Sunlight and Daylight Access Analysis

of

the Proposed Development

on

Lands at Devoy Barracks, Naas, Co. Kildare

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1.0 Introduction

1.1 Introduction

ARC Architectural Consultants Ltd has been retained by the Land Development Agency to carry out an analysis of the impact of the proposed development on lands at Devoy Barracks, Naas, Co. Kildare on sunlight and daylight access in the surrounding area. This report also includes an assessment of sunlight and daylight access within the proposed development.

This report was prepared by Amy Hastings BCL BL MSc (Spatial Planning) MIPI, who has worked as a partner in ARC Consultants since 2004. She is qualified as a planner and a barrister and has worked as a planning consultant in private practice since 2002. Her role in ARC is the provision of environmental assessment services, planning services and planning legal services. Since 2004, Amy has undertaken hundreds of assessments of sunlight and daylight access, as part of planning applications, planning enforcement matters and rights to light cases. She conducted research into the relationship between rights to light law and modern town planning (see, for example, 'Rights to Light Law and the Potential for Use of its Principles in the Assessment of Planning Applications under the Planning and Development Act 2000, as amended' (2011) 18(2) IPELJ 74. She has also delivered continuous professional development lectures on the subject of sunlight and daylight access analysis to planning professionals and was an occasional lecturer on the subject of sunlight and daylight access analysis to the UCD School of Architecture, Planning and Environmental Policy.

Note on Reference to Context under Technical and Guidance Documents and on Reference to Methodology

In order to avoid repetition, the sections outlining the relevant recommendations of technical and guidance documents and the methodologies used in undertaking this assessment have been set out in the Technical Appendix at the end of the written section of this report.

1.2 Receiving Environment

The application site comprises a large vacant site on the northern side of John Devoy Road, a short distance to the southeast of Naas Town Centre. John Devoy Road runs along the southern boundary of the site.

To the east, the application site is bounded by lands associated with Kildare County Council, these lands accommodating a large surface car park, a two storey Mid Eastern Region Innovation Think Space (MERITS) building which is currently under construction, a single storey building associated with Kildare Civil Defence and the four storey county government offices. There are a number of single storey warehouses in commercial use at the northeastern edge of the site. Two storey housing estates bound the application site to the north (Devoy Terrace) and to the west (Arconagh). Given the vacant character of the site, the shadow environment of the existing site and of its immediate surroundings is inconsistent with what would normally be expected in the residential suburbs surrounding Naas.

1.3 Relevant Characteristics of the Proposed Development

The development site is located on John Devoy Road, Naas, Co Kildare, known as Devoy Barracks. The proposed development is for the construction of 219 no. residential units, comprising of a mix of terraced houses (42 no. in total), and duplex / apartment units (177 no. in total) ranging in height from 2 to 5 storeys, a 59-place childcare facility, public and communal open spaces and all associated site works and infrastructure. Vehicular and pedestrian access is proposed via an existing access point on the John Devoy Road along the southern boundary with additional pedestrian and cycle access provided to the east, and future pedestrian and cycle connection opportunities provided to the north, west and east.

Figure 2.1: Indicative diagram showing location of sample windows and gardens assessed as part of this analysis.

2.0 Assessment of the Impact of the Proposed Development on Daylight Access

Site layout planning for daylight and sunlight: a guide to good practice (the BRE Guide, BR209, 2011) provides, at section 2.1.1, that *"The quantity and quality of daylight inside a room will be impaired if obstructing buildings are large in relation to their distance away"*. Generally speaking, new development is most likely to affect daylight access in existing buildings in close proximity to the application site.

2.1 Overview of the potential impact of the proposed development on daylight access to existing buildings outside the application site

ARC's analysis indicates that the construction of the proposed development will result in little or no change in daylight access within neighbouring existing buildings. The potential impact of the proposed development on daylight access within neighbouring existing residences surrounding the application site (e.g. on residential lands surrounding the site at Devoy Terrace, Arconagh or Elsmore Grove) is, therefore, likely to range from none to "imperceptible".

Similarly, the potential impact of the proposed development on non-residential lands to the north and east of the site is likely to be minor. ARC assesses the potential impact on daylight access within existing non-residential buildings to the north, adjacent to St. Patrick's Terrace (e.g. the commercial warehouses off the R445), and to the east (on Kildare County Council lands) as ranging from none to "imperceptible" to "slight" under a worst case scenario.

Given that the potential for development to result in impacts on daylight access diminishes with distance, it is the finding of ARC's analysis the proposed development will have no undue adverse impact on daylight access within buildings in the wider area surrounding the application site.

2.2 *Detailed analysis of the potential impact of the proposed development on daylight access (Vertical Sky Component) to existing buildings outside the application site*

This Sunlight and Daylight Access Analysis assesses the impact of the proposed development to all potential receptors surrounding the application site; - these impacts are described in Section 2.1 above. However, by way of example in order to illustrate briefly the findings outlined in the overview section, ARC conducted detailed analysis of the potential for the proposed development to result in impacts on daylight access to a representative sample of sensitive receptors (i.e. rooms) in buildings in proximity to the application site (please see Figure 2.1 above).

In assessing sunlight and daylight access, Irish practitioners tend to refer to the relevant PJ Littlefair's 2011 revision of the 1991 publication *Site layout planning for daylight and sunlight: a guide to good practice* for the Building Research Establishment (BR209, the BRE Guide).

Section 1.7 of the BRE Guide (2011) provides: *"The guidance here is intended for use in the UK and Republic of Ireland"*. Its use in assessing impacts on sunlight and daylight access as part of the planning process is supported by national government planning policy including the *Guidelines for Planning Authorities on Sustainable Residential Development in Urban Areas*, which, at Section 7.2 states: *"Planning authorities should require that daylight and shadow projection diagrams be submitted in all such proposals. The recommendations of "Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice" (B.R.E. 1991)*[1] *or B.S. 8206 "Lighting for Buildings, Part 2 1992: Code of Practice for Daylighting" should be followed in this regard."*

The only Irish statutory guidance to provide advice on undertaking sunlight and daylight access impact analysis is set out in the *Advice Notes on Current Practice* prepared by the Environmental Protection Agency (2003), which accompany the *Guidelines on the Information to be Contained in Environmental Impact Statements* prepared by the Environmental Protection Agency (2002). These Advice notes state: *"Climate in an Environmental Impact Statement generally refers to the local climatological conditions or "microclimate" of an area, such as local wind flow, temperature, rainfall or solar radiation patterns ... it is important to identify receptors which may be* ***particularly sensitive*** *to climate change."* [Emphasis added.] Having regard to the Advice Notes and to the BRE Guide (2011), ARC undertook detailed quantitative analysis of those receptors particularly sensitive to changes in the daylight environment in order to provide an empirical basis for the conclusions outlined in Section 2.1 above.

In identifying receptors particularly sensitive to changes in the shadow environment, ARC considered two factors:

(i) ***the use of receptors (i.e. buildings) surrounding the application site***: Section 2.2.2 of the BRE Guide (2011) provides: *"The guidelines here are intended for use for rooms in adjoining dwellings where daylight is required, including living rooms, kitchens and bedrooms. Windows to bathrooms, toilets, storerooms, circulation areas and garages need not be analysed. The guidelines may also be applied to any existing non-domestic building where the occupants have a reasonable expectation of daylight; this would normally include schools, hospitals, hotels and hostels, small workshops and some offices"*;

(ii) ***the location of receptors relative to the application site:*** as set out in section 2.2.21 of the BRE Guide (2011), *"If any part of a new building or extension, measured in vertical section perpendicular to a main window wall of an existing building, from the centre of the* ***lowest window****, subtends to an angle of more than 25° to the horizontal, then the diffuse daylighting of the existing building may be adversely affected."* (Emphasis added).

Given this, the receptors most sensitive to changes in the daylight environment as a result of the construction of development on the application site would be windows facing towards the proposal at low levels of accommodation in buildings in residential use in close proximity to the site (i.e. low level rooms at Devoy Terrace to the north, Arconagh to the west and Elsmore Close to the south). Therefore, ARC identified a representative sample of rooms and windows at Devoy Terrace, Arconagh and Elsmore Close for detailed quantitative analysis. That representative sample of buildings includes worst case scenario receptors, including windows in existing buildings closest to proposed large or tall structures and windows at lower levels of accommodation. In the interests of completeness, ARC also assessed the potential impact of the proposed development on daylight access to the closest Council buildings to the west, the Kildare Civil Defence building and the Mid Eastern Region Innovation Think Space (MERITS) building (now under construction). ARC did not include any sample windows in the existing commercial warehouses to the north of the site, adjacent to St. Patrick's Terrace (i.e. as accessed from the R445) given the distance between these buildings and proposed new structures and given that these buildings appear to be primarily lit by roof light windows.

In carrying out the detailed analysis of the proposed development on neighbouring existing buildings, ARC measured daylight access to existing buildings before and after the construction of the proposed development with reference to Vertical Sky Component. The Building Research Establishment's *Site layout planning for daylight and sunlight: a guide to good practice* (the BRE Guide, 2011) defines Vertical Sky Component as 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".

Section 2.2.21 of the BRE Guide (2011) suggests that:

> *"If any part of a new building or extension, measured in a vertical section perpendicular to a main window wall of an existing building, from the centre of the lowest window, subtends an angle of more than 25° to the horizontal, then the diffuse daylighting of the existing building may be adversely affected. This will be the case if ...*
>
> - *the VSC measured at the centre of an existing main window is less than 27%, and less than 0.8 times its former value..."*

It should be noted that the BRE Guide (2011) does not set out rigid standards or limits and is preceded by the following very clear warning 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."* [Emphasis added.]

The results of ARC's analysis are set out in Table 2.1 below.

1 The *Guidelines for Planning Authorities on Sustainable Residential Development in Urban Areas* refer to the first edition of the BRE Guide as published in 1991. A second edition of the Guide was published in 2011.

Table 2.1
Potential impact of the proposed development on daylight access to sample windows* in existing buildings in proximity to the application site

Zone	Window	Location	Floor	Vertical Sky Component				
				Existing	Proposed	Change (Change under "Existing" scenario expressed as "times proposed value")	Potential Impact	Comment
Zone 01	a	Devoy Terrace	Floor 00	37.40%	35.00%	0.94	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
	b	Devoy Terrace	Floor 00	37.10%	34.50%	0.93	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
Zone 02	a	Devoy Terrace	Floor 00	37.00%	34.40%	0.93	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
	b	Devoy Terrace	Floor 00	37.30%	34.30%	0.92	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
Zone 03	a	Devoy Terrace	Floor 00	29.20%	28.10%	0.96	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
	b	Devoy Terrace	Floor 00	34.80%	32.50%	0.93	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
Zone 04	a	Devoy Terrace	Floor 00	30.20%	29.40%	0.97	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
	b	Devoy Terrace	Floor 00	32.00%	30.80%	0.96	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
Zone 05	a	Arconagh	Floor 00	33.10%	32.20%	0.97	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
	b	Arconagh	Floor 00	17.50%	16.30%	0.93	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is not likely to fall to less than 0.8 times its former value, the potential impact of the proposed development on this window is assessed as "imperceptible".
Zone 06	a	Arconagh	Floor 00	36.40%	36.00%	0.99	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
	b	Arconagh	Floor 00	36.20%	35.90%	0.99	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
Zone 07	a	Arconagh	Floor 00	32.50%	29.10%	0.90	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
	b	Arconagh	Floor 00	38.00%	33.50%	0.88	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
Zone 08	a	Arconagh	Floor 00	31.10%	29.90%	0.96	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
	b	Arconagh	Floor 00	36.90%	34.80%	0.94	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".

Table 2.1
Potential impact of the proposed development on daylight access to sample windows* in existing buildings in proximity to the application site

Zone	Window	Location	Floor	Vertical Sky Component				
				Existing	Proposed	Change (Change under "Existing" scenario expressed as "times proposed value")	Potential Impact	Comment
Zone 09	a	Arconagh	Floor 00	36.80%	33.80%	0.92	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
	b	Arconagh	Floor 00	38.00%	34.00%	0.89	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
Zone 10	a	Arconagh	Floor 00	34.40%	29.20%	0.85	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
	b	Arconagh	Floor 00	38.30%	32.10%	0.84	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
Zone 11	a	Elsmore Close	Floor 00	39.00%	37.30%	0.96	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
	b	Elsmore Close	Floor 00	39.00%	37.20%	0.95	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
Zone 12	a	Kildare Civil Defence	Floor 00	39.30%	27.90%	0.71	Imperceptible to Slight	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component decreases to not less than 0.8 times its former value after the construction of a development. While the BRE Guide would suggest that an impact of this extent is not likely to be noticeable, taking a conservative approach, this impact is assessed as "imperceptible" to "slight" as the construction of the proposal is likely to reduce Vertical Sky Component at the window to just above the recommended 27% Vertical Sky Component.
	b	Kildare Civil Defence	Floor 00	39.10%	36.60%	0.94	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".
Zone 13	-	MERITS Building	Floor 00	38.30%	32.10%	0.84	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".

* Survey information of all structures on private lands surrounding the application site was not available. Where insufficient survey information was available and window sizes / locations could not be informed by information available from the online planning register or from aerial photography, window sizes / locations were estimated by ARC.

3.0 Assessment of the Impact of the Proposed Development on Sunlight Access

The statistics of Met Eireann, the Irish Meteorological Service, indicate that the sunniest months in Ireland are May and June. During December, Dublin (at Casement Aerodrome, the closest station to Naas) receives a mean daily duration of 1.5 hours of sunlight out of a potential 6.9 hours sunlight each day (i.e., only 22% of potential sunlight hours). This can be compared with a mean daily duration of 5.3 hours of sunlight out of a potential 16.0 hours each day received at Casement Aerodrome during June (i.e., 33% of potential sunlight hours). Therefore, impacts caused by overshadowing are generally most noticeable during the summer months and least noticeable during the winter months. Due to the low angle of the sun in mid winter, the shadow environment in all urban and suburban areas is generally dense throughout winter.

In assessing the impact of a development on sunlight access, the comments of PJ Littlefair in *Site layout planning for daylight and sunlight: a guide to good practice* (the BRE Guide, 2011) should be taken into consideration. The BRE Guide (2011) states that *"it must be borne in mind that nearly all structures will create areas of new shadow, and some degree of transient overshadowing of a space is to be expected."*

3.1 *Overview of the potential impact of shadows cast by the proposed development outside the application site*

ARC's analysis of the potential impact of shadows cast by the proposed development assesses the impact of the proposed development on sunlight access over the course of the year. However, please note that the shadow diagrams provided with this report were prepared for a number of representative days of the year: the summer and winter solstices, and at the equinox (taken as 21st March for the purposes of this report).

Having regard to the shape, layout and orientation of the application site and to the scale of the development now proposed, the potential of the proposed development to result in overshadowing of lands outside the application site is limited.

To the west, shadows cast by the proposed development are likely to extend outside the boundaries of the application site to the residential estate at Arconagh to a small extent during the mornings throughout the year. To the south, shadows cast by the proposed development are likely to extend to houses and gardens along the southern boundary of the site for a short time during the very early mornings and very late evenings during the spring, summer and autumn months. ARC's analysis indicates that shadows cast by the proposed development are not likely to interfere with the capacity of any house or garden at Arconagh to receive an adequate amount of sunshine over the course of the year within the meaning of the BRE Guide (2011). Similarly, ARC's analysis indicates that amenity spaces within Arconagh will continue to receive a level of sunlight in excess of the level recommended by BRE Guide, 2011) to achieve an appearance of adequate sunlighting over the course of the year after the construction of the proposed development. Given this, the proposed development is not likely to result in any undue adverse impacts on sunlight access to the residential estate at Arconagh. The potential impact of the proposed development on sunlight access to Arconagh is assessed as none to "imperceptible".

Similarly, the subject development is likely to have little or no impact on the Elsmore residential estate to the south. The potential impact of the proposed development on sunlight access to the Elsmore residential estate is assessed as none to "imperceptible".

During the spring, summer and autumn months, shadows cast by the proposed development will extend to the rear of a number of rear gardens at Devoy Terrace for a very short time during the mornings resulting in an "imperceptible" change in the shadow environment. During the winter months when the shadow environment is dense and shadows are long, shadows cast by the proposed development are likely to result to extend further into the rear gardens and to the rear of some houses at Devoy Terrace during the mornings and early afternoons. Notwithstanding the construction of the proposed development, relevant windows within the existing dwellings at Devoy Terrace and their associated rear gardens will continue to receive a level of sunlight in excess of the level recommended by the BRE Guide (2011) to achieve an appearance of adequate sunlighting over the course of the year. The potential impact of the proposed development on sunlight access to Devoy Terrace is assessed as none to "imperceptible" to "slight".

To the east, shadows cast by the proposed development are likely to extend onto Kildare County Council lands during the afternoons and evenings throughout the year. Additional overshadowing is likely to fall on the surface car park, on the existing single storey Kildare Civil Defence building and on the two storey Mid Eastern Region Innovation Think Space (MERITS) building (now under construction). While shadows cast by the proposed development will result in additional overshadowing of the Kildare Civil Defence building and the Mid Eastern Region Innovation Think Space (MERITS) building (now under construction), ARC's analysis indicates relevant windows within the existing buildings are likely to continue to receive a level of sunlight in excess of the level recommended by the BRE Guide (2011) to achieve an appearance of adequate sunlighting over the course of the year after the construction of the proposed development. For a time around mid winter, shadows cast by the proposal have the potential to extend as far as the Kildare County Offices for a short time during the late afternoon / evening. However, the shadow environment at this time of year is so dense that the impact of this additional overshadowing is not likely to be noticeable. The potential impact of the proposed development on sunlight access to Kildare County Council lands is assessed as none to "imperceptible" to "slight".

