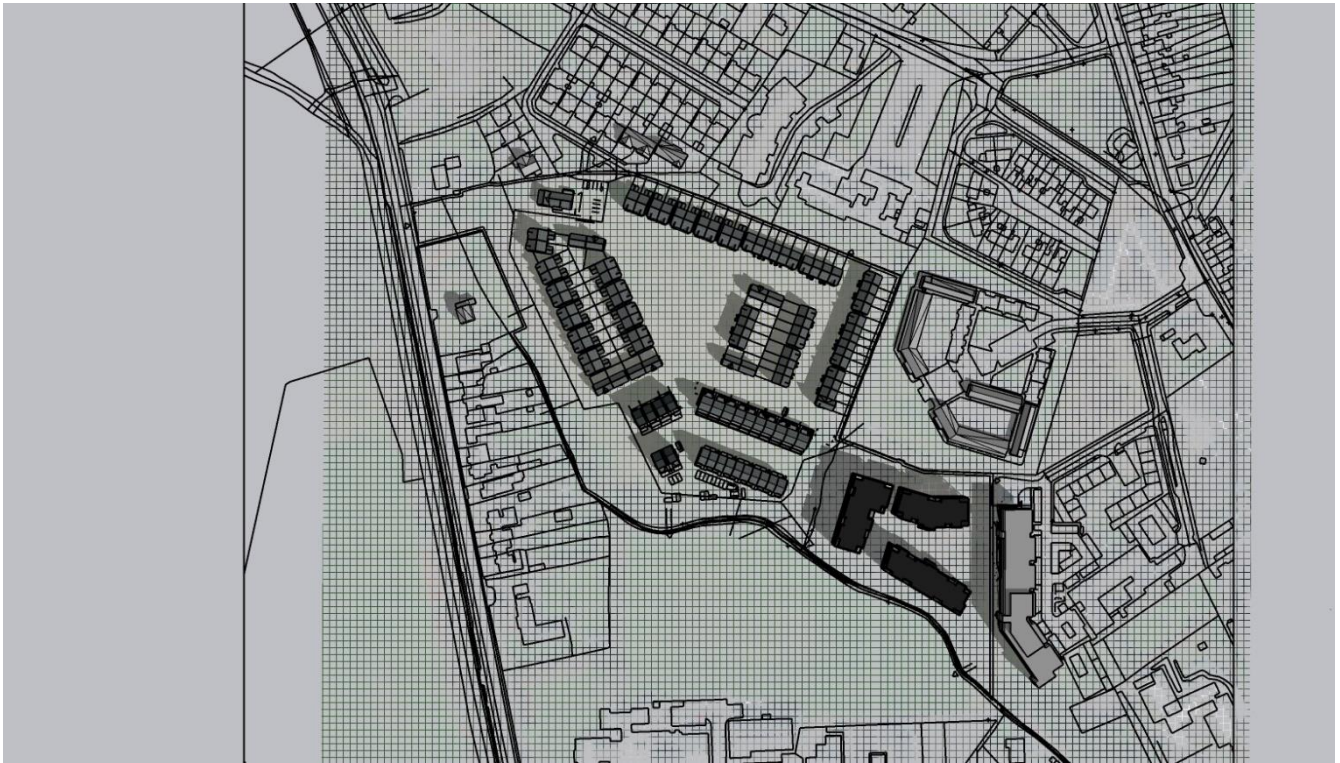
08.00 March 21st



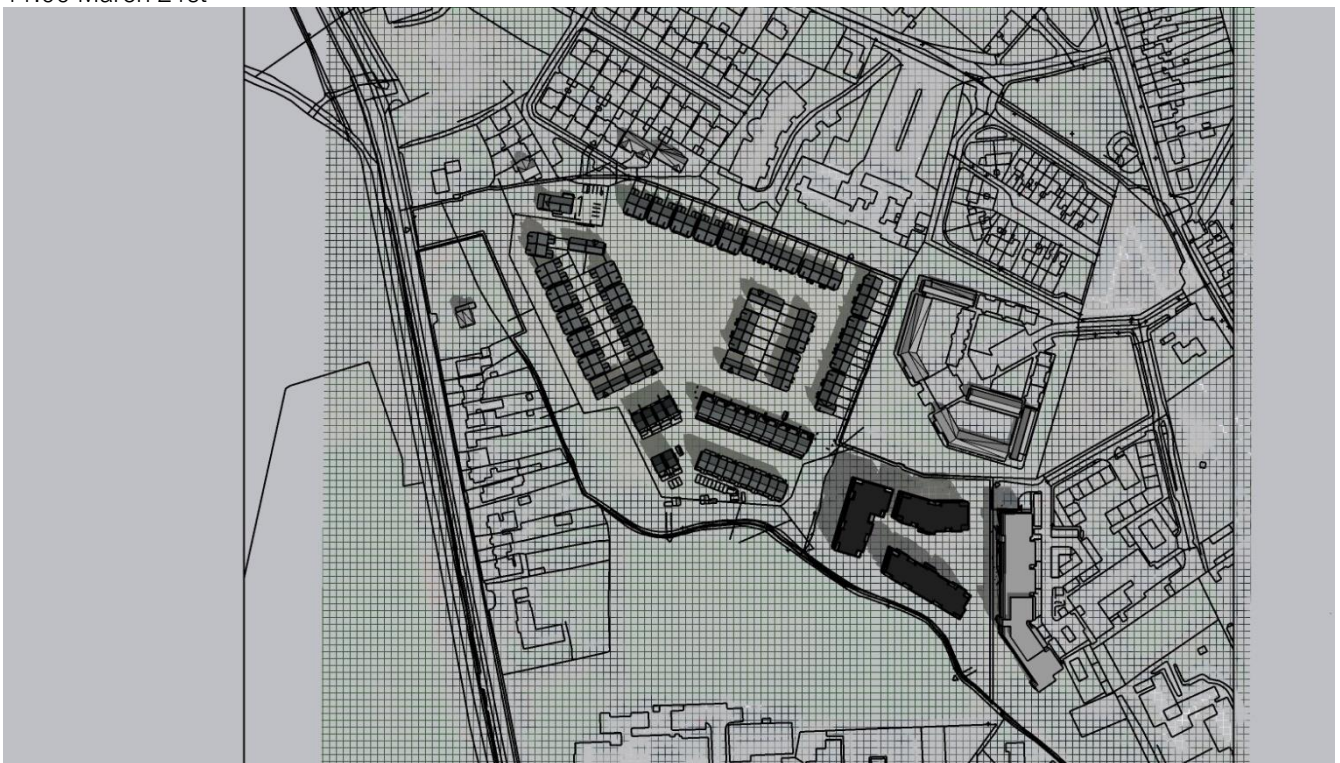
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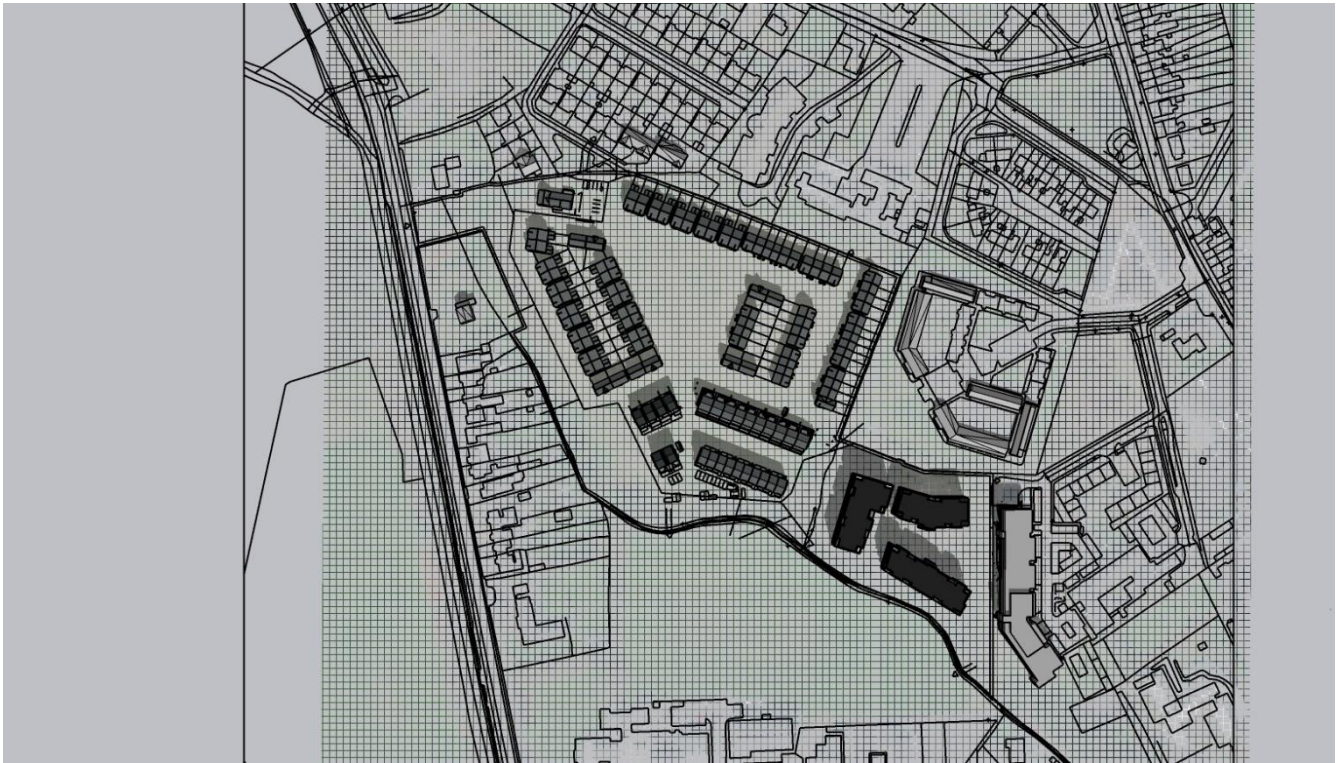
10.00 March 21st



