Douglas

Proposed Residential Development

Daylight and Sunlight Analysis Report

Carrigaline Road/Churchyard Lane,
Douglas,
Co. Cork

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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 Barrys Field Ltd to carry out the analysis and report for the proposed development at Carrigaline Road/Churchyard Lane, Douglas, Cork.

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

Permission for the following Large-Scale Residential Development (LRD) located at Carrigaline Road and Churchyard Lane, Douglas, Cork, comprising the construction of 124 no. residential apartments (consisting of a mix of 1, 2 and 3 bed units), 1 no. cafe unit and 2 no. office units, in a development ranging in height from 1 to 5 storeys and all associated site development works including footpaths, car and bicycle parking, drainage, bicycle and bin stores, lighting, fencing, landscaping/amenity areas, ESB substation/switchroom and plant room. Site development works include 2 no. new uncontrolled pedestrian crossings and footpath improvements on Churchyard Lane which requires the removal of 6 no. existing on-street car parking spaces. The proposed development works include a connection and construction of a new storm water and foul sewer along Carrigaline Road. Access to the site will be via a new vehicle access point and a new pedestrian connection from Carrigaline Road and 2 new pedestrian connections onto Churchyard Lane. The new vehicular access requires the removal of 4 no. existing car parking spaces.

1.5 Geographical overview

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



Image 1.1: Proposed development site boundary. Imagery © Google 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 and Method 2 described in the methodology section.
- Assessed in accordance with BS EN 17037:2018 National Annex.
- The results from table 5.1 are reviewed under each standard below. The daylight reception assessment has been targeted to all habitable rooms within the proposed development on the ground floor and a number of habitable rooms on the first floor. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms.

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

- Level 00: Residential rooms achieved an average daylight factor (DF) of 3.1% and an illuminance of 465 lux on over 50% of the floor area for over 50% of the available daylight hours. An average DF of 1.1% and an illuminance of 153 lux on over 95% of the floor area for over 50% of the available daylight hours was achieved.
- Level 01: Residential rooms achieved an average daylight factor (DF) of 3.0% and an illuminance of 457 lux on over 50% of the floor area for over 50% of the available daylight hours. An average DF of 1.1% and an illuminance of 151 lux on over 95% of the floor area for over 50% of the available daylight hours was achieved.
- All units above the examined and compliant rooms are further deemed compliant as the proposed rooms are similar in parameters and they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor typically 0.3%-0.5% per floor level.
- Overall compliance for proposed development = 100%.

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

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

- Overall compliance for proposed development = 100%

In summary, the calculation results have achieved full compliance under IS EN17037 / BS EN17307 and full compliance under 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 high level of residential daylight amenity to future occupants.

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

Based on the BRE guidelines at least 50% of the amenity space should receive at least two hours of sunlight on the 21st of March. From the calculation results in table 5.4 we note the selected amenity spaces all achieved sunlight above the recommended guidelines or minimum recommendations, see image 5.3 for receptor/amenity space location. Summary of results are as follows:

- The public open space amenity area calculated sunlight on at least 50% of the area on March 21st is 6.0 hours.
- The communal space amenity area calculated sunlight on at least 50% of the area on March 21st is 4.0 hours.

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

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

Impact on daylight reception analysis on existing environment

The BRE recommends that the effects of a new development on daylight reception should not impact any existing VSC by more than 20% or have a maximum change factor in excess of 0.80. From the calculation results we note all selected neighbouring habitable receptors are affected to some degree with regards to daylight reception due to the introduction of the proposed development in their respective habitable rooms facing the proposed development. The calculated change in daylight reception in all of the neighbouring receptors/windows achieved a change factor ranging from 0.83 to 0.91. 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):

- North east / East receptors: Receptor no. 1 to 13: Dwellings located on the Old Carrigaline road with ground floor windows were examined and resulted in a change factor range of 0.86 to 0.91. These receptors are comfortably within the guidelines and the effect is determined as negligible under BRE definitions.
- North west receptors: Receptor no. 14 to 16: The private dwelling with ground floor windows were examined and resulted in a change factor range of 0.83 to 0.86. These receptors are within the guidelines and the effect is determined as negligible under BRE definitions.
- Overall, the average change ratio for VSC is 0.88.

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 and 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 receptor: Receptor no. 1, Douglas graveyard resulted in a change factor of 0.93. The change happens in the early morning hours of 07.00-10.00. The calculation findings are comfortably within guidelines, and the effect is determined as negligible under BRE definitions.
- North receptor: Receptor no. 2, a private garden resulted in a change factor of 0.88. The change happens in the morning hours of 07.00-13.00. The calculation findings are well within guidelines, and the effect is determined as negligible under BRE definitions.
- East receptors: These spaces are private amenity garden/front yard to houses on the Old Carrigaline road. Receptor no. 3 and 4 resulted in a change factor of 0.88 & 0.85. The change happens in the late afternoon hours of 15.00-18.00. The calculation findings are within guidelines, and the effect is determined as negligible under BRE definitions.

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

3 Standards and guidelines

3.1 Standards and guidelines overview

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

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

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

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

3.3 EN 17037:2018: Daylight in Buildings

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

3.4 IS EN 17037:2018: Daylight in Buildings

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

3.5 BS EN 17037:2018: Daylight in buildings

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

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

4 Approach and methodology

4.1 General approach

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

Performance of proposed development

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

Impact of proposed development on the existing surrounding environment:

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

4.2 Note on the nature and effects of daylight and sunlight

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

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

4.3 Assessment methodology

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

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

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

4.4 New buildings

Daylight provision:

Daylight provision within IS EN 17037 guidelines

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

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

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

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

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

Nation	Capital	Geographical latitude 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 (Ev,d,med) for the capital cities throughout Europe to account for external local illuminance levels.
- Method 2-Illuminance method: This calculation method uses the illuminance targets on the reference plane. The assessment requires the use of a suitable weather file which accounts for varying sky conditions and sun positions throughout the year and takes into account the orientation of the space

Equivalent daylight factor targets to achieve a target illuminance over at least half of the daylight hours in a year are based on the formula: Target daylight factor (DT)= target illuminance/Ev,d,med x 100 [%].
Where, Ev,d,med is the median diffuse horizontal illuminance from the sky (as recommended for Dublin, Ireland).

The daylight factor (D) addresses daylight provision as a ratio of unobstructed external illuminance under overcast sky conditions. The daylight factor is defined as D =Ei/Eo x 100[%], where,
Ei=illuminance due to daylight at a point on the indoors working plane.
Eo= 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 21st	Acceptable sunlight reception parameters
Sunlight reception	Minimum sunlight reception in amenity spaces	At least 50% of the total area to receive at least 2 hours sunshine

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

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

4.5 Existing buildings

Impact on daylight provision:

Daylight provision to surrounding existing buildings

The impact of the proposed development on the existing buildings with respect to daylight can 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.

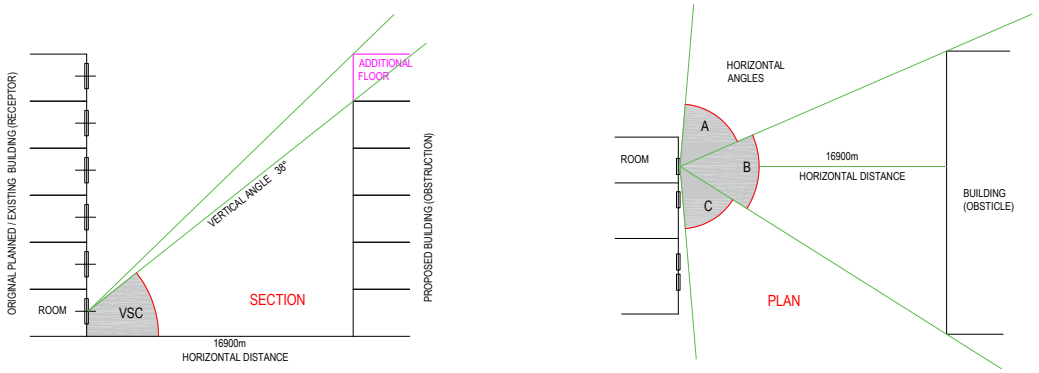


Image 4.1:

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 21st	Acceptable sunlight reception parameters
Sunlight reception	Minimum sunlight reception in amenity spaces	At least 80% or 0.8 x its former sunlight reception.

Table 4.9: Sunlight in existing amenity areas.

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

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

4.6 Summary of analysis

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

Element	Guidelines	
Performance of proposed development		
Daylight	Daylight – IS EN 17037 / BS EN 17307	To achieve the daylight provision outlined in IS / BS EN 17037:2018 a given room is recommended to achieve: Using method 1: • 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. Or using method 2: • A target illuminance of 300 lux must be achieved on over 50% of the floor area for over 50% of the available daylight hours. • A target illuminance of 100 lux must be achieved on over 95% of the floor area for over 50% of the available daylight hours.
	Daylight - National annex BS EN 17037	To achieve the alternate minimum daylight provision outlined in the national annex of BS EN 17037:2018, the room is recommended to achieve: • Kitchens, 1.3% target daylight factor or 200 lux over 50% of the floor area for over half the daylight hours. • Living rooms, 1.0% target daylight factor or 150 lux over 50% of the floor area for over half the daylight hours. • Bedrooms, 0.7% target daylight factor or 100 lux 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:

5.1 Receptor selection – Rooms within the proposed development

The daylight reception assessment has been targeted to all habitable rooms within the proposed development on the ground floor and a selected number of habitable rooms on the first floor. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms. Receptors / rooms within the proposed development are indicated in image 5.1 – 5.3 below.

