DAYLIGHT, SUNLIGHT AND OVERSHADOWING ASSESSMENT

for the

THE REDEVELOPMENT OF THE FORMER CHIVER'S FACTORY SITE

at

COOLOCK DRIVE
DUBLIN 17

for

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04	05/09/2018	77	DRAFT_DESIGN TEAM REVIEW	SC	CMcC	MR
03	04/09/2018	78	DRAFT_DESIGN TEAM REVIEW	SC	CMcC	MR
02	31/08/2018	66	DRAFT_DESIGN TEAM REVIEW	SC	CMcC	MR
01	24/08/2018	47	DRAFT_DESIGN TEAM REVIEW	SC	CMcC	MR
00	06/04/2018	48	DRAFT_DESIGN TEAM REVIEW	SC	CMcC	MR

CONTENTS

APPENDIX B DAYLIGHT DISTRIBUTION IMAGES

APPENDIX C SHADOW IMAGES

EXECUTIVE SUMMARY

METEC Consulting Engineers have been instructed by our client, Platinum Land Ltd, to carry out an assessment of the Daylight and Sunlight levels that will be achieved by the proposed dwellings at the former Chivers Factory Site, Coolock Drive, Coolock. This report also assesses the impact, if any, that the proposed development will have on the existing surrounding properties in terms of Daylight, Sunlight and Overshadowing.

Description of the Proposed Development

Our client is proposing the redevelopment of the former Chivers Factory Site, where, following demolition of existing buildings, the site would be redeveloped to accommodate 495 apartments, communal facilities, private amenity space, communal open space, public open space, car parking, bicycle parking, community / recreation space that includes a crèche, café and gym. In addition the proposed development includes road and pedestrian improvements.

Overall Methodology

The assessment of the proposed development was prepared using the methodology's set out in the British Standard: Lighting for Buildings – Part 2: Code for Practice for Daylighting, BRE 209, 'Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice', Second Edition 2011, by P. J. Littlefair and the Design Standards for New Apartments - Guidelines for Planning Authorities (March 2018).

BRE Guide and Advisory Note

The numerical guidelines given in these documents are purely advisory. The BRE Guide states that:

"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." "It is purely advisory and the numerical target values within it may be varied to meet the needs of the development and its location".

Overall Conclusion.

In our opinion, after carrying out a comprehensive daylight and sunlight assessment of the proposed development using simulation modelling and comparing results achieved against the BRE Guide and BS recommended guidelines, based on the results in this report we see no reason to refuse planning permission on these grounds.

Executive Summary Results Table

Design Parameters which have been reviewed as part of this study	Methodology	Recommended Guidelines (note these are not mandatory values)	Compliance achieved in line with BRE Guide & BS 8206-2
Vertical Sky Component (VSC) (Referring to nearby 3rd Party Residential)	IES VE Radiance Daylight Simulation	**BRE Guide [2.2]** • VSC ≥ 27% (Or where that is not achieved) • ≤ 20% reduction in VSC compared to its previous value before the proposed development (as simulated)	All calculated VSCs achieve the BRE recommended guidelines for maintaining daylight. Therefore, this confirms that all 3rd party nearby residential amenity in terms of access to daylight achieve the recommended guidelines for safeguarding daylight with the proposed development in place. Refer to Section 8.0 of this Report for a more in depth commentary.
Average Daylight Factor (ADF) (Referring to the Proposed Development)	IES VE Radiance Daylight Simulation	**BRE Guide [2.1.8]** • 2% for Kitchens • 1.5% for Living Rooms • 1% for Bedrooms	Of the 202 Apartments (Blocks A1 and A2 ground, first, second, third and fourth floors, and Blocks B and C ground and first floor) analysed as part of this study, which included 580 individual rooms, 97% achieved the BRE metric for daylight levels. Those that did not achieve the BRE metric for daylight levels (calculated to be 3%) were found to be only marginally short (typically within 10% of the target value). However when using the 1.5% guideline target for Kitchen Living Dining areas which is applicable to living rooms, 100% of the assessed rooms achieved the BRE Guide recommended daylight levels. If all apartments were analysed i.e. the inclusion of more upper floors, the percentage pass rate would increase further because the Average Daylight Factor of the upper floors are even less obstructed. Refer to Section 9.0 of this Report for a more in depth commentary.

Design Parameters which have been reviewed as part of this study	Methodology	Recommended Guidelines (note these are not mandatory values)	Compliance achieved in line with BRE Guide & BS 8206-2
Sunlight Assessment on <u>Adjacent Neighbouring Buildings</u> – Annual Probable Sunlight Hours (APSH) **(Referring to nearby 3rd Party Residential)**	IES VE SunCast Simulation	**BRE Guide [3.2.]** • Receives more than 25% of annual probable sunlight hours, and more than 5% of annual probable sunlight hours between 21st September and 21st March; (Or where that is not achieved) • ≤ 20% reduction in APSH compared to its previous value before the proposed development (as simulated) • Has a reduction in sunlight received over the whole year less than 4% of annual probable sunlight hours.	All calculated Annual Probable Sunlight Hours achieve the BRE recommended values for safeguarding access to sunlight in existing dwellings. Therefore 3rd party residential amenity in terms of access to sunlight when compared with their existing baseline experience shall not compromised as a result of this proposed development. Refer to Section 10.0 of this Report for a more in depth commentary.
Sunlight Assessment on <u>Proposed Buildings</u> – Annual Probable Sunlight Hours (APSH) **(Referring to Proposed Development)**	IES VE SunCast Simulation	**BRE Guide [3.1.15]** The centre of at least one window to a main living room can receive 25% of annual probable sunlight hours, including at least 5% of annual probable sunlight hours in the winter months between 21st of September and 21st March.	Based on the results presented within Section 11.0 of this report it can be seen that the elevations / facades of proposed development will receive very good levels of Sunlight. The majority of living rooms achieve the BRE Guide recommend metric for Sunlight availability (93% of living rooms during the winter months and 82% over the whole year). Those that have not fully achieved the BRE metrics, in the majority of cases were only marginally short of the threshold values.
Sunlight Assessment on <u>Amenity Space on</u> – Annual Probable Sunlight Hours (APSH) **(Referring to Proposed Development)**	IES VE SunCast Simulation	**BRE Guide [3.3]** 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 March.	The BRE Guide recommended criteria for safeguarding Sunlight in amenity spaces is achieved for this proposed development as **all** central courtyards exceed the recommended sunlight levels. Within the central courtyards, the play areas, seating and communal dining areas have been situated in areas that will receive the most amount of sunlight.

Design Parameters which have been reviewed as part of this study	Methodology	Recommended Guidelines (note these are not mandatory values)	Compliance achieved in line with BRE Guide & BS 8206-2
			Refer to Section 12.0 of this Report for a more in depth commentary.
Solar Shading **(Referring to nearby 3rd Party Residential)**	IES VE SunCast Simulation	**BRE Guide [3.3.17]** 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 the day and year.	Existing and proposed solar shading images have been presented to illustrate the shadows that will occur on March 21st and June 21st. While some additional shade is identified here, it is important to note that the results of the VSC simulation have demonstrated that the guidelines for maintaining light received by existing buildings with the proposed development in place have been achieved. Refer to Section 13.0 of this Report for a more in depth commentary.
Potential Adjoining Development Land **(Referring to Lands to the East and South of the Development Site)**	IES VE Radiance Daylight Simulation	**BRE Guide [2.3]** A development site next to a proposed new building will retain potential for good diffuse daylighting provided that on each common boundary (a)No new building, measured in a vertical section perpendicular to the boundary, from a point 1.6m above ground level, subtends an angle of more than 43° to the horizontal (b) Or if (a) is not satisfied, then all points 1.6m above the boundary line are within 4m (measured along the boundary) of a point which has a VSC (looking towards the new building(s) of 17% or more.	The BRE Guide recommended criteria for safeguarding the diffuse daylighting potential of the neighbouring site next to the proposed Chivers redevelopment is achieved because all points simulated 1.6m above the boundary line achieve a VSC (looking towards the new building(s) of 17% or more. Refer to Section 14.0 of this Report for a more in depth commentary.

1.0 INTRODUCTION

METEC Consulting Engineers have been instructed by our client, Platinum Land Ltd, to carry out an assessment of the Daylight and Sunlight levels that will be achieved by the proposed dwellings at the former Chivers Factory Site, Coolock Drive, Coolock. This report also assesses the impact, if any, that the proposed development will have on the existing surrounding properties in terms of Daylight, Sunlight and Overshadowing.

Daylight and Sunlight calculations have been carried out in accordance with BRE's 'Site Layout Planning for Sunlight and Daylight: A Guide to Good Practice' (2011) (herein referred to as the "BRE Guide") by P J Littlefair and BS 8206-2:2008 Lighting for Buildings – Part 2 Code of Practice for Daylighting, which are accepted as good practice guidelines by Planning Authorities. The Design Standards for New Apartments - Guidelines for Planning Authorities (March 2018) and the Urban Development and Building Heights – Guidelines for Planning Authorities (December 2018) were also considered as part of this study.

The BRE Guide gives advice on site layout to achieve provision of daylight and sunlight both within buildings, and in the open spaces between them. In general it aims to aid designers in considering the relationship between new and existing buildings to ensure that each retains the potential to achieve good daylighting and sunlight levels.

The BRE Guide states in the introduction that: *"The guide is intended for building designers and their clients, consultants and planning officials.* ***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. In special circumstances the developer or planning authority may wish to use different target values. For example, in a historic city centre, or in an area with modern high rise buildings, a higher degree of obstruction may be unavoidable if new developments are to match the height and proportions of existing buildings."*

It is therefore important that the guidelines that exist in relation to daylight and sunlight are read in the correct context and are not viewed as mandatory requirements for all dwellings.

2.0 SITE DESCRIPTION AND DEVELOPMENT OVERVIEW

Platinum Land Ltd are proposing the redevelopment of the former Chivers Factory Site, where, following demolition of existing buildings, the site would be redeveloped to accommodate 495 apartments, residential support facilities, amenities and services in 4 no. blocks. A service building including 1 no. crèche, café and gym would also be provided. In addition the proposed development includes highway and pedestrian improvements.

Figure 2.0.1 – Proposed Residential Site layout Plan

3.0 DEFINITIONS AND MODEL ASSUMPTIONS

The technical definitions that are referred to in this report are explained below.

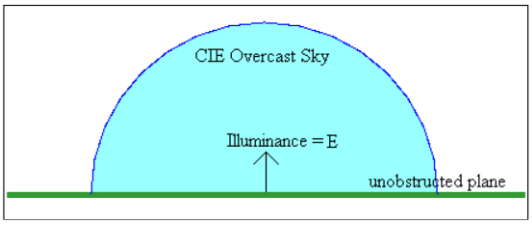
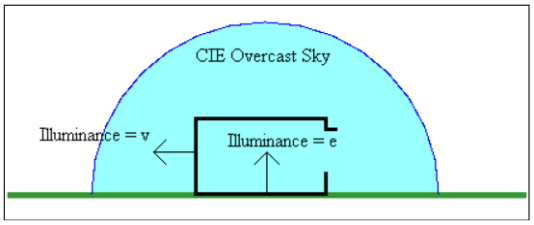
BRE	**Building Research Establishment.**
Average Daylight Factor (ADF)	The ratio of total daylight flux incident on a reference area to total area of reference area, expressed as a percentage of outdoor illuminance on a horizontal plane due to an unobstructed hemisphere of sky of assumed or known luminance distribution.
Vertical Sky Component (VSC)	The Vertical Sky Component (VSC) is the "Ratio of that part of illuminance, at a point on a given vertical plane that is received directly from a 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.  E= illuminance on an unobstructed plane.  e= illuminance at point in interior Sky Component =e/E (often expressed as a percentage) Vertical Sky Component = v/E
CIE Standard Overcast Sky	A completely overcast sky for which the ratio of its luminance Ly at an angle of elevation y above the horizontal to the luminance Lz at the zenith is given by; $L_y = L_z \frac{(1 + 2\sin y)}{3}$ The CIE standard overcast sky is darkest at the horizon and brightest at the zenith (vertically overhead).
Annual Probable Sunlight Hours	The long-term average of the total number of hours during a year in which direct sunlight reaches the unobstructed ground (when clouds are taken into account).

Table 3.0.1 – Definitions of key terms referenced in this study

Table 3.0.2 below presents the assumptions that have been specified within the simulation model used in this study. These parameters are required for the calculation of ADF.

Parameter	Value
Surface Reflectance's	
• Internal ceilings	85% e.g. light coloured ceiling
• Internal walls	85% e.g. light coloured walls
• Internal floors	50% e.g. light coloured timber floor
Surface Maintenance Factor	95%
Glazing Maintenance Factor	95%
Glazing Transmittance	80%
Frame	0.10m frame width
Working Plane	0.85m
Area of Interest (AOI)	0.5m inset from perimeter
Simulation Settings	Radiance custom settings: Ambient bounces – 8 Ambient accuracy – 0.18 Ambient resolution – 2048 Ambient divisions – 4096 Ambient super samples – 1024 Limit reflection – 8

Table 3.0.2 – Daylight Modelling Software inputs

4.0 GUIDANCE DOCUMENTS REFERENCED DURING THIS STUDY

This Daylight, Sunlight and Overshadowing Assessment, has been carried out in accordance with the methodology outlined in the BRE Guide and BS 8206-2:2008.

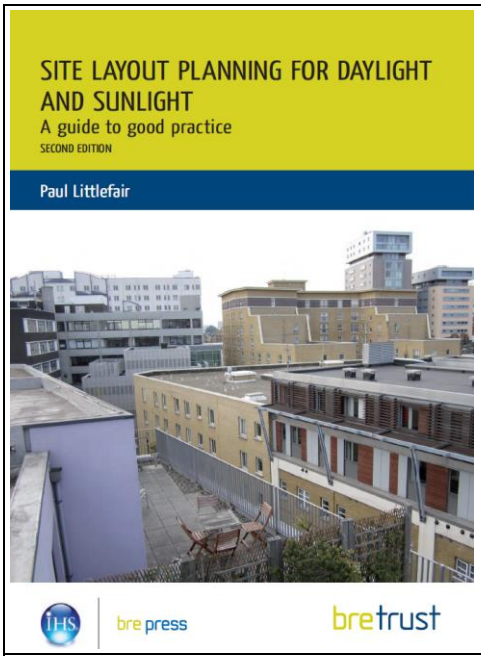
	This document gives advice on site layout planning to achieve good sun lighting and daylighting, both within buildings and in the open spaces between them. This authoritative document is widely used to provide advice during the planning and design stages of building development in the UK and Ireland. Guidance is given on site layout for good sun lighting and daylighting; safeguarding of daylight and sunlight within existing buildings nearby; and the protection of daylighting of adjoining land for future development.
	BS 8206-2 describes good practice in daylighting design and presents criteria intended to enhance the well-being and satisfaction of people in buildings.
	Design Standards for New Apartments - Guidelines for Planning Authorities (March 2018).
	Urban Development and Building Heights – Guidelines for Planning Authorities (December 2018).

Table 4.0.1 – Guidance Documents Referenced for this Study

It is therefore important that the guidelines that exist in relation to daylight and sunlight are read in the correct context and are not viewed as mandatory requirements for all dwellings.

5.0 ASSESSMENT METHODOLOGY

This Daylight, Sunlight and Overshadowing Assessment was carried out using the simulation software IES VE. The simulation results were then compared against metrics referenced in the BRE Guide and BS 8206-2:2008. It is important to note that the BRE Guide does not contain mandatory requirements and the guide should not be seen as an instrument of planning policy. Section 1.6 of the BRE Guide states that: *"Although it gives numerical guidelines, these should be interpreted flexibly since natural lighting is only one of many factors in site layout design. In special circumstances the developer or planning authority may wish to use different target values"*

Average Daylight Factor (ADF)

ADF is a measure of the adequacy of diffuse daylight within a room, and accounts for factors such as the size of a window in relation to the size of the room; the reflectance of the walls; and, the nature of the glazing and number of windows.

BRE Guide confirms that the recommended minimum ADF target value depends on the room use. That is 1% for a bedroom, 1.5% for a living room and 2% for a kitchen. In cases where one room serves more than one purpose, the BRE Guide states that the minimum ADF should be that for the room type with the higher value. Refer to Section 9.0 of this Report for further details.

Annual Probable Sunlight Hours (APSH)

Paragraph 3.1.11 of the BRE Guide states that if a room faces significantly north of due east or west it is unlikely to meet the recommended sunlight levels. Therefore, these orientations were not analysed for APSH because the BRE Guide recognises that that it is unachievable for these orientations. This approach was agreed with Diarmuid Murphy of the Dublin City Council (DCC) via a telephone conversation on the 27th of July 2018.

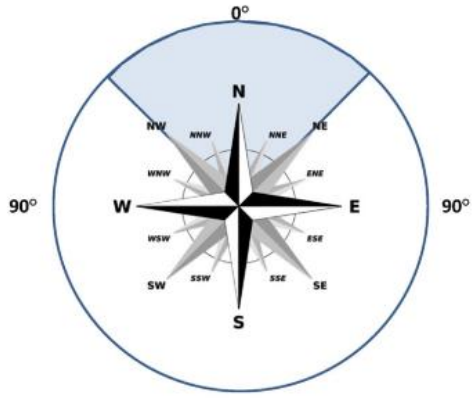


Figure 5.0.1 – Orientations analysed for APSH.

6.0 SIMULATION SOFTWARE DESCRIPTION

IES VIRTUAL ENVIRONMENT

IES Virtual Environment is the world's leading building performance analysis tool. The software provides an in-depth suite of integrated analysis tools which allow an integrated design approach and highly detailed results.

IES VIRTUAL ENVIRONMENT - RADIANCE

Radiance is a software package developed by the Lighting Systems Research group at the Lawrence Berkeley Laboratory in California, USA. Radiance was developed as a research tool for predicting the distribution of visible radiation in illuminated spaces.

IES VIRTUAL ENVIRONMENT - SUNCAST

SunCast enables engineers to perform shading and solar insolation analysis studies and can generate images and animations. SunCast generates shadows and internal solar insolation from any sun position defined by date, time, orientation, site latitude and longitude. SunCast can be used at any stage of the design process from a model created by the IES Model Builder.

7.0 SIMULATION MODEL IMAGES

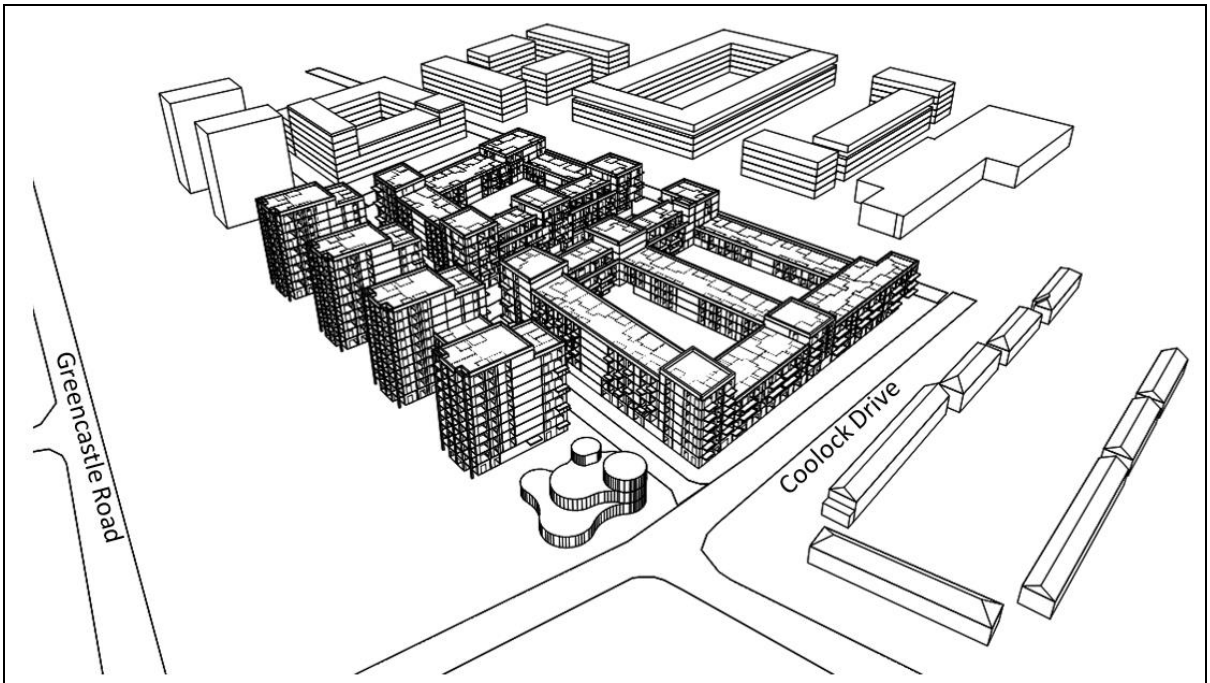


Figure 7.0.1 View from the North Orientation (also includes adjoining potential development lands beyond application site boundary).

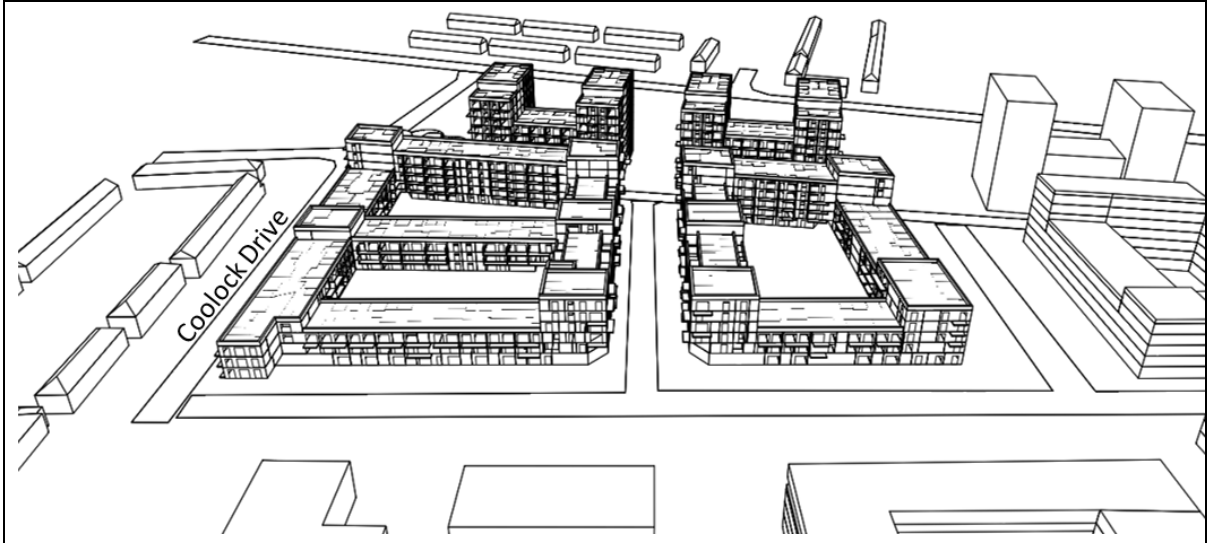


Figure 7.0.2 View from the South West Orientation (also includes adjoining potential development lands beyond application site boundary).

8.0 DAYLIGHT ASSESSMENT – EXISTING NEIGHBOURING PROPERTIES

The guidelines given within the BRE Guide 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.

Site Layout Assumed Building Type Based on Desktop Study

1 & 2	Residential
3	Commercial
4	Industrial
5	Golf Course

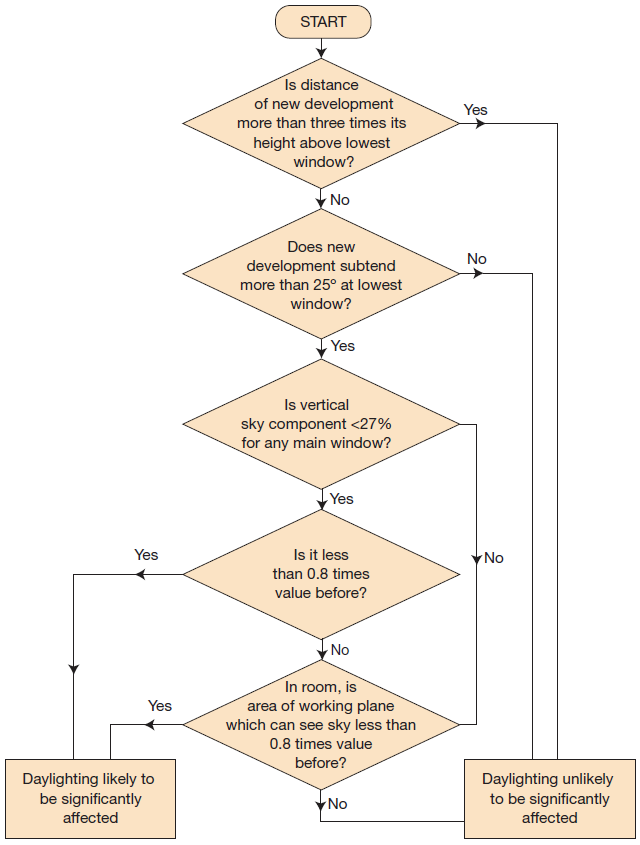
Figure 8.0.1 – Site Plan

In analysing the proposed site and surrounding buildings the primary areas of interest identified are:

1) Dwellings on Coolock Drive;
2) Dwellings on Greencastle Road;
3) Commercial Units on Greencastle Road;
4) Industrial Units (potential future development land); and
5) Golf Course (potential future development land).

To analyse the effects of the proposed development on the adjacent dwellings on Coolock Drive, a Vertical Sky Component (VSC) simulation was carried out using the IES Radiance software package. For the VSC definition refer to Section 3.0 of this report (page 12). The VSC was calculated with the proposed development in place using a simulation model. In accordance with Section 2.2 of the BRE Guide, where a VSC of 27% or greater is achieved, "enough skylight should still be reaching the existing building" and therefore daylighting will not be significantly affected. The BRE Methodology is summarised below.

Methodology (as referenced in Section 2.2 of the BRE Guide)



Decision chart / methodology used to quantify the impact of a new development on daylight levels of nearby buildings / dwellings.

Figure 8.0.2 – BRE Guide VSC Decision Chart

The VSC has been calculated for all main windows of the dwellings on Coolock Drive (area of interest 1) which is adjacent to the proposed development. The results of this analysis along Coolock Drive are presented below.

Simulation Results - Coolock Drive (No.57, 59, 61 & 63)

Window Reference	VSC with Proposed Development (%)	Compliant with BRE Guide (2011) for Safeguarding Daylight
W1	31.59	Yes
W2	32.09	Yes
W3	31.66	Yes
W4	31.87	Yes
W5	31.35	Yes
W6	31.39	Yes
W7	31.47	Yes
W8	31.60	Yes
W9	28.92	Yes
W10	28.71	Yes
W11	28.91	Yes
W12	28.92	Yes
W13	29.09	Yes

Table 8.0.1 – VSC Results for Coolock Drive (No.57, 59, 61 & 63)

The results confirm that the access to daylight for residents of No.57, 59, 61 & 63 Coolock Drive, when compared with their existing baseline experience, will not be compromised as a result of this proposed development because the VSC in all cases is ≥ 27%.

Simulation Results - Coolock Drive (No.49, 51, 53 & 55)

Window Reference	VSC with Proposed Development (%)	Compliant with BRE Guide (2011) for Safeguarding Daylight
W1	31.84	Yes
W2	31.70	Yes
W3	31.77	Yes
W4	32.00	Yes
W5	31.83	Yes
W6	31.51	Yes
W7	31.61	Yes
W8	31.75	Yes
W9	28.49	Yes
W10	28.73	Yes
W11	28.63	Yes
W12	29.00	Yes

Table 8.0.2 – VSC Results for Coolock Drive (No.49, 51, 53 & 55)

The results confirm that the access to daylight for residents of No.49, 51, 53 & 55 Coolock Drive, when compared with their existing baseline experience, will not be compromised as a result of this proposed development because the VSC in all cases is ≥ 27%.

Simulation Results - Coolock Drive (No.41, 43, 45 & 47)

Window Reference	VSC with Proposed Development (%)	Compliant with BRE Guide (2011) for Safeguarding Daylight
W1	32.62	Yes
W2	32.41	Yes
W3	32.24	Yes
W4	31.92	Yes
W5	31.89	Yes
W6	31.78	Yes
W7	31.27	Yes
W8	30.79	Yes
W9	30.79	Yes
W10	30.24	Yes
W11	29.98	Yes
W12	28.35	Yes

Table 8.0.3 – VSC Results for Coolock Drive (No.41, 43, 45 & 47)

The results confirm that the access to daylight for residents of No.41, 43, 45 & 47 Coolock Drive, when compared with their existing baseline experience, will not be compromised as a result of this proposed development because the VSC in all cases is ≥ 27%.

Simulation Results - Coolock Drive (No.33, 35, 37 & 39)

Window Reference	VSC with Proposed Development (%)	Compliant with BRE Guide (2011) for Safeguarding Daylight
W1	36.02	Yes
W2	35.68	Yes
W3	35.39	Yes
W4	35.01	Yes
W5	34.31	Yes
W6	34.04	Yes
W7	33.54	Yes
W8	32.87	Yes
W9	34.74	Yes
W10	33.60	Yes
W11	32.95	Yes
W12	30.85	Yes

Table 8.0.4 – VSC Results for Coolock Drive (No.33, 35, 37 & 39)

The results confirm that the access to daylight for residents of No.33, 35, 37 & 39 Coolock Drive, when compared with their existing baseline experience, will not be compromised as a result of this proposed development because the VSC in all cases is ≥ 27%.

Simulation Results - Coolock Drive (No.25, 27, 29 & 31)

Window Reference	VSC with Proposed Development (%)	Compliant with BRE Guide (2011) for Safeguarding Daylight
W1	37.08	Yes
W2	37.20	Yes
W3	37.11	Yes
W4	37.34	Yes
W5	36.79	Yes
W6	36.74	Yes
W7	36.73	Yes
W8	36.52	Yes
W9	15.33 (Current VSC = 17.06)	Yes VSC is greater than 80% of former value
W10	36.34	Yes
W11	35.95	Yes
W12	35.27	Yes

Table 8.0.5 – VSC Results for Coolock Drive (No.25, 27, 29 & 31)

The results confirm that the access to daylight for residents of No.25, 27, 29 & 31 Coolock Drive, when compared with their existing baseline experience, will not be compromised as a result of this proposed development because the calculated VSC is either ≥ 27% or ≥0.8 times its existing value prior to the proposed development.

The simulation model used confirms that the BRE Guide Metrics for safeguarding diffuse skylight to existing buildings adjacent to the proposed development have been achieved. This was demonstrated in accordance with the BRE Guide by calculating the VSC of the windows adjacent to the proposed development. **All calculated VSCs achieve the recommended metrics for maintaining daylight.**

The buildings on Greencastle Road (areas of interest 2 & 3) are sufficiently distant from the proposed development to conclude that the diffuse skylight enjoyed by the existing buildings will not be affected by the proposed development. This has been determined in accordance with the BRE Guide whereby the angle that the proposed development creates with the windows of the existing buildings on the Greencastle Road are never more than 25° for the whole development. As this criteria is achieved no more analysis is required to determine loss of skylight / daylight.

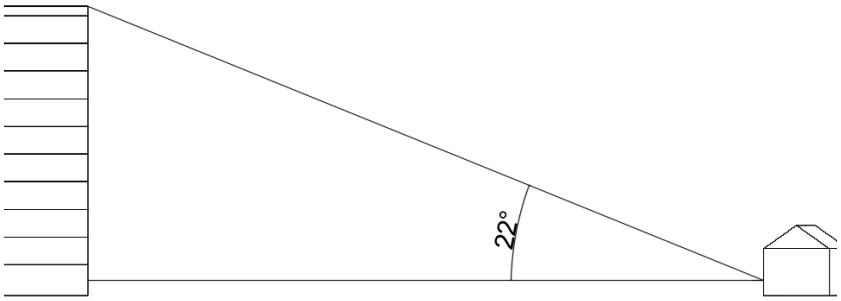


Figure 8.0.3
Section in plane perpendicular to the buildings on Greencastle Road

The adjacent Industrial units (area of interest 4) and Golf Course (area of interest 5) do not have a reasonable expectation or specific daylight requirement so they have not been analysed in this respect. They have, however, been considered as potential future development land to ensure that proposed development site is not seen in isolation from adjoining lands. To allow the potential impacts of the proposed development on the adjacent Z6 land to be analysed, a potential masterplan which encompasses the adjoining Z6 lands has been developed by Plus Architecture. It should be noted that the wider masterplan does not form part of this application. Nonetheless, it allowed the masterplan to be analysed and developed holistically thus ensuring that all lands can retain good level of daylight in the future. The masterplan is discussed further in Section 13 of this report.