3.2 *Detailed analysis of the potential impact of shadows cast by the proposed development on existing buildings outside the application site*

This Sunlight and Daylight Access Analysis assesses the impact of the proposed development to all potential receptors surrounding the application site - these impacts are described in Section 3.1 above. However, by way of example in order to illustrate briefly the findings outlined in the overview section, ARC conducted detailed analysis of the potential for the proposed development to result in impacts on sunlight access to a representative sample of sensitive receptors (i.e. windows) in buildings in proximity to the application site (please see Figure 3.1).

The only Irish statutory guidance to provide advice on undertaking sunlight and daylight access impact analysis is set out in the *Advice Notes on Current Practice* prepared by the Environmental Protection Agency (2003), which accompany the *Guidelines on the Information to be Contained in Environmental Impact Statements* prepared by the Environmental Protection Agency (2002). These Advice notes state: *"Climate in an Environmental Impact Statement generally refers to the local climatological conditions or "microclimate" of an area, such as local wind flow, temperature, rainfall or solar radiation patterns ... it is important to identify receptors which may be* ***particularly sensitive*** *to climate change."* [Emphasis added.] Having regard to the Advice Notes, ARC undertook detailed quantitative analysis of those receptors particularly sensitive to changes in the sunlight environment in order to illustrate the empirical basis for the conclusions outlined in Section 3.1 above.

In identifying receptors particularly sensitive to changes in the shadow environment, ARC considered two factors:

(i) ***the use of receptors (i.e. buildings) surrounding the application site***: buildings in residential use (and, particularly, the living rooms of residences) would be considered to be sensitive to changes in the shadow environment;

(ii) ***the location of receptors relative to the application site:*** as set out in section 3.2.2 of the BRE Guide (2011), *"obstruction to sunlight may become an issue if some part of a new development is situated within 90° of due south of a main windows wall of an existing building"* and if *"in the section drawn perpendicular to this existing window wall, the new development subtends an angle greater than 25° to the horizontal measured from the centre of the* ***lowest window*** *to a main living room"* (Emphasis added).

Given this, the receptors most sensitive to changes in the daylight environment as a result of the construction of development on the application site would be low level windows to the west, north and east of the proposal in buildings in residential use, which face within 90° of due south and which are in close proximity to the site (i.e. low level rooms at Arconagh to the west and at Devoy Terrace to the north). Therefore, ARC identified a representative sample of rooms and windows at Arconagh and Devoy Terrace for detailed quantitative analysis (please see Figure 3.1 below).

While the BRE Guide (2011) does not identify a need to analyse windows in existing buildings facing within 90° of due north, ARC also assessed the potential for shadows cast by the proposed development to affect sunlight access to sample windows facing north, such as those in buildings to the south of the site at Arconagh and Elsmore Close. ARC also assessed the potential impact of the proposed development on daylight access to the closest Council buildings to the west, the Kildare Civil Defence building

Figure 3.1: Indicative diagram showing location of sample windows and gardens assessed as part of this analysis.

and the Mid Eastern Region Innovation Think Space (MERITS) building (now under construction). That representative sample of buildings includes worst case scenario receptors, including windows in existing buildings closest to proposed large or tall structures and windows at lower levels of accommodation.

Section 3.2.1 of the *Site layout planning for daylight and sunlight: a guide to good practice* (the BRE Guide, 2011) provides as follows in relation to the assessment of the impact of development on sunlight access to existing buildings.

> *"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 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 sunlighting of the existing dwelling 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 21 September and 21 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."*

> [Emphasis added]

This excerpt from the BRE Guide (2011) suggests that where the construction of a new development has the potential to reduce sunlight access values below the recommended annual level, to less than 0.8 times the former level of sunlight access or by more than 4% APSH during the relevant periods, the potential impact of that proposed development will not be noticed. However, in the interests of presenting a worst case scenario for the purposes of this assessment, some impacts identified as falling into "imperceptible" ranges under the BRE Guide (2011) have been classified as either "imperceptible" to "slight" or "imperceptible" to "moderate" having regard to a range of factors including the extent of sunlight access previously available to the studied window and the extent of potential reduction in sunlight access to the studied windows after the construction of the proposed development.

The results of ARC's analysis are outlined in Table 3.1 below.

Table 3.1
Potential impact of the proposed development on sunlight access to sample windows** in existing buildings in proximity to the application site

Zone	Win	Floor	Annual Probable Sunlight Hours												
			Existing			Proposed			Does window face 90° of due south?	BRE Guide - Section 3.2.1 Criteria				Potential Impact	Comment
			Annual	Summer*	Winter*	Annual	Summer*	Winter*		Does window achieve 25% APSH, incl. 5% APSH in winter after construction of proposed development?	Annual Change under proposed scenario expressed as "times existing value"	Winter Change under proposed scenario expressed as "times existing value"	Is reduction greater than 4% over the course of the year?		
Zone 01	a	Floor 00	80%	56%	24%	78%	56%	22%	Yes	Yes	0.98	0.94	No	Imperceptible	As this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable.
	b	Floor 00	74%	54%	20%	73%	54%	19%	Yes	Yes	0.99	0.95	No	Imperceptible	As this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable.
Zone 02	a	Floor 00	78%	54%	24%	77%	54%	23%	Yes	Yes	0.99	0.96	No	Imperceptible	As this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable.
	b	Floor 00	74%	54%	20%	74%	54%	20%	Yes	Yes	1.00	1.00	No	None	ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.
Zone 03	a	Floor 00	66%	47%	19%	66%	47%	19%	Yes	Yes	1.00	1.00	No	None	ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.
	b	Floor 00	71%	51%	20%	70%	51%	19%	Yes	Yes	0.99	0.97	No	Imperceptible	As this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable.
Zone 04	a	Floor 00	59%	48%	11%	57%	48%	9%	Yes	Yes	0.97	0.81	No	Imperceptible	As this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable.
	b	Floor 00	71%	49%	22%	68%	49%	19%	Yes	Yes	0.96	0.86	No	Imperceptible	As this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable.
Zone 05	a	Floor 00	79%	57%	22%	78%	57%	21%	Yes	Yes	0.98	0.95	No	Imperceptible	As this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable.
	b	Floor 00	42%	34%	8%	39%	32%	7%	Yes	Yes	0.92	0.88	No	Imperceptible	As this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable.
Zone 06	a	Floor 00	12%	12%	0%	10%	10%	0%	No	No	0.85	1.00	No	Imperceptible	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, the BRE Guide would suggest the impact of the proposed development on this window would be "imperceptible" as Annual Probable Sunlight Hours received by this window are not likely fall to less than 0.8 times their former value after the construction of the proposed development.
	b	Floor 00	13%	13%	0%	10%	10%	0%	No	No	0.79	1.00	No	Imperceptible to Not Significant	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, the BRE Guide would suggest the impact of the proposed development on this window would be "imperceptible" as Annual Probable Sunlight Hours received by this window is not likely to experience a reduction in sunlight over the whole year greater than 4% of annual probable sunlight hours after the construction of the proposed development. If noticeable, shadows cast by the proposed development are not likely to result in "significant consequences" for the character of the sunlight environment. This impact is assessed as "imperceptible" to "not significant".
Zone 07	a	Floor 00	32%	29%	3%	28%	26%	2%	No	No	0.88	0.69	No	Imperceptible	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, the BRE Guide would suggest the impact of the proposed development on this window would be "imperceptible" as Annual Probable Sunlight Hours received by this window are not likely fall to less than 0.8 times their former value after the construction of the proposed development.
	b	Floor 00	46%	34%	12%	43%	32%	11%	No	Yes	0.93	0.92	No	Imperceptible	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, as this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable.

Table 3.1
Potential impact of the proposed development on sunlight access to sample windows** in existing buildings in proximity to the application site

Zone	Win	Floor	Annual Probable Sunlight Hours												
			Existing			Proposed			Does window face 90° of due south?	BRE Guide - Section 3.2.1 Criteria				Potential Impact	Comment
			Annual	Summer*	Winter*	Annual	Summer*	Winter*		Does window achieve 25% APSH, incl. 5% APSH in winter after construction of proposed development?	Annual Change under proposed scenario expressed as "times existing value"	Winter Change under proposed scenario expressed as "times existing value"	Is reduction greater than 4% over the course of the year?		
Zone 08	a	Floor 00	31%	29%	2%	30%	28%	2%	No	No	0.97	1.00	No	Imperceptible	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, the BRE Guide would suggest the impact of the proposed development on this window would be "imperceptible" as Annual Probable Sunlight Hours received by this window are not likely fall to less than 0.8 times their former value after the construction of the proposed development.
	b	Floor 00	44%	33%	11%	43%	32%	11%	No	Yes	0.98	1.00	No	Imperceptible	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, as this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable.
Zone 09	a	Floor 00	9%	9%	0%	9%	9%	0%	No	No	1.00	1.00	No	None	ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.
	b	Floor 00	13%	13%	0%	12%	12%	0%	No	No	0.93	1.00	No	Imperceptible	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, the BRE Guide would suggest the impact of the proposed development on this window would be "imperceptible" as Annual Probable Sunlight Hours received by this window are not likely fall to less than 0.8 times their former value after the construction of the proposed development.
Zone 10	a	Floor 00	7%	7%	0%	4%	4%	0%	No	No	0.58	1.00	No	Imperceptible to Slight	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, the BRE Guide would suggest the impact of the proposed development on this window would be "imperceptible" as Annual Probable Sunlight Hours received by this window is not likely to experience a reduction in sunlight over the whole year greater than 4% of annual probable sunlight hours after the construction of the proposed development. If noticeable, shadows cast by the proposed development are not likely to affect the sensitivities of the sunlight environment. This impact is assessed as "imperceptible" to "slight".
	b	Floor 00	18%	17%	1%	16%	15%	1%	No	No	0.89	1.00	No	Imperceptible	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, the BRE Guide would suggest the impact of the proposed development on this window would be "imperceptible" as Annual Probable Sunlight Hours received by this window are not likely fall to less than 0.8 times their former value after the construction of the proposed development.
Zone 11	a	Floor 00	31%	26%	5%+	31%	26%	5%+	No	Yes	1.00	1.00	No	None	ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.
	b	Floor 00	31%	26%	5%+	30%	25%	5%+	No	Yes	0.97	1.00	No	Imperceptible	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, the BRE Guide would suggest the impact of the proposed development on this window would be "imperceptible" as Annual Probable Sunlight Hours received by this window are not likely fall to less than 0.8 times their former value after the construction of the proposed development.
Zone 12	a	Floor 00	54%	38%	16%	38%	27%	11%	Yes	Yes	0.71	0.69	Yes	Imperceptible to Slight	As this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable. If noticeable, shadows cast by the proposed development are not likely to affect the sensitivities of the sunlight environment. This impact is assessed as "imperceptible" to "slight".
	b	Floor 00	87%	59%	28%	77%	54%	23%	Yes	Yes	0.88	0.82	Yes	Imperceptible	As this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable.
Zone 13	-	Floor 00	54%	38%	16%	46%	34%	12%	Yes	Yes	0.85	0.76	Yes	Imperceptible	As this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable.

* For the purposes of this calculation, summer is taken to mean the period between March and September, and winter is considered to be the period between September and March.
** Survey information of all structures on private lands surrounding the application site was not available. Where insufficient survey information was available and window sizes / locations could not be informed by information available from the online planning register or from aerial photography, window sizes / locations were estimated by ARC.
+ Please note that all figures in this table have been rounded. In the interests of clarity, please note that these windows were found to receive 4.9% Annual Probable Sunlight Hours during the winter period.

3.3 *Detailed analysis of the potential impact of shadows cast by the proposed development on gardens and amenity areas outside the application site*

Insofar as amenity spaces / gardens are concerned, the BRE Guide (2011) provides that *"It is recommended that for it to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least two hours of sunlight on 21 March. If as a result of new development an existing garden or amenity area does not meet the above, **and** the area which can receive two hours of sun on 21 March is less than 0.8 times its former value, then the loss of sunlight is likely to be noticeable."* [Emphasis added.] This suggests that where a garden or amenity area can receive two hours of sun over half its area on 21 March notwithstanding the construction of a proposed development, loss of sunlight as a result of additional overshadowing is not likely to be noticed.

Having regard to the criteria for identifying receptors particularly sensitive to changes in the shadow environment discussed above, ARC undertook detailed quantitative analysis of the gardens most likely to be affected by shadows cast by the proposed development on 21st March. Table 2.2 sets out the likely proportion of neighbouring gardens in sunlight before and after the construction of the proposed development throughout the day on 21st March.

Table 3.2
Potential impact of the proposed development* on sunlight access to sample neighbouring gardens on 21st March

Zone	21st March Time	Existing Percentage area in sunlight	Proposed Percentage area in sunlight
Zone 01 Devoy Terrace Rear Garden	08:00	58%	57%
	09:00	82%	81%
	10:00	88%	88%
	11:00	90%	90%
	12:00	90%	90%
	13:00	86%	86%
	14:00	79%	79%
	15:00	79%	79%
	16:00	69%	69%
	17:00	44%	44%
Potential "imperceptible" impact. ARC's analysis indicates that the construction of the proposed development is likely to result in a minor change in sunlight access to this garden (236 sq m) during the early morning of 21st March, although this change is likely to be so minor that it will not be noticeable. ARC's analysis indicates that at least half of the garden will continue to receive at least two hours of sunlight on 21st March after the construction of the proposed development.			
Zone 02 Devoy Terrace Rear Garden	08:00	26%	15%
	09:00	64%	64%
	10:00	88%	88%
	11:00	93%	93%
	12:00	95%	95%
	13:00	88%	88%
	14:00	79%	79%
	15:00	71%	71%
	16:00	64%	63%
	17:00	18%	17%
Potential "imperceptible" impact. ARC's analysis indicates that the construction of the proposed development is likely to result in a minor change in sunlight access to this garden (151 sq m) during the early morning and late evening of 21st March, although this change is likely to be so minor that it will not be noticeable. ARC's analysis indicates that at least half of the garden will continue to receive at least two hours of sunlight on 21st March after the construction of the proposed development.			

Table 3.2
Potential impact of the proposed development* on sunlight access to sample neighbouring gardens on 21st March

Zone	21st March Time	Existing Percentage area in sunlight	Proposed Percentage area in sunlight
Zone 03 Devoy Terrace Rear Garden	08:00	46%	21%
	09:00	77%	76%
	10:00	94%	94%
	11:00	97%	97%
	12:00	97%	97%
	13:00	93%	93%
	14:00	80%	80%
	15:00	69%	69%
	16:00	55%	55%
	17:00	13%	13%
Potential "imperceptible" impact. ARC's analysis indicates that the construction of the proposed development is likely to result in a minor change in sunlight access to this garden (179 sq m) during the early morning and late evening of 21st March, although this change is likely to be so minor that it will not be noticeable. ARC's analysis indicates that at least half of the garden will continue to receive at least two hours of sunlight on 21st March after the construction of the proposed development.			
Zone 04 Devoy Terrace Rear Garden	08:00	2%	0%
	09:00	34%	34%
	10:00	48%	48%
	11:00	57%	57%
	12:00	64%	64%
	13:00	64%	64%
	14:00	50%	50%
	15:00	42%	42%
	16:00	27%	27%
	17:00	0%	0%
Potential "imperceptible" impact. ARC's analysis indicates that the construction of the proposed development is likely to result in a minor change in sunlight access to this garden (69 sq m) during the early morning of 21st March, although this change is likely to be so minor that it will not be noticeable. ARC's analysis indicates that at least half of the garden will continue to receive at least two hours of sunlight on 21st March after the construction of the proposed development.			
Zone 05 Arconagh Rear Garden	08:00	4%	0%
	09:00	32%	32%
	10:00	49%	49%
	11:00	60%	60%
	12:00	76%	76%
	13:00	82%	82%
	14:00	74%	74%
	15:00	69%	69%
	16:00	62%	62%
	17:00	24%	24%
Potential "imperceptible" impact. ARC's analysis indicates that the construction of the proposed development is likely to result in a minor change in sunlight access to this garden (65 sq m) during the early morning of 21st March, although this change is likely to be so minor that it will not be noticeable. ARC's analysis indicates that at least half of the garden will continue to receive at least two hours of sunlight on 21st March after the construction of the proposed development.			