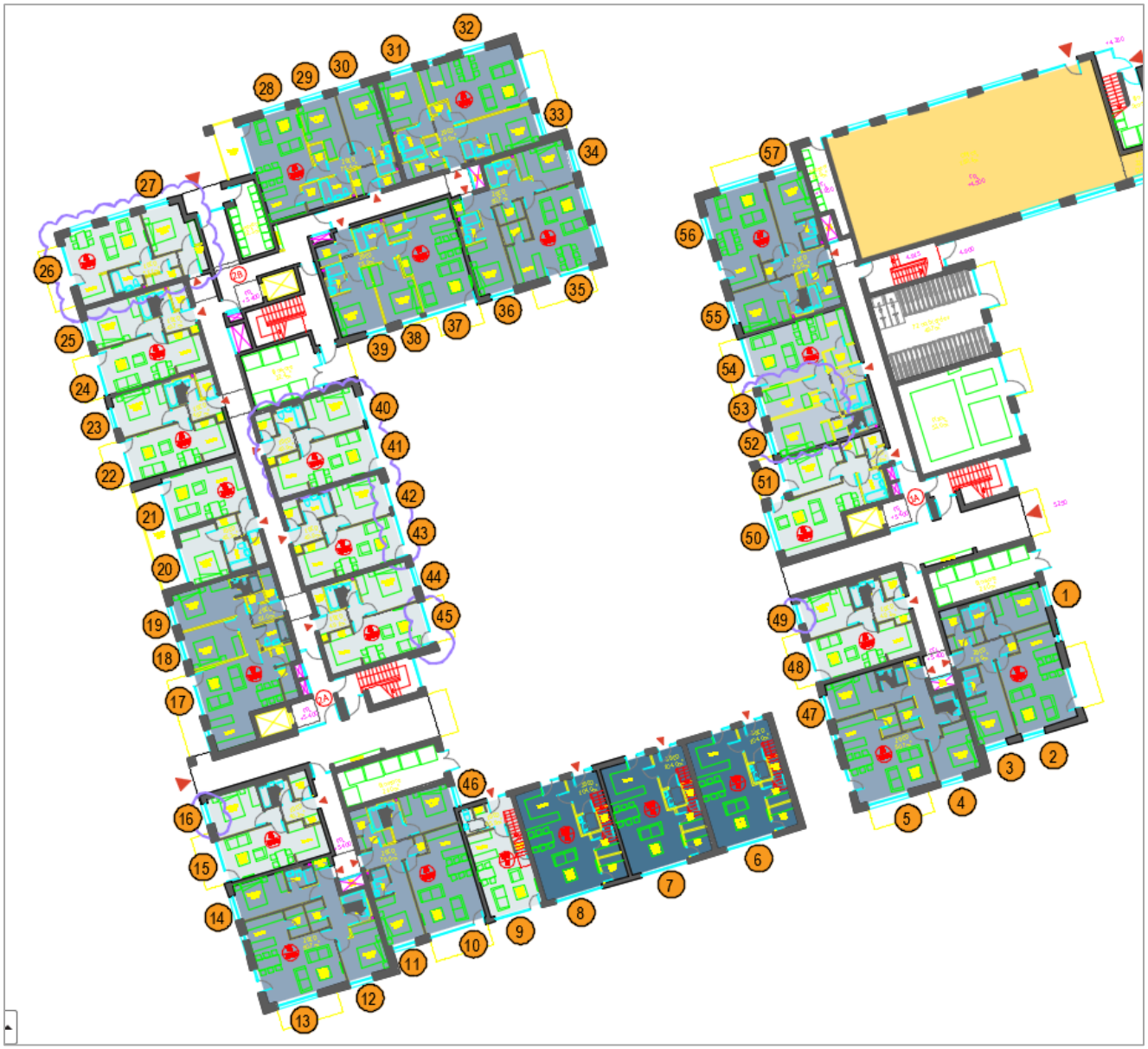


Image 5.1: Level 00 (ground floor). Receptor no. 1 to 57.

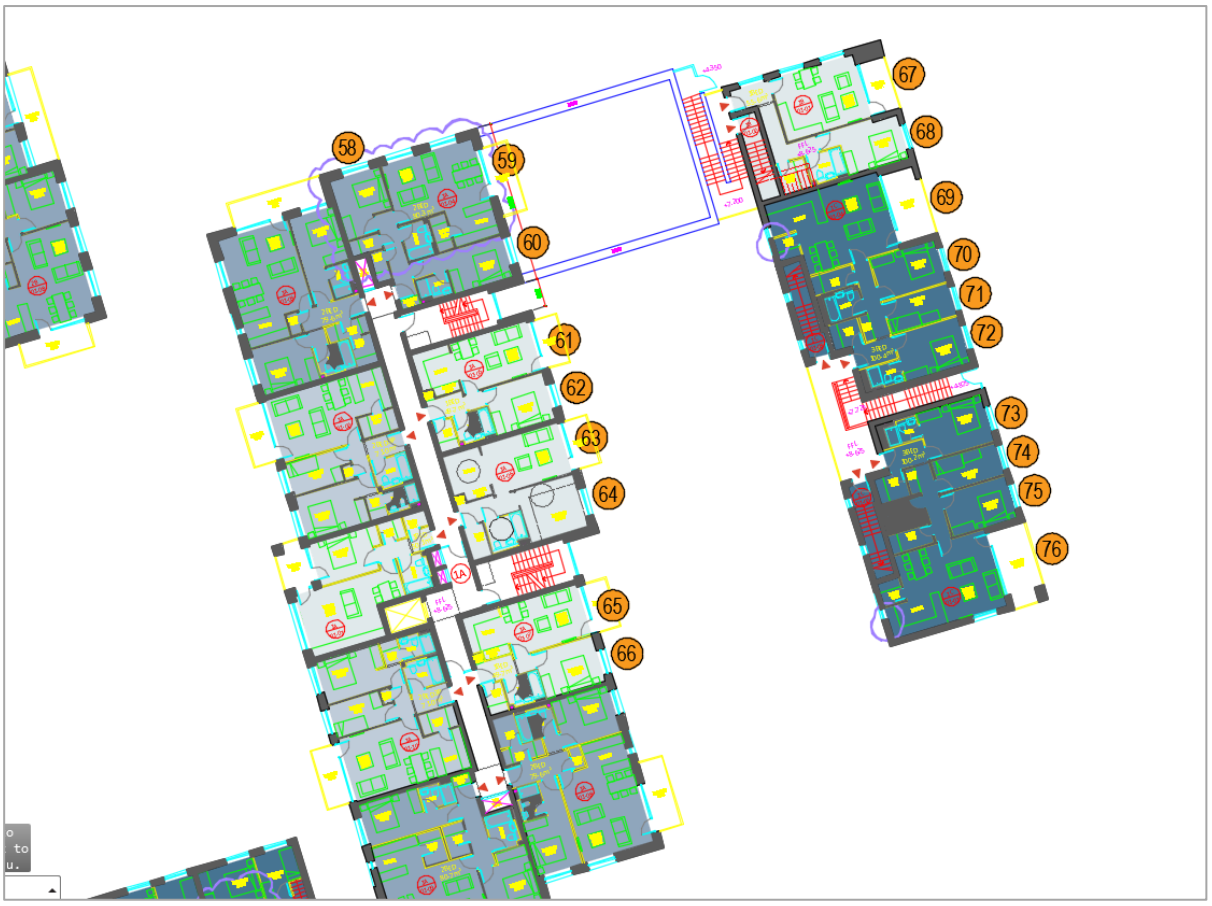


Image 5.2: Level 01 (first floor). Receptor no. 58 to 76. (rooms above the commercial units on the ground floor).

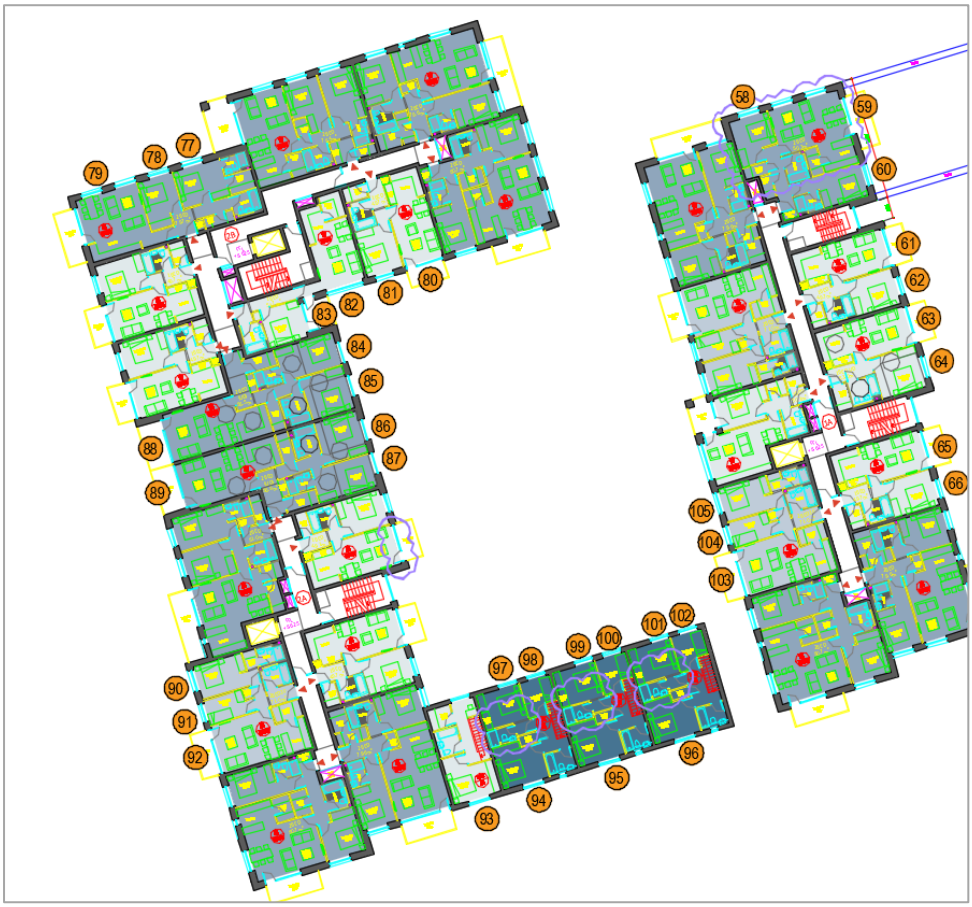


Image 5.3: Level 01 (first floor). Receptor no. 77 to 105. (units that have a different configuration than the ground floor).

