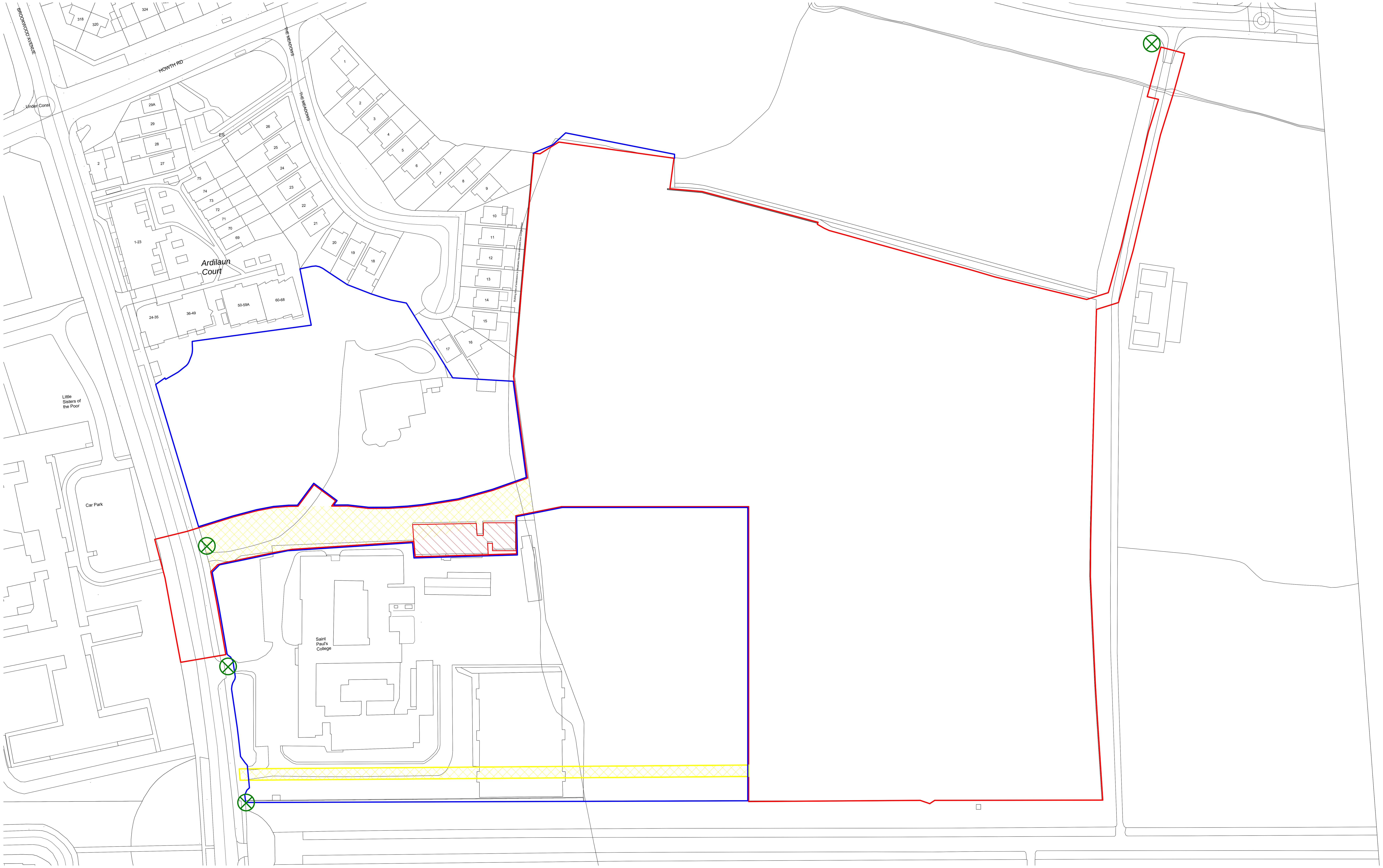
Appendix A Drawings



0 50 m 100 m
SCALE 1:1000
N

Rev	Description	Date
P1	Issued for Planning	03.06.22
P2	Issued for Planning	31.08.22

KEY

- Red line shows site under application
- Yellow hatch shows the extent of wayleaves
- Classroom block for demolition
- Adjacent lands under control of the applicant or the person who owns the land which is the subject of the application
- Location of Site Notice

CENTRE COORDINATES:
ITM 720474,737448

PUBLISHED: 12/07/2021
ORDER NO.: 50206116_1

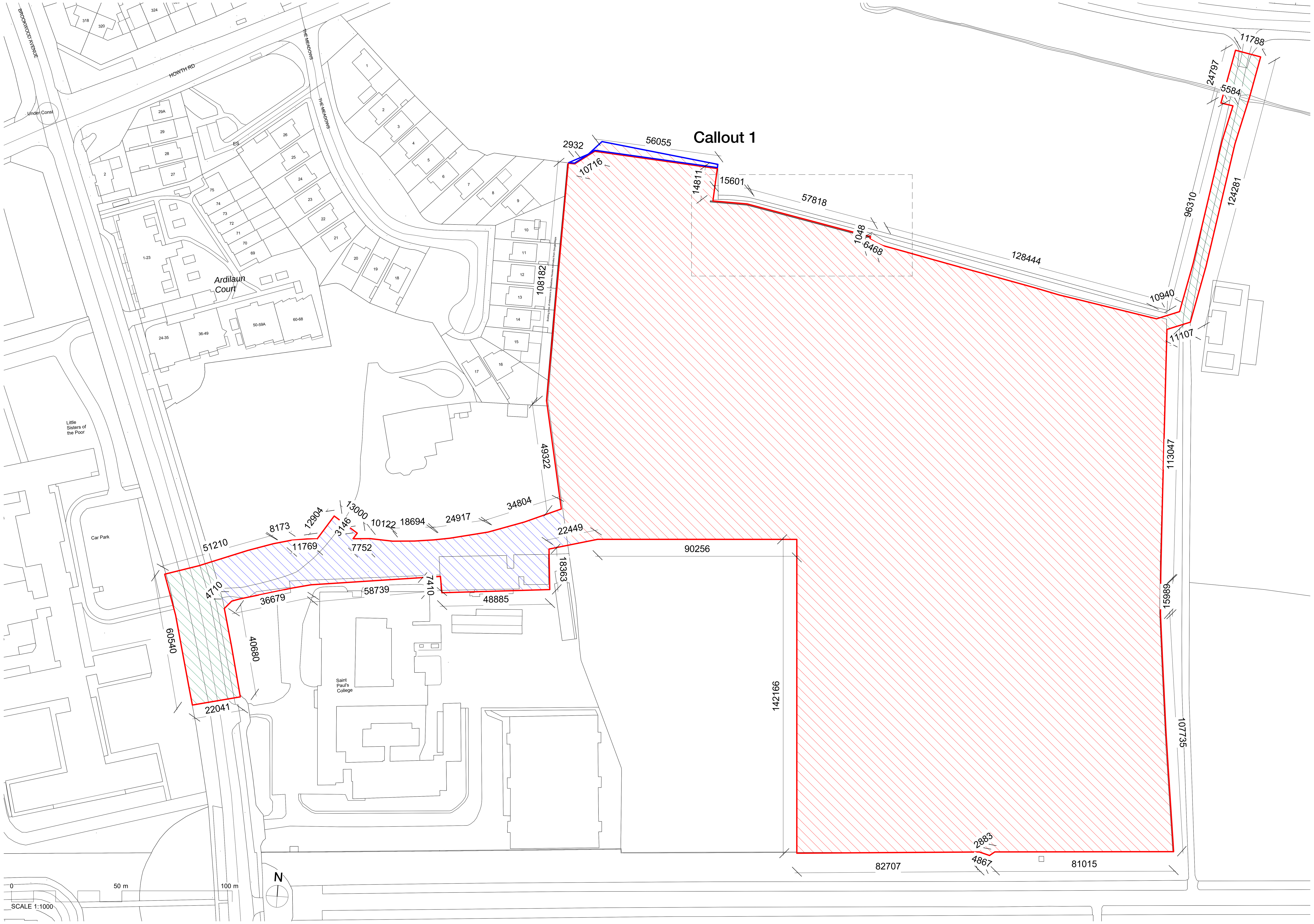
MAP SERIES:	MAP SHEETS:
1:1,000	3199-01
1:1,000	3199-02
1:1,000	3199-06
1:1,000	3199-07