11.00 March 21st



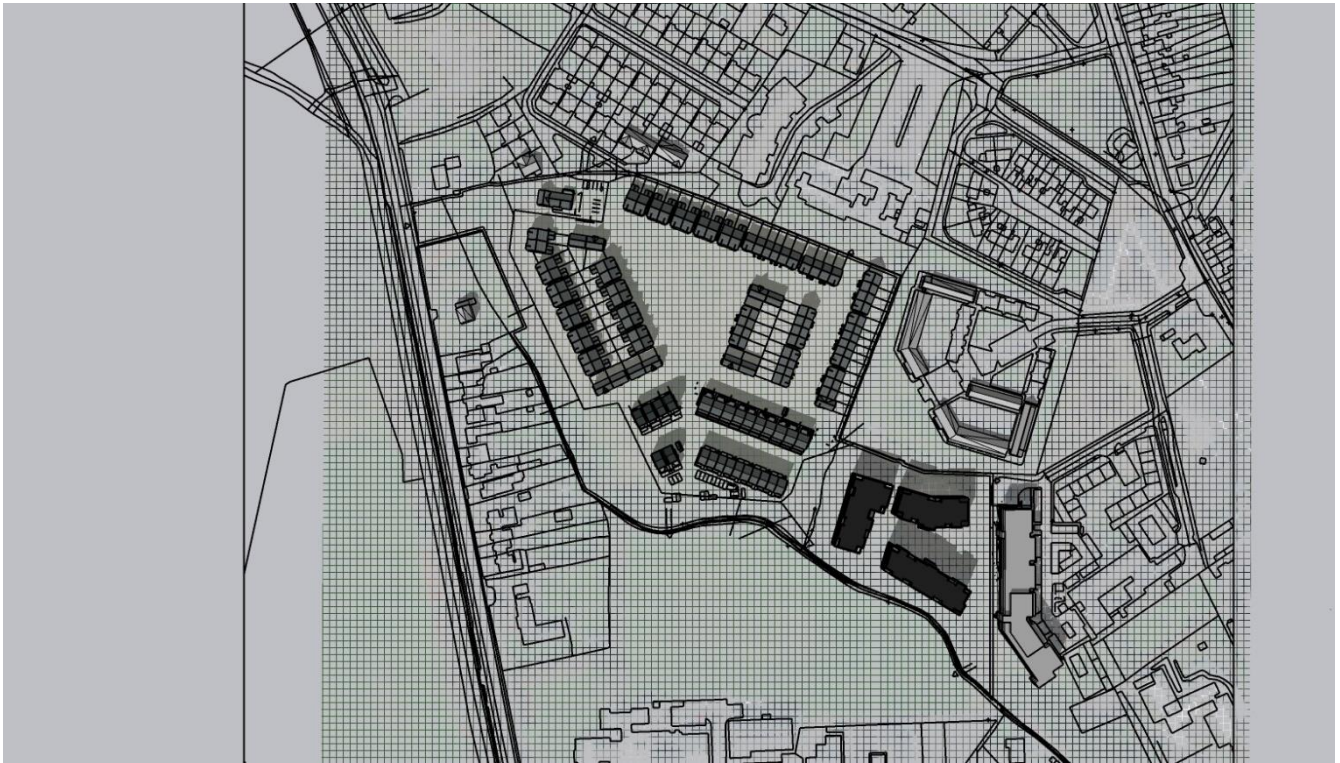
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13.00 March 21st



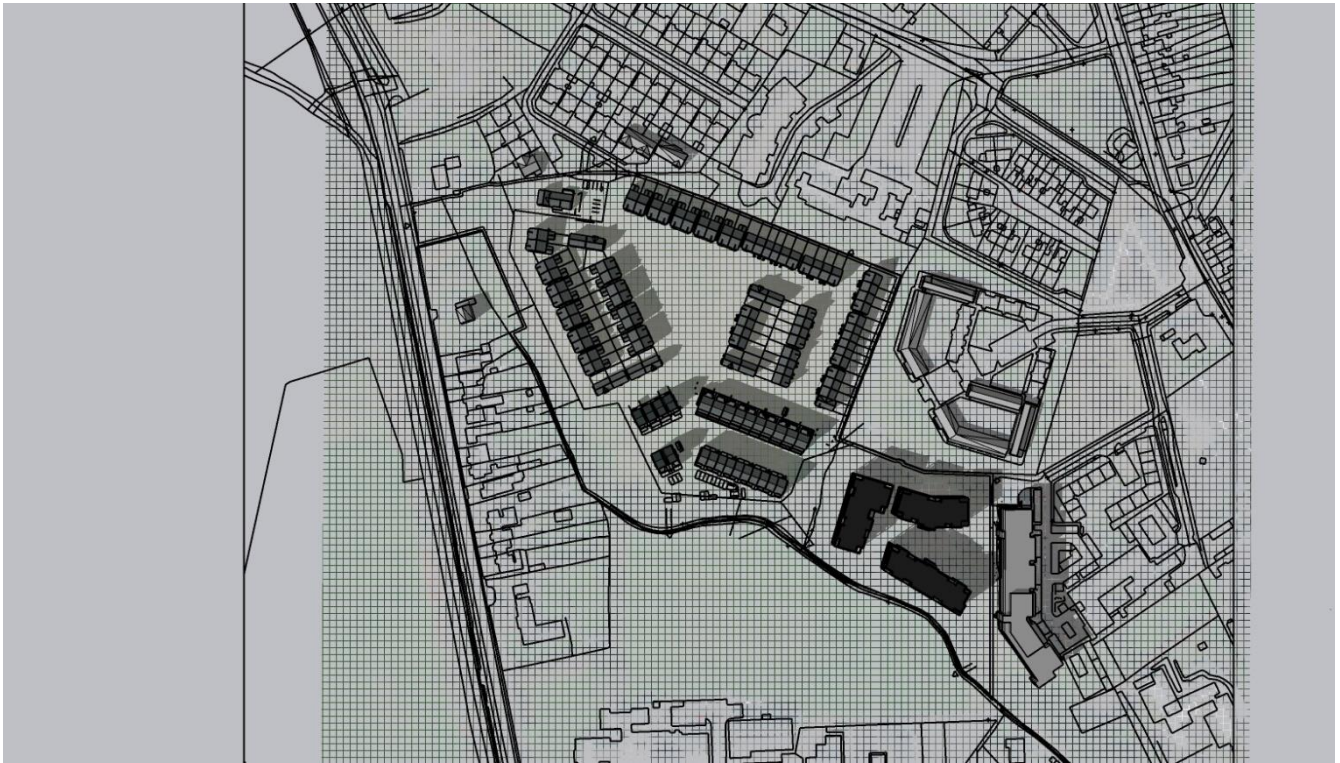
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15.00 March 21st