5.2 Calculation result table

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

Compliance hierarchy

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

Receptor	Level/Floor	Block /Unit ID	Room / type	glass area	room area	glass ratio	Dept/Width	∑ VSC (total)	ISEN17037 DAY LIGHT FACTOR 50% area 50% sun hrs		95% area 50% sun hrs		ISEN17037 ILLUMINANCE 50% area 50% sun hrs		95% area 50% sun hrs		BSEN17037 - ANNEX illuminance		day light factor	
										min		min		min		min		min		min
				m2	m2	%			%	%	%	%	lx	lx	lx	lx	lx	lx	%	%
1	00		Bed room	3.22	11.5	28.1	1.95	31%	2.88	2.00	1.01	0.70	436	300	144	100	641	100	4.30	0.7
2	00		Living-Kitchen	11.27	29.6	38.1	1.36	32%	5.23	2.00	1.83	0.70	790	300	261	100	1162	200	7.80	1.3
3	00		Bed room	3.91	9.4	41.8	1.84	25%	3.22	2.00	1.13	0.70	486	300	160	100	715	100	4.80	0.7
4	00		Bed room	3.91	7.3	53.9	3.38	30%	4.56	2.00	1.59	0.70	689	300	227	100	1013	100	6.80	0.7
5	00		Living-Kitchen	7.59	29.4	25.8	1.90	20%	2.14	2.00	0.75	0.70	324	300	107	100	477	200	3.20	1.3
6	00		Living-Kitchen	11.96	34.4	34.7	2.49	26%	3.95	2.00	1.38	0.70	598	300	197	100	879	200	5.90	1.3
7	00		Living-Kitchen	8.55	34.0	25.1	1.00	24%	2.68	2.00	0.94	0.70	405	300	134	100	596	200	4.00	1.3
8	00		Living-Kitchen	8.55	34.0	25.1	1.00	24%	2.68	2.00	0.94	0.70	405	300	134	100	596	200	4.00	1.3
9	00		Living-Kitchen	5.98	24.8	24.1	1.30	24%	2.41	2.00	0.84	0.70	365	300	120	100	536	200	3.60	1.3
10	00		Living-Kitchen	9.20	30.4	30.3	1.29	30%	3.89	2.00	1.36	0.70	588	300	194	100	864	200	5.80	1.3
11	00		Bed room	3.91	10.4	37.5	1.94	24%	2.88	2.00	1.01	0.70	436	300	144	100	641	100	4.30	0.7
12	00		Bed room	3.91	10.6	37.0	2.32	30%	3.62	2.00	1.27	0.70	547	300	181	100	805	100	5.40	0.7
13	00		Living-Kitchen	11.50	30.6	37.6	1.83	30%	4.96	2.00	1.73	0.70	750	300	247	100	1103	200	7.40	1.3
14	00		Bed room	3.91	10.3	38.1	1.78	33%	4.02	2.00	1.41	0.70	608	300	201	100	894	100	6.00	0.7
15	00		Living-Kitchen	4.60	23.7	19.4	0.99	33%	2.55	2.00	0.89	0.70	385	300	127	100	566	200	3.80	1.3
16	00		Bed room	2.99	11.1	26.9	1.92	33%	2.95	2.00	1.03	0.70	446	300	147	100	656	100	4.40	0.7
17	00		Living-Kitchen	7.59	30.1	25.2	1.18	29%	3.15	2.00	1.10	0.70	476	300	157	100	700	200	4.70	1.3
18	00		Bed room	3.22	8.4	38.3	1.48	31%	3.48	2.00	1.22	0.70	527	300	174	100	775	100	5.20	0.7
19	00		Bed room	3.22	11.5	28.0	1.68	31%	2.88	2.00	1.01	0.70	436	300	144	100	641	100	4.30	0.7
20	00		Living-Kitchen	8.05	30.0	26.9	0.96	24%	2.61	2.00	0.91	0.70	395	300	130	100	581	200	3.90	1.3
21	00		Living-Kitchen	8.05	30.0	26.9	0.96	24%	2.61	2.00	0.91	0.70	395	300	130	100	581	200	3.90	1.3
22	00		Living-Kitchen	6.90	23.7	29.1	0.99	33%	3.75	2.00	1.31	0.70	567	300	187	100	834	200	5.60	1.3
23	00		Bed room	3.22	14.0	23.0	1.91	33%	2.68	2.00	0.94	0.70	405	300	134	100	596	100	4.00	0.7
24	00		Living-Kitchen	6.90	23.7	29.1	0.99	33%	3.75	2.00	1.31	0.70	567	300	187	100	834	200	5.60	1.3
25	00		Bed room	3.22	14.0	23.0	1.91	33%	2.68	2.00	0.94	0.70	405	300	134	100	596	100	4.00	0.7
26	00		Living-Kitchen	12.42	24.0	51.8	2.33	27%	5.63	2.00	1.97	0.70	851	300	281	100	1252	200	8.40	1.3
27	00		Bed room	3.91	9.2	42.3	2.08	28%	3.62	2.00	1.27	0.70	547	300	181	100	805	100	5.40	0.7
28	00		Living-Kitchen	11.27	29.8	37.8	1.16	31%	4.96	2.00	1.73	0.70	750	300	247	100	1103	200	7.40	1.3
29	00		Bed room	3.91	10.7	36.4	1.89	31%	3.69	2.00	1.29	0.70	557	300	184	100	820	100	5.50	0.7
30	00		Bed room	3.91	12.8	30.6	1.59	31%	3.22	2.00	1.13	0.70	486	300	160	100	715	100	4.80	0.7
31	00		Bed room	3.91	11.1	35.2	1.92	31%	3.62	2.00	1.27	0.70	547	300	181	100	805	100	5.40	0.7
32	00		Living-Kitchen	11.50	30.2	38.0	2.34	31%	5.03	2.00	1.76	0.70	760	300	251	100	1118	200	7.50	1.3
33	00		Bed room	3.91	10.2	38.5	2.00	24%	2.88	2.00	1.01	0.70	436	300	144	100	641	100	4.30	0.7
34	00		Bed room	3.91	10.2	38.2	2.40	25%	2.95	2.00	1.03	0.70	446	300	147	100	656	100	4.40	0.7
35	00		Living-Kitchen	14.72	30.9	47.7	1.93	21%	4.36	2.00	1.52	0.70	659	300	217	100	969	200	6.50	1.3
36	00		Bed room	3.91	10.5	37.1	1.73	21%	2.48	2.00	0.87	0.70	375	300	124	100	551	100	3.70	0.7
37	00		Living-Kitchen	8.05	30.1	26.7	1.18	21%	2.41	2.00	0.84	0.70	365	300	120	100	536	200	3.60	1.3
38	00		Bed room	3.22	10.4	31.1	1.86	21%	2.08	2.00	0.73	0.70	314	300	104	100	462	100	3.10	0.7
39	00		Bed room	3.22	10.2	31.6	2.51	20%	2.01	2.00	0.70	0.70	304	300	100	100	447	100	3.00	0.7
40	00		Bed room	3.91	11.7	33.4	1.82	20%	2.21	2.00	0.77	0.70	334	300	110	100	492	100	3.30	0.7
41	00		Living-Kitchen	5.29	23.1	22.9	1.06	22%	2.01	2.00	0.70	0.70	304	300	100	100	447	200	3.00	1.3
42	00		Bed room	3.91	11.7	33.4	1.82	24%	2.61	2.00	0.91	0.70	395	300	130	100	581	100	3.90	0.7
43	00		Living-Kitchen	5.29	23.1	22.9	1.06	24%	2.14	2.00	0.75	0.70	324	300	107	100	477	200	3.20	1.3
44	00		Bed room	3.91	11.7	33.4	1.82	24%	2.61	2.00	0.91	0.70	395	300	130	100	581	100	3.90	0.7