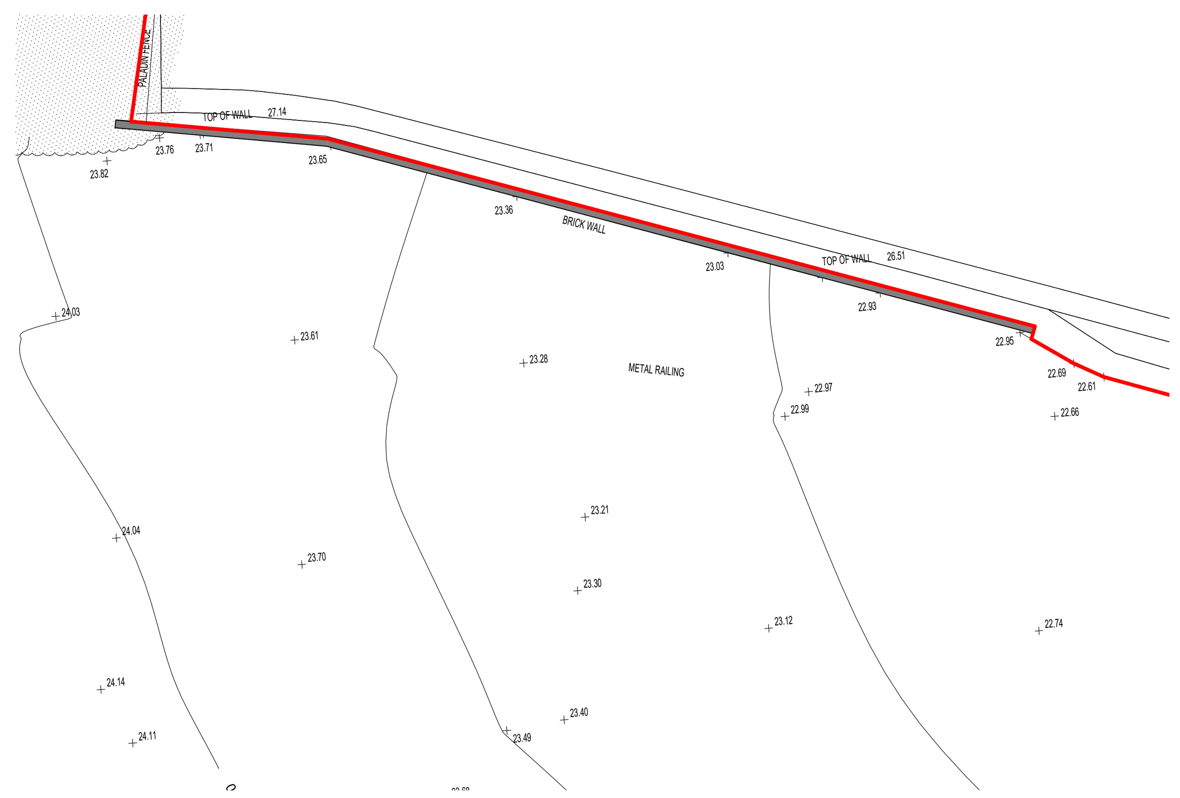
Scale @ A1	Date	Job Number
1 : 1000	23/12/21	210196
Drawn By	**Checked By**	**Status**
AW	EC	S4
Drawing No.	**Rev**	**Purpose of Issue**
FORA-HBA-SW-XX-DR-A-00-0000	P2	For Planning

Project
Foxlands, Raheny
Lands East of St Paul's College
Sybil Hill Road
Raheny
Dublin 5

Drawing
Site Location Map

22 Ely Place, Dublin 2, Ireland
mail@hawkinsbrown.com
hawkinsbrown.com
Hawkins\Brown





Callout 1 - Topographic Survey

1 : 500

Rev	Description	Date
P1	Issued for Planning	03.06.22
P2	Issued for Planning	31.08.22

KEY

- Red line shows site under application
- Blue line shows adjacent lands within the ownership of the applicant
- CREKAV TRADING GP LTD
- DUBLIN CITY COUNCIL
- ORSIGNY COMPANY LIMITED BY GUARANTEE (THE VINCENTIANS)

Scale @ A1	Date	Job Number
As indicated	11/11/21	210196
Drawn By	**Checked By**	**Status**
LT	RW	S4

Drawing No.: FORA-HBA-SW-XX-DR-A-00-0001

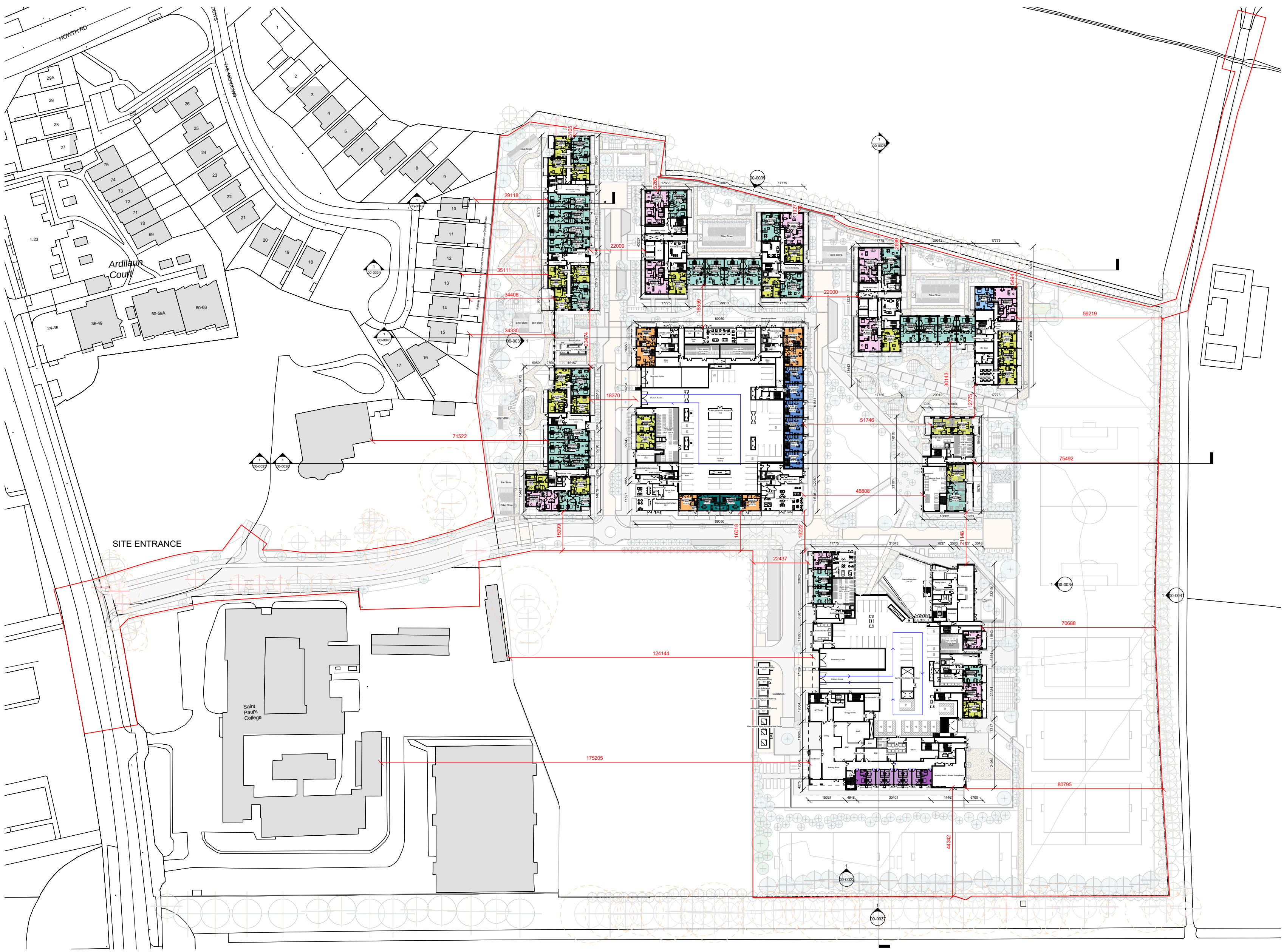
Rev: P2

Purpose of Issue: For Planning

Project
Foxlands, Raheny
Lands East of St Paul's College
Sybil Hill Road
Raheny
Dublin 5

Drawing
Land Ownership within Red Line

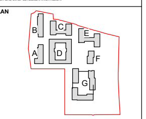
22 Ely Place, Dublin 2, Ireland
mail@hawkinsbrown.com
hawkinsbrown.com
Hawkins\Brown



SCALE 1:500

Proposed Site Layout Plan
1 : 500

KEYPLAN



NOTES

For full Car Parking distribution refer to drawings XXX

Refer to NMP Drawings L1-500 to L1-507 for Ground Floor landscape information and full Cycle Storage distribution

Rev	Description	Date
P2	Issued for Planning	31.08.22
P1	Issued for Planning	03.06.22

22 Ely Place, Dublin 2, Ireland
mail@hawkinsbrown.com
hawkinsbrown.com

Hawkins\Brown

Client
Marlet Property Group

Project
Foxlands, Raheny
Lands East of St Paul's College
Sybil Hill Road
Raheny
Dublin 5

Drawing
Proposed Ground Site Plan

Scale @ A0	Date
As indicated	23/12/21
Drawn By	**Checked By**
AW	EC

Job Number	Status	Purpose of Issue
210196	S4	For Planning

Drawing No.	Rev
FORA-HBA-SW-00-DR-A-00-0011	P2

Legend:

Site Boundary

Project:

Proposed Development, Foxlands, Raheny, Dublin 5

Client:

Raheny 3 Limited Partnership

Title:

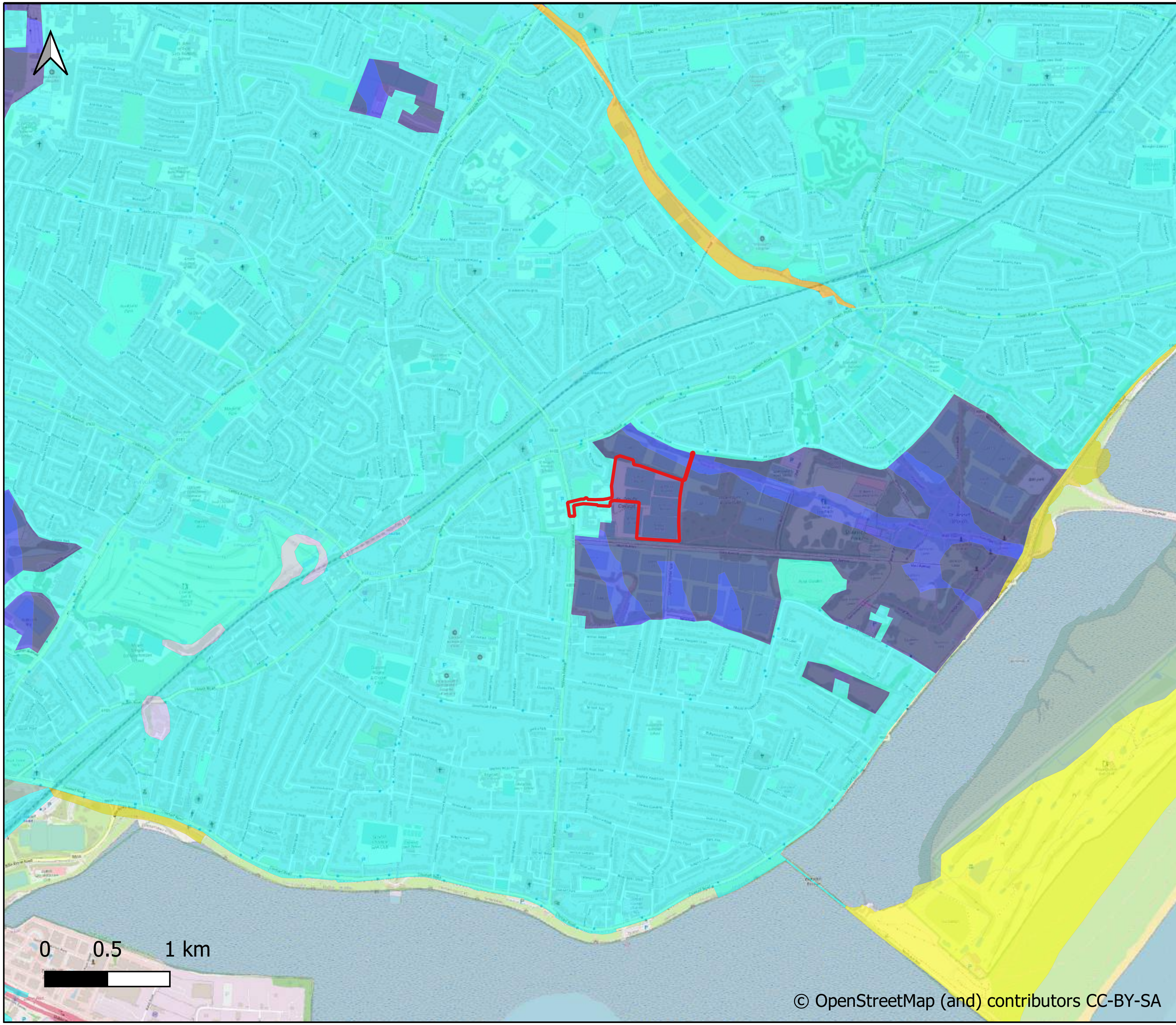
Site Location

Enviroguide CONSULTING
a 3D Core C, Block 71, The Plaza Park West, Dublin 12 D12F9TN
w www.enviroguide.ie
e info@enviroguide.ie
t +353 (0)1 565 4730

Drawn By: CS	**Projection:** IRENET95 / Irish Transverse Mercator
Checked: CC	
Date: 07/07/2022	**Scale @ A4: 1:20000**

Notes:

Site boundaries shown are for illustration purposes only and do not represent legal or exact boundaries



Legend:

Site Boundary

Teagasc Soils

- BminDW - Deep well drained mineral (Mainly basic)
- BminPD - Mineral poorly drained (Mainly basic)
- BminSW - Shallow well drained mineral (Mainly basic)
- AlluvMIN - Alluvial (mineral)
- AeoUND - Aeolian undifferentiated
- MarSands - Marine sand and gravel
- MarSed - Marine/estuarine sediments
- Made - Made ground

Project:

Proposed Development, Foxlands, Raheny, Dublin 5

Client:

Raheny 3 Limited Partnership

Title:

Soils

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Drawn By: CS	**Projection:** IRENET95 / Irish Transverse Mercator
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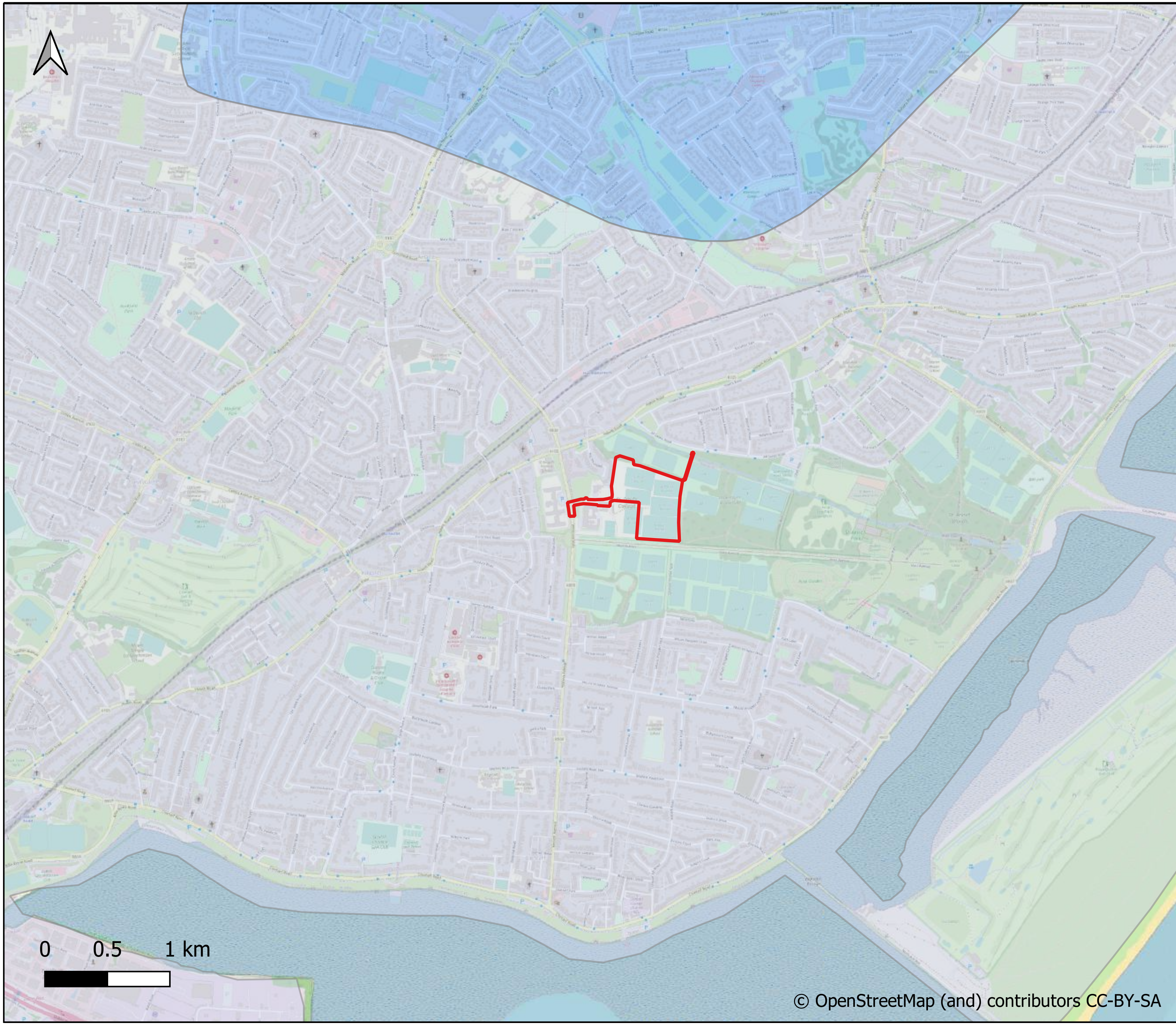

Legend:

Site Boundary

Bedrock Geology

61, Marine shelf & ramp facies; Argillaceous dark-grey bioclastic limestone, subsidiary shale

65, Marine basinal facies (Tobercolleen & Lucan Fms - "Calp"); Dark-grey argillaceous & cherty limestone & shale

Project:

Proposed Development, Foxlands, Raheny, Dublin 5

Client:

Raheny 3 Limited Partnership

Title:

Bedrock Geology

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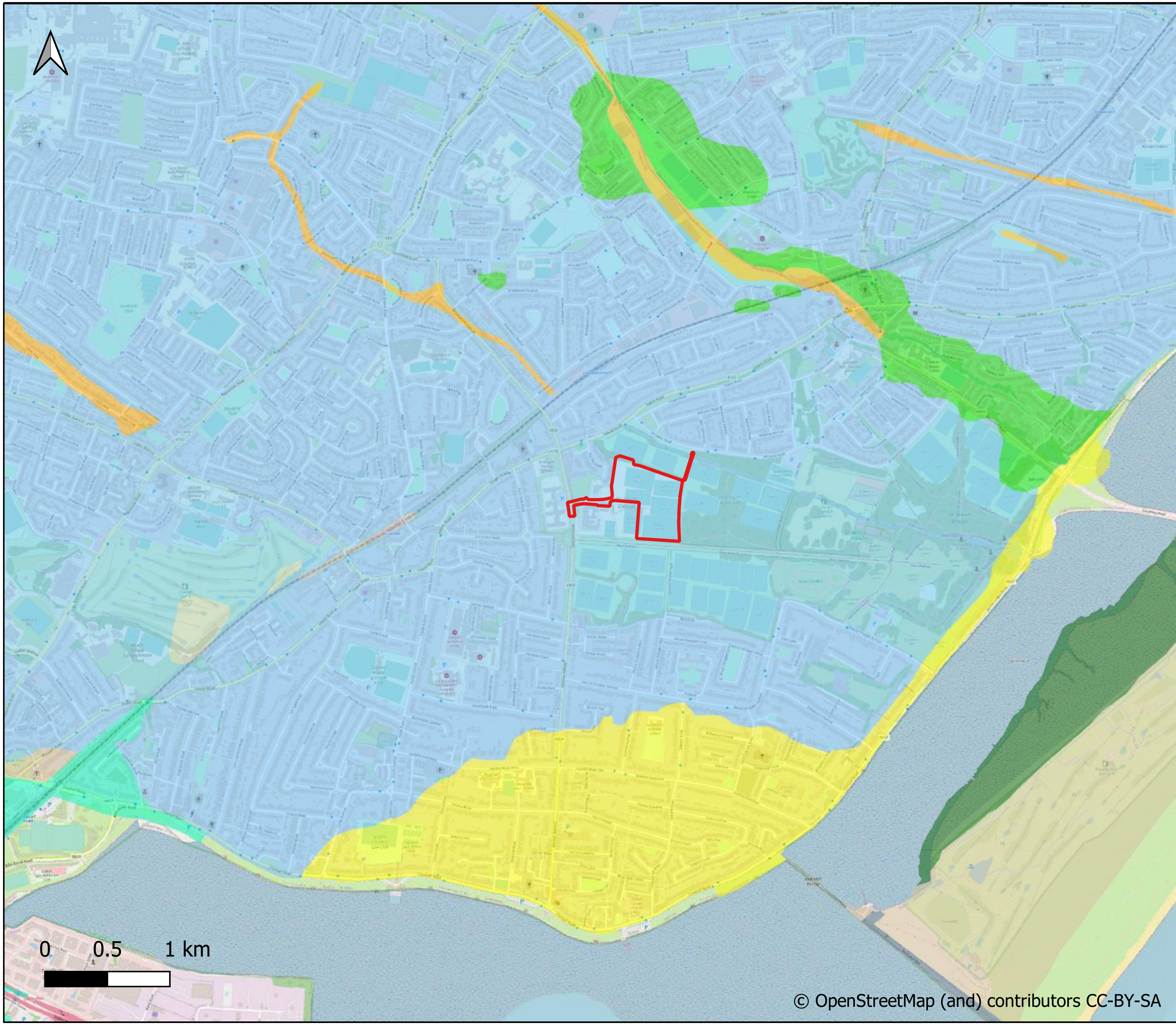

Legend:

- Site Boundary
- Till derived from limestones
- Gravels derived from Limestones
- Alluvium
- Tidal Marsh
- Marine beach sands
- Urban
- Bedrock outcrop or subcrop

Project:

Proposed Development, Foxlands, Raheny, Dublin 5

Client:

Raheny 3 Limited Partnership

Title:

Quaternary Soils

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Drawn By: CS	**Projection:** IRENET95 / Irish Transverse Mercator
Checked: CC	
Date: 07/07/2022	**Scale @ A4: 1:20000**

Notes:
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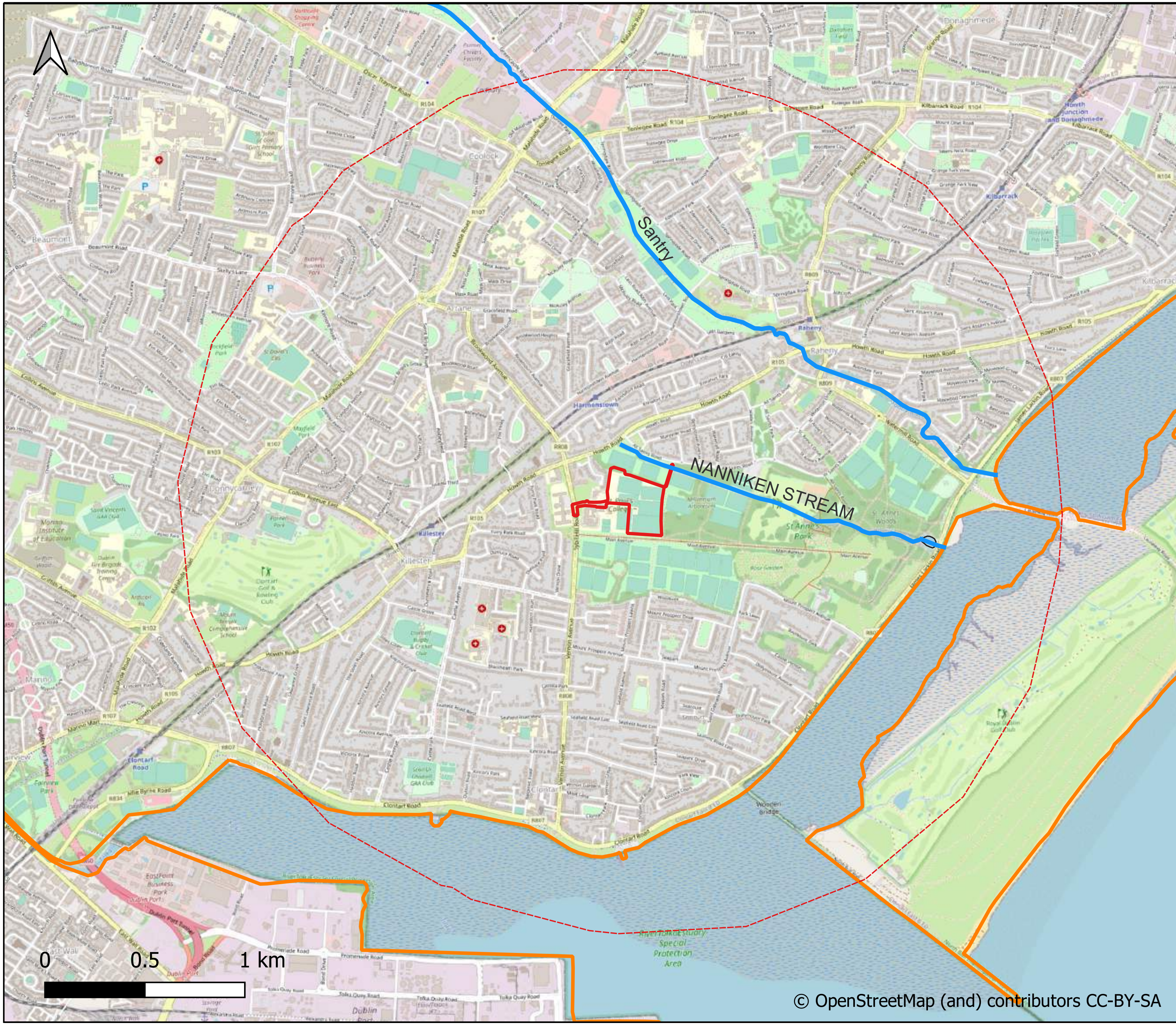

Legend:

- Site Boundary
- 2km Buffer
- River/Stream
- WFD Catchments
- Lake

Project:

Proposed Development, Foxlands, Raheny, Dublin 5

Client:

Raheny 3 Limited Partnership

Title:

Local Surface Water

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Drawn By: CS	**Projection:** IRENET95 / Irish Transverse Mercator
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Date: 07/07/2022	**Scale @ A4: 1:25000**

Notes:

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Legend:

Site Boundary

Bedrock Aquifer

LI - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones

PI - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones

Project:

Proposed Development, Foxlands, Raheny, Dublin 5

Client:

Raheny 3 Limited Partnership

Title:

Bedrock Aquifer

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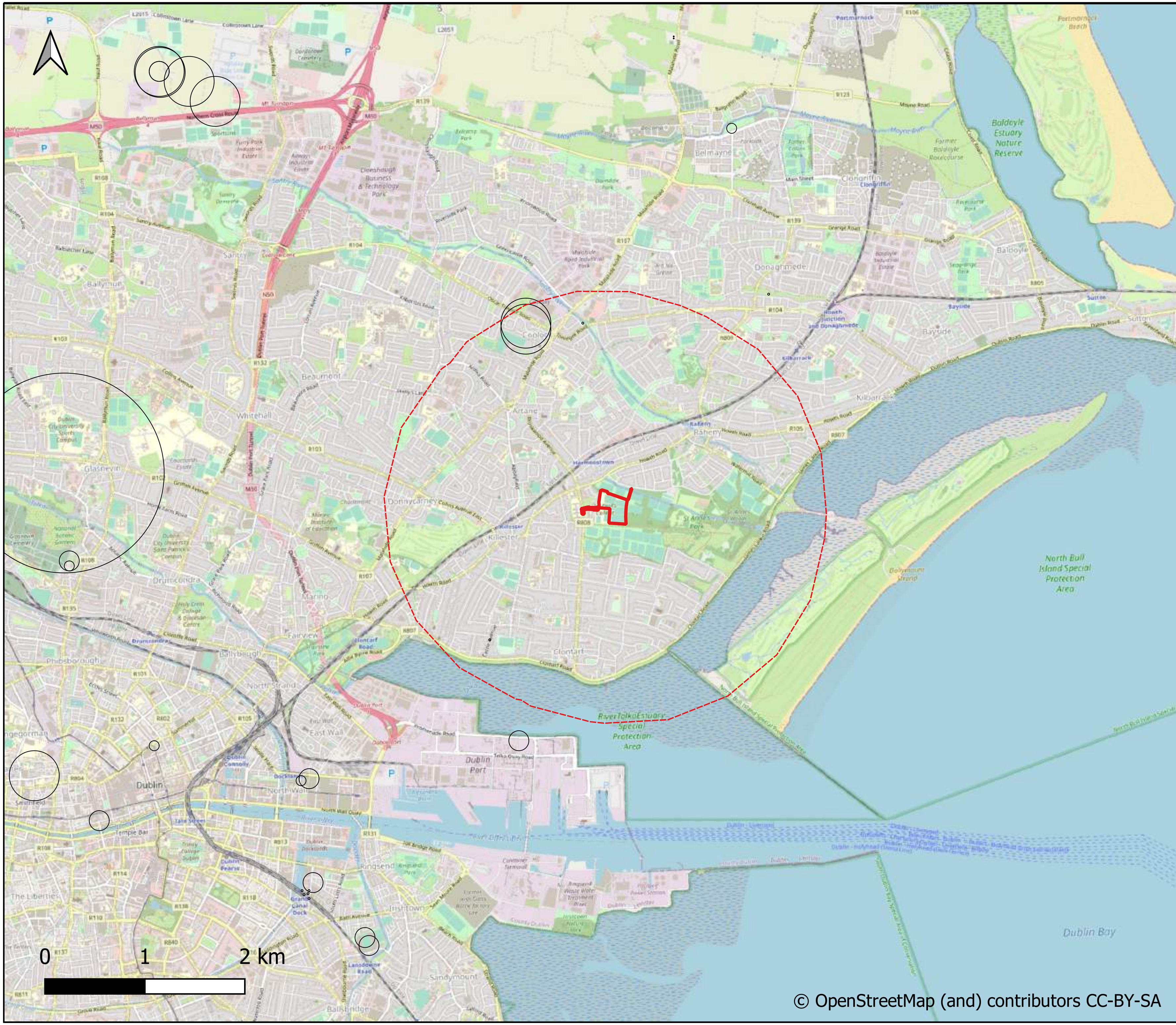

Legend:

- Site Boundary
- 2km Buffer

Public Supply SPAs

- SI-Inner Protection Area
- SO-Outer Protection Area
- Group Scheme Preliminary SPAs
- Groundwater Wells and Springs

Project:

Proposed Development, Foxlands, Raheny, Dublin 5

Client:

Raheny 3 Limited Partnership

Title:

Groundwater Wells, Springs and Source Protection Areas

Enviroguide CONSULTING

a 3D Core C, Block 71, The Plaza Park West, Dublin 12 D12F9TN
w www.enviroguide.ie
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Drawn By: CS

Checked: CC

Date: 07/07/2022

Projection: IRENET95 / Irish Transverse Mercator

Scale @ A4: 1:50000

Notes:

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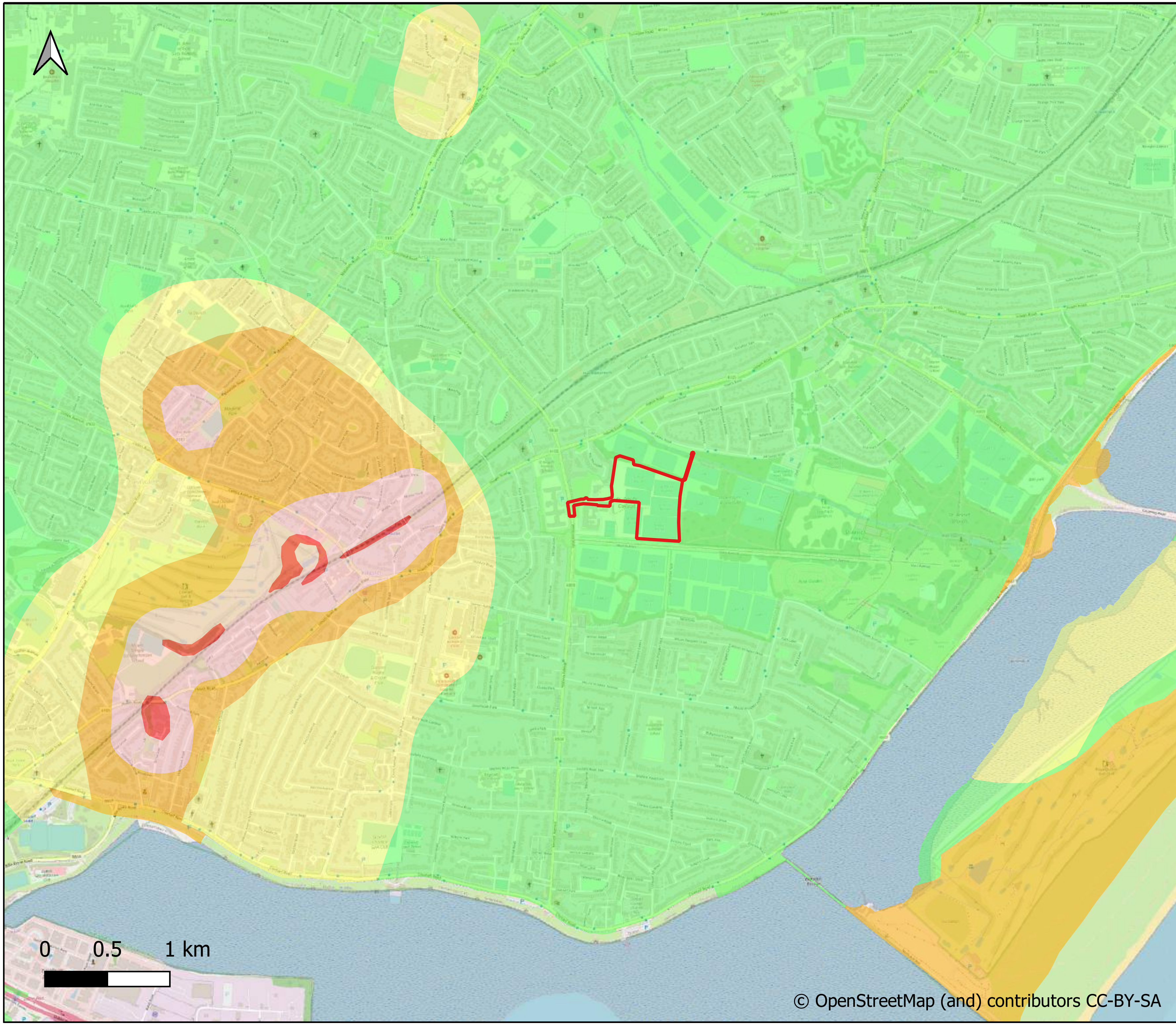

Legend:

Site Boundary

Groundwater Vulnerability

- Rock at or near Surface or Karst
- Extreme
- High
- Moderate
- Low

Project:

Proposed Development, Foxlands, Raheny, Dublin 5

Client:

Raheny 3 Limited Partnership

Title:

Groundwater Vulnerability

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Notes:
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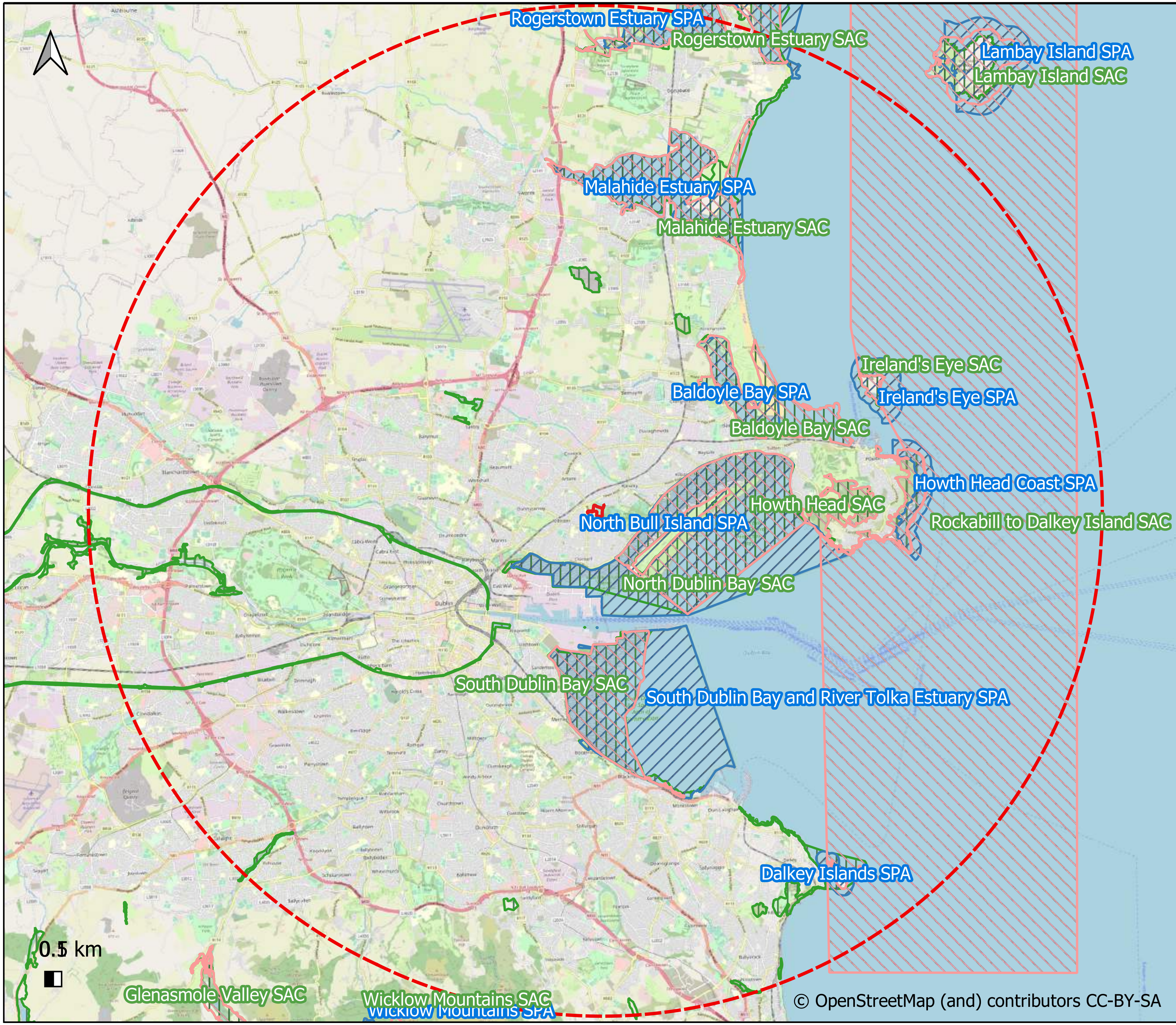