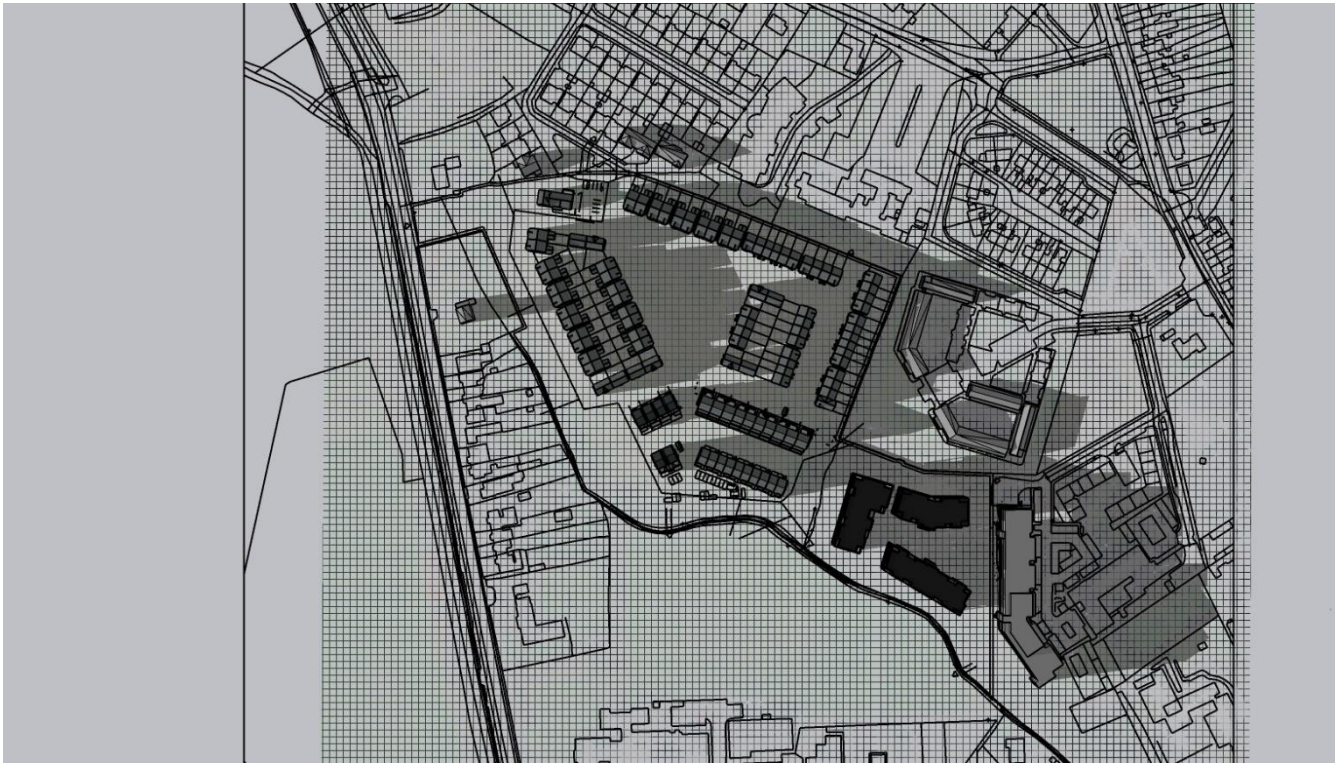
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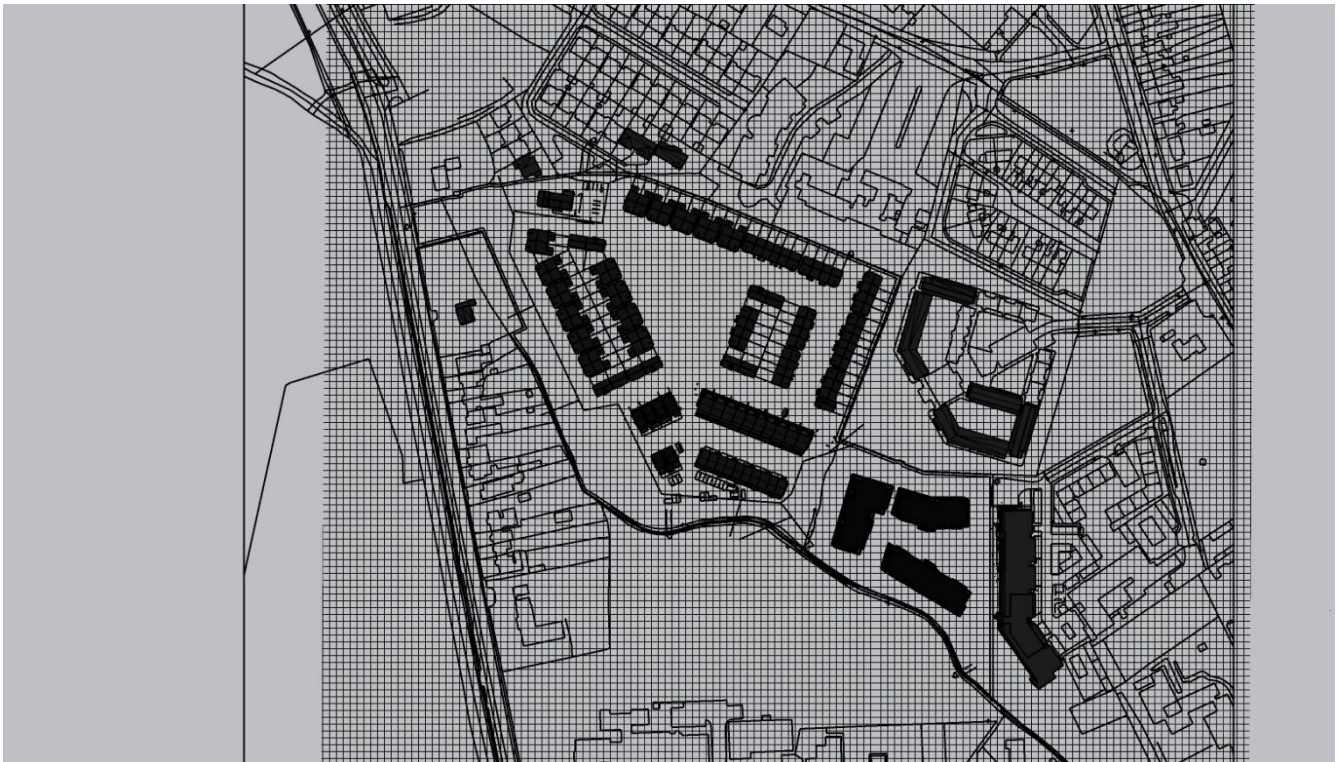
17.00 March 21st



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 21st together with the recommended BRE sunlight standards.