Table 3.2 Potential impact of the proposed development* on sunlight access to sample neighbouring gardens on 21st March			
Zone	21st March Time	Existing Percentage area in sunlight	Proposed Percentage area in sunlight
Zone 06 Arconagh Rear Garden	08:00	53%	53%
	09:00	73%	73%
	10:00	72%	72%
	11:00	76%	76%
	12:00	73%	73%
	13:00	69%	69%
	14:00	54%	54%
	15:00	49%	49%
	16:00	54%	54%
	17:00	47%	47%
Potential "imperceptible" impact. ARC's analysis indicates that the construction of the proposed development is likely to result in a minor change in sunlight access to this garden (181 sq m) during the morning of 21st March, although this change is likely to be so minor that it will not be noticeable. ARC's analysis indicates that at least half of the garden will continue to receive at least two hours of sunlight on 21st March after the construction of the proposed development.			
Zone 07 Arconagh Rear Garden	08:00	49%	49%
	09:00	66%	66%
	10:00	65%	65%
	11:00	66%	66%
	12:00	69%	69%
	13:00	67%	67%
	14:00	56%	56%
	15:00	34%	34%
	16:00	15%	15%
	17:00	0%	0%
No potential change in sunlight access. ARC's analysis indicates that the construction of the proposed development is unlikely to result in any change in sunlight access to this garden (108 sq m) on 21st March.			
Zone 08 Arconagh Rear Garden	08:00	64%	64%
	09:00	76%	76%
	10:00	70%	70%
	11:00	77%	77%
	12:00	76%	76%
	13:00	76%	76%
	14:00	78%	78%
	15:00	71%	69%
	16:00	67%	67%
	17:00	49%	49%
No potential change in sunlight access. ARC's analysis indicates that the construction of the proposed development is unlikely to result in any change in sunlight access to this garden (322 sq m) on 21st March.			

Table 3.2 Potential impact of the proposed development* on sunlight access to sample neighbouring gardens on 21st March			
Zone	21st March Time	Existing Percentage area in sunlight	Proposed Percentage area in sunlight
Zone 09 Arconagh Rear Garden	08:00	50%	50%
	09:00	75%	75%
	10:00	72%	72%
	11:00	74%	74%
	12:00	78%	78%
	13:00	74%	74%
	14:00	60%	60%
	15:00	59%	59%
	16:00	63%	63%
	17:00	43%	43%
Potential "imperceptible" impact. ARC's analysis indicates that the construction of the proposed development is likely to result in a minor change in sunlight access to this garden (207 sq m) during the early morning of 21st March, although this change is likely to be so minor that it will not be noticeable. ARC's analysis indicates that at least half of the garden will continue to receive at least two hours of sunlight on 21st March after the construction of the proposed development.			
Zone 10 Arconagh Rear Garden	08:00	45%	45%
	09:00	83%	83%
	10:00	81%	81%
	11:00	64%	64%
	12:00	55%	55%
	13:00	51%	51%
	14:00	45%	45%
	15:00	29%	29%
	16:00	11%	11%
	17:00	0%	0%
Potential "imperceptible" impact. ARC's analysis indicates that the construction of the proposed development is likely to result in a change in sunlight access to this garden (125 sq m) during the early morning of 21st March, although this change is likely to be so minor that it will not be noticeable. ARC's analysis indicates that at least half of the garden will continue to receive at least two hours of sunlight on 21st March after the construction of the proposed development.			

* The BRE Guide (as updated in 2011), which states that the *"question of whether trees or fences should be included in the calculation depends upon the type of shade they produce. Normally trees and shrubs need not be included, and partly because the dappled shade of a tree is more pleasant than the deep shadow of a building (this applies especially to deciduous trees)."* Given this, ARC did not include existing or proposed trees within the analysis model.

4.0 Assessment of Daylight Access within the Proposed Development

The *Sustainable Urban Housing: Design Standards for New Apartments Guidelines for Planning Authorities* provide that *"planning authorities should have regard to quantitative performance approaches to daylight provision outlined in guides like the BRE guide 'Site Layout Planning for Daylight and Sunlight' (2nd edition) or BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting' when undertaken by development proposers which offer the capability to satisfy minimum standards of daylight provision."*

4.1 Initial daylight assessment of proposed residences

In relation to daylight access in rooms, the BRE Guide (2011) provides, at section 2.1.21:

> *"Obstructions can limit access to light from the sky. This can be checked by measuring or calculating the angle of visible sky **θ**, angle of obstruction or vertical sky component (VSC) at the centre of the lowest window where daylight is required. If VSC is ... at least 27% (**θ** is greater than 65°, obstruction angle less than 25°) conventional window design will usually give reasonable results."*

Section 2.1.12 suggests that Vertical Sky Component of points along the lowest storey base could be measured as an initial test of daylight access to proposed rooms. Given this, ARC assessed Vertical Sky Component to windows in all ground floor habitable rooms within the proposed development. The results of ARC's analysis are set out in Table 4.1 below.

Table 4.1
Initial testing of Vertical Sky Component ground floor habitable rooms in proposed new dwellings

Unit	Vertical Sky Component (%)	Does the window achieve the recommended 27% Vertical Sky Component?
001 KD Main	32.57	Yes
001 KD Side	35.55	Yes
001 KD Small	31.42	Yes
001 Living Main	30.79	Yes
001 Living Small	30.61	Yes
002 KD Main	30.67	Yes
002 Living	32.52	Yes
003 KD Main	30.02	Yes
003 Living	32.68	Yes
004 KD Main	29.40	Yes
004 Living	32.65	Yes
005 KD Main	29.07	Yes
005 Living	32.00	Yes
006 KD Main	28.75	Yes
006 Living	32.02	Yes
007 KD Main	27.75	Yes
007 Living	32.77	Yes
008 Living	31.77	Yes
008 KD Main	27.40	Yes
009 KD Main	27.48	Yes
009 Living	32.54	Yes
010 KD Main	27.64	Yes
010 Living	32.85	Yes
011 KD Main	27.97	Yes
011 Living	33.64	Yes
012 KD Main	28.82	Yes
012 Living	34.04	Yes
013 KD Main	29.40	Yes
013 Living	33.40	Yes
014 KD Main	29.67	Yes
014 Living	33.59	Yes
015 KD Main	29.81	Yes
015 Living	34.25	Yes
016 KD Main	29.98	Yes
016 Living	34.32	Yes
017 KD Main	30.44	Yes
017 Living	32.90	Yes
018 KD Main	30.89	Yes
018 Living	30.68	Yes
019 KD Main	27.84	Yes
019 Living	32.77	Yes
020 Living	31.28	Yes
020 KD Main	31.26	Yes
021 KD Main	31.59	Yes
021 Living	31.71	Yes
022 KD Main	31.34	Yes
022 Living	31.94	Yes
023 KD Main	28.06	Yes
023 KD Side	30.59	Yes
023 KD Small	26.14	No
023 Living Main	35.71	Yes
023 Living Small	35.20	Yes
024 KD Main	36.01	Yes
024 Living	28.06	Yes
025 KD Main	36.07	Yes
025 Living	30.07	Yes
026 KD Main	32.42	Yes
026 KD Side	35.02	Yes
026 KD Small	29.75	Yes

Table 4.1 Initial testing of Vertical Sky Component ground floor habitable rooms in proposed new dwellings		
Unit	Vertical Sky Component (%)	Does the window achieve the recommended 27% Vertical Sky Component?
026 Living Main	35.81	Yes
026 Living Small	35.34	Yes
027 Bedroom	31.64	Yes
029 Bedroom	31.54	Yes
031 Bedroom	31.19	Yes
033 Bedroom	31.05	Yes
035 Bedroom	31.22	Yes
037 Bedroom	31.20	Yes
039 Bedroom 1	30.58	Yes
039 Bedroom 2	30.44	Yes
039 KLD Main	18.38	No
039 KLD Side	27.88	Yes
039 KLD Small	28.40	Yes
042 Bedroom	30.40	Yes
044 Bedroom	29.94	Yes
046 Bedroom	29.22	Yes
048 Bedroom	28.88	Yes
050 Bedroom	32.27	Yes
052 Bedroom	32.40	Yes
054 Bedroom	32.45	Yes
056 Bedroom	32.35	Yes
058 Bedroom	32.14	Yes
060 Bedroom	32.18	Yes
062 Bedroom	35.82	Yes
064 Bedroom	35.57	Yes
066 Bedroom	35.30	Yes
068 Bedroom	35.00	Yes
070 Bedroom	34.77	Yes
072 Bedroom	34.59	Yes
074 Bedroom	32.10	Yes
104 Bedroom 1	29.04	Yes
104 Bedroom 2	29.00	Yes
104 KLD Main	20.19	No
104 KLD Side	27.44	Yes
104 KLD Small	30.94	Yes
107 Bedroom	33.22	Yes
107 KLD Main	17.88	No

Table 4.1 Initial testing of Vertical Sky Component ground floor habitable rooms in proposed new dwellings		
Unit	Vertical Sky Component (%)	Does the window achieve the recommended 27% Vertical Sky Component?
107 KLD Small	21.69	No
109 Bedroom	33.57	Yes
109 KLD Main	26.53	No
109 KLD Small	26.78	No
111 Bedroom	33.83	Yes
111 KLD Main	29.19	Yes
111 KLD Small	27.47	Yes
113 Bedroom	34.23	Yes
113 KLD Main*	28.40	Yes
113 KLD Small	25.09	No
115 Bedroom	34.47	Yes
115 KLD Main	23.22	No
115 KLD Small	17.17	No
117 Bedroom 1	35.55	Yes
117 Bedroom 2	35.40	Yes
117 KLD Main	22.49	No
117 KLD Side	32.95	Yes
117 KLD Small	32.79	Yes
120 KD Main*	27.48	Yes
120 KD Small	25.20	No
120 Living	35.70	Yes
121 KD Main*	28.66	Yes
121 KD Small	26.82	No
121 Living	35.70	Yes
123 KD Main	29.18	Yes
123 KD Small	27.43	Yes
123 Living	35.56	Yes
124 KD Main	29.47	Yes
124 KD Small	27.66	Yes
124 Living	35.35	Yes
126 KD Main	29.49	Yes
126 KD Small	27.84	Yes
126 Living	34.72	Yes
127 KD Main	29.54	Yes
127 KD Small	27.75	Yes
127 Living	33.49	Yes
129 Bedroom	32.52	Yes

Table 4.1
Initial testing of Vertical Sky Component ground floor habitable rooms in proposed new dwellings

Unit	Vertical Sky Component (%)	Does the window achieve the recommended 27% Vertical Sky Component?
129 KLD Main	25.57	No
129 KLD Small	25.26	No
131 Bedroom	31.48	Yes
131 KLD Main*	28.39	Yes
131 KLD Small	26.84	No
133 Bedroom 1	30.56	Yes
133 Bedroom 2	30.43	Yes
133 KLD Main	17.24	No
133 KLD Side	27.87	Yes
133 KLD Small	27.27	Yes
136 Bedroom	28.36	Yes
136 KLD Main	25.47	No
136 KLD Small	18.67	No
138 Bedroom	27.88	Yes
138 KLD Main	30.23	Yes
138 KLD Small	27.30	Yes
140 Bedroom	27.66	Yes
140 KLD Main	31.51	Yes
140 KLD Small	29.25	Yes
142 Bedroom	27.63	Yes
142 KLD Main	31.29	Yes
142 KLD Small	29.68	Yes
144 Bedroom	27.09	Yes
144 KLD Main	29.09	Yes
144 KLD Small	28.80	Yes
146 Bedroom Main	28.40	Yes
146 Bedroom Small	30.81	Yes
146 KLD Main	18.03	No
146 KLD Small	17.16	No
149 KD Main	28.06	Yes
149 KD Small	24.42	No
149 Living	32.25	Yes
151 KD Main	30.66	Yes
151 KD Small	29.11	Yes
151 Living	32.30	Yes
152 KD Main	30.16	Yes
152 KD Small	28.79	Yes

Table 4.1
Initial testing of Vertical Sky Component ground floor habitable rooms in proposed new dwellings

Unit	Vertical Sky Component (%)	Does the window achieve the recommended 27% Vertical Sky Component?
152 Living	31.99	Yes
154 KD Main	29.97	Yes
154 KD Small	28.13	Yes
154 Living	31.38	Yes
155 KD Main	29.64	Yes
155 KD Small	27.85	Yes
155 Living	30.92	Yes
157 KD Main	28.94	Yes
157 KD Small	27.06	Yes
157 Living	29.95	Yes
158 KD Main*	27.76	Yes
158 KD Small	25.51	No
158 Living	29.44	Yes
160 KD Main	35.78	Yes
160 KD Side	34.17	Yes
160 KD Small	33.17	Yes
160 Living Main	30.58	Yes
160 Living Small	30.37	Yes
161 KD	30.52	Yes
161 Living	33.23	Yes
162 KD	30.28	Yes
162 Living	33.31	Yes
163 KD	30.35	Yes
163 Living	33.15	Yes
164 KD	30.27	Yes
164 Living	32.73	Yes
165 KD	30.16	Yes
165 Living	32.68	Yes
166 KD	30.34	Yes
166 Living	32.69	Yes
167 KD	30.89	Yes
167 Living	32.31	Yes
168 KD	29.56	Yes
168 Living	33.80	Yes
169 KD	31.57	Yes
169 Living	32.36	Yes
170 KD	31.79	Yes

Table 4.1
Initial testing of Vertical Sky Component ground floor habitable rooms in proposed new dwellings

Unit	Vertical Sky Component (%)	Does the window achieve the recommended 27% Vertical Sky Component?
170 Living	32.55	Yes
171 KD	31.81	Yes
171 Living	32.59	Yes
172 KD	31.70	Yes
172 Living	32.77	Yes
173 KD	31.93	Yes
173 Living	33.14	Yes
174 KD	32.35	Yes
174 Living	33.11	Yes
175 KD	32.78	Yes
175 Living	34.07	Yes
176 Bedroom 2	31.27	Yes
176 Bedrrom 1	31.52	Yes
176 KLD Main	17.07	No
176 KLD Side	28.42	Yes
176 KLD Small	27.09	Yes
179 Bedroom	28.20	Yes
179 KLD Main*	30.64	Yes
179 KLD Small	22.19	No
181 Bedroom	27.75	Yes
181 KLD Main	33.76	Yes
181 KLD Small	31.40	Yes
183 Bedroom	27.59	Yes
183 KLD Main	33.72	Yes
183 KLD Small	31.75	Yes
185 Bedroom	27.68	Yes
185 KLD Main	33.09	Yes
185 KLD Small	31.17	Yes
187 Bedroom	28.23	Yes
187 KLD Main	32.43	Yes
187 KLD Small	30.55	Yes
189 Bedroom	28.67	Yes
189 KLD Main	31.71	Yes
189 KLD Small	29.87	Yes
191 Bedroom	29.45	Yes
191 KLD Main	29.55	Yes
191 KLD Small	29.17	Yes

Table 4.1
Initial testing of Vertical Sky Component ground floor habitable rooms in proposed new dwellings

Unit	Vertical Sky Component (%)	Does the window achieve the recommended 27% Vertical Sky Component?
193 Bedroom 1	28.39	Yes
193 Bedroom 2	29.42	Yes
193 KLD Main	19.14	No
193 KLD Side	28.45	Yes
193 KLD Small	29.73	Yes
196 KD Main	22.95	No
196 KD Small	25.50	No
196 Living	31.80	Yes
198 KD Main	29.59	Yes
198 KD Small	27.52	Yes
198 Living	32.54	Yes
200 KD Main	28.15	Yes
200 KD Small	24.45	No
200 Living	32.85	Yes
202 KD Main	24.81	No
202 KD Small	21.89	No
202 Living	33.70	Yes
204 Bedroom 1	20.04	No
204 Bedroom 2	33.88	Yes
204 KLD	25.13	No
206 Bedroom 1	19.92	No
206 Bedroom 2	32.75	Yes
206 KLD	29.60	Yes
208 Bedroom 1	18.49	No
208 Bedroom 2	32.35	Yes
208 KLD	28.84	Yes
210 Bedroom 1	18.22	No
210 Bedroom 2	30.77	Yes
210 KLD	30.44	Yes
212 Bedroom 1	17.22	No
212 Bedroom 2	30.50	Yes
212 KLD	30.23	Yes
214 Bedroom 1	17.20	No
214 Bedroom 2	30.18	Yes
214 KLD	31.69	Yes
216 Bedroom 1	17.17	No
216 Bedroom 2	30.19	Yes

Table 4.1 Initial testing of Vertical Sky Component ground floor habitable rooms in proposed new dwellings		
Unit	Vertical Sky Component (%)	Does the window achieve the recommended 27% Vertical Sky Component?
216 KLD	31.46	Yes
218 Bedroom 1	17.28	No
218 Bedroom 2	30.51	Yes
218 KLD	32.67	Yes

* Please note that, where the main window serving a room is likely to receive in excess of 27% Vertical Sky Component, the room was determined to receive adequate daylight within the meaning of the BRE Guide (2011) for the purposes of this analysis.

The BRE Guide (2011) goes on to state, at section 2.1.22: *"To check that adequate daylight is provided in new rooms, the ADF may be calculated and compared with the recommendations in BS 8206-2 Code of practice for daylighting"*. Given this, where ARC's analysis indicated that there was a potential for the windows serving a habitable room to receive less than the BRE Guide (2011) recommendation of 27% Vertical Sky Component, Average Daylight Factor within the room was assessed in order to identify whether daylight access within the room would be sufficient. This is discussed in more detail below.