Legend:

- Site Boundary
- 15km Buffer
- SAC
- SPA
- pNHA

Project:

Proposed Development, Foxlands, Raheny, Dublin 5

Client:

Raheny 3 Limited Partnership

Title:

Designated sites within 15km of the Proposed Development Site

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Drawn By: CS	**Projection:** IRENET95 / Irish Transverse Mercator
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Date: 07/07/2022	**Scale @ A4: 1:150000**

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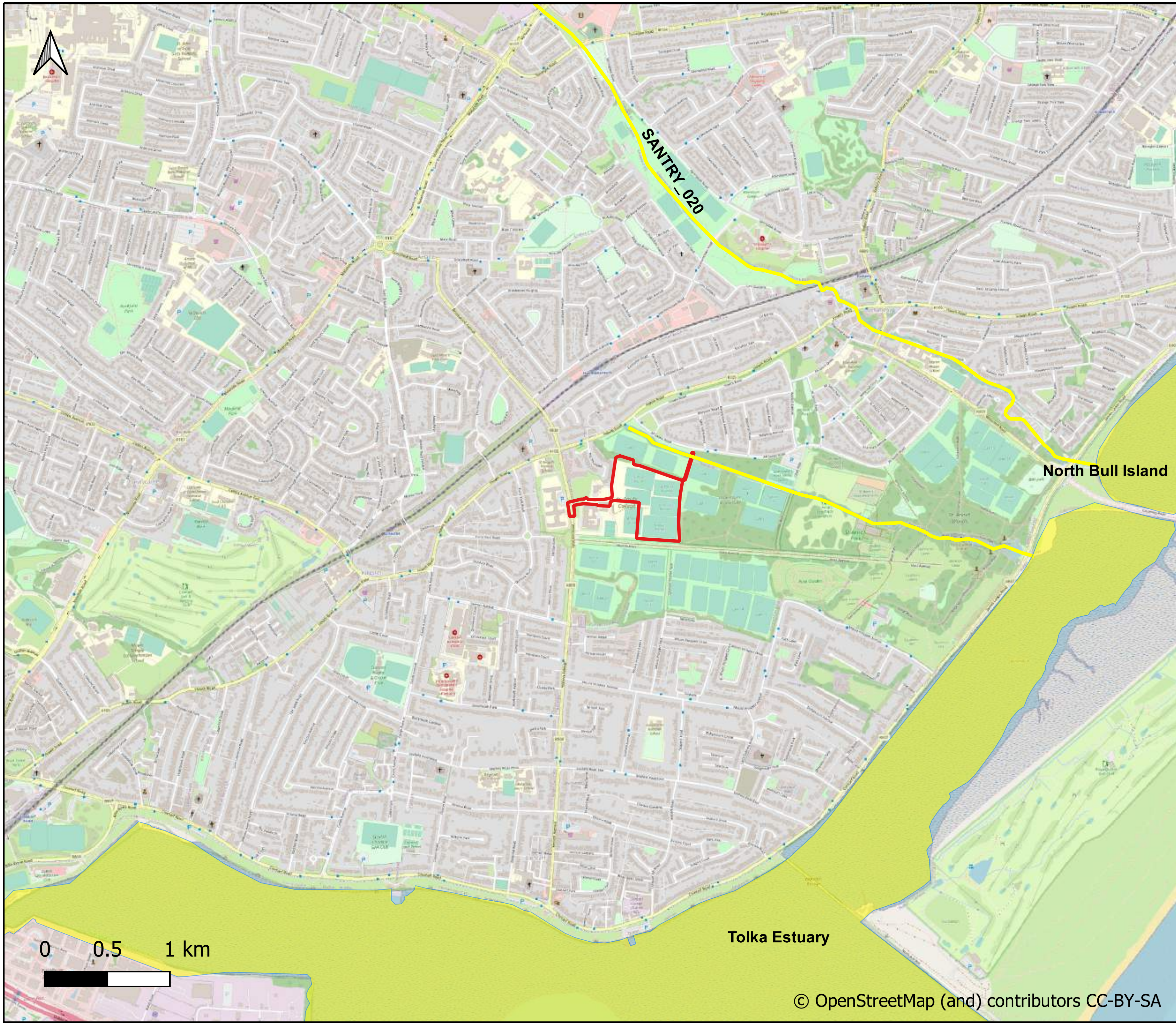

Legend:

Site Boundary

Transitional Waterbody WFD Status 2013-2018

Moderate

River Waterbody WFD Status 2013-2018

Moderate

Project:

Proposed Development, Foxlands, Raheny, Dublin 5

Client:

Raheny 3 Limited Partnership

Title:

WFD Status

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Drawn By: CS	**Projection:** IRENET95 / Irish Transverse Mercator
Checked: CC	
Date: 07/07/2022	**Scale @ A4: 1:20000**

Notes:

Site boundaries shown are for illustration purposes only and do not represent legal or exact boundaries

Appendix B Social Infrastructure and Childcare Needs Assessment

Social Infrastructure Report and Childcare Needs Assessment

FOR

Mixed Use Housing Development

AT

Sybil Hill Road, Raheny, Dublin 5

August 2022

ON BEHALF OF

Raheny 3 Limited Partnership

Prepared by
Enviroguide Consulting

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3D Core C, Block 71, The Plaza,
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DOCUMENT CONTROL SHEET

Client	Raheny 3 Limited Partnership
Project Title	Foxlands Housing Development
Document Title	Social Infrastructure Report

Rev.	Status	Author(s)	Reviewed by	Approved by	Issue Date
01	Draft for Internal Review	Janet O'Shea *Technical Director* Louise Hewitt *Environmental Consultant*	Janet O'Shea *Technical Director*	Janet O'Shea *Technical Director*	07/07/2022
02	Draft for Legal Review	Louise Hewitt *Environmental Consultant*	-	-	11/07/2022
03	Final Issue	Louise Hewitt *Environmental Consultant*	Janet O'Shea *Technical Director*	Janet O'Shea *Technical Director*	03/08/2022
04	Final Issue	Louise Hewitt *Environmental Consultant*	Janet O'Shea *Technical Director*	Janet O'Shea *Technical Director*	26/08/2022

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The methodology adopted and the sources of information used by Enviroguide in providing its services are outlined in this Report.

The work described in this Report is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

All work carried out in preparing this report has used, and is based upon, Enviroguide's professional knowledge and understanding of the current relevant national legislation. Future changes in applicable legislation may cause the opinion, advice, recommendations or conclusions set out in this report to become inappropriate or incorrect. However, in giving its opinions, advice, recommendations and conclusions, Enviroguide has considered pending changes to environmental legislation and regulations of which it is currently aware. Following delivery of this report, Enviroguide will have no obligation to advise the client of any such changes, or of their repercussions.

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Unless otherwise stated in this Report, the assessments made assume that the site and facilities will continue to be used for their current or stated proposed purpose without significant changes.

The content of this report represents the professional opinion of experienced environmental consultants. Enviroguide does not provide legal advice or an accounting interpretation of liabilities, contingent liabilities or provisions.

If the scope of work includes subsurface investigation such as boreholes, trial pits and laboratory testing of samples collected from the subsurface or other areas of the site, and environmental or engineering interpretation of such information, attention is drawn to the fact that special risks occur whenever engineering, environmental and related disciplines are applied to identify subsurface conditions. Even a comprehensive sampling and testing programme implemented in accordance with best practice and a professional standard of care may fail to detect certain conditions. Laboratory testing results are not independently verified by Enviroguide and have been assumed to be accurate. The environmental, ecological, geological, geotechnical, geochemical and hydrogeological conditions that Enviroguide interprets to exist between sampling points may differ from those that actually exist. Passage of time, natural occurrences and activities on and/or near the site may substantially alter encountered conditions.

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1 INTRODUCTION

Social infrastructure is the provision of services and structures that support the quality of life in a region, city or community to make a community an appealing place to live. The provision of accessible social infrastructure within communities contributes to the quality of life and is essential for health, wellbeing and social development of a community. The purpose of such infrastructure is to provide a service and to promote community cohesion and community identity and in doing so combat social isolation and alienation.

Social infrastructure facilities include, as examples, education, transport, healthcare, community support, public space, sports and recreation, information, faith and arts and culture. In addition to the actual activity and function, social infrastructure facilities can provide an invisible platform for community and social interaction upon which some residents may rely for personal wellbeing. It is important that social infrastructure facilities be provided in tandem with the development of new dwellings and neighbourhoods.