1						488.00 m ²
NEW STATUS						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area	
24 Hr	% / %		min	m ²	min*m ²	
6.00	100%	0%	60	0	0	
7.00	96%	4%	60	20	1,171	
8.00	92%	8%	60	39	2,342	
9.00	83%	17%	60	83	4,978	
10.00	59%	41%	60	200	12,005	
11.00	41%	59%	60	288	17,275	
12.00	34%	66%	60	322	19,325	
13.00	12%	88%	60	429	25,766	
14.00	5%	95%	60	464	27,816	
15.00	5%	95%	60	464	27,816	
16.00	10%	90%	60	439	26,352	
17.00	43%	57%	60	278	16,690	
18.00	77%	23%	60	112	6,734	
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)						6.43
Achieved daily sun time * area						188270

2						2292.00 m ²
NEW STATUS						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area	
24 Hr	% / %		min	m ²	min*m ²	
6.00	100%	0%	60	0	0	
7.00	99%	1%	60	23	1,375	
8.00	66%	34%	60	779	46,757	
9.00	29%	71%	60	1627	97,639	
10.00	18%	82%	60	1879	112,766	
11.00	11%	89%	60	2040	122,393	
12.00	6%	94%	60	2154	129,269	
13.00	0%	100%	60	2292	137,520	
14.00	6%	94%	60	2154	129,269	
15.00	9%	91%	60	2086	125,143	
16.00	10%	90%	60	1902	114,142	
17.00	37%	63%	60	1444	86,638	
18.00	88%	12%	60	275	16,502	
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)						8.14
Achieved daily sun time * area						1119413

3						540.00 m ²
NEW STATUS						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area	
24 Hr	% / %		min	m ²	min*m ²	
6.00	100%	0%	60	0	0	
7.00	100%	0%	60	0	0	
8.00	47%	53%	60	286	17,172	
9.00	21%	79%	60	427	25,596	
10.00	0%	100%	60	540	32,400	
11.00	0%	100%	60	540	32,400	
12.00	0%	100%	60	540	32,400	
13.00	0%	100%	60	540	32,400	
14.00	0%	100%	60	540	32,400	
15.00	0%	100%	60	540	32,400	
16.00	0%	100%	60	540	32,400	
17.00	63%	37%	60	200	11,988	
18.00	87%	13%	60	70	4,212	
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)						8.82
Achieved daily sun time * area						285768

4						2315.00 m ²
NEW STATUS						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area	
24 Hr	% / %		min	m ²	min*m ²	
6.00	100%	0%	60	0	0	
7.00	92%	8%	60	185	11,112	
8.00	55%	45%	60	1042	62,505	
9.00	51%	49%	60	1134	68,061	
10.00	45%	55%	60	1273	76,395	
11.00	46%	54%	60	1250	75,006	
12.00	49%	51%	60	1181	70,839	
13.00	49%	51%	60	1181	70,839	
14.00	56%	44%	60	1019	61,116	
15.00	56%	44%	60	1019	61,116	
16.00	60%	40%	60	926	55,560	
17.00	72%	28%	60	648	38,892	
18.00	75%	25%	60	579	34,725	
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)						4.94
Achieved daily sun time * area						686166

5						525.00 m ²
NEW STATUS						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area	
24 Hr	% / %		min	m ²	min*m ²	
6.00	100%	0%	60	0	0	
7.00	100%	0%	60	0	0	
8.00	100%	0%	60	0	0	
9.00	100%	0%	60	0	0	
10.00	100%	0%	60	0	0	
11.00	100%	0%	60	0	0	
12.00	81%	19%	60	100	5,985	
13.00	39%	61%	60	320	19,215	
14.00	0%	100%	60	525	31,500	
15.00	0%	100%	60	525	31,500	
16.00	0%	100%	60	525	31,500	
17.00	0%	100%	60	525	31,500	
18.00	44%	56%	60	294	17,640	
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)						5.36
Achieved daily sun time * area						168840

6						915.00 m ²
NEW STATUS						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area	
24 Hr	% / %		min	m ²	min*m ²	
6.00	100%	0%	60	0	0	
7.00	96%	4%	60	37	2,196	
8.00	58%	42%	60	384	23,058	
9.00	43%	57%	60	522	31,293	
10.00	36%	64%	60	586	35,136	
11.00	22%	78%	60	714	42,822	
12.00	19%	81%	60	741	44,469	
13.00	20%	80%	60	732	43,920	
14.00	23%	77%	60	705	42,273	
15.00	25%	75%	60	686	41,175	
16.00	29%	71%	60	650	38,979	
17.00	39%	61%	60	558	33,489	
18.00	53%	47%	60	430	25,803	
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)						7.37
Achieved daily sun time * area						404613



7							70.00 m ²
NEW STATUS							March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area		
24 Hr	% / %		min	m ²	min*m ²		
6.00	100%	0%	60	0	0		
7.00	98%	4%	60	3	168		
8.00	96%	4%	60	3	168		
9.00	96%	4%	60	3	168		
10.00	72%	28%	60	20	1,176		
11.00	31%	69%	60	48	2,898		
12.00	7%	93%	60	65	3,906		
13.00	7%	93%	60	65	3,906		
14.00	7%	93%	60	65	3,906		
15.00	7%	93%	60	65	3,906		
16.00	7%	93%	60	65	3,906		
17.00	16%	84%	60	59	3,528		
18.00	59%	41%	60	29	1,722		
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)							6.99
Achieved daily sun time * area							29358

8							80.00 m ²
NEW STATUS							March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area		
24 Hr	% / %		min	m ²	min*m ²		
6.00	100%	0%	60	0	0		
7.00	96%	4%	60	3	192		
8.00	8%	92%	60	74	4,416		
9.00	8%	92%	60	74	4,416		
10.00	8%	92%	60	74	4,416		
11.00	29%	71%	60	57	3,408		
12.00	74%	26%	60	21	1,248		
13.00	95%	5%	60	4	240		
14.00	91%	9%	60	7	432		
15.00	77%	23%	60	18	1,104		
16.00	47%	53%	60	42	2,544		
17.00	79%	21%	60	17	1,008		
18.00	95%	5%	60	4	240		
19.00	100%	0%	60	0	0		
Required sun hours @ 50% area							2
Achieved sun hours on @ 50% area							5.00
Achieved total sun time (hrs)							4.93
Achieved daily sun time * area							23664

9							2047.00 m ²
NEW STATUS							March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area		
24 Hr	% / %		min	m ²	min*m ²		
6.00	100%	0%	60	0	0		
7.00	96%	4%	60	82	4,913		
8.00	91%	9%	60	184	11,054		
9.00	79%	21%	60	430	25,792		
10.00	49%	51%	60	1044	62,638		
11.00	22%	78%	60	1597	95,800		
12.00	19%	81%	60	1658	99,484		
13.00	17%	83%	60	1699	101,941		
14.00	16%	84%	60	1719	103,169		
15.00	17%	83%	60	1699	101,941		
16.00	17%	83%	60	1699	101,941		
17.00	21%	79%	60	1617	97,028		
18.00	39%	61%	60	1249	74,920		
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)							7.17
Achieved daily sun time * area							880619

10							1520.00 m ²
NEW STATUS							March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area		
24 Hr	% / %		min	m ²	min*m ²		
6.00	100%	0%	60	0	0		
7.00	100%	0%	60	0	0		
8.00	73%	27%	60	410	24,624		
9.00	38%	62%	60	942	56,544		
10.00	0%	100%	60	1520	91,200		
11.00	0%	100%	60	1520	91,200		
12.00	0%	100%	60	1520	91,200		
13.00	0%	100%	60	1520	91,200		
14.00	0%	100%	60	1520	91,200		
15.00	0%	100%	60	1520	91,200		
16.00	0%	100%	60	1520	91,200		
17.00	52%	48%	60	730	43,776		
18.00	79%	21%	60	319	19,152		
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)							8.58
Achieved daily sun time * area							782496

11							4992.00 m ²
NEW STATUS							March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area		
24 Hr	% / %		min	m ²	min*m ²		
6.00	100%	0%	60	0	0		
7.00	96%	4%	60	200	11,981		
8.00	82%	18%	60	899	53,914		
9.00	57%	43%	60	2147	128,794		
10.00	53%	47%	60	2346	140,774		
11.00	31%	69%	60	3444	206,669		
12.00	31%	69%	60	3444	206,669		
13.00	30%	70%	60	3494	209,664		
14.00	30%	70%	60	3494	209,664		
15.00	37%	63%	60	3145	188,698		
16.00	46%	54%	60	2696	161,741		
17.00	53%	47%	60	2346	140,774		
18.00	68%	32%	60	1597	95,846		
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)							5.86
Achieved daily sun time * area							1755187

12							70.00 m ²
NEW STATUS							March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area		
24 Hr	% / %		min	m ²	min*m ²		
6.00	100%	0%	60	0	0		
7.00	96%	4%	60	3	168		
8.00	77%	23%	60	16	966		
9.00	61%	39%	60	27	1,638		
10.00	90%	10%	60	7	420		
11.00	90%	10%	60	7	420		
12.00	81%	19%	60	13	798		
13.00	47%	53%	60	37	2,226		
14.00	0%	100%	60	70	4,200		
15.00	63%	37%	60	26	1,554		
16.00	89%	11%	60	8	462		
17.00	83%	17%	60	12	714		
18.00	77%	23%	60	16	966		
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)							3.46
Achieved daily sun time * area							14532



