

Large Scale Residential Development (LRD) at the site of the former DELL EMC premises, Innishmore, Ballincollig, Cork

Daylight & Sunlight Assessment

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BUILDING PERFORMANCE CONSULTING

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Glossary

Illuminance

A measure of the amount of light falling on a surface, usually measured in lux.

Target illuminance (E_T)

Illuminance from daylight that should be achieved for at least half of annual daylight hours across a specified fraction of the reference plane in a daylit space.

Minimum target illuminance (E_{TM})

Illuminance from daylight that should be achieved for at least half of annual daylight hours across 95% of the reference plane in spaces with vertical and/or inclined daylight apertures.

Daylight factor (D)

Ratio of total daylight illuminance at a reference point on the working plane within a space to outdoor illuminance on a horizontal plane due to an unobstructed CIE standard overcast sky. Thus a 1% DF would mean that the indoor illuminance at that point in the space would be one hundredth the outdoor unobstructed horizontal illuminance.

Daylight, natural light

Part of global solar radiation capable of causing a visual sensation. (CIE, 2020) (Combined skylight and sunlight.)

No sky line

The outline on the working plane of the area from which no sky can be seen.

Obstruction Angle

The angular altitude of the top of an obstruction above the horizontal, measured from a reference point in a vertical plane in a section perpendicular to the vertical plane.

Skylight

Part of *diffuse* sky radiation capable of causing a visual sensation. (CIE, 2020)

Sunlight

Part of direct solar radiation capable of causing a visual sensation. (CIE, 2020)

Winter Probable Sunlight Hours (WPSH)

The long-term average of the total number of hours between the 21st of September and the 21st of March in which direct sunlight reaches the unobstructed ground (when clouds are considered).

Vertical Sky Component (VSC)

Ratio of that part of illuminance, at a point on a given vertical plane, that is received directly from a sky of assumed or known luminance distribution (usually CIE standard overcast sky), to illuminance on a horizontal plane due to an unobstructed hemisphere of this sky. Usually the 'given vertical plane' is the outside of a window wall. The VSC does not include reflected light, either from the ground or from other buildings.

Reference plane or working plane

Horizontal, vertical or inclined plane in which a visual task lies. Normally the working plane may be taken to be horizontal, 0.85 m above the floor in houses and factories, 0.7 m above the floor in offices.

Spatial Daylight Autonomy (sDA)

Spatial Daylight Autonomy (sDA) is a metric describing annual sufficiency of ambient daylight levels in interior environments. It is defined as the percent of an analysis area that meets a minimum daylight illuminance level for a specified fraction of the operating/daylight hours per year. The sDA value is expressed as a percentage of area.

1 Executive Summary

This report provides information on the daylight and sunlight analysis undertaken for the proposed development at the site of the former DELL EMC premises, Innishmore, Ballincollig, Cork.

The analysis and assessments in this report have been carried in line with the recommendations of BRE's "Site Layout Planning for daylight and sunlight, a Guide to good practice" (BRE Building Technology Group, 2022) and BS EN 17037.

The BRE Guide provides useful recommendations to ensure adequate levels of daylight and sunlight in the proposed development. However, it has relevance to the impact of the proposed development on existing neighbouring dwellings also. The Guidelines make it clear that levels of daylight and sunlight cannot be expected to be as high in dense urban locations as would be the case in suburban or rural ones. It should be noted that whilst widely used, these are guidelines, and they do not have a statutory or mandatory basis.

There is no significant impact from the proposed development on surrounding buildings and therefore the proposed development will not affect:

- access to skylight to existing neighbouring buildings,
- access to sunlight to existing neighbouring buildings, and
- sunlight to gardens/open spaces to existing neighbouring buildings.

In terms of internal daylight levels within the proposed development, the results show that 86% of all rooms meet or exceed the BRE's minimum recommendations for internal daylight provision in dwellings. Therefore, we believe the proposed development performs at a high level for a scheme of this scale and aligns to national policy to ensure high quality sustainable development. Following pre-planning discussions with Cork City Council, the design team reviewed and implemented design changes to individual elements, which improved the overall outcome. Please refer to the documentation prepared by Meitheal Architects for further information.

In order to maximise available light, glazing to all habitable rooms is in excess of 20%. The design team have developed the proposed building using the principles of the BREs "Site Layout Planning for Daylight and Sunlight, A guide to good practice (2022)".

In terms of the amenity spaces provided the results show the open spaces that receive greater than 2 hours of sunlight on March 21st. The cumulative area of the spaces exceeds the recommended criteria for sunlight. It should be noted that the amenity area is in excess of the required area for such a scheme.

Overall, the development has been designed with due consideration for sunlight and daylight and meets the recommendations as set out in the BRE Guide – BR 209 "Site Layout Planning for Daylight and Sunlight, A guide to good practice (2022)."

2 Introduction

Site layout planning to achieve good daylighting and sun lighting, within buildings and in the open spaces around them is an important aspect in designing new buildings or developments. Daylight animates an interior and makes it attractive and interesting, as well as providing light to work or read by. Good daylight and sunlight can contribute to making a building energy-efficient; they can reduce the need for electric lighting, while winter solar gain can reduce heating requirements.

This report provides information on the daylight and sunlight analysis undertaken for the proposed development.

Castle Peak Properties Ltd intend to apply for planning permission for a Large-Scale Residential Development (LRD) at this c. 1.0 ha site of the former DELL EMC premises, Innishmore, Ballincollig, Cork.

The proposed development will consist of the demolition of the existing former 2 no. storey DELL EMC building (c. 3882 sq m) and ancillary plant area, with associated site clearance works. The proposed development will provide for the 130 no. residential units, arranged in 3 no. blocks in a development ranging in height from 3 to 6 no. storeys.

The development will comprise a mix of 108 no. apartments (total apartment blocks area - c. 10,657 sqm), arranged in 2 no. blocks, providing a unit mix of 52 no. 1-bed and 56 no. 2-bed apartment units. In addition, the proposed development will provide 22 no. duplex units (total duplex block area - c. 2,159 sqm), arranged in 1 no. block, providing a unit mix of 4 no. 1-bed, 9 no. 2-bed, and 9 no. 3 beds.

Vehicular, cyclist and pedestrian access to the proposed development will be via 2 no. entrances from Innishmore Lawn (to the north east) and Mechterstadt Road (to the south west) and the development will include for pedestrian and cyclist permeability. Additionally, pedestrian access points are provided to the west of the subject site and to the south, off Mechterstadt Road.

The development will also include the provision of private, communal and public open space (including all balconies); car parking at ground floor level and undercroft; bicycle parking; internal roads and pathways; bin stores; hard and soft landscaping; boundary treatments; the provision of new surface water and foul drainage pipes and any associated pipe diversion works; retaining walls; changes in level; services provision and related ducting, piping and cabling; electric vehicle charging points; attenuation tanks; SUDS; signage; 1 no. ESB substation; wayfinding structures; public realm works including public lighting; and all site development and excavation works above and below ground. The application contains a statement setting out how the proposal will be consistent with the objectives of the Cork City Development Plan 2022-2028.

The analysis and assessments in this report have been carried in line with the recommendations of BRE's "Site Layout Planning for daylight and sunlight, a Guide to good practice" (BRE Building Technology Group, 2022) and BS EN 17037. The aforementioned BRE guide is also known as BRE Guide BR 209 and may be referenced as such or simply as the "BRE Guide" hereafter in this document.

This report will assess the proposed development's impact on daylight and sunlight to the existing buildings by the following means:

- Obstruction Angle Check (25-degree Line test)
- Vertical Sky Component (VSC)
- Sunlight to Gardens/Open Spaces

The report also assesses access to sunlight for the proposed development by means of sunlight to gardens/open spaces

Additionally, Appendix B provides shadow images for the proposed development.

3 Site Description

3.1 Location & Context

The site located to the north of Mechterstadt road.

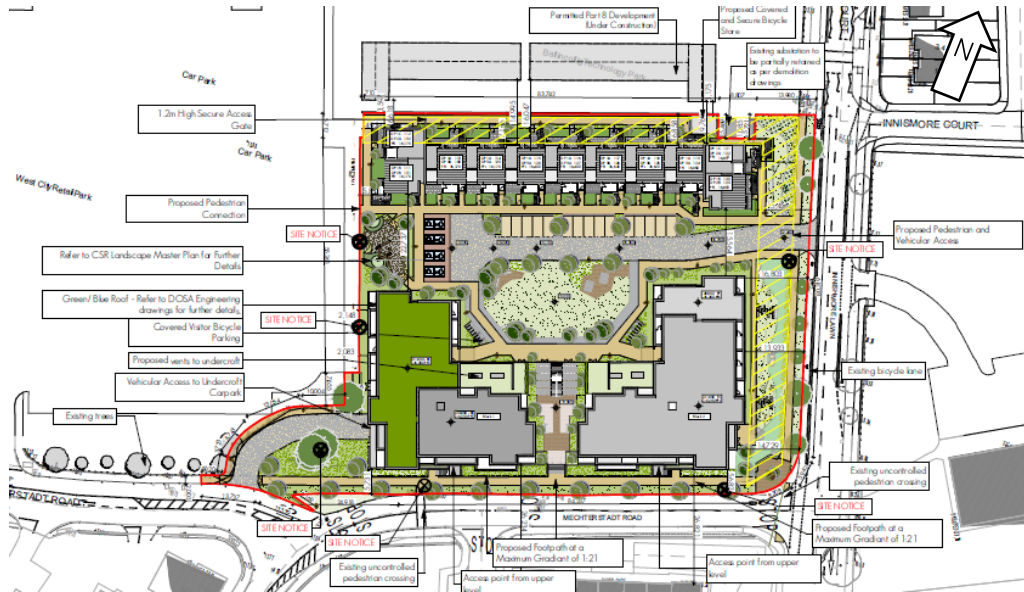


Figure 1: Site Plan of Proposed Site (source: Meitheal Architects drawing ref: 231064-MA-ZZ-00-DR-A-1004-P07 Proposed Site Layout Plan)



Figure 2: Aerial View of Site (Courtesy Google Maps) [Site boundary is only indicative. Refer to architectural drawings for accurate site boundary details.]

3.2 Proposed Development

The following images provide details of the proposed apartment and duplex blocks within the development.



Figure 3: Block-A Section D_D & C_C Elevation (source: Meitheal Architects elevational drawings)

Figure 4: Block-A Section D_D & C_C Elevation (source: Meitheal Architects elevational drawings)



Figure 5: Block-A Section D_D & C_C Elevation (source: Meitheal Architects elevational drawings)

3.3 Sensitive 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 these criteria are considered to be 'sensitive receptors'. Paragraph 2.2.2 of 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.

Sensitive receptors that may be affected by the proposed development are highlighted in Table 1 below.

Table 1: Sensitive Receptors

Sensitive Receptors Image/Map	Legend
 (Background Image/Map credit: https://www.eircode.ie/)	— Site Boundary ● Potential Sensitive Receptors
	Notes: 1. Properties highlighted in blue will not definitely be impacted by the proposed development. This is just an initial indication of properties that will be assessed.

4 Methodology & Assessment Criteria

The analyses and assessments are based on the guidelines set out in the BRE guide (BR 209) "Site Layout Planning for Daylight and Sunlight, A Guide to Good Practice" (BRE Building Technology Group, 2022). This guide is intended to be used in conjunction with interior lighting recommendations in BS EN 17037 Daylight in buildings, and in the CIBSE publication LG 10 Daylighting – a guide for designers.

It should also be noted that although the BRE guide gives numerical guidelines, *"these should be interpreted flexibly since natural lighting is only one of many factors in site layout design."* (BRE Building Technology Group, 2022)

Advanced lighting simulation software is used to perform the analysis. The software combines 3D modelling capabilities with a suite of programs which employ advanced raytracing. The software fully meets all relevant guidelines set out in the BRE Guide BR209. The software has the ability to perform annual simulations based on hourly climatic data. This type of simulation is used for the assessment of internal daylight provision in new buildings (discussed in section 4.2.)

Throughout this report an effort will be made to differentiate between metrics used to assess skylight only, sunlight only or a combination of both - daylight. As defined in the glossary of the BRE Guide, "Daylight" is an umbrella term that includes both skylight and sunlight—the diffuse and direct components of light from the sky respectively. Unfortunately, the terms daylight and skylight are often used interchangeably but this report will aim to specify when daylight specifically refers to skylight or when it also encompasses sunlight.

The following sub-sections outline the methodology and assessment criteria used.

4.1 Existing Buildings

The impact of the proposed development on the existing buildings (sensitive receptors only) with respect to daylight is assessed using the following methodologies. The

methodologies are grouped into sub-sections based on whether they are "Light from the sky" analysis or "Sun lighting" analysis.

4.1.1 Light from the Sky

4.1.1.1 Obstruction Angle Check

The BRE guide states that:

"Loss of light to existing windows need not be analysed if the distance of each part of the proposed development from the existing window is three or more times its height above the centre of the existing window. In these cases, the loss of light will be small." (BRE Building Technology Group, 2022)

Therefore, in Figure , if the distance s_1 was at least 3 times greater than h_1 , loss of light to the existing windows would not need to be analysed.

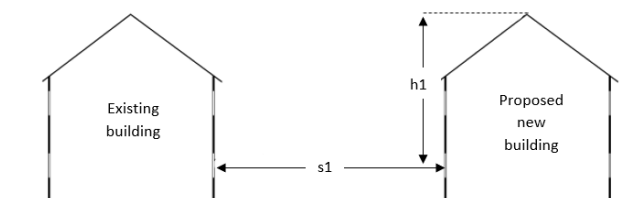


Figure 6: Spacing-to-Height Ratio

If the development is taller or closer than this, then the obstruction angle of the new development can be checked, where the obstruction angle is the angle subtended by the new development at the level of the centre of the lowest window in the existing building.

"If this angle is less than 25° for the whole of the development then it is unlikely to have a substantial effect on the diffuse skylight enjoyed by the existing building." (BRE Building Technology Group, 2022)

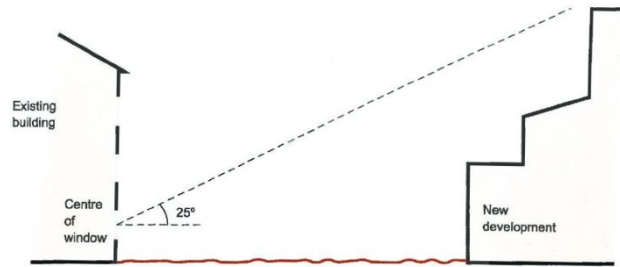


Figure 7: Obstruction Angle Check (25 Degree Line Test)

The obstruction angle is measured from the 3D CAD model. This check is suitable for existing windows where the proposed development is directly opposite an existing window, i.e. proposed development is cut by a vertical section drawn perpendicular to the window.

If, for any part of the new development, this angle is more than 25°, a more detailed check is needed to find the loss of skylight to the existing building. This may also be required in cases where the existing windows are not opposite the proposed development.

4.1.1.2 Vertical Sky Component (VSC)

Any reduction in the total amount of skylight for the existing properties can be calculated by finding the VSC at the centre of each main window. The Vertical Sky Component (VSC) is the ratio of the direct sky illuminance at the vertical reference point, to the simultaneous illuminance on an unobstructed horizontal plane. Reflected light is not included.

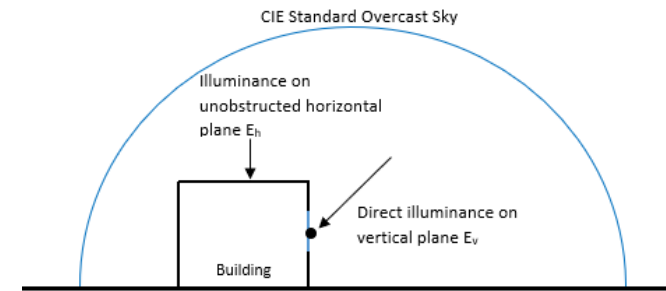


Figure 8: Vertical Sky Component

In the case of a floor-to-ceiling window such as a patio door, a point 1.6 m above ground (or balcony level for an upper storey) on the centre line of the window is used. The reference point is in the external plane of the window wall. Windows to bathrooms, toilets, storerooms, circulation areas and garages are not analysed.

Note that because the CIE standard overcast sky model is used, VSC is independent of orientation and location. (It is a *skylight* metric.)

The diffuse daylighting of any existing building may be adversely affected if:

"the VSC measured at the centre of an existing main window [or 1.6m above bottom of glazed door] is less than 27%, and less than 0.8 times its former value." (BRE Building Technology Group, 2022)

4.1.1.3 No Skyline

While VSC provides an indication of skylight availability, it does provide any information on the distribution of light within a space. In addition to external obstructions, the distribution of daylight within a space is dependent on window sizes and positioning, and room layouts. The no skyline divides points on the working plane which can and cannot see the sky.

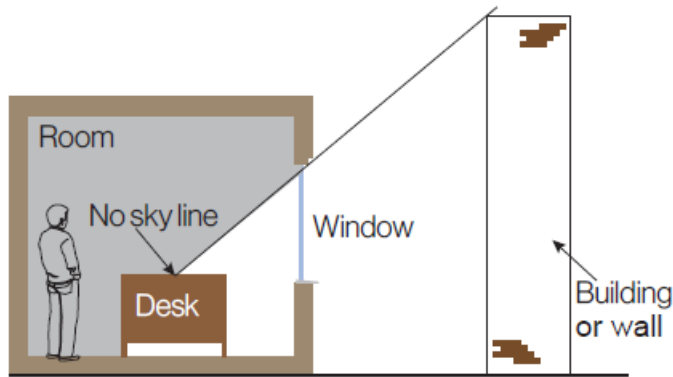


Figure 9: No Skyline [courtesy (BRE Building Technology Group, 2022)]

Areas beyond the no skyline, since they receive no direct daylight, usually look dark and gloomy compared with the rest of the room.

Where room layouts are known, the impact on the daylighting distribution in the existing building should be found by plotting the no sky line in each of the main rooms.

The diffuse daylighting of an existing building may be adversely affected if:

“the area of the working plane in a room which can receive direct skylight is reduced to less than 0.80 times its former value.” (BRE Building Technology Group, 2022)

(Room layouts for neighbouring buildings are often not readily available, hence VSC is often the only analysis performed.)

4.1.2 Sun lighting

“In designing a new development or extension to a building, care should be taken to safeguard the access to sunlight both for existing dwellings, and for any nearby non-domestic buildings where there is a particular requirement for sunlight.” (BRE Building Technology Group, 2022)

Obstruction to sunlight may become an issue if:

- Some part of a new development is situated within 90° of due south of a main window wall of an existing building.
- In the section drawn perpendicular to this existing window wall, the new development subtends an angle greater than 25° to the horizontal measured from the centre of the lowest window to a main living room.