4.2 Detailed daylight assessment of proposed residences

4.2.1 Assessment of Daylight Access within the Proposed Development - Average Daylight Factor (BRE Guide, 2011)

The BRE Guide (2011) states as follows (at paragraph 2.1.8) in relation to daylight access within new development:

> *"2.1.8 Daylight provision in new rooms may be checked using the average daylight factor (ADF). The ADF is a measure of the overall amount of daylight in a space... BS 8206-2 Code of practice for daylighting, recommends an ADF of 5% for a well daylit space and 2% for a partly daylit space. Below 2% the room will look dull and electric lighting is likely to be turned on. In housing BS 8206-2 also gives minimum value of ADF of 2% for kitchens, 1.5% for living rooms and 1% for bedrooms."*

While not expressly discussed in the BRE Guide (2011), Section 5.6 of the *BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting'* (withdrawn in May 2019) states as follows in relation to multi-function rooms: *"Where one room serves more than one purpose, the minimum average daylight factor should be that for the room type with the highest value. For example, in a space which combines a living room and a kitchen the minimum average daylight factor should be 2%."* Given this, this assessment applies a standard of 2% Average Daylight Factor for mixed function rooms (e.g. 2% Average Daylight Factor for kitchen / living / dining rooms and for kitchen / dining rooms).

As discussed in Section 4.1 above, where ARC's analysis indicated that there was a potential for the main window serving a habitable room to receive less than the BRE Guide (2011) recommendation of 27% Vertical Sky Component, Average Daylight Factor within the room was assessed in order to identify whether daylight access within the room would be sufficient. In addition to those rooms, ARC also analysed Average Daylight Factor within a number of first floor apartments in the interests of completeness.

The results of ARC's analysis are set out in Table 4.2 and summarised in Section 4.3 below. The locations of the sample study rooms analysed as part of this analysis of daylight access within residences within the proposed development are illustrated at Figures 4.1-4.5 below.

4.2.2 Assessment of Daylight Access within the Proposed Development - Daylight Factor (IS EN 17037 / BS EN 17037)

The *BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting'* was withdrawn in May 2019, while *BS EN 17037: Daylight in Buildings* was adopted in the United Kingdom in May 2019. In Ireland, *IS EN 17037: Daylight in Buildings* was published by the National Standards Authority of Ireland on 28th January 2019.

The standards for daylight access (and the methodologies recommended for assessing whether rooms meet those standards) in the BRE Guide (2011) are different from those set out in IS EN 17037: 2018 and BS EN 17037: 2018. Given this and given that the *Sustainable Urban Housing: Design Standards for New Apartments Guidelines for Planning Authorities* refers to the BRE Guide (2011) and not to IS EN 17037: 2018 or BS EN 17037: 2018, the status of the IS EN 17037: 2018 and BS EN 17037: 2018 under the planning process is unclear. However, in the interests of completeness, this report also assesses daylight access within habitable rooms with reference to IS EN 17037 and to BS EN 17037, as well as with reference to the standards for daylight access (and the methodologies recommended for assessing whether rooms meet those standards) set out in the BRE Guide (2011).

Under a minimum scenario, *IS EN 17037: Daylight in Buildings* recommends a target illuminance of 300 lux across 50% of a reference plane (a horizontal plane 0.85 m above the ground within a studied room) and a minimum target illuminance of 100 lux across 95% of that reference plane (Table A.1 for vertical windows). Applying Method 1, this corresponds to a recommendation to achieve 2.0% daylight factor across 50% of the reference plane and 0.7% daylight factor across 95% of the reference plane (see Table A.3 for Ireland, Dublin).

The IS EN 17037 does not identify daylighting targets for specific room types. The National Annex attached to the *BS EN 17037: Daylight in Buildings* states as follows:

> *"The UK committee supports the recommendations for daylight in buildings given in BS EN 17037: 2018; however, it is the opinion of the UK committee that the recommendations for daylight provision in a space... may not be achievable for some buildings, particularly dwellings."*

The BS EN 17037 goes on to recommend that at least 50% of a horizontal reference plane (at 0.85 m) achieve the following target illuminances for each room type: 100 lux for bedrooms, 150 lux for living rooms and 200 lux for kitchens. This is understood to correspond to a recommendation to achieve 0.7% daylight factor for bedrooms, 1.1% daylight factor for living rooms and 1.4% daylight factor for kitchens over 50% of the horizontal reference plane.

ARC analysed each habitable room within the proposed development with reference to these criteria and the results are set out in Table 4.2 below. Please note that, in relation to the assessment under BS EN 17037, the results of analysis are provided only in relation to the relevant room type (e.g. for a bedroom, the proportion of the room achieving 0.7% daylight factor across the working plane is provided and the table cells related to the proportion of the room achieving 1.1% daylight factors (i.e. the recommendation for living rooms) and 1.4% daylight factor (i.e. the recommendation for kitchens) are marked as "Not Applicable" as this is not applicable to the assessment).

4.3 Summary Results: Daylight Access Analysis

ARC's analysis indicates that the main window of the overwhelming majority of habitable rooms at ground floor level is likely to receive in excess of 27% Vertical Sky Component and, therefore, be adequately daylit within the meaning of the BRE Guide (2011). Further analysis of habitable rooms at ground floor level not likely to achieve 27% Vertical Sky Component at the main window (as well as apartments on the first floor) indicates as follows:

- 34 of 34 (100%) of sample rooms subject to detailed daylight access analysis are likely to achieve the Average Daylight Factor recommendations set out in the BRE Guide of 2011 (1% Average Daylight Factor for bedrooms, 1.5% Average Daylight Factor for living rooms; 2% Average Daylight Factor for kitchens.) Please note that a standard of 2% Average Daylight Factor was applied to mixed function rooms (e.g. 2% Average Daylight Factor for kitchen / living / dining rooms and for kitchen / dining rooms).

- 20 of 34 (59%) of sample rooms subject to detailed daylight access analysis are likely to achieve the recommendations set out in IS EN 17037: 2018 for Method 1 / Daylight Factor analysis.

- 34 of 34 (100%) of sample rooms subject to detailed daylight access analysis are likely to achieve the recommendations for residential development set out in the National Annex to BS EN 17037: 2018.

Overall, the results of ARC's analysis of Vertical Sky Component of lowest level habitable rooms and supplementary Average Daylight Factor analysis indicate that all habitable rooms within proposed residences are likely to achieve the recommendations of *Site layout planning for daylight and sunlight: a guide to good practice* (the BRE Guide, 2011) for daylight access in residential development.

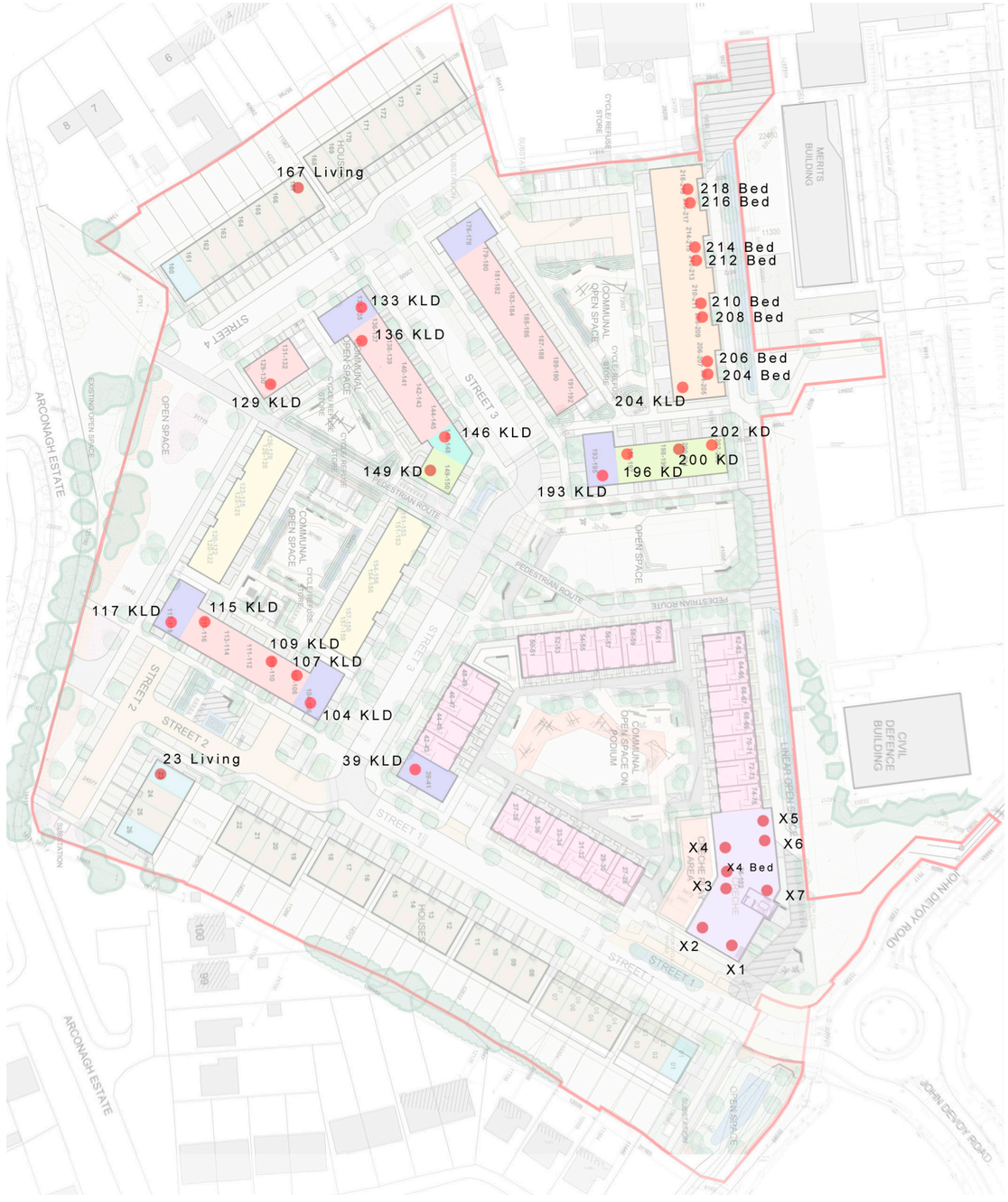
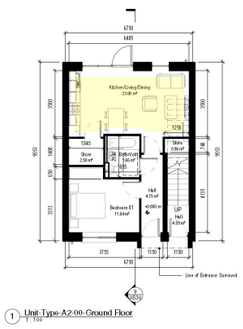
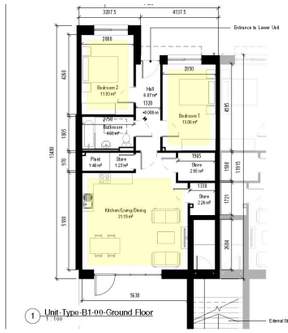


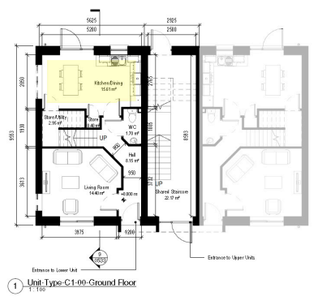
Figure 4.1: Overview diagram indicating the location of sample rooms within the proposed development assessed subject to detailed daylight analysis (Section 4.2)



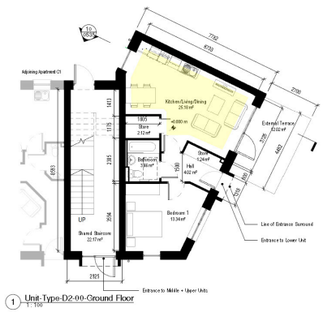
1 Unit-Type-A2-00-Ground Floor
1 : 100



1 Unit-Type-B1-00-Ground Floor
1 : 100

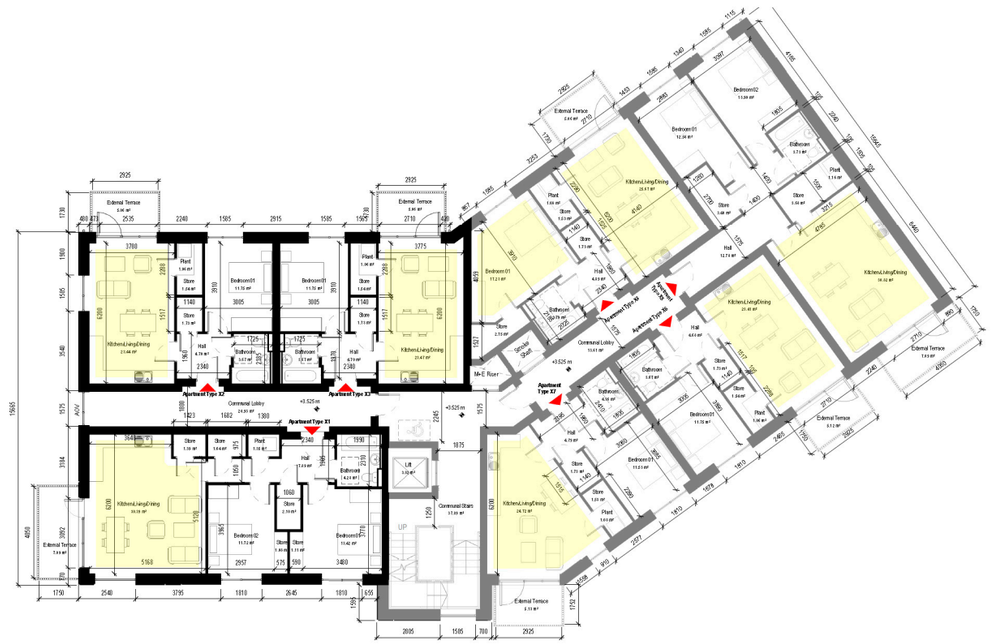


1 Unit-Type-C1-00-Ground Floor
1 : 100



1 Unit-Type-D2-00-Ground Floor
1 : 100

Figure 4.2: Indicative diagram based on floor plan prepared by Coady Architects showing extent of sample rooms (in yellow) analysed as part of the detailed assessment of daylight access within the proposed development (Section 4.2) - typical A to D Type Units – annotated in yellow by ARC. Please refer to Figure 4.1 for location of sample rooms within the overall proposal.



2 Unit Type X Apartments - 01 - First Floor
1 : 100

Figure 4.4: Indicative diagram based on floor plan prepared by Coady Architects showing extent of sample rooms (in yellow) analysed as part of the detailed assessment of daylight access within the proposed development (Section 4.2) - typical X Type Units – annotated in yellow by ARC. Please refer to Figure 4.1 for location of sample rooms within the overall proposal.

1 Duplex Type E 1 - Ground Floor
1 : 100

1 Unit-Type-F1-00-Ground Floor
1 : 100

1 Unit-Type-F2-00-Ground Floor
1 : 100

1 Unit-Type-K1-00-Ground Floor
1 : 100

1 GA-TYP-L1-00-Ground-Floor-Plan
1 : 100

Figure 4.3: Indicative diagram based on floor plan prepared by Coady Architects showing extent of sample rooms (in yellow) analysed as part of the detailed assessment of daylight access within the proposed development (Section 4.2) - typical E to L Type Units – annotated in yellow by ARC. Please refer to Figure 4.1 for location of sample rooms within the overall proposal.