45	00		Living-Kitchen	5.29	23.1	22.9	1.06	24%	2.14	2.00	0.75	0.70	324	300	107	100	477	200	3.20	1.3
46	00		Bed room	3.22	10.2	31.6	2.09	20%	2.01	2.00	0.70	0.70	304	300	100	100	447	100	3.00	0.7
47	00		Bed room	3.91	10.3	38.1	1.78	22%	2.61	2.00	0.91	0.70	395	300	130	100	581	100	3.90	0.7
48	00		Living-Kitchen	6.90	23.4	29.4	1.05	19%	2.21	2.00	0.77	0.70	334	300	110	100	492	200	3.30	1.3
49	00		Bed room	3.22	12.1	26.6	1.85	25%	2.28	2.00	0.80	0.70	344	300	114	100	507	100	3.40	0.7
50	00		Living-Kitchen	6.90	24.2	28.5	1.38	27%	3.08	2.00	1.08	0.70	466	300	154	100	685	200	4.60	1.3
51	00		Bed room	4.60	10.6	43.2	1.81	16%	2.21	2.00	0.77	0.70	334	300	110	100	492	100	3.30	0.7
52	00		Bed room	3.22	11.5	28.0	1.68	22%	2.01	2.00	0.70	0.70	304	300	100	100	447	100	3.00	0.7
53	00		Bed room	3.22	8.0	40.3	1.44	23%	2.61	2.00	0.91	0.70	395	300	130	100	581	100	3.90	0.7
54	00		Living-Kitchen	8.05	28.3	28.5	1.18	25%	2.95	2.00	1.03	0.70	446	300	147	100	656	200	4.40	1.3
55	00		Bed room	3.91	11.1	35.2	1.92	24%	2.75	2.00	0.96	0.70	415	300	137	100	611	100	4.10	0.7
56	00		Living-Kitchen	11.50	29.7	38.7	2.13	21%	3.48	2.00	1.22	0.70	527	300	174	100	775	200	5.20	1.3
57	00		Bed room	3.91	10.2	38.5	2.00	21%	2.55	2.00	0.89	0.70	385	300	127	100	566	100	3.80	0.7
58	01		Bed room	3.91	9.9	39.5	2.48	33%	4.15	2.00	1.45	0.70	628	300	207	100	924	100	6.20	0.7
59	01		Living-Kitchen	14.72	30.5	48.2	1.63	30%	6.37	2.00	2.23	0.70	963	300	318	100	1416	200	9.50	1.3
60	01		Bed room	3.91	10.5	37.1	1.73	29%	3.48	2.00	1.22	0.70	527	300	174	100	775	100	5.20	0.7
61	01		Living-Kitchen	6.90	23.1	29.9	1.06	29%	3.42	2.00	1.20	0.70	517	300	171	100	760	200	5.10	1.3
62	01		Bed room	3.22	11.7	27.5	1.82	29%	2.68	2.00	0.94	0.70	405	300	134	100	596	100	4.00	0.7
63	01		Living-Kitchen	6.90	23.1	29.9	1.06	29%	3.42	2.00	1.20	0.70	517	300	171	100	760	200	5.10	1.3
64	01		Bed room	3.91	12.5	31.2	1.95	29%	3.15	2.00	1.10	0.70	476	300	157	100	700	100	4.70	0.7
65	01		Living-Kitchen	6.90	23.1	29.9	1.06	29%	3.42	2.00	1.20	0.70	517	300	171	100	760	200	5.10	1.3
66	01		Bed room	3.22	11.7	27.5	1.82	29%	2.68	2.00	0.94	0.70	405	300	134	100	596	100	4.00	0.7
67	01		Living-Kitchen	11.84	23.1	51.3	1.49	27%	5.63	2.00	1.97	0.70	851	300	281	100	1252	200	8.40	1.3
68	01		Bed room	3.22	11.2	28.8	1.72	33%	3.08	2.00	1.08	0.70	466	300	154	100	685	100	4.60	0.7
69	01		Living-Kitchen	8.40	34.8	24.1	1.23	20%	2.14	2.00	0.75	0.70	324	300	107	100	477	200	3.20	1.3
70	01		Bed room	3.22	11.8	27.4	1.64	33%	2.95	2.00	1.03	0.70	446	300	147	100	656	100	4.40	0.7
71	01		Bed room	3.22	8.8	36.5	1.41	33%	3.48	2.00	1.22	0.70	527	300	174	100	775	100	5.20	0.7
72	01		Bed room	3.22	13.0	24.7	1.72	33%	2.75	2.00	0.96	0.70	415	300	137	100	611	100	4.10	0.7
73	01		Bed room	3.22	13.0	24.7	1.72	33%	2.75	2.00	0.96	0.70	415	300	137	100	611	100	4.10	0.7
74	01		Bed room	3.22	8.8	36.5	1.41	33%	3.48	2.00	1.22	0.70	527	300	174	100	775	100	5.20	0.7
75	01		Bed room	3.22	11.8	27.4	1.64	33%	2.95	2.00	1.03	0.70	446	300	147	100	656	100	4.40	0.7
76	01		Living-Kitchen	11.62	34.5	33.7	1.27	20%	3.02	2.00	1.05	0.70	456	300	150	100	671	200	4.50	1.3
77	01		Bed room	3.91	12.8	30.5	2.52	29%	3.02	2.00	1.05	0.70	456	300	150	100	671	100	4.50	0.7
78	01		Bed room	3.91	10.5	37.2	2.03	29%	3.48	2.00	1.22	0.70	527	300	174	100	775	100	5.20	0.7
79	01		Living-Kitchen	11.42	28.1	40.7	1.69	29%	4.96	2.00	1.73	0.70	750	300	247	100	1103	200	7.40	1.3
80	01		Living-Kitchen	5.70	23.1	24.7	1.06	23%	2.14	2.00	0.75	0.70	324	300	107	100	477	200	3.20	1.3
81	01		Bed room	3.22	11.4	28.2	1.87	22%	2.08	2.00	0.73	0.70	314	300	104	100	462	100	3.10	0.7
82	01		Living-Kitchen	5.70	21.4	26.6	1.19	21%	2.14	2.00	0.75	0.70	324	300	107	100	477	200	3.20	1.3
83	01		Bed room	4.60	11.2	41.1	2.09	15%	2.01	2.00	0.70	0.70	304	300	100	100	447	100	3.00	0.7
84	01		Bed room	3.91	14.0	27.9	1.37	22%	2.14	2.00	0.75	0.70	324	300	107	100	477	100	3.20	0.7
85	01		Bed room	3.91	13.0	30.2	2.14	23%	2.41	2.00	0.84	0.70	365	300	120	100	536	100	3.60	0.7
86	01		Bed room	3.91	13.0	30.2	2.14	25%	2.55	2.00	0.89	0.70	385	300	127	100	566	100	3.80	0.7
87	01		Bed room	3.91	14.0	27.9	1.37	25%	2.35	2.00	0.82	0.70	355	300	117	100	522	100	3.50	0.7
88	01		Living-Kitchen	8.05	32.0	25.2	1.01	25%	2.68	2.00	0.94	0.70	405	300	134	100	596	200	4.00	1.3
89	01		Living-Kitchen	8.05	32.0	25.2	1.01	25%	2.68	2.00	0.94	0.70	405	300	134	100	596	200	4.00	1.3
90	01		Bed room	3.91	9.8	39.9	1.96	32%	4.02	2.00	1.41	0.70	608	300	201	100	894	100	6.00	0.7
91	01		Bed room	3.22	6.9	46.5	1.79	32%	4.15	2.00	1.45	0.70	628	300	207	100	924	100	6.20	0.7
92	01		Living-Kitchen	6.90	28.0	24.6	1.15	32%	3.28	2.00	1.15	0.70	496	300	164	100	730	200	4.90	1.3
93	01		Bed room	3.91	14.0	27.9	2.30	26%	2.55	2.00	0.89	0.70	385	300	127	100	566	100	3.80	0.7
94	01		Bed room	3.91	13.0	30.2	2.14	26%	2.68	2.00	0.94	0.70	405	300	134	100	596	100	4.00	0.7
95	01		Bed room	3.91	13.0	30.2	2.14	26%	2.68	2.00	0.94	0.70	405	300	134	100	596	100	4.00	0.7
96	01		Bed room	3.91	13.0	30.2	2.14	26%	2.68	2.00	0.94	0.70	405	300	134	100	596	100	4.00	0.7
97	01		Bed room	3.22	11.2	28.9	2.49	25%	2.35	2.00	0.82	0.70	355	300	117	100	522	100	3.50	0.7
98	01		Bed room	3.22	7.3	44.2	2.37	25%	3.15	2.00	1.10	0.70	476	300	157	100	700	100	4.70	0.7
99	01		Bed room	3.22	11.2	28.9	2.49	26%	2.41	2.00	0.84	0.70	365	300	120	100	536	100	3.60	0.7
100	01		Bed room	3.22	7.3	44.2	2.37	26%	3.22	2.00	1.13	0.70	486	300	160	100	715	100	4.80	0.7
101	01		Bed room	3.22	11.2	28.9	2.49	25%	2.35	2.00	0.82	0.70	355	300	117	100	522	100	3.50	0.7
102	01		Bed room	3.22	7.3	44.2	2.37	25%	3.08	2.00	1.08	0.70	466	300	154	100	685	100	4.60	0.7
103	01		Living-Kitchen	6.90	27.9	24.7	1.20	21%	2.21	2.00	0.77	0.70	334	300	110	100	492	200	3.30	1.3
104	01		Bed room	3.22	6.9	46.5	1.79	21%	2.68	2.00	0.94	0.70	405	300	134	100	596	100	4.00	0.7
105	01		Bed room	3.22	9.8	32.9	1.96	21%	2.14	2.00	0.75	0.70	324	300	107	100	477	100	3.20	0.7

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

5.3 Daylight reception of proposed development conclusion

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

- Assessed in accordance with IS EN17037 / BS EN17307, carried out in accordance with Method 1 and Method 2 described in the methodology section.
- Assessed in accordance with BS EN 17037:2018 National Annex.
- The results from table 5.1 are reviewed under each standard below. The daylight reception assessment has been targeted to all habitable rooms within the proposed development on the ground floor and a number of habitable rooms on the first floor. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms.

IS EN17037 / BS EN17307:

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

- Level 00: Residential rooms achieved an average daylight factor (DF) of 3.1% and an illuminance of 465 lux on over 50% of the floor area for over 50% of the available daylight hours. An average DF of 1.1% and an illuminance of 153 lux on over 95% of the floor area for over 50% of the available daylight hours was achieved.
- Level 01: Residential rooms achieved an average daylight factor (DF) of 3.0% and an illuminance of 457 lux on over 50% of the floor area for over 50% of the available daylight hours. An average DF of 1.1% and an illuminance of 151 lux on over 95% of the floor area for over 50% of the available daylight hours was achieved.
- All units above the examined and compliant rooms are further deemed compliant as the proposed rooms are similar in parameters and they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor typically 0.3%-0.5% per floor level.
- Overall compliance for proposed development = 100%.

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

BS EN 17037:2018 National Annex:

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

- Overall compliance for proposed development = 100%

In summary, the calculation results have achieved full compliance under IS EN17037 / BS EN17307 and full compliance under 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 high 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 5.4 below indicates the open space amenity areas that have been selected and analysed on the basis that the shadow casted from the proposed 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 5.4: New proposed amenity spaces within the development.

Receptor	Amenity Description	Amenity area (m²)
A	Public open space	1,444.9
B	Communal open space	789.7

Table 5.3: 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

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

Amenity space ID ref	Amenity space area (m²)	Achieved daily sun time * area	Achieved total sun time (hrs)	Required sun hours @ 50% area	Achieved sun hours on @ 50% area
A	1444.9	439538.6	5.07	2.0	6.0
B	789.7	176734.9	3.73	2.0	4.0

Table 5.4: Calculation results: Summary table of sunlight analysis of proposed amenity space communal.

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 in table 5.4 we note the selected amenity spaces all achieved sunlight above the recommended guidelines or minimum recommendations, see image 5.4 for receptor/amenity space location. Summary of results are as follows:

- The public open space amenity area calculated sunlight on at least 50% of the area on March 21st is 6.0 hours.
- The communal open space amenity area calculated sunlight on at least 50% of the area on March 21st is 4.0 hours.

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

6 Impact of proposed development – Calculation results and conclusion

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

Impact on Daylight Reception:

Vertical sky component (VSC):

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



Image 6.1: Daylight impact: Neighbouring receptors – Overall view (receptor no. 1 - 16).

Receptor/window *	Level	Location / Address	Dwelling description
1, 2, 3, 4, 5, 6, 7, 8, 9	00	Tramway close, carrigaline road, Douglas, Co. Cork	Residential
10, 11	00	East grove, carrigaline road, Douglas, Co. Cork	Residential
12, 13	00	River view, Douglas east, Douglas, Co. Cork	Residential
14, 15, 16	00	The bungalow, church street, Douglas, Co. Cork	Residential

Table 6.1: List of receptors selected for analysis.

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

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

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

6.2 Calculation result table

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

Compliance guide

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

Receptor ID	Existing baseline VSC value [%]	Proposed VSC value [%]	Change factor	Comment / Effect of proposed development
Receptor 1	36%	32%	0.90	Negligible
Receptor 2	36%	32%	0.90	Negligible
Receptor 3	36%	32%	0.90	Negligible
Receptor 4	36%	32%	0.90	Negligible
Receptor 5	36%	32%	0.89	Negligible
Receptor 6	36%	31%	0.88	Negligible
Receptor 7	36%	31%	0.87	Negligible
Receptor 8	36%	31%	0.86	Negligible
Receptor 9	36%	31%	0.86	Negligible
Receptor 10	34%	29%	0.87	Negligible
Receptor 11	35%	30%	0.86	Negligible
Receptor 12	35%	32%	0.91	Negligible
Receptor 13	36%	32%	0.90	Negligible
Receptor 14	36%	31%	0.86	Negligible
Receptor 15	36%	31%	0.85	Negligible
Receptor 16	36%	30%	0.83	Negligible

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

6.3 Impact on daylight reception conclusion

The BRE recommends that the effects of a new development on daylight reception should not impact any existing VSC by more than 20% or have a maximum change factor in excess of 0.80. From the calculation results we note all selected neighbouring habitable receptors are affected to some degree with regards to daylight reception due to the introduction of the proposed development in their respective habitable rooms facing the proposed development. The calculated change in daylight reception in all of the neighbouring receptors/windows achieved a change factor ranging from 0.83 to 0.91. 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):

- North east / East receptors: Receptor no. 1 to 13: Dwellings located on the Old Carrigaline road with ground floor windows were examined and resulted in a change factor range of 0.86 to 0.91. These receptors are comfortably within the guidelines and the effect is determined as negligible under BRE definitions.
- North west receptors: Receptor no. 14 to 16: The private dwelling with ground floor windows were examined and resulted in a change factor range of 0.83 to 0.86. These receptors are within the guidelines and the effect is determined as negligible under BRE definitions.
- Overall, the average change ratio for VSC is 0.88.