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 ^o	Ver ^o	Σ	VSC	Section 1	Section 2	Section 3	Section 4	Hor ^o	Ver ^o	Σ	VSC					
Receptor A																					
VSC test distance 39 m																					
Target distance 73m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
	78	5	48	3	54	5			180	36%	74	5	49	7	43	9	14	8	180	35%	0.98
Receptor B																					
VSC test distance 39 m																					
Target distance 70m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
	60	5	67	3	53	5			180	36%	63	5	54	7	44	9	9	8	170	35%	0.98
Receptor C																					
VSC test distance 39 m																					
Target distance 88m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
	65	5	58	3	57	5			180	36%	81	5	53	8	38	9	8	8	180	35%	0.98
Receptor D																					
VSC test distance 30 m																					
Target distance 63m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
	64	5	67	3	49	5			180	36%	22	5	64	8	40	9	54	5	180	35%	0.98
Receptor E																					
VSC test distance 30 m																					
Target distance 69m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
	81	5	49	3	50	5			180	36%	27	5	68	8	32	9	53	5	180	35%	0.98
Receptor F																					
VSC test distance 30 m																					
Target distance 55m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
	63	5	69	3	48	5			180	36%	22	5	111	9	47	9			180	34%	0.96
Receptor G																					
VSC test distance 30 m																					
Target distance 63m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
	73	5	60	3	47	5			180	36%	29	5	80	9	25	9	46	5	180	34%	0.97
Receptor H																					
VSC test distance 30 m																					
Target distance 62m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
	76	5	57	3	47	5			180	36%	31	5	85	10	22	7	42	5	180	34%	0.97
Receptor I																					
VSC test distance 30 m																					
Target distance 50m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
	78	5	57	3	45	5			180	36%	30	5	96	10	17	7	37	5	180	34%	0.97
Receptor J																					
VSC test distance 30 m																					
Target distance 49m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
	83	5	54	3	43	4			180	36%	41	5	97	10	10	7	32	4	180	34%	0.97
Receptor K																					
VSC test distance 30 m																					
Target distance 57m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
	98	6	45	3	37	5			180	35%	98	6	60	7	22	5			180	35%	0.99
Receptor L																					
VSC test distance 30 m																					
Target distance 12m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
	67	5	51	3	62	3			180	36%	59	5	80	19	41	5			180	33%	0.91
Receptor L.1																					
VSC test distance 30 m																					
Target distance 16m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
	121	8	34	4	25	3			180	35%	121	8	25	7	34	18			180	34%	0.97



Receptor M	EXISTING								NEW								change			
	Section 1	Section 2	Section 3	Section 4	Hor ^o	Ver ^o	Σ	VSC	Section 1	Section 2	Section 3	Section 4	Hor ^o	Ver ^o	Σ	VSC				
VSC test distance 30 m																				
Target distance 24m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC		
	35	6	71	4	74	3			180	36%	35	6	64	10	81	16		180	33%	
																	0.91			
Receptor N	EXISTING								NEW								change			
VSC test distance 30 m																				
Target distance 19m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC		
	37	6	75	4	68	3			180	36%	37	6	61	9	82	18		180	32%	
																	0.91			
Receptor O	EXISTING								NEW								change			
VSC test distance 30 m																				
Target distance 22m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC		
	34	6	76	4	70	3			180	36%	34	6	29	9	117	19		180	31%	
																	0.88			
Receptor P	EXISTING								NEW								change			
VSC test distance 30 m																				
Target distance 30m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC		
	30	8	127	3	23	4			180	36%	30	8	127	16	23	7		180	32%	
																	0.89			
Receptor Q	EXISTING								NEW								change			
VSC test distance 30 m																				
Target distance 30m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC		
	22	7	127	3	31	5			180	36%	21	7	128	16	31	7		180	32%	
																	0.89			
Receptor Q.1	EXISTING								NEW								change			
VSC test distance 30 m																				
Target distance 25m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC		
	19	6	103	3	58	11			180	35%	16	6	94	16	12	11	58	11	180	32%
																	0.91			
Receptor R	EXISTING								NEW								change			
VSC test distance 30 m																				
Target distance 22m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC		
	66	9	28	5	54	3	32	3	180	35%	66	9	98	18	16	3		180	32%	
																	0.91			
Receptor R.1	EXISTING								NEW								change			
VSC test distance 30 m																				
Target distance 22m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC		
	56	8	34	5	90	3			180	36%	38	8	124	18	18	3		180	31%	
																	0.89			
Receptor R.2	EXISTING								NEW								change			
VSC test distance 30 m																				
Target distance 24m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC		
	49	8	38	5	93	3			180	36%	26	8	134	18	20	3		180	31%	
																	0.89			
Receptor R.3	EXISTING								NEW								change			
VSC test distance 39 m																				
Target distance 40m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC		
	12	8	75	4	60	3	33	6	180	36%	48	10	35	8	90	17	7	8	180	32%
																	0.90			
Receptor R.4	EXISTING								NEW								change			
VSC test distance 39 m																				
Target distance 31m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC		
	42	4	76	3	62	9			180	35%	29	10	89	22	62	9		180	31%	
																	0.89			
Receptor R.5	EXISTING								NEW								change			
VSC test distance 39 m																				
Target distance 32m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC		
	39	4	71	3	70	11			180	35%	24	10	86	22	70	11		180	31%	
																	0.89			
Receptor S	EXISTING								NEW								change			
VSC test distance 39 m																				
Target distance 21m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC		
	29	8	39	4	49	3	63	4	180	36%	29	8	109	29	19	4	23	4	180	29%
																	0.83			
Receptor S.1	EXISTING								NEW								change			
VSC test distance 39 m																				
Target distance 22m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC		
	21	7	75	4	84	4			180	36%	17	7	118	29	45	4		180	29%	
																	0.82			
Receptor S.2	EXISTING								NEW								change			
VSC test distance 39 m																				
Target distance 22m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC		
	19	6	76	4	85	4			180	36%	13	6	94	29	73	4		180	30%	
																	0.86			



Appendix D

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

A							350 m ²						
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	time * area
24 Hr	% / %	% / %	min	m ²	min*m ²	min*m ²	24 Hr	% / %	% / %	min	m ²	min*m ²	min*m ²
6.00	100%	0%	60	0	0	0	6.00	100%	0%	60	0	0	0
7.00	75%	25%	60	88	5,250	-4,410	7.00	96%	4%	60	14	840	-4,410
8.00	70%	30%	60	105	6,300	-1,260	8.00	76%	24%	60	84	5,040	-1,260
9.00	44%	56%	60	196	11,760	0	9.00	44%	56%	60	196	11,760	0
10.00	24%	76%	60	266	15,960	0	10.00	24%	76%	60	266	15,960	0
11.00	17%	83%	60	291	17,430	0	11.00	17%	83%	60	291	17,430	0
12.00	17%	83%	60	291	17,430	0	12.00	17%	83%	60	291	17,430	0
13.00	17%	83%	60	291	17,430	0	13.00	17%	83%	60	291	17,430	0
14.00	17%	83%	60	291	17,430	0	14.00	17%	83%	60	291	17,430	0
15.00	21%	79%	60	277	16,590	0	15.00	21%	79%	60	277	16,590	0
16.00	35%	65%	60	228	13,650	0	16.00	35%	65%	60	228	13,650	0
17.00	67%	33%	60	116	6,930	0	17.00	67%	33%	60	116	6,930	0
18.00	72%	28%	60	98	5,880	0	18.00	72%	28%	60	98	5,880	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	8.00	Achieved sun hours on (hrs) @ 50% area	8.00
Achieved total sun time (hrs)	7.24	Achieved total sun time (hrs)	6.97 0.96
Achieved daily sun time * area	152040	Achieved daily sun time * area	146370 0.96