9.0 DAYLIGHT ASSESSMENT – PROPOSED DEVELOPMENT

Daylight Assessment

202 Apartments were analysed as part of this study, which included 580 individual rooms. Starting at ground floor level of Blocks A1, A2, B and C, all rooms were assessed in terms of daylight to determine whether the metrics referenced in the BRE Guide were achieved. If an entire floor within a Block did not achieve a 100% compliance rate the next floor level up was assessed, this approach was continued until a 100% compliance rate was achieved for each Block. For Block A1 and A2 all apartments from Ground Floor level to Fourth Floor level were assessed. For Blocks B and C, as some of the apartments are split over two floors all apartments on the Ground Floor and First Floor level were assessed, all apartments assessed in Blocks B and C achieved the daylight metrics referenced in the BRE Guide.

Of the 580 rooms analysed, 97% achieved the BRE Guide metrics. Only 18 rooms did not meet the BRE Guide metrics, this equates to 3%. Those that did not achieve the BRE metrics were only marginally short (typically within 10% of the target value). However when using the 1.5% guideline target for Kitchen Living and Dining areas which is applicable to living rooms, 100% of the assessed rooms achieved the BRE metrics.

If all apartments were analysed i.e. with the inclusion of additional upper floors, the percentage pass rate would increase further because the Average Daylight Factor of the upper floors are even less obstructed from receiving daylight.

In accordance with section 6.7 of the Design Standards for New Apartments, the following measures have been included in the proposed apartment designs to compensate units that have not fully met the daylighting recommendations. These include;

- All units noted as being short of the target daylight values have an apartment floor area that is ≥10% larger than the design standards for new apartments;
- A high proportion of glazing provided to all the units. Specification of glazing with a high glazing transmittance value to ensure maximum light penetration into apartments;
- Balcony space exceeds the design standards referenced in the March 2018 apartment guidelines; and
- Of the units noted as being short of the target daylight values 59% are dual aspect.

The ADF results are included within Appendix A of this report.

Appendix B presents daylight distribution images for all assessed apartments.

10.0 SUNLIGHT ASSESSMENT – EXISTING NEIGHBOURING PROPERTIES

In designing a new development or extension to a building, it is important to safeguard the access to sunlight where there is a particular requirement for sunlight. To assess the sunlight impact to existing buildings the BRE Guide has been followed. A summary of the BRE Guide for safeguarding sunlight is provided in the table below.

Methodology (as referenced in Section 3.2 of the BRE Guide)

Design Issue	BRE Recommended Criteria – Section 3.2
Safeguarding Sunlight to Neighbouring Properties	If a living room of an existing dwelling has a main window facing within 90° of due south, and any part of a new development subtends at an angle of more than 25° to the horizontal measured from the centre of the window in a vertical section perpendicular to the window, then the sun lighting of the window may be adversely affected. This will be the case if the centre of the window:
	Receives less than 25% of annual probable sunlight hours, or less than 5% of annual probable sunlight hours between 21st September and 21st March; and
	Receives less than 0.8 times its former sunlight hours during either period; and
	Has a reduction in sunlight received over the whole year greater than 4% of annual probable sunlight hours.

Table 10.0.1 – BRE Guide methodology for safeguarding sunlight

As previously identified within this report the buildings on Greencastle Road (area of interest 2 & 3) are sufficiently distant from the proposed development to conclude that they will not be adversely affected by the new development in terms of daylight or sunlight impact. This has been determined in accordance with the BRE Guide whereby the angle that the new development creates with the windows of the existing buildings on the Greencastle Road are never more than 25° for the whole development. As this criteria is achieved it can be concluded that the buildings on the Greencastle Road will not be adversely affected and that no further analysis is required to assess any sunlight impact.

The adjacent Industrial units (area of interest 4) have not been assessed for Sunlight impact as generally they would not have a reasonable expectation or specific sunlight requirement.

The Golf Course (area of interest 5) will not be affected by the proposed development in terms of sunlight impact as it is located south of the proposed development where it will receive unrestricted sunlight.

The adjacent dwellings on Coolock Drive have been assessed in terms of Annual Probable Sunlight Hours (APSH) and the results are presented below.

Simulation Results - Coolock Drive (No.57, 59, 61 & 63)

Window Reference	APSH with Proposed Development (%) (Recommended Value ≥25%)	APSH Between 21st September and 21st March with Proposed Development (%) (Recommended Value ≥5%)	Compliant with BRE Guide (2011) for Safeguarding Access to Sunlight
W1	48	46	Yes
W2	50	48	Yes
W3	51	49	Yes
W4	51	48	Yes
W5	53	50	Yes
W6	52	51	Yes
W7	51	51	Yes
W8	51	50	Yes
W9	43	38	Yes
W10	44	38	Yes
W11	44	35	Yes
W12	45	37	Yes
W13	46	37	Yes

Table 10.0.2 APSH Results for Coolock Drive (No.57, 59, 61 & 63)

Simulation Results - Coolock Drive (No.49, 51, 53 & 55)

Window Reference	APSH with Proposed Development (%) (Recommended Value ≥25%)	APSH Between 21st September and 21st March with Proposed Development (%) (Recommended Value ≥5%)	Compliant with BRE Guide (2011) for Safeguarding Access to Sunlight
W1	50	52	Yes
W2	50	48	Yes
W3	50	49	Yes
W4	51	49	Yes
W5	49	46	Yes
W6	49	48	Yes
W7	48	49	Yes
W8	49	46	Yes
W9	42	41	Yes
W10	43	41	Yes
W11	42	39	Yes
W12	43	40	Yes

Table 10.0.3 APSH Results for Coolock Drive (No.49, 51, 53 & 55)

Simulation Results - Coolock Drive (No.41, 43, 45 & 47)

Window Reference	APSH with Proposed Development (%) (Recommended Value ≥25%)	APSH Between 21st September and 21st March with Proposed Development (%) (Recommended Value ≥5%)	Compliant with BRE Guide (2011) for Safeguarding Access to Sunlight
W1	50	50	Yes
W2	49	48	Yes
W3	49	49	Yes
W4	49	49	Yes
W5	50	49	Yes
W6	50	49	Yes
W7	49	49	Yes
W8	48	49	Yes
W9	45	45	Yes
W10	45	42	Yes
W11	45	42	Yes
W12	44	41	Yes

Table 10.0.4 APSH Results for Coolock Drive (No.41, 43, 45 & 47)

Simulation Results - Coolock Drive (No.33, 35, 37 & 39)

Window Reference	APSH with Proposed Development (%) (Recommended Value ≥25%)	APSH Between 21st September and 21st March with Proposed Development (%) (Recommended Value ≥5%)	Compliant with BRE Guide (2011) for Safeguarding Access to Sunlight
W1	56	69	Yes
W2	56	69	Yes
W3	55	65	Yes
W4	54	62	Yes
W5	53	62	Yes
W6	52	56	Yes
W7	52	56	Yes
W8	50	52	Yes
W9	54	65	Yes
W10	53	62	Yes
W11	51	58	Yes
W12	46	46	Yes

Table 10.0.5 APSH Results for Coolock Drive (No.33, 35, 37 & 39)

Simulation Results - Coolock Drive (No.25, 27, 29 & 31)

Window Reference	APSH with Proposed Development (%) (Recommended Value ≥25%)	APSH Between 21st September and 21st March with Proposed Development (%) (Recommended Value ≥5%)	Compliant with BRE Guide (2011) for Safeguarding Access to Sunlight
W1	58	65	Yes
W2	57	65	Yes
W3	57	65	Yes
W4	57	65	Yes
W5	57	65	Yes
W6	57	66	Yes
W7	57	67	Yes
W8	57	68	Yes
W9	29	51	Yes
W10	54	64	Yes
W11	56	64	Yes
W12	55	64	Yes

Table 10.0.6 APSH Results for Coolock Drive (No.25, 27, 29 & 31)

These results confirm that the access to Sunlight for residents of Coolock Drive, when compared with their existing baseline experience, will not be compromised as a result of this proposed development because the Annual Probable Sunlight Hours calculated achieve the BRE Guide recommended values for safeguarding access to sunlight in existing dwellings.

The buildings on Greencastle Road (areas of interest 2 & 3 as demonstrated on page 17 of this report) are sufficiently distant from the proposed development (i.e. the angle that the proposed development creates with the windows of the existing buildings are never more than 25° for the whole development) to conclude that the diffuse skylight enjoyed by the existing buildings will not be affected by the proposed development.

11.0 SUNLIGHT ASSESSMENT – PROPOSED DEVELOPMENT

In general, a dwelling, or non-domestic building which has a particular requirement for sunlight, will appear reasonably sunlit provided the following recommended BRE Guide metrics are achieved.

Methodology (as referenced in Section 3.1 of the BRE Guide)

Design Issue	BRE Recommended Criteria – Section 3.1
Sunlight	In general a dwelling, of non-domestic building which has a particular requirement for sunlight will appear reasonably sunlit provided;
	(1) At least one main window wall faces within 90º of due south; and
	(2) The centre of at least one window to a main living room can receive 25% of annual probable sunlight hours, including at least 5% of annual probable sunlight hours in the winter months between 21st September and 21st March.

BRE Guidelines and Advisory Notes

It is important that the guidelines that exist in relation to sunlight are read in the correct context and are not viewed as mandatory requirements for all dwellings.

1. The BRE Guide states "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" (Section 3.1.16). In our opinion this outlines that there is not an expectation that all dwellings will achieve the guidelines for Sunlight, particularly in high density developments.

2. Paragraph 3.1.11 of the BRE Guide states that if a room faces significantly north of due east or west it is unlikely to meet the recommended levels. Therefore taking this BRE statement into account, only windows that face significantly south of due east and west were assessed as part of this study. This approach was agreed with Diarmuid Murphy of the DCC via phone conversation on the 27th of July 2018.

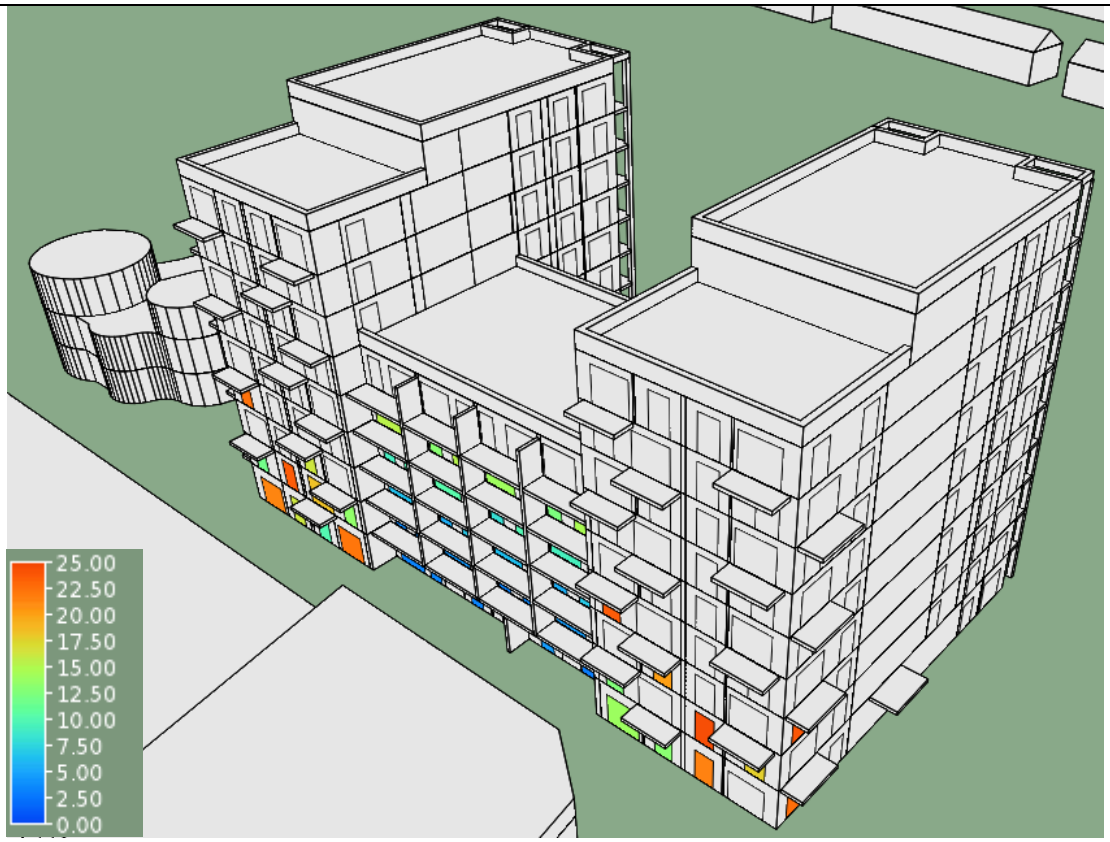
3. It is also important to note that BS 8206-2 suggests that sunlight satisfaction is related to expectation. The BS document states that:
   "The degree of satisfaction is related to the expectation of sunlight. If a room is necessarily north facing or if the building is in a densely-built urban area, the absence of sunlight is more acceptable than when its exclusion seems arbitrary".

4. Site orientation plays a key role in the levels of sunlight that will be received by a development. The BRE Guide states that:

   "A south-facing window will, in general receive most sunlight, while a north-facing one will only receive it on a handful of occasions (early morning and late evenings in summer). East and west facing windows will receive sunlight only at certain times of the day. A dwelling with no main window wall within 90° of due south is likely to be perceived as insufficiently sunlit. This is usually only an issue for flats. Sensitive layout design of flats will attempt to ensure that each individual dwelling has at least one main living room which can receive a reasonable amount of sunlight. In both flats and houses, a sensible approach is to try and match internal room layout with window wall orientation. Where possible, living rooms should face the southern or western parts of the sky and kitchens towards the north or east".

   The site layout design has followed the BRE Guide with the aim of maximising the sunlight received by the dwellings of the proposed development. This was achieved by designing the site layout so that the taller buildings are located to the north of the site, and living rooms located on the north façade have an east or west facing window and by arranging dwellings to be dual aspect where possible.

Simulation Results

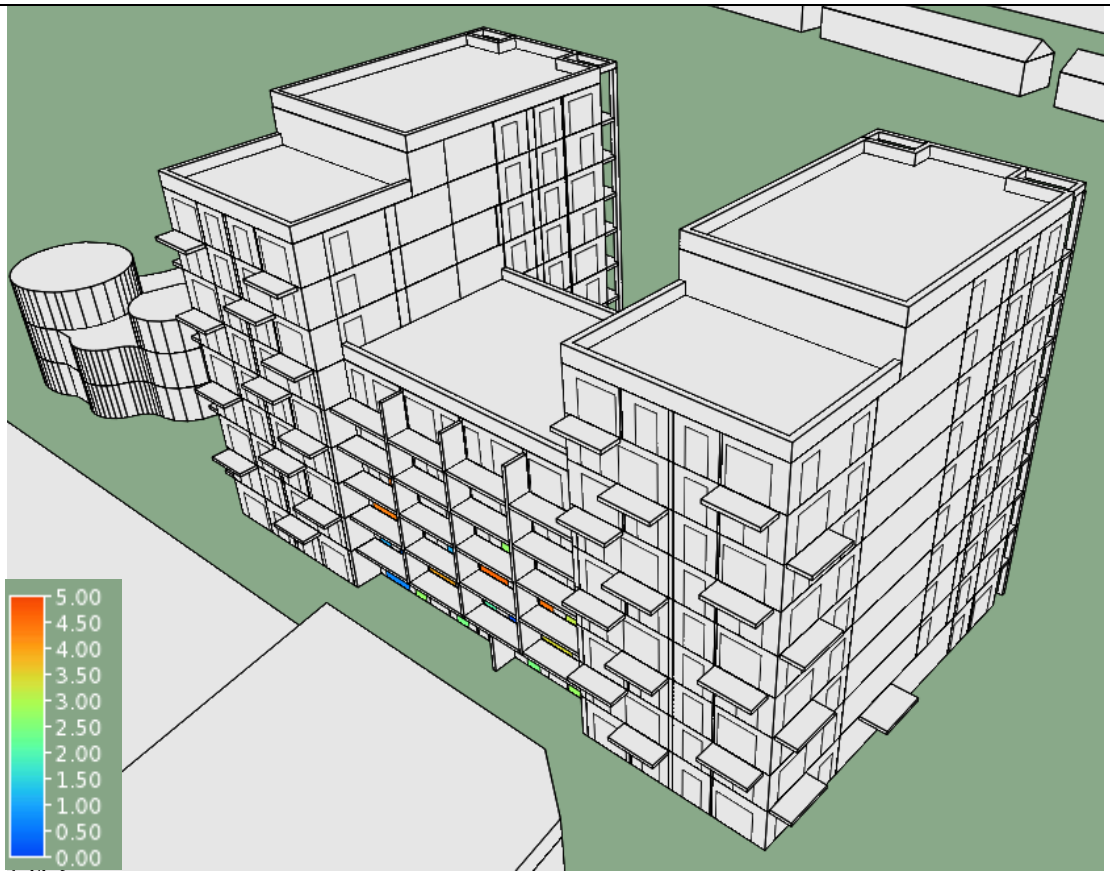


Block A1 Full Year Simulation.

The Sunlight target is 25% APSH (refer to legend). Windows shown in white achieve the BRE targets as the APSH is greater than 25%. Using the legend the specific APSH can be determined for windows that do not exceed the target value. Windows coloured red/orange demonstrate results that are very close to the target value are achieved i.e. 20-25%.

The results demonstrate that the majority of windows achieve the target sunlight values. Generally where the sunlight targets are not achieved it is at the lower levels where typically there is a lower expectation of sunlight.

Note: As outlined in the methodology only windows that face significantly south of due east and west were assessed as part of this study. This approach was agreed with Diarmuid Murphy of Dublin City Council via phone conversation and is in line with BRE Guidelines.

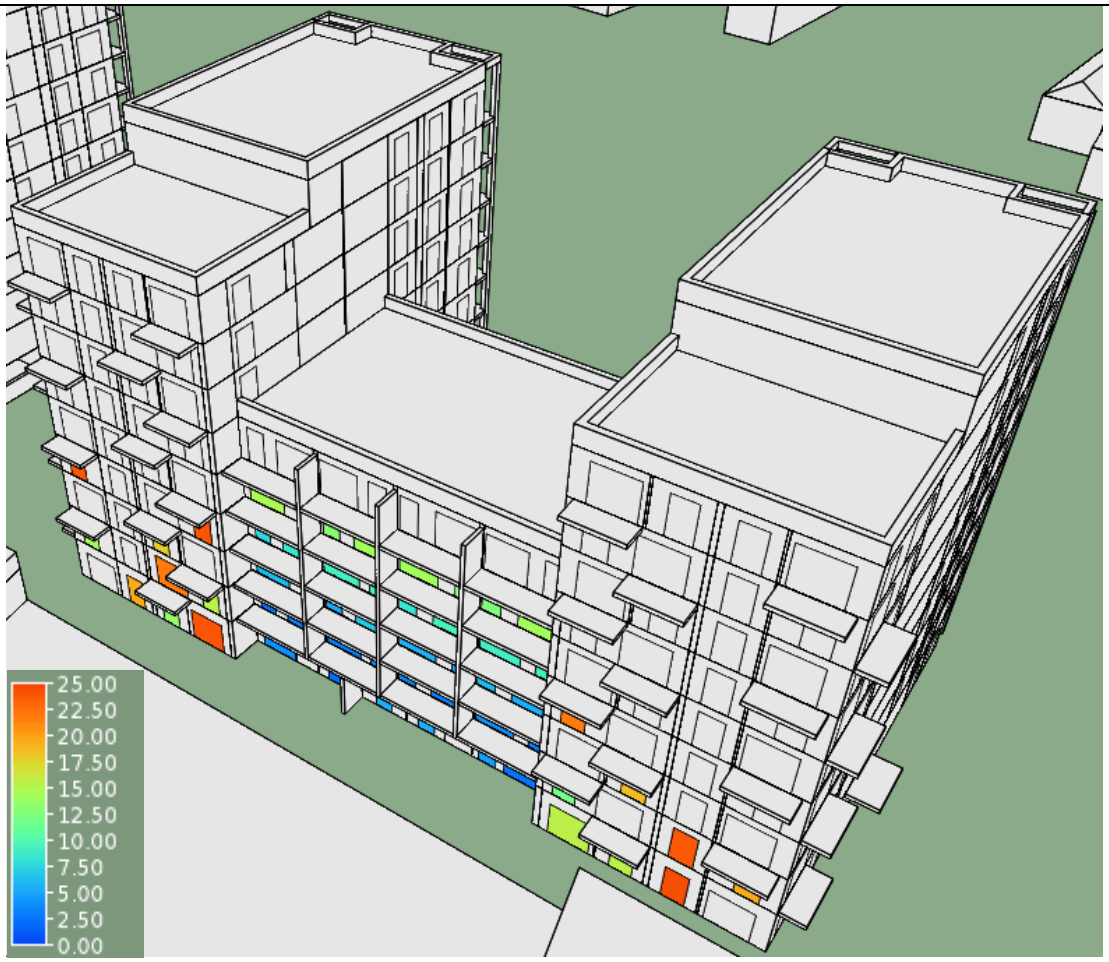


Block A1 Winter Simulation

The Sunlight target is 5% APSH (refer to legend). Windows shown in white achieve the BRE targets as the APSH is greater than 5%. Using the legend the specific APSH can be determined for windows that do not exceed the target value. Windows coloured red/orange demonstrate results that are very close to the target value are achieved i.e. 4-5%.

The results demonstrate that the majority of windows achieve the target sunlight values. Generally where the sunlight targets are not achieved it is at the lower levels where typically there is a lower expectation of sunlight.

Note: As outlined in the methodology only windows that face significantly south of due east and west were assessed as part of this study. This approach was agreed with Diarmuid Murphy of Dublin City Council via phone conversation and is in line with BRE Guide.



Block A2 Full Year Simulation.

The Sunlight target is 25% APSH (refer to legend). Windows shown in white achieve the BRE targets as the APSH is greater than 25%. Using the legend the specific APSH can be determined for windows that do not exceed the target value. Windows coloured red/orange demonstrate results that are very close to the target value are achieved i.e. 20-25%.

The results demonstrate that the majority of windows achieve the target sunlight values. Generally where the sunlight targets are not achieved it is at the lower levels where typically there is a lower expectation of sunlight.

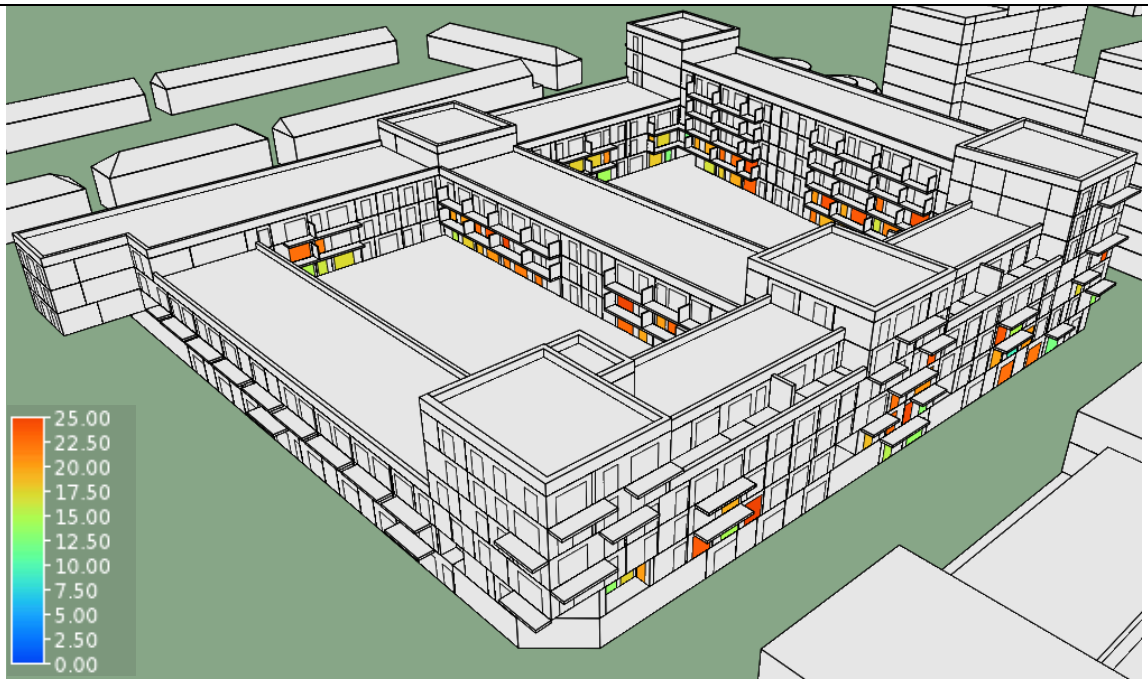
Note: As outlined in the methodology only windows that face significantly south of due east and west were assessed as part of this study. This approach was agreed with Diarmuid Murphy of Dublin City Council via phone conversation and is in line with BRE Guide.

Block A2 Winter Simulation

The Sunlight target is 5% APSH (refer to legend). Windows shown in white achieve the BRE targets as the APSH is greater than 5%. Using the legend the specific APSH can be determined for windows that do not exceed the target value. Windows coloured red/orange demonstrate results that are very close to the target value are achieved i.e. 4-5%.

The results demonstrate that the majority of windows achieve the target sunlight values. Generally where the sunlight targets are not achieved it is at the lower levels where typically there is a lower expectation of sunlight.

Note: As outlined in the methodology only windows that face significantly south of due east and west were assessed as part of this study. This approach was agreed with Diarmuid Murphy of Dublin City Council via phone conversation and is in line with BRE Guide.

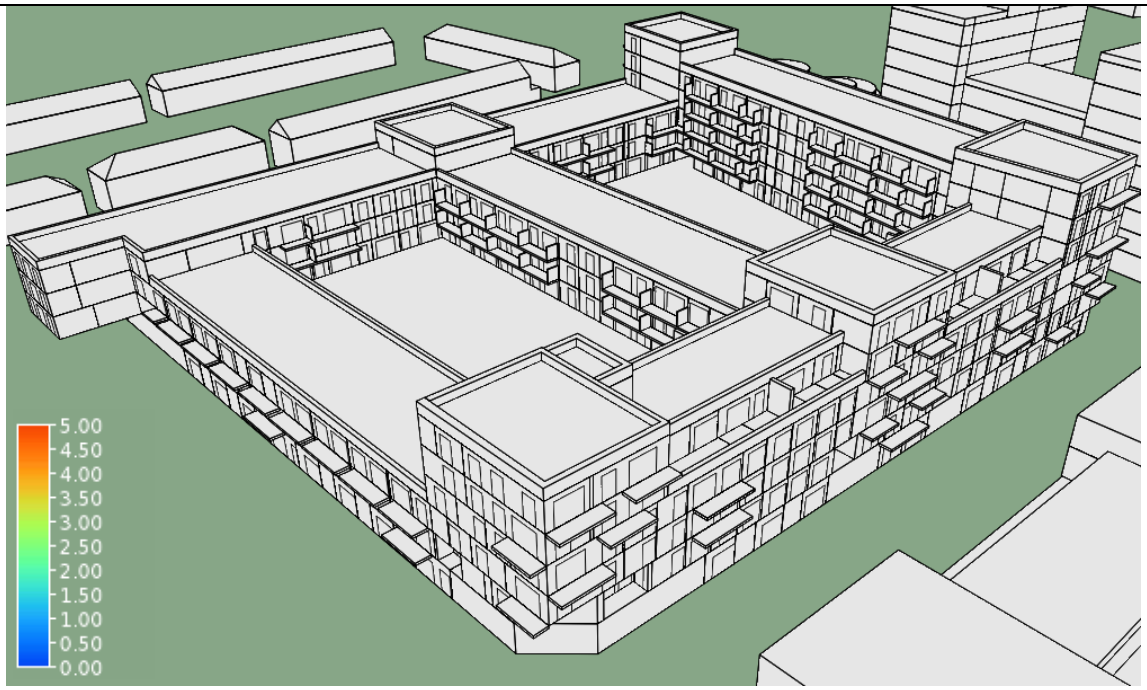


Block B Full Year Simulation.

The Sunlight target is 25% APSH (refer to legend). Windows shown in white achieve the BRE targets as the APSH is greater than 25%. Using the legend the specific APSH can be determined for windows that do not exceed the target value. Windows coloured red/orange demonstrate results that are very close to the target value are achieved i.e. 20-25%.

The results demonstrate that the majority of windows achieve the target sunlight values. Generally where the sunlight targets are not achieved it is at the lower levels where typically there is a lower expectation of sunlight.

Note: As outlined in the methodology only windows that face significantly south of due east and west were assessed as part of this study. This approach was agreed with Diarmuid Murphy of Dublin City Council via phone conversation and is in line with BRE Guide.

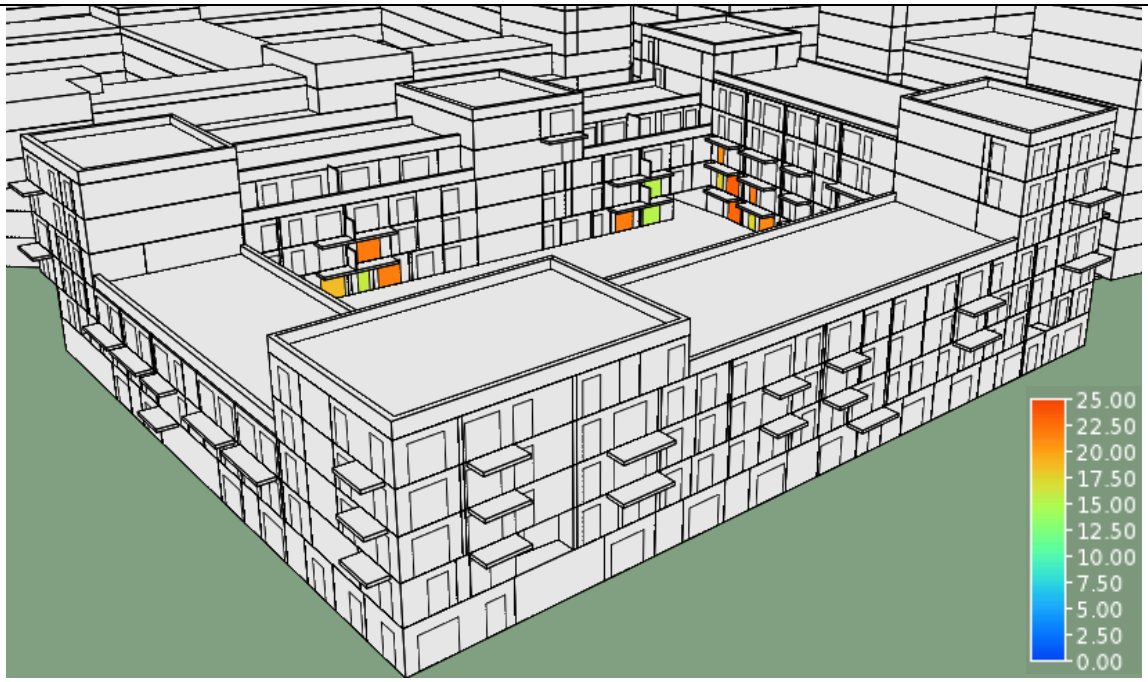


Block B Winter Simulation

All windows shown in white achieve the BRE targets.

The Sunlight target is 5% APSH (refer to legend). Windows shown in white achieve the BRE targets as the APSH is greater than 5%. The results demonstrate that all windows achieve the target sunlight values.

Note: As outlined in the methodology only windows that face significantly south of due east and west were assessed as part of this study. This approach was agreed with Diarmuid Murphy of Dublin City Council via phone conversation and is in line with BRE Guide.

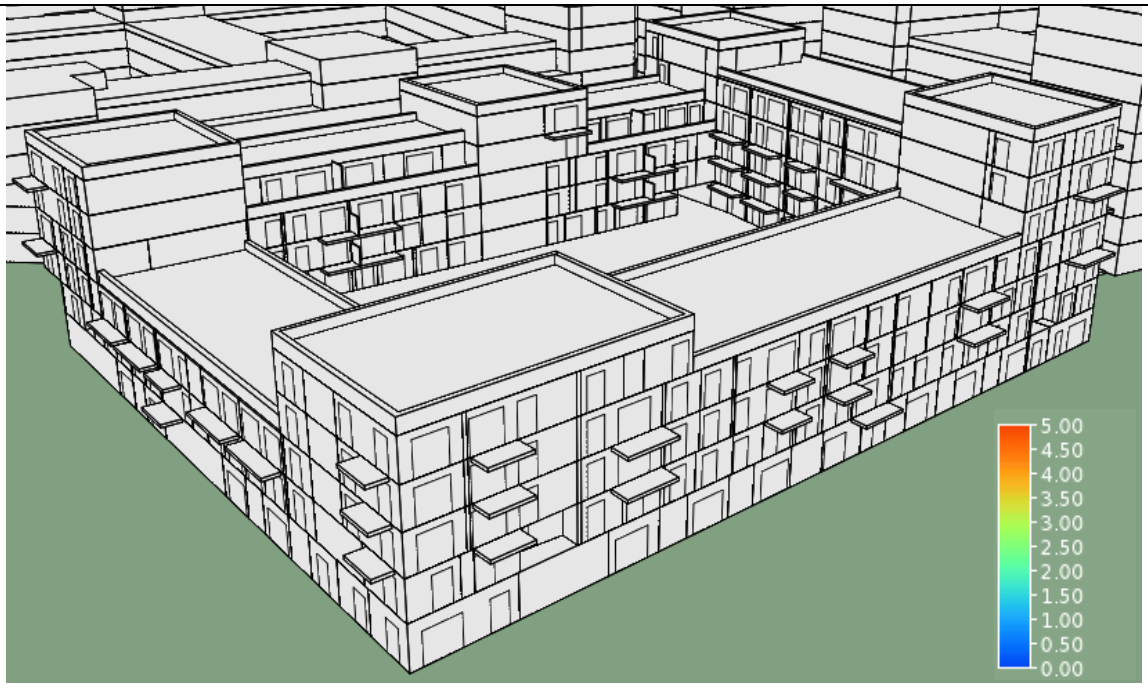


Block C Full Year Simulation.