This Social Infrastructure Report has been prepared by Synergy Environmental Ltd t/a Enviroguide Consulting (hereinafter referred to as Enviroguide Consulting) on behalf of Raheny 3 Limited Partnership in respect of a Proposed Development at lands to the east of St. Paul's College, Sybil Hill Road, Raheny, Dublin 5.

This Social Infrastructure Report is produced as an assessment of social infrastructure in the Dublin 5 area in relation to Proposed Development. It provides a contextual overview of the area surrounding the site, a review of the social infrastructure within its catchment and identifies possible future needs in the area.

Social Infrastructure covers a diverse range services and facilities. In this instance this Social Infrastructure Report has categorised as follows.

- Education: Schools including Primary, Post Primary or further education, afterschool care, childcare.
- Transport: access to transport services and walkways.
- Sports & Recreation and Open Space: Parks, sport pitches and club facilities, playgrounds, nature, recreation and social activities.
- Public Safety: Emergency services.
- Health & Wellbeing: Hospitals, General Practitioners (GP)s and Medical Centres, Pharmacies.
- Art and Culture.
- Religious and Faith: Areas of worship, churches, cemeteries.
- Retail.
- Community Support: Public Facilities and Community Groups, information: Areas to access information, Libraries, Post Offices, Credit Unions, Banks, Recycling Bring Centres and key retail locations.

This report also includes a Childcare Needs Assessment in Section 5.2 which details the existing childcare services in the area and the predicted childcare demand generated by the Proposed Development.

2 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

2.1 Description of Proposed Development

Raheny 3 Limited Partnership are applying for permission for development on lands east of St Paul's College, Sybil Hill Road, Raheny, Dublin 5. The site is bound to the north, east and south by St Anne's Park and to the west by residential development at The Meadows, Sybil Hill House (a Protected Structure) and St Paul's College. Vehicular access to the site is from Sybil Hill Road. The size of the site is c. 6.7 hectares.

The Proposed Development consists of the construction of a residential and nursing home development set out in 7 no. blocks, ranging in height from 4-7 storeys to accommodate 580 no. apartments, residential tenant amenity spaces, a crèche and a 100-bed nursing home. The site will accommodate car parking spaces, bicycle parking spaces, storage, services and plant areas at both basement and podium level.

Landscaping will include extensive communal amenity areas, and a significant public open space provision on the east and south of the site. The proposed application includes all site landscaping works, green roofs, substations, boundary treatments, lighting, servicing, signage, surface water attenuation facilities and associated and ancillary works, including site development works and services above and below ground. For a full description of the Proposed Development please refer to the Statutory Notices.

The Proposed Development also features a Communal Amenity Space with the following features.

- Games lounge is sited off the central green and offers a place to play games within a club room like environment.
- Conventional gym space to promote well-being.
- Screening room offers an opportunity for residents to have to come together whilst watching a film. The space could also host events.
- Multi-functional space: Flexible space that can be used for parties, yoga, coffee mornings, meetings or used by the crèche (Design Statement, Hawkins Brown, 2022).

The Proposed Development includes a creche facility which will offer the Early Childhood Care and Education (ECCE) scheme. The Early Childhood Care and Education Programme (ECCE) programme is a universal two-year pre-school programme available to all children within the eligible age range. It provides children with their first formal experience of early learning prior to commencing primary school. The programme is provided for three hours per day, five days per week over 38 weeks per year and the programme year runs from September to June each year. Childcare services taking part in the ECCE programme must provide an appropriate pre-school educational programme which adheres to the principles of Síolta, the national framework for early years care and education. There is no charge to parents for the playschool or daycare hours provided under the ECCE scheme. The State capitation fee pays the playschool or daycare service to provide these ECCE hours (Department of Children, Equality, Disability, Integration and Youth, August 2022).

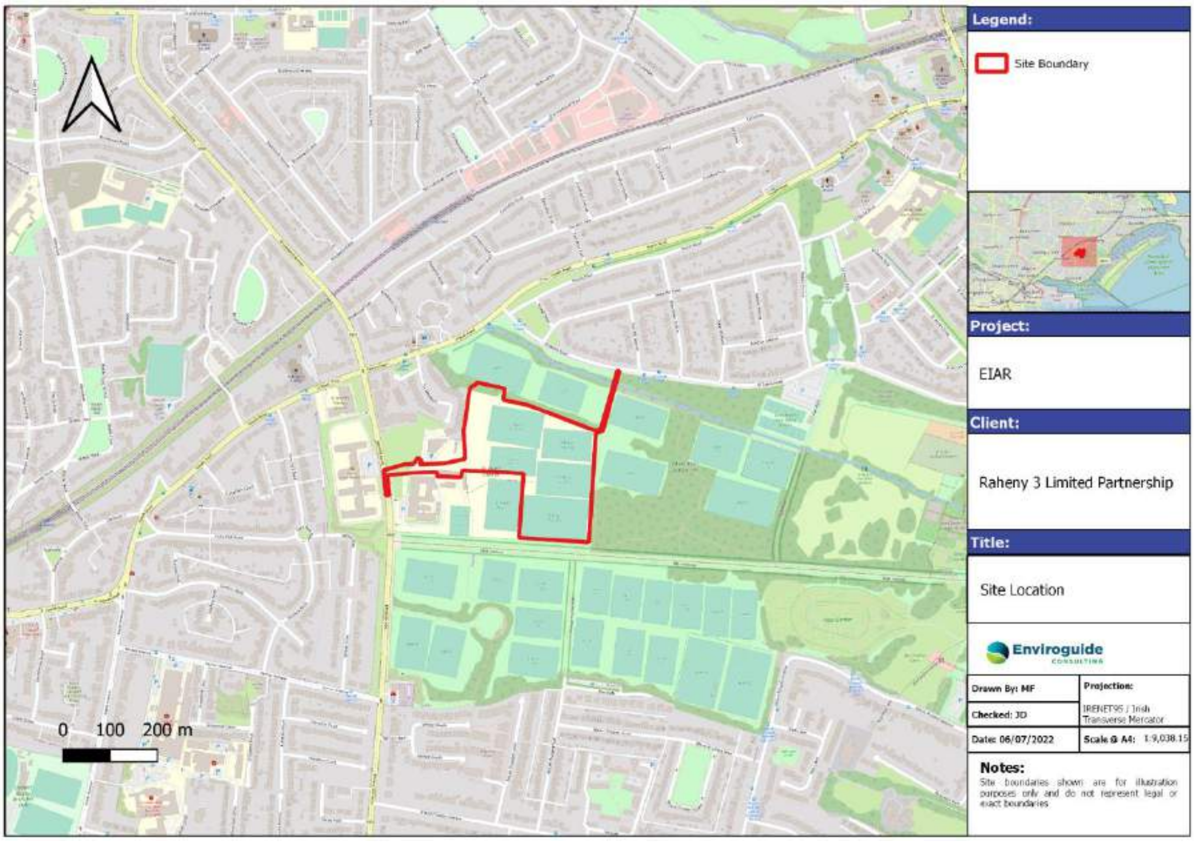


Figure 2-1: Site Location Map

2.2 Site Context

The Site is bound to the north, east and south by St Anne's Park and to the west by residential development at The Meadows, Sybil Hill House (a Protected Structure) and St Paul's College. Vehicular access to the site is from Sybil Hill Road.

2.3 Schedule of Accommodation

The Proposed Development includes 580 no. residential units, a creche and a 100-bed nursing home.

	Description	1-Bed	2-Bed	3-Bed	Total
Apartment Blocks	Block A	31	25	5	61
	Block B	44	26	-	70
	Block C	46	57	9	113
	Block D	56	58	22	136
	Block E	47	46	3	96
	Block F	23	9	4	36
Mixed-Use (Block G)	Apartments	25	27	17	69
	Nursing Home	100 Bed-Spaces			-
	Crèche	6 Classrooms			-
Total		**272**	**248**	**60**	**580**

Figure 2-2: Schedule of Accommodation (Waterman Moylan, 2022)

2.4 Study Area

The Study Area for this assessment has been defined by an approximate 2 km radius of the Proposed Development site. This distance is equivalent to approximately a 20 to 30-minute walking distance which is considered to be accessible to future residents of the Proposed Development.

3 Policy Context

The key provisions of national and local planning policy as it relates to this Social Infrastructure Report is set out in the following sections.

The key policy and guidance documents of relevance to the Proposed Development are as follows:

- Dublin City Development Plan 2016–2022
- Guidelines for Planning Authorities on Childcare Facilities (2001)
- Sustainable Urban Housing: Design Standards for New Apartments - Guidelines for Planning Authorities (2020)
- Project Ireland 2040 - National Planning Framework
- Eastern and Midland Regional Assembly Regional Spatial & Economic Strategy 2019-2031
- Age Friendly Principles and Guidelines for the Planning Authority (2021)
- Play here, Play there, Play everywhere, Dublin City Play Plan 2012–2017, Dublin City Development Board (no further updated document)
- Guidelines for Planning Authorities on Sustainable Residential Development in Urban Areas (2009)

3.1 Dublin City Development Plan 2016–2022

The Site of the Proposed Development is within lands zoned Z15 as detailed in Figure 3-1.

Zone Z15 to protect and provide for institutional and community uses.

Under the zoning objective, the proposed residential use is open for consideration.