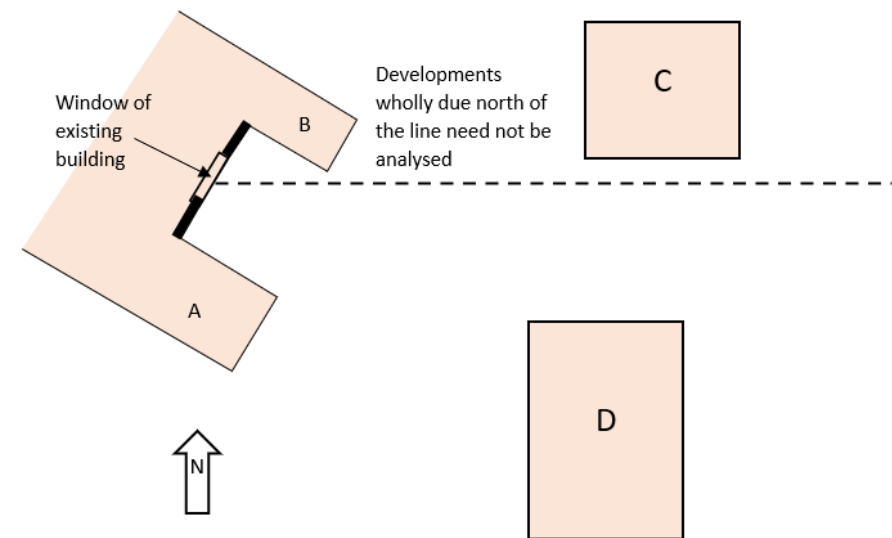


Figure 10: Sunlight Analysis Scenarios for Existing Buildings

No sunlight check is required on the existing window for proposed extension B and new building C, as they lie within 90° of due north of the window. The impact on sunlight to the existing window should be checked for proposed extension A, and new building D if it subtends more than 25° to the horizontal, measured in section from the centre of the window.

To assess loss of sunlight to an existing building, it is suggested that all main living rooms of dwellings, and conservatories, should be checked if they have a window facing within 90° of due south.

4.1.2.1 Probable Sunlight Hours

To calculate the loss of sunlight to an existing building over the year, the annual probable sunlight hours (APSH) metric can be used. *“Here ‘probable sunlight hours’ means the total number of hours in the year that the sun is expected to shine on unobstructed ground, allowing for average levels of cloudiness for the location in question (based on sunshine probability data). The sunlight reaching a window is quantified as a percentage of this unobstructed annual total.”* (BRE Building Technology Group, 2022)

Sunlight to an existing dwelling may be adversely affected if the centre of a main living room window (which faces within 90° of due south):

- receives less than 25% of annual probable sunlight hours (APSH) and less than 0.80 times its former annual value.
- or less than 5% of annual probable sunlight hours between 21 September and 21 March (often referred to as winter probable sunlight hours - WPSH) and less than 0.80 times its former value during that period.
- and has a reduction in sunlight received over the whole year greater than 4% of annual probable sunlight hours.

4.1.2.2 Basic Assessment

It is not always necessary to do a full calculation using Annual Probable Sunlight Hours APSH (section 4.1.2.1). The same “spacing-to-height ratio” and “obstruction angle” checks discussed in section 4.1.1.1 can be used to determine if a more detailed calculation is necessary or not. Additionally, depending on the VSC and orientation of the existing windows an APSH assessment may not be required. The recommendation for safeguarding sunlight to existing neighbouring buildings will be met if:

- *“the distance of each part of the new development from the existing window is three or more times its height above the centre of the existing window [see Figure] (note: obstructions within 90° of due north of the existing window need not count here).*
- *The window wall faces within 90° of due south and no obstruction, measured in the section perpendicular to the window wall, subtends an angle of more than 25° to the horizontal [Figure]. Again, obstructions within 90° of due north of the existing window need not be counted.*
- *The window wall faces within 20° of due south and the reference point has a VSC of 27% or more.”* (BRE Building Technology Group, 2022)

4.1.3 Sunlight to Existing Gardens & Open Spaces

Good site layout planning for daylight and sunlight should not limit itself to providing natural lighting inside buildings. Sunlight in the spaces between buildings has an important impact on the overall appearance and ambience of a development.

“It is recommended that for it to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least two hours of sunlight on 21 March. If as a result of new development an existing garden or amenity area does not meet the above, and the area which can receive two hours of sun on 21 March is less than 0.8 times its former value, then the loss of sunlight is likely to be noticeable.” (BRE Building Technology Group, 2022)

4.1.3.1 Shadow Plots

The BRE guide states:

“Where a large building is proposed which may affect a number of gardens or open spaces it is often illustrative to plot a shadow plan showing the location of shadows at different times of day and year.”

4.1.4 Impact Classification

Appendix H of the BRE Guide – “Environmental Impact Assessment” states that the impact of a new building on its surroundings can be classified as negligible, minor, moderate or major adverse. Where the loss of skylight or sunlight fully meets the guidelines in the BRE guide, the impact is assessed as negligible or minor adverse.

Where the loss of skylight or sunlight does not meet the BRE guidelines, the impact is assessed as minor, moderate or major adverse.

Table 2 provides a more detailed description of the impact classification.

Table 2: Environmental Impact Assessment: Impact Classification

<i>Negligible impact</i>	• <i>Loss of light well within guidelines, or</i> • <i>only a small number of windows losing light (within the guidelines) or</i> • <i>limited area of open space losing light (within the guidelines)</i>
<i>Minor adverse impact (a)</i>	• <i>Loss of light only just within guidelines and</i> ○ <i>a larger number of windows are affected or</i> ○ <i>larger area of open space is affected (within the guidelines)</i>
<i>Minor adverse impact (b)</i>	• <i>only a small number of windows or limited open space areas are affected</i> • <i>the loss of light is only marginally outside the guidelines</i> • <i>an affected room has other sources of skylight or sunlight</i> • <i>the affected building or open space only has a low-level requirement for skylight or sunlight</i> • <i>there are particular reasons why an alternative, less stringent, guideline should be applied</i>
<i>Major adverse impact</i>	• <i>large number of windows or large open space areas are affected</i> • <i>the loss of light is substantially outside the guidelines</i> • <i>all the windows in a particular property are affected</i> • <i>the affected indoor or outdoor spaces have a particularly strong requirement for skylight or sunlight (living rooms / playground)</i>

A moderate adverse impact falls somewhere between the criteria for “Minor Adverse Impact (b)” and “Major Adverse Impact”.

4.2 New Buildings

The daylight provision was also checked for the proposed development.

4.2.1 Light from the Sky

Section 2.1.8 of the BRE 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 (D)”.

Both methods are measures of the overall amount of daylight in a space.

The daylight factor (D) method addresses daylight provision as a ratio of unobstructed external illuminance under overcast sky conditions. This method involves calculating the daylight factor (D) that would be exceeded over half of the room, i.e. the median daylight factor (this is not the same as the average daylight factor used in the previous standard, BS8206-2). The recommended daylight factor values are location specific. This method will not be discussed in any more detail in this report as the illuminance method is the preferred option.

4.2.1.1 Illuminance Method (Target Illuminance E_T)

The illuminance method *“involves using climatic data for the location of the site (via the use of an appropriate, typical or average year, weather file within the software) to calculate the illuminance from daylight at each point on an assessment grid on the reference plane at an at least hourly interval for a typical year.”* (BRE Building Technology Group, 2022)

“A target illuminance (E_T) should be achieved across at least half of the reference plane in a daylit space for at least half of the daylight hours. Another target illuminance (E_{TM}) should also be achieved across 95% of the reference plane for at least half of the daylight hours; this is the minimum target illuminance to be achieved towards the back of the room.” (BRE Building Technology Group, 2022)

(Note that since hourly climatic data is used based on the location of the site, location and orientation are accounted for. The target illuminance can therefore be considered a *daylight* metric, i.e. incorporating both skylight and sunlight.)

BS EN 17037 gives three levels of recommendation for daylight provision in interior spaces: minimum, medium and high. For compliance with the standard, a daylit space should achieve the minimum level of recommendation.

Table 3 gives the target illuminances for side lit rooms. Different targets, given in Table A2 of BS EN 17037, apply in spaces with horizontal rooflights.

Table 3: EN 17037 Target Illuminances

Level of recommendation	Target illuminance E_T (lx) for half of assessment grid	Target illuminance E_{TM} (lx) for 95% of assessment grid
Minimum	300	100
Medium	500	300
High	750	500

The guidance contained in BR 209 is intended to be used with BS EN 17037 and its UK National Annex. The UK National Annex gives specific minimum recommendations for habitable rooms in dwellings in the UK. Although Ireland adopted EN17037 directly as IS EN EN17037, it is expected that all councils in Ireland will adopt the UK National Annex recommendations. The Dublin City Council Development Plan 2022-2028 states:

“is important to note that no amendments were made to [the IS EN 17037] document and unlike BS EN 17037, it does not contain a national annex. It offers only a single target for new buildings (there are no space-by-space targets – e.g. a kitchen would have the same target as a warehouse or office). [...] These limitations make it unsuitable for use in planning policy or during planning applications. BR 209 must still be used for this purpose.”

Even if a predominantly daylit appearance is not achievable for a room in a dwelling, the National Annex NA recommends that the target illuminance values given in Table 4 are exceeded over 50% of the points on a reference plane 0.85 m above the floor, for at least half of the daylight hours.

Table 4: BS EN 17037 NA Target Illuminances for dwellings

Room type	Target illuminance E_T (lx)
Bedroom	100
Living Room	150
Kitchen	200

Where one room in a dwelling serves more than a single purpose, it is recommended that the target illuminance is that for the room type with the highest value – for example, in a space that combines a living room and a kitchen the target illuminance is recommended to be 200 lx.

However, it is recommended that local authorities use discretion here. For example: *“the target for a living room could be used for a combined living/dining/kitchen area if the kitchens are not treated as habitable spaces..”* (BRE Building Technology Group, 2022). This may be appropriate in instances where small internal kitchens are unavoidable in apartment developments.

The minimum target illuminance level to be achieved across 95% of the reference plane within a space need not be applied to rooms in dwellings.

To avoid any confusion, the targets in Table 4 are those used for the purposes of this analysis.

The illuminance method is detailed and calculation intensive. It can take some time to process depending on the software, detail of the calculation model and the available

computing power hence why the daylight factor (D) method may be preferred by some. However, it can provide additional information beyond the limits of the Daylight Factor method due to the use of hourly climate data.

There are a few ways the results of this type of analysis can be presented. One method is to report the % area of the reference plane exceeding the target illuminance E_T (for half of the daylight hours.) (This area should be greater than 50% to meet the BS EN 17037 recommendations.) This is equivalent to Spatial Daylight Autonomy (sDA). BR209 recommends reporting the median illuminance (exceeded over 50% of the reference plane) as this enables comparison with the different recommendations in BS EN 17037. It says that *“As an optional extra, the proportional area of the reference plane exceeding a particular target value may be presented”*. It should be noted that the calculation methodology and results are the same in both instances. It is only the *presented* result that differs. For completeness, the results will be presented in both ways, i.e. both of the below metrics will be presented:

- The **median illuminance** (the illuminance exceeded over 50% of the reference plane).
- The **% area** of the reference plane exceeding a particular target illuminance (lux).

The settings used in the computational model for the illuminance calculations are outlined below:

- The reference/working plane is taken to be 0.85m above the floor.

The settings used in the computational model for the illuminance calculations are outlined below:

- The reference/working plane is taken to be 0.85m above the floor.
- The grid spacing is 0.1m.
- A band of 0.3m from the walls is excluded from the grid.

- Window frame factor is set to 20% (This is based on the size of the window openings and the area of the window which is framing.)
- The glazing transmittance (normal) was set to 0.70.
- The glazing maintenance factor is set to 96% (This accounts for the reduction in glazing transmittance due to dirt; 4% loss of daylight compared with clean glazing.)
- The illuminance calculations take account of light which has been reflected from both external and internal surfaces. In the absence of detailed information on surface reflectances the recommended default reflectances from BR209 2022 have been used. These are detailed in Table 5 below.

Table 5: Surface Reflectances

Surface Type	Reflectance
Interior walls	0.50
Floors	0.20
Ceilings	0.70
Exterior walls and obstructions	0.20
Exterior Ground	0.20

Table 6: Balcony Glazing Properties

Surface Type	Properties
Balcony Glazing	Transmittance: 0.80 Refractive Index: 1.52

4.2.2 Sun lighting

For interiors, access to sunlight can be quantified based on the methodology set out in BS EN 17037.

"In general, a dwelling, or non-domestic building that has a particular requirement for sunlight, will appear reasonably sunlit provided:

- *at least one main window wall faces within 90° of due south and*
- *a habitable room, preferably a main living room, can receive a total of at least 1.5 hours of sunlight on 21 March. This is assessed at the inside centre of the window(s); sunlight received by different windows can be added provided they occur at different times and sunlight hours are not double counted.*

Where groups of dwellings are planned, site layout design should aim to maximise the number of dwellings with a main living room that meets the above recommendations." (BRE Building Technology Group, 2022)

There are 3 levels of recommendation provided in EN 17037 relating to sunlight to a room:

- 1.5 hours is the minimum level,
- 3 hours is the medium level, and
- 4 hours is the high level

For dwellings, as outlined above, at least one habitable room, preferably a main living room, should meet at least the minimum criterion.

4.2.3 Sunlight to Proposed Open Spaces

The BRE Guide recommends:

"That for it to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least two hours of sunlight on 21 March."

The communal open spaces and amenity space are analysed and assessed against the above criterion.

5 Analysis

5.1 Overview of Computational Models

3D models of the existing the proposed scenarios were created. The site plans and 2D drawings provided by the architect were used to correctly position the surrounding buildings relative to the existing and proposed buildings.

3D models of the existing the proposed schemes were created. The existing and analysed (surrounding) models are based on 2D drawings provided by the architect

supplemented by Google Street Maps and OS maps. The proposed model is based on the 2D CAD drawings provided by the architect:

In the following figures the building colours correspond to the following:

- Beige/buff elements represent the existing surrounding buildings that are analysed
- The blue elements are the buildings in the proposed development.



Figure 11: Existing Model (Plan View)



Figure 12: Existing Model (Perspective view looking North)



Figure 13: Proposed Model (Plan View)



Figure 14: Proposed Model (Perspective view looking North)

5.2 Existing Buildings

5.2.1 25 Degree Line Test

The obstruction angle was checked for the closest properties to the site that have windows directly opposite the proposed development.

25-degree planes were drawn from the centre of the closest windows of the neighbouring properties. As these windows are the closest to the proposed development, if they are not adversely impacted, then it follows that the other adjacent neighbouring properties will not be adversely impacted.

The results for the “25-degree line test” are shown in the following figures. The 25-degree planes are shown in red.

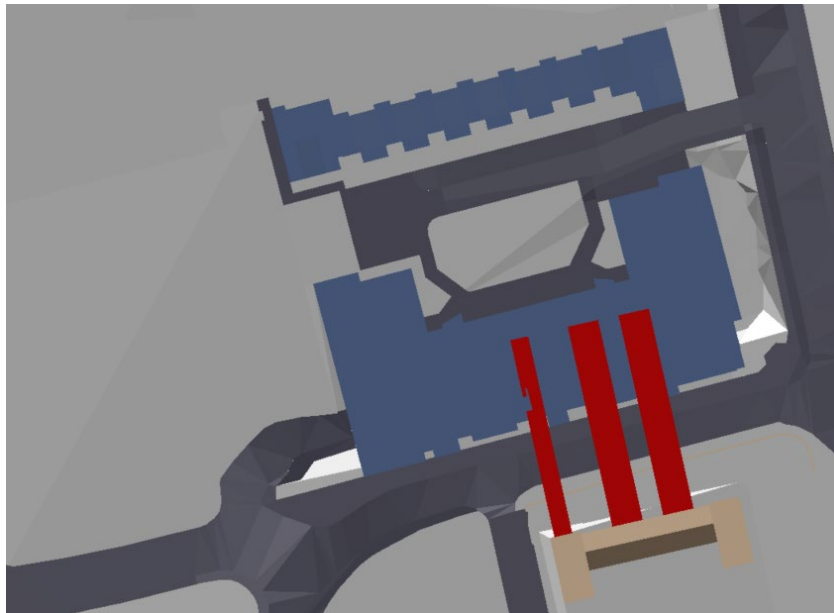


Figure 15: 25 Degree Planes Plan View



Figure 16: 25 Degree Planes Perspective View (looking from East)

The analysis shows that none of the 25-degree planes cut the proposed development. That is to say, the obstruction angle is less than 25 degrees for all of the properties/windows tested. Therefore, the proposed development will have a negligible impact on the skylight enjoyed by the existing neighbouring dwellings (See Table 1: Sensitive Receptors for building labels).

5.2.2 VSC Analysis

The 25-degree plane test shows that the development will have a negligible impact on the existing neighbouring houses. However, not all neighbouring properties are directly opposite the proposed development, so VSC analysis has been performed for the remaining neighbouring properties. These are labelled in Table 1: Sensitive Receptors as:

1. 31 Westview Ballincollig
2. 32 Westview Ballincollig
3. 33 Westview Ballincollig
4. 34 Westview Ballincollig
5. 35 Westview Ballincollig
6. 36 Westview Ballincollig
7. 37-38-39 Westview Ballincollig

Some assumptions had to be made for window positions at the rear of these properties where information could not be gleaned from Google Street View or otherwise. Where assumptions must be made, multiple VSC points are spaced evenly across each facade facing the proposed development. The VSC points for each property are shown in the following figures.