The Sunlight target is 25% APSH (refer to legend). Windows shown in white achieve the BRE targets as the APSH is greater than 25%. Using the legend the specific APSH can be determined for windows that do not exceed the target value. Windows coloured red/orange demonstrate results that are very close to the target value are achieved i.e. 20-25%.

The results demonstrate that the majority of windows achieve the target sunlight values. Generally where the sunlight targets are not achieved it is at the lower levels where typically there is a lower expectation of sunlight.

Note: As outlined in the methodology only windows that face significantly south of due east and west were assessed as part of this study. This approach was agreed with Diarmuid Murphy of Dublin City Council via phone conversation and is in line with BRE Guide.



Block C Winter Simulation

All windows shown in white achieve the BRE targets.

The Sunlight target is 5% APSH (refer to legend). Windows shown in white achieve the BRE targets as the APSH is greater than 5%. The results demonstrate that all windows achieve the target sunlight values.

Note: As outlined in the methodology only windows that face significantly south of due east and west were assessed as part of this study. This approach was agreed with Diarmuid Murphy of Dublin City Council via phone conversation and is in line with BRE Guide.

Commentary on the APSH Results

Blocks A1 & A2

Blocks A1 & A2 achieve good APSH on main window walls facing 135° of due south. The areas that fall below the recommendations are overshadowed by balconies and balcony dividers which were unavoidable if the maximum number of living rooms facing within 135° of due south was to be considered.

Blocks B & C

The vast majority of apartments have a main window wall facing within 135° of due south. This helps to maximise the number of apartments that meet the recommendations.

General Note

Of the main window walls facing within 90° of due south, the majority meet the BRE Guides Sunlight recommendations. Most of windows dropping below the recommendations have their own balconies as well as balconies above, and face the courtyard. This arrangement was unavoidable while trying to maximise the number of apartments facing within 90° of due south.

93% of living rooms meet the BRE metrics for APSH during the winter months and 82% meet the BRE metrics over the whole year.

Based on these results it can be seen:

- That the elevations / facades of proposed development will receive very good levels of Sunlight;
- The majority of living rooms achieve the BRE Guides criteria for Sunlight availability; and
- Those that have not fully achieved the BRE metrics, in the majority of cases were only marginally short of the threshold values. Generally where the sunlight targets are not achieved it is at the lower levels where typically there is a lower expectation of sunlight.

12.0 SUNLIGHT ASSESSMENT – AMENITY SPACE

The BRE Guide recommends that for an amenity space to appear adequately sunlit throughout the year, at least half of the amenity space should receive at least two hours of sunlight on the design day, March 21st.

Methodology (as referenced in Section 3.3 of the BRE Guide)

Design Issue	BRE Recommended Criteria – Section 3.3.7
Sunlight in Gardens, Communal Open Spaces, Play Areas etc.	It is recommended that at least half (≥50%) of the amenity areas should receive at least two hours of sunlight on 21st March.

Table 12.0.1 – BRE methodology for safeguarding sunlight in amenity spaces

The massing of the proposed development has been carefully designed so that all amenity areas exceed the BRE Guides recommended criteria for sunlight. This will ensure that a positive appearance and ambiance will be achieved by development. This is demonstrated by Figures 12.0.1 and 12.0.2 on the following pages whereby all amenity areas exceed the BRE Guides recommended criteria.

Within the central courtyards, the location of seating and play areas have been strategically situated in areas that will receive the most amount of sunlight, this has been achieved as a direct result of close collaboration with the Landscape Architect. The Landscape Design Report states that

'Courtyard 'B1' the play area is placed on the sunnier south facing side. In courtyard 'B2' outdoor gym equipment is being proposed for the shadier side and seating areas to the sunnier south facing area. In courtyard 'C' the seating area has been designated to the sunnier side while the play area is to receive partial shade.'

Refer to the Landscaping Design Report and Drawings for further details.

Simulation Results

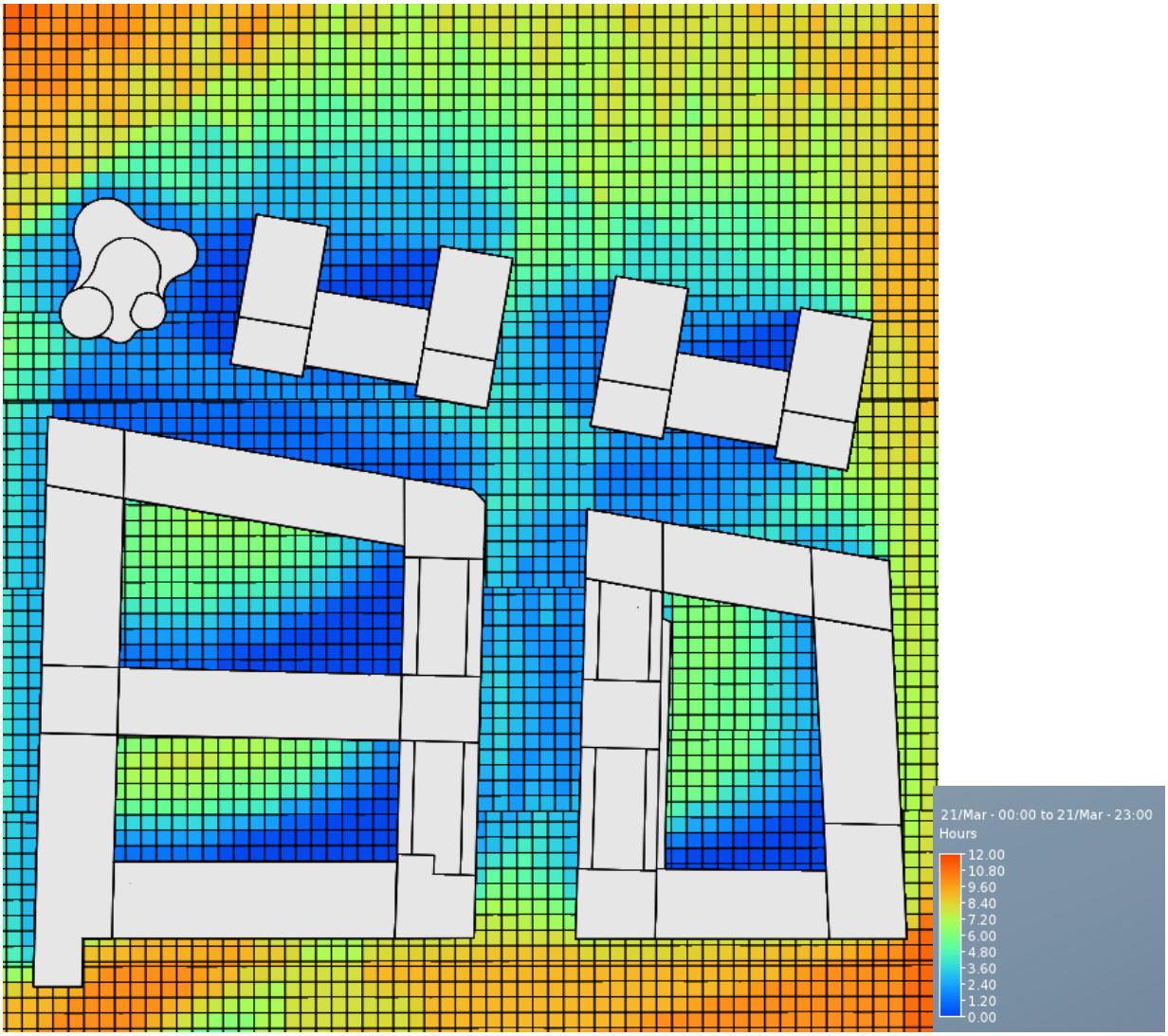


Figure 12.0.1 Amenity Space - Cells coloured dependant on the number of hours of sunlight they receive on March 21st

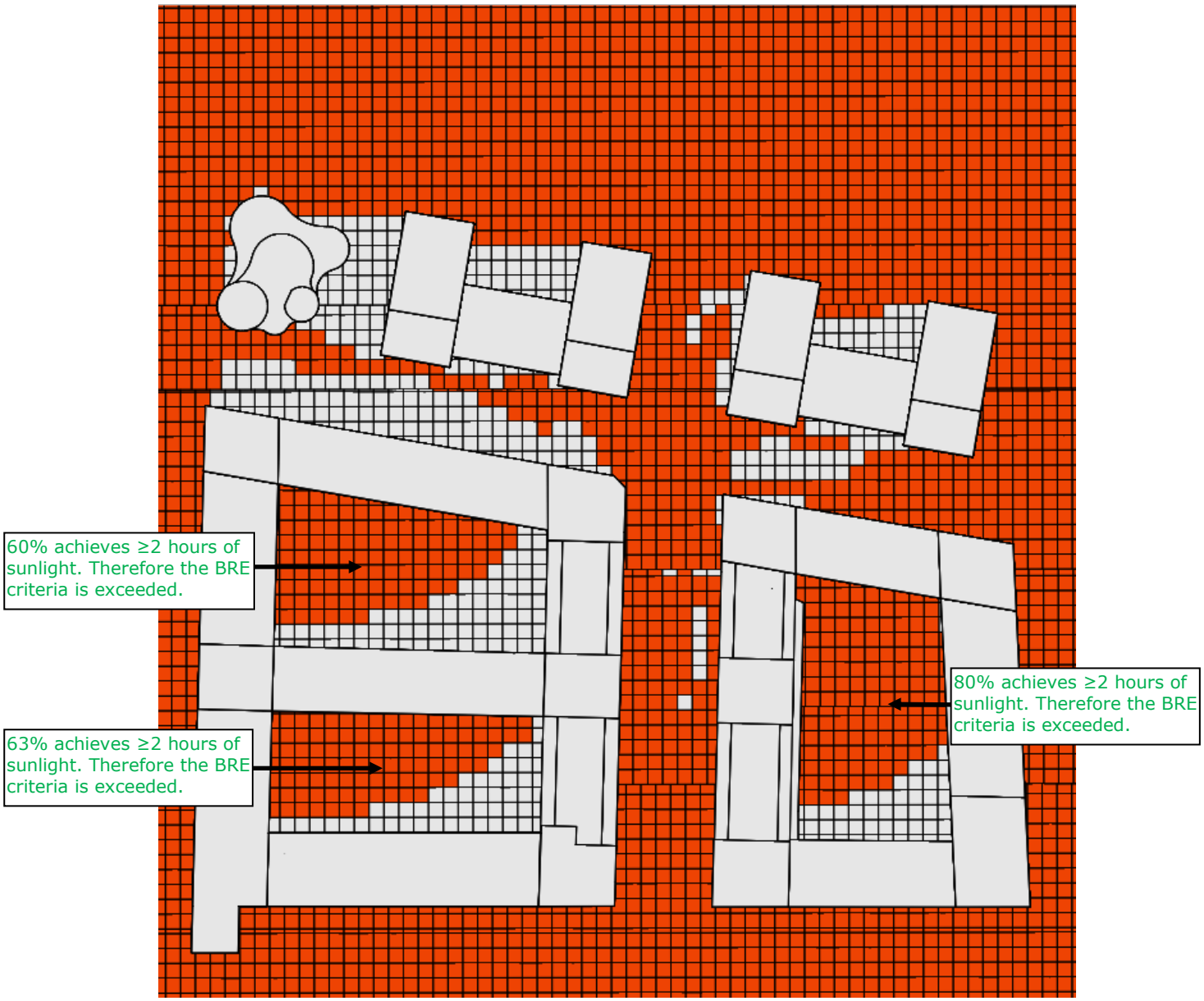


Figure 12.0.2 Amenity Space - Cells coloured red if they receive more than two hours of sunlight on March 21st therefore achieve the BRE recommended criteria.

Shown below for information purposes is the sunlight exposure on June 21st, this represents the summer sunlight scenario. Cells coloured red achieve receive more than two hours of sunlight on June 21st. This demonstrates that the site in general has been designed to achieve a good level of sunlight access.

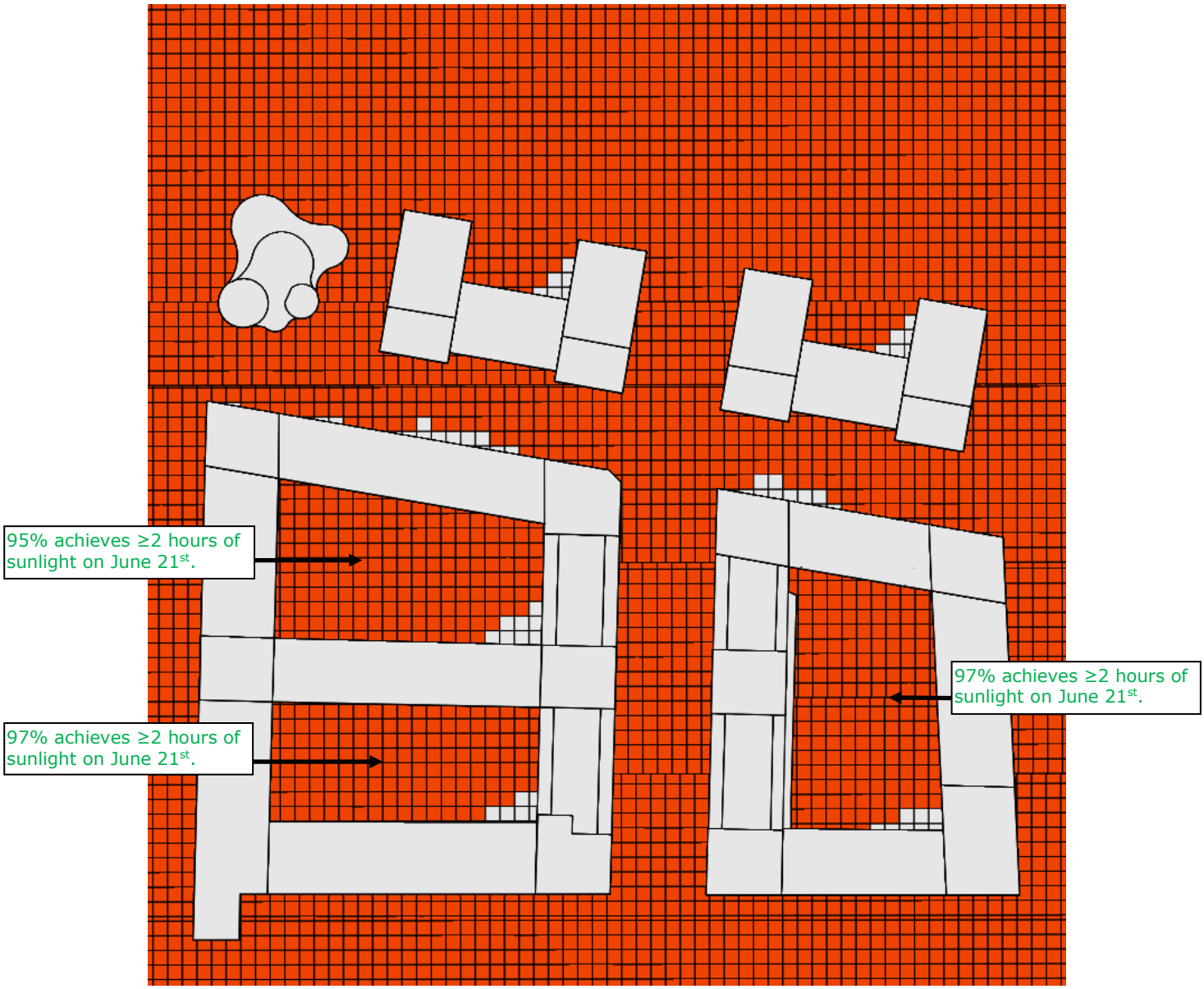


Figure 12.0.3 Amenity Space - Cells coloured red if they receive more than two hours of sunlight on June 21st.

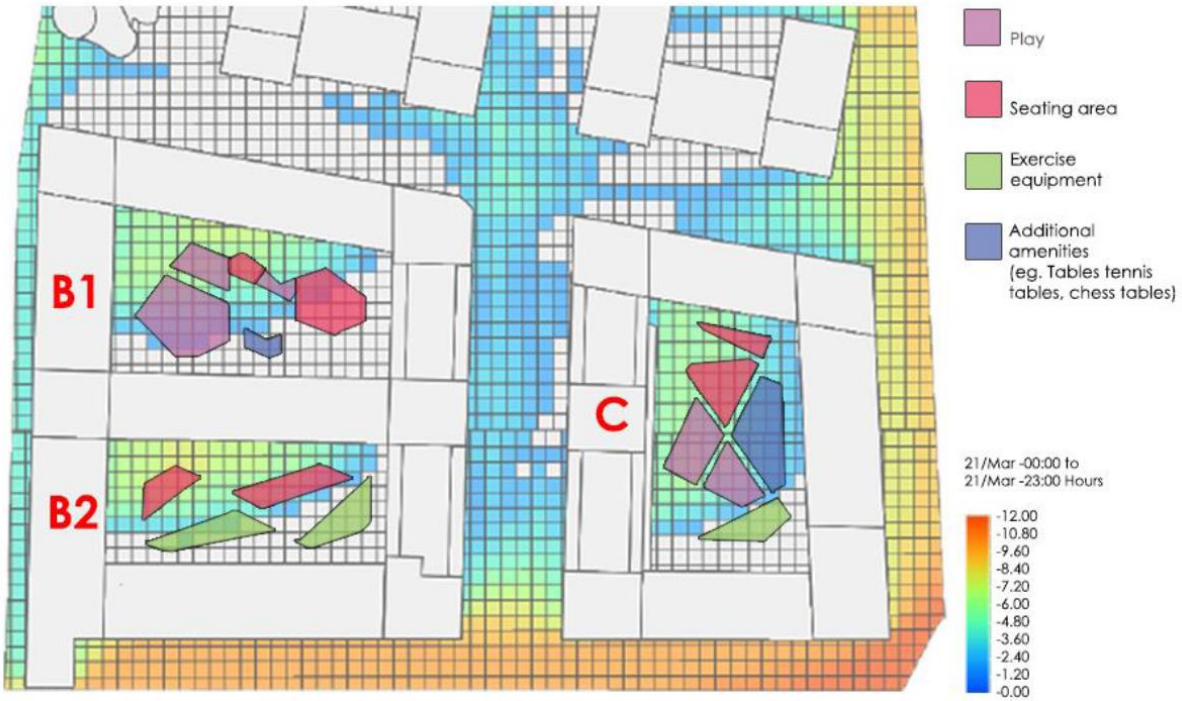


Figure 12.0.3 Amenity Space Sunlight Availability Coordination

(Extract from Landscape Design Statement)

The BRE recommended criteria for safeguarding Sunlight in amenity spaces is achieved for this proposed development. Within the central courtyards, the play areas, seating and communal dining areas have been situated in areas that will receive most amount of sunlight. This has been achieved as a direct result of close collaboration with the Landscape Architect. Refer to the Landscaping Design Report and Drawings for further details.

13.0 SOLAR SHADING ASSESSMENT

Shadow Images from the IES SunCast simulation package are presented in Appendix C for both the existing scenario and with the Redevelopment of the Former Chivers Factor Site. Images are presented for the design days of March 21st and June 21st as recommended by the BRE Guide and as agreed in correspondence with the Dublin City Council. These design days provide the best dates for shadow images, March 21st gives an average overshadowing day while June 21st represents the best case minimum shadow scenario.

Any overshadowing that is likely to occur will be to the adjacent properties on Coolock Drive and to a lesser extent the properties on the Greencastle Road. The industrial units to the east of the proposed development site will also incur a small level of evening shade, however this is not considered critical as these units do not have a specific sunlight requirement.

The images show that for the design day of March 21st additional morning shade occurs to the adjacent properties on Coolock Drive and some evening shade is shown to the properties on Greencastle Road as a result of the proposed development. For the design day of June 21st a small level of morning shade is shown to the adjacent properties on Coolock Drive, no additional shade is shown to the properties on Greencastle Road. **While some additional shade is identified here, it is important to note that the results of the VSC simulation have demonstrated that the guidelines for maintaining light received by existing buildings with the proposed development in place have been achieved.**

14.0 POTENTIAL ADJOINING DEVELOPMENT LAND

To ensure that the quality of daylight to adjoining development land (areas of interest 4 and 5) is not compromised by building too close to the boundary, an overall potential masterplan has been developed which allows for future development of the adjoining Z6 lands – see Figure 14.0.1 below. This masterplan was also developed so that those who may consider redeveloping these lands in the future, could in turn, take account for any potential impacts from future potential developments.

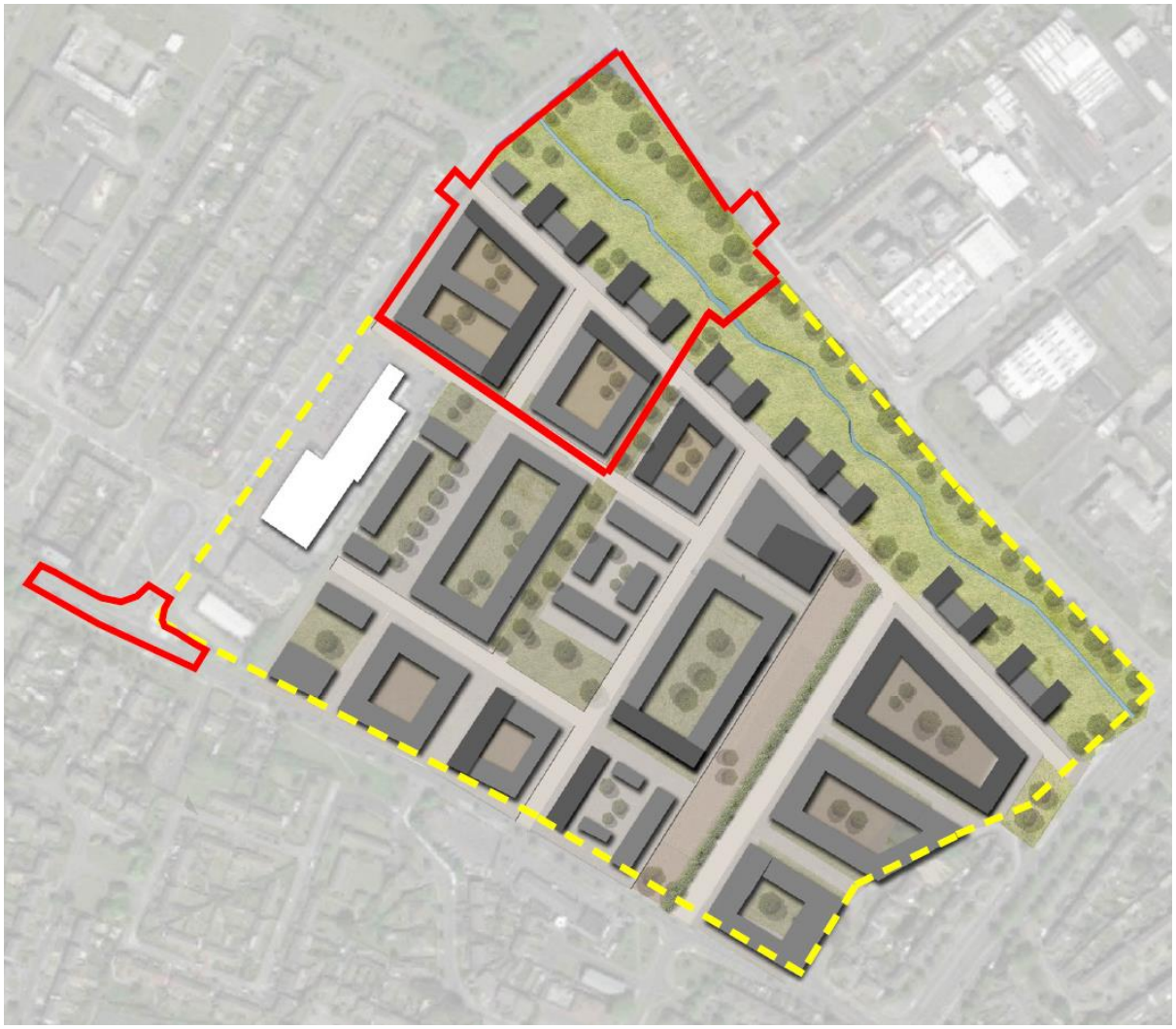


Figure 14.0.1 – Potential masterplan site and adjoining development land

The masterplan was developed by working closely with the project architects to ensure that all sites would maintain their daylight potential should future development occur. The masterplan adopted similar spacing and massing strategies thus ensuring that the daylight potential of all sites would maintain into the future.

Methodology (as referenced in Section 2.3 of the BRE Guide)

Design Issue	BRE Recommended Criteria – Section 2.3.10
Safeguarding the diffuse daylighting potential of the neighbouring site next to the proposed Chivers redevelopment.	A development site next to a proposed new building will retain potential for good diffuse daylighting provided that on each common boundary:
	(a) No new building, measured in a vertical section perpendicular to the boundary, from a point 1.6m above ground level, subtends an angle of more than 43° to the horizontal.
	(b) Or if (a) is not satisfied, then all points 1.6m above the boundary line are within 4m (measured along the boundary) of a point which has a VSC (looking towards the new building(s) of 17% or more.

Table 14.0.1 – BRE methodology for safeguarding diffuse daylighting potential of the neighbouring site next to the proposed Chivers Factory Site Redevelopment.

Simulation Results

The BRE recommended criteria for safeguarding the diffuse daylighting potential of the neighbouring site next to the proposed Chivers Factory Site redevelopment is achieved because all points simulated 1.6m above the boundary line achieve a VSC (looking towards the new building(s) of 17% or more.

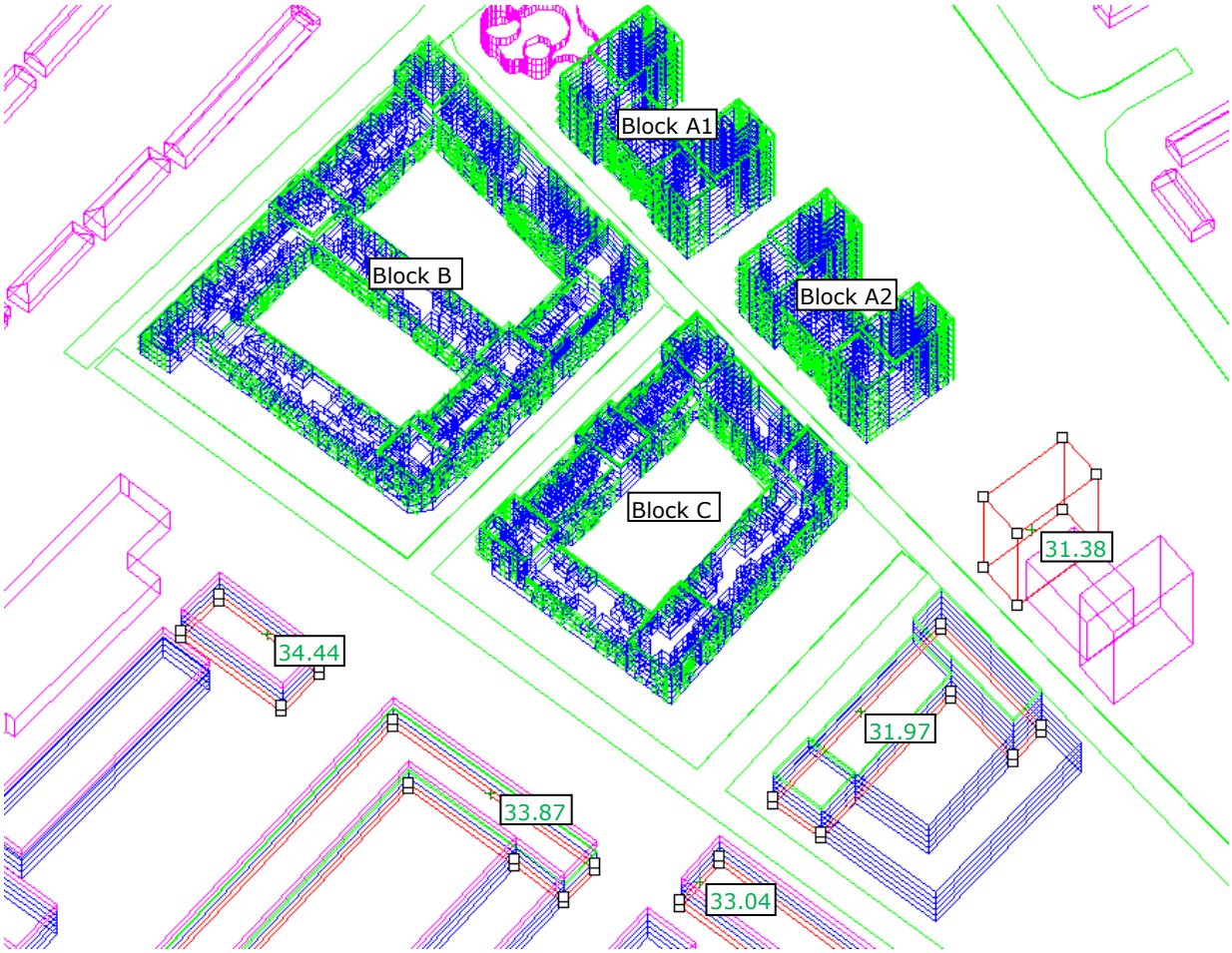


Figure 14.0.2 – Screenshot from our IES VE Radiance Simulation Model

15.0 CONCLUSION

The Daylight, Sunlight and Overshadowing assessment of the proposed development was prepared using the methodology's set out in the British Standard: Lighting for Buildings – Part 2: Code for Practice for Daylighting, BRE 209, 'Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice', Second Edition 2011, by P. J. Littlefair and the Design Standards for New Apartments - Guidelines for Planning Authorities (March 2018).

Neither the British Standard nor the BRE Guide set out rigid standards or limits. The BRE Guide is preceded by the following very clear statement as to how the design advice contained therein should be used.

"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."

Our conclusions with respect to daylight & sunlight are summarised as follows;

Existing 3rd Party Neighbouring Properties

A comprehensive study on all existing neighbouring properties has been carried out based on the BRE Guide methodology. At these properties it can be confirmed that the adjacent residential amenity at these properties, in terms of access to daylight and sunlight when compared with their existing baseline experience will not compromised as a result of this proposed development.

The buildings on Greencastle Road (areas of interest 2 & 3) are sufficiently distant from the proposed development to conclude that the diffuse skylight enjoyed by the existing buildings will not be affected by the proposed development. This has been determined in accordance with the BRE Guide whereby the angle that the proposed development creates with the window of the existing buildings on the Greencastle Road are never more than 25° for the whole development. As this criteria is achieved no more analysis is required to determine loss of skylight / daylight.

Sunlight & Daylight Assessment within the Proposed Development.

Daylight (Average Daylight Factor)

Of the 202 Apartments analysed as part of this comprehensive study, which included 580 individual rooms, 97% achieved the BRE Guide recommendations. Only 18 rooms did not

meet the recommended threshold. Therefore, this equates to a 97% pass rate which is an excellent result considering the density / site constraints. It should be noted that this is a direct result of the close collaboration (particularly in relation to daylight and sunlight requirements) among the Design Team from the conceptual design stage. This detailed collaboration informed the overall design and it was established that the northern part of the site adjacent to the park has the greatest potential for height in terms of having the least shadowing impacts over existing, proposed and future potential residential development.

It is important to note that this study primarily focused on apartments that would be considered "worst case" in terms of receiving obstructions to daylight i.e. the lower floors. If all apartments were analysed i.e. with the inclusion of more of the upper floors, the percentage "pass rate" would increase further because the Average Daylight Factor of the upper floors are even less obstructed. Of the rooms that did not meet the BRE Guide recommended values, most were only marginally short of the target values. However when using the 1.5% guideline target for Kitchen Living and Dining areas which is applicable to living rooms, 100% of the assessed rooms achieved the BRE Guide recommended values.

In accordance with section 6.7 of the Design Standards for New Apartments, the following measures have been included in the proposed apartment designs to compensate units that have not fully met the daylighting recommendations. These include;

- Units have an apartment floor area that is ≥10% larger than the design standards for new apartments;
- A high proportion of glazing provided to all the units. Specification of glazing with a high glazing transmittance value to ensure maximum light penetration into apartments;
- Balcony space exceeding the minimum design standards referenced in the March 2018 apartment guidelines; and
- 27% of the units noted as being short of the target daylight values are dual aspect.