B							280 m ²						
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	time * area
24 Hr	% / %	% / %	min	m ²	min*m ²	min*m ²	24 Hr	% / %	% / %	min	m ²	min*m ²	min*m ²
6.00	100%	0%	60	0	0	0	6.00	100%	0%	60	0	0	0
7.00	75%	25%	60	70	4,200	-3,528	7.00	96%	4%	60	11	672	-3,528
8.00	70%	30%	60	84	5,040	-1,848	8.00	81%	19%	60	53	3,192	-1,848
9.00	44%	56%	60	157	9,408	0	9.00	44%	56%	60	157	9,408	0
10.00	24%	76%	60	213	12,768	0	10.00	24%	76%	60	213	12,768	0
11.00	17%	83%	60	232	13,944	0	11.00	17%	83%	60	232	13,944	0
12.00	17%	83%	60	232	13,944	0	12.00	17%	83%	60	232	13,944	0
13.00	17%	83%	60	232	13,944	0	13.00	17%	83%	60	232	13,944	0
14.00	17%	83%	60	232	13,944	0	14.00	17%	83%	60	232	13,944	0
15.00	21%	79%	60	221	13,272	0	15.00	21%	79%	60	221	13,272	0
16.00	35%	65%	60	182	10,920	0	16.00	35%	65%	60	182	10,920	0
17.00	67%	33%	60	92	5,544	0	17.00	67%	33%	60	92	5,544	0
18.00	72%	28%	60	78	4,704	0	18.00	72%	28%	60	78	4,704	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	8.00	Achieved sun hours on (hrs) @ 50% area	8.00
Achieved total sun time (hrs)	7.24	Achieved total sun time (hrs)	6.92 0.96
Achieved daily sun time * area	121632	Achieved daily sun time * area	116256 0.96

C							410 m ²						
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	time * area
24 Hr	% / %	% / %	min	m ²	min*m ²	min*m ²	24 Hr	% / %	% / %	min	m ²	min*m ²	min*m ²
6.00	100%	0%	60	0	0	0	6.00	100%	0%	60	0	0	0
7.00	75%	25%	60	103	6,150	-5,412	7.00	97%	3%	60	12	738	-5,412
8.00	70%	30%	60	123	7,380	-4,182	8.00	87%	13%	60	53	3,198	-4,182
9.00	44%	56%	60	230	13,776	0	9.00	44%	56%	60	230	13,776	0
10.00	24%	76%	60	312	18,696	0	10.00	24%	76%	60	312	18,696	0
11.00	17%	83%	60	340	20,418	0	11.00	17%	83%	60	340	20,418	0
12.00	17%	83%	60	340	20,418	0	12.00	17%	83%	60	340	20,418	0
13.00	17%	83%	60	340	20,418	0	13.00	17%	83%	60	340	20,418	0
14.00	17%	83%	60	340	20,418	0	14.00	17%	83%	60	340	20,418	0
15.00	21%	79%	60	324	19,434	0	15.00	21%	79%	60	324	19,434	0
16.00	35%	65%	60	267	15,990	0	16.00	35%	65%	60	267	15,990	0
17.00	67%	33%	60	135	8,118	0	17.00	67%	33%	60	135	8,118	0
18.00	72%	28%	60	115	6,888	0	18.00	72%	28%	60	115	6,888	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	8.00	Achieved sun hours on (hrs) @ 50% area	8.00
Achieved total sun time (hrs)	7.24	Achieved total sun time (hrs)	6.85 0.95
Achieved daily sun time * area	178104	Achieved daily sun time * area	168510 0.95



D 180 m²

EXISTING STATUS						March 21st	
Time	Shadow	Sunlight	Sun time	Sun area	time * area		
24 Hr	% / %		min	m ²	min*m ²		
6.00	100%	0%	60	0	0		
7.00	75%	25%	60	45	2,700		
8.00	70%	30%	60	54	3,240		
9.00	44%	56%	60	101	6,048		
10.00	24%	76%	60	137	8,208		
11.00	17%	83%	60	149	8,964		
12.00	17%	83%	60	149	8,964		
13.00	17%	83%	60	149	8,964		
14.00	17%	83%	60	149	8,964		
15.00	21%	79%	60	142	8,532		
16.00	35%	65%	60	117	7,020		
17.00	67%	33%	60	59	3,564		
18.00	72%	28%	60	50	3,024		
19.00	100%	0%	60	0	0		

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	8.00
Achieved total sun time (hrs)	7.24
Achieved daily sun time * area	78192

NEW STATUS March 21st change

Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m ²	min*m ²	min*m ²
6.00	100%	0%	60	0	0	0
7.00	97%	3%	60	5	324	-2,376
8.00	88%	12%	60	22	1,296	-1,944
9.00	44%	56%	60	101	6,048	0
10.00	24%	76%	60	137	8,208	0
11.00	17%	83%	60	149	8,964	0
12.00	17%	83%	60	149	8,964	0
13.00	17%	83%	60	149	8,964	0
14.00	17%	83%	60	149	8,964	0
15.00	21%	79%	60	142	8,532	0
16.00	35%	65%	60	117	7,020	0
17.00	67%	33%	60	59	3,564	0
18.00	72%	28%	60	50	3,024	0
19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	8.00
Achieved total sun time (hrs)	6.84 0.95
Achieved daily sun time * area	73872 0.95

E 170 m²

EXISTING STATUS						March 21st	
Time	Shadow	Sunlight	Sun time	Sun area	time * area		
24 Hr	% / %		min	m ²	min*m ²		
6.00	100%	0%	60	0	0		
7.00	75%	25%	60	43	2,550		
8.00	70%	30%	60	51	3,060		
9.00	44%	56%	60	95	5,712		
10.00	24%	76%	60	129	7,752		
11.00	12%	88%	60	150	8,976		
12.00	10%	90%	60	153	9,180		
13.00	10%	90%	60	153	9,180		
14.00	10%	90%	60	153	9,180		
15.00	17%	83%	60	141	8,466		
16.00	33%	67%	60	114	6,834		
17.00	64%	36%	60	61	3,672		
18.00	69%	31%	60	53	3,162		
19.00	100%	0%	60	0	0		

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	8.00
Achieved total sun time (hrs)	7.62
Achieved daily sun time * area	77724

NEW STATUS March 21st change

Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m ²	min*m ²	min*m ²
6.00	100%	0%	60	0	0	0
7.00	97%	3%	60	5	306	-2,244
8.00	93%	7%	60	12	714	-2,346
9.00	44%	56%	60	95	5,712	0
10.00	24%	76%	60	129	7,752	0
11.00	12%	88%	60	150	8,976	0
12.00	10%	90%	60	153	9,180	0
13.00	10%	90%	60	153	9,180	0
14.00	10%	90%	60	153	9,180	0
15.00	17%	83%	60	141	8,466	0
16.00	33%	67%	60	114	6,834	0
17.00	64%	36%	60	61	3,672	0
18.00	69%	31%	60	53	3,162	0
19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	8.00
Achieved total sun time (hrs)	7.17 0.94
Achieved daily sun time * area	73134 0.94

F 1,500 m²

EXISTING STATUS						March 21st	
Time	Shadow	Sunlight	Sun time	Sun area	time * area		
24 Hr	% / %		min	m ²	min*m ²		
6.00	100%	0%	60	0	0		
7.00	64%	36%	60	540	32,400		
8.00	28%	72%	60	1080	64,800		
9.00	10%	90%	60	1350	81,000		
10.00	10%	90%	60	1350	81,000		
11.00	10%	90%	60	1350	81,000		
12.00	10%	90%	60	1350	81,000		
13.00	13%	87%	60	1305	78,300		
14.00	14%	86%	60	1290	77,400		
15.00	18%	82%	60	1230	73,800		
16.00	20%	80%	60	1200	72,000		
17.00	36%	64%	60	960	57,600		
18.00	51%	49%	60	735	44,100		
19.00	100%	0%	60	0	0		

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	10.00
Achieved total sun time (hrs)	9.16
Achieved daily sun time * area	82440

NEW STATUS March 21st change

Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m ²	min*m ²	min*m ²
6.00	100%	0%	60	0	0	0
7.00	96%	4%	60	60	3,600	-28,800
8.00	96%	4%	60	60	3,600	-61,200
9.00	10%	90%	60	1350	81,000	0
10.00	10%	90%	60	1350	81,000	0
11.00	10%	90%	60	1350	81,000	0
12.00	10%	90%	60	1350	81,000	0
13.00	13%	87%	60	1305	78,300	0
14.00	14%	86%	60	1290	77,400	0
15.00	18%	82%	60	1230	73,800	0
16.00	20%	80%	60	1200	72,000	0
17.00	36%	64%	60	960	57,600	0
18.00	51%	49%	60	735	44,100	0
19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	9.00
Achieved total sun time (hrs)	8.16 0.89
Achieved daily sun time * area	73440 0.89