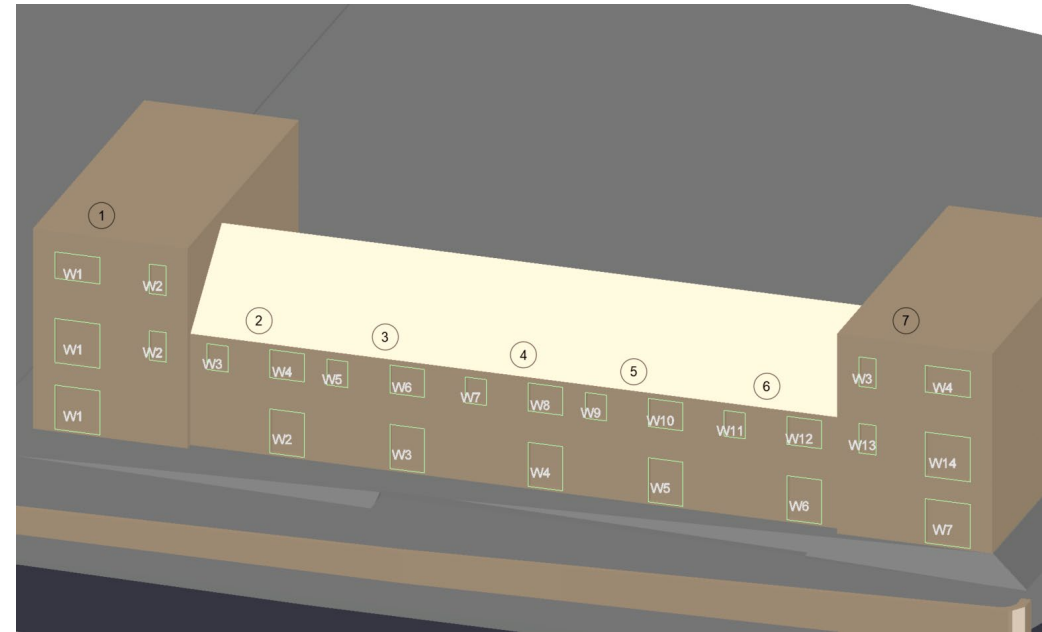


Figure 17: 31-39 Westview Ballincollig

Table 7: VSC Results

Floor Ref.	Window Ref.	VSC	Pr/Ex	Meets BRE Criteria
31-39 WESTVIEW BALLINCOLLIG				
Ground	W1	Existing 39.25	0.81	YES
		Proposed 31.75		
	W2	Existing 39.12	0.78	YES
		Proposed 30.43		
	W3	Existing 39.15	0.77	YES
		Proposed 30.13		
	W4	Existing 39.12	0.77	YES
		Proposed 29.96		
	W5	Existing 39.06	0.77	YES
		Proposed 29.92		
	W6	Existing 38.11	0.75	YES
		Proposed 28.73		
	W7	Existing 39.05	0.74	YES
		Proposed 28.98		
First	W1	Existing 39.55	0.85	YES
		Proposed 33.74		
	W2	Existing 39.56	0.85	YES
		Proposed 33.49		
	W3	Existing 38.54	0.83	YES
		Proposed 32.06		
	W4	Existing 39.47	0.83	YES
		Proposed 32.77		
	W5	Existing 39.52	0.83	YES
		Proposed 32.63		
	W6	Existing 39.53	0.82	YES
		Proposed 32.54		
	W7	Existing 39.52	0.82	YES
		Proposed 32.42		

Table 8: VSC Results

Floor Ref.	Window Ref.	VSC	Pr/Ex	Meets BRE Criteria
31-39 WESTVIEW BALLINCOLLIG				
First	W8	Existing 39.53	0.82	YES
		Proposed 32.39		
	W9	Existing 39.52	0.82	YES
		Proposed 32.32		
	W10	Existing 39.50	0.82	YES
		Proposed 32.31		
	W11	Existing 39.42	0.81	YES
		Proposed 32.08		
	W12	Existing 38.57	0.81	YES
		Proposed 31.12		
	W13	Existing 39.53	0.81	YES
		Proposed 31.95		
	W14	Existing 39.51	0.79	YES
		Proposed 31.39		
Second	W1	Existing 39.62	0.91	YES
		Proposed 35.99		
	W2	Existing 39.62	0.90	YES
		Proposed 35.63		
	W3	Existing 39.62	0.87	YES
		Proposed 34.34		
	W4	Existing 39.62	0.86	YES
		Proposed 34.14		

Table 9: VSC Summary Results

Property	Number of Windows Tested	Windows that meet BRE Guidelines	
		No.	%
31-39 WESTVIEW BALLINCOLLIG	25	25	100%
Total	25	25	100%

All windows tested have VSC values greater than 27% with the proposed development in place. Therefore, these windows will still receive adequate amounts of skylight after the proposed development is built and the impact to all windows will be negligible.

The results meet the recommendations of the BRE Guide and show that the proposed development will have a negligible impact on skylight to the neighbouring dwelling.

5.3 Proposed Development

5.3.1 Daylight Analysis for Proposed Development

The daylight provision in the apartments and duplex units in the proposed development was checked using the target illuminance (E_T) method. The results are presented in the following tables.

Floor Ref	Room Ref	Property Type	Room Use	Median Lux	% of Area Meeting Req Lux	Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	Meets Criteria
Resi. Apartment										
Lower Ground	R1	Residential	LKD	153	44%	200	50%	50%	4380	NO
	R2	Residential	Bedroom	164	92%	100	50%	50%	4380	YES
	R3	Residential	Bedroom	466	100%	100	50%	50%	4380	YES
	R4	Residential	LKD	360	76%	200	50%	50%	4380	YES
	R5	Residential	LKD	355	75%	200	50%	50%	4380	YES
	R6	Residential	Bedroom	353	100%	100	50%	50%	4380	YES
	R7	Residential	Bedroom	362	100%	100	50%	50%	4380	YES
	R8	Residential	Bedroom	193	98%	100	50%	50%	4380	YES
	R9	Residential	LKD	184	47%	200	50%	50%	4380	NO
	R10	Residential	Bedroom	188	98%	100	50%	50%	4380	YES
	R11	Residential	LKD	203	50%	200	50%	50%	4380	YES
	R12	Residential	LKD	131	32%	200	50%	50%	4380	NO
	R13	Residential	Bedroom	325	100%	100	50%	50%	4380	YES
	R14	Residential	Bedroom	331	100%	100	50%	50%	4380	YES
	R15	Residential	Bedroom	414	100%	100	50%	50%	4380	YES
	R16	Residential	Bedroom	414	100%	100	50%	50%	4380	YES
	R17	Residential	LKD	144	37%	200	50%	50%	4380	NO
	R18	Residential	Bedroom	412	100%	100	50%	50%	4380	YES
	R19	Residential	Bedroom	414	100%	100	50%	50%	4380	YES
	R20	Residential	LKD	405	81%	200	50%	50%	4380	YES
	R21	Residential	LKD	330	77%	200	50%	50%	4380	YES
	R22	Residential	Bedroom	281	100%	100	50%	50%	4380	YES
	R23	Residential	Bedroom	269	100%	100	50%	50%	4380	YES

Table 10: Illuminance Results – Resi. Apartment Lower Ground Floor

Floor Ref	Room Ref	Property Type	Room Use	Median Lux	% of Area Meeting Req Lux	Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	Meets Criteria
Resi. Apartment										
Ground	R1	Residential	Bedroom	46	11%	100	50%	50%	4380	NO
	R2	Residential	Bedroom	110	53%	100	50%	50%	4380	YES
	R3	Residential	LKD	91	19%	200	50%	50%	4380	NO
	R4	Residential	LKD	172	45%	200	50%	50%	4380	NO
	R5	Residential	Bedroom	182	98%	100	50%	50%	4380	YES
	R6	Residential	Bedroom	512	100%	100	50%	50%	4380	YES
	R7	Residential	LKD	386	82%	200	50%	50%	4380	YES
	R8	Residential	LKD	401	81%	200	50%	50%	4380	YES
	R9	Residential	Bedroom	373	100%	100	50%	50%	4380	YES
	R10	Residential	Bedroom	391	100%	100	50%	50%	4380	YES
	R11	Residential	Bedroom	208	98%	100	50%	50%	4380	YES
	R12	Residential	LKD	228	56%	200	50%	50%	4380	YES
	R13	Residential	Bedroom	207	98%	100	50%	50%	4380	YES
	R14	Residential	LKD	231	56%	200	50%	50%	4380	YES
	R15	Residential	LKD	129	33%	200	50%	50%	4380	NO
	R16	Residential	Bedroom	369	100%	100	50%	50%	4380	YES
	R17	Residential	Bedroom	386	100%	100	50%	50%	4380	YES
	R18	Residential	Bedroom	288	100%	100	50%	50%	4380	YES
	R19	Residential	Bedroom	300	100%	100	50%	50%	4380	YES
	R20	Residential	LKD	592	97%	200	50%	50%	4380	YES
	R21	Residential	Bedroom	377	100%	100	50%	50%	4380	YES
	R22	Residential	LKD	150	42%	200	50%	50%	4380	NO
	R23	Residential	LKD	248	57%	200	50%	50%	4380	YES
	R24	Residential	Bedroom	224	100%	100	50%	50%	4380	YES
	R25	Residential	Bedroom	468	100%	100	50%	50%	4380	YES
	R26	Residential	Bedroom	453	100%	100	50%	50%	4380	YES
	R27	Residential	LKD	423	89%	200	50%	50%	4380	YES
	R28	Residential	LKD	401	85%	200	50%	50%	4380	YES
	R29	Residential	Bedroom	493	100%	100	50%	50%	4380	YES

Table 11: Illuminance Results – Resi. Apartment Ground Floor

Floor Ref	Room Ref	Property Type	Room Use	Median Lux	% of Area Meeting Req Lux	Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	Meets Criteria
Resi. Apartment										
Ground	R30	Residential	Bedroom	505	100%	100	50%	50%	4380	YES
	R31	Residential	Bedroom	262	98%	100	50%	50%	4380	YES
	R32	Residential	LKD	291	66%	200	50%	50%	4380	YES
	R33	Residential	LKD	195	49%	200	50%	50%	4380	NO
	R34	Residential	Bedroom	419	100%	100	50%	50%	4380	YES
	R35	Residential	LKD	702	100%	200	50%	50%	4380	YES
	R36	Residential	Bedroom	337	100%	100	50%	50%	4380	YES
	R37	Residential	Bedroom	309	100%	100	50%	50%	4380	YES
	R38	Residential	Bedroom	434	100%	100	50%	50%	4380	YES
	R39	Residential	Bedroom	431	100%	100	50%	50%	4380	YES
	R40	Residential	LKD	151	39%	200	50%	50%	4380	NO
	R41	Residential	Bedroom	430	100%	100	50%	50%	4380	YES
	R42	Residential	Bedroom	429	100%	100	50%	50%	4380	YES
	R43	Residential	LKD	150	38%	200	50%	50%	4380	NO
	R44	Residential	Bedroom	428	100%	100	50%	50%	4380	YES
	R45	Residential	Bedroom	428	100%	100	50%	50%	4380	YES
	R46	Residential	LKD	440	84%	200	50%	50%	4380	YES
	R47	Residential	LKD	375	81%	200	50%	50%	4380	YES
	R48	Residential	Bedroom	310	100%	100	50%	50%	4380	YES
	R49	Residential	Bedroom	303	100%	100	50%	50%	4380	YES
	R50	Residential	LKD	109	25%	200	50%	50%	4380	NO
	R51	Residential	Bedroom	221	100%	100	50%	50%	4380	YES
	R52	Residential	Bedroom	193	84%	100	50%	50%	4380	YES
	R53	Residential	Bedroom	45	10%	100	50%	50%	4380	NO
	R54	Residential	LKD	169	40%	200	50%	50%	4380	NO
	R55	Residential	LKD	365	94%	200	50%	50%	4380	YES
	R56	Residential	Bedroom	152	94%	100	50%	50%	4380	YES
	R57	Residential	Bedroom	156	93%	100	50%	50%	4380	YES
	R58	Residential	LKD	373	97%	200	50%	50%	4380	YES
	R59	Residential	LKD	181	44%	200	50%	50%	4380	NO

Table 12: Illuminance Results – Resi. Apartment Ground Floor

Floor Ref	Room Ref	Property Type	Room Use	Median Lux	% of Area Meeting Req Lux	Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	Meets Criteria
Resi. Apartment										
First	R1	Residential	Bedroom	46	7%	100	50%	50%	4380	NO
	R2	Residential	Bedroom	120	58%	100	50%	50%	4380	YES
	R3	Residential	LKD	101	20%	200	50%	50%	4380	NO
	R4	Residential	LKD	204	51%	200	50%	50%	4380	YES
	R5	Residential	Bedroom	206	100%	100	50%	50%	4380	YES
	R6	Residential	Bedroom	583	100%	100	50%	50%	4380	YES
	R7	Residential	LKD	409	83%	200	50%	50%	4380	YES
	R8	Residential	LKD	426	84%	200	50%	50%	4380	YES
	R9	Residential	Bedroom	400	100%	100	50%	50%	4380	YES
	R10	Residential	Bedroom	422	100%	100	50%	50%	4380	YES
	R11	Residential	Bedroom	191	98%	100	50%	50%	4380	YES
	R12	Residential	LKD	240	58%	200	50%	50%	4380	YES
	R13	Residential	Bedroom	190	98%	100	50%	50%	4380	YES
	R14	Residential	LKD	242	59%	200	50%	50%	4380	YES
	R15	Residential	LKD	121	29%	200	50%	50%	4380	NO
	R16	Residential	Bedroom	397	100%	100	50%	50%	4380	YES
	R17	Residential	Bedroom	417	100%	100	50%	50%	4380	YES
	R18	Residential	Bedroom	313	100%	100	50%	50%	4380	YES
	R19	Residential	Bedroom	329	100%	100	50%	50%	4380	YES
	R20	Residential	LKD	603	99%	200	50%	50%	4380	YES
	R21	Residential	LKD	152	38%	200	50%	50%	4380	NO
	R22	Residential	Bedroom	503	100%	100	50%	50%	4380	YES
	R23	Residential	Bedroom	521	100%	100	50%	50%	4380	YES
	R24	Residential	LKD	286	63%	200	50%	50%	4380	YES
	R25	Residential	Bedroom	218	100%	100	50%	50%	4380	YES
	R26	Residential	Bedroom	522	100%	100	50%	50%	4380	YES
	R27	Residential	Bedroom	505	100%	100	50%	50%	4380	YES
	R28	Residential	LKD	446	93%	200	50%	50%	4380	YES
	R29	Residential	LKD	433	90%	200	50%	50%	4380	YES
	R30	Residential	Bedroom	520	100%	100	50%	50%	4380	YES
	R31	Residential	Bedroom	539	100%	100	50%	50%	4380	YES

Table 13: Illuminance Results – Resi. Apartment First Floor

Floor Ref	Room Ref	Property Type	Room Use	Median Lux	% of Area Meeting Req Lux	Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	Meets Criteria
Resi. Apartment										
First	R32	Residential	Bedroom	239	100%	100	50%	50%	4380	YES
	R33	Residential	LKD	314	69%	200	50%	50%	4380	YES
	R34	Residential	Bedroom	556	100%	100	50%	50%	4380	YES
	R35	Residential	Bedroom	529	100%	100	50%	50%	4380	YES
	R36	Residential	LKD	165	42%	200	50%	50%	4380	NO
	R37	Residential	LKD	688	100%	200	50%	50%	4380	YES
	R38	Residential	Bedroom	385	100%	100	50%	50%	4380	YES
	R39	Residential	Bedroom	367	100%	100	50%	50%	4380	YES
	R40	Residential	Bedroom	459	100%	100	50%	50%	4380	YES
	R41	Residential	Bedroom	456	100%	100	50%	50%	4380	YES
	R42	Residential	LKD	138	34%	200	50%	50%	4380	NO
	R43	Residential	Bedroom	455	100%	100	50%	50%	4380	YES
	R44	Residential	Bedroom	455	100%	100	50%	50%	4380	YES
	R45	Residential	LKD	138	34%	200	50%	50%	4380	NO
	R46	Residential	Bedroom	455	100%	100	50%	50%	4380	YES
	R47	Residential	Bedroom	455	100%	100	50%	50%	4380	YES
	R48	Residential	LKD	446	86%	200	50%	50%	4380	YES
	R49	Residential	LKD	389	84%	200	50%	50%	4380	YES
	R50	Residential	Bedroom	359	100%	100	50%	50%	4380	YES
	R51	Residential	Bedroom	344	100%	100	50%	50%	4380	YES
	R52	Residential	LKD	105	22%	200	50%	50%	4380	NO
	R53	Residential	Bedroom	269	100%	100	50%	50%	4380	YES
	R54	Residential	Bedroom	226	92%	100	50%	50%	4380	YES
	R55	Residential	Bedroom	43	8%	100	50%	50%	4380	NO
	R56	Residential	LKD	172	39%	200	50%	50%	4380	NO
	R57	Residential	LKD	431	99%	200	50%	50%	4380	YES
	R58	Residential	Bedroom	217	100%	100	50%	50%	4380	YES
	R59	Residential	Bedroom	185	100%	100	50%	50%	4380	YES
	R60	Residential	LKD	435	99%	200	50%	50%	4380	YES
	R61	Residential	LKD	187	46%	200	50%	50%	4380	NO

Table 14: Illuminance Results – Resi. Apartment First Floor

Floor Ref	Room Ref	Property Type	Room Use	Median Lux	% of Area Meeting Req Lux	Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	Meets Criteria
Resi. Apartment										
Second	R1	Residential	Bedroom	49	7%	100	50%	50%	4380	NO
	R2	Residential	Bedroom	139	66%	100	50%	50%	4380	YES
	R3	Residential	LKD	116	25%	200	50%	50%	4380	NO
	R4	Residential	LKD	228	56%	200	50%	50%	4380	YES
	R5	Residential	Bedroom	175	100%	100	50%	50%	4380	YES
	R6	Residential	Bedroom	629	100%	100	50%	50%	4380	YES
	R7	Residential	LKD	520	89%	200	50%	50%	4380	YES
	R8	Residential	LKD	504	88%	200	50%	50%	4380	YES
	R9	Residential	Bedroom	409	100%	100	50%	50%	4380	YES
	R10	Residential	Bedroom	430	100%	100	50%	50%	4380	YES
	R11	Residential	Bedroom	195	98%	100	50%	50%	4380	YES
	R12	Residential	LKD	245	58%	200	50%	50%	4380	YES
	R13	Residential	Bedroom	195	98%	100	50%	50%	4380	YES
	R14	Residential	LKD	249	60%	200	50%	50%	4380	YES
	R15	Residential	LKD	123	29%	200	50%	50%	4380	NO
	R16	Residential	Bedroom	408	100%	100	50%	50%	4380	YES
	R17	Residential	Bedroom	429	100%	100	50%	50%	4380	YES
	R18	Residential	Bedroom	285	100%	100	50%	50%	4380	YES
	R19	Residential	Bedroom	336	100%	100	50%	50%	4380	YES
	R20	Residential	LKD	621	99%	200	50%	50%	4380	YES
	R21	Residential	LKD	164	40%	200	50%	50%	4380	NO
	R22	Residential	Bedroom	523	100%	100	50%	50%	4380	YES
	R23	Residential	Bedroom	539	100%	100	50%	50%	4380	YES
	R24	Residential	LKD	307	68%	200	50%	50%	4380	YES
	R25	Residential	Bedroom	234	100%	100	50%	50%	4380	YES
	R26	Residential	Bedroom	545	100%	100	50%	50%	4380	YES
	R27	Residential	Bedroom	525	100%	100	50%	50%	4380	YES
	R28	Residential	LKD	481	96%	200	50%	50%	4380	YES
	R29	Residential	LKD	491	95%	200	50%	50%	4380	YES
	R30	Residential	Bedroom	537	100%	100	50%	50%	4380	YES
	R31	Residential	Bedroom	559	100%	100	50%	50%	4380	YES

Table 15: Illuminance Results – Resi. Apartment Second Floor

Floor Ref	Room Ref	Property Type	Room Use	Median Lux	% of Area Meeting Req Lux	Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	Meets Criteria
Resi. Apartment										
Second	R32	Residential	Bedroom	242	100%	100	50%	50%	4380	YES
	R33	Residential	LKD	326	71%	200	50%	50%	4380	YES
	R34	Residential	Bedroom	560	100%	100	50%	50%	4380	YES
	R35	Residential	Bedroom	535	100%	100	50%	50%	4380	YES
	R36	Residential	LKD	167	42%	200	50%	50%	4380	NO
	R37	Residential	LKD	691	100%	200	50%	50%	4380	YES
	R38	Residential	Bedroom	389	100%	100	50%	50%	4380	YES
	R39	Residential	Bedroom	370	100%	100	50%	50%	4380	YES
	R40	Residential	Bedroom	463	100%	100	50%	50%	4380	YES
	R41	Residential	Bedroom	458	100%	100	50%	50%	4380	YES
	R42	Residential	LKD	139	34%	200	50%	50%	4380	NO
	R43	Residential	Bedroom	459	100%	100	50%	50%	4380	YES
	R44	Residential	Bedroom	458	100%	100	50%	50%	4380	YES
	R45	Residential	LKD	139	34%	200	50%	50%	4380	NO
	R46	Residential	Bedroom	460	100%	100	50%	50%	4380	YES
	R47	Residential	Bedroom	458	100%	100	50%	50%	4380	YES
	R48	Residential	LKD	458	86%	200	50%	50%	4380	YES
	R49	Residential	LKD	412	86%	200	50%	50%	4380	YES
	R50	Residential	Bedroom	376	100%	100	50%	50%	4380	YES
	R51	Residential	Bedroom	376	100%	100	50%	50%	4380	YES
	R52	Residential	LKD	119	26%	200	50%	50%	4380	NO
	R53	Residential	Bedroom	293	100%	100	50%	50%	4380	YES
	R54	Residential	Bedroom	245	97%	100	50%	50%	4380	YES
	R55	Residential	Bedroom	46	8%	100	50%	50%	4380	NO
	R56	Residential	LKD	185	45%	200	50%	50%	4380	NO
	R57	Residential	LKD	492	99%	200	50%	50%	4380	YES
	R58	Residential	Bedroom	267	100%	100	50%	50%	4380	YES
	R59	Residential	Bedroom	232	100%	100	50%	50%	4380	YES
	R60	Residential	LKD	483	99%	200	50%	50%	4380	YES
	R61	Residential	LKD	207	51%	200	50%	50%	4380	YES