Sunlight (Annual Probable Sunlight Hours)

The BRE Guide recognises that sunlight is less important than daylight in the amenity of a room and is heavily influenced by orientation. North facing windows may receive sunlight on only a handful of occasions (early morning and late evening in summer), and windows facing eastwards or westwards will only receive sunlight for some of the day. The BRE Guide document states that if a room faces significantly north of due east or west it is unlikely to meet the recommended levels. Therefore these were not analysed because the BRE Guide recognises that that it is unachievable for these orientations. It should be noted

that north facing windows will to overlook the proposed parkland area to the north of the site providing a compensatory and appealing view.

It is important that the guidelines that exist in relation to sunlight are read in the correct context and are not viewed as mandatory requirements for all dwellings.

The BRE Guide states "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" (Section 3.1.16). In our opinion this outlines that there is not an expectation that all dwellings will achieve the guidelines for Sunlight, particularly in high density developments.

Based on the results presented within Section 11.0 of this report it can be seen that the elevations / facades of proposed development will receive very good levels of Sunlight. The majority of living rooms achieve the BRE Guide criteria for Sunlight availability (93% of living rooms during the winter months and 82% over the whole year). Those that have not fully achieved the BRE metrics, in the majority of cases were only marginally short of the threshold values.

Sunlight

Amenity Spaces (Gardens & Open Spaces)

The BRE Guide recommends that for an amenity space to receive adequate sunlight throughout the year, at least half of the amenity space should receive at least two hours of sunlight on the design day, March 21st.

The BRE Guides recommended criteria for safeguarding Sunlight in amenity spaces is exceeded for this proposed development. Within the central courtyards, the location of seating and play areas have been strategically situated in areas that will receive the most amount of sunlight. This has been achieved as a direct result of close collaboration with the Landscape Architect.

Solar Shading

Additional morning shade was found to occur to the adjacent properties on Coolock Drive and evening shade to the properties on Greencastle Road during the design day of March 21st. For the design day of June 21st a small level of morning shade was found to occur to the adjacent properties on Coolock Drive. No additional shade was shown to the properties on Greencastle Road. However, while additional shade was identified, it is important to note that the results of the VSC and sunlight simulation have demonstrated that the guidelines

for maintaining light received by existing buildings with the proposed development in place have been achieved.

Potential Adjoining Development Land.

Our IES VE Radiance Simulation Model demonstrated that the diffuse daylighting potential of the neighbouring site next to the proposed Chivers redevelopment is protected as the VSC of all points measured are greater than 17%.

Overall Conclusion.

In our opinion, after carrying out a comprehensive daylight and sunlight assessment of the proposed development using simulation modelling and comparing results achieved against the BRE Guide and BS recommended guidelines, based on the results in this report we see no reason to refuse planning permission on these grounds.

APPENDIX A – AVERAGE DAYLIGHT FACTOR RESULTS

Apartment Reference	Room	Target ADF (%)	ADF Achieved (%)	Target ADF Achieved
A1.00.01	Kitchen Living Dining	2	7.35	Yes
	Bedroom	1	3.79	Yes
A1.00.02	Kitchen Living Dining	2	5.21	Yes
	Bedroom 1	1	2.29	Yes
	Bedroom 2	1	2.91	Yes
A1.00.03	Kitchen Living Dining	2	6.54	Yes
	Bedroom	1	2.48	Yes
A1.00.04	Kitchen Living Dining	2	2.33	Yes
	Bedroom	1	2.33	Yes
A1.00.05	Kitchen Living Dining	2	1.95	No
	Bedroom 1	1	1.75	Yes
	Bedroom 2	1	1.9	Yes
A1.00.06	Kitchen Living Dining	2	1.8	No
	Bedroom	1	1.74	Yes
A1.00.07	Kitchen Living Dining	2	7.38	Yes
	Bedroom 1	1	2.68	Yes
	Bedroom 2	1	3.5	Yes
A1.00.08	Kitchen Living Dining	2	8.25	Yes
	Bedroom	1	3.41	Yes
A1.00.09	Kitchen Living Dining	2	2.33	Yes
	Bedroom	1	3.11	Yes
A1.00.10	Kitchen Living Dining	2	5.18	Yes
	Bedroom	1	3.26	Yes
A1.01.01	Kitchen Living Dining	2	7.01	Yes
	Bedroom 1	1	3.31	Yes
	Bedroom 2	1	4.75	Yes
A1.01.02	Kitchen Living Dining	2	5.9	Yes
	Bedroom 1	1	2.38	Yes
	Bedroom 2	1	3.2	Yes
A1.01.03	Kitchen Living Dining	2	6.98	Yes
	Bedroom	1	2.93	Yes
A1.01.04	Studio	2	2.82	Yes
A1.01.05	Studio	2	1.89	No
A1.01.06	Kitchen Living Dining	2	1.7	No
	Bedroom 1	1	2.32	Yes
	Bedroom 2	1	3.66	Yes
	Bedroom 3	1	2.95	Yes
A1.01.07	Kitchen Living Dining	2	1.58	No
	Bedroom 1	1	2.09	Yes

Apartment Reference	Room	Target ADF (%)	ADF Achieved (%)	Target ADF Achieved
	Bedroom 2	1	3.34	Yes
	Bedroom 3	1	2.97	Yes
A1.01.08	Studio	2	1.84	No
A1.01.09	Kitchen Living Dining	2	5.38	Yes
	Bedroom 1	1	2.37	Yes
	Bedroom 2	1	2.8	Yes
A1.01.10	Kitchen Living Dining	2	5.43	Yes
	Bedroom 1	1	2.12	Yes
	Bedroom 2	1	3.16	Yes
A1.01.11	Studio	2	2.85	Yes
A1.01.12	Kitchen Living Dining	2	5.68	Yes
	Bedroom	1	2.8	Yes
A1.02.01	Kitchen Living Dining	2	7.12	Yes
	Bedroom 1	1	3.5	Yes
	Bedroom 2	1	4.95	Yes
A1.02.02	Kitchen Living Dining	2	5.32	Yes
	Bedroom 1	1	2.45	Yes
	Bedroom 2	1	3.39	Yes
A1.02.03	Kitchen Living Dining	2	8.45	Yes
	Bedroom	1	3.36	Yes
A1.02.04	Kitchen Living Dining	2	3.26	Yes
	Bedroom	1	2	Yes
A1.02.05	Studio	2	2.11	Yes
A1.02.06	Kitchen Living Dining	2	1.79	No
	Bedroom 1	1	2.32	Yes
	Bedroom 2	1	3.69	Yes
	Bedroom 3	1	2.96	Yes
A1.02.07	Kitchen Living Dining	2	1.77	No
	Bedroom 1	1	2.1	Yes
	Bedroom 2	1	3.36	Yes
	Bedroom 3	1	3.01	Yes
A1.02.08	Studio	2	2.03	Yes
A1.02.09	Kitchen Living Dining	2	5.44	Yes
	Bedroom 1	1	2.34	Yes
	Bedroom 2	1	2.93	Yes
A1.02.10	Kitchen Living Dining	2	6.21	Yes
	Bedroom 1	1	2.23	Yes
	Bedroom 2	1	3.32	Yes
A1.02.11	Kitchen Living Dining	2	3.06	Yes
	Bedroom	1	1.97	Yes
A1.02.12	Kitchen Living Dining	2	5.72	Yes

Apartment Reference	Room	Target ADF (%)	ADF Achieved (%)	Target ADF Achieved
	Bedroom	1	3.1	Yes
A1.03.01	Kitchen Living Dining	2	7.2	Yes
	Bedroom 1	1	3.64	Yes
	Bedroom 2	1	5.09	Yes
A1.03.02	Kitchen Living Dining	2	6.12	Yes
	Bedroom 1	1	2.59	Yes
	Bedroom 2	1	3.68	Yes
A1.03.03	Kitchen Living Dining	2	7.75	Yes
	Bedroom	1	3.78	Yes
A1.03.04	Studio	2	3.57	Yes
A1.03.05	Studio	2	2.34	Yes
A1.03.06	Kitchen Living Dining	2	2.12	Yes
	Bedroom 1	1	2.35	Yes
	Bedroom 2	1	3.7	Yes
	Bedroom 3	1	2.93	Yes
A1.03.07	Kitchen Living Dining	2	1.95	No
	Bedroom 1	1	2.12	Yes
	Bedroom 2	1	3.38	Yes
	Bedroom 3	1	3.02	Yes
A1.03.08	Studio	2	2.26	Yes
A1.03.09	Kitchen Living Dining	2	5.51	Yes
	Bedroom 1	1	2.55	Yes
	Bedroom 2	1	3.15	Yes
A1.03.10	Kitchen Living Dining	2	5.53	Yes
	Bedroom 1	1	2.37	Yes
	Bedroom 2	1	3.51	Yes
A1.03.11	Studio	2	3.45	Yes
A1.03.12	Kitchen Living Dining	2	6.79	Yes
	Bedroom	1	3.44	Yes
A1.04.01	Kitchen Living Dining	2	7.26	Yes
	Bedroom 1	1	3.72	Yes
	Bedroom 2	1	5.19	Yes
A1.04.02	Kitchen Living Dining	2	5.46	Yes
	Bedroom 1	1	2.8	Yes
	Bedroom 2	1	4.07	Yes
A1.04.03	Kitchen Living Dining	2	9.64	Yes
	Bedroom	1	4.26	Yes
A1.04.04	Kitchen Living Dining	2	4.17	Yes
	Bedroom	1	2.68	Yes
A1.04.05	Studio	2	2.78	Yes
A1.04.06	Kitchen Living Dining	2	2.34	Yes

Apartment Reference	Room	Target ADF (%)	ADF Achieved (%)	Target ADF Achieved
	Bedroom 1	1	2.37	Yes
	Bedroom 2	1	3.76	Yes
	Bedroom 3	1	3.92	Yes
A1.04.07	Kitchen Living Dining	2	2.31	Yes
	Bedroom 1	1	2.16	Yes
	Bedroom 2	1	3.43	Yes
	Bedroom 3	1	3.05	Yes
A1.04.08	Studio	2	2.63	Yes
A1.04.09	Kitchen Living Dining	2	5.59	Yes
	Bedroom 1	1	2.63	Yes
	Bedroom 2	1	3.48	Yes
A1.04.10	Kitchen Living Dining	2	6.43	Yes
	Bedroom 1	1	2.51	Yes
	Bedroom 2	1	3.75	Yes
A1.04.11	KLD	2	3.88	Yes
	Bedroom 1	1	2.42	Yes
A1.04.12	Kitchen Living Dining	2	6.66	Yes
	Bedroom	1	3.87	Yes
A2.00.01	Kitchen Living Dining	2	7.6	Yes
	Bedroom	1	2.43	Yes
A2.00.02	Kitchen Living Dining	2	5.2	Yes
	Bedroom 1	1	2.26	Yes
	Bedroom 2	1	2.92	Yes
A2.00.03	Kitchen Living Dining	2	4.87	Yes
	Bedroom	1	2.76	Yes
A2.00.04	Kitchen Living Dining	2	2.33	Yes
	Bedroom	1	2.52	Yes
A2.00.05	Kitchen Living Dining	2	1.73	No
	Bedroom	1	1.37	Yes
A2.00.06	Kitchen Living Dining	2	1.92	No
	Bedroom 1	1	1.33	Yes
	Bedroom 2	1	1.37	Yes
A2.00.07	Kitchen Living Dining	2	6.71	Yes
	Bedroom 1	1	2.56	Yes
	Bedroom 2	1	2.27	Yes
A2.00.08	Kitchen Living Dining	2	7.33	Yes
	Bedroom	1	4.72	Yes
A2.00.09	Kitchen Living Dining	2	2.09	Yes
	Bedroom	1	2.26	Yes
A2.00.10	Kitchen Living Dining	2	7.09	Yes
	Bedroom	1	2.36	Yes

Apartment Reference	Room	Target ADF (%)	ADF Achieved (%)	Target ADF Achieved
A2.01.01	Kitchen Living Dining	2	5.5	Yes
	Bedroom 1	1	2.15	Yes
	Bedroom 2	1	2.98	Yes
A2.01.02	Kitchen Living Dining	2	5.23	Yes
	Bedroom 1	1	2.38	Yes
	Bedroom 2	1	3.18	Yes
A2.01.03	Kitchen Living Dining	2	5.48	Yes
	Bedroom	1	3.11	Yes
A2.01.04	Studio	2	2.87	Yes
A2.01.05	Studio	2	1.85	No
A2.01.06	Kitchen Living Dining	2	1.68	No
	Bedroom 1	1	2.31	Yes
	Bedroom 2	1	3.65	Yes
	Bedroom 3	1	2.94	Yes
A2.01.07	Kitchen Living Dining	2	1.57	No
	Bedroom 1	1	2.08	Yes
	Bedroom 2	1	3.34	Yes
	Bedroom 3	1	2.97	Yes
A2.01.08	Studio	2	1.86	No
A2.01.09	Kitchen Living Dining	2	6	Yes
	Bedroom 1	1	2.37	Yes
	Bedroom 2	1	2.81	Yes
A2.01.10	Kitchen Living Dining	2	6.95	Yes
	Bedroom 1	1	3.31	Yes
	Bedroom 2	1	4.99	Yes
A2.01.11	Studio	2	2.84	Yes
A2.01.12	Kitchen Living Dining	2	7.63	Yes
	Bedroom	1	2.78	Yes
A2.02.01	Kitchen Living Dining	2	6.24	Yes
	Bedroom 1	1	2.25	Yes
	Bedroom 2	1	3.12	Yes
A2.02.02	Kitchen Living Dining	2	5.29	Yes
	Bedroom 1	1	2.43	Yes
	Bedroom 2	1	3.35	Yes
A2.02.03	Kitchen Living Dining	2	5.85	Yes
	Bedroom	1	3.38	Yes
A2.02.04	Kitchen Living Dining	2	2.04	Yes
	Bedroom	1	3.13	Yes
A2.02.05	Studio	2	2.05	Yes
A2.02.06	Kitchen Living Dining	2	1.76	No
	Bedroom 1	1	2.32	Yes

Apartment Reference	Room	Target ADF (%)	ADF Achieved (%)	Target ADF Achieved
	Bedroom 2	1	3.67	Yes
	Bedroom 3	1	3.04	Yes
A2.02.07	Kitchen Living Dining	2	1.77	No
	Bedroom 1	1	2.09	Yes
	Bedroom 2	1	3.36	Yes
	Bedroom 3	1	2.97	Yes
A2.02.08	Studio	2	2.06	Yes
A2.02.09	Kitchen Living Dining	2	5.45	Yes
	Bedroom 1	1	2.2	Yes
	Bedroom 2	1	2.96	Yes
A2.02.10	Kitchen Living Dining	2	6.99	Yes
	Bedroom 1	1	3.35	Yes
	Bedroom 2	1	5.02	Yes
A2.02.11	Kitchen Living Dining	2	3.15	Yes
	Bedroom	1	1.98	Yes
A2.02.12	Kitchen Living Dining	2	8.59	Yes
	Bedroom	1	3.44	Yes
A2.03.01	Kitchen Living Dining	2	5.61	Yes
	Bedroom 1	1	2.41	Yes
	Bedroom 2	1	3.3	Yes
A2.03.02	Kitchen Living Dining	2	5.35	Yes
	Bedroom 1	1	2.57	Yes
	Bedroom 2	1	3.63	Yes
A2.03.03	Kitchen Living Dining	2	6.21	Yes
	Bedroom	1	3.65	Yes
A2.03.04	Studio	2	3.42	Yes
A2.03.05	Studio	2	2.24	Yes
A2.03.06	Kitchen Living Dining	2	2.08	Yes
	Bedroom 1	1	2.35	Yes
	Bedroom 2	1	3.7	Yes
	Bedroom 3	1	3.06	Yes
A2.03.07	Kitchen Living Dining	2	1.95	No
	Bedroom 1	1	2.1	Yes
	Bedroom 2	1	3.38	Yes
	Bedroom 3	1	3.57	Yes
A2.03.08	Studio	2	2.3	Yes
A2.03.09	Kitchen Living Dining	2	6.21	Yes
	Bedroom 1	1	2.49	Yes
	Bedroom 2	1	3.17	Yes
A2.03.10	Kitchen Living Dining	2	7.03	Yes
	Bedroom 1	1	3.39	Yes

Apartment Reference	Room	Target ADF (%)	ADF Achieved (%)	Target ADF Achieved
	Bedroom 2	1	5.07	Yes
A2.03.11	Studio	2	3.53	Yes
A2.03.12	Kitchen Living Dining	2	7.97	Yes
	Bedroom	1	3.54	Yes
A2.04.01	Kitchen Living Dining	2	6.45	Yes
	Bedroom 1	1	2.57	Yes
	Bedroom 2	1	3.52	Yes
A2.04.02	Kitchen Living Dining	2	5.42	Yes
	Bedroom 1	1	2.78	Yes
	Bedroom 2	1	4.03	Yes
A2.02.03	Kitchen Living Dining	2	6.71	Yes
	Bedroom	1	4.04	Yes
A2.04.04	Kitchen Living Dining	2	3.94	Yes
	Bedroom	1	2.45	Yes
A2.04.05	Studio	2	2.64	Yes
A2.04.06	Kitchen Living Dining	2	2.28	Yes
	Bedroom 1	1	2.36	Yes
	Bedroom 2	1	3.74	Yes
	Bedroom 3	1	3.1	Yes
A2.04.07	Kitchen Living Dining	2	2.31	Yes
	Bedroom 1	1	2.13	Yes
	Bedroom 2	1	3.41	Yes
	Bedroom 3	1	3.03	Yes
A2.04.08	Studio	2	2.7	Yes
A2.04.09	Kitchen Living Dining	2	5.59	Yes
	Bedroom 1	1	2.64	Yes
	Bedroom 2	1	3.51	Yes
A2.04.10	Kitchen Living Dining	2	7.08	Yes
	Bedroom 1	1	3.42	Yes
	Bedroom 2	1	5.1	Yes
A2.04.11	Kitchen Living Dining	2	4.02	Yes
	Bedroom	1	2.56	Yes
A2.04.12	Kitchen Living Dining	2	9.47	Yes
	Bedroom	1	3.99	Yes
B.00.01	Kitchen Living Dining	2	6.22	Yes
	Bedroom	1	3.43	Yes
B.00.02	Kitchen Living Dining	2	3.2	Yes
	Bedroom 1	1	4.7	Yes
	Bedroom 2	1	5.28	Yes
	Living Room	1.5	3.46	Yes
B.00.03	Kitchen Living Dining	2	3.55	Yes

Apartment Reference	Room	Target ADF (%)	ADF Achieved (%)	Target ADF Achieved
	Bedroom 1	1	5.82	Yes
	Bedroom 2	1	3.85	Yes
	Bedroom 3	1	7.38	Yes
	Living Room	1.5	5.3	Yes
B.00.04	Kitchen Living Dining	2	3.54	Yes
	Bedroom 1	1	5.18	Yes
	Bedroom 2	1	5.04	Yes
	Living Room	1.5	5.63	Yes
B.00.05	Kitchen Living Dining	2	2.88	Yes
	Bedroom 1	1	2.95	Yes
	Bedroom 2	1	3.67	Yes
	Bedroom 3	1	3.39	Yes
	Living Room	1.5	4.03	Yes
B.00.06	Kitchen Living Dining	2	2.44	Yes
	Bedroom	1	3.64	Yes
B.00.07	Kitchen Living Dining	2	3.27	Yes
	Bedroom 1	1	5.5	Yes
	Bedroom 2	1	5.32	Yes
	Living Room	1.5	7.03	Yes
B.00.08	Kitchen Living Dining	2	3.22	Yes
	Bedroom 1	1	3.37	Yes
	Bedroom 2	1	3.55	Yes
	Bedroom 3	1	3.39	Yes
	Living Room	1.5	4.86	Yes
B.00.09	Kitchen Living Dining	2	3.43	Yes
	Bedroom 1	1	5.35	Yes
	Bedroom 2	1	6.04	Yes
	Bedroom 3	1	3.37	Yes
	Living Room	1.5	4.3	Yes
B.00.10	Kitchen Living Dining	2	2.79	Yes
	Bedroom	1	2.18	Yes
B.00.11	Kitchen Living Dining	2	3.37	Yes
	Bedroom 1	1	5.16	Yes
	Bedroom 2	1	5.5	Yes
	Bedroom 3	1	3.15	Yes
	Living Room	1.5	4.93	Yes
B.00.12	Kitchen Living Dining	2	3.34	Yes
	Bedroom 1	1	5.45	Yes
	Bedroom 2	1	5.87	Yes
	Bedroom 3	1	3.16	Yes
	Living Room	1.5	5.15	Yes

Apartment Reference	Room	Target ADF (%)	ADF Achieved (%)	Target ADF Achieved
B.00.13	Kitchen Living Dining	2	3.38	Yes
	Bedroom 1	1	3.75	Yes
	Bedroom 2	1	4.11	Yes
	Living Room	1.5	5.21	Yes
B.00.14	Studio	2	3.48	Yes
B.00.15	Kitchen Living Dining	2	4.65	Yes
	Bedroom 1	1	4.88	Yes
	Bedroom 2	1	4.89	Yes
	Bedroom 3	1	8.11	Yes
	Living Room	1.5	9.17	Yes
B.00.16	Kitchen Living Dining	2	4.86	Yes
	Bedroom 1	1	5.91	Yes
	Bedroom 2	1	4.52	Yes
	Bedroom 3	1	8.01	Yes
	Living Room	1.5	9.72	Yes
B.00.17	Kitchen Living Dining	2	4.1	Yes
	Bedroom	1	6.89	Yes
B.00.18	Kitchen Living Dining	2	4.09	Yes
	Bedroom 1	1	4.85	Yes
	Bedroom 2	1	5.01	Yes
	Bedroom 3	1	9.23	Yes
	Living Room	1.5	9.97	Yes
B.00.19	Kitchen Living Dining	2	3.94	Yes
	Bedroom 1	1	4.94	Yes
	Bedroom 2	1	4.93	Yes
	Bedroom 3	1	9.24	Yes
	Living Room	1.5	9.82	Yes
B.00.20	Kitchen Living Dining	2	4.1	Yes
	Bedroom 1	1	5.02	Yes
	Bedroom 2	1	5	Yes
	Living Room	1.5	5.24	Yes
B.00.21	Kitchen Living Dining	2	4.63	Yes
	Bedroom	1	4.63	Yes
	Study	2	3.68	Yes
B.00.22	Kitchen Living Dining	2	4.98	Yes
	Bedroom 1	1	4.69	Yes
	Bedroom 2	1	5.24	Yes
	Bedroom 3	1	3.16	Yes
	Living Room	1.5	4.99	Yes
B.00.23	Kitchen Living Dining	2	4.94	Yes
	Bedroom 1	1	4.57	Yes

Apartment Reference	Room	Target ADF (%)	ADF Achieved (%)	Target ADF Achieved
	Bedroom 2	1	5.11	Yes
	Bedroom 3	1	3.35	Yes
	Living Room	1.5	5.37	Yes
B.00.24	Kitchen Living Dining	2	4.89	Yes
	Bedroom 1	1	7.28	Yes
	Bedroom 2	1	7.55	Yes
	Bedroom 3	1	4.74	Yes
	Living Room	1.5	7.36	Yes
B.00.25	Kitchen Living Dining	2	3.68	Yes
	Bedroom 1	1	5.41	Yes
	Bedroom 2	1	5.74	Yes
	Bedroom 3	1	3.88	Yes
	Living Room	1.5	4.61	Yes
B.00.26	Kitchen Living Dining	2	5.19	Yes
	Bedroom	1	6.14	Yes
B.00.27	Kitchen Living Dining	2	5	Yes
	Bedroom 1	1	6.35	Yes
	Bedroom 2	1	7.2	Yes
	Bedroom 3	1	3.76	Yes
	Living Room	1.5	5.98	Yes
B.00.28	Kitchen Living Dining	2	4.96	Yes
	Bedroom 1	1	4.23	Yes
	Bedroom 2	1	5.39	Yes
	Bedroom 3	1	3.13	Yes
	Living Room	1.5	4.8	Yes
B.00.29	Kitchen Living Dining	2	4.96	Yes
	Bedroom 1	1	4.38	Yes
	Bedroom 2	1	4.74	Yes
	Bedroom 3	1	3.03	Yes
	Living Room	1.5	4.92	Yes
B.00.30	Kitchen Living Dining	2	4.93	Yes
	Bedroom 1	1	6.3	Yes
	Bedroom 2	1	7.25	Yes
	Bedroom 3	1	4.03	Yes
	Living Room	1.5	6.92	Yes
B.00.31	Kitchen Living Dining	2	4.79	Yes
	Bedroom 1	1	5.78	Yes
	Bedroom 2	1	2.7	Yes
	Bedroom 3	1	2.45	Yes
	Living Room	1.5	3.33	Yes
B.00.32	Kitchen Living Dining	2	5.06	Yes

Apartment Reference	Room	Target ADF (%)	ADF Achieved (%)	Target ADF Achieved
	Bedroom	1	4.65	Yes
B.01.01	Kitchen Living Dining	2	6.18	Yes
	Bedroom	1	3.41	Yes
B.01.02	Kitchen Living Dining	2	2.95	Yes
	Bedroom 1	1	3.6	Yes
	Bedroom 2	1	3.91	Yes
	Bedroom 3	1	6.15	Yes
B.01.03	Kitchen Living Dining	2	2.31	Yes
	Bedroom 1	1	2.59	Yes
	Bedroom 2	1	4.17	Yes
	Bedroom 3	1	4.34	Yes
B.01.04	Studio	2	2.77	Yes
B.01.05	Kitchen Living Dining	2	3.71	Yes
	Bedroom 1	1	3.5	Yes
	Bedroom 2	1	2.87	Yes
	Bedroom 3	1	4.13	Yes
B.01.06	Kitchen Living Dining	2	2.1	Yes
	Bedroom 1	1	2.04	Yes
	Bedroom 2	1	3.58	Yes
B.01.07	Kitchen Living Dining	2	3.75	Yes
	Bedroom	1	3.07	Yes
B.01.08	Kitchen Living Dining	2	3.19	Yes
	Bedroom	1	4.34	Yes
B.01.09	Studio	2	3.82	Yes
B.01.10	Kitchen Living Dining	2	6.74	Yes
	Bedroom	1	4.05	Yes
B.01.11	Studio	2	4.25	Yes
B.01.12	Kitchen Living Dining	2	7.8	Yes
	Bedroom 1	1	8.88	Yes
	Bedroom 2	1	4.59	Yes
B.01.13	Kitchen Living Dining	2	5.23	Yes
	Bedroom 1	1	7.63	Yes
	Study	2	4.92	Yes
B.01.14	Kitchen Living Dining	2	2.06	Yes
	Bedroom 1	1	4.87	Yes
	Bedroom 2	1	4.47	Yes
B.01.15	Kitchen Living Dining	2	3.2	Yes
	Bedroom	1	3.06	Yes
B.01.16	Kitchen Living Dining	2	3.83	Yes
	Bedroom 1	1	4.21	Yes
	Bedroom 2	1	3.79	Yes

Apartment Reference	Room	Target ADF (%)	ADF Achieved (%)	Target ADF Achieved
	Bedroom 3	1	7.38	Yes
B.01.17	Kitchen Living Dining	2	4.36	Yes
	Bedroom 1	1	5.12	Yes
	Bedroom 2	1	5.55	Yes
	Bedroom 3	1	7.16	Yes
B.01.18	Kitchen Living Dining	2	4.88	Yes
	Bedroom 1	1	6.43	Yes
	Bedroom 2	1	6.48	Yes
B.01.19	Kitchen Living Dining	2	4.65	Yes
	Bedroom 1	1	5.22	Yes
	Bedroom 2	1	5.91	Yes
	Bedroom 3	1	5.97	Yes
B.01.20	Kitchen Living Dining	2	3.8	Yes
	Bedroom	1	4.91	Yes
C.00.01	Kitchen Living Dining	2	3.94	Yes
	Bedroom	1	2.18	Yes
C.00.02	Kitchen Living Dining	2	2.55	Yes
	Bedroom 1	1	4.08	Yes
	Bedroom 2	1	4.85	Yes
	Living Room	1.5	2.16	Yes
C.00.03	Kitchen Living Dining	2	5.76	Yes
	Bedroom 1	1	2.43	Yes
	Bedroom 2	1	4.36	Yes
	Bedroom 3	1	4.62	Yes
C.00.04	Kitchen Living Dining	2	4.15	Yes
	Bedroom 1	1	4.93	Yes
	Bedroom 2	1	2.75	Yes
	Living Room	1.5	3.53	Yes
C.00.05	Kitchen Living Dining	2	4.6	Yes
	Bedroom 1	1	2.55	Yes
	Bedroom 2	1	3.7	Yes
	Bedroom 3	1	2.12	Yes
	Living Room	1.5	3.43	Yes
C.00.06	Kitchen Living Dining	2	4.16	Yes
	Bedroom 1	1	4	Yes
	Bedroom 2	1	2.88	Yes
	Bedroom 3	1	4.22	Yes
	Living Room	1.5	5.5	Yes
C.00.07	Kitchen Living Dining	2	4.4	Yes
	Bedroom	1	2.87	Yes
C.00.08	Kitchen Living Dining	2	4.87	Yes

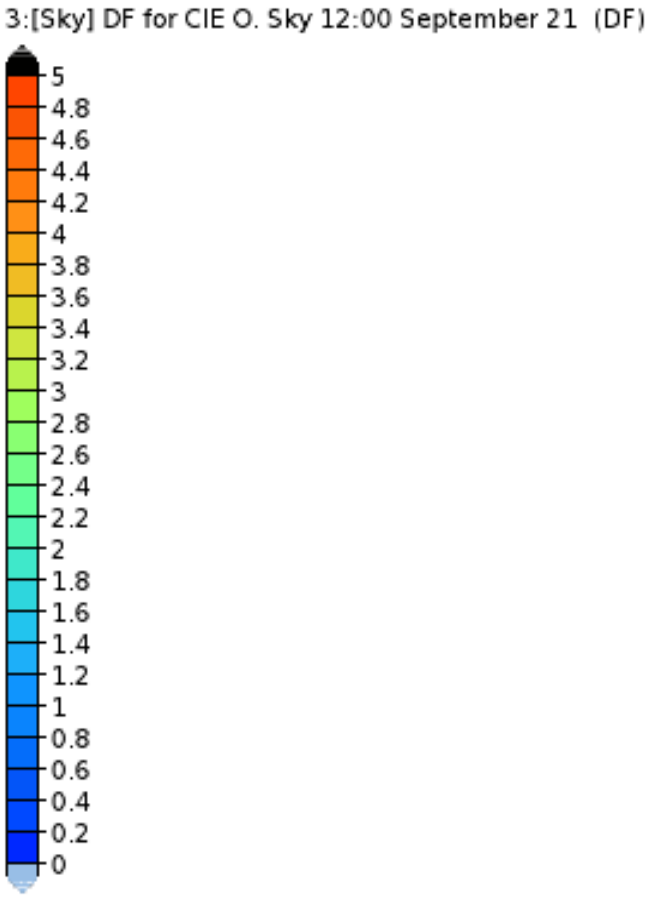
Apartment Reference	Room	Target ADF (%)	ADF Achieved (%)	Target ADF Achieved
	Bedroom 1	1	3.5	Yes
	Bedroom 2	1	4.31	Yes
	Bedroom 3	1	7.85	Yes
	Living Room	1.5	3.41	Yes
C.00.09	Kitchen Living Dining	2	4.53	Yes
	Bedroom 1	1	4.9	Yes
	Bedroom 2	1	4.2	Yes
	Bedroom 3	1	2.8	Yes
	Living Room	1.5	4.83	Yes
C.00.10	Kitchen Living Dining	2	3.89	Yes
	Bedroom 1	1	2.79	Yes
	Bedroom 2	1	3.08	Yes
	Living Room	1.5	3.59	Yes
C.00.11	Kitchen Living Dining	2	6.87	Yes
	Bedroom 1	1	3.56	Yes
	Bedroom 2	1	3.58	Yes
C.00.12	Kitchen Living Dining	2	4.45	Yes
	Bedroom 1	1	4.1	Yes
	Bedroom 2	1	4.88	Yes
	Living Room	1.5	3.74	Yes
C.00.13	Kitchen Living Dining	2	4.05	Yes
	Bedroom 1	1	5.51	Yes
	Bedroom 2	1	5.9	Yes
	Bedroom 3	1	6.51	Yes
	Living Room	1.5	6.71	Yes
C.00.14	Kitchen Living Dining	2	4.41	Yes
	Bedroom 1	1	6.36	Yes
	Bedroom 2	1	6.46	Yes
	Bedroom 3	1	7.04	Yes
	Living Room	1.5	6.62	Yes
C.00.15	Kitchen Living Dining	2	4.63	Yes
	Bedroom 1	1	6.22	Yes
	Bedroom 2	1	5.88	Yes
	Living Room	1.5	5.62	Yes
C.00.16	Kitchen Living Dining	2	3.41	Yes
	Bedroom 1	1	3.33	Yes
	Bedroom 2	1	6.05	Yes
	Living Room	1.5	2.63	Yes
C.00.17	Kitchen Living Dining	2	3.39	Yes
	Bedroom 1	1	2.78	Yes
	Bedroom 2	1	6.17	Yes