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



Image 6.2: Sunlight impact: Existing neighbouring amenity spaces.

Receptor	Location / Address	Amenity description	Approx. area (m^2)
1	Churchyard lane, graveyard, Douglas, Cork	Graveyard	7,000
2	The bungalow, church street, Douglas, Co. Cork	Private garden amenity area	1,400
3	River view, Douglas east, Douglas, Co. Cork	Private front amenity area	30
4	East grove, carrigaline road, Douglas, Co. Cork	Private garden amenity area	1,000

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
x	10%	In excess of

Amenity space ID	Amenity space area (m²)	EXISTING STATUS			NEW STATUS			Change factor	Comment / effect of proposed development
		sun hours * amenity space area (Sun Hr*m²)	total sun hours (Sun Hr)	sun hours on 50% of the area	sun hours * amenity space area (Sun Hr*m²)	total sun hours (Sun Hr)	sun hours on 50% of the area		
1	7,000	4519200	10.76	10.0	4174800	9.94	10.0	0.93	Negligible
2	1,400	609000	7.25	9.0	534240	6.36	7.0	0.88	Negligible
3	30	15606	8.67	11.0	13698	7.61	9.0	0.88	Negligible
4	1,000	459000	7.65	9.0	388800	6.48	8.0	0.85	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 and 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 receptor: Receptor no. 1, Douglas graveyard resulted in a change factor of 0.93. The change happens in the early morning hours of 07.00-10.00. The calculation findings are comfortably within guidelines, and the effect is determined as negligible under BRE definitions.
- North receptor: Receptor no. 2, a private garden resulted in a change factor of 0.88. The change happens in the morning hours of 07.00-13.00. The calculation findings are well within guidelines, and the effect is determined as negligible under BRE definitions.
- East receptors: These spaces are private amenity garden/front yard to houses on the Old Carrigaline road. Receptor no. 3 and 4 resulted in a change factor of 0.88 & 0.85. The change happens in the late afternoon hours of 15.00-18.00. The calculation findings are within guidelines, and the effect is determined as negligible under BRE definitions.

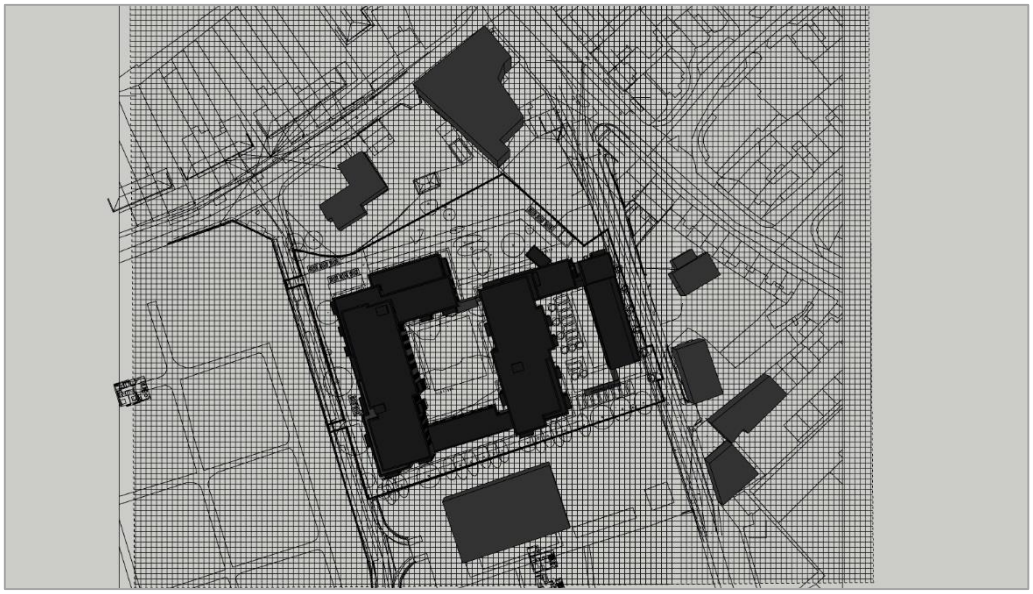
We conclude that the new proposed development's effect on sunlight reception in the neighbouring amenity areas are all within the constraints and minimum recommendations of the BRE Report – Site Layout and Planning for Daylight and Sunlight BR209 2022, and we therefore deem the proposed development to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

Appendix A

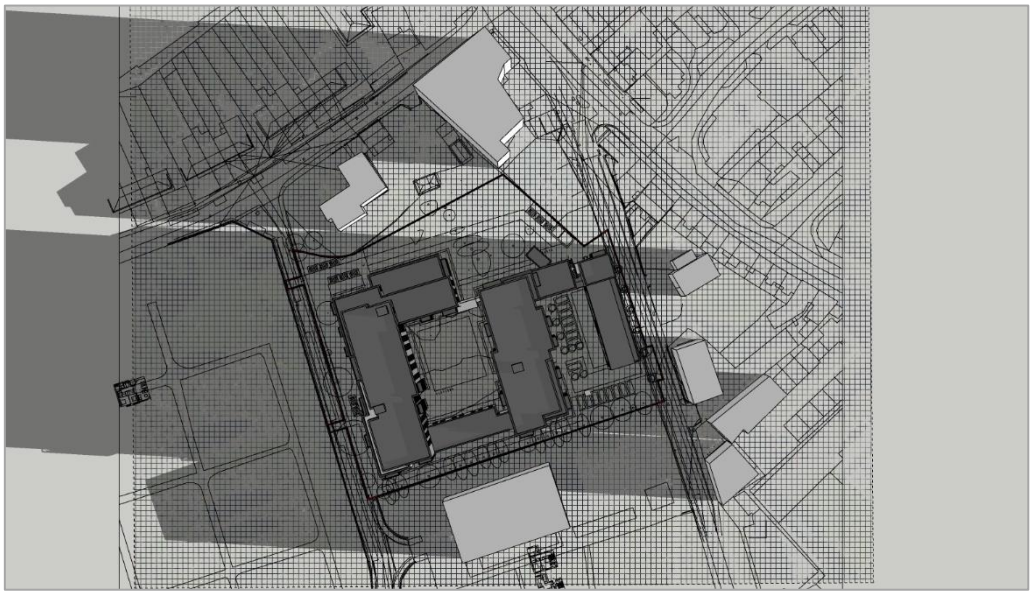
Sunlight analysis illustrations: plotted in one hourly illustration time frames for March 21st (Spring equinox).