Table 16: Illuminance Results – Resi. Apartment Second Floor

Floor Ref	Room Ref	Property Type	Room Use	Median Lux	% of Area Meeting Req Lux	Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	Meets Criteria
Resi. Apartment										
Third	R1	Residential	Bedroom	86	40%	100	50%	50%	4380	NO
	R2	Residential	Bedroom	186	91%	100	50%	50%	4380	YES
	R3	Residential	LKD	185	47%	200	50%	50%	4380	NO
	R4	Residential	LKD	430	78%	200	50%	50%	4380	YES
	R5	Residential	Bedroom	419	100%	100	50%	50%	4380	YES
	R6	Residential	Bedroom	368	100%	100	50%	50%	4380	YES
	R7	Residential	LKD	355	75%	200	50%	50%	4380	YES
	R8	Residential	Bedroom	354	100%	100	50%	50%	4380	YES
	R9	Residential	LKD	360	72%	200	50%	50%	4380	YES
	R10	Residential	LKD	166	44%	200	50%	50%	4380	NO
	R11	Residential	Bedroom	414	100%	100	50%	50%	4380	YES
	R12	Residential	Bedroom	435	100%	100	50%	50%	4380	YES
	R13	Residential	Bedroom	315	100%	100	50%	50%	4380	YES
	R14	Residential	Bedroom	304	100%	100	50%	50%	4380	YES
	R15	Residential	LKD	779	100%	200	50%	50%	4380	YES
	R16	Residential	LKD	240	57%	200	50%	50%	4380	YES
	R17	Residential	Bedroom	417	100%	100	50%	50%	4380	YES
	R18	Residential	Bedroom	430	100%	100	50%	50%	4380	YES
	R19	Residential	LKD	490	83%	200	50%	50%	4380	YES
	R20	Residential	Bedroom	509	100%	100	50%	50%	4380	YES
	R21	Residential	Bedroom	469	100%	100	50%	50%	4380	YES
	R22	Residential	Bedroom	425	100%	100	50%	50%	4380	YES
	R23	Residential	LKD	758	100%	200	50%	50%	4380	YES
	R24	Residential	LKD	539	97%	200	50%	50%	4380	YES
	R25	Residential	Bedroom	540	100%	100	50%	50%	4380	YES
	R26	Residential	Bedroom	566	100%	100	50%	50%	4380	YES
	R27	Residential	Bedroom	244	100%	100	50%	50%	4380	YES
	R28	Residential	LKD	331	71%	200	50%	50%	4380	YES

Table 17: Illuminance Results – Resi. Apartment Third Floor

Floor Ref	Room Ref	Property Type	Room Use	Median Lux	% of Area Meeting Req Lux	Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	Meets Criteria
Resi. Apartment										
Third	R29	Residential	Bedroom	564	100%	100	50%	50%	4380	YES
	R30	Residential	Bedroom	539	100%	100	50%	50%	4380	YES
	R31	Residential	LKD	169	42%	200	50%	50%	4380	NO
	R32	Residential	LKD	906	100%	200	50%	50%	4380	YES
	R33	Residential	Bedroom	366	100%	100	50%	50%	4380	YES
	R34	Residential	Bedroom	380	100%	100	50%	50%	4380	YES
	R35	Residential	Bedroom	466	100%	100	50%	50%	4380	YES
	R36	Residential	Bedroom	462	100%	100	50%	50%	4380	YES
	R37	Residential	LKD	184	48%	200	50%	50%	4380	NO
	R38	Residential	Bedroom	364	100%	100	50%	50%	4380	YES
	R39	Residential	Bedroom	368	100%	100	50%	50%	4380	YES
	R40	Residential	LKD	263	60%	200	50%	50%	4380	YES
	R41	Residential	Bedroom	417	100%	100	50%	50%	4380	YES
	R42	Residential	Bedroom	370	100%	100	50%	50%	4380	YES
	R43	Residential	LKD	650	97%	200	50%	50%	4380	YES
	R44	Residential	LKD	585	91%	200	50%	50%	4380	YES
	R45	Residential	Bedroom	317	100%	100	50%	50%	4380	YES
	R46	Residential	Bedroom	334	100%	100	50%	50%	4380	YES
	R47	Residential	LKD	184	48%	200	50%	50%	4380	NO
	R48	Residential	Bedroom	343	100%	100	50%	50%	4380	YES
	R49	Residential	Bedroom	278	100%	100	50%	50%	4380	YES
	R50	Residential	Bedroom	48	8%	100	50%	50%	4380	NO
	R51	Residential	LKD	202	52%	200	50%	50%	4380	YES
	R52	Residential	LKD	546	99%	200	50%	50%	4380	YES
	R53	Residential	Bedroom	307	100%	100	50%	50%	4380	YES
	R54	Residential	Bedroom	308	100%	100	50%	50%	4380	YES
	R55	Residential	LKD	597	99%	200	50%	50%	4380	YES
	R56	Residential	LKD	295	93%	200	50%	50%	4380	YES

Table 18: Illuminance Results – Resi. Apartment Third Floor

Floor Ref	Room Ref	Property Type	Room Use	Median Lux	% of Area Meeting Req Lux	Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	Meets Criteria
Resi. Apartment										
Fourth	R1	Residential	LKD	654	99%	200	50%	50%	4380	YES
	R2	Residential	Bedroom	543	100%	100	50%	50%	4380	YES
	R3	Residential	Bedroom	566	100%	100	50%	50%	4380	YES
	R4	Residential	LKD	241	60%	200	50%	50%	4380	YES
	R5	Residential	Bedroom	897	100%	100	50%	50%	4380	YES
	R6	Residential	Bedroom	458	100%	100	50%	50%	4380	YES
	R7	Residential	Bedroom	455	100%	100	50%	50%	4380	YES
	R8	Residential	LKD	930	100%	200	50%	50%	4380	YES
	R9	Residential	Bedroom	472	100%	100	50%	50%	4380	YES
	R10	Residential	LKD	332	96%	200	50%	50%	4380	YES
	R11	Residential	LKD	648	100%	200	50%	50%	4380	YES
	R12	Residential	Bedroom	338	100%	100	50%	50%	4380	YES

Table 19: Illuminance Results – Resi. Apartment Fourth Floor

Floor Ref	Room Ref	Property Type	Room Use	Median Lux	% of Area Meeting Req Lux	Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	Meets Criteria
DP-01-02										
Ground	R1	Residential	LKD	461	100%	200	50%	50%	4380	YES
	R2	Residential	Bedroom	158	99%	100	50%	50%	4380	YES
	R3	Residential	LKD	279	64%	200	50%	50%	4380	YES
	R4	Residential	Bedroom	347	100%	100	50%	50%	4380	YES
First	R1	Residential	LKD	307	85%	200	50%	50%	4380	YES
	R2	Residential	LKD	330	72%	200	50%	50%	4380	YES
Second	R1	Residential	Bedroom	645	100%	100	50%	50%	4380	YES
	R2	Residential	Bedroom	301	100%	100	50%	50%	4380	YES
	R3	Residential	Bedroom	506	100%	100	50%	50%	4380	YES
	R4	Residential	Bedroom	195	83%	100	50%	50%	4380	YES
	R5	Residential	Bedroom	273	100%	100	50%	50%	4380	YES

Table 20: Illuminance Results DP-01-02

Floor Ref	Room Ref	Property Type	Room Use	Median Lux	% of Area Meeting Req Lux	Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	Meets Criteria
DP-03-04										
Ground	R1	Residential	LKD	310	71%	200	50%	50%	4380	YES
	R2	Residential	LKD	294	68%	200	50%	50%	4380	YES
	R3	Residential	Bedroom	291	100%	100	50%	50%	4380	YES
	R4	Residential	Bedroom	408	100%	100	50%	50%	4380	YES
	R5	Residential	Bedroom	283	99%	100	50%	50%	4380	YES
	R6	Residential	Bedroom	357	100%	100	50%	50%	4380	YES
First	R1	Residential	LKD	173	43%	200	50%	50%	4380	NO
	R2	Residential	LKD	189	48%	200	50%	50%	4380	NO
Second	R1	Residential	Bedroom	625	100%	100	50%	50%	4380	YES
	R2	Residential	Bedroom	166	94%	100	50%	50%	4380	YES
	R3	Residential	Bedroom	241	100%	100	50%	50%	4380	YES
	R4	Residential	Bedroom	642	100%	100	50%	50%	4380	YES
	R5	Residential	Bedroom	170	94%	100	50%	50%	4380	YES
	R6	Residential	Bedroom	241	100%	100	50%	50%	4380	YES

Table 21: Illuminance Results DP-03-04

Floor Ref	Room Ref	Property Type	Room Use	Median Lux	% of Area Meeting Req Lux	Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	Meets Criteria
DP-05-06										
Ground	R1	Residential	LKD	306	74%	200	50%	50%	4380	YES
	R2	Residential	LKD	299	73%	200	50%	50%	4380	YES
	R3	Residential	Bedroom	295	100%	100	50%	50%	4380	YES
	R4	Residential	Bedroom	417	100%	100	50%	50%	4380	YES
	R5	Residential	Bedroom	295	100%	100	50%	50%	4380	YES
	R6	Residential	Bedroom	417	100%	100	50%	50%	4380	YES
First	R1	Residential	LKD	197	50%	200	50%	50%	4380	YES
	R2	Residential	LKD	205	51%	200	50%	50%	4380	YES
Second	R1	Residential	Bedroom	644	100%	100	50%	50%	4380	YES
	R2	Residential	Bedroom	178	95%	100	50%	50%	4380	YES
	R3	Residential	Bedroom	644	100%	100	50%	50%	4380	YES
	R4	Residential	Bedroom	260	100%	100	50%	50%	4380	YES
	R5	Residential	Bedroom	177	95%	100	50%	50%	4380	YES
	R6	Residential	Bedroom	253	100%	100	50%	50%	4380	YES

Table 22: Illuminance Results DP-05-06

Floor Ref	Room Ref	Property Type	Room Use	Median Lux	% of Area Meeting Req Lux	Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	Meets Criteria
DP-07-08-09										
Ground	R1	Residential	LKD	311	74%	200	50%	50%	4380	YES
	R2	Residential	LKD	303	72%	200	50%	50%	4380	YES
	R3	Residential	LKD	281	67%	200	50%	50%	4380	YES
	R4	Residential	Bedroom	289	100%	100	50%	50%	4380	YES
	R5	Residential	Bedroom	420	100%	100	50%	50%	4380	YES
	R6	Residential	Bedroom	298	100%	100	50%	50%	4380	YES
	R7	Residential	Bedroom	423	100%	100	50%	50%	4380	YES
	R8	Residential	Bedroom	298	100%	100	50%	50%	4380	YES
	R9	Residential	Bedroom	423	100%	100	50%	50%	4380	YES
First	R1	Residential	LKD	207	51%	200	50%	50%	4380	YES
	R2	Residential	LKD	211	54%	200	50%	50%	4380	YES
	R3	Residential	LKD	197	49%	200	50%	50%	4380	NO
Second	R1	Residential	Bedroom	648	100%	100	50%	50%	4380	YES
	R2	Residential	Bedroom	180	94%	100	50%	50%	4380	YES
	R3	Residential	Bedroom	256	100%	100	50%	50%	4380	YES
	R4	Residential	Bedroom	641	100%	100	50%	50%	4380	YES
	R5	Residential	Bedroom	179	94%	100	50%	50%	4380	YES
	R6	Residential	Bedroom	252	100%	100	50%	50%	4380	YES
	R7	Residential	Bedroom	637	100%	100	50%	50%	4380	YES
	R8	Residential	Bedroom	151	81%	100	50%	50%	4380	YES
	R9	Residential	Bedroom	261	100%	100	50%	50%	4380	YES

Table 23: Illuminance Results DP-07-08-09

Floor Ref	Room Ref	Property Type	Room Use	Median Lux	% of Area Meeting Req Lux	Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	Meets Criteria
DP-10-11										
Ground	R1	Residential	LKD	399	99%	200	50%	50%	4380	YES
	R2	Residential	Bedroom	283	100%	100	50%	50%	4380	YES
	R3	Residential	LKD	222	56%	200	50%	50%	4380	YES
	R4	Residential	Bedroom	131	78%	100	50%	50%	4380	YES
First	R1	Residential	LKD	282	72%	200	50%	50%	4380	YES
	R2	Residential	LKD	290	69%	200	50%	50%	4380	YES
Second	R1	Residential	Bedroom	401	100%	100	50%	50%	4380	YES
	R2	Residential	Bedroom	692	100%	100	50%	50%	4380	YES
	R3	Residential	Bedroom	243	100%	100	50%	50%	4380	YES
	R4	Residential	Bedroom	177	78%	100	50%	50%	4380	YES
	R5	Residential	Bedroom	390	100%	100	50%	50%	4380	YES

Table 24: Illuminance Results DP-10-11

Table 25: Illuminance Results Summary

Property	Number of Rooms Tested	Rooms satisfying Criteria		Rooms not satisfying Criteria
		No.	%	
Resi. Apartment	272	228	84%	44
DP-10-11	11	11	100%	0
DP-07-08-09	21	20	95%	1
DP-05-06	14	14	100%	0
DP-03-04	14	12	86%	2
DP-01-02	11	11	100%	0
Total	343	296	86%	47

A summary of the results is provided above for the residential units. The results show that 86% of all rooms meet or exceed the BRE's minimum recommendations for internal daylight provision in dwellings. Therefore, we believe the proposed development performs at a high level for a scheme of this scale and aligns to national policy to ensure high quality sustainable development. The design team intend to improve this result in the coming we

5.3.2 Sunlight to Proposed Amenity Spaces

The BRE guide recommends:

"That for it to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least two hours of sunlight on 21 March."

The main communal open spaces and the open space was analysed. These areas are identified in the following figures and labelled for reference in the results Table 26

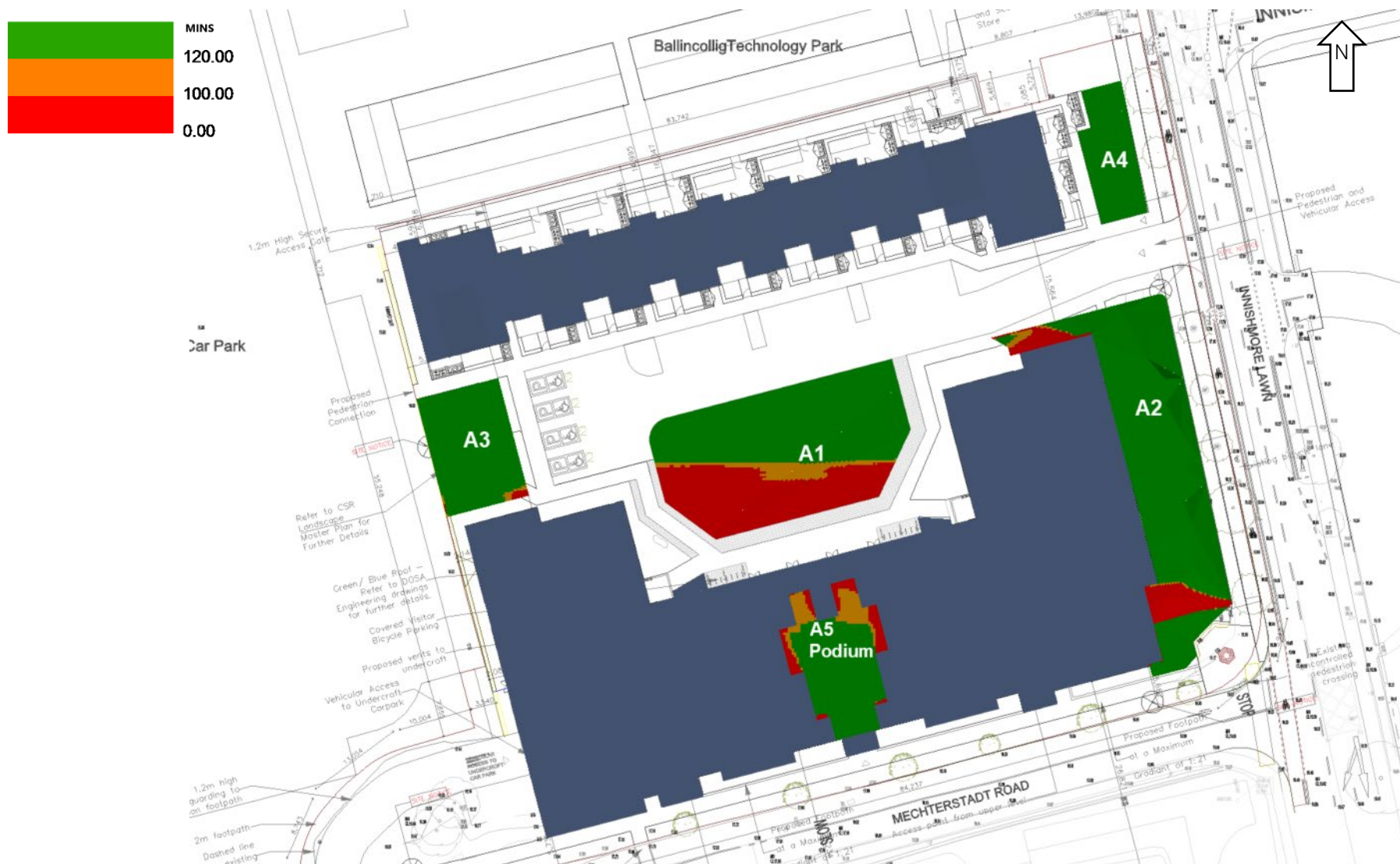


Figure 18: Proposed Resi. APT Amenity Space, 2hr Sunlight Test

Table 26: Open Spaces 2hr Sunlight Test Results

Open Space	Area (m ²)	2hr Sun Area (m ²)	% Area	Meets Criteria
Amenity A1	565.42	334.84	59.22%	YES
Amenity A2	570.94	498.16	87.25%	YES
Amenity A3	189.47	184.58	97.42%	YES
Amenity A4	117.61	117.61	100.00%	YES
Amenity A5 Podium	199.95	144.35	72.20%	YES
Total	1643.39	1279.54	77.86%	YES

The results show the open spaces that receive greater than 2 hours of sunlight on March 21st. The cumulative area of the spaces exceeds the recommended criteria for sunlight. It should be noted that the amenity area is in excess of the required area for such a scheme.

6 Conclusion

The analysis and assessments in this report have been carried out in line with the recommendations of BRE's "Site Layout Planning for daylight and sunlight, a Guide to good practice" (BRE Building Technology Group, 2022) and BS EN 17037.