Table 4.1
Predicted daylight access to sample rooms within the proposed development

Unit	Room Type	Floor	BR209 (BRE Guide)		IS EN 17037			BS EN 17037			
			Average Daylight Factor	Does the room achieve BR209 recommendations?	Minimum Target Daylight Factor (D_{TM}) Proportion (%) of room achieving 0.7% daylight factor (Target = 95%)	Target Daylight Factor (D_T) Proportion (%) of room achieving 2.0% daylight factor (Target = 50%)	Does the room achieve IS EN 17037 recommendations?	Proportion (%) of room achieving 0.7% daylight factor Target for bedrooms = 50%	Proportion (%) of room achieving 1.1% daylight factor Target for living rooms= 50%	Proportion (%) of room achieving 1.4% daylight factor Target for kitchens / KLDs = 50%	Does the room achieve BS EN 17037 recommendation?
023 Liv	Living room	Floor 00	3.52%	Yes	100.00%	100.00%	Yes	Not Applicable	100.00%	Not Applicable	Yes
039 KLD	Kitchen / living / dining room	Floor 00	3.64%	Yes	100.00%	94.30%	Yes	Not Applicable	Not Applicable	100.00%	Yes
104 KLD	Kitchen / living / dining room	Floor 00	3.84%	Yes	100.00%	93.50%	Yes	Not Applicable	Not Applicable	100.00%	Yes
107 KLD	Kitchen / living / dining room	Floor 00	2.30%	Yes	100.00%	48.30%	No	Not Applicable	Not Applicable	100.00%	Yes
109 KLD	Kitchen / living / dining room	Floor 00	2.76%	Yes	100.00%	79.10%	Yes	Not Applicable	Not Applicable	100.00%	Yes
115 KLD	Kitchen / living / dining room	Floor 00	2.31%	Yes	100.00%	62.80%	Yes	Not Applicable	Not Applicable	100.00%	Yes
117 KLD	Kitchen / living / dining room	Floor 00	3.60%	Yes	100.00%	94.10%	Yes	Not Applicable	Not Applicable	100.00%	Yes
129 KLD	Kitchen / living / dining room	Floor 00	4.75%	Yes	100.00%	100.00%	Yes	Not Applicable	Not Applicable	100.00%	Yes
133 KLD	Kitchen / living / dining room	Floor 00	3.05%	Yes	100.00%	92.80%	Yes	Not Applicable	Not Applicable	100.00%	Yes
136 KLD	Kitchen / living / dining room	Floor 00	3.50%	Yes	100.00%	83.90%	Yes	Not Applicable	Not Applicable	100.00%	Yes
146 KLD	Kitchen / living / dining room	Floor 00	2.68%	Yes	100.00%	56.20%	Yes	Not Applicable	Not Applicable	100.00%	Yes
149 KD	Kitchen / dining room	Floor 00	2.92%	Yes	100.00%	93.40%	Yes	Not Applicable	Not Applicable	100.00%	Yes
176 KLD	Kitchen / living / dining room	Floor 00	3.54%	Yes	100.00%	85.80%	Yes	Not Applicable	Not Applicable	100.00%	Yes
193 KLD	Kitchen / living / dining room	Floor 00	3.70%	Yes	100.00%	79.30%	Yes	Not Applicable	Not Applicable	100.00%	Yes
196 KD	Kitchen / dining room	Floor 00	2.58%	Yes	100.00%	62.10%	Yes	Not Applicable	Not Applicable	100.00%	Yes
200 KD	Kitchen / dining room	Floor 00	2.63%	Yes	100.00%	58.60%	Yes	Not Applicable	Not Applicable	100.00%	Yes
202 KD	Kitchen / dining room	Floor 00	4.29%	Yes	100.00%	100.00%	Yes	Not Applicable	Not Applicable	100.00%	Yes
204 Bedroom 1	Bedroom	Floor 00	2.20%	Yes	100.00%	37.00%	No	100.00%	Not Applicable	Not Applicable	Yes
204 KLD	Kitchen / living / dining room	Floor 00	3.09%	Yes	100.00%	51.40%	Yes	Not Applicable	Not Applicable	100.00%	Yes
206 Bedroom 1	Bedroom	Floor 00	2.26%	Yes	100.00%	37.00%	No	100.00%	Not Applicable	Not Applicable	Yes
208 Bedroom 1	Bedroom	Floor 00	2.20%	Yes	100.00%	35.20%	No	100.00%	Not Applicable	Not Applicable	Yes
210 Bedroom 1	Bedroom	Floor 00	2.09%	Yes	100.00%	25.90%	No	100.00%	Not Applicable	Not Applicable	Yes
212 Bedroom 1	Bedroom	Floor 00	2.07%	Yes	100.00%	33.30%	No	100.00%	Not Applicable	Not Applicable	Yes
214 Bedroom 1	Bedroom	Floor 00	2.10%	Yes	100.00%	33.30%	No	100.00%	Not Applicable	Not Applicable	Yes
216 Bedroom 1	Bedroom	Floor 00	2.16%	Yes	100.00%	35.20%	No	100.00%	Not Applicable	Not Applicable	Yes
218 Bedroom 1	Bedroom	Floor 00	2.08%	Yes	100.00%	29.60%	No	100.00%	Not Applicable	Not Applicable	Yes
X1 KLD	Kitchen / living / dining room	Floor 01	3.90%	Yes	100.00%	82.90%	No	Not Applicable	Not Applicable	95.70%	Yes
X2 KLD	Kitchen / living / dining room	Floor 01	4.29%	Yes	100.00%	75.00%	Yes	Not Applicable	Not Applicable	100.00%	Yes
X3 KLD	Kitchen / living / dining room	Floor 01	2.50%	Yes	100.00%	42.20%	No	Not Applicable	Not Applicable	70.30%	Yes
X4 KLD	Kitchen / living / dining room	Floor 01	2.44%	Yes	100.00%	31.60%	No	Not Applicable	Not Applicable	68.50%	Yes
X4 Bedroom	Bedroom	Floor 01	2.69%	Yes	100.00%	33.70%	No	100.00%	Not Applicable	Not Applicable	Yes
X5 KLD	Kitchen / living / dining room	Floor 01	2.16%	Yes	100.00%	30.60%	No	Not Applicable	Not Applicable	94.40%	Yes
X6 KLD	Kitchen / living / dining room	Floor 01	2.38%	Yes	100.00%	46.70%	No	Not Applicable	Not Applicable	100.00%	Yes
X7 KLD	Kitchen / living / dining room	Floor 01	2.91%	Yes	100.00%	100.00%	Yes	Not Applicable	Not Applicable	100.00%	Yes

Figure 5.1: Location of sample rooms and communal amenity areas within the proposed development assessed as part of this report

5.0 Assessment of Sunlight Access within the Proposed Open Spaces

Section 3 of the Building Research Establishment's *Site layout planning for daylight and sunlight: a guide to good practice* sets out design advice and recommendations for site layout planning to ensure good sunlight access suggests 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 sunlight at the equinox.

Please note that, in determining whether or not to include existing and proposed substantial trees in the three dimensional model for the purposes of this quantitative analysis, ARC made reference to the BRE Guide (as updated in 2011), which states that the *"question of whether trees or fences should be included in the calculation depends upon the type of shade they produce. Normally trees and shrubs need not be included, and partly because the dappled shade of a tree is more pleasant than the deep shadow of a building (this applies especially to deciduous trees)."* Given this, ARC did not show the shadows cast by any landscape planting in the assessment model.

As part of this analysis, ARC assessed the likely proportion of the proposed communal open space serving the proposed residential development (please see Figure 5.1) predicted to receive sunlight access on 21st March. The results of ARC's analysis are set out in Table 5.1 below.

Table 5.1
Approximate areas of proposed communal open space in sunshine on 21st March

Time	Open Space 01	Open Space 02	Open Space 03	Open Space 04	Open Space 05	Open Space 06	Open Space Crèche
0900	39%	52%	62%	9%	84%	53%	0%
1000	62%	82%	94%	37%	83%	68%	3%
1100	86%	91%	99%	67%	83%	82%	3%
1200	94%	93%	100%	92%	85%	94%	12%
1300	100%	97%	91%	100%	85%	92%	52%
1400	100%	88%	66%	100%	83%	87%	92%
1500	100%	68%	43%	91%	83%	82%	98%
1600	97%	46%	11%	64%	90%	75%	68%
1700	71%	24%	0%	0%	96%	43%	31%

As suggested by the results set out in Table 5.1, the proposed communal open spaces are predicted to receive levels of sunlight considerably in excess of the level recommended by the BRE Guide (2011) for amenity spaces. ARC's analysis, therefore, indicates that the proposed communal open spaces will appear adequately sunlit throughout the year within the meaning of the BRE Guide (2011).

More than this, the proposed internal open spaces are predicted to receive a high level of sunlight access throughout the day and for most of the year. ARC's analysis indicates that this proposed communal open space will afford residents a place within the proposed development where they can go to sit and enjoy the sunshine on a sunny day for a significant portion of the day for most of the year.

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March 2022

Technical Appendix

Explanatory Note

In assessing sunlight and daylight access, Irish practitioners tend to refer to the relevant PJ Littlefair's 2011 revision of the 1991 publication *Site layout planning for daylight and sunlight: a guide to good practice* for the Building Research Establishment (the BRE Guide).

Section 1.7 of the BRE Guide (2011) provides: *"The guidance here is intended for use in the UK and Republic of Ireland"*. Its use in assessing impacts on sunlight and daylight access as part of the planning process is supported by national government planning policy including:

- The *Guidelines for Planning Authorities on Sustainable Residential Development in Urban Areas*, which, at Section 7.2 states: *"Planning authorities should require that daylight and shadow projection diagrams be submitted in all such proposals. The recommendations of "Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice" (B.R.E. 1991)*[1] *or B.S. 8206 "Lighting for Buildings, Part 2 1992: Code of Practice for Daylighting" should be followed in this regard."*

- The *Sustainable Urban Housing: Design Standards for New Apartments Guidelines for Planning Authorities*, which, at Section 6.6, states: *"Planning authorities should have regard to quantitative performance approaches to daylight provision outlined in guides like the BRE guide 'Site Layout Planning for Daylight and Sunlight' (2nd edition) or BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting' when undertaken by development proposers which offer the capability to satisfy minimum standards of daylight provision."*

- The *Urban Development and Building Height Guidelines*, which, at Section 3.2, states: *"Appropriate and reasonable regard should be taken of quantitative performance approaches to daylight provision outlined in guides like the Building Research Establishment's 'Site Layout Planning for Daylight and Sunlight' (2nd edition) or BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting'."*

The standards for daylight and sunlight access in buildings (and the methodologies for assessment of same) suggested in the BRE Guide (2011) have been referenced in this Sunlight and Daylight Access Analysis.

The BRE Guide (2011) does not set out rigid standards or limits, but is preceded by the following very clear warning 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."* [Emphasis added.]

Where appropriate, this report also references *IS EN 17037: Daylight in Buildings* and *BS EN 17037: Daylight in Buildings*.

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1 The *Guidelines for Planning Authorities on Sustainable Residential Development in Urban Areas* refer to the first edition of the BRE Guide as published in 1991. A second edition of the Guide was published in 2011.

Daylight Access to Buildings

Context under Technical and Guidance Documents

Section 2.2.21 of the BRE Guide (2011) suggests that:

> *"If any part of a new building or extension, measured in a vertical section perpendicular to a main window wall of an existing building, from the centre of the lowest window, subtends an angle of more than 25° to the horizontal, then the diffuse daylighting of the existing building may be adversely affected. This will be the case if ...*
>
> - *the VSC measured at the centre of an existing main window is less than 27%, and less than 0.8 times its former value..."*

The BRE Guide (2011) states as follows (at paragraph 2.1.8) in relation to daylight access within new development:

> *"2.1.8 Daylight provision in new rooms may be checked using the average daylight factor (ADF). The ADF is a measure of the overall amount of daylight in a space... BS 8206-2 Code of practice for daylighting, recommends an ADF of 5% for a well daylit space and 2% for a partly daylit space. Below 2% the room will look dull and electric lighting is likely to be turned on. In housing BS 8206-2 also gives minimum value of ADF of 2% for kitchens, 1.5% for living rooms and 1% for bedrooms."*

The British Standard, BS 8206-2, goes on to state, at Section 5.6, that *"Where one room serves more than one purpose, the minimum average daylight factor should be that for the room type with the highest value. For example, in a space which combines a living room and a kitchen the minimum average daylight factor should be 2%."*

IS EN 17037: Daylight in Buildings states as follows:

> *"The daylight in an interior space depends, primarily, on the availability of natural light and, thereafter, the properties of the space and its surroundings. The standard proposes two methods to assess daylight provision in the interior: a calculation method based on daylight factor and cumulative daylight availability (method 1); or a calculation method based on the direct prediction of illuminance levels using hourly climate data (method 2).*
>
> *Both methods apply the annual occurrence of an absolute value for internal illuminance calculated from the availability of external horizontal illuminance as determined from climate data suitable for the site of evaluation.*
>
> *Calculation method 1 using daylight factors on a reference plane should achieve a target daylight factor (D_T) and/or a minimum target daylight factor (D_{TM}) across a fraction of the reference plane for at least half of the daylight hours, where D_T and D_{TM} are based on the provision of recommended target illuminance values, (E_T) and minimum target illuminance (E_{TM}), both in lx."*

Under a minimum scenario, *IS EN 17037: Daylight in Buildings* recommends a target illuminance of 300 lux across 50% of a reference plane (a horizontal plane 0.85 m above the ground within a studied room) and a minimum target illuminance of 100 lux across 95% of that reference plane (Table A.1 for vertical windows). Applying Method 1, this corresponds to a recommendation to achieve 2.0% daylight factor across 50% of the reference plane and 0.7% daylight factor across 95% of the reference plane (see Table A.3 for Ireland, Dublin).

The IS EN 17037 does not identify daylighting targets for specific room types. The National Annex attached to the *BS EN 17037: Daylight in Buildings* states as follows:

> *"The UK committee supports the recommendations for daylight in buildings given in BS EN 17037: 2018; however, it is the opinion of the UK committee that the recommendations for daylight provision in a space... may not be achievable for some buildings, particularly dwellings."*

The BS EN 17037 goes on to recommend that at least 50% of a horizontal reference plane (at 0.85 m) achieve the following target illuminances for each room type: 100 lux for bedrooms, 150 lux for living rooms and 200 lux for kitchens. For Belfast, this

corresponds to a recommendation to achieve 0.7% daylight factor for bedrooms, 1.1% daylight factor for living rooms and 1.4% daylight factor for kitchens over 50% of the horizontal reference plane.

Assessment Methodology for Daylight Access

A three dimensional digital model of the proposed development and of existing buildings in the area was constructed by ARC Consultants based on drawings and three dimensional models supplied by the Design Team. Where survey data of surrounding context was not available, assumptions were made, with reference to on-site, satellite and aerial photography and to the online planning register, where relevant, in the creation of the three dimensional model. Existing and proposed landscaping was not included in this model.

In assessing the impact of the proposed development on existing buildings, ARC assessed the Vertical Sky Component of each window at a point at the centre of each window.

Having regard to the extreme variability in sky luminance over the course of any given day depending on weather conditions and the changing seasons, in order for daylight factor to be a meaningful and comparable measure of daylight access, it is necessary to assume a particular luminance distribution for the sky when calculating Average Daylight Factor. This daylight access analysis uses the Commission Internationale de l'Eclairage (CIE) Standard Overcast Sky Distribution model in its calculations, which is the standard sky most commonly used in daylight access analysis. This model assumes that sky luminance varies from horizon to zenith and is considered to correspond to an overcast day. As such, calculation of Average Daylight Factor in a room in circumstances where the sky luminance corresponds to the CIE Standard Overcast Sky Distribution could be considered to represent a worst case scenario. Unless specifically referenced, analysis of uniformity of daylight access within a room has not been carried out as part of this assessment.

In assessing daylight access within rooms within the proposed development, the following assumptions were made:

- Grid: 0.5 m x 0.5 m
- Internal floor reflectance: 40%
- Internal wall reflectance: 65%
- Internal ceiling reflectance: 80%
- External ground reflectance: 20%
- Glazing transmission: 70%
- Glazing maintenance factor: 90%
- Working plane height: 0.85 m

The area of the grid points within rooms analysed excludes a band of 0.5 m from the walls for assessment of Average Daylight Factor and for Daylight Factor (in relation to Daylight Factor, this approach is recommended at Section B.2 of IS EN 17037).

In applying the recommendations of the National Annex of BS EN 17037, the recommendations outlined in Table NA.5 - Supplement to Table A.3 for 10 UK and Channel Islands Locations for Belfast were applied. As Belfast is located at a more northerly latitude than Dublin, the recommendations for minimum daylight factors for Belfast are considered to be conservative and represent a worst case scenario.

Definition of Impacts on Daylight Access

The assessment of the impact of the proposed development on daylight access had regard to the *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* prepared by the Environmental Protection Agency (Draft of 2017), and to Directive 2011/92/EU (as amended by Directive 2014/52/EU) on the assessment of the likely effects of certain public and private projects on the environment.

In assessing whether a predicted effect of the proposal on daylight access is likely to be "imperceptible", "not significant", "slight", "moderate", "significant", "very significant" or "profound" within the meaning of the EPA's *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*, ARC referred to Appendix I of the BRE Guide (2011) sets out advice on environment impact assessment. It states:

> *I4 The assessment of impact will depend on a combination of factors, and there is no simple rule of thumb that can be applied.*
>
> *I5 Where the loss of skylight or sunlight fully meets the guidelines in this book, the impact is assessed as negligible or minor adverse. Where the loss of light is well within the guidelines, or only a small number of windows or a limited area of open space lose light (within the guidelines), a classification of negligible impact is more appropriate, especially if there is a particularly strong requirement for daylight and sunlight in the affected building or open space.*
>
> *I6 Where the loss of skylight or sunlight does not meet the guidelines in this book, the impact is assessed as minor, moderate or major adverse. Factors tending towards a minor adverse impact include:*
> - *only a small number of windows or limited area of open space are affected*
> - *the loss of light is only marginally outside the guidelines*
> - *an affected room has other source of skylight or sunlight*
> - *the affected building or open space only has a low level requirement for skylight or sunlight*
> - *there are particular reasons why an alternative, less stringent, guidelines should be applied (see Appendix F).*
>
> *I7 Factors tending towards a major adverse impact include:*
> - *a large number of windows or large area of open space are affected*
> - *the loss of light is substantially outside the guidelines*
> - *all the windows in a particular property are affected*
> - *the affected indoor or outdoor spaces have a particularly strong requirement for skylight or sunlight, eg a living room in a dwelling or a children's playground.*

Having considered the factors outlined in Appendix I of the BRE Guide (2011), ARC's assessment classifies the impact of the proposed development on daylight access within existing buildings with reference to the list of definitions set out at Table 3.3: Descriptions of Effects contained in the *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* prepared by the Environmental Protection Agency. The definitions from the EPA document are in italics, while some comment is also given below on what ARC considers these definitions might imply in the case of daylight access (e.g. having regard to Appendix I of the BRE Guide, 2011). Please note that, for the purpose of this report, the word "effect" is taken to have the same meaning as the word "impact".