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

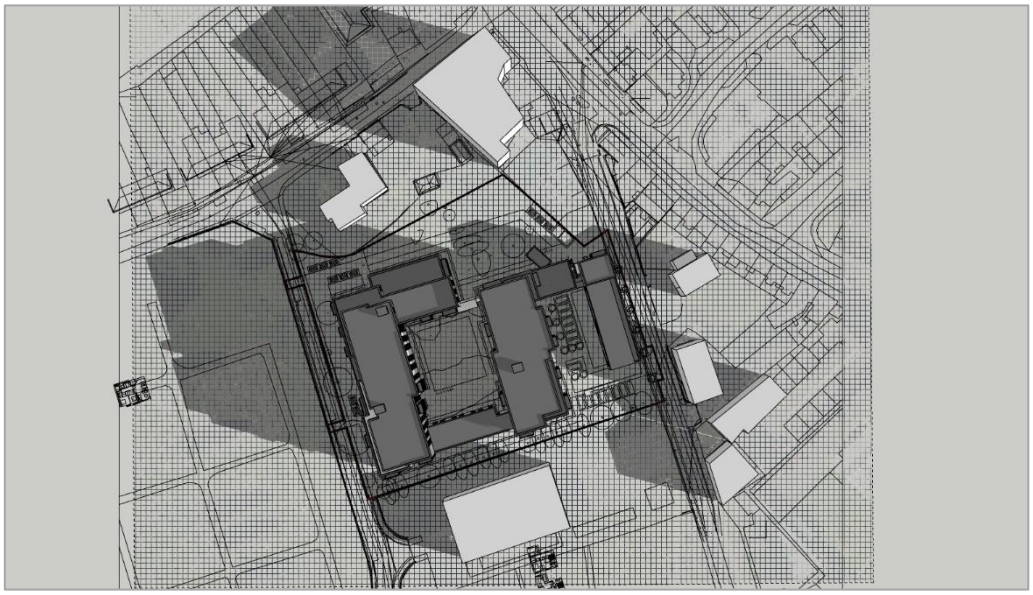
06.00 March 21st



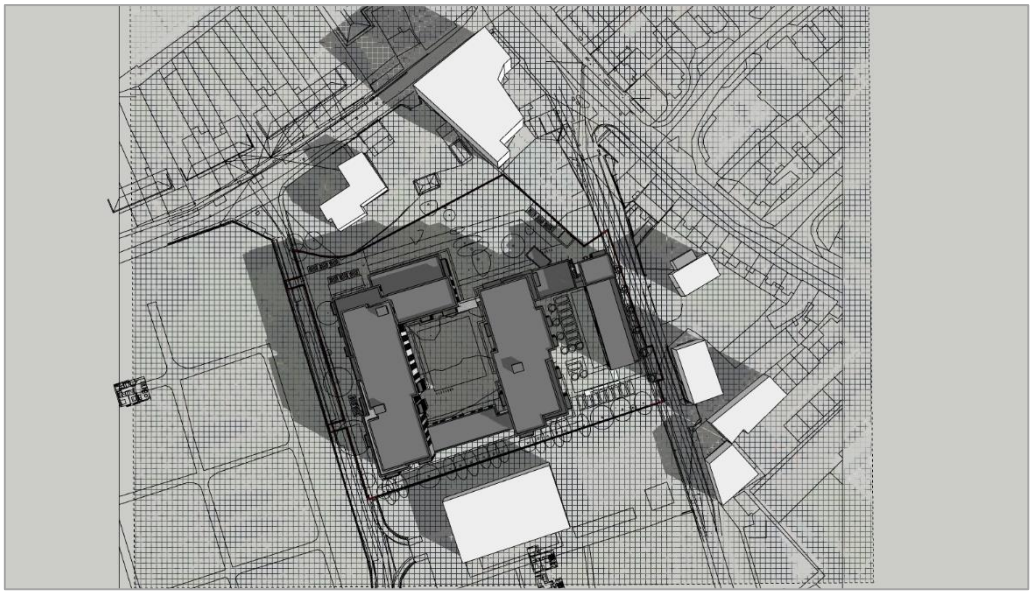
07.00 March 21st



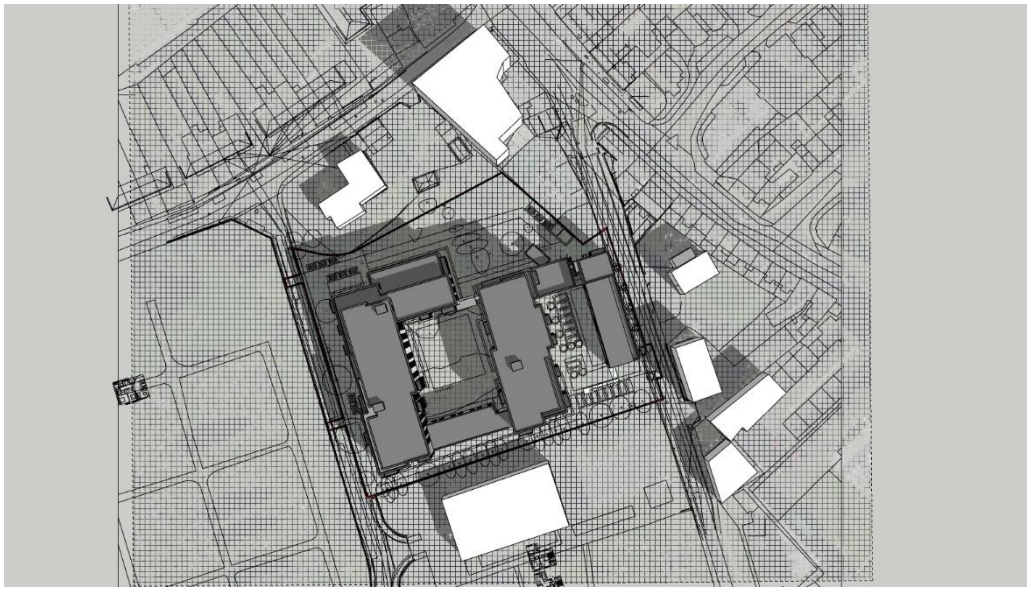
08.00 March 21st



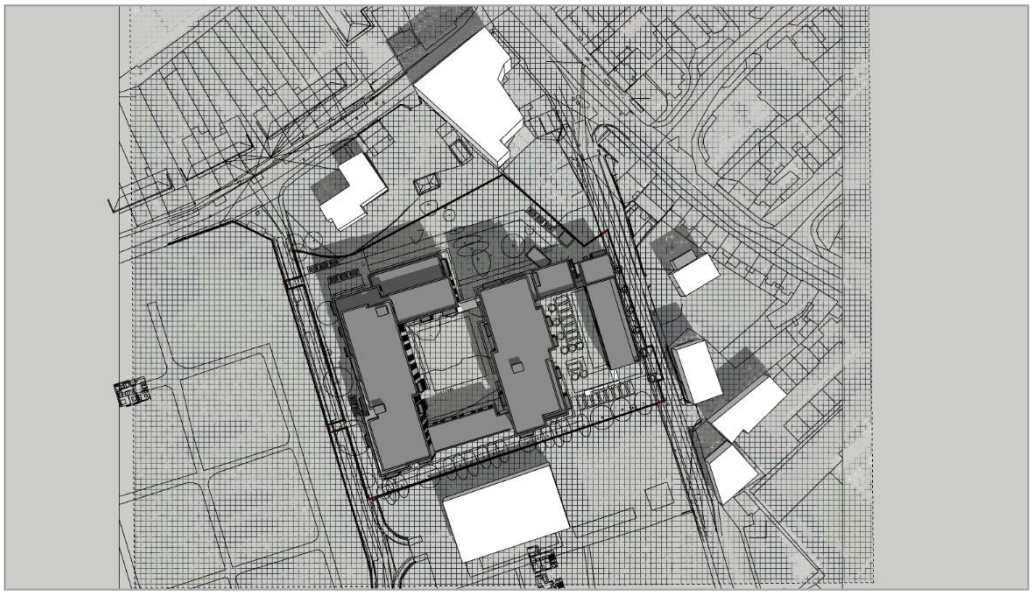
09.00 March 21st



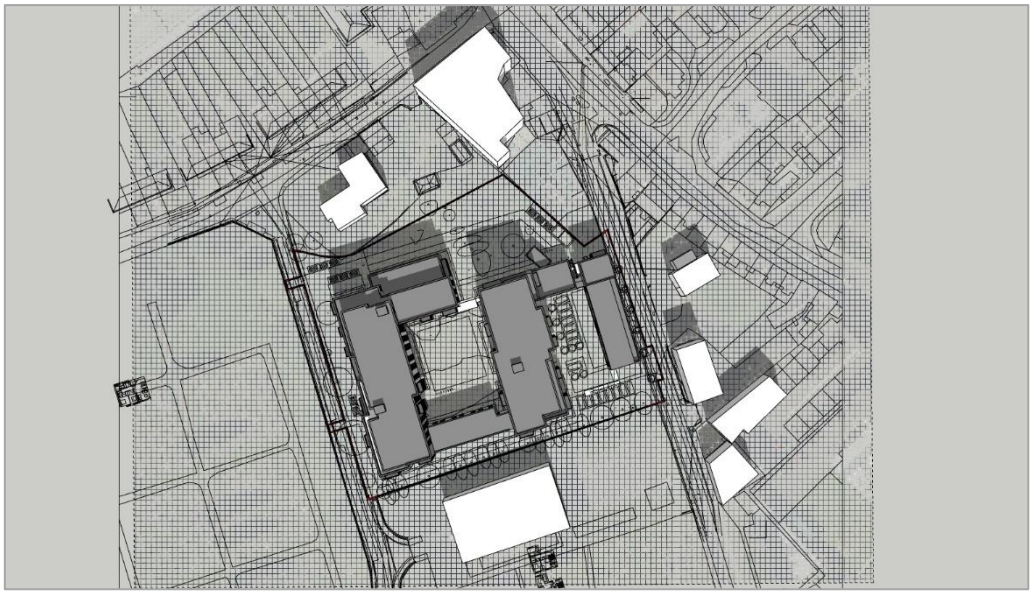
10.00 March 21st



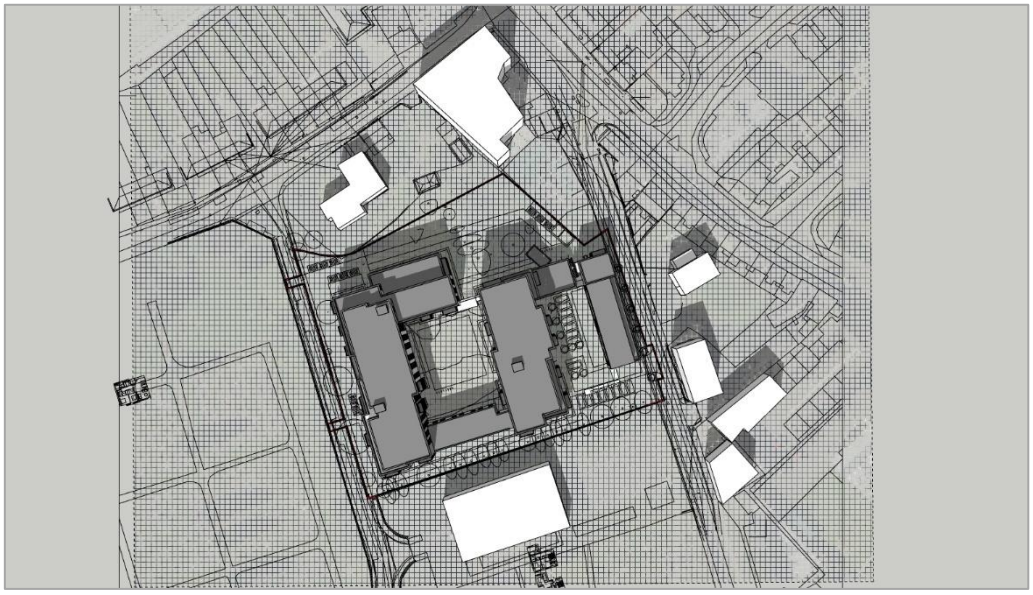
11.00 March 21st



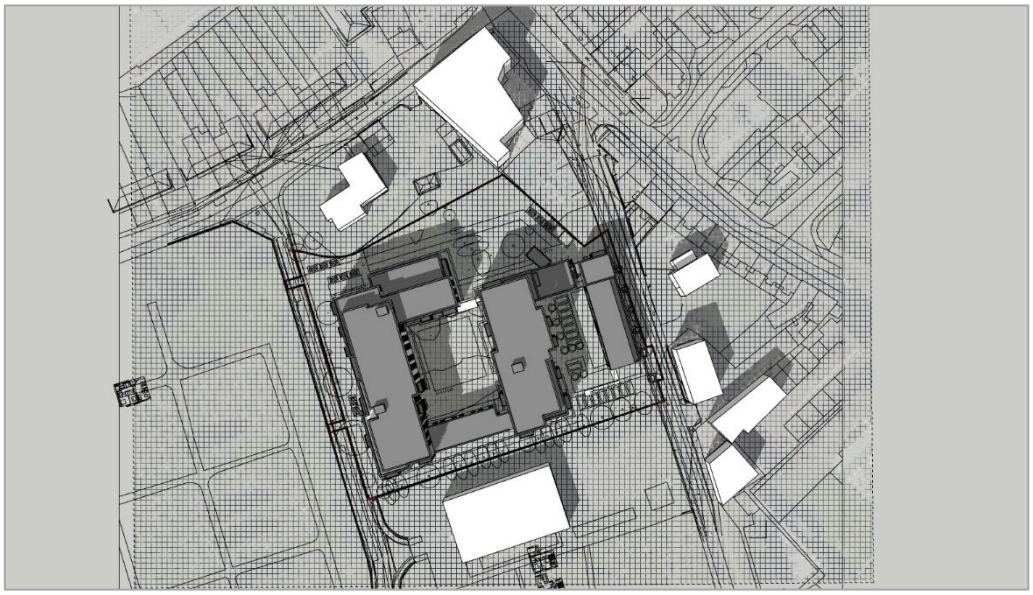
12.00 March 21st



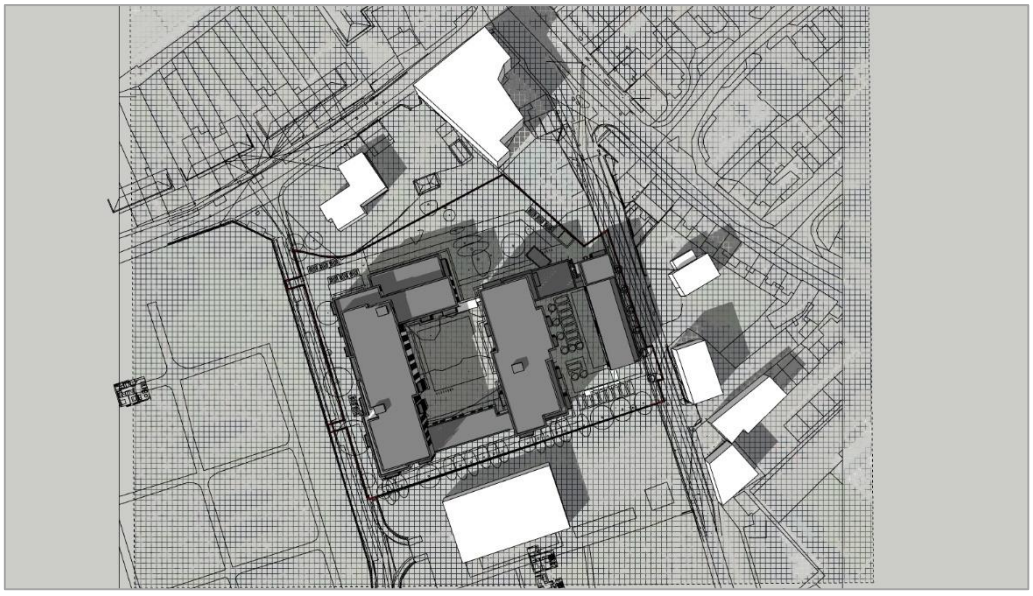
13.00 March 21st



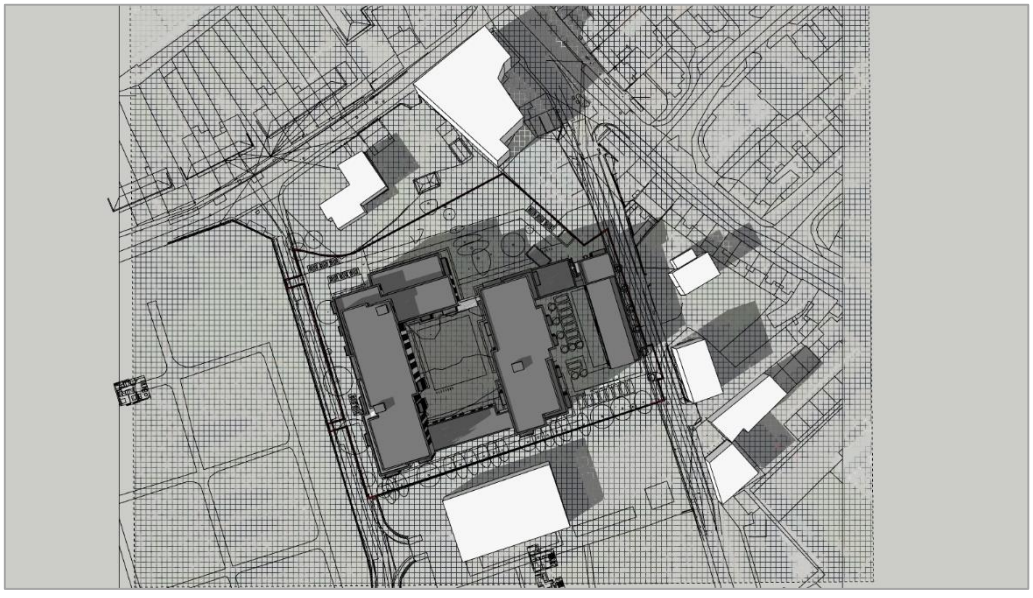
14.00 March 21st



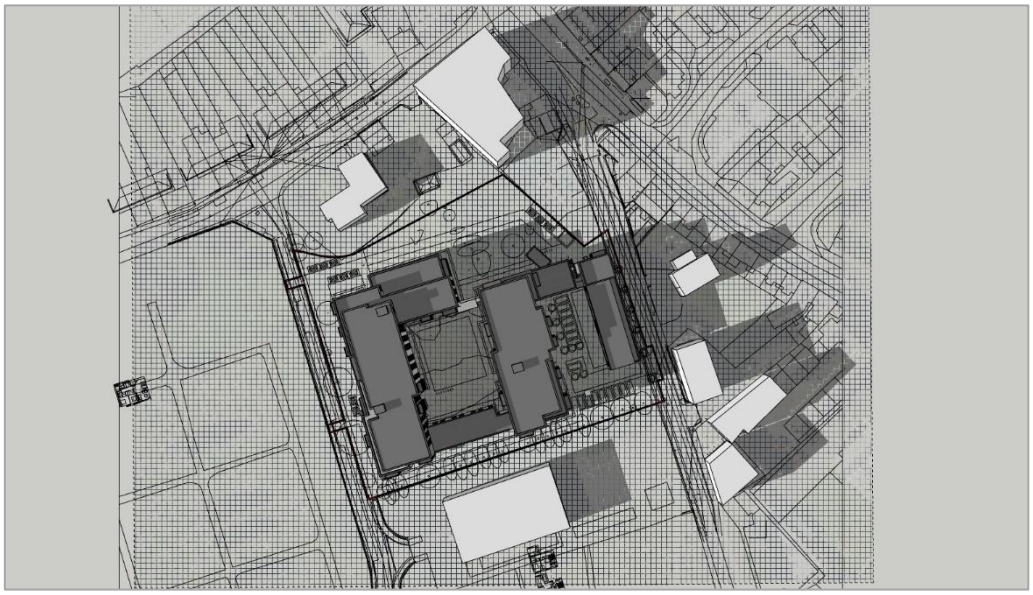
15.00 March 21st



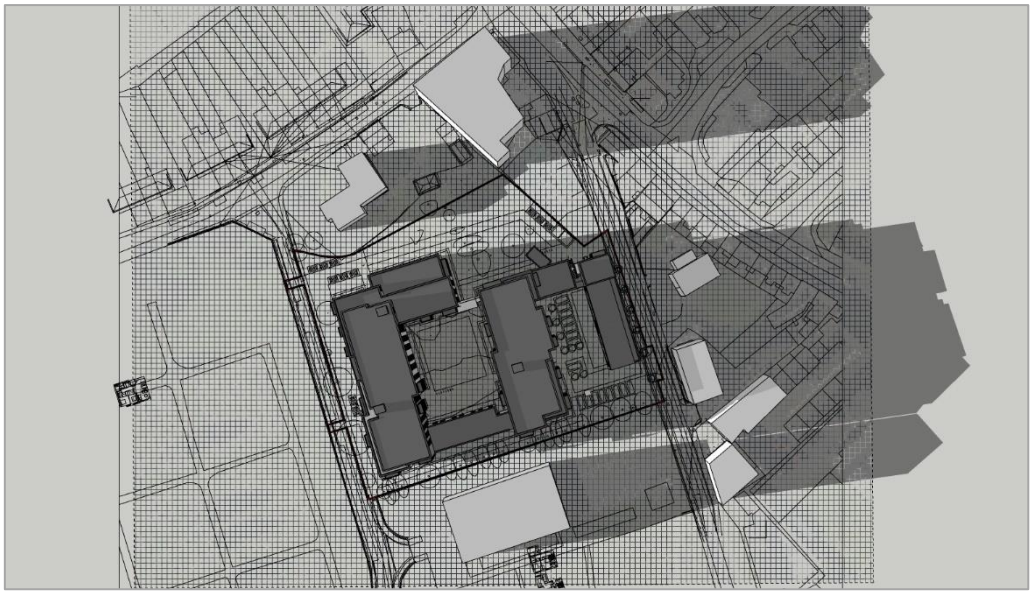