There is no significant impact from the proposed development on surrounding buildings and therefore the proposed development will not affect:

- access to skylight to existing neighbouring buildings,
- access to sunlight to existing neighbouring buildings, and
- sunlight to gardens/open spaces to existing neighbouring buildings.

In terms of internal daylight levels within the proposed development, the results show that 86% of all rooms meet or exceed the BRE's minimum recommendations for internal daylight provision in dwellings. Therefore, we believe the proposed development performs at a high level for a scheme of this scale and aligns to national policy to ensure high quality sustainable development.

In order to maximise available light, glazing to all habitable rooms is in excess of 20%. The design team have developed the proposed building using the principles of the BRE's "Site Layout Planning for Daylight and Sunlight, A guide to good practice".

In terms of the amenity spaces provided the results show the open spaces that receive greater than 2 hours of sunlight on March 21st. The cumulative area of the spaces exceeds the recommended criteria for sunlight. It should be noted that the amenity area is in excess of the required area for such a scheme.

Overall, the development has been designed with due consideration for sunlight and daylight and meets the recommendations as set out in the BRE Guide – BR 209 "Site Layout Planning for Daylight and Sunlight, A guide to good practice (2022)."

Appendix A Proposed Illuminance Contours (with Room & Window Legends)

A.1 Proposed Residential Apartment

SDA % of Hours > req. lux

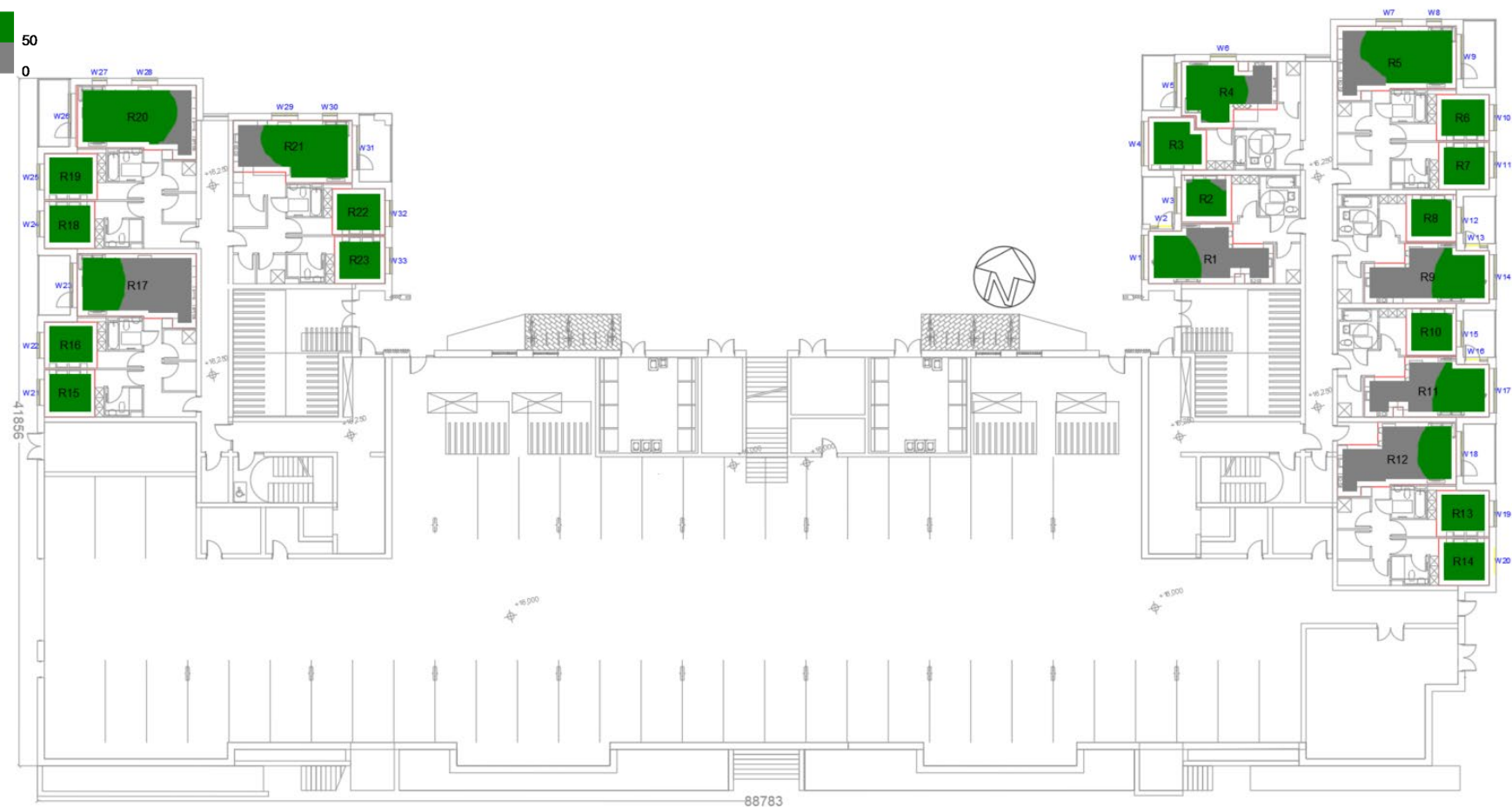


Figure 19: Resi. Apartment Lower Ground Floor sDA Contours

SDA % of Hours > req. lux



Figure 20: Resi. Apartment Ground Floor sDA Contours

SDA % of Hours > req. lux



Figure 21: Resi. Apartment First Floor sDA Contours



Figure 22: Resi. Apartment Second Floor sDA Contours

SDA % of Hours > req. lux



Figure 23: Resi. Apartment Third Floor sDA Contours

SDA % of Hours > req. lux

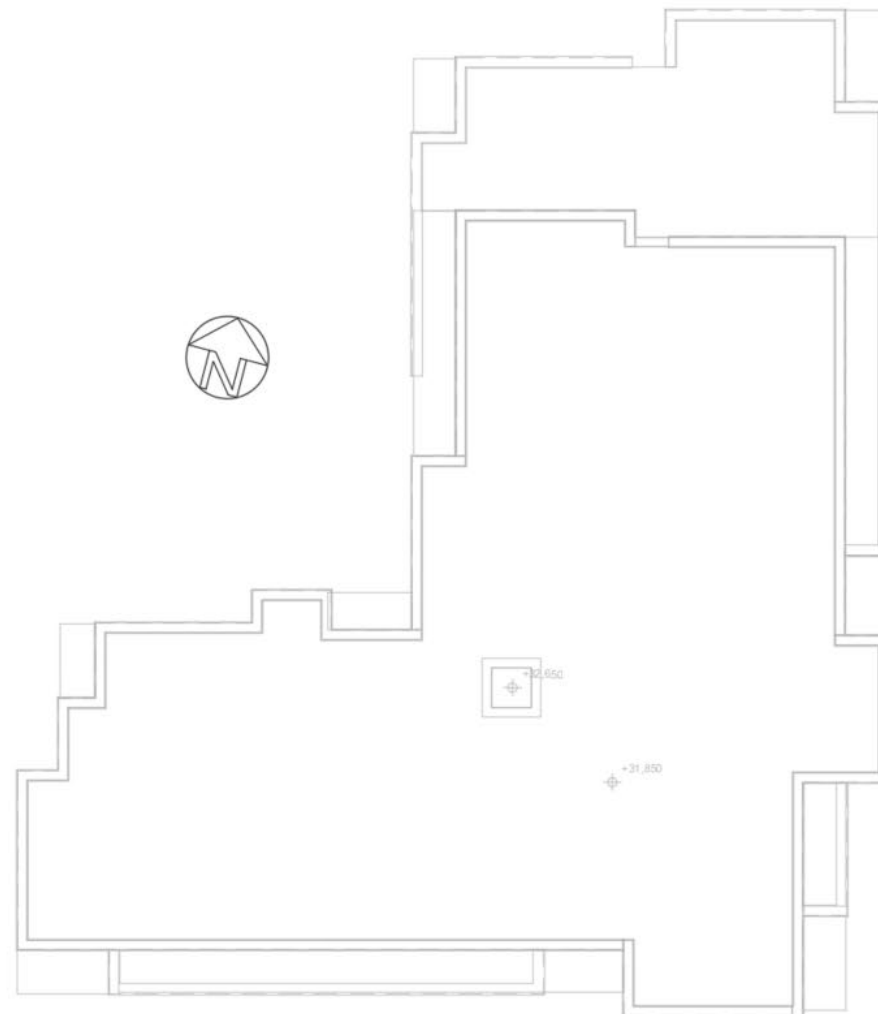


Figure 24: Resi. Apartment Forth Floor sDA Contours

A.2 Proposed Duplex Houses (DP-01-02)



Figure 25: DP-01-02 Ground Floor sDA Contours

SDA % of Hours > req. lux

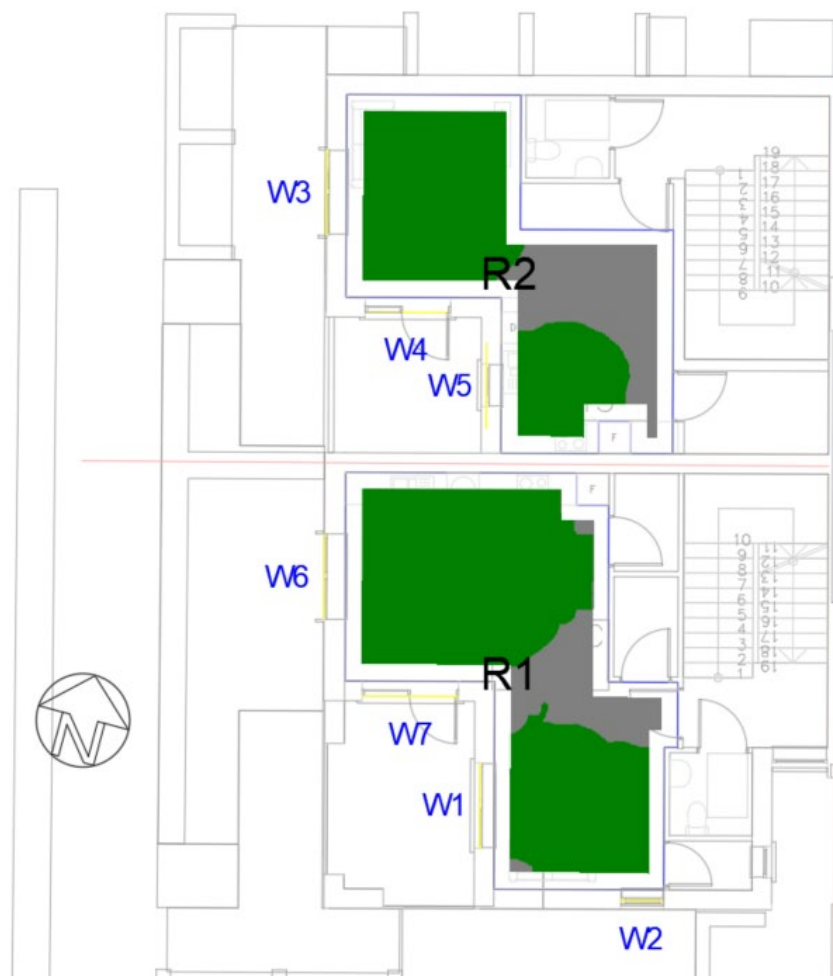


Figure 26: DP-01-02 First Floor sDA Contours

SDA % of Hours > req. lux



Figure 27: DP-01-02 Second Floor sDA Contours

A.3 Proposed Duplex Houses (DP-03-04)

SDA % of Hours > req. lux



Figure 28: DP-03-04 Ground Floor sDA Contours

SDA % of Hours > req. lux



Figure 29: DP-03-04 First Floor sDA Contours

SDA % of Hours > req. lux

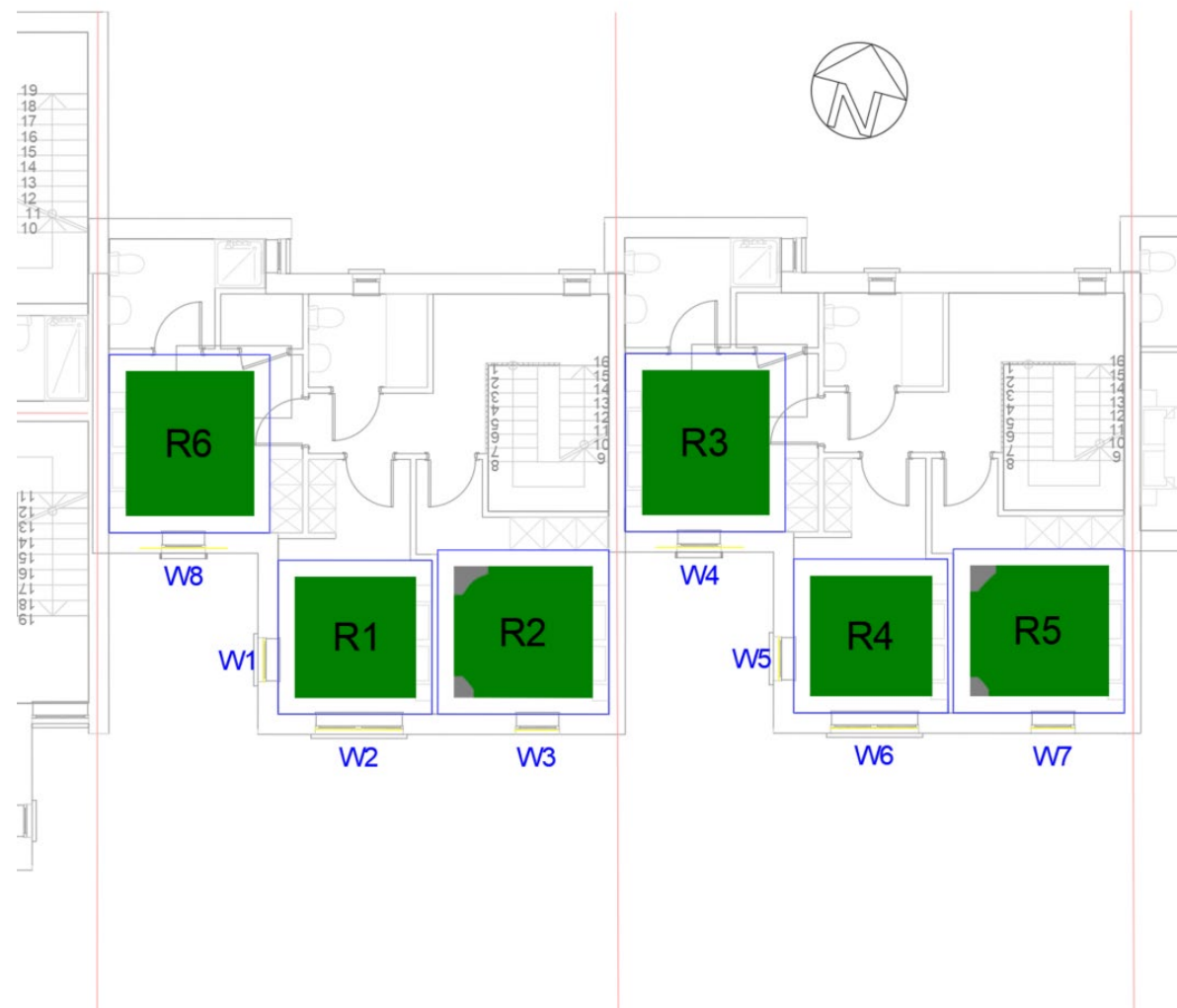


Figure 30: DP-03-04 Second Floor sDA Contours

A.4 Proposed Duplex Houses (DP-05-06)