G 800 m²

EXISTING STATUS						March 21st	
Time	Shadow	Sunlight	Sun time	Sun area	time * area		
24 Hr	% / %		min	m ²	min*m ²		
6.00	100%	0%	60	0	0		
7.00	79%	21%	60	168	10,080		
8.00	61%	39%	60	312	18,720		
9.00	54%	46%	60	368	22,080		
10.00	51%	49%	60	392	23,520		
11.00	31%	69%	60	552	33,120		
12.00	12%	88%	60	704	42,240		
13.00	15%	85%	60	680	40,800		
14.00	21%	79%	60	632	37,920		
15.00	21%	79%	60	632	37,920		
16.00	21%	79%	60	632	37,920		
17.00	21%	79%	60	632	37,920		
18.00	39%	61%	60	488	29,280		
19.00	100%	0%	60	0	0		

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	8.00
Achieved total sun time (hrs)	7.74
Achieved daily sun time * area	371520

NEW STATUS March 21st change

Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m ²	min*m ²	min*m ²
6.00	100%	0%	60	0	0	0
7.00	79%	21%	60	168	10,080	0
8.00	76%	24%	60	192	11,520	-7,200
9.00	71%	29%	60	232	13,920	-8,160
10.00	51%	49%	60	392	23,520	0
11.00	31%	69%	60	552	33,120	0
12.00	12%	88%	60	704	42,240	0
13.00	15%	85%	60	680	40,800	0
14.00	21%	79%	60	632	37,920	0
15.00	21%	79%	60	632	37,920	0
16.00	21%	79%	60	632	37,920	0
17.00	21%	79%	60	632	37,920	0
18.00	39%	61%	60	488	29,280	0
19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	8.00
Achieved total sun time (hrs)	7.42 0.96
Achieved daily sun time * area	356160 0.96



H						140
EXISTING STATUS						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	time * area	
24 Hr	% / %		min	m2	min*m2	
6.00	100%	0%	60	0	0	
7.00	84%	16%	60	22	1,344	
8.00	53%	47%	60	66	3,948	
9.00	42%	58%	60	81	4,872	
10.00	19%	81%	60	113	6,804	
11.00	12%	88%	60	123	7,392	
12.00	12%	88%	60	123	7,392	
13.00	9%	91%	60	127	7,644	
14.00	9%	91%	60	127	7,644	
15.00	9%	91%	60	127	7,644	
16.00	9%	91%	60	127	7,644	
17.00	15%	85%	60	119	7,140	
18.00	20%	80%	60	112	6,720	
19.00	100%	0%	60	0	0	

Required sun hours @ 50% area (hr) 2
 Achieved sun hours on (hrs) @ 50% area 10.00
 Achieved total sun time (hrs) 9.07
 Achieved daily sun time * area 76188

NEW STATUS						March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area	
24 Hr	% / %		min	m2	min*m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0	0
7.00	84%	16%	60	22	1,344	0	0
8.00	76%	24%	60	34	2,016	-1,932	
9.00	76%	24%	60	34	2,016	-2,856	
10.00	48%	52%	60	73	4,368	-2,436	
11.00	42%	58%	60	81	4,872	-2,520	
12.00	23%	77%	60	108	6,468	-924	
13.00	9%	91%	60	127	7,644	0	
14.00	9%	91%	60	127	7,644	0	
15.00	9%	91%	60	127	7,644	0	
16.00	9%	91%	60	127	7,644	0	
17.00	15%	85%	60	119	7,140	0	
18.00	20%	80%	60	112	6,720	0	
19.00	100%	0%	60	0	0	0	0

Required sun hours @ 50% area (hr) 2
 Achieved sun hours on (hrs) @ 50% area 9.00
 Achieved total sun time (hrs) 7.8
 Achieved daily sun time * area 65520

I						420
EXISTING STATUS						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	time * area	
24 Hr	% / %		min	m2	min*m2	
6.00	100%	0%	60	0	0	
7.00	71%	29%	60	122	7,308	
8.00	46%	54%	60	227	13,608	
9.00	10%	90%	60	378	22,680	
10.00	10%	90%	60	378	22,680	
11.00	10%	90%	60	378	22,680	
12.00	10%	90%	60	378	22,680	
13.00	10%	90%	60	378	22,680	
14.00	10%	90%	60	378	22,680	
15.00	15%	85%	60	357	21,420	
16.00	21%	79%	60	332	19,908	
17.00	69%	31%	60	130	7,812	
18.00	83%	17%	60	71	4,284	
19.00	100%	0%	60	0	0	

Required sun hours @ 50% area (hr) 2
 Achieved sun hours on (hrs) @ 50% area 9.00
 Achieved total sun time (hrs) 8.35
 Achieved daily sun time * area 210420

NEW STATUS						March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area	
24 Hr	% / %		min	m2	min*m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0	0
7.00	71%	29%	60	122	7,308	0	0
8.00	46%	54%	60	214	12,852	-756	
9.00	16%	84%	60	353	21,168	-1,512	
10.00	13%	87%	60	365	21,924	-756	
11.00	10%	90%	60	378	22,680	0	
12.00	10%	90%	60	378	22,680	0	
13.00	10%	90%	60	378	22,680	0	
14.00	12%	88%	60	370	22,176	-504	
15.00	18%	82%	60	344	20,664	-756	
16.00	23%	77%	60	323	19,404	-504	
17.00	74%	26%	60	109	6,552	-1,260	
18.00	83%	17%	60	71	4,284	0	
19.00	100%	0%	60	0	0	0	0

Required sun hours @ 50% area (hr) 2
 Achieved sun hours on (hrs) @ 50% area 9.00
 Achieved total sun time (hrs) 8.11
 Achieved daily sun time * area 204372

J						540
EXISTING STATUS						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	time * area	
24 Hr	% / %		min	m2	min*m2	
6.00	100%	0%	60	0	0	
7.00	68%	32%	60	173	10,368	
8.00	38%	62%	60	335	20,088	
9.00	24%	76%	60	410	24,624	
10.00	19%	81%	60	437	26,244	
11.00	18%	82%	60	443	26,568	
12.00	18%	82%	60	443	26,568	
13.00	18%	82%	60	443	26,568	
14.00	18%	82%	60	443	26,568	
15.00	27%	73%	60	394	23,652	
16.00	34%	66%	60	356	21,384	
17.00	49%	51%	60	275	16,524	
18.00	61%	39%	60	211	12,636	
19.00	100%	0%	60	0	0	

Required sun hours @ 50% area (hr) 2
 Achieved sun hours on (hrs) @ 50% area 10.00
 Achieved total sun time (hrs) 8.08
 Achieved daily sun time * area 261792

NEW STATUS						March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area	
24 Hr	% / %		min	m2	min*m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0	0
7.00	68%	32%	60	173	10,368	0	0
8.00	38%	62%	60	335	20,088	0	0
9.00	24%	76%	60	410	24,624	0	0
10.00	19%	81%	60	437	26,244	0	0
11.00	18%	82%	60	443	26,568	0	0
12.00	18%	82%	60	443	26,568	0	0
13.00	20%	80%	60	432	25,920	-648	
14.00	23%	77%	60	416	24,948	-1,620	
15.00	33%	67%	60	362	21,708	-1,944	
16.00	48%	52%	60	281	16,848	-4,536	
17.00	73%	27%	60	146	8,748	-7,776	
18.00	82%	18%	60	97	5,832	-6,804	
19.00	100%	0%	60	0	0	0	0

Required sun hours @ 50% area (hr) 2
 Achieved sun hours on (hrs) @ 50% area 9.00
 Achieved total sun time (hrs) 7.36
 Achieved daily sun time * area 238464