16.00 March 21st



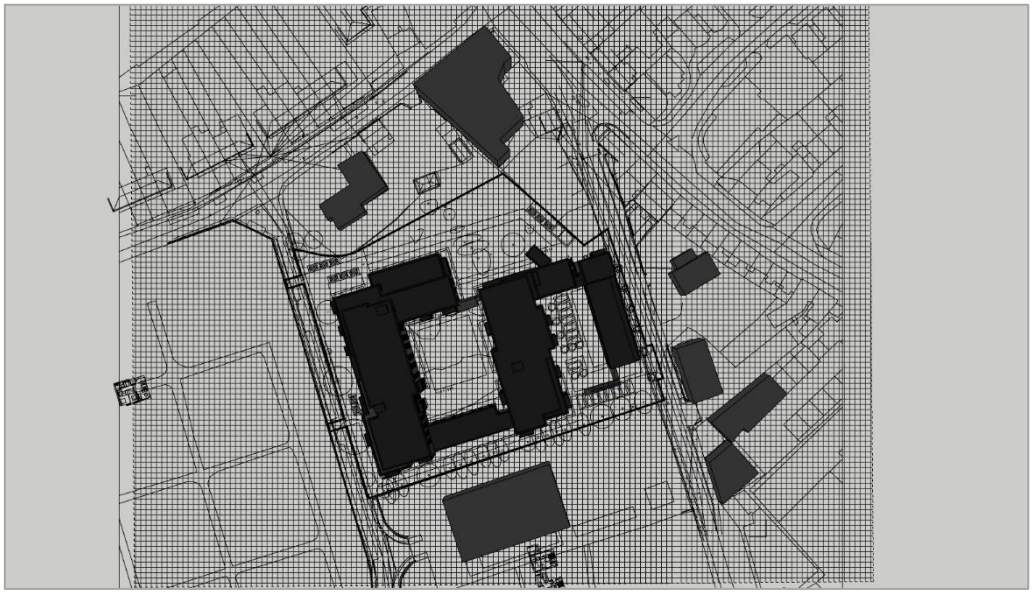
17.00 March 21st



18.00 March 21st



19.00 March 21st



Appendix B

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

A					1444.90 m2
NEW STATUS					March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	100%	0%	60	0	0
8.00	73%	27%	60	390	23,407
9.00	70%	30%	60	433	26,008
10.00	63%	37%	60	535	32,077
11.00	51%	49%	60	708	42,480
12.00	47%	53%	60	766	45,948
13.00	47%	53%	60	766	45,948
14.00	43%	57%	60	824	49,416
15.00	43%	57%	60	824	49,416
16.00	46%	54%	60	780	46,815
17.00	49%	51%	60	737	44,214
18.00	61%	39%	60	564	33,811
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)					5.07
Achieved daily sun time * area					439539