Apartment Reference	Room	Target ADF (%)	ADF Achieved (%)	Target ADF Achieved
	Bedroom 3	1	2.6	Yes
	Living Room	1.5	4.75	Yes
C.00.18	Kitchen Living Dining	2	3.11	Yes
	Bedroom 1	1	2.36	Yes
	Bedroom 2	1	2.69	Yes
C.00.19	Kitchen Living Dining	2	3.19	Yes
	Bedroom 1	1	1.79	Yes
	Bedroom 2	1	4.42	Yes
	Bedroom 3	1	3.79	Yes
	Living Room	1.5	4.69	Yes
C.00.20	Kitchen Living Dining	2	3.17	Yes
	Bedroom 1	1	3.28	Yes
	Bedroom 2	1	2.22	Yes
	Bedroom 3	1	3.41	Yes
	Living Room	1.5	3.21	Yes
C.00.21	Kitchen Living Dining	2	3.11	Yes
	Bedroom 1	1	3.33	Yes
	Bedroom 2	1	3.98	Yes
	Living Room	1.5	2.06	Yes
C.00.22	Kitchen Living Dining	2	3.59	Yes
	Bedroom	1	3.09	Yes
C.01.01	Kitchen Living Dining	2	4.12	Yes
	Bedroom	1	2.86	Yes
C.01.02	Kitchen Living Dining	2	3.52	Yes
	Bedroom	1	5.13	Yes
C.01.03	Kitchen Living Dining	2	3.36	Yes
	Bedroom 1	1	4.93	Yes
	Bedroom 2	1	4.12	Yes
	Bedroom 3	1	3.83	Yes
C.01.04	Kitchen Living Dining	2	4.53	Yes
	Bedroom 1	1	2.26	Yes
	Bedroom 2	1	4.82	Yes
	Study	2	5.36	Yes
C.01.05	Kitchen Living Dining	2	3.41	Yes
	Bedroom 1	1	2.94	Yes
	Bedroom 2	1	5.62	Yes
C.01.06	Kitchen Living Dining	2	4.23	Yes
	Bedroom 1	1	3.65	Yes
	Bedroom 2	1	6.16	Yes
C.01.07	Studio	2	4.69	Yes
C.01.08	Studio	2	3.45	Yes

Apartment Reference	Room	Target ADF (%)	ADF Achieved (%)	Target ADF Achieved
C.01.09	Kitchen Living Dining	2	2.22	Yes
	Bedroom	1	2.35	Yes
C.01.10	Kitchen Living Dining	2	2.05	Yes
	Bedroom 1	1	5.24	Yes
	Bedroom 2	1	6.38	Yes
C.01.11	Kitchen Living Dining	2	4.18	Yes
	Bedroom	1	2.4	Yes
C.01.12	Kitchen Living Dining	2	3.86	Yes
	Bedroom	1	2.23	Yes

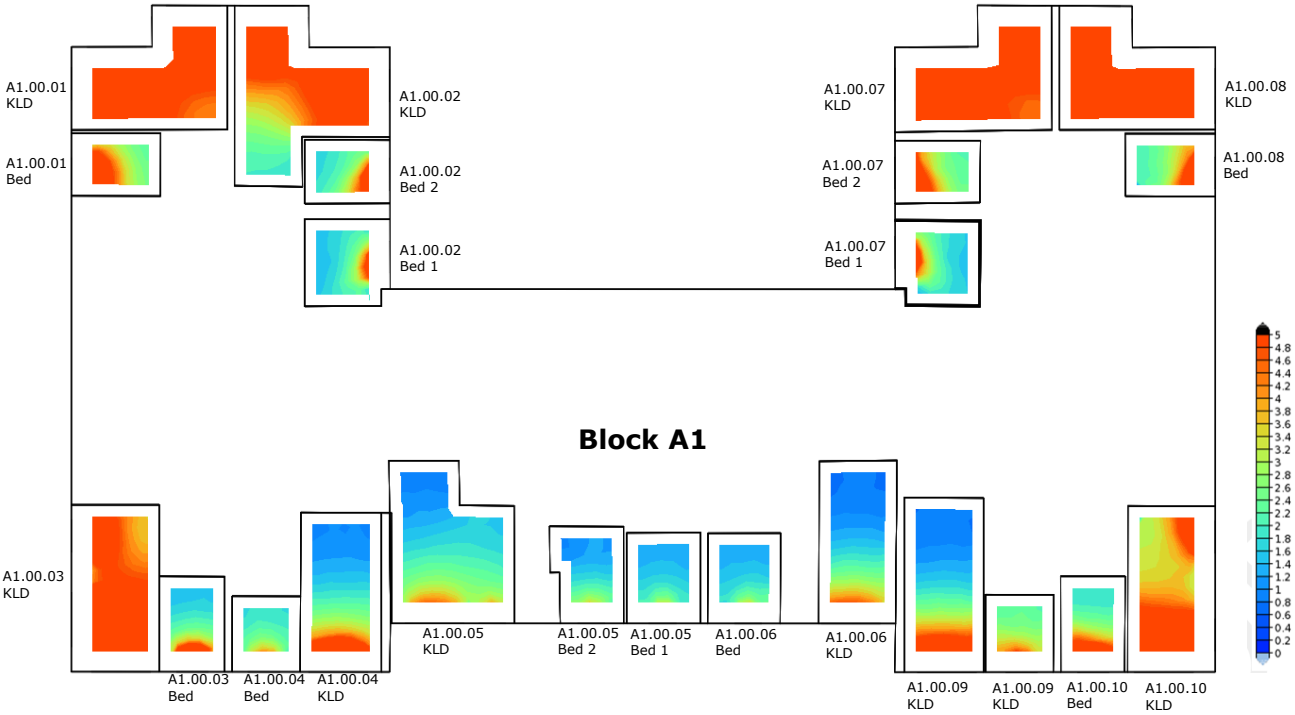
Table A1

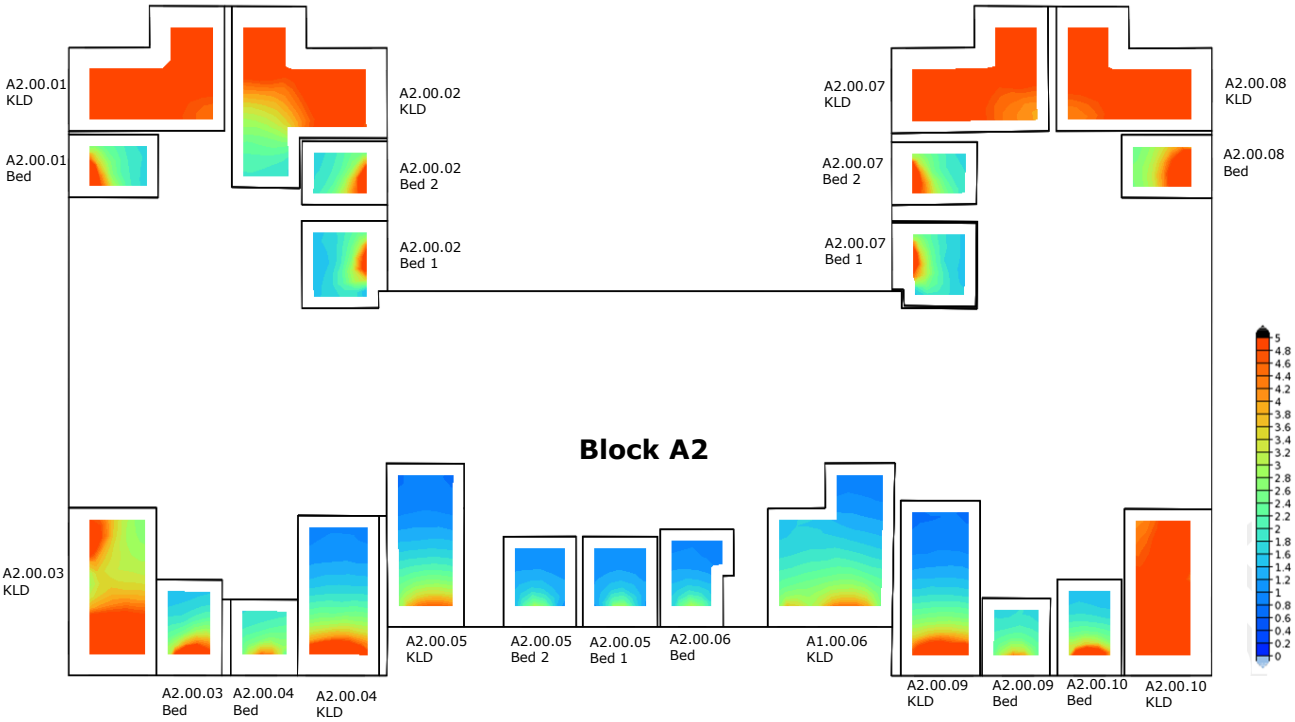
APPENDIX B – DAYLIGHT DISTRIBUTION IMAGES