- ***Imperceptible:*** *An effect capable of measurement but without significant consequences.* The definition implies that the development would cause a change in the daylight received at a location, capable of measurement, but not noticeable to the casual observer. If the development caused no change in daylight access, there could be no effect. Examples of "imperceptible" impacts on daylight access would include:
  (a) a scenario where the proposed development is predicted to reduce the Vertical Sky Component received by a sample window, but the sample window will continue to receive the relevant recommended level of Vertical Sky Component after the construction of the proposed development; and
  (b) a scenario where the proposed development is predicted to reduce the Vertical Sky Component to not less than 0.8 times its former value (i.e. the BRE Guide (2011) threshold for an adverse impact).

- ***Not Significant:*** *An effect which causes noticeable2 changes in the character of the environment but without significant consequences* (the footnote "2" to the word *"noticeable"* is: *"for the purposes of planning consent procedures"*). The definition implies that the

development would cause a change in the daylight received at a location, which is capable of measurement and capable of being noticed by an observer who is taking an active interest in the extent to which the proposal might affect daylight access.

- ***Slight:*** *An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.* For this definition to apply, the amount of daylight received at a location would be changed by the construction of the development to an extent that is both capable of measurement and is noticeable to a minor degree. However, the daylight environment within an existing building should remain largely unchanged. An example of a "slight" impact would be a scenario where, although the impact of the proposed development is not predicted to reduce the amount of daylight received by a sample window to less than 0.8 times its former value, the amount of light received by the sample window is predicted to fall below a key recommended level, whether that is the BRE Guide (2011) recommended target value or an alternative target value. A further example of a "slight" impact would be where, although the construction of the proposed development is predicted to reduce the amount of light received to a level below the BRE Guide (2011) threshold for an adverse impact, the predicted reduction is just outside that BRE Guide (2011) threshold (e.g. the amount of daylight received by a sample window or sunlight received by a sample window or garden falls to not less than 0.7 times its existing value*). A "slight" impact could also occur where there is a more considerable reduction in daylight or sunlight by a sample window within an existing building, but only a small number of windows within that property are affected to that extent.

- ***Moderate:*** *An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.* In this case, a development must bring about a change in the daylight environment within an existing building; and this change must be consistent with a pattern of change that is already occurring or is likely to occur. A moderate effect would occur where other developments were bringing about changes in daylight access of similar extent in the area. A "moderate" impact might also be considered to occur where the level of daylight received by a sample window falls below the BRE Guide (2011) recommended level and to between 0.5 and 0.7 times its existing value, subject to consideration of other factors*.

- ***Significant:*** *An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.* The definition implies that the existence of the development would change the extent of daylight access in a manner that is not *"consistent with existing and emerging baseline trends"*. For example, a development resulting in a *"significant"* diminution of daylight access would reduce daylight to the extent that minimum standards for daylighting are not met and artificial lighting is required for part of the day. A "significant" impact could occur where the predicted reduction in daylight access is greater than what is envisaged to occur if the application site were developed in line with existing and emerging baseline trends. Subject to consideration of other factors, a "significant" impact could occur where daylight access to the sample window falls to between 0.25 and 0.5 times its former value*.

- ***Very Significant:*** *An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.* The definition implies that the existence of the development would change the extent of daylight access to a considerable degree and in a manner that is not *"consistent with existing and emerging baseline trends"*. For example, a *"very significant"* effect would occur where a development would result in daylight received in a room falling well below the minimum standards for daylighting and where artificial lighting would be required in that room as the principal source of lighting all the time. A "very significant" impact could occur where the predicted reduction in daylight access is considerably greater than what is envisaged to occur if the application site were developed in line with existing and emerging baseline trends. Subject to consideration of other factors, a "very significant" impact could occur where daylight access to the sample window or sunlight access to the sample window or garden falls to between 0.01 and 0.25 times its former value*.

- ***Profound:*** *An effect which obliterates sensitive characteristics.* Examples of development resulting in a ***"profound"*** effect on daylight access would include facilitating daylight access to a room in an existing building where the existing room has none (e.g. as a result of the demolition of a building) or by removal of all access to daylight within an existing building.

* Please note that, while this section sets out indicative quantitative ranges that could apply to each type of impact, this assessment considers a range of factors (such as relevant target values, the use of the affected building, the number of rooms affected within the building, etc) in classifying impacts.

In relation to daylight access, it is conceivable that a development could result in positive effects, but this implies that a development would involve a reduction of the size or scale of built form (e.g. such as the demolition of a building, which might result in an increase in daylight access). Though that is possible, it is usually unlikely as most development involves the construction of new obstructions to daylight access.

Sunlight Access to Buildings and Open Spaces

Context under Technical and Guidance Documents

Section 3.2.1 of the *Site layout planning for daylight and sunlight: a guide to good practice* (the BRE Guide, 2011) provides as follows in relation to the assessment of the impact of development on sunlight access to existing buildings.

> *"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 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 sunlighting of the existing dwelling 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 21 September and 21 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."*
>
> [Emphasis added]

The BRE Guide (2011) states that *"Any reduction in sunlight access below this level should be kept to a minimum. If the available sunlight hours are both less than the amount above and less than 0.8 times their former value, either over the whole year or just in the winter months (21 September to 21 March), then the occupants of the existing building will notice the loss of sunlight … The room may appear colder and less cheerful and less pleasant"*.

Section 3.3 of the Building Research Establishment's *Site layout planning for daylight and sunlight: a guide to good practice* sets out design advice and recommendations for site layout planning to ensure good sunlight access to amenity spaces and to minimise the impact of new development on existing amenity spaces. The Guide suggests 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 sunlight at the equinox. The BRE Guide (2011) recommends that, as a rule of thumb, the centre of the space should receive at least two hours of sunlight on the 21st March in order to appear adequately sunlit throughout the year.

Assessment Methodology for Sunlight Access

A three dimensional digital model of the proposed development and of existing buildings in the area was constructed by ARC Consultants based on drawings and three dimensional models supplied by the Design Team. Where survey data of surrounding context was not available, assumptions were made, with reference to on-site, satellite and aerial photography and to the online planning register, where relevant, in the creation of the three dimensional model. Existing and proposed landscaping was not included in this model.

Using the digital model, shadows were cast by ARC at several times of the day at the summer and winter solstices, and at the equinox. An equinox occurs twice a year: the March or vernal equinox (typically in or around the 20th to 21st March) and the September or autumnal equinox (typically in or around the 21st to 23rd September). For the purposes of this analysis and with reference to the BRE Guide (2011), shadows were cast at several times of the day on 21st March.

The results are presented in shadow study diagrams associated with this report. Two images have been prepared for each time period on each representative date as follows:

- ***Receiving Environment:*** this image shows the shadows cast by the existing buildings only. Existing buildings surrounding the application site are shown in light grey, while existing buildings on the application site are shown in orange. The shadows cast are shown in a dark grey tone.
- ***Proposed Development:*** this image shows the shadows cast by the existing buildings together with the shadows cast by the proposed development. The existing buildings surrounding the site are shown in light grey, while the proposed development on the application site is shown in blue. The shadows cast are shown in a dark grey tone.

In order to calculate sunlight access to rooms, ARC referenced the methodology outlined in *Appendix A: Indicators to calculate access to skylight, sunlight and solar radiation* of the BRE Guide (2011). Using proprietary sunlight and daylight access analysis software, ARC analysed a sunpath diagram overlaid with a shading mask corresponding to the existing or proposed shadow environment (as appropriate) and the sunlight probability diagram for a latitude of 53° N (i.e. Dublin) for a reference point (i.e. the centre point) of

each sample study window. The sunlight availability indicator has 100 spots on it. Each of these represents 1% of annual probable sunlight hours (APSH). The percentage of APSH at the reference point is found by counting up all the unobstructed spots.

Definition of Impacts on Sunlight Access

The assessment of the impact of the proposed development on sunlight access had regard to the *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* prepared by the Environmental Protection Agency (Draft of 2017), and to Directive 2011/92/EU (as amended by Directive 2014/52/EU) on the assessment of the likely effects of certain public and private projects on the environment.

In assessing whether a predicted effect of the proposal on sunlight access is likely to be "imperceptible", "not significant", "slight", "moderate", "significant", "very significant" or "profound" within the meaning of the EPA's *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*, ARC referred to Appendix I of the BRE Guide (2011) sets out advice on environment impact assessment. It states:

> *I4 The assessment of impact will depend on a combination of factors, and there is no simple rule of thumb that can be applied.*
>
> *I5 Where the loss of skylight or sunlight fully meets the guidelines in this book, the impact is assessed as negligible or minor adverse. Where the loss of light is well within the guidelines, or only a small number of windows or a limited area of open space lose light (within the guidelines), a classification of negligible impact is more appropriate, especially if there is a particularly strong requirement for daylight and sunlight in the affected building or open space.*
>
> *I6 Where the loss of skylight or sunlight does not meet the guidelines in this book, the impact is assessed as minor, moderate or major adverse. Factors tending towards a minor adverse impact include:*
> - *only a small number of windows or limited area of open space are affected*
> - *the loss of light is only marginally outside the guidelines*
> - *an affected room has other source of skylight or sunlight*
> - *the affected building or open space only has a low level requirement for skylight or sunlight*
> - *there are particular reasons why an alternative, less stringent, guidelines should be applied (see Appendix F).*
>
> *I7 Factors tending towards a major adverse impact include:*
> - *a large number of windows or large area of open space are affected*
> - *the loss of light is substantially outside the guidelines*
> - *all the windows in a particular property are affected*
> - *the affected indoor or outdoor spaces have a particularly strong requirement for skylight or sunlight, eg a living room in a dwelling or a children's playground.*

Having considered the factors outlined in Appendix I of the BRE Guide (2011), ARC's assessment classifies the impact of the proposed development on sunlight access within existing buildings or open spaces with reference to the list of definitions set out at Table 3.3: Descriptions of Effects contained in the *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* prepared by the Environmental Protection Agency. The definitions from the EPA document are in italics, while some comment is also given below on what ARC considers these definitions might imply in the case of sunlight access (e.g. having regard to Appendix I of the BRE Guide, 2011). Please note that, for the purpose of this report, the word "effect" is taken to have the same meaning as the word "impact".

- ***Imperceptible:*** *An effect capable of measurement but without significant consequences.* The definition implies that the development would cause a change in the sunlight received at a location, capable of measurement, but not noticeable to the casual observer. If the development caused no change in sunlight access, there could be no effect. Examples of "imperceptible" impacts on sunlight access would include:
  (a) a scenario where the proposed development is predicted to reduce the amount of sunlight received by a sample window, but the sample window will continue to receive the relevant recommended level of Annual Probable Sunlight Hours after the construction of the proposed development; and
  (b) a scenario where the proposed development is predicted to reduce the Annual Probable Sunlight Hours received by a sample window to not less than 0.8 times its existing value (i.e. the BRE Guide (2011) threshold for an adverse impact). Similarly, where sunlight access to a sample garden is reduced, the impact of proposed development could be considered to be "imperceptible" or "not significant" where the sample garden continues to the receive at least two hours of sunlight over half its area on 21st March, and, where the area of the garden capable of receiving sunlight on 21st March does not drop to less than 0.8 times its existing level after the construction of the proposed development.

- ***Not Significant:*** *An effect which causes noticeable[2] changes in the character of the environment but without significant consequences* (the footnote "2" to the word *"noticeable"* is: *"for the purposes of planning consent procedures"*). The definition implies that the development would cause a change in the sunlight received at a location, which is capable of measurement and capable of being noticed by an observer who is taking an active interest in the extent to which the proposal might affect sunlight access.

- ***Slight:*** *An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.* For this definition to apply, the amount of sunlight received at a location would be changed by shadows cast by the development to an extent that is both capable of measurement and is noticeable to a minor degree. However, the shadow environment of the surrounding environment should remain largely unchanged. An example of a "slight" impact would be a scenario where, although the impact of the proposed development is not predicted to reduce the amount of sunlight received by a sample window or garden to less than 0.8 times its former value, the amount of light received by the sample window or garden is predicted to fall below a key recommended level, whether that is the BRE Guide (2011) recommended target value or an alternative target value. A further example of a "slight" impact would be where, although the construction of the proposed development is predicted to reduce the amount of light received to a level below the BRE Guide (2011) threshold for an adverse impact, the predicted reduction is just outside that BRE Guide (2011) threshold (e.g. the amount of daylight received by a sample window or sunlight received by a sample window or garden falls to not less than 0.7 times its existing value*). A "slight" impact could also occur where there is a more considerable reduction in sunlight by a sample window within an existing building, but only a small number of windows within that property are affected to that extent.

- ***Moderate:*** *An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.* In this case, a development must bring about a change in the shadow environment of the area; and this change must be consistent with a pattern of change that is already occurring or is likely to occur. A moderate effect would occur where other developments were bringing about changes in sunlight access of similar extent in the area. A "moderate" impact might also be considered to occur where the level of sunlight access to a sample window or garden falls below the BRE Guide (2011) recommended level and to between 0.5 and 0.7 times its existing value, subject to consideration of other factors*.

- ***Significant:*** *An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.* The definition implies that the existence of the development would change the extent of sunlight access in a manner that is not *"consistent with existing and emerging baseline trends"*. For example, a development resulting in a *"significant"* diminution of sunlight access would overshadow a location to the extent that there is a significant change in the amount of direct sunlight received at that location. A "significant" impact could occur where the predicted reduction in sunlight access is greater than what is envisaged to occur if the application site were developed in line with existing and emerging baseline trends. Subject to consideration of other factors, a "significant" impact could occur where sunlight access to the sample window or garden falls to between 0.25 and 0.5 times its former value*.

- ***Very Significant:*** *An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.* For example, a *"very significant"* reduction in sunlight access would occur where the development overshadows a location for most of the time that the location would have been in sunlight prior to the construction of the development and where overshadowing of that magnitude is not *"consistent with existing and emerging baseline trends"*. A "very significant" impact could occur where the predicted reduction in sunlight access is considerably greater than what is envisaged to occur if the application site were developed in line with existing and emerging baseline trends. Subject to consideration of other factors, a "very significant" impact could occur where sunlight access to the sample window or garden falls to between 0.01 and 0.25 times its former value*.

- ***Profound:*** *An effect which obliterates sensitive characteristics.* Examples of development resulting in a *"profound"* effect on sunlight access would include facilitating sunlight access at a location where that location has previously had none (e.g. facilitating sunlight access as a result of the demolition of a building) or by removal of all access to sunlight at a location.

* Please note that, while this section sets out indicative quantitative ranges that could apply to each type of impact, this assessment considers a range of factors (such as relevant target values, the use of the affected building, the number of rooms affected within the building, etc) in classifying impacts.