SDA % of Hours > req. lux

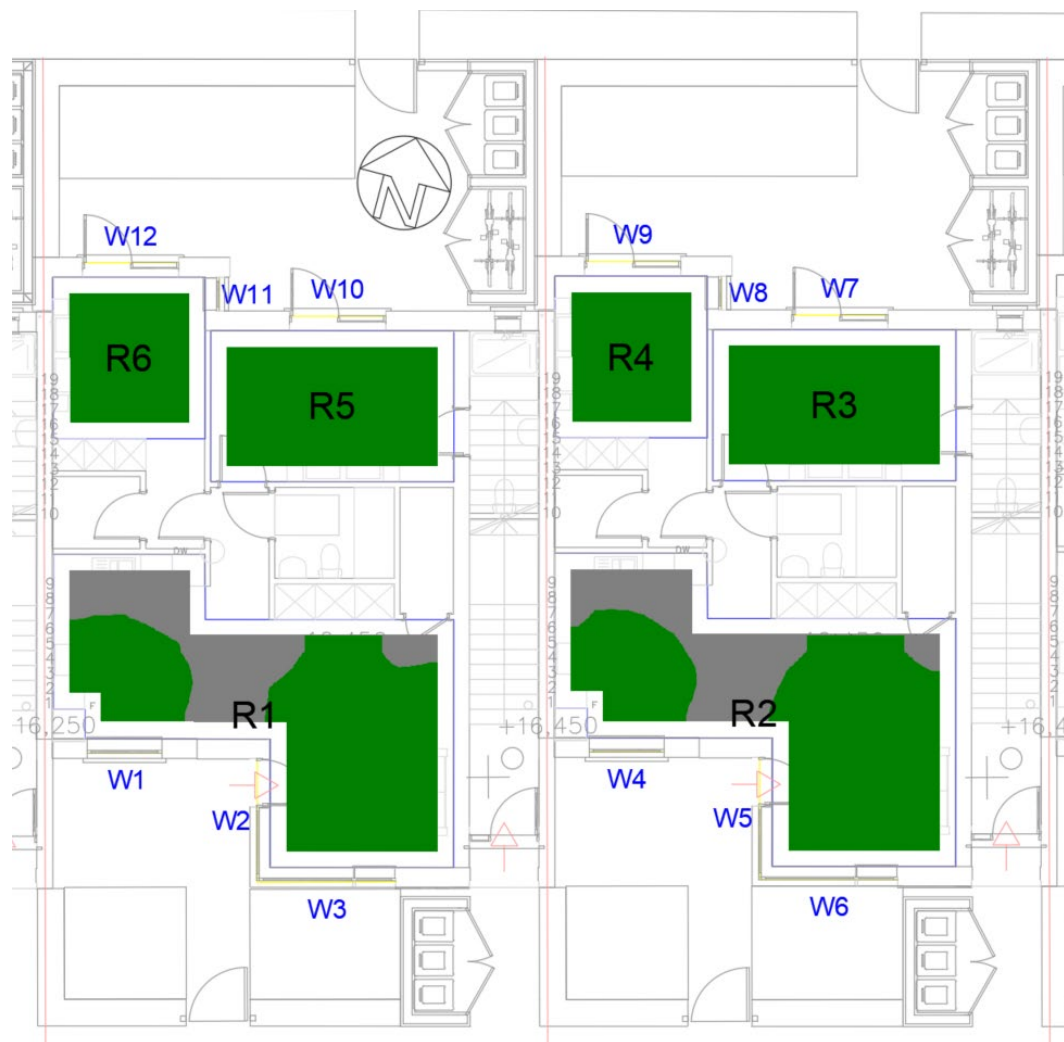


Figure 31: DP-05-06 Ground Floor sDA Contours

SDA % of Hours > req. lux

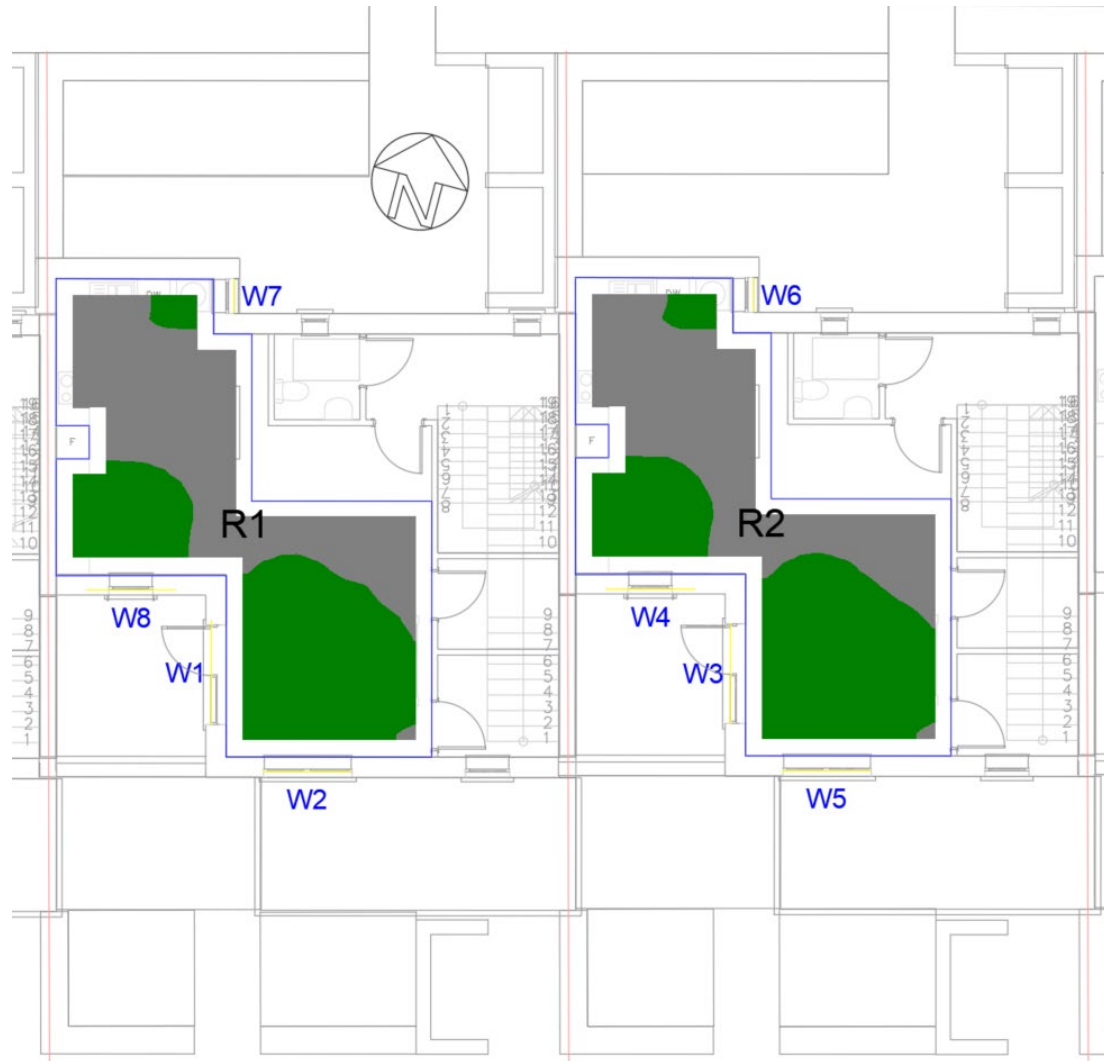


Figure 32: DP-05-06 First Floor sDA Contours

SDA % of Hours > req. lux

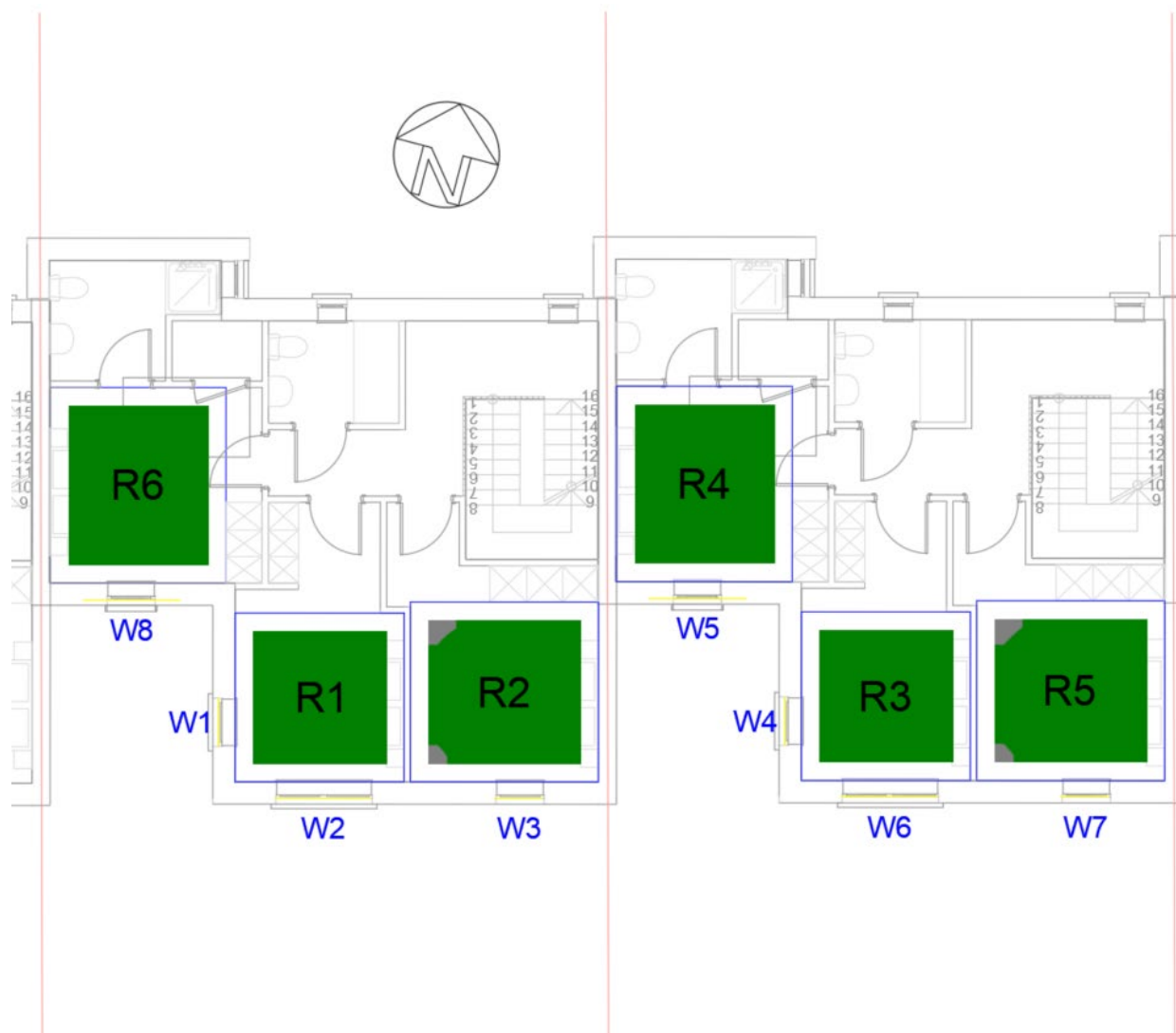


Figure 33: DP-05-06 Second Floor sDA Contours

A.5 Proposed Duplex Houses (DP-07-08-09)

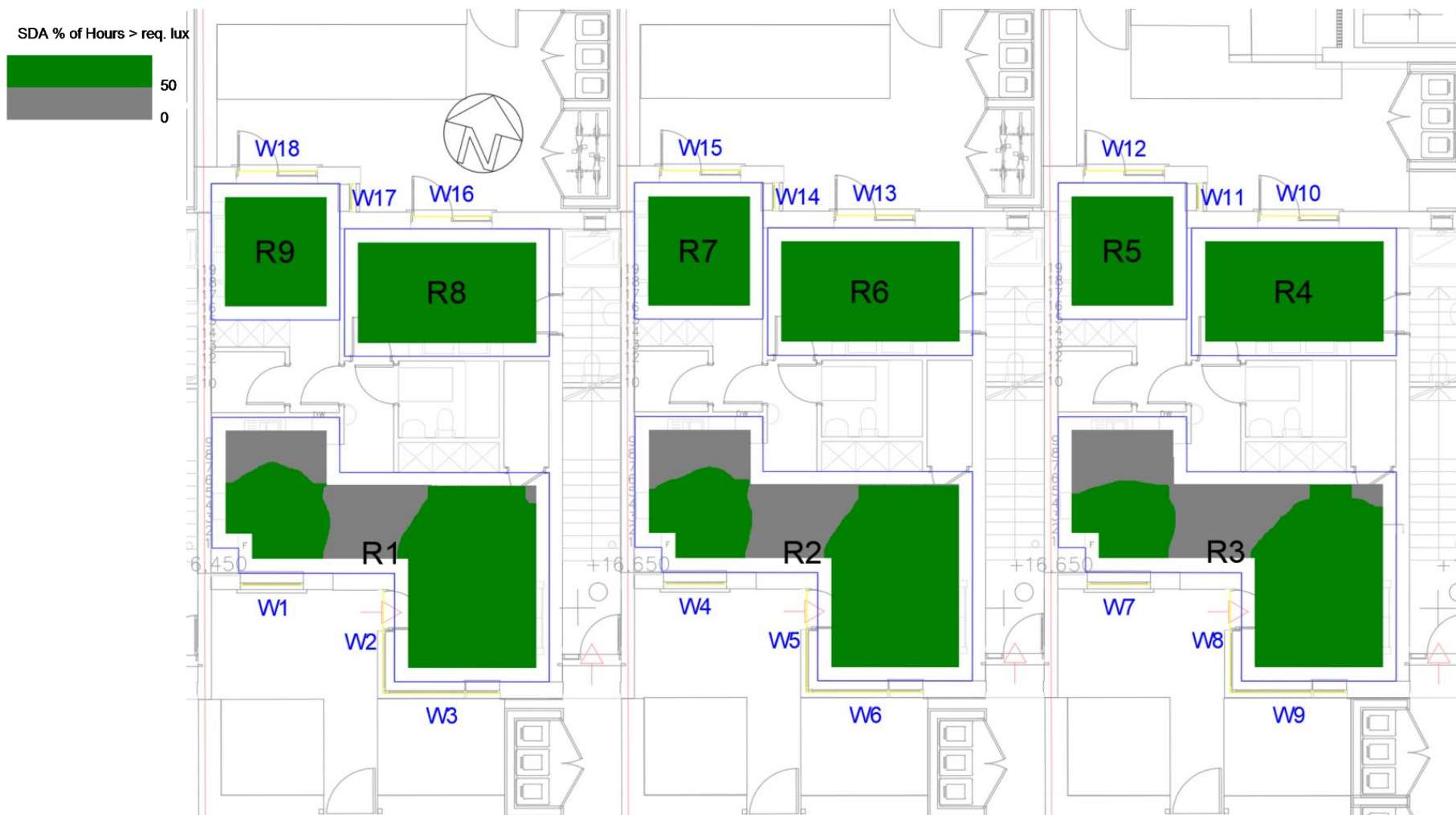


Figure 34: DP-07-08-09 Ground Floor sDA Contours

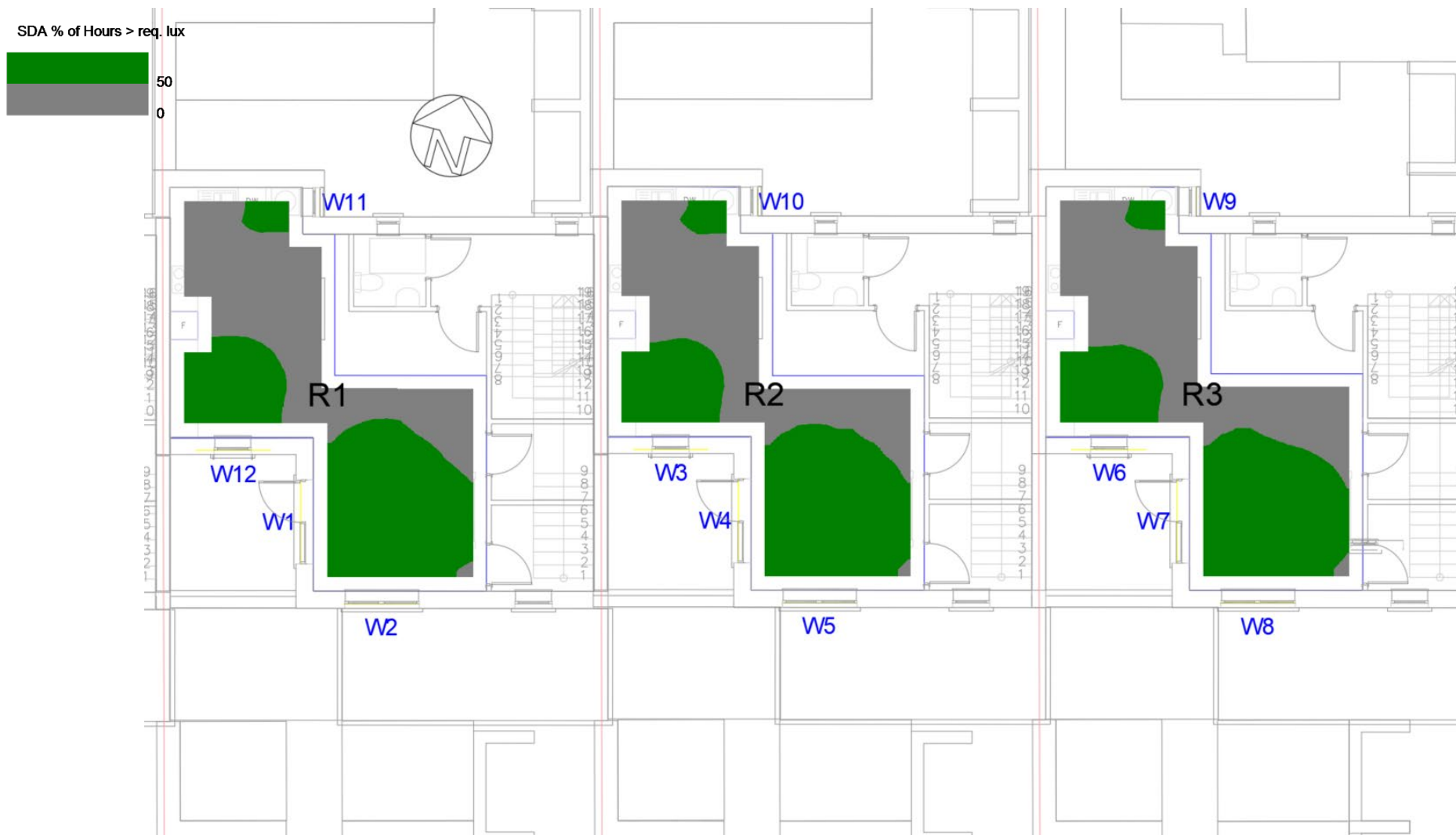


Figure 35: DP-07-08-09 First Floor sDA Contours

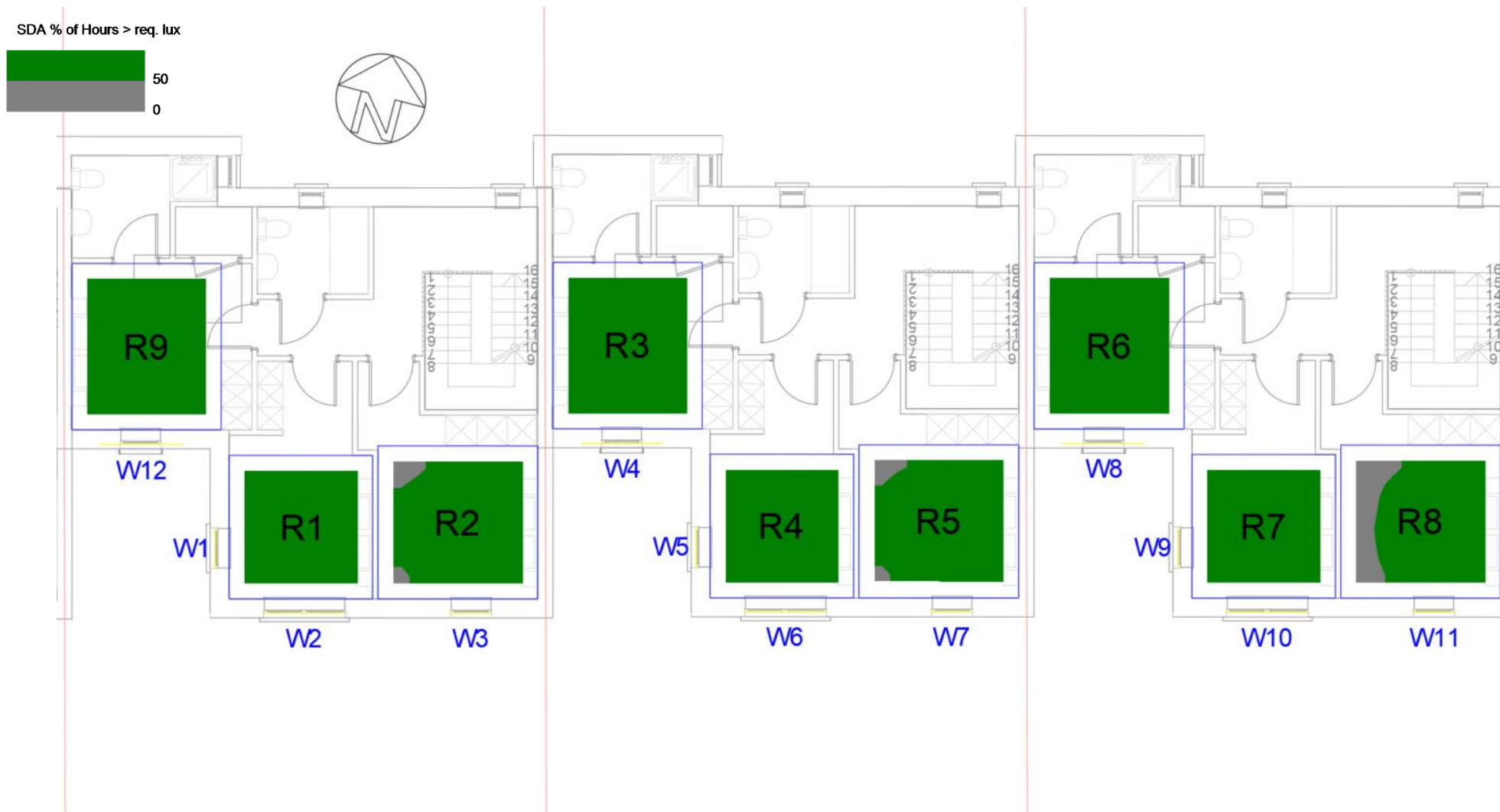


Figure 36: DP-07-08-09 Second Floor sDA Contours

A.6 Proposed Duplex Houses (DP-10-11)