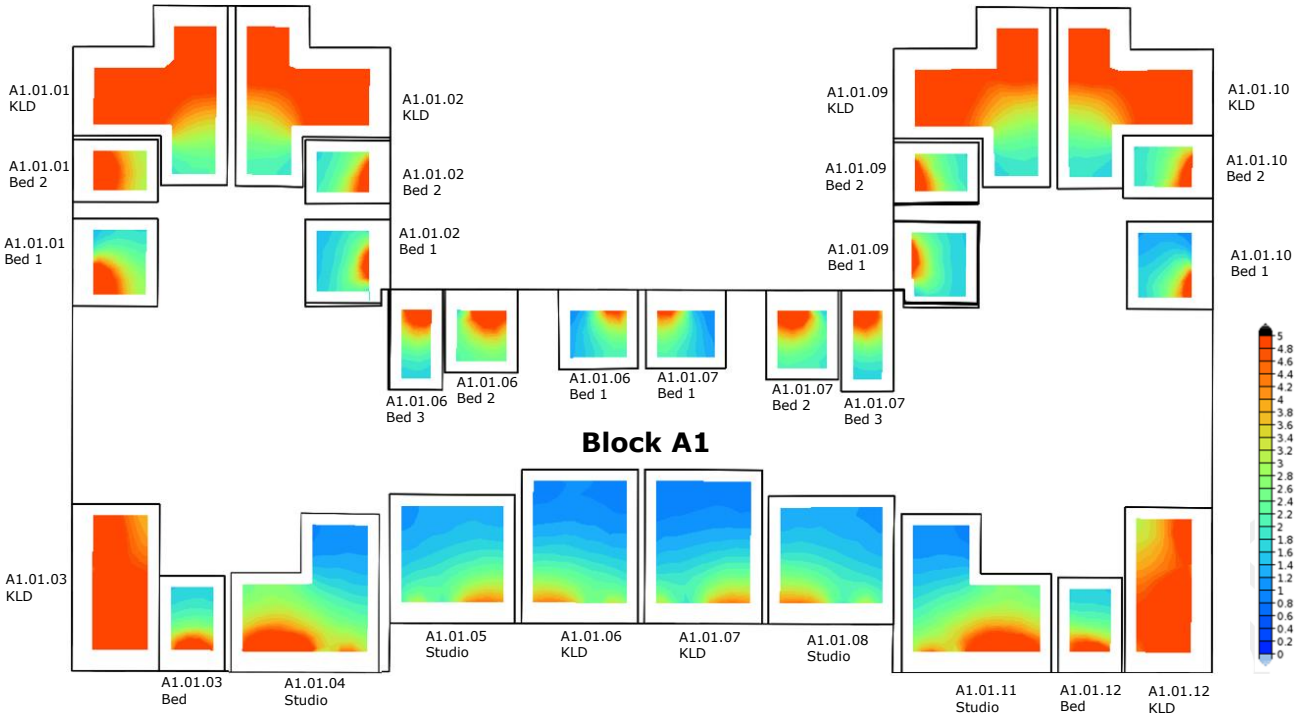
Daylight Factor Scale

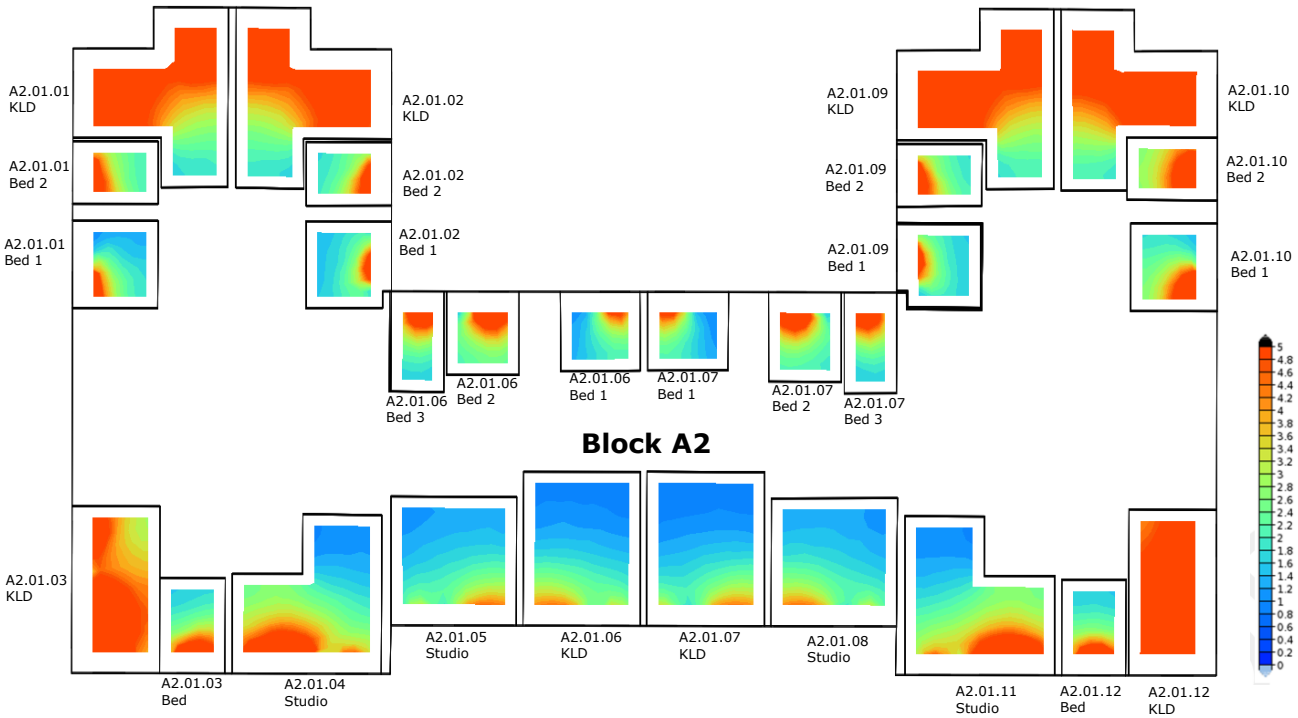
Block A1 & A2 Ground Floor



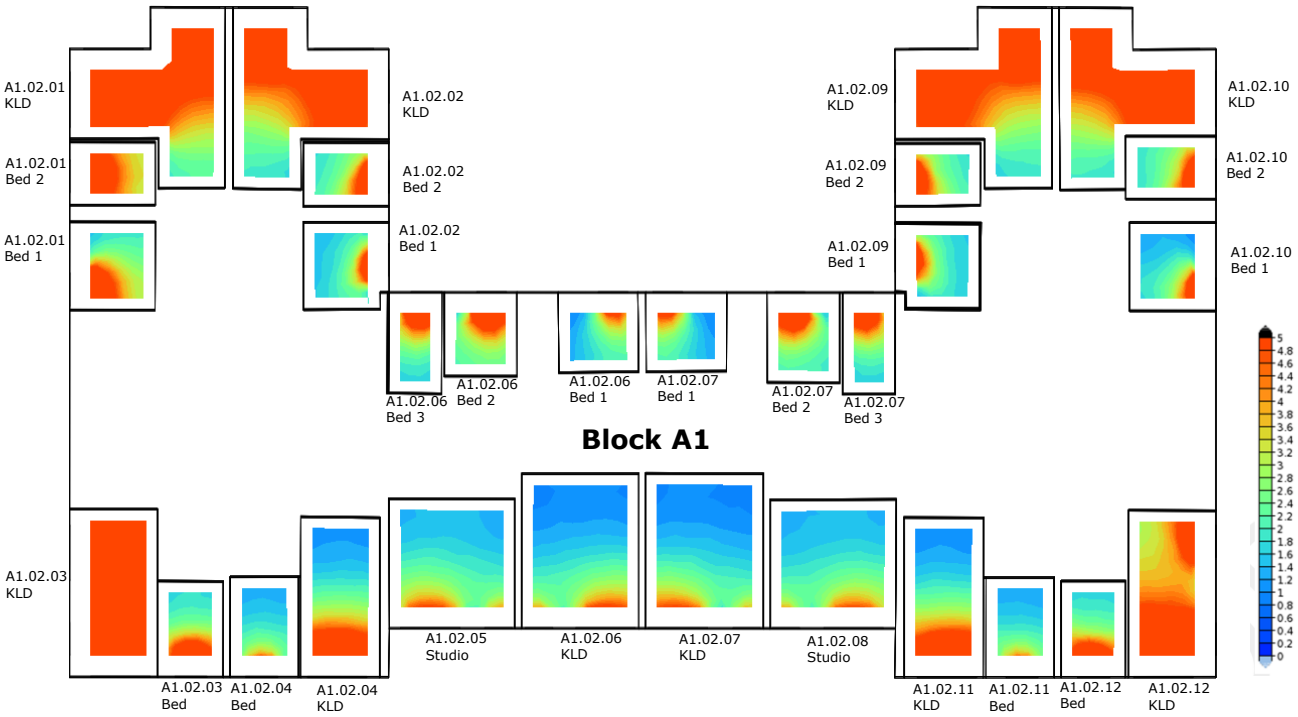


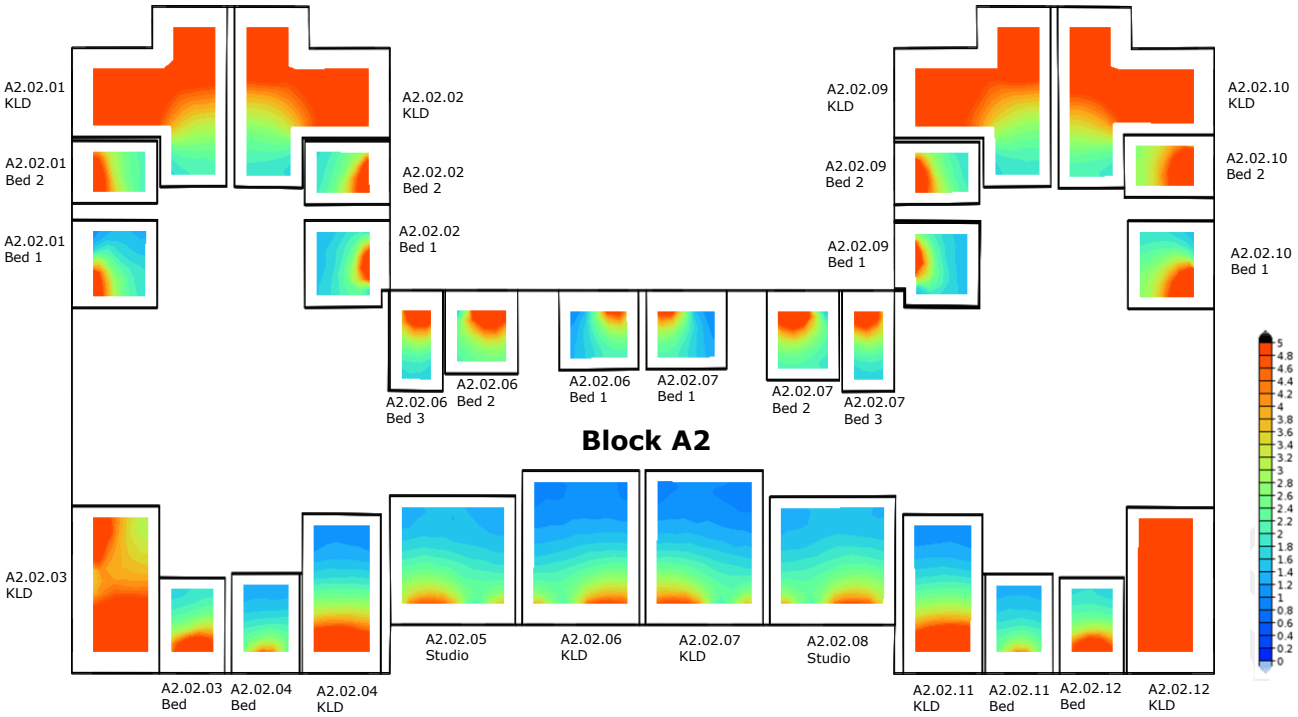
Block A1 & A2 First Floor



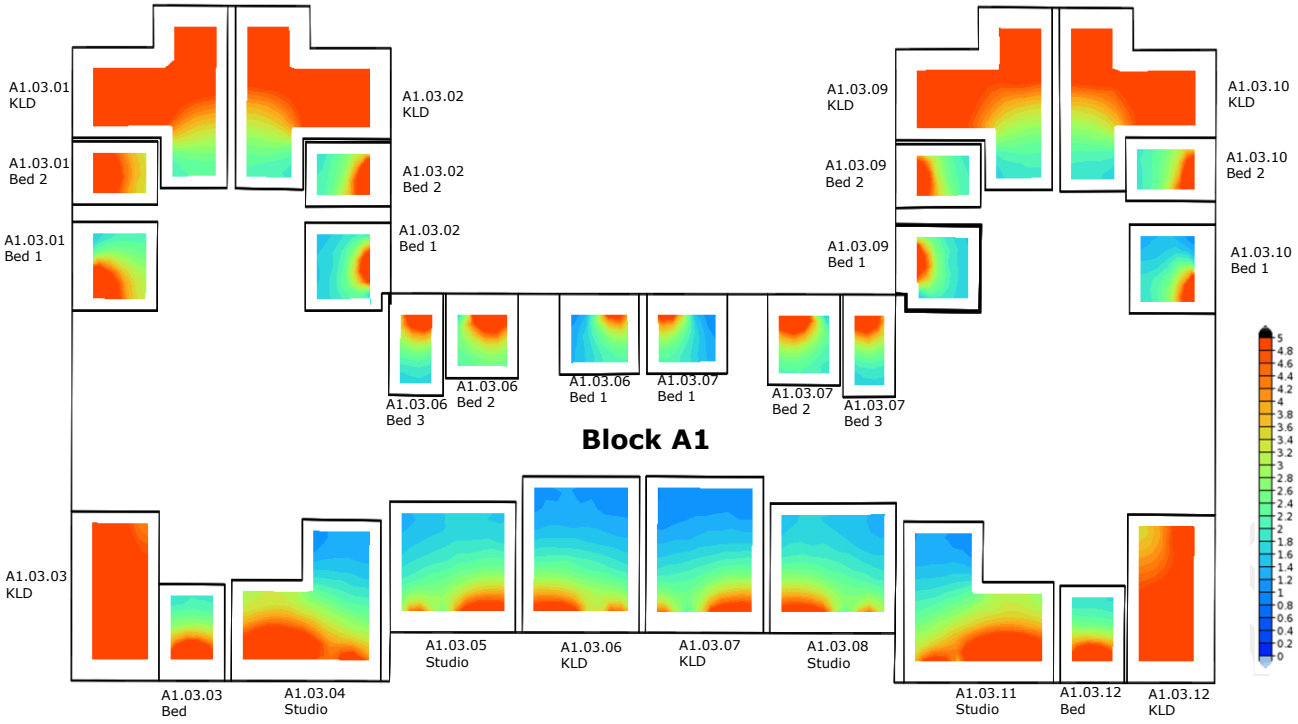


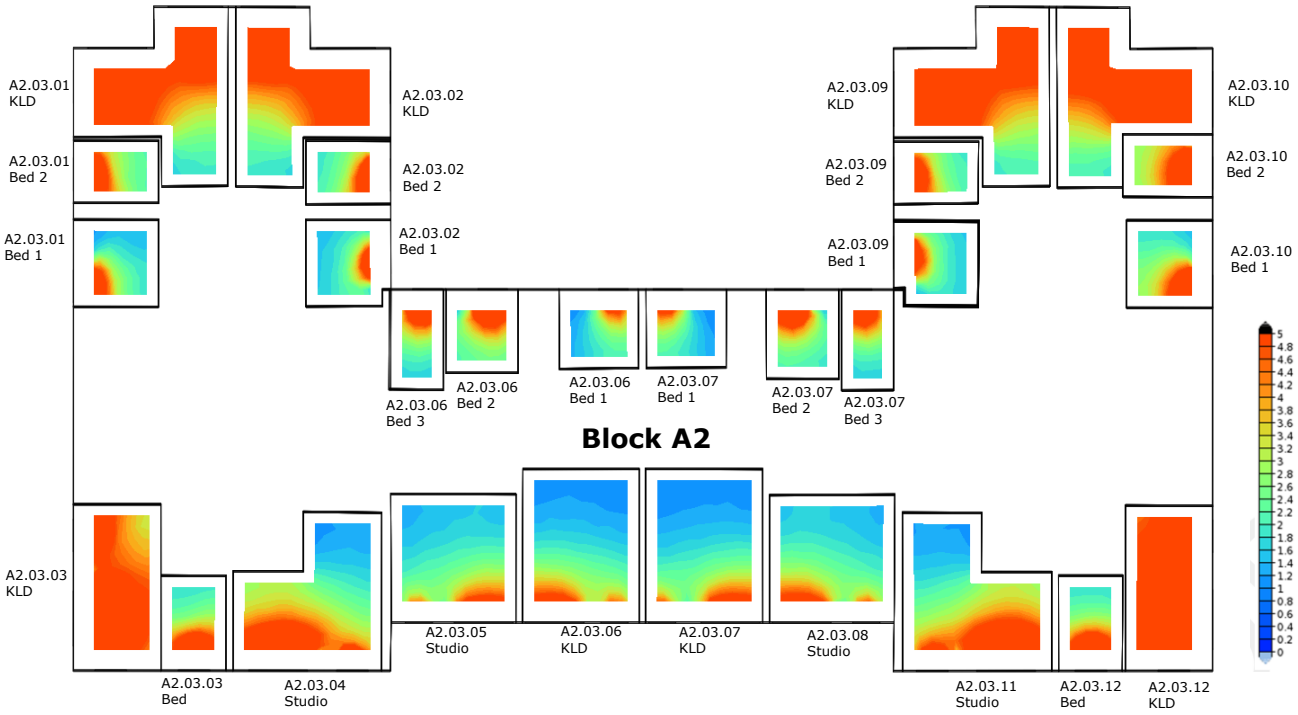
Block A1 & A2 Second Floor



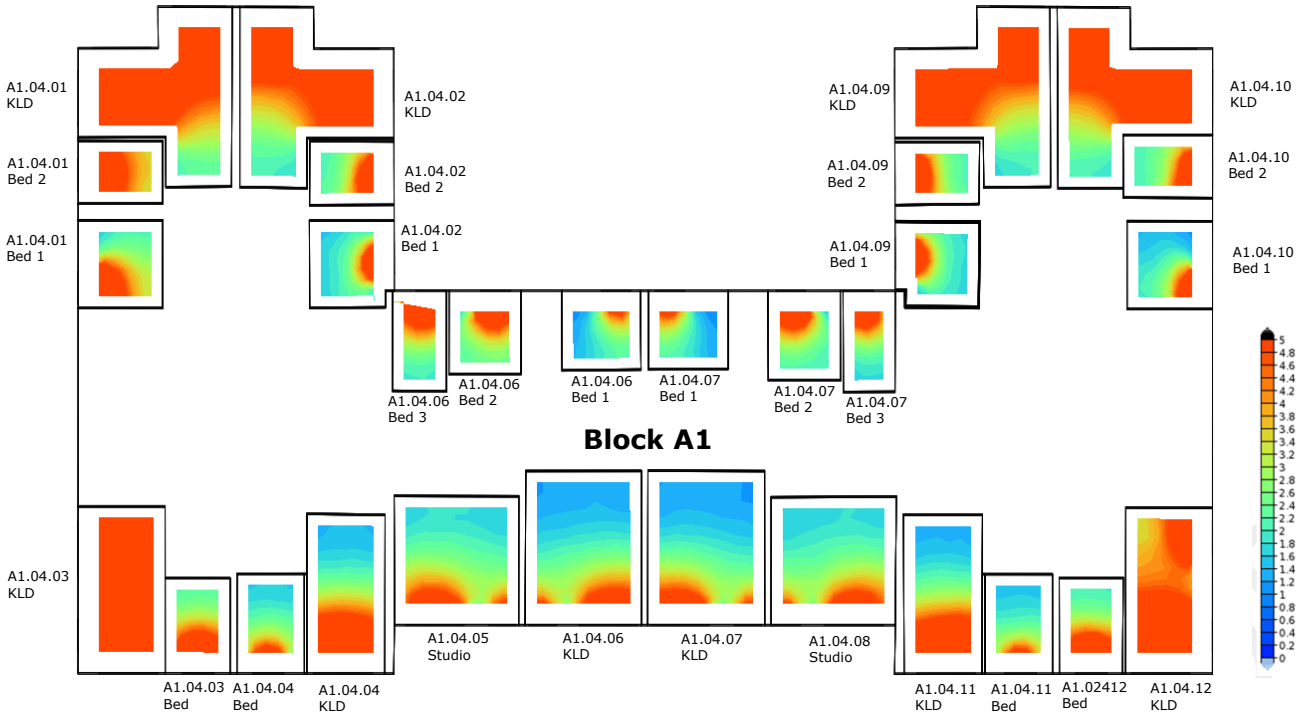


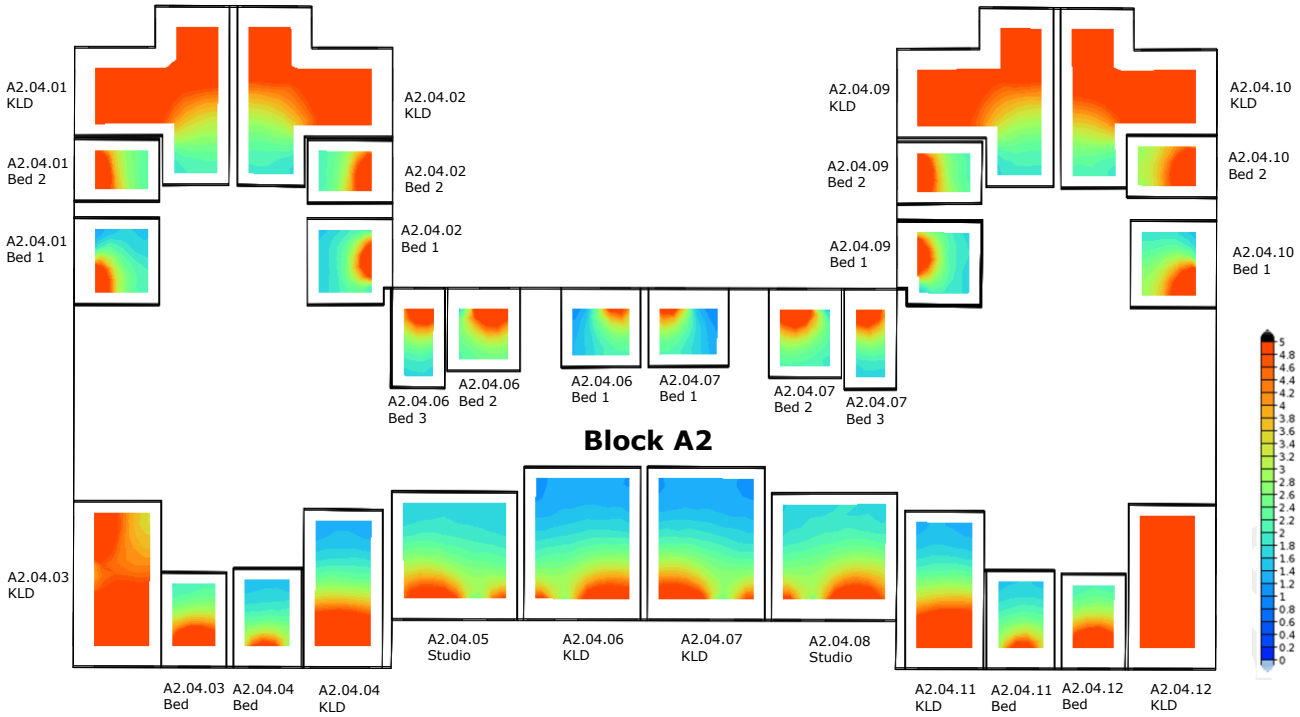
Block A1 & A2 Third Floor



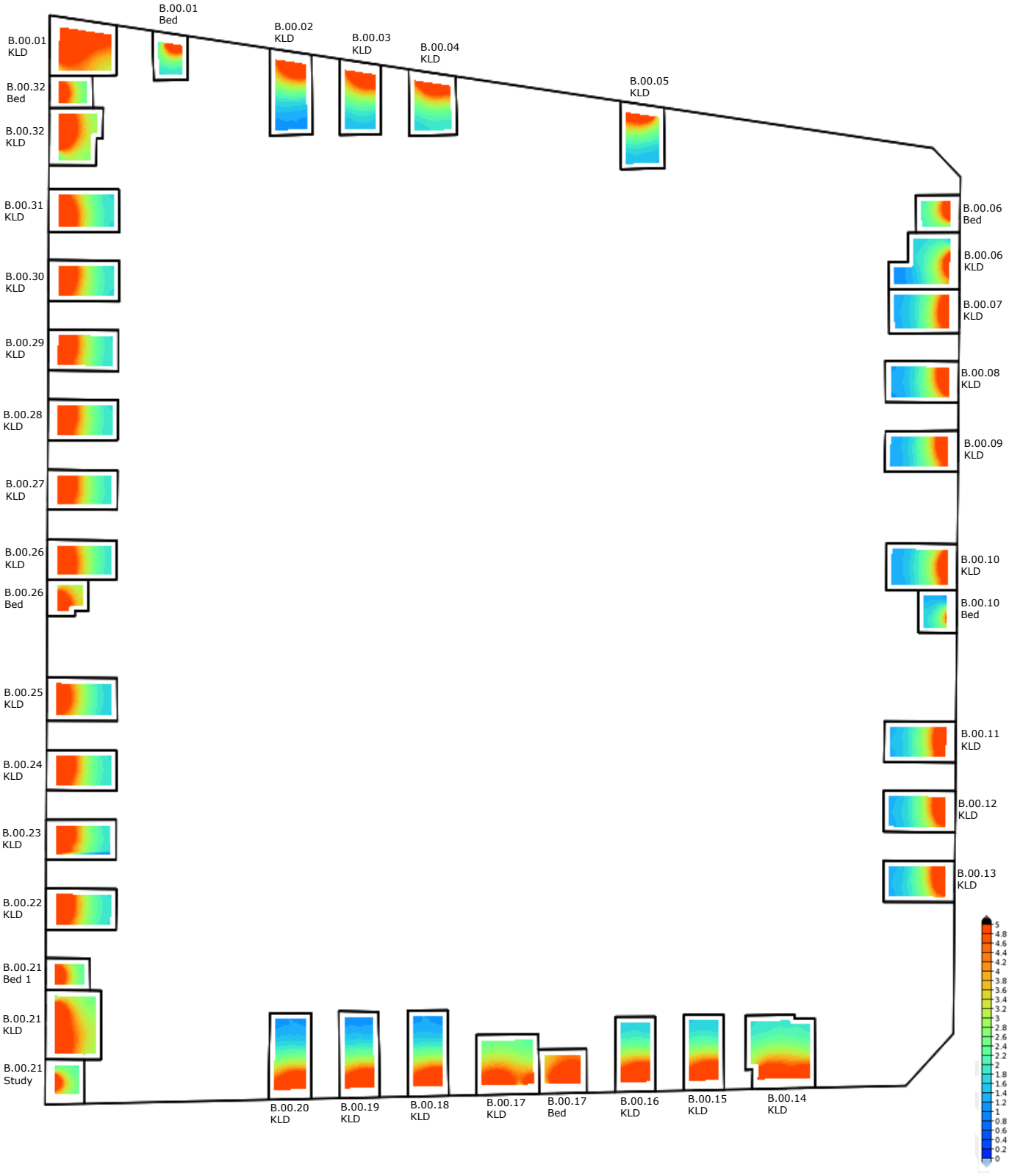


Block A1 & A2 Fourth Floor

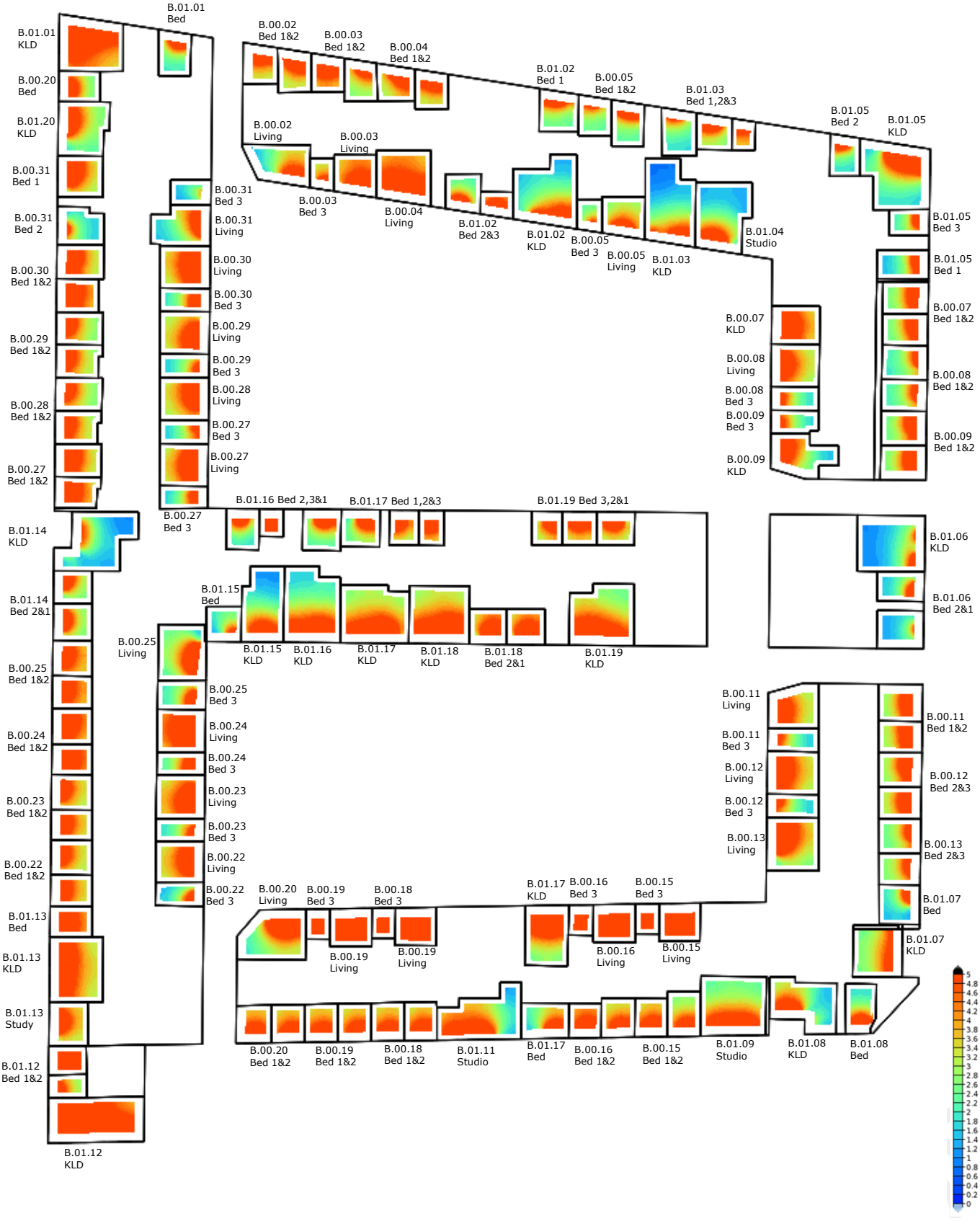




Block B Ground Floor

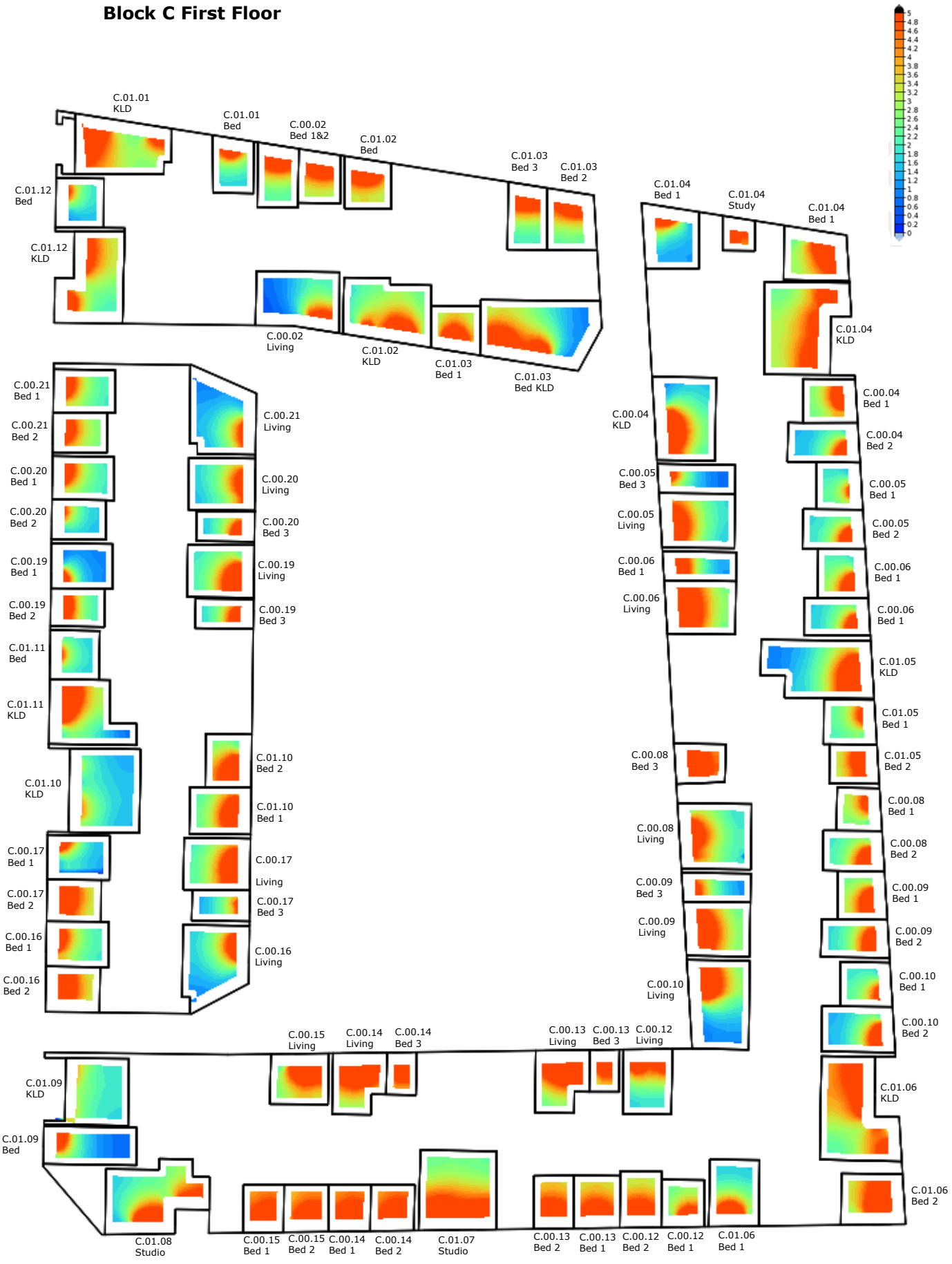


Block B First Floor



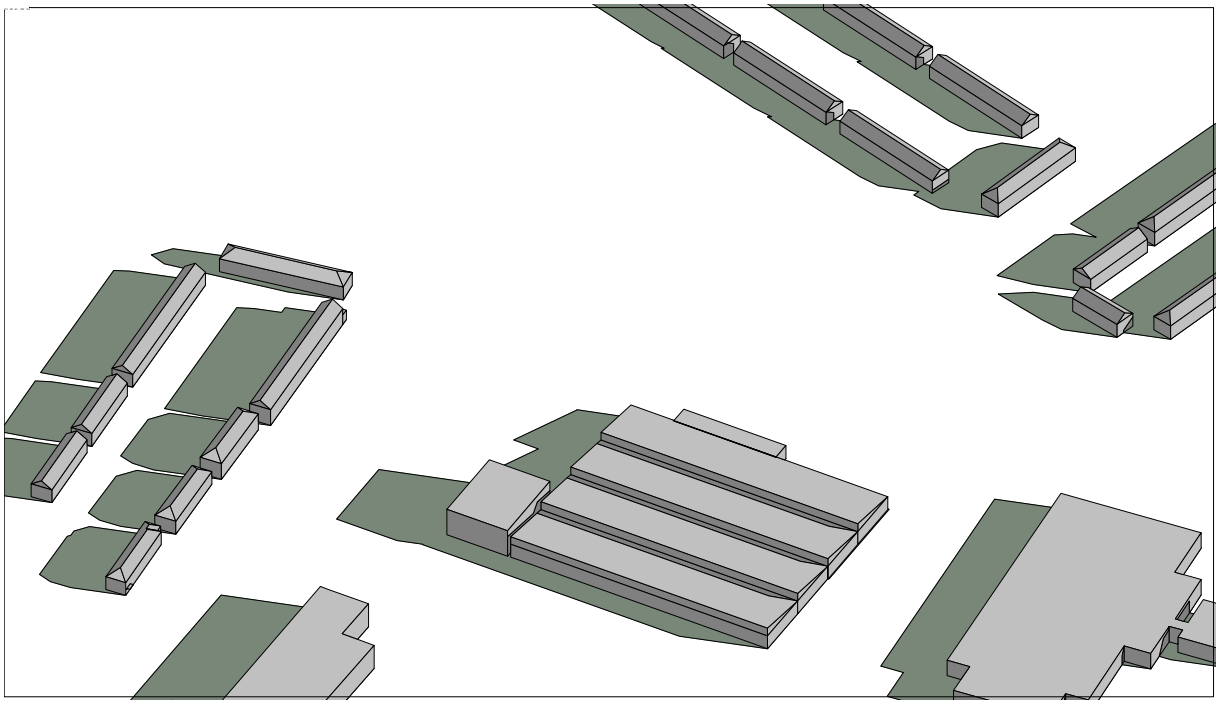
Block C Ground Floor

Block C First Floor

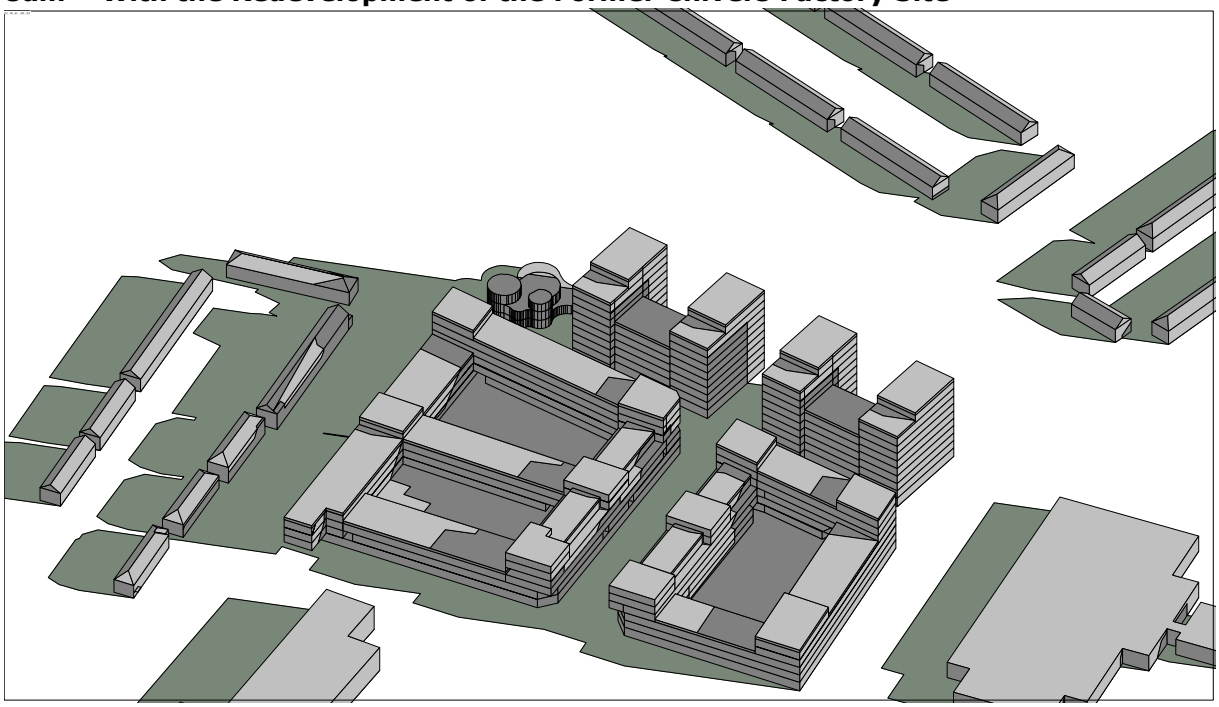


APPENDIX C – SHADOW IMAGES

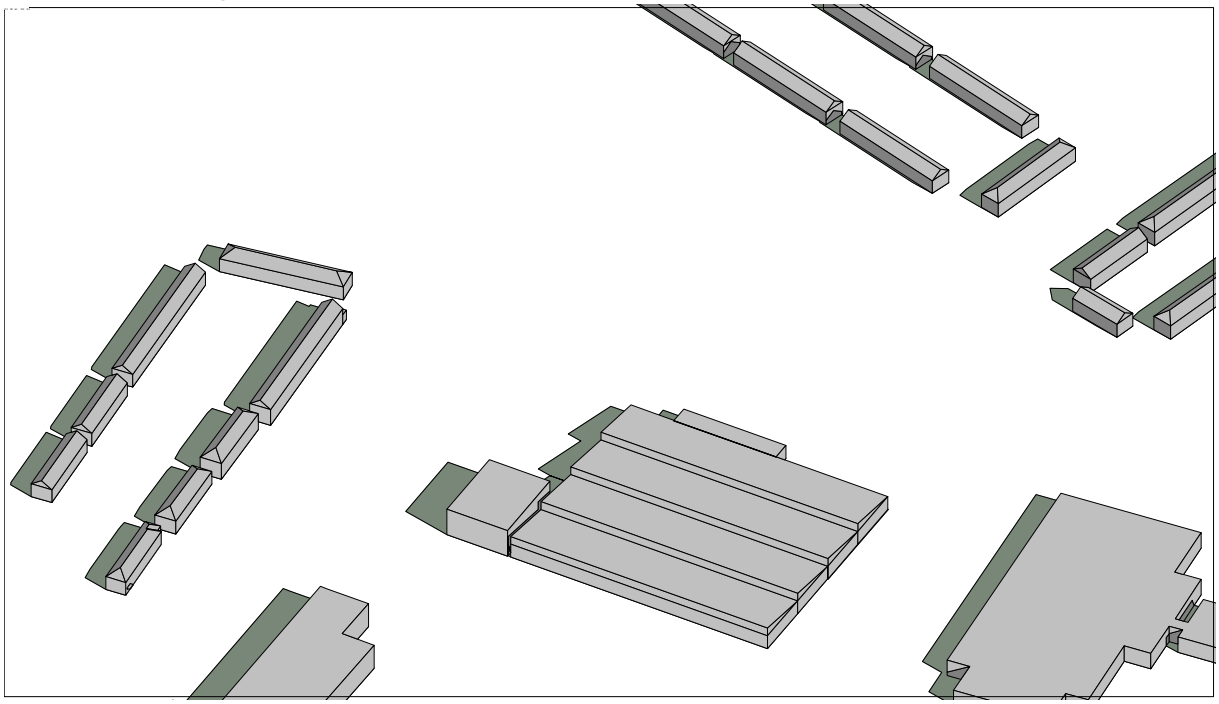
21st March
8am – Existing Scenario



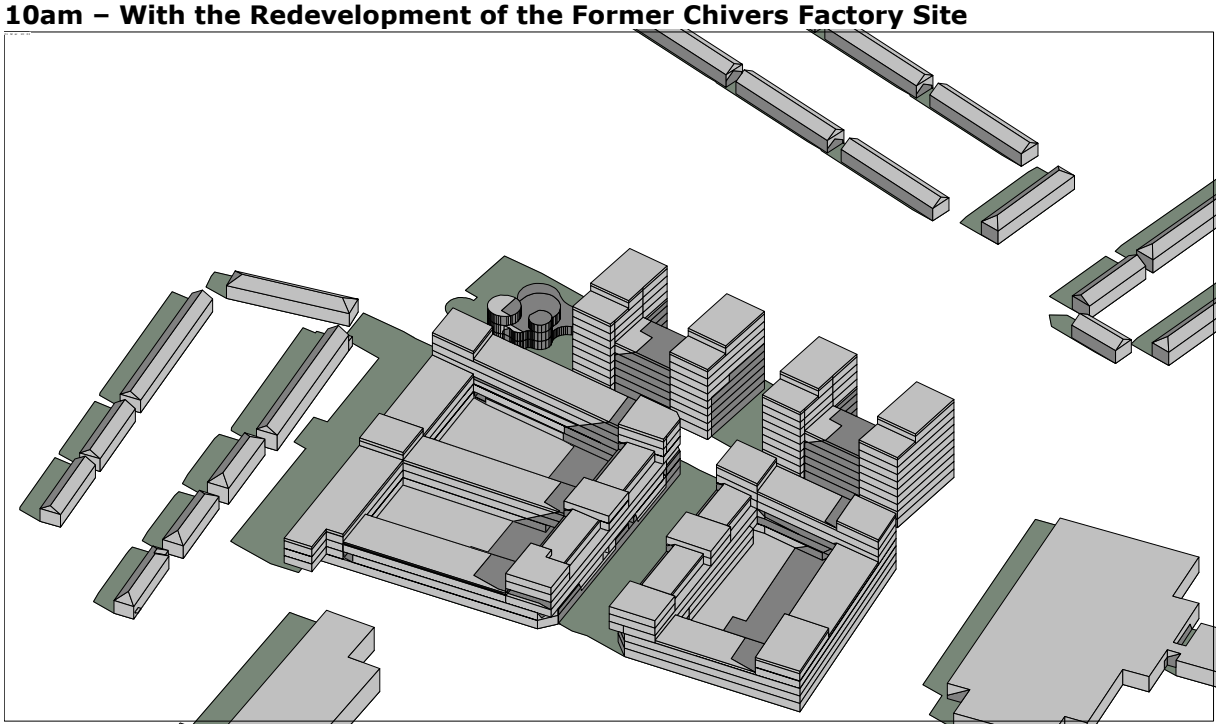
21st March
8am – With the Redevelopment of the Former Chivers Factory Site



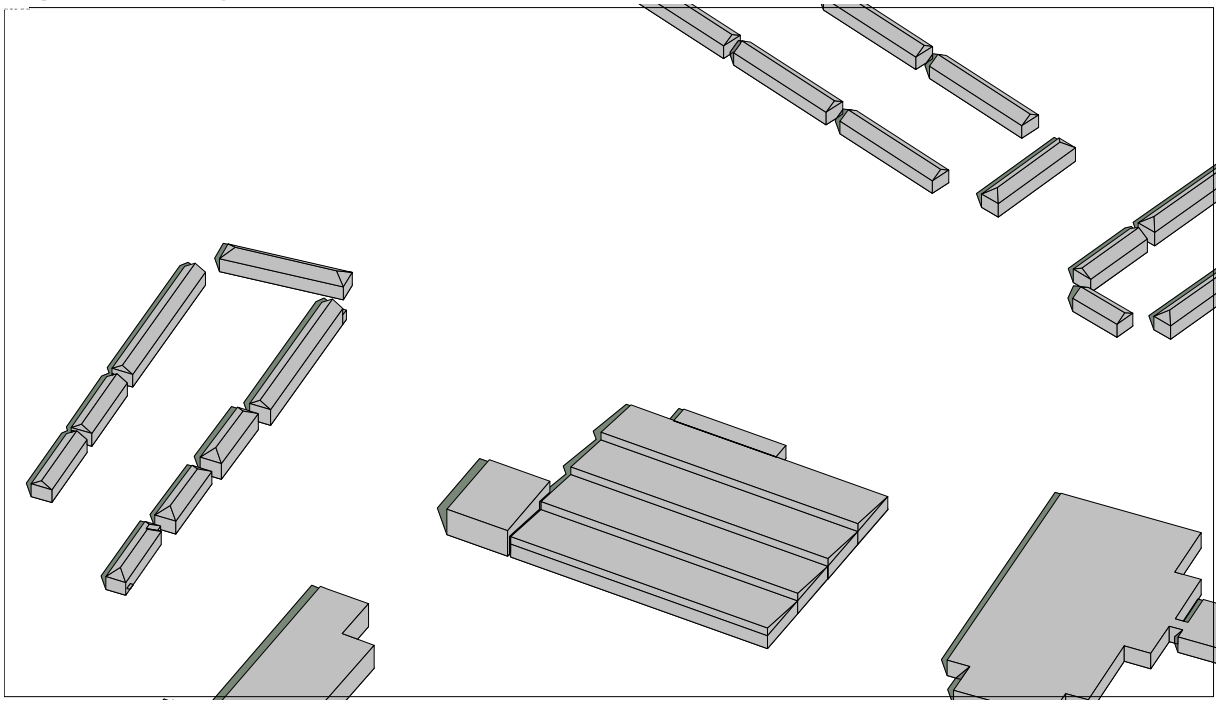
21st March
10am – Existing Scenario



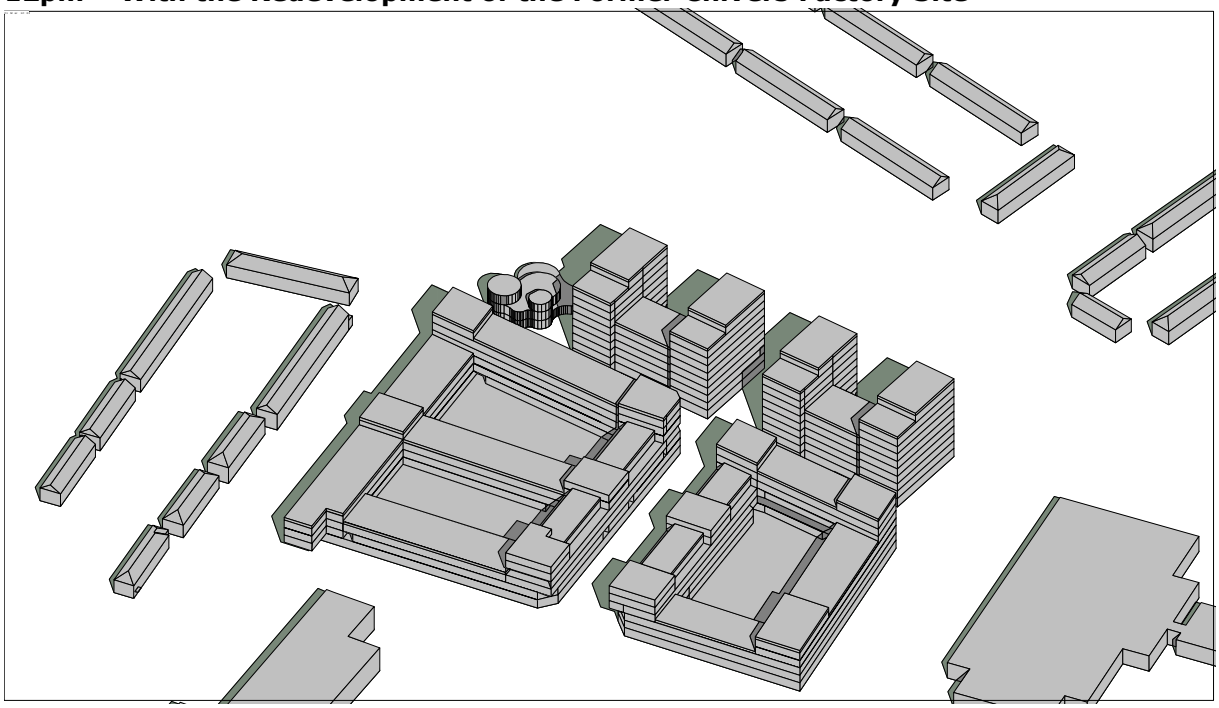
21st March
10am – With the Redevelopment of the Former Chivers Factory Site



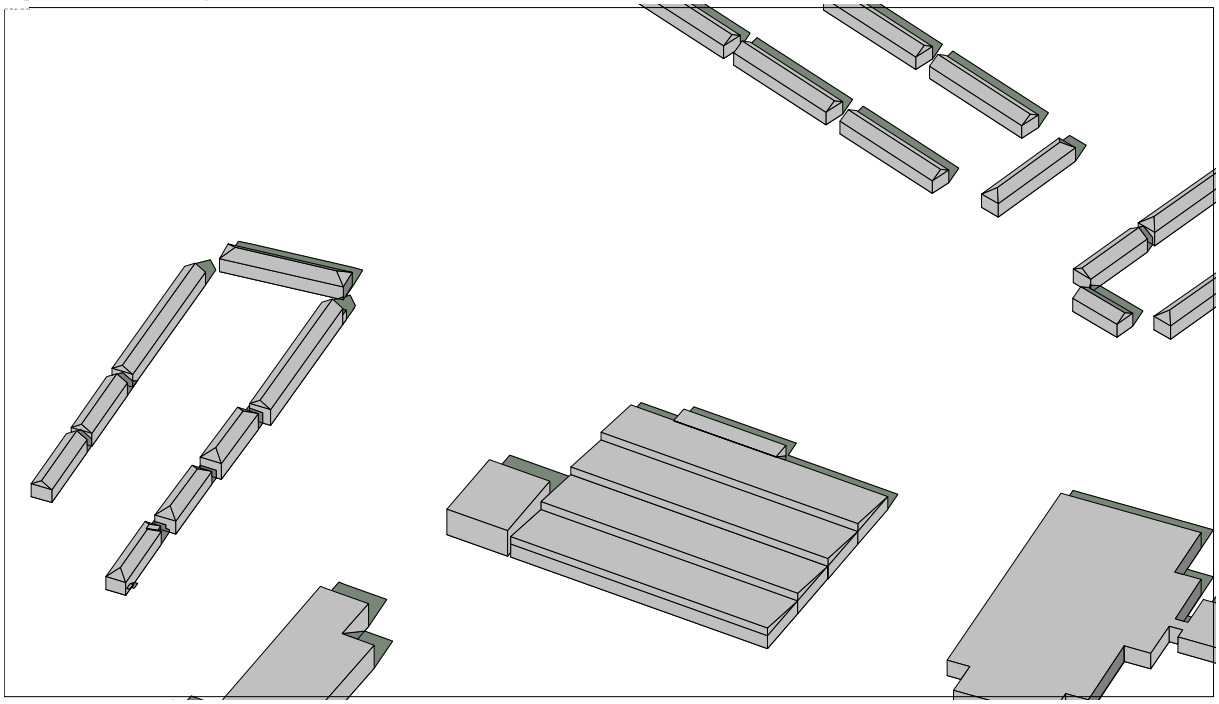
21st March
12pm – Existing Scenario



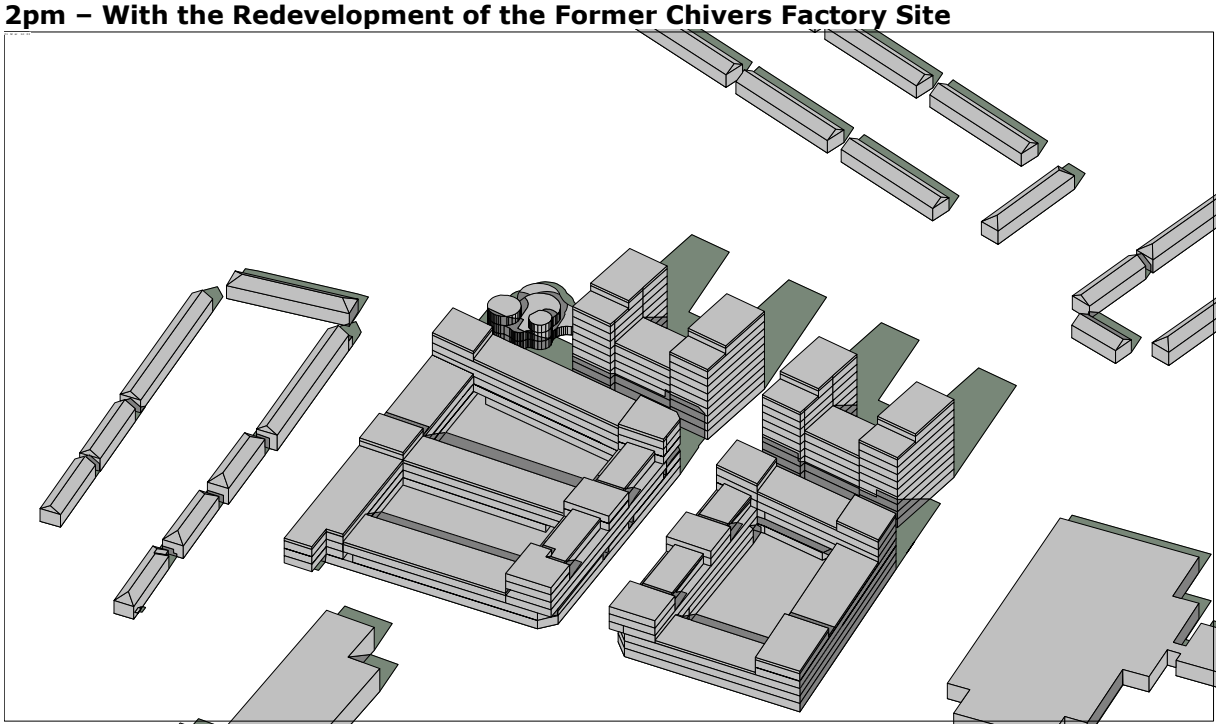
21st March
12pm – With the Redevelopment of the Former Chivers Factory Site