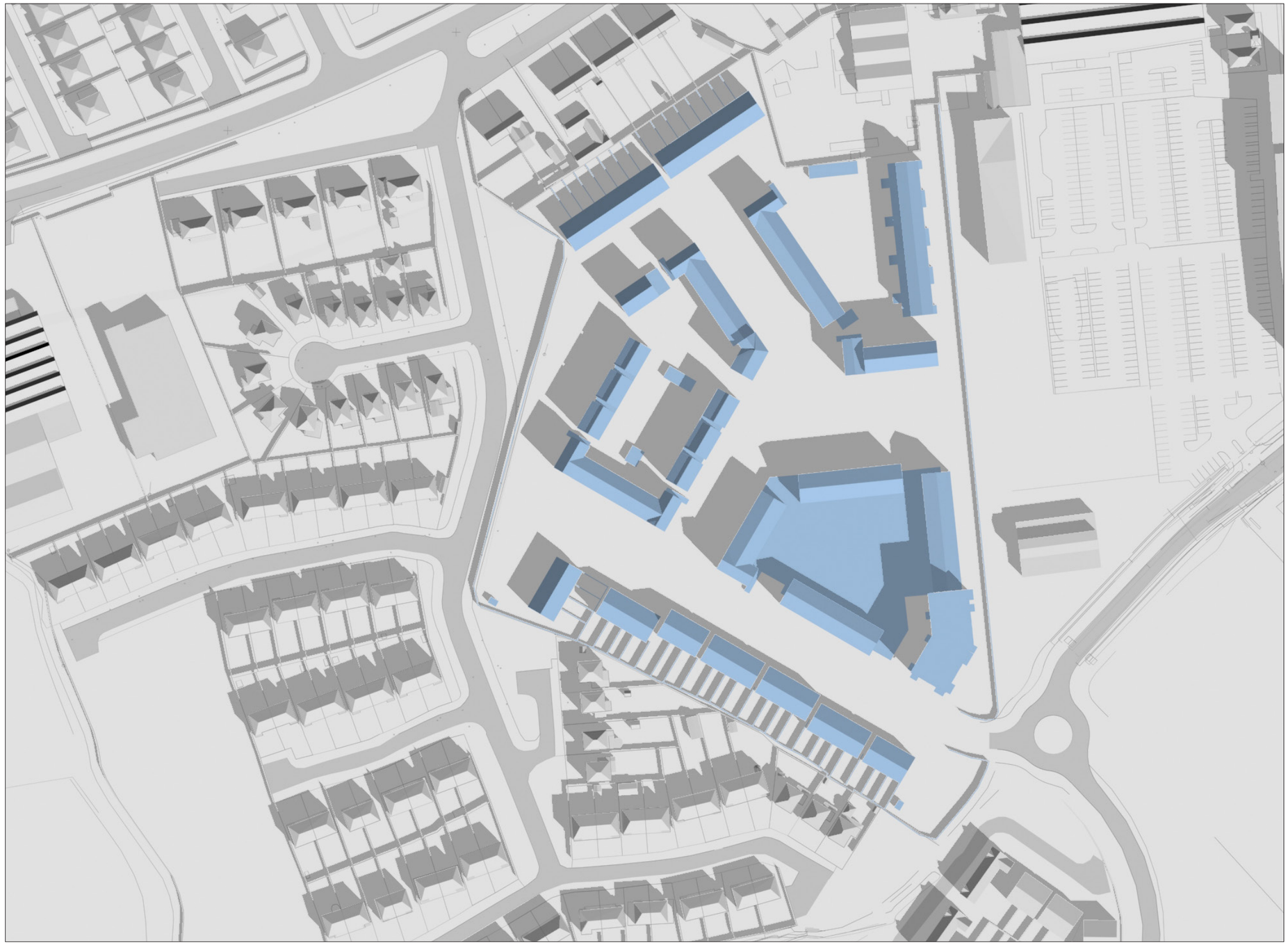
RECEIVING
ENVIRONMENT

N

SHADOW STUDY
LANDS AT DEVOY BARRACKS, NAAS, CO. KILDARE
MARCH 2022

DATE : MARCH 21ST - EQUINOX
SUNRISE : 6.27 AM
SUNSET : 6.42 PM

TIME :
10.00 AM



PROPOSED
DEVELOPMENT

N

SHADOW STUDY
LANDS AT DEVOY BARRACKS, NAAS, CO. KILDARE
MARCH 2022

DATE : MARCH 21ST - EQUINOX
SUNRISE : 6.27 AM
SUNSET : 6.42 PM

TIME :
10.00 AM

RECEIVING
ENVIRONMENT

N

SHADOW STUDY
LANDS AT DEVOY BARRACKS, NAAS, CO. KILDARE
MARCH 2022

DATE : MARCH 21ST - EQUINOX
SUNRISE : 6.27 AM
SUNSET : 6.42 PM

TIME :
12.00 PM

PROPOSED
DEVELOPMENT

N

SHADOW STUDY
LANDS AT DEVOY BARRACKS, NAAS, CO. KILDARE
MARCH 2022

DATE : MARCH 21ST - EQUINOX
SUNRISE : 6.27 AM
SUNSET : 6.42 PM

TIME :
12.00 PM

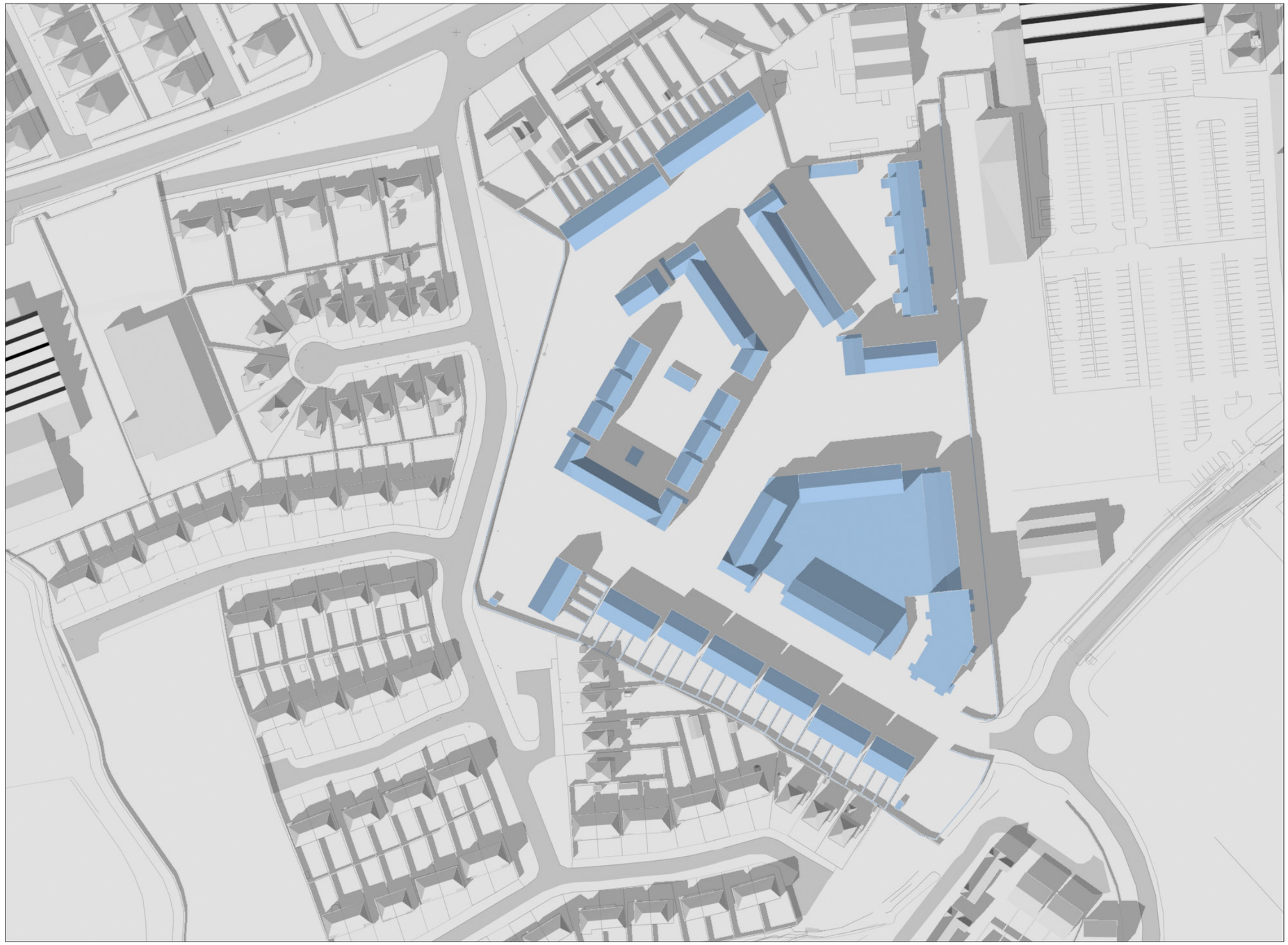
RECEIVING ENVIRONMENT

N

SHADOW STUDY
LANDS AT DEVOY BARRACKS, NAAS, CO. KILDARE
MARCH 2022

DATE : MARCH 21ST - EQUINOX
SUNRISE : 6.27 AM
SUNSET : 6.42 PM

TIME :
3.00 PM



PROPOSED
DEVELOPMENT

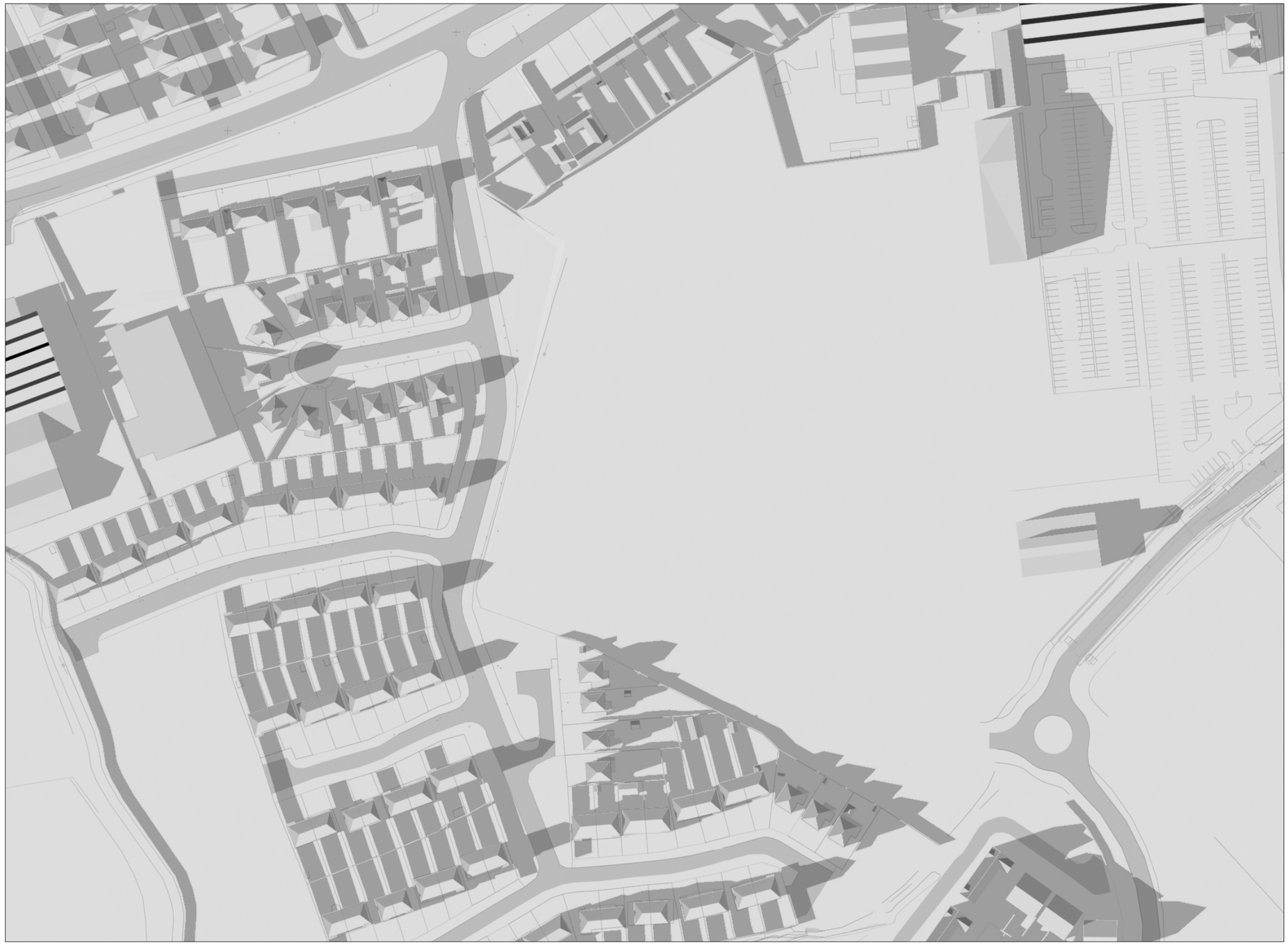
N

SHADOW STUDY
LANDS AT DEVOY BARRACKS, NAAS, CO. KILDARE
MARCH 2022

DATE : MARCH 21ST - EQUINOX
SUNRISE : 6.27 AM
SUNSET : 6.42 PM

TIME :
3.00 PM

RECEIVING
ENVIRONMENT



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SHADOW STUDY
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MARCH 2022

DATE : MARCH 21ST - EQUINOX
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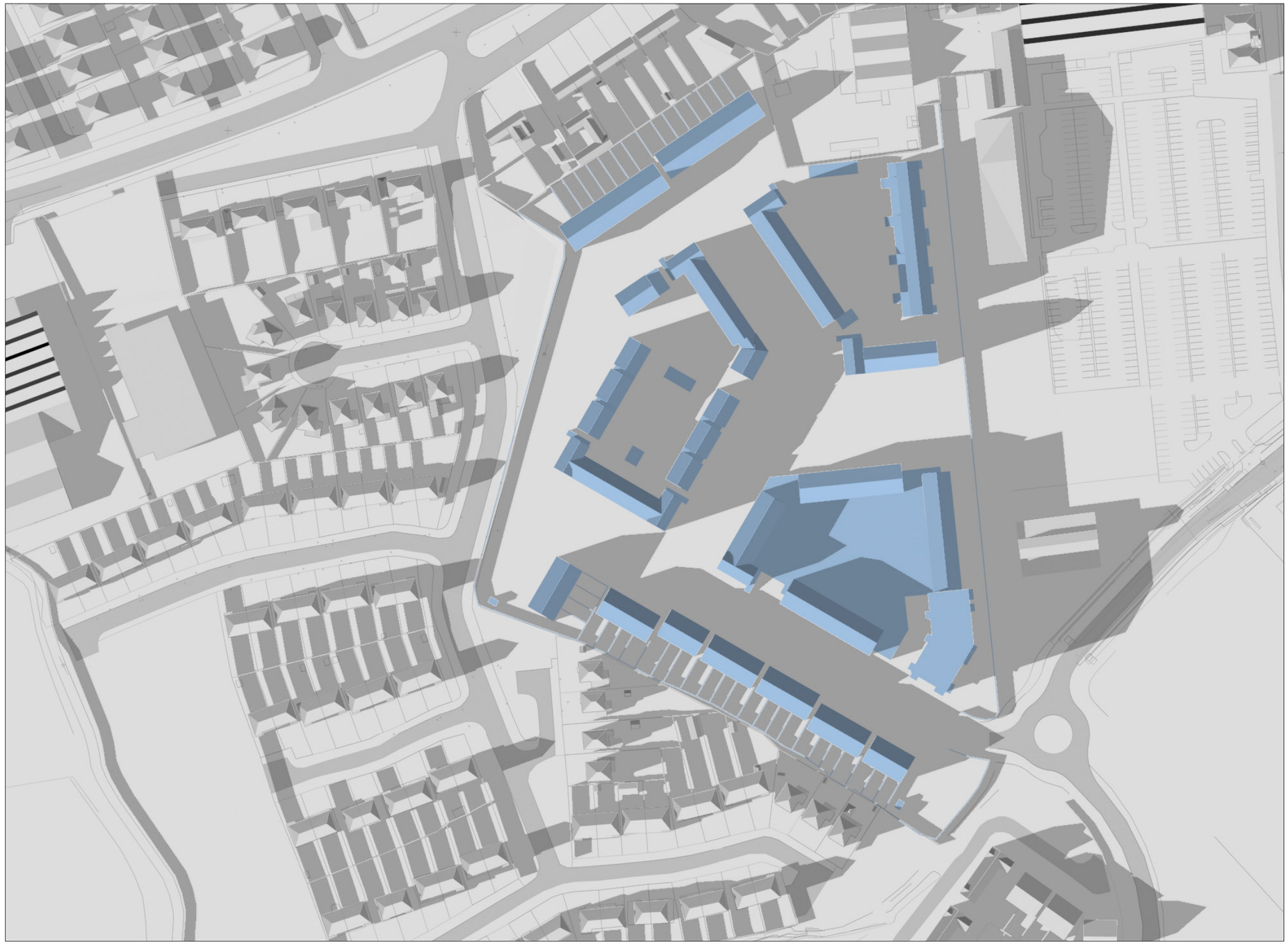
TIME :
5.00 PM



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SHADOW STUDY
LANDS AT DEVOY BARRACKS, NAAS, CO. KILDARE
MARCH 2022

DATE : JUNE 21ST - SUMMER SOLSTICE
SUNRISE : 4.59 AM
SUNSET : 9.57 PM

TIME :
9.00 AM

PROPOSED
DEVELOPMENT

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SUNRISE : 4.59 AM
SUNSET : 9.57 PM

TIME :
12.00 PM

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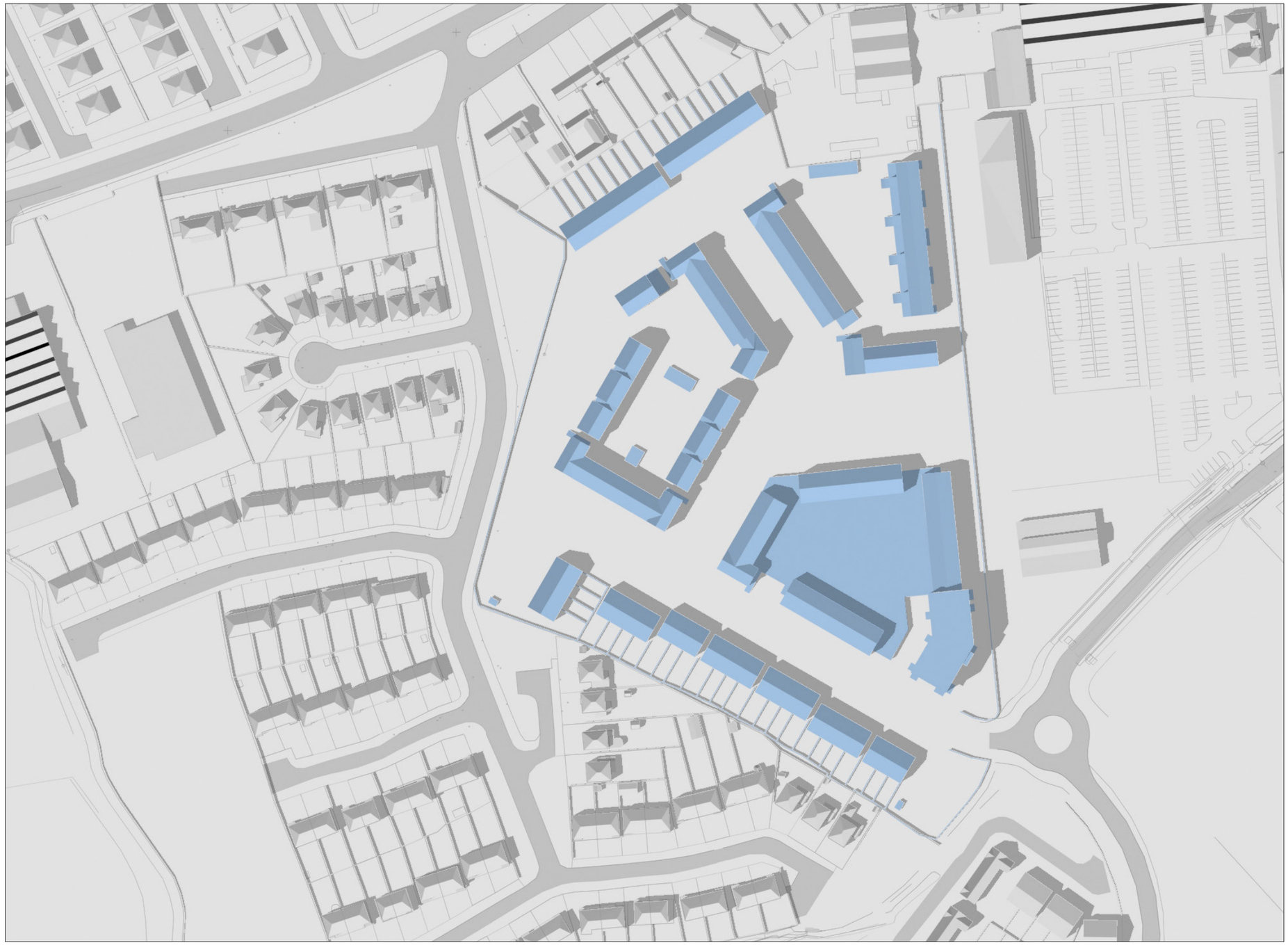