B					789.70 m2
NEW STATUS					March 21st
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	100%	0%	60	0	0
8.00	100%	0%	60	0	0
9.00	100%	0%	60	0	0
10.00	59%	41%	60	324	19,427
11.00	11%	89%	60	703	42,170
12.00	0%	100%	60	790	47,382
13.00	15%	85%	60	671	40,275
14.00	48%	52%	60	411	24,639
15.00	94%	6%	60	47	2,843
16.00	100%	0%	60	0	0
17.00	100%	0%	60	0	0
18.00	100%	0%	60	0	0
19.00	100%	0%	60	0	0
Required sun hours @ 50% area					2
Achieved sun hours on @ 50% area					4.00
Achieved total sun time (hrs)					3.73
Achieved daily sun time * area					176735

Appendix C

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

1 — **7,000** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	52%	48%	60	3360	201,600	7.00	88%	12%	60	840	50,400	-151,200
8.00	15%	85%	60	5950	357,000	8.00	39%	61%	60	4270	256,200	-100,800
9.00	0%	100%	60	7000	420,000	9.00	22%	78%	60	5460	327,600	-92,400
10.00	0%	100%	60	7000	420,000	10.00	0%	100%	60	7000	420,000	0
11.00	0%	100%	60	7000	420,000	11.00	0%	100%	60	7000	420,000	0
12.00	0%	100%	60	7000	420,000	12.00	0%	100%	60	7000	420,000	0
13.00	0%	100%	60	7000	420,000	13.00	0%	100%	60	7000	420,000	0
14.00	0%	100%	60	7000	420,000	14.00	0%	100%	60	7000	420,000	0
15.00	0%	100%	60	7000	420,000	15.00	0%	100%	60	7000	420,000	0
16.00	0%	100%	60	7000	420,000	16.00	0%	100%	60	7000	420,000	0
17.00	0%	100%	60	7000	420,000	17.00	0%	100%	60	7000	420,000	0
18.00	57%	43%	60	3010	180,600	18.00	57%	43%	60	3010	180,600	0
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0
Required sun hours @ 50% area (hr)					2	Required sun hours @ 50% area (hr)					2	
Achieved sun hours on (hrs) @ 50% area					10.00	Achieved sun hours on (hrs) @ 50% area					10.00	
Achieved total sun time (hrs)					10.76	Achieved total sun time (hrs)					9.94	0.93
Achieved daily sun time * area					4519200	Achieved daily sun time * area					4174800	0.93

2 — **1,400** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	69%	31%	60	434	26,040	7.00	80%	20%	60	280	16,800	-9,240
8.00	36%	64%	60	896	53,760	8.00	58%	42%	60	588	35,280	-18,480
9.00	32%	68%	60	952	57,120	9.00	52%	48%	60	672	40,320	-16,800
10.00	30%	70%	60	980	58,800	10.00	45%	55%	60	770	46,200	-12,600
11.00	30%	70%	60	980	58,800	11.00	40%	60%	60	840	50,400	-8,400
12.00	30%	70%	60	980	58,800	12.00	39%	61%	60	854	51,240	-7,560
13.00	28%	72%	60	1008	60,480	13.00	30%	70%	60	980	58,800	-1,680
14.00	28%	72%	60	1008	60,480	14.00	28%	72%	60	1008	60,480	0
15.00	28%	72%	60	1008	60,480	15.00	28%	72%	60	1008	60,480	0
16.00	28%	72%	60	1008	60,480	16.00	28%	72%	60	1008	60,480	0
17.00	61%	39%	60	546	32,760	17.00	61%	39%	60	546	32,760	0
18.00	75%	25%	60	350	21,000	18.00	75%	25%	60	350	21,000	0
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0
Required sun hours @ 50% area (hr)					2	Required sun hours @ 50% area (hr)					2	
Achieved sun hours on (hrs) @ 50% area					9.00	Achieved sun hours on (hrs) @ 50% area					7.00	
Achieved total sun time (hrs)					7.25	Achieved total sun time (hrs)					6.36	0.88
Achieved daily sun time * area					609000	Achieved daily sun time * area					534240	0.88

3 — **30** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	100%	0%	60	0	0	7.00	100%	0%	60	0	0	0
8.00	39%	61%	60	18	1,098	8.00	39%	61%	60	18	1,098	0
9.00	29%	71%	60	21	1,278	9.00	29%	71%	60	21	1,278	0
10.00	18%	82%	60	25	1,476	10.00	18%	82%	60	25	1,476	0
11.00	18%	82%	60	25	1,476	11.00	18%	82%	60	25	1,476	0
12.00	18%	82%	60	25	1,476	12.00	18%	82%	60	25	1,476	0
13.00	18%	82%	60	25	1,476	13.00	18%	82%	60	25	1,476	0
14.00	18%	82%	60	25	1,476	14.00	18%	82%	60	25	1,476	0
15.00	10%	90%	60	27	1,620	15.00	66%	34%	60	10	612	-1,008
16.00	10%	90%	60	27	1,620	16.00	43%	57%	60	17	1,026	-594
17.00	10%	90%	60	27	1,620	17.00	20%	80%	60	24	1,440	-180
18.00	45%	55%	60	17	990	18.00	52%	48%	60	14	864	-126
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0
Required sun hours @ 50% area (hr)					2	Required sun hours @ 50% area (hr)					2	
Achieved sun hours on (hrs) @ 50% area					11.00	Achieved sun hours on (hrs) @ 50% area					9.00	
Achieved total sun time (hrs)					8.67	Achieved total sun time (hrs)					7.61	0.88
Achieved daily sun time * area					15606	Achieved daily sun time * area					13698	0.88

4 — **1,000** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	89%	11%	60	110	6,600	7.00	89%	11%	60	110	6,600	0
8.00	55%	45%	60	450	27,000	8.00	55%	45%	60	450	27,000	0
9.00	36%	64%	60	640	38,400	9.00	36%	64%	60	640	38,400	0
10.00	34%	66%	60	660	39,600	10.00	34%	66%	60	660	39,600	0
11.00	30%	70%	60	700	42,000	11.00	30%	70%	60	700	42,000	0
12.00	18%	82%	60	820	49,200	12.00	18%	82%	60	820	49,200	0
13.00	18%	82%	60	820	49,200	13.00	18%	82%	60	820	49,200	0
14.00	23%	77%	60	770	46,200	14.00	23%	77%	60	770	46,200	0
15.00	23%	77%	60	770	46,200	15.00	23%	77%	60	770	46,200	0
16.00	28%	72%	60	720	43,200	16.00	47%	53%	60	530	31,800	-11,400
17.00	28%	72%	60	720	43,200	17.00	79%	21%	60	210	12,600	-30,600
18.00	53%	47%	60	470	28,200	18.00	100%	0%	60	0	0	-28,200
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0
Required sun hours @ 50% area (hr)					2	Required sun hours @ 50% area (hr)					2	
Achieved sun hours on (hrs) @ 50% area					9.00	Achieved sun hours on (hrs) @ 50% area					8.00	
Achieved total sun time (hrs)					7.65	Achieved total sun time (hrs)					6.48	0.85
Achieved daily sun time * area					459000	Achieved daily sun time * area					388800	0.85

Appendix D

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

Receptor 1	EXISTING										NEW										
VSC test distance 33 m	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	
Target distance 22m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
	27	9	153	3					180	36%	27	9	68	3	42	19	43	22	180	32%	0.90

Receptor 2	EXISTING										NEW										
VSC test distance 33 m	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	
Target distance 21m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
	28	9	152	3					180	36%	28	9	69	3	40	19	43	22	180	32%	0.90

Receptor 3	EXISTING										NEW										
VSC test distance 33 m	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	
Target distance 20m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
	28	9	152	3					180	36%	28	9	77	3	37	20	38	25	180	32%	0.90

Receptor 4	EXISTING										NEW										
VSC test distance 33 m	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	
Target distance 17m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
	28	8	152	3					180	36%	28	8	75	3	33	20	44	25	180	32%	0.90

Receptor 5	EXISTING										NEW										
VSC test distance 33 m	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	
Target distance 15m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
	28	8	152	3					180	36%	28	8	74	3	32	20	46	31	180	32%	0.89

Receptor 6	EXISTING										NEW										
VSC test distance 33 m	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	
Target distance 14m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
	28	8	152	3					180	36%	28	8	72	3	28	20	52	31	180	31%	0.88

Receptor 7	EXISTING										NEW										
VSC test distance 33 m	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	
Target distance 14m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
	28	8	152	3					180	36%	28	8	72	3	21	20	59	34	180	31%	0.87

Receptor 8	EXISTING										NEW										
VSC test distance 33 m	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	
Target distance 13m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
	28	8	152	3					180	36%	28	8	70	3	19	20	63	34	180	31%	0.86

Receptor 9	EXISTING										NEW										
VSC test distance 33 m	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	
Target distance 13m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
	28	8	152	3					180	36%	28	8	69	3	17	20	66	34	180	31%	0.86

Receptor 10	EXISTING										NEW										
VSC test distance 33 m	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	
Target distance 19m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
	40	31	140	2					180	34%	40	31	50	2	90	25			180	29%	0.87

Receptor 11	EXISTING										NEW										
VSC test distance 33 m	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	
Target distance 18m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
	32	28	148	2					180	35%	32	28	57	2	91	25			180	30%	0.86

Receptor 12	EXISTING										NEW										
VSC test distance 33 m	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor ⊥	∑ VSC	
Target distance 18m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
	26	25	154	2					180	35%	26	25	77	2	77	22			180	32%	0.91

Receptor 13	EXISTING										NEW									
VSC test distance 33 m	Section 1		Section 2		Section 3		Section 4		∑ Hor ↓	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor ↓	∑ VSC	
Target distance 18m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
	23	23	157	2					180	36%	23	23	81	2	76	22			180	32%	0.90

Receptor 14	EXISTING										NEW									
VSC test distance 51 m	Section 1		Section 2		Section 3		Section 4		∑ Hor ↓	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor ↓	∑ VSC	
Target distance 25m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
	89	3	91	2					180	36%	76	30	21	9	83	3			180	31%	0.86

Receptor 15	EXISTING										NEW									
VSC test distance 51 m	Section 1		Section 2		Section 3		Section 4		∑ Hor ↓	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor ↓	∑ VSC	
Target distance 23m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
	89	3	91	2					180	36%	77	34	19	9	84	3			180	31%	0.85

Receptor 16	EXISTING										NEW									
VSC test distance 51 m	Section 1		Section 2		Section 3		Section 4		∑ Hor ↓	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor ↓	∑ VSC	
Target distance 19m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
	89	3	91	2					180	36%	81	37	16	9	83	3			180	30%	0.83

End of Report