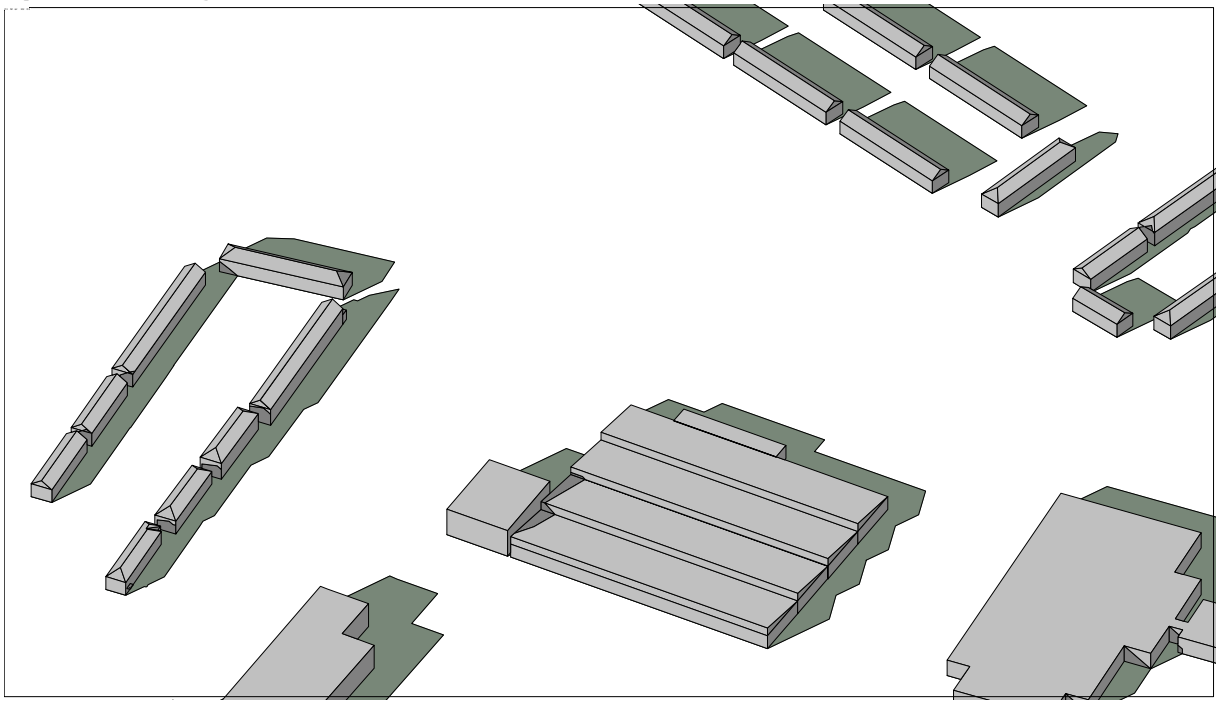
21st March
2pm – Existing Scenario



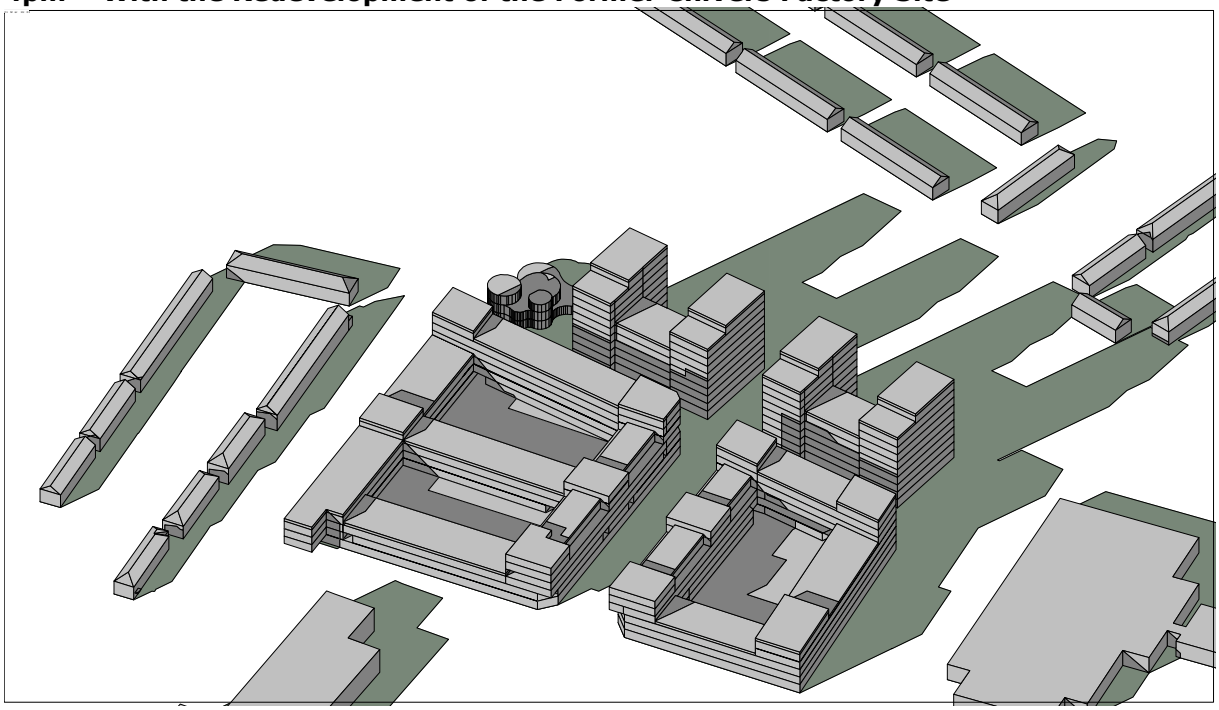
21st March
2pm – With the Redevelopment of the Former Chivers Factory Site



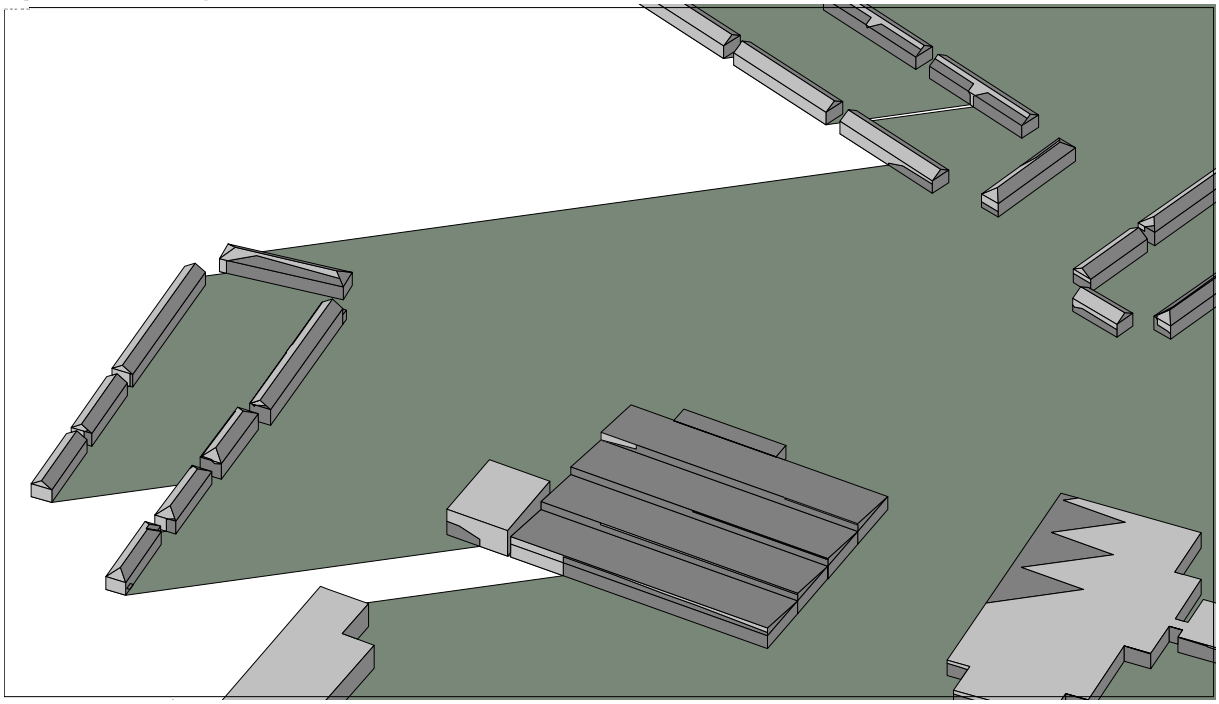
21st March
4pm – Existing Scenario



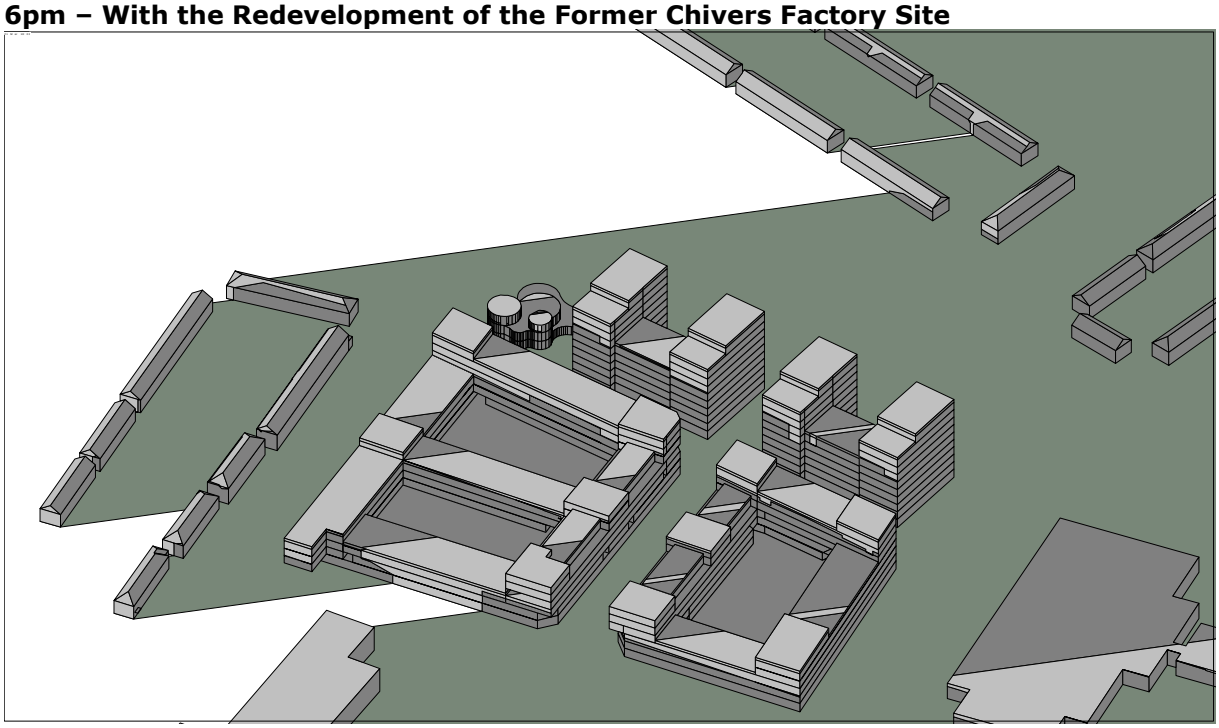
21st March
4pm – With the Redevelopment of the Former Chivers Factory Site



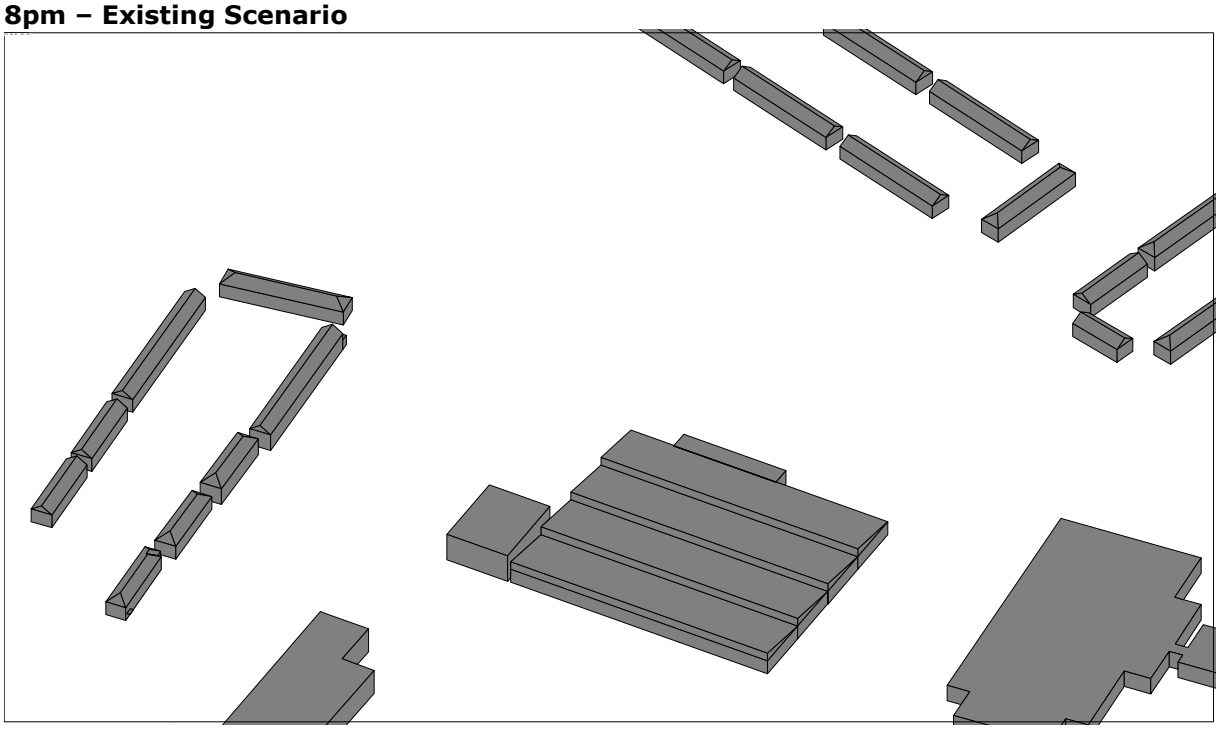
21st March
6pm – Existing Scenario



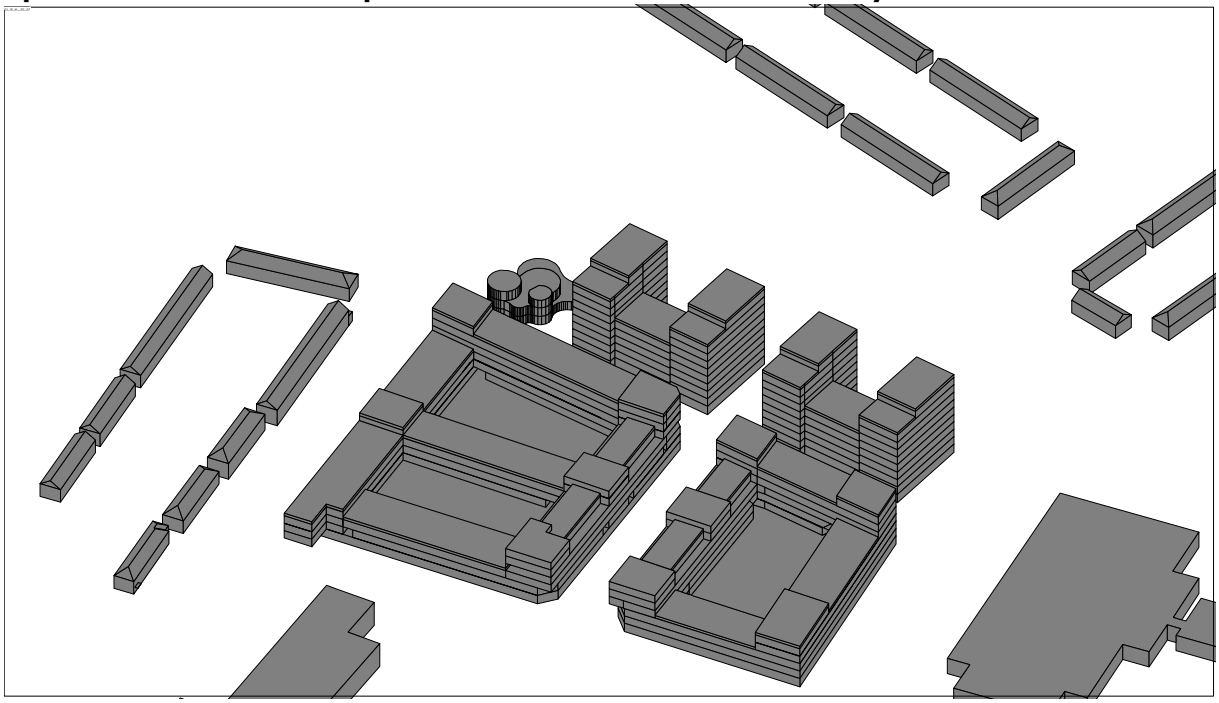
21st March
6pm – With the Redevelopment of the Former Chivers Factory Site



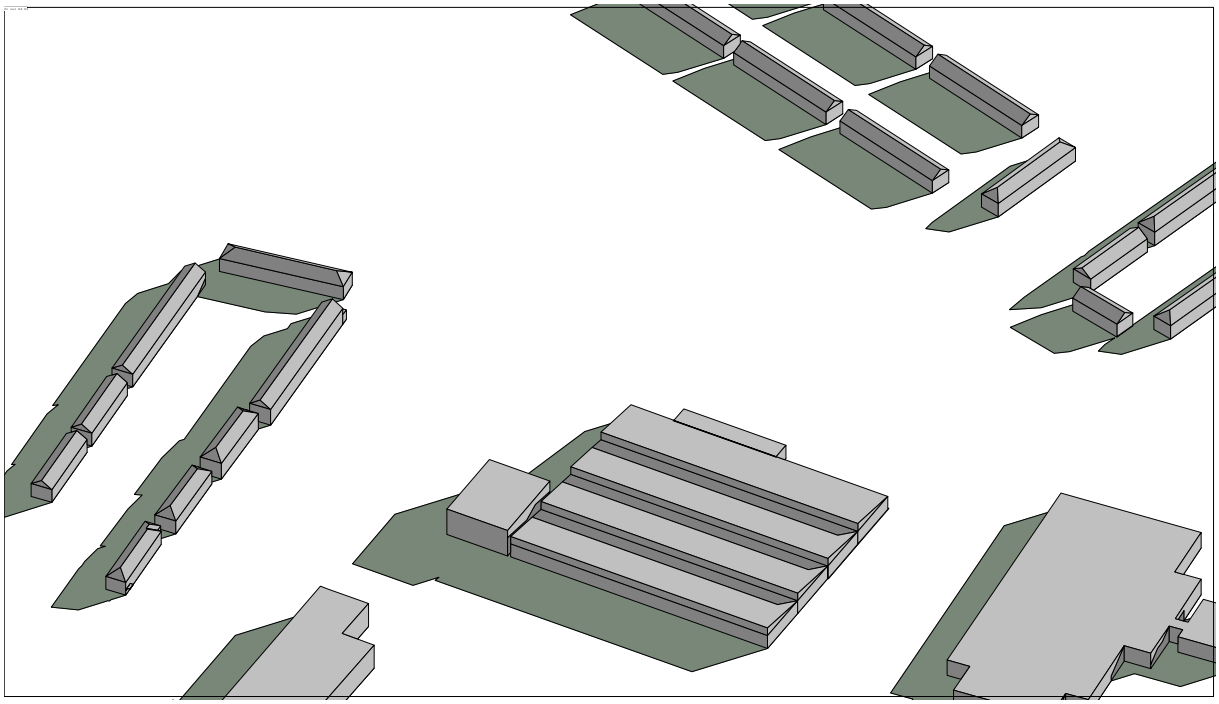
21st March
8pm – Existing Scenario



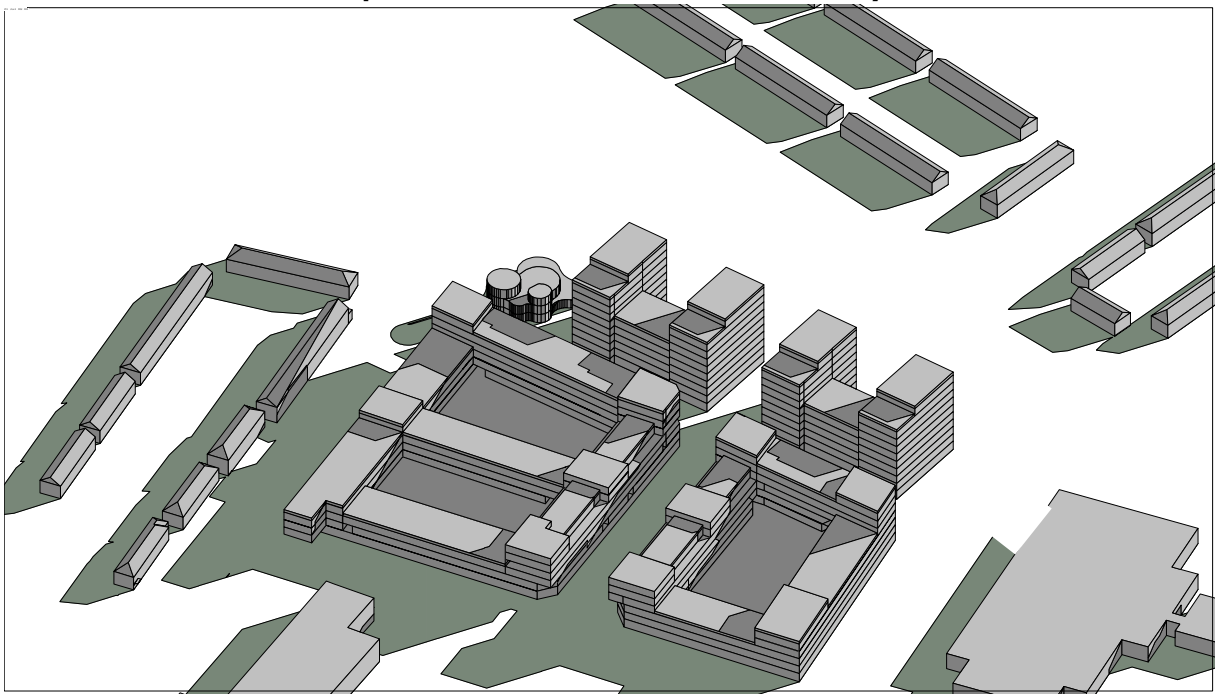
21st March
8pm – With the Redevelopment of the Former Chivers Factory Site



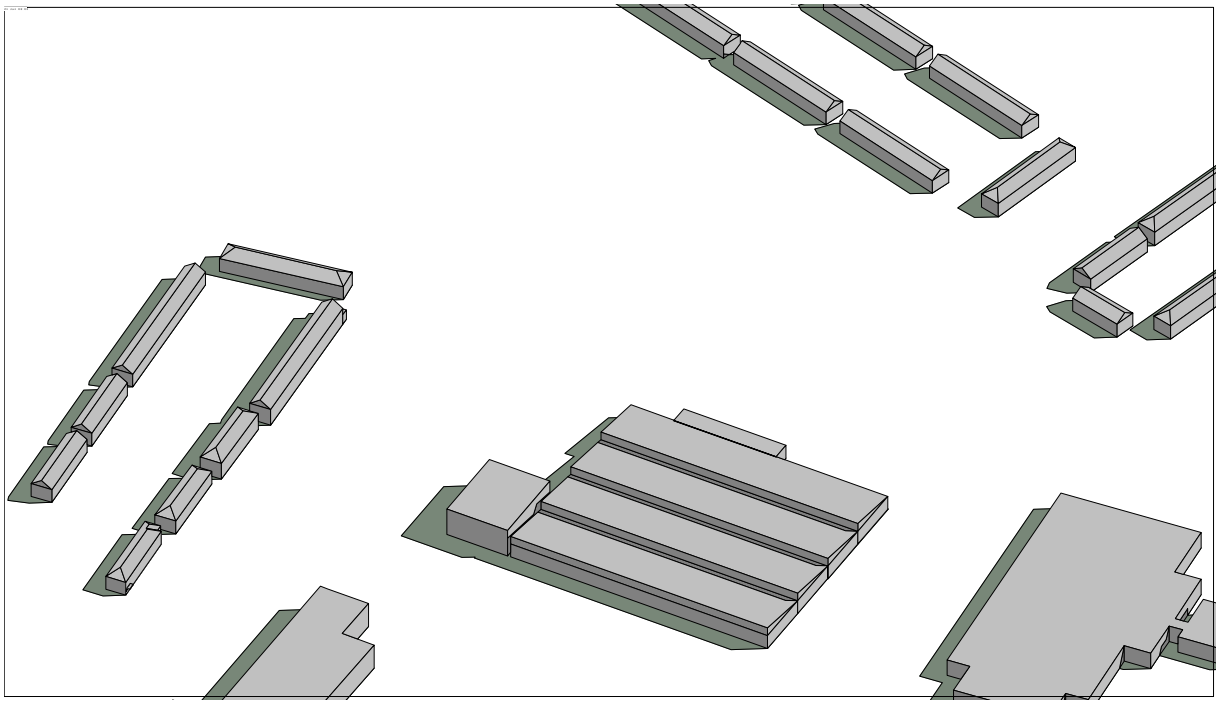
21st June
6am – With Proposed Development



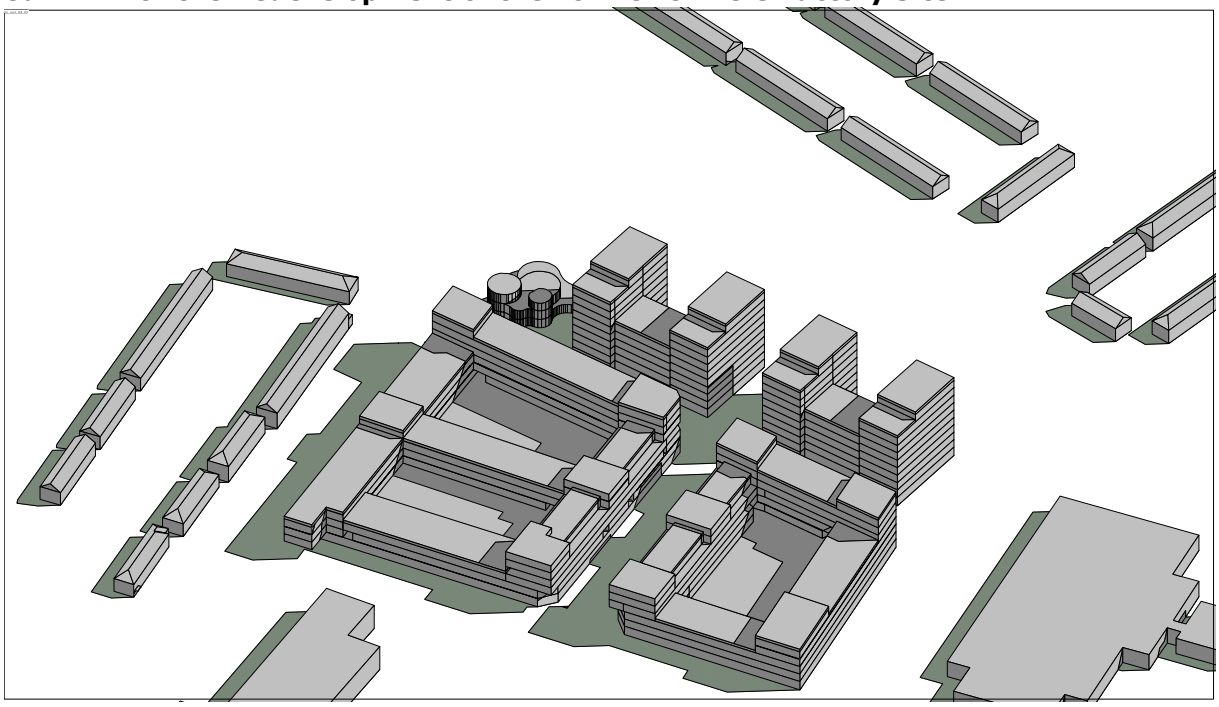
21st June
6am – With the Redevelopment of the Former Chivers Factory Site



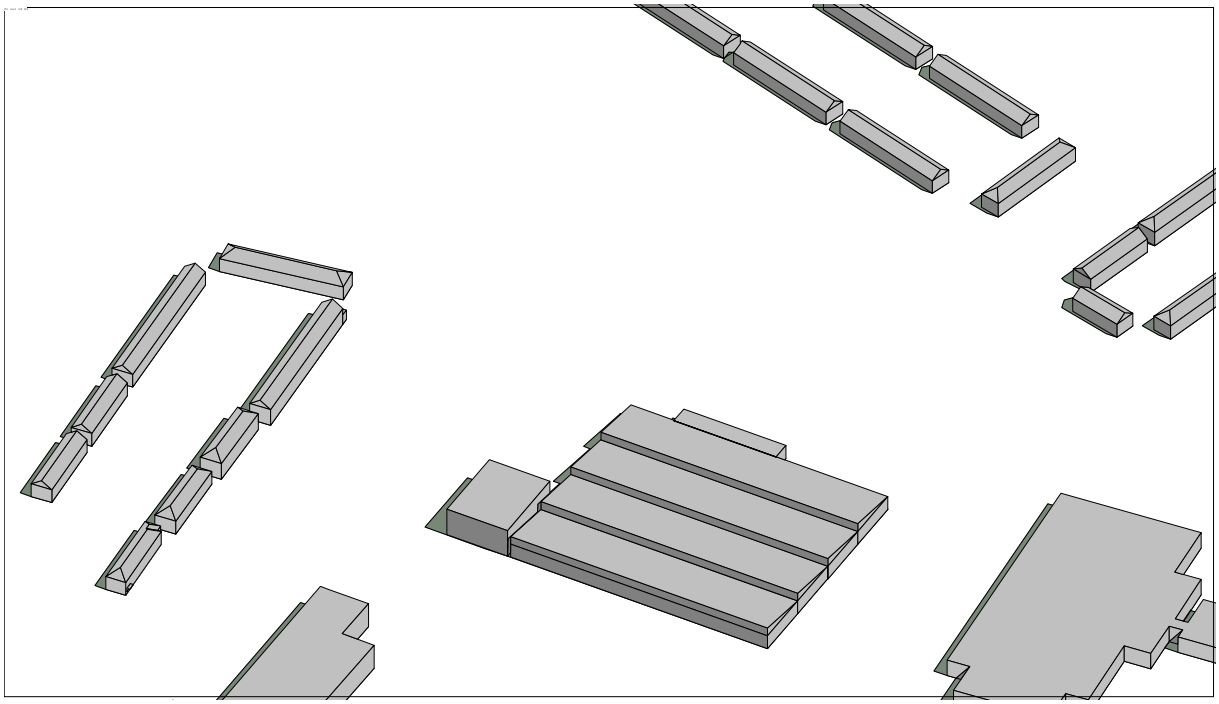
21st June
8am – Existing Scenario



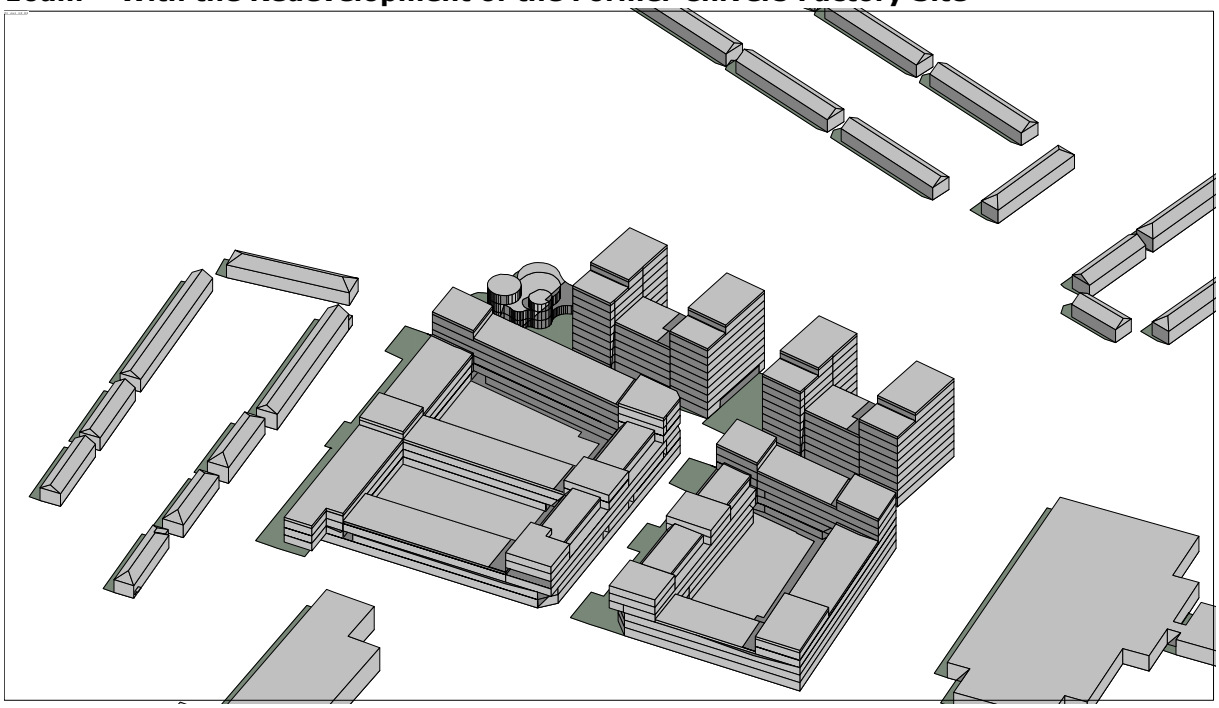
21st June
8am – With the Redevelopment of the Former Chivers Factory Site