SDA % of Hours > req. lux

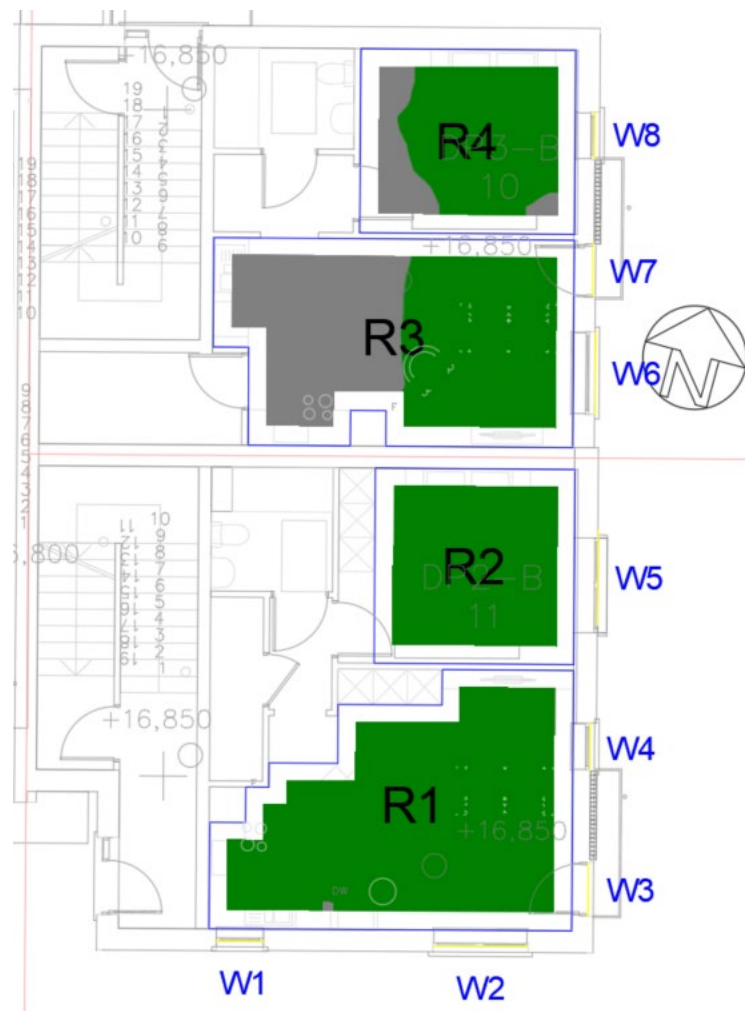


Figure 37: DP-10-11 Ground Floor sDA Contours

SDA % of Hours > req. lux

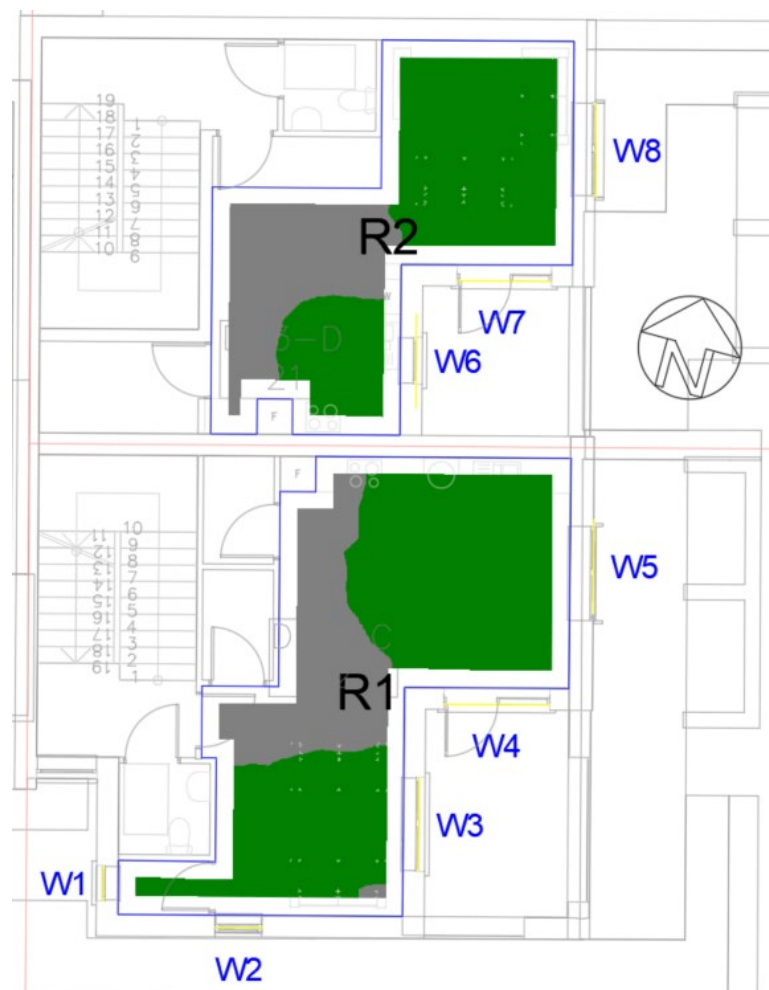


Figure 38: DP-10-11 First Floor sDA Contours

SDA % of Hours > req. lux

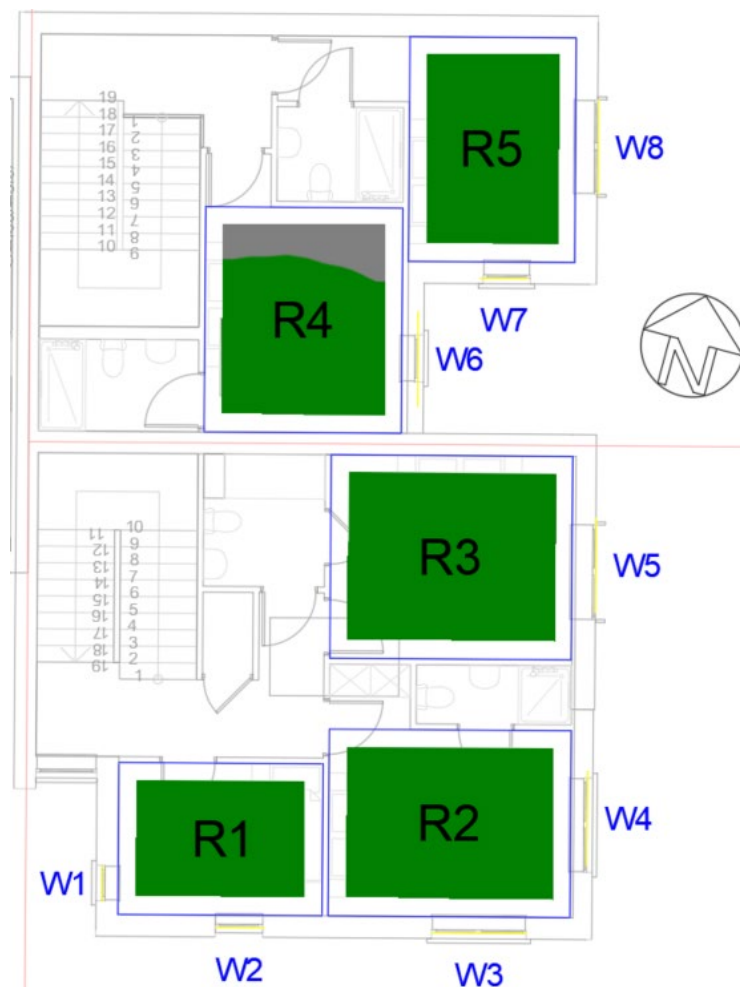


Figure 39: DP-10-11 Second Floor sDA Contours

Appendix B Shadow Images

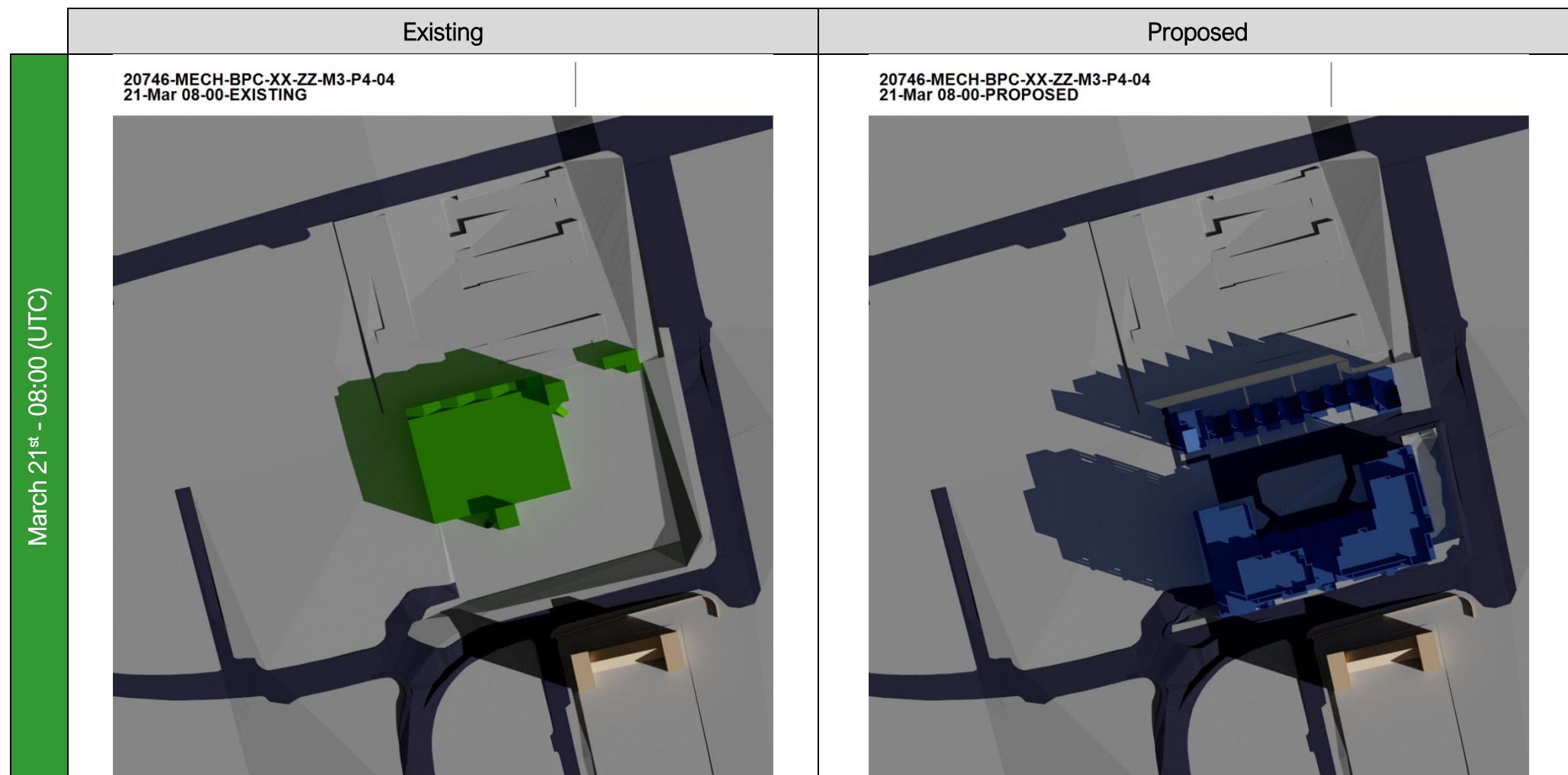
Shadow plots are used to show the shadows which the proposed building makes. *“In interpreting the impact of such differences, it must be borne in mind that nearly all structures will create areas of new shadow, and some degree of transient overshadowing of a space is to be expected.”* (BRE Building Technology Group, 2022)

Shadow plots were created for March 21st and June 21st. March 21st is the equinox and as such provides the average level of shadowing that can be expected. June 21st

is a summertime plot and represents the best case for shadow. (December 21st has not been plotted as at this time of year even low buildings will cast long shadows. In a built-up area, it is common for large areas of the ground to be in shadow in December.)

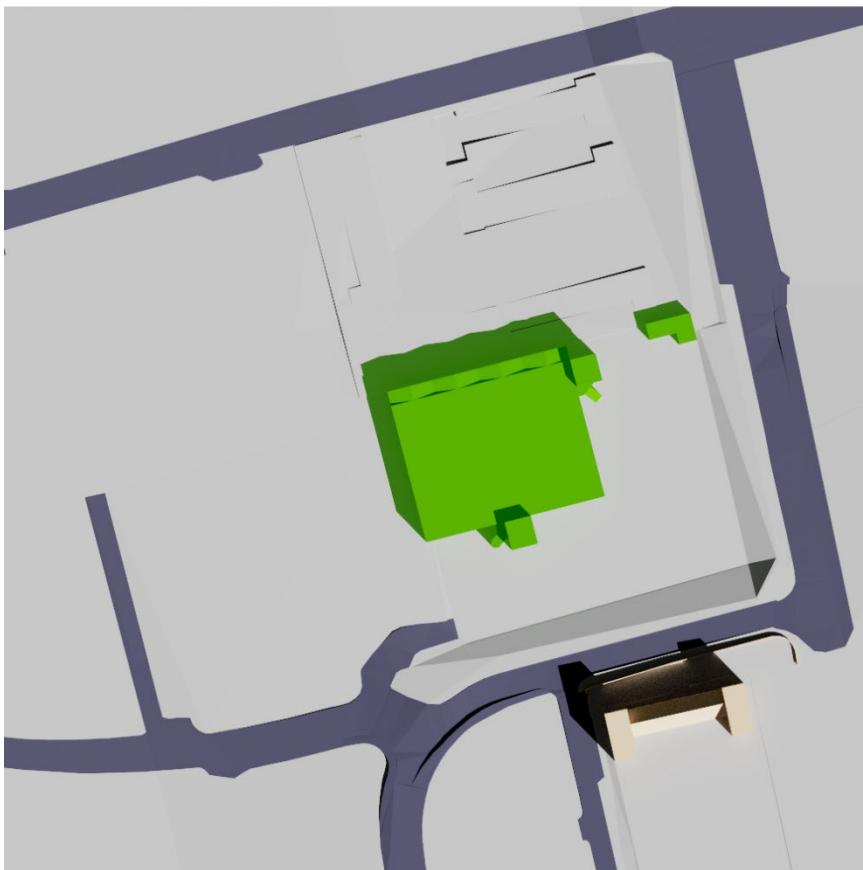
The shadow plots are purely illustrative (as opposed to other quantitative or quantitative metrics used in the analysis).

B.1 March 21st

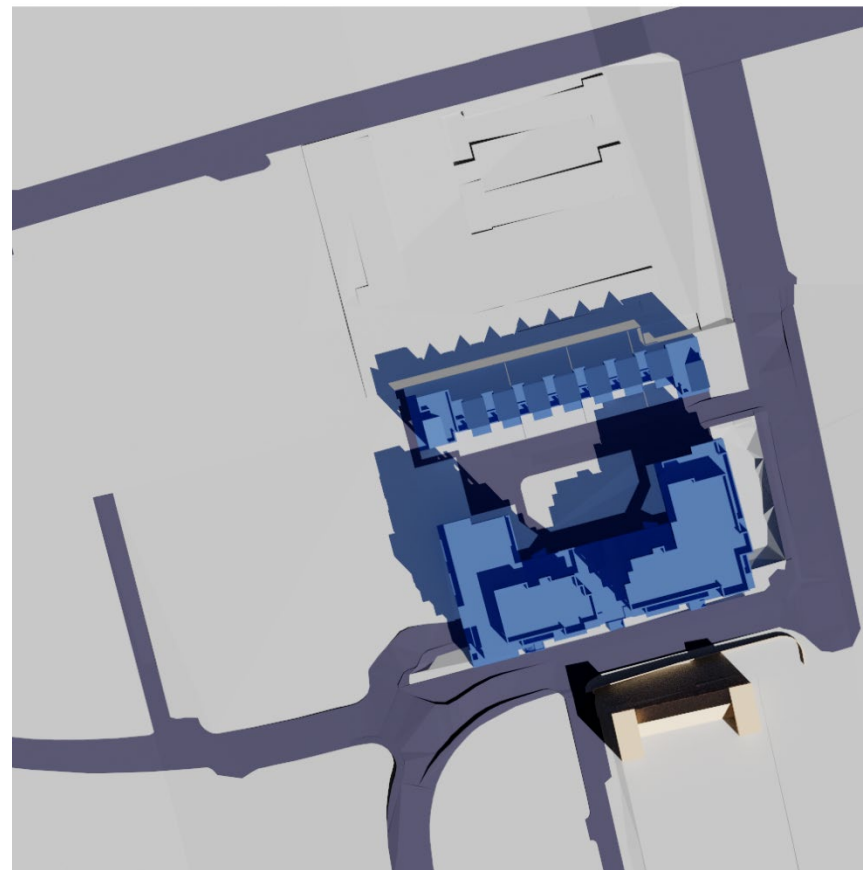


March 21st – 10:00 (UTC)

20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Mar 10-00-EXISTING



20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Mar 10-00-PROPOSED

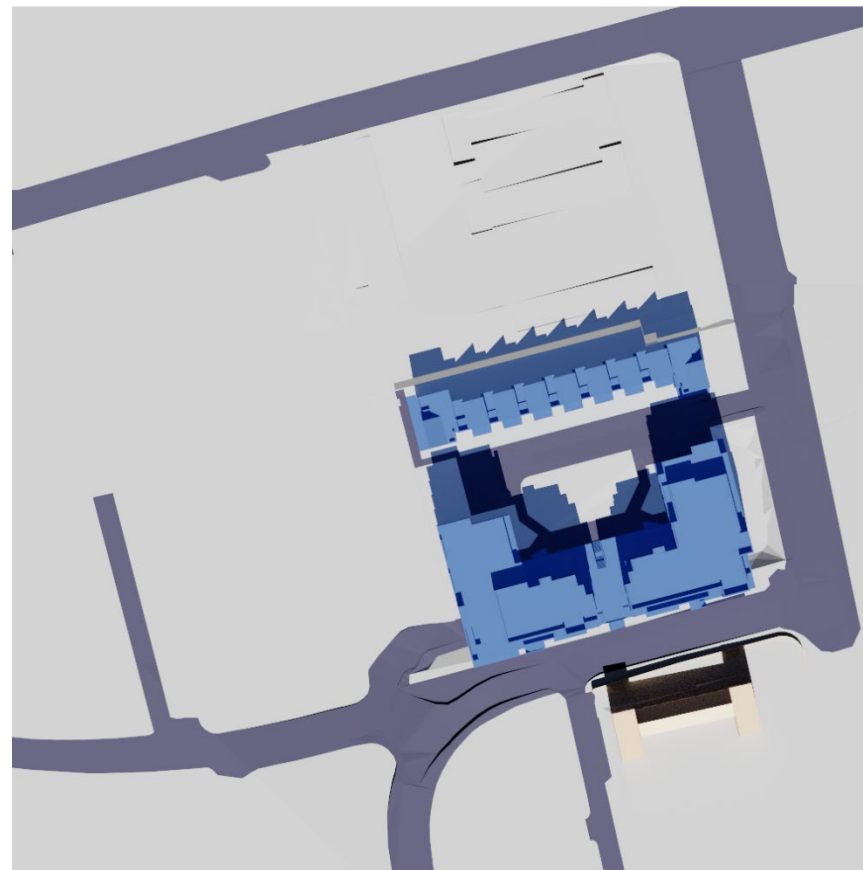


March 21st - 12:00 (UTC)