K						600
EXISTING STATUS						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	time * area	
24 Hr	% / %		min	m2	min*m2	
6.00	100%	0%	60	0	0	
7.00	93%	7%	60	42	2,520	
8.00	66%	34%	60	204	12,240	
9.00	41%	59%	60	354	21,240	
10.00	15%	85%	60	510	30,600	
11.00	15%	85%	60	510	30,600	
12.00	15%	85%	60	510	30,600	
13.00	15%	85%	60	510	30,600	
14.00	15%	85%	60	510	30,600	
15.00	15%	85%	60	510	30,600	
16.00	15%	85%	60	510	30,600	
17.00	26%	74%	60	444	26,640	
18.00	48%	52%	60	312	18,720	
19.00	100%	0%	60	0	0	

Required sun hours @ 50% area (hr) 2
 Achieved sun hours on (hrs) @ 50% area 10.00
 Achieved total sun time (hrs) 8.21
 Achieved daily sun time * area 295560

NEW STATUS						March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area	
24 Hr	% / %		min	m2	min*m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0	0
7.00	93%	7%	60	42	2,520	0	0
8.00	66%	34%	60	204	12,240	0	0
9.00	41%	59%	60	354	21,240	0	0
10.00	15%	85%	60	510	30,600	0	0
11.00	15%	85%	60	510	30,600	0	0
12.00	15%	85%	60	510	30,600	0	0
13.00	15%	85%	60	510	30,600	0	0
14.00	18%	82%	60	492	29,520	-1,080	
15.00	26%	74%	60	444	26,640	-3,960	
16.00	48%	52%	60	312	18,720	-11,880	
17.00	79%	21%	60	126	7,560	-19,080	
18.00	97%	3%	60	18	1,080	-17,640	
19.00	100%	0%	60	0	0	0	0

Required sun hours @ 50% area (hr) 2
 Achieved sun hours on (hrs) @ 50% area 8.00
 Achieved total sun time (hrs) 6.72
 Achieved daily sun time * area 241920



L						1,400 m ²
EXISTING STATUS						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	time * area	
24 Hr	% / %		min	m ²	min*m ²	
6.00	100%	0%	60	0	0	
7.00	66%	34%	60	476	28,560	
8.00	47%	53%	60	742	44,520	
9.00	32%	68%	60	952	57,120	
10.00	17%	83%	60	1162	69,720	
11.00	17%	83%	60	1162	69,720	
12.00	17%	83%	60	1162	69,720	
13.00	17%	83%	60	1162	69,720	
14.00	17%	83%	60	1162	69,720	
15.00	26%	74%	60	1036	62,160	
16.00	38%	62%	60	868	52,080	
17.00	45%	55%	60	770	46,200	
18.00	55%	45%	60	630	37,800	
19.00	100%	0%	60	0	0	

Required sun hours @ 50% area (hr) 2
 Achieved sun hours on (hrs) @ 50% area 10.00
 Achieved total sun time (hrs) 8.06
 Achieved daily sun time * area 677040

NEW STATUS						March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area	
24 Hr	% / %		min	m ²	min*m ²	min*m ²	
6.00	100%	0%	60	0	0	0	0
7.00	66%	34%	60	476	28,560	28,560	0
8.00	47%	53%	60	742	44,520	44,520	0
9.00	32%	68%	60	952	57,120	57,120	0
10.00	19%	81%	60	1134	68,040	68,040	-1,680
11.00	21%	79%	60	1106	66,360	66,360	-3,360
12.00	23%	77%	60	1078	64,680	64,680	-5,040
13.00	25%	75%	60	1050	63,000	63,000	-6,720
14.00	32%	68%	60	952	57,120	57,120	-12,600
15.00	26%	74%	60	1036	62,160	62,160	0
16.00	38%	62%	60	868	52,080	52,080	-12,600
17.00	42%	58%	60	756	45,360	45,360	-31,080
18.00	59%	41%	60	618	37,080	37,080	-36,960
19.00	100%	0%	60	0	0	0	0

Required sun hours @ 50% area (hr) 2
 Achieved sun hours on (hrs) @ 50% area 8.00
 Achieved total sun time (hrs) 6.75
 Achieved daily sun time * area 567000

0.84
0.84

M						3,500 m ²
EXISTING STATUS						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	time * area	
24 Hr	% / %		min	m ²	min*m ²	
6.00	100%	0%	60	0	0	
7.00	98%	2%	60	70	4,200	
8.00	56%	44%	60	1540	92,400	
9.00	45%	55%	60	1925	115,500	
10.00	34%	66%	60	2310	138,600	
11.00	28%	72%	60	2520	151,200	
12.00	16%	84%	60	2940	176,400	
13.00	19%	81%	60	2835	170,100	
14.00	19%	81%	60	2835	170,100	
15.00	19%	81%	60	2835	170,100	
16.00	19%	81%	60	2835	170,100	
17.00	19%	81%	60	2835	170,100	
18.00	19%	81%	60	2835	170,100	
19.00	100%	0%	60	0	0	

Required sun hours @ 50% area (hr) 2
 Achieved sun hours on (hrs) @ 50% area 10.00
 Achieved total sun time (hrs) 8.09
 Achieved daily sun time * area 1698900

NEW STATUS						March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area	
24 Hr	% / %		min	m ²	min*m ²	min*m ²	
6.00	100%	0%	60	0	0	0	0
7.00	98%	2%	60	70	4,200	4,200	0
8.00	56%	44%	60	1540	92,400	92,400	0
9.00	45%	55%	60	1925	115,500	115,500	0
10.00	34%	66%	60	2310	138,600	138,600	0
11.00	28%	72%	60	2520	151,200	151,200	0
12.00	16%	84%	60	2940	176,400	176,400	0
13.00	19%	81%	60	2835	170,100	170,100	0
14.00	22%	78%	60	2730	163,800	163,800	-6,300
15.00	25%	75%	60	2625	157,500	157,500	-12,600
16.00	35%	65%	60	2275	136,500	136,500	-33,600
17.00	67%	33%	60	1155	69,300	69,300	-100,800
18.00	87%	13%	60	455	27,300	27,300	-142,800
19.00	100%	0%	60	0	0	0	0

Required sun hours @ 50% area (hr) 2
 Achieved sun hours on (hrs) @ 50% area 8.00
 Achieved total sun time (hrs) 6.68
 Achieved daily sun time * area 1402800

0.83
0.83

N						650 m ²
EXISTING STATUS						March 21st
Time	Shadow	Sunlight	Sun time	Sun area	time * area	
24 Hr	% / %		min	m ²	min*m ²	
6.00	100%	0%	60	0	0	
7.00	83%	17%	60	111	6,630	
8.00	75%	25%	60	163	9,750	
9.00	71%	29%	60	189	11,310	
10.00	36%	64%	60	416	24,960	
11.00	19%	81%	60	527	31,590	
12.00	13%	87%	60	566	33,930	
13.00	13%	87%	60	566	33,930	
14.00	15%	85%	60	553	33,150	
15.00	15%	85%	60	553	33,150	
16.00	15%	85%	60	553	33,150	
17.00	15%	85%	60	553	33,150	
18.00	26%	74%	60	481	28,860	
19.00	100%	0%	60	0	0	

Required sun hours @ 50% area (hr) 2
 Achieved sun hours on (hrs) @ 50% area 9.00
 Achieved total sun time (hrs) 8.04
 Achieved daily sun time * area 313560

NEW STATUS						March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area	
24 Hr	% / %		min	m ²	min*m ²	min*m ²	
6.00	100%	0%	60	0	0	0	0
7.00	83%	17%	60	111	6,630	6,630	0
8.00	75%	25%	60	163	9,750	9,750	0
9.00	71%	29%	60	189	11,310	11,310	0
10.00	36%	64%	60	416	24,960	24,960	0
11.00	19%	81%	60	527	31,590	31,590	0
12.00	13%	87%	60	566	33,930	33,930	0
13.00	13%	87%	60	566	33,930	33,930	0
14.00	15%	85%	60	553	33,150	33,150	0
15.00	15%	85%	60	553	33,150	33,150	0
16.00	15%	85%	60	553	33,150	33,150	0
17.00	15%	85%	60	553	33,150	33,150	0
18.00	26%	74%	60	481	28,860	28,860	0
19.00	100%	0%	60	0	0	0	0

Required sun hours @ 50% area (hr) 2
 Achieved sun hours on (hrs) @ 50% area 9.00
 Achieved total sun time (hrs) 8.04
 Achieved daily sun time * area 313560

1.00
1.00



End of Report