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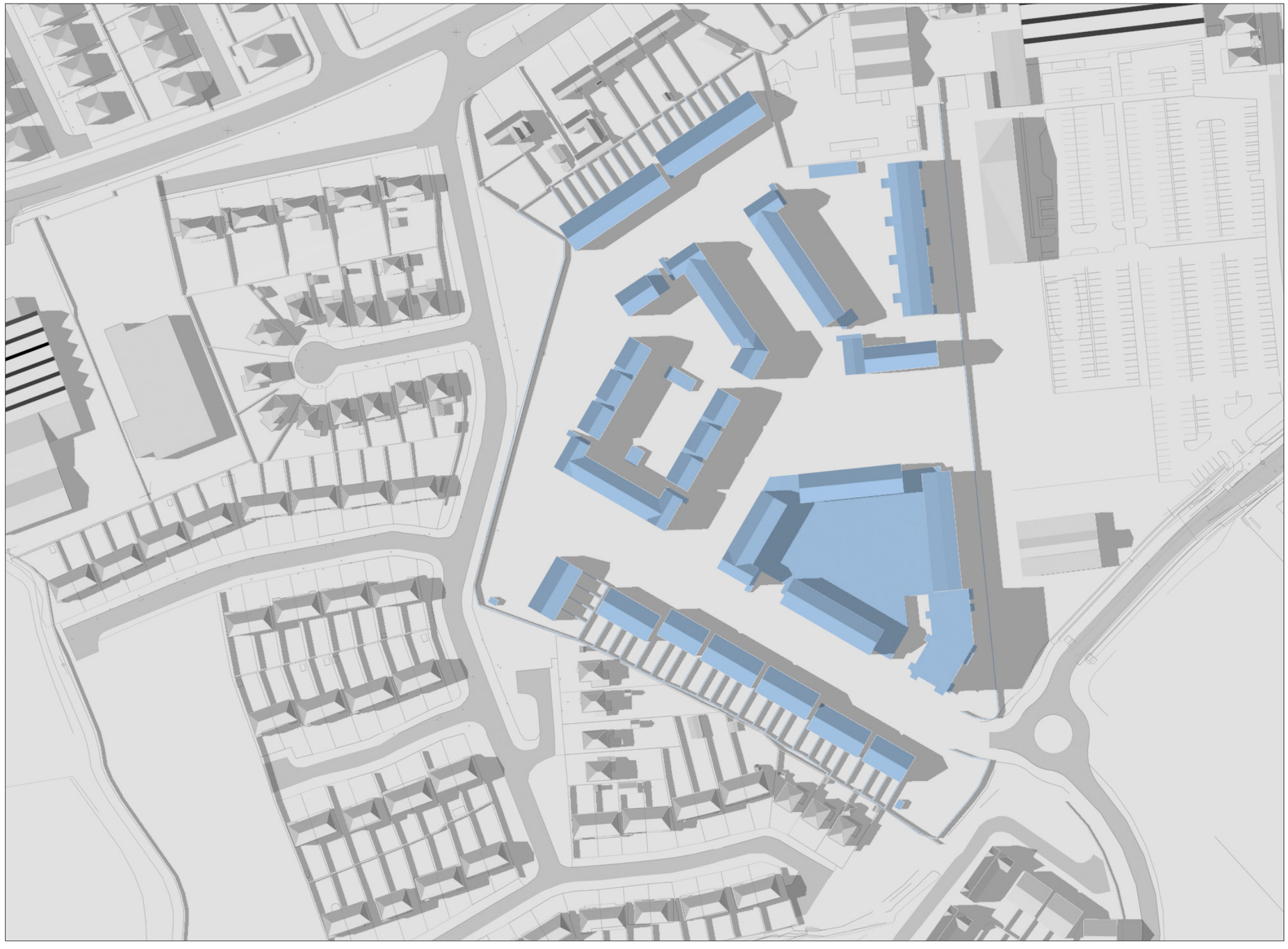

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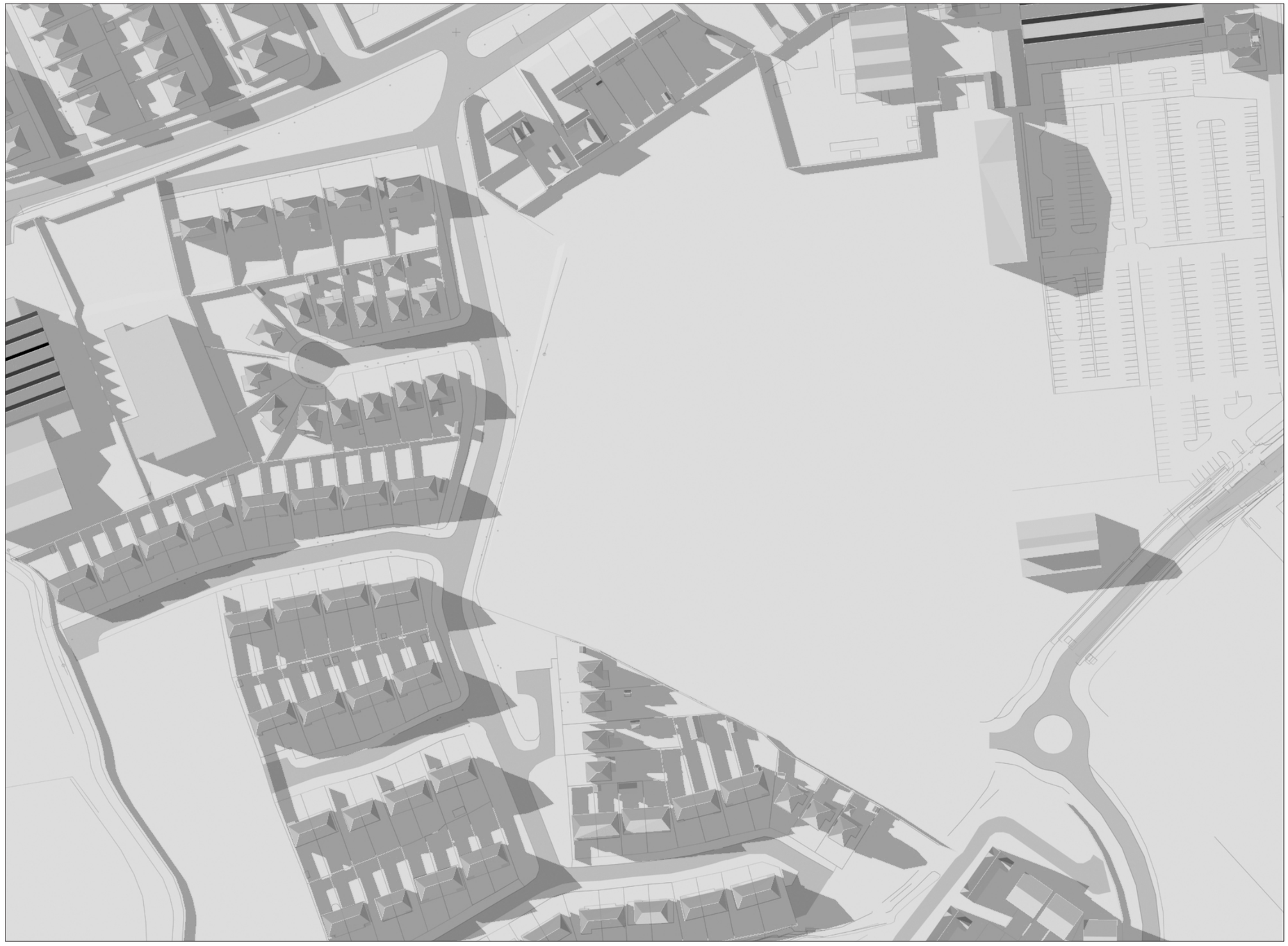

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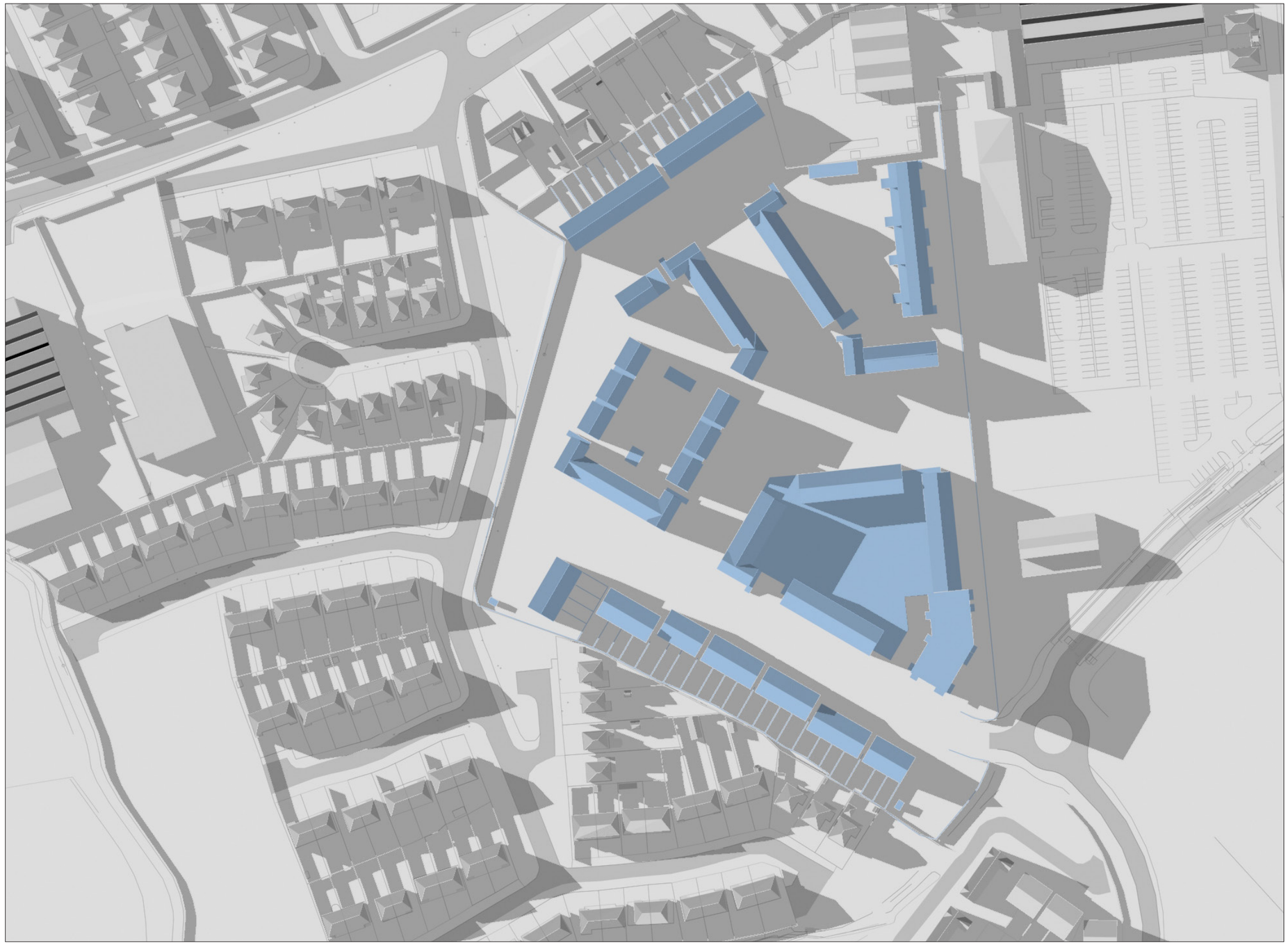

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MARCH 2022

DATE : DECEMBER 21ST - WINTER SOLSTICE
SUNRISE : 8.39 AM
SUNSET : 4.11 PM

TIME :
10.30 AM

PROPOSED
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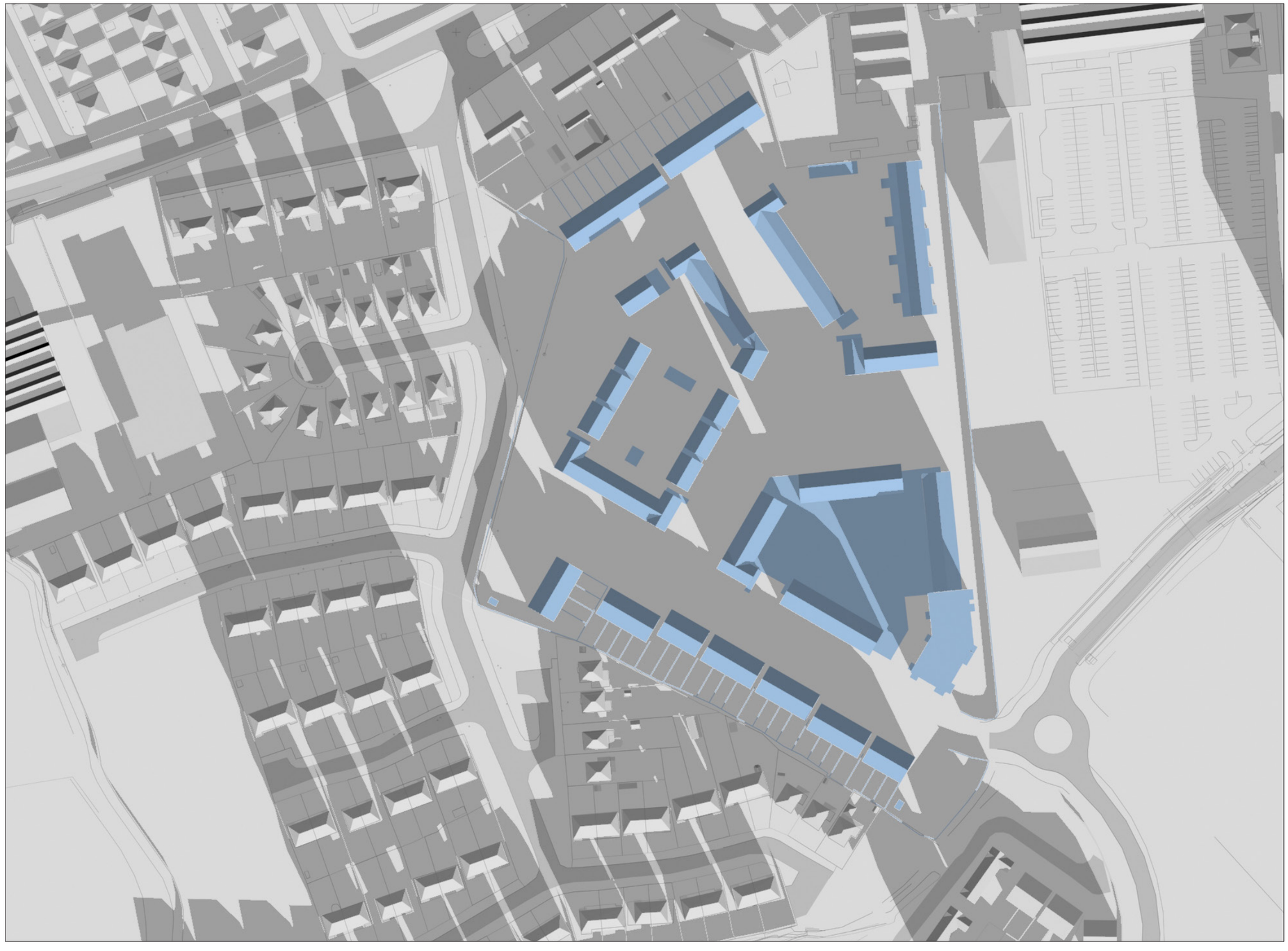

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