20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Mar 12-00-EXISTING



20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Mar 12-00-PROPOSED

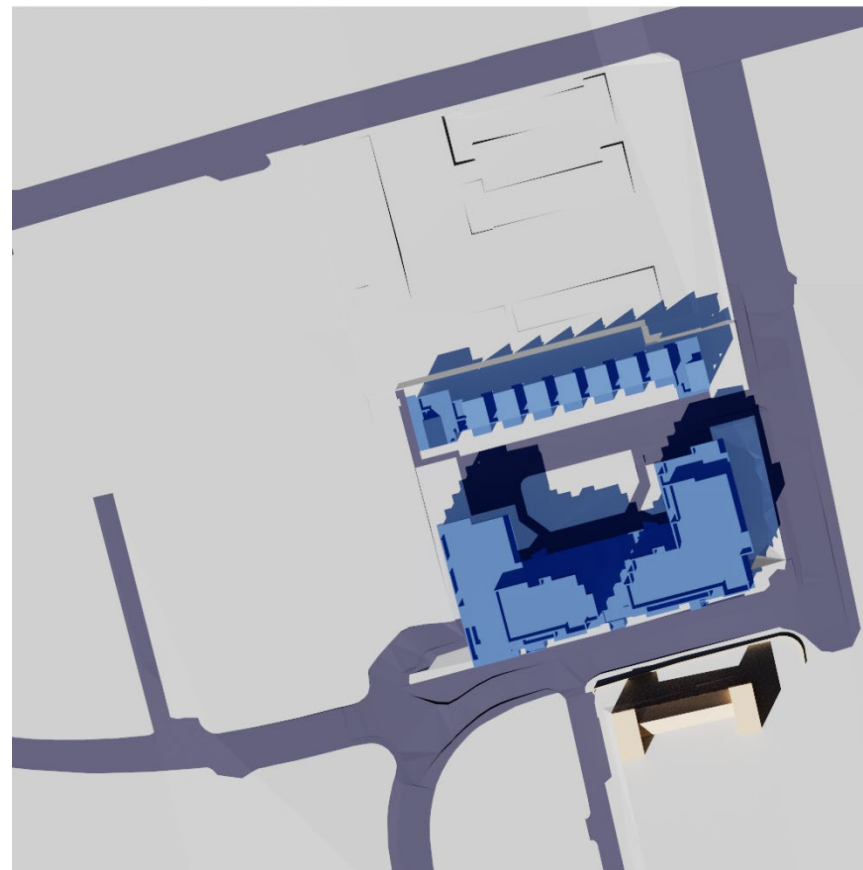


March 21st - 14:00 (UTC)

20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Mar 14-00-EXISTING



20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Mar 14-00-PROPOSED

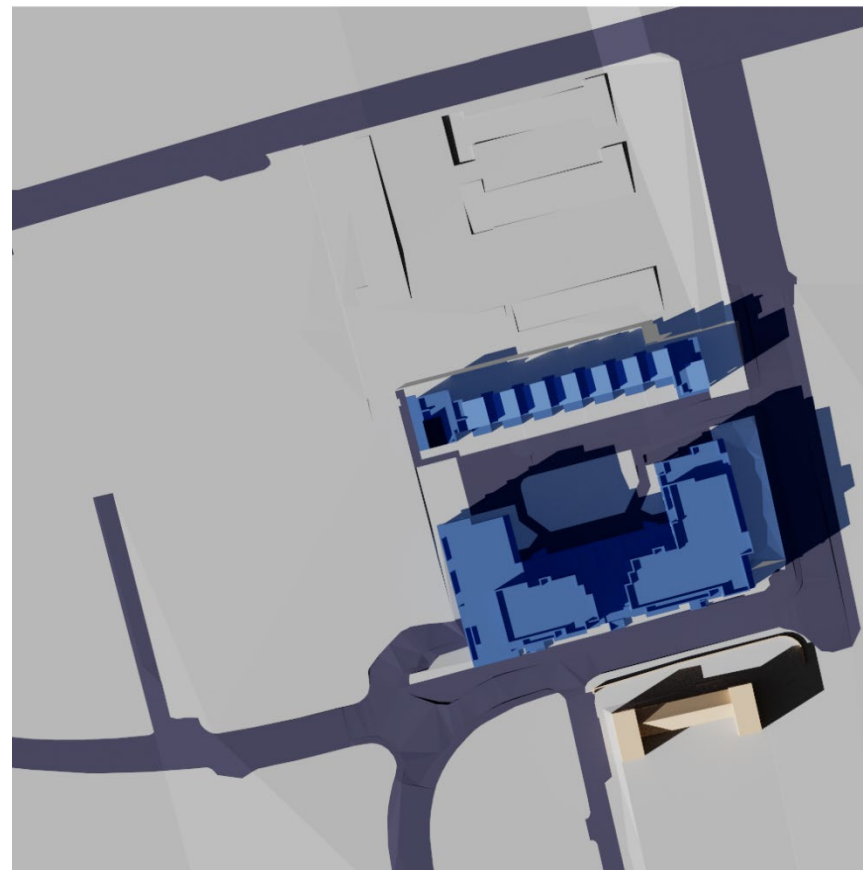


March 21st - 16:00 (UTC)

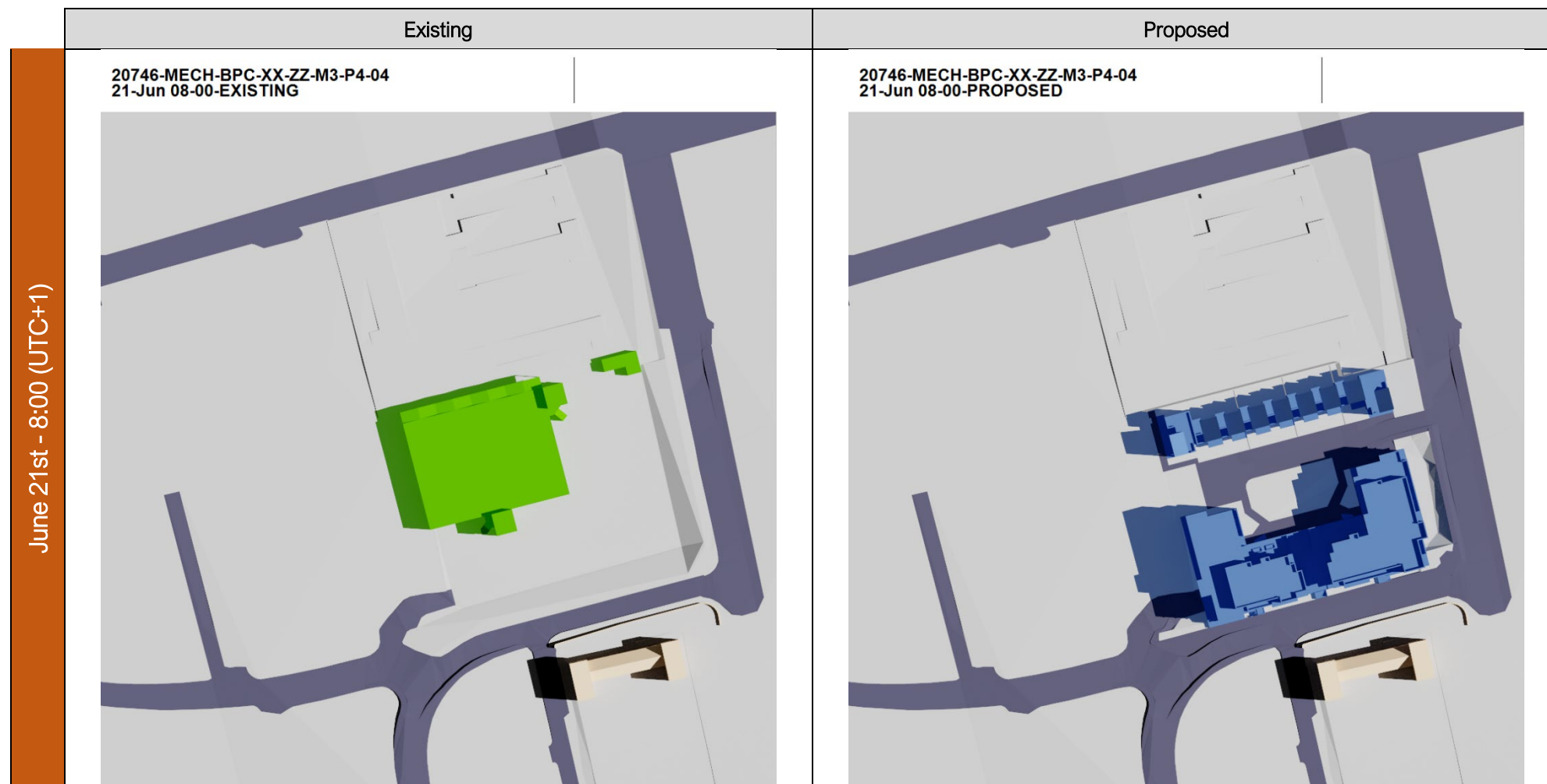
20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Mar 16-00-EXISTING



20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Mar 16-00-PROPOSED



B.2 June 21st

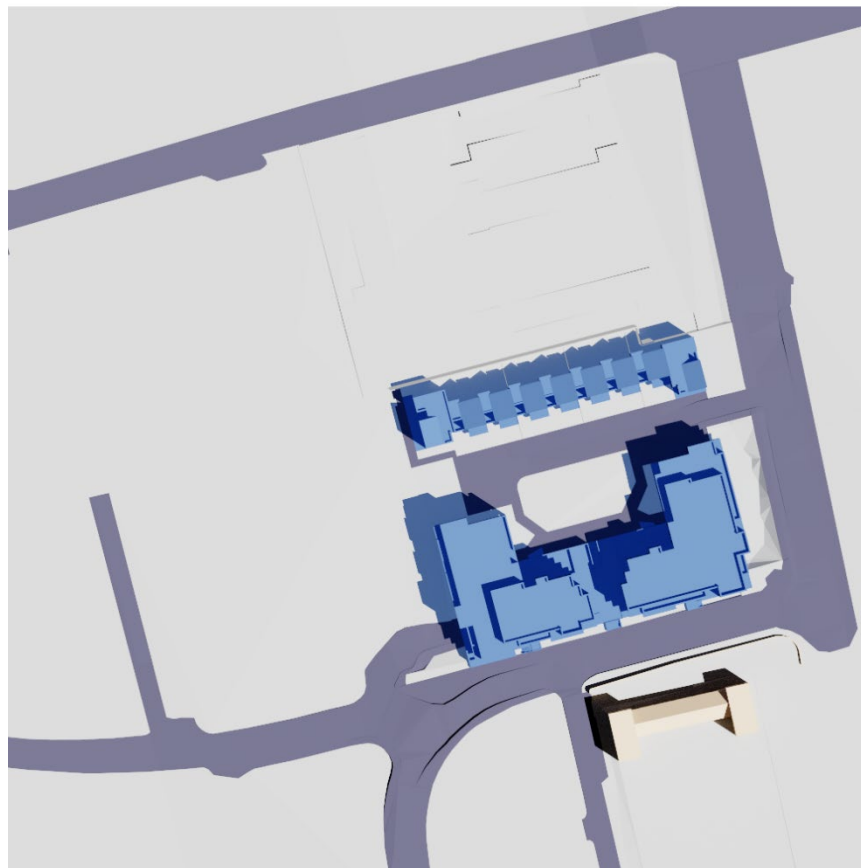


June 21st - 10:00 (UTC+1)

20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Jun 10-00-EXISTING



20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Jun 10-00-PROPOSED



June 21st - 12:00 (UTC+1)

20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Jun 12-00-EXISTING



20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Jun 12-00-PROPOSED

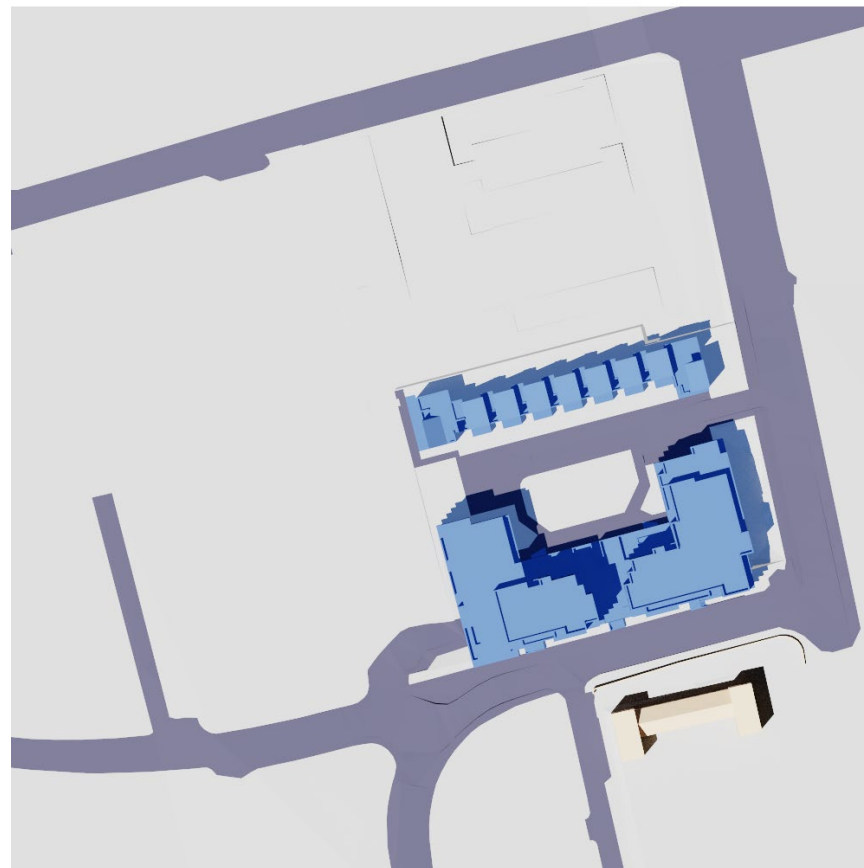


June 21st - 14:00 (UTC+1)

20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Jun 14-00-EXISTING



20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Jun 14-00-PROPOSED



June 21st - 16:00 (UTC+1)

20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Jun 16:00-EXISTING

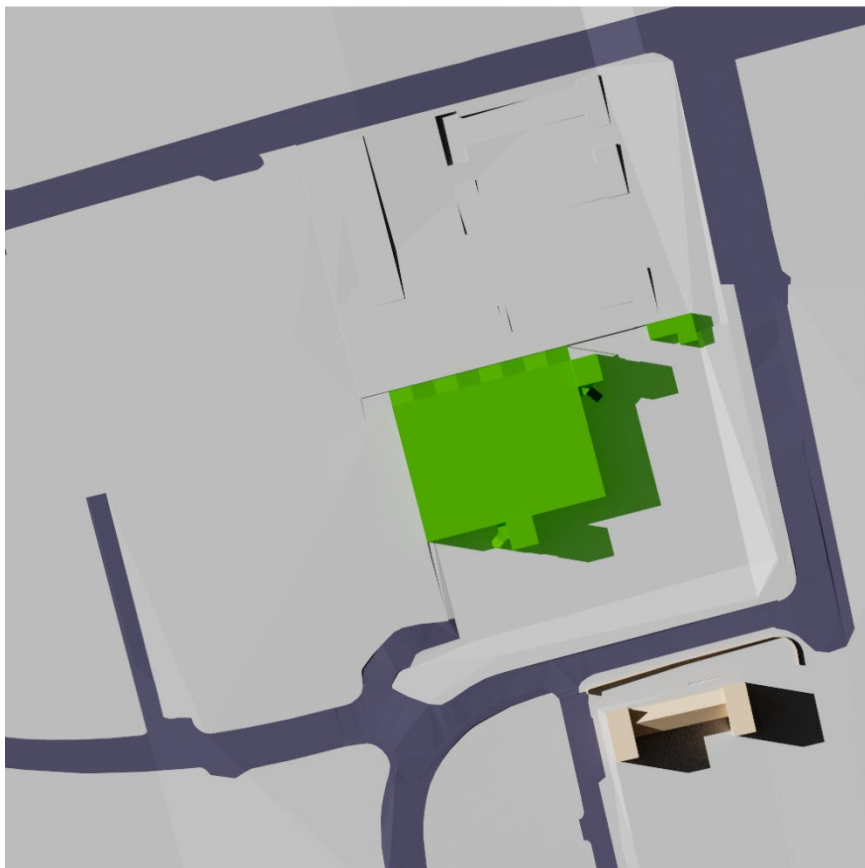


20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Jun 16:00-PROPOSED

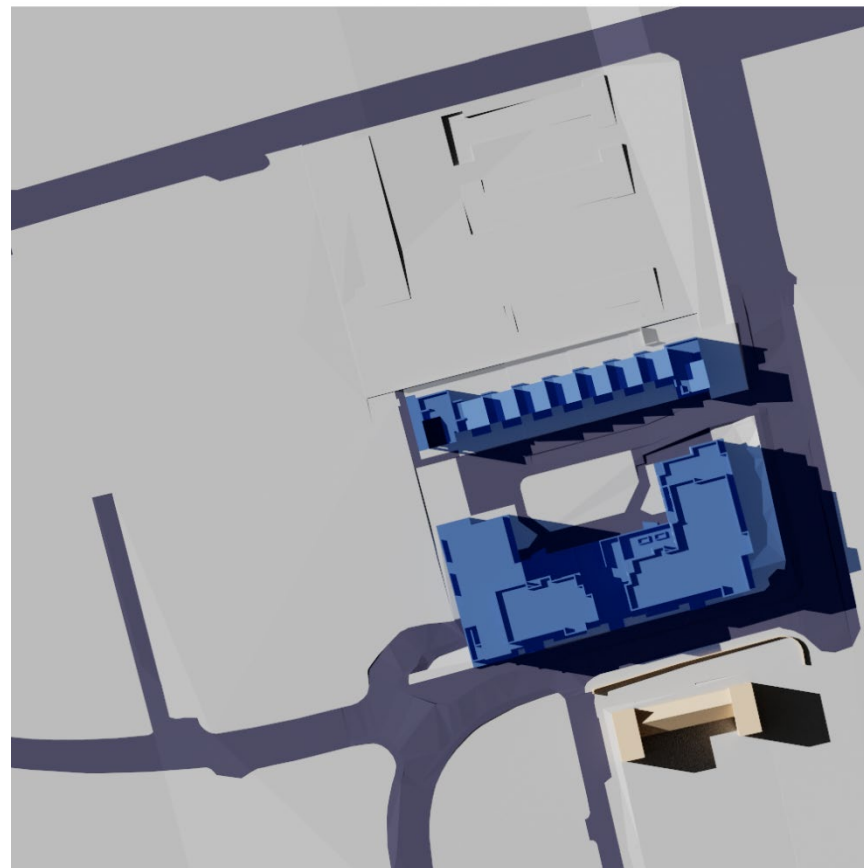


June 21st – 18:00 (UTC+1)

20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Jun 18-00-EXISTING



20746-MECH-BPC-XX-ZZ-M3-P4-04
21-Jun 18-00-PROPOSED



7 Bibliography

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