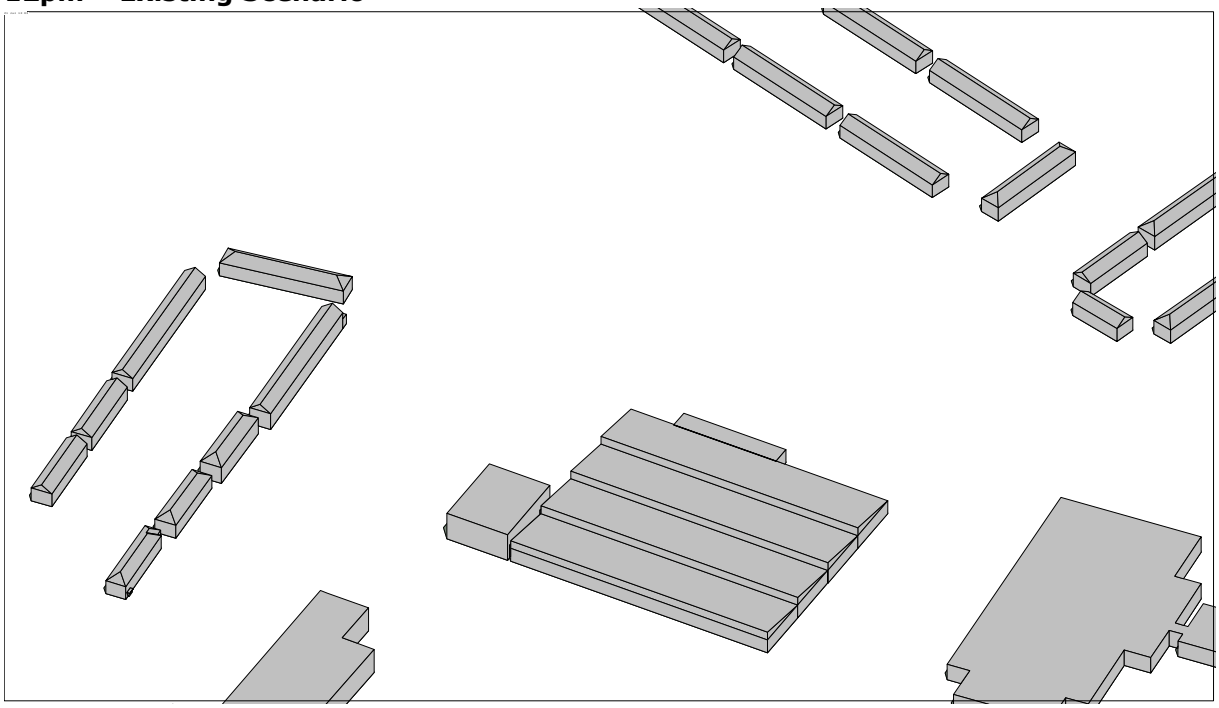
21st June
10am – Existing Scenario



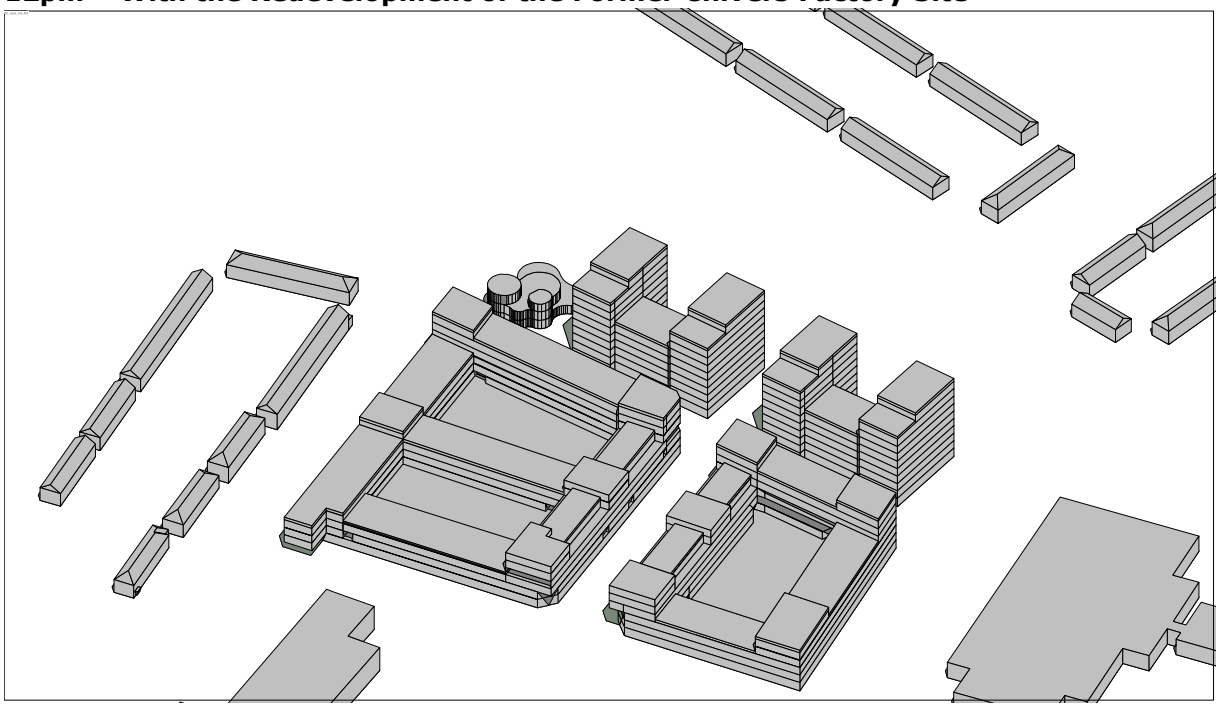
21st June
10am – With the Redevelopment of the Former Chivers Factory Site



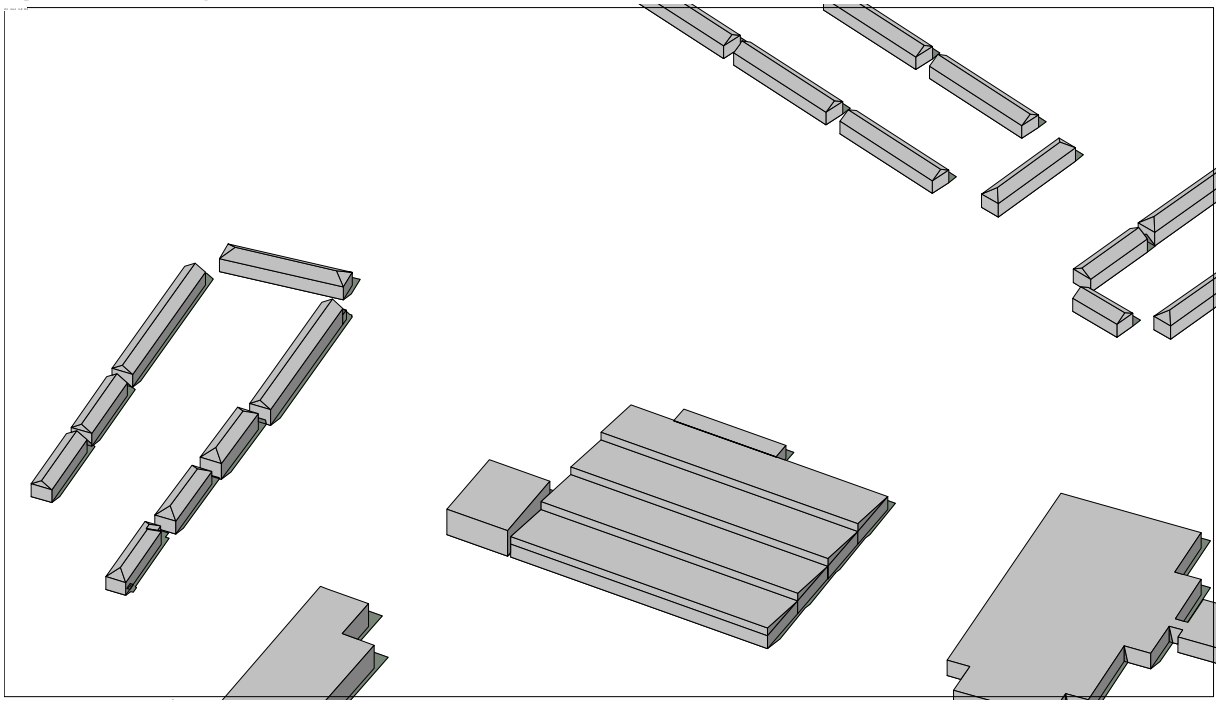
21st June
12pm – Existing Scenario



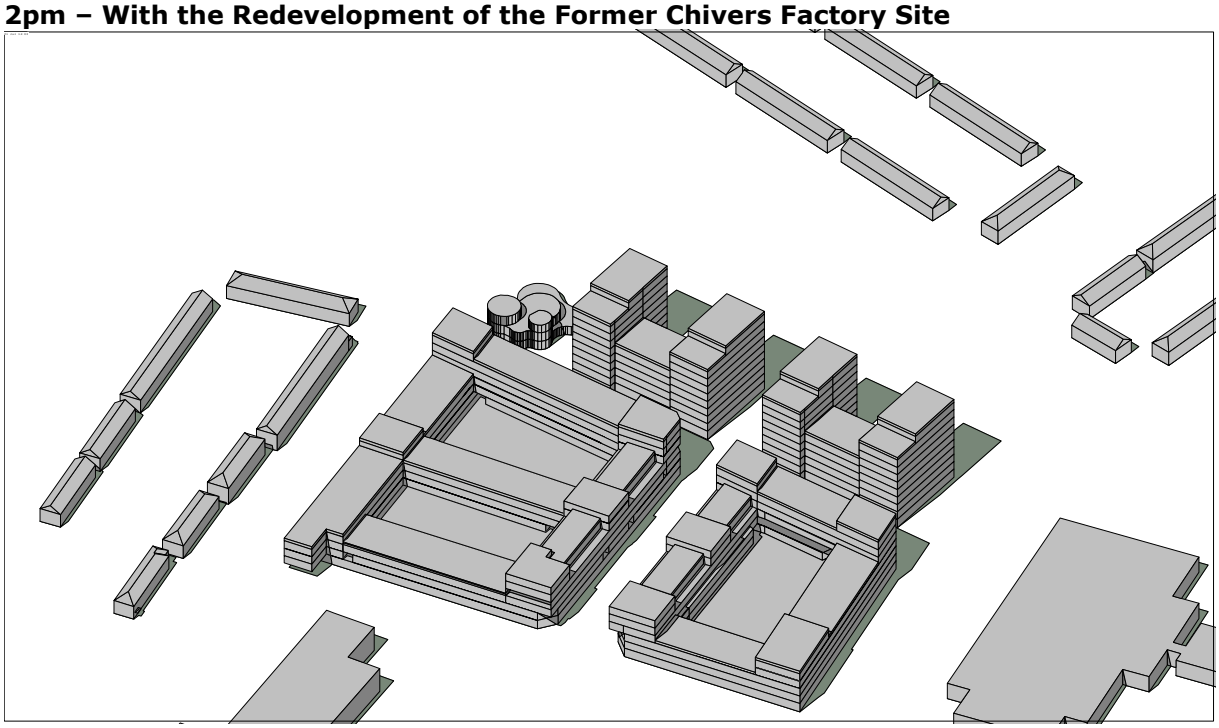
21st June
12pm – With the Redevelopment of the Former Chivers Factory Site



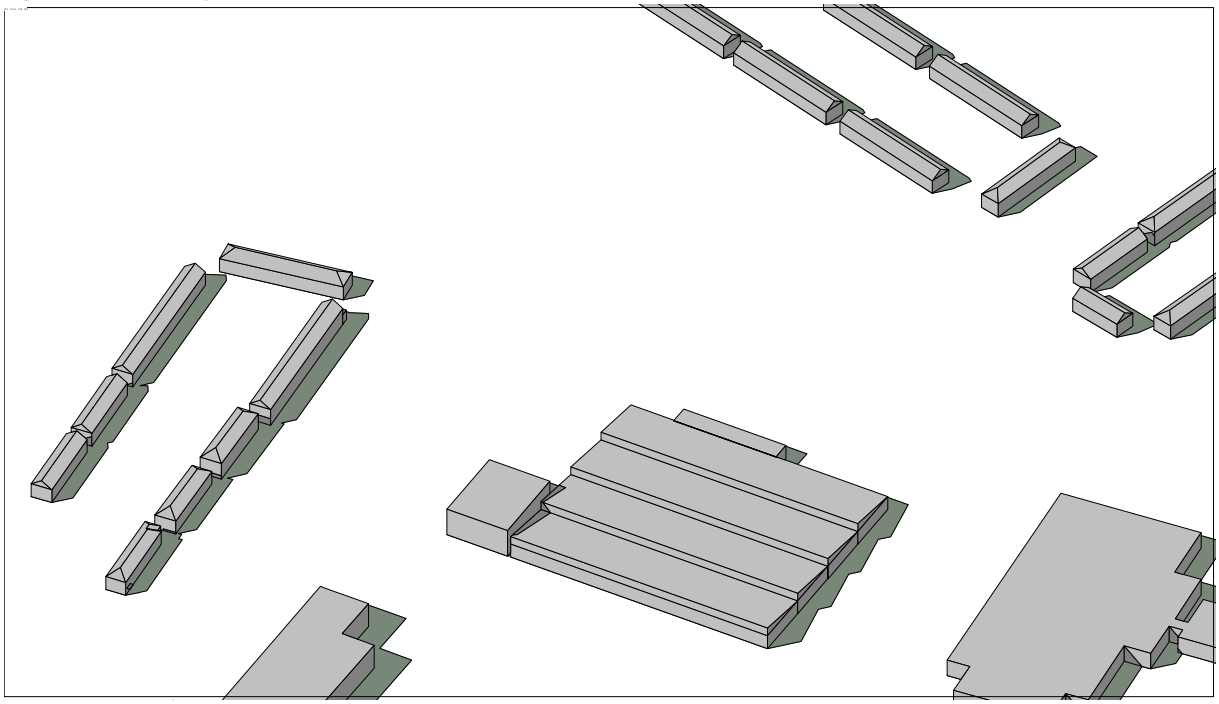
21st June
2pm – Existing Scenario



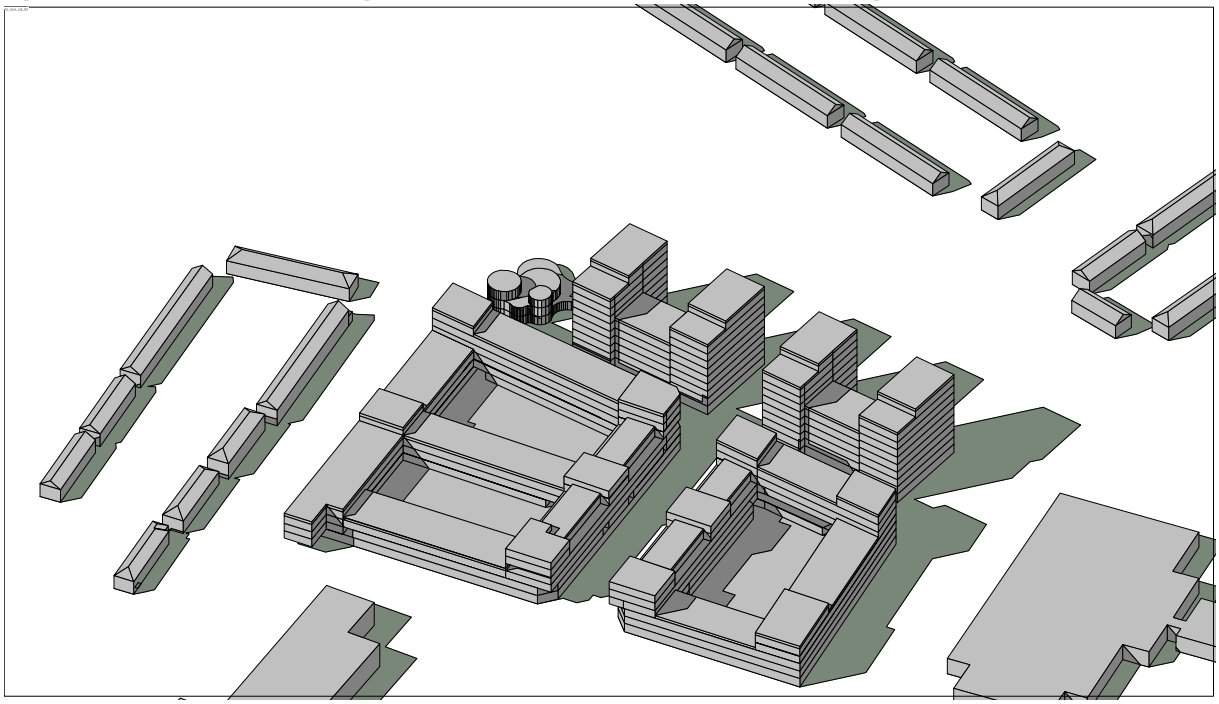
21st June
2pm – With the Redevelopment of the Former Chivers Factory Site



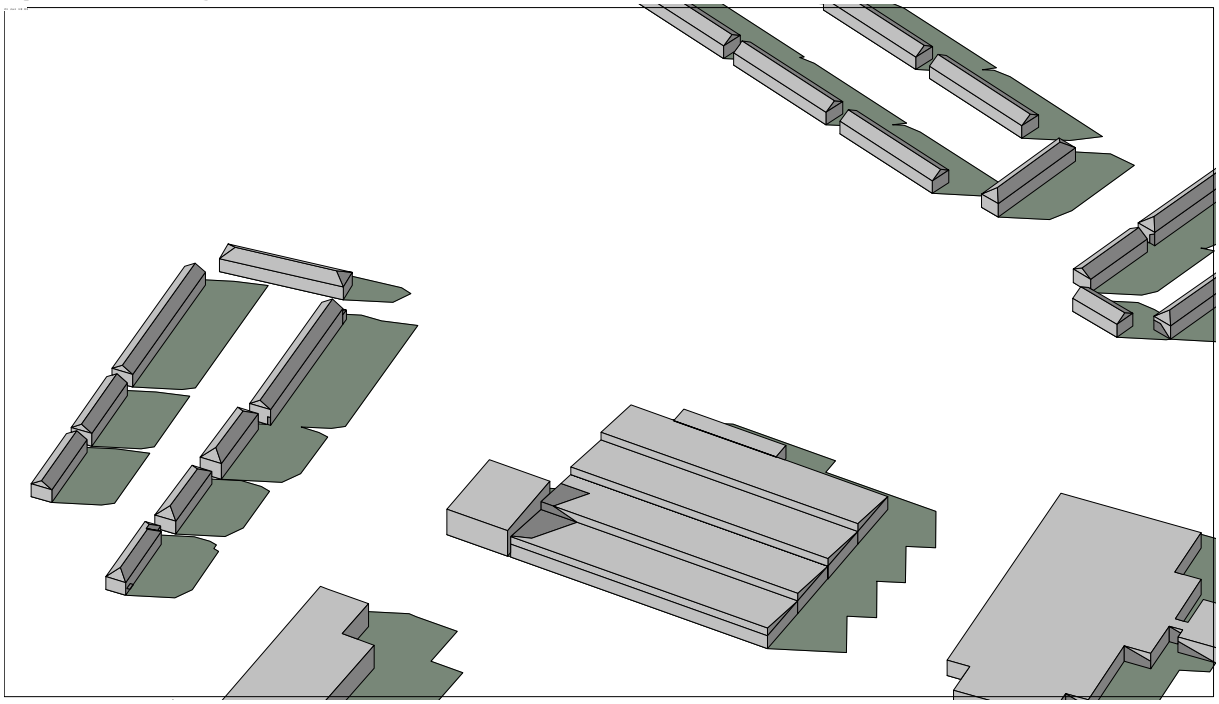
21st June
4pm – Existing Scenario



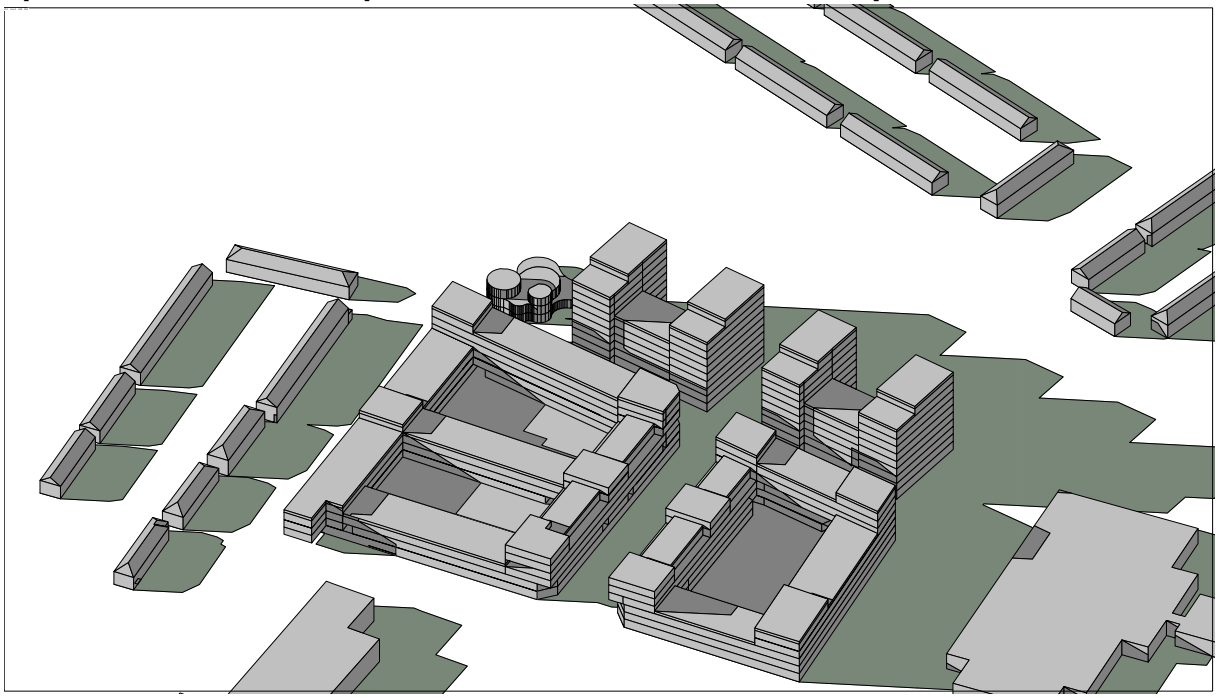
21st June
4pm – With the Redevelopment of the Former Chivers Factory Site



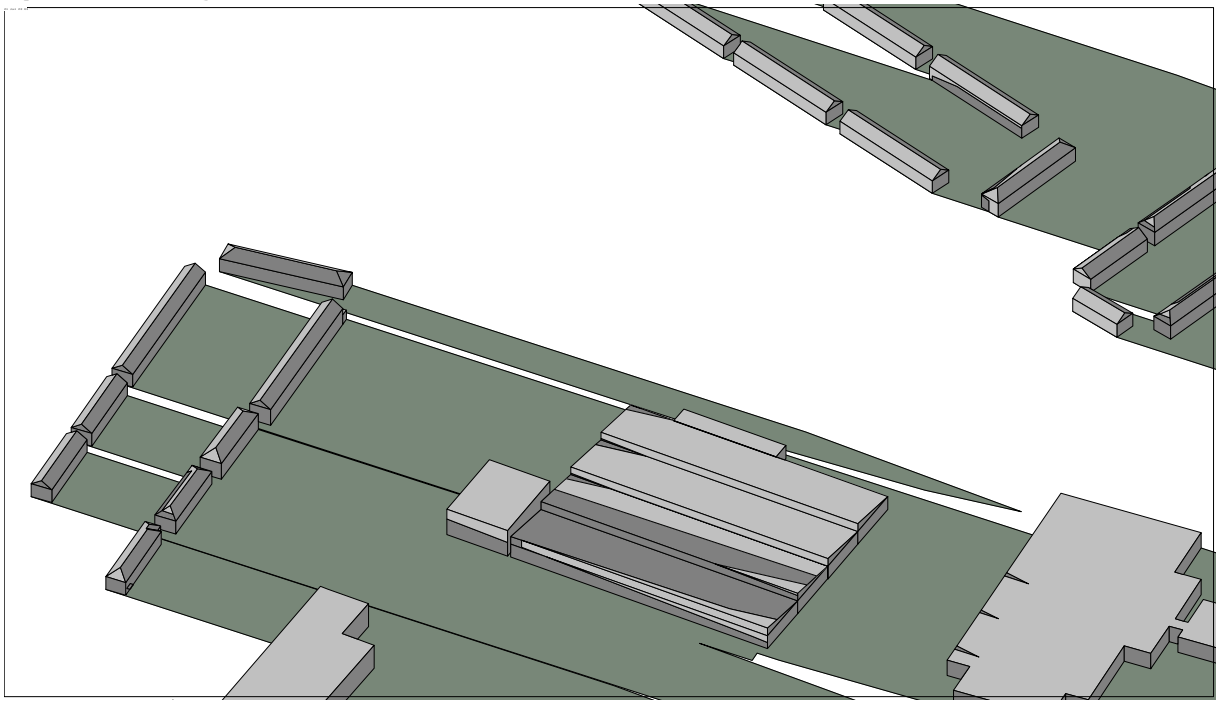
21st June
6pm – Existing Scenario



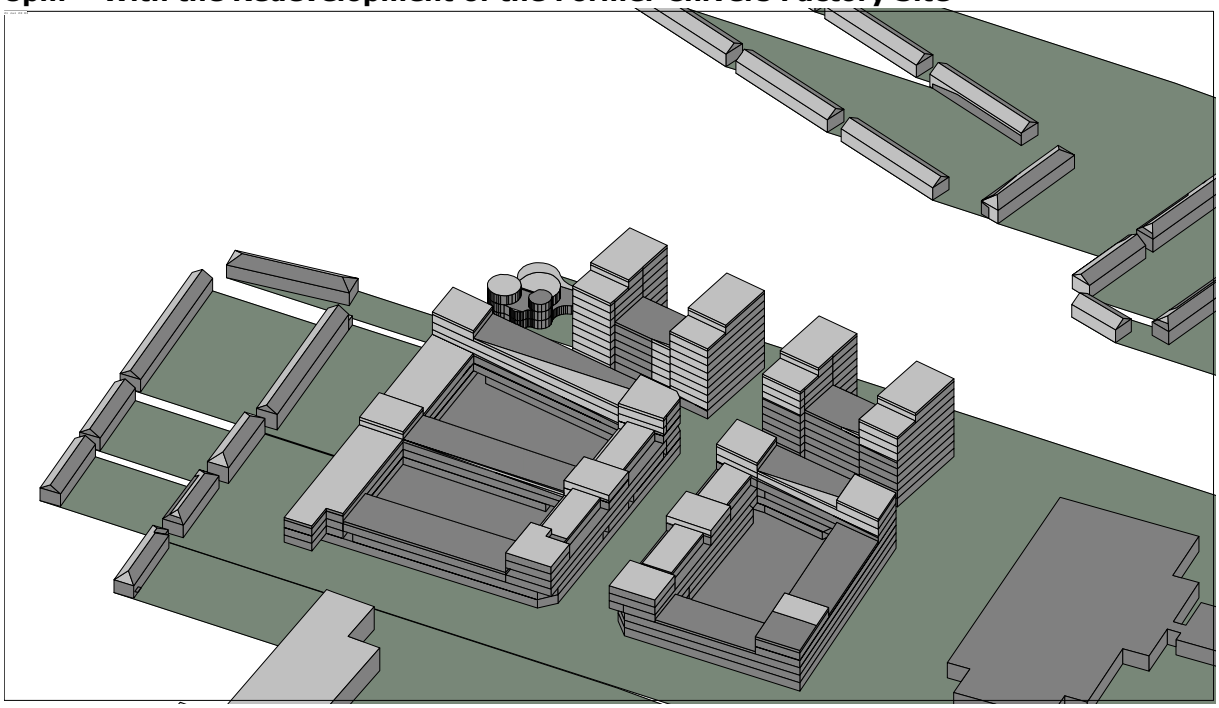
21st June
6pm – With the Redevelopment of the Former Chivers Factory Site



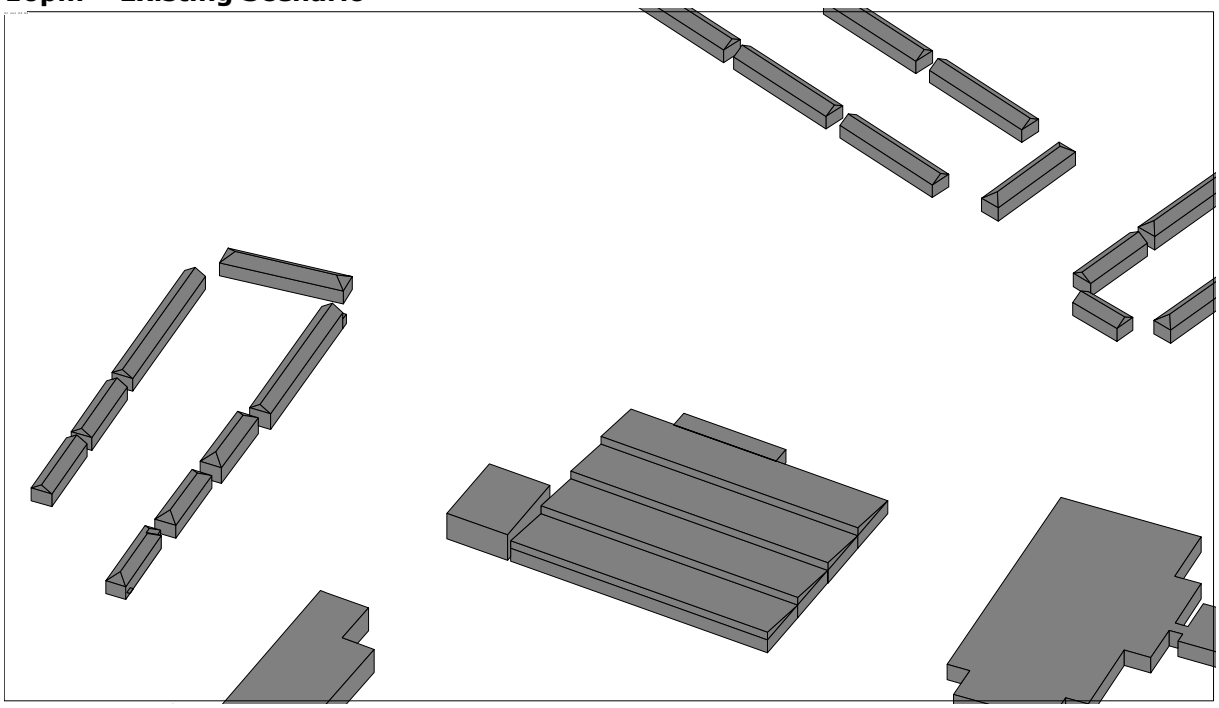
21st June
8pm – Existing Scenario



21st June
8pm – With the Redevelopment of the Former Chivers Factory Site



21st June
10pm – Existing Scenario



21st June
10pm – With the Redevelopment of the Former Chivers Factory Site