The Dublin City Development Plan details the permissible uses of lands zoned Z15. *Zoning Objective Z15: Permissible Uses Buildings for the health, safety and welfare of the public; childcare facility, community facility, cultural/recreational building and uses, education, medical and related consultants, open space, place of public worship, public service installation, residential institution.*

A small section of the application site is zoned Z9 "*Amenity/Open Space Lands/Green Network*" as this includes lands within St. Anne's Park required to provide for the routing of a surface water discharge from the site via St. Anne's Park to the Naniken River. The application also seeks permission for the demolition and reconstruction of the existing pedestrian river crossing in St. Anne's Park with integral surface water discharge to Naniken River as requested by Dublin City Council. No residential development is proposed on the lands contained within the application boundary which are zoned Z9.

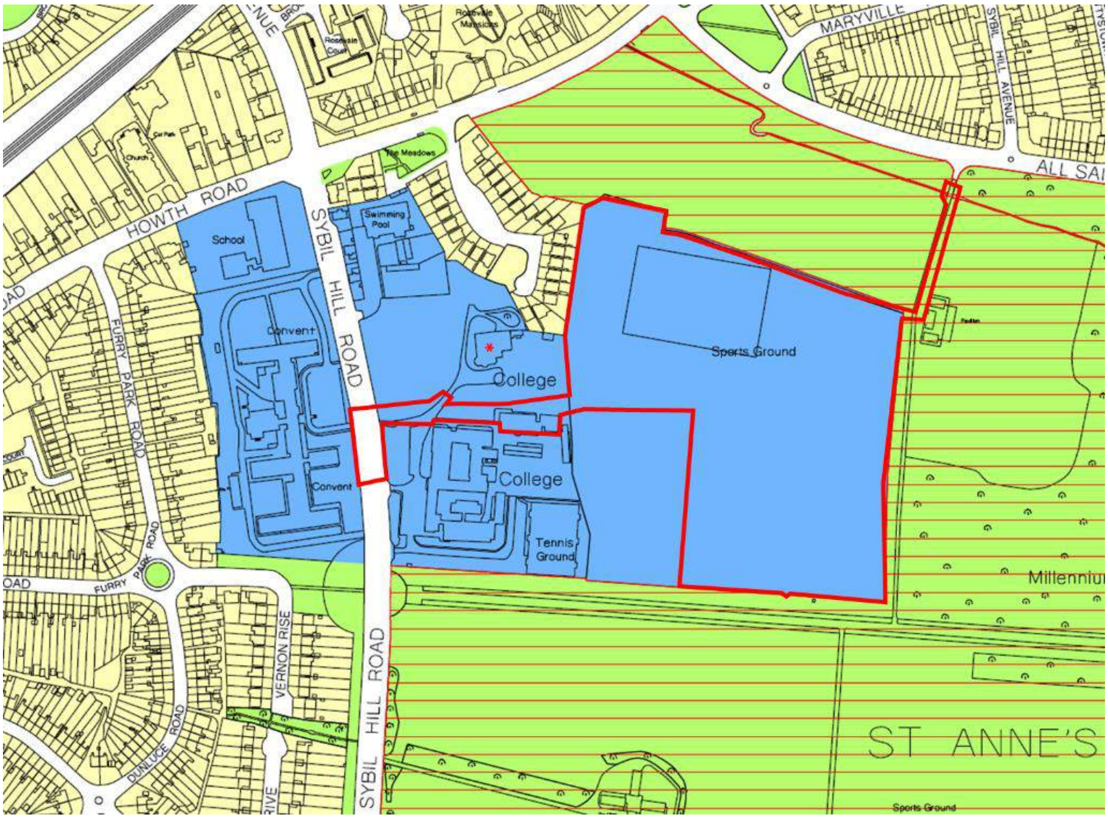


Figure 3-1 Land Use Zoning Map Extract (Source: Dublin City Development Plan 2016 - 2022, Zoning Map Set B)

The following policies are included in the Dublin City Development Plan regarding social infrastructure requirements as part of new developments:

QH18: *To promote the provision of high-quality apartments within sustainable neighbourhoods by achieving suitable levels of amenity within individual apartments, and within each apartment development, and ensuring that suitable social* *infrastructure and other support facilities are available in the neighbourhood, in accordance with the standards for residential accommodation.*

QH19: *To promote the optimum quality and supply of apartments for a range of needs and aspirations, including households with children, in attractive, sustainable, mixed-income, mixed-use neighbourhoods supported by appropriate social and other infrastructure.*

QH20: *To ensure apartment developments on City Council sites are models of international best practice and deliver the highest quality energy efficient apartments with all the necessary infrastructure where a need is identified, to include community hubs, sports and recreational green open spaces and public parks and suitable shops contributing to the creation of attractive, sustainable, mixed-use and mixed-income neighbourhoods.*

QH13: *To ensure that all new housing is designed in a way that is adaptable and flexible to the changing needs of the homeowner as set out in the Residential Quality Standards and with regard to the Lifetime Homes Guidance contained in Section 5.2 of the Department of Environment, Heritage and Local Government 'Quality Housing for Sustainable Communities – Best Practice Guidelines for Delivering Homes Sustaining Communities' (2007).*

QH14: *To support the concept of independent living and assisted living for older people, to support the provision of specific purpose-built accommodation, and to promote the opportunity for older people to avail of the option of 'downsizing'. To support the promotion of policies that will:*

- *Encourage/promote full usage of dwellings units.*
- *Incentivise property owners of underutilised dwellings to relocate to smaller age-friendly dwellings.*
- *Actively promote surrendering larger accommodation/financial contribution schemes without compulsion.*

SN17: *To facilitate the provision in suitable locations of sustainable, fit-for-purpose childcare facilities in residential, employment, and educational settings, taking into account the existing provision of childcare facilities and emerging demographic trends in an area.*

SN15: *To ensure the optimum use of community facilities and that high-quality facilities are accessible to all.*

The following objectives are included in the Dublin City Development Plan regarding social infrastructure requirements as part of new developments:

QHO3: *To instigate the design of a prototype block of age-friendly apartments for older people based on age-friendly design principles in conjunction with other bodies, as appropriate, in order to inform a model of good practice.*

The Statement of Consistency and Planning Report (Brady Shipman Martin, 2022) which accompanies this planning application as separate standalone document has assessed the Proposed Development and concluded that it complies with the polices of the CDP. The

Proposed Development has an appropriate mix of uses ensuring that future residents of the development are fully supported by associated infrastructure.

3.2 Childcare Facilities - Guidelines for Planning Authorities (2001)

Guidelines for Planning Authorities on Childcare Facilities provide a framework to guide both local authorities in preparing development plans and assessing applications for planning permission, and developers and childcare providers in formulating development proposals.

Childcare is defined in these guidelines as *"full day-care and sessional facilities and services for pre-school children and school-going children out of school hours. It includes services involving care, education and socialisation opportunities for children. Thus, services such as pre-schools, naíonraí (Irish language playgroups), day-care services, crèches, playgroups, and after-school groups are encompassed by these Guidelines. Conversely childminding, schools, (primary, secondary and special) and residential centres for children are not covered by these Guidelines.*

Section 2.4 of the Guidelines detail's appropriate locations for childcare facilities which includes "New communities / Larger new housing developments".

"Planning authorities should require the provision of at least one childcare facility for new housing areas unless there are significant reasons to the contrary for example, development consisting of single bed apartments or where there are adequate childcare facilities in adjoining developments. For new housing areas, an average of one childcare facility for each 75 dwellings would be appropriate. (See also paragraph 3.3.1 and Appendix 2 below). The threshold for provision should be established having regard to the existing geographical distribution of childcare facilities and the emerging demographic profile of areas. Authorities could consider requiring the provision of larger units catering for up to 30/40 children in areas of major residential development on the basis that such a large facility might be able to offer a variety of services – sessional/drop in/after-school, etc."

Section 3.3.1 of the Guidelines also states in relation to new housing areas *"a standard of one childcare facility providing for a minimum 20 childcare places per approximately 75 dwellings may be appropriate."* The Guidelines clarify that this standard is a guideline only and not a strict requirement and the capacity of childcare facilities "*will depend on the particular circumstances of each individual site."*

This Social Infrastructure Report has considered the above guidelines and includes an assessment of the existing childcare capacity within the defined Study Area. This is detailed in Section 5.2 of this report.

3.3 Sustainable Urban Housing: Design Standards for New Apartments - Guidelines for Planning Authorities (2020)

The 2020 Sustainable Urban Housing: Design Standards for New Apartments Guidelines (as amended) were

Section 4.7 states the following in relation to Communal Facilities.

"Notwithstanding the Planning Guidelines for Childcare Facilities (2001), in respect of which a review is to be progressed, and which recommend the provision of one child-care facility (equivalent to a minimum of 20 child places) for every 75 dwelling units, the threshold for provision of any such facilities in apartment schemes should be established having regard to 21 the scale and unit mix of the proposed development and the existing geographical distribution of childcare facilities and the emerging demographic profile of the area. One bedroom or studio type units should not generally be considered to contribute to a requirement for any childcare provision and subject to location, this may also apply in part or whole, to units with two or more bedrooms."

Section 4.13 also states the following in relation to Children's Play:

"The recreational needs of children must be considered as part of communal amenity space within apartment schemes. Experience in Ireland and elsewhere has shown that children will play everywhere. Therefore, as far as possible, their safety needs to be taken into consideration and protected throughout the entire site, particularly in terms of safe access to larger communal play spaces. Children's play needs around the apartment building should be catered for:

- *within the private open space associated with individual apartments (see chapter 3).*
- *within small play spaces (about 85 – 100 sq. metres) for the specific needs of toddlers and children up to the age of six, with suitable play equipment, seating for parents/guardians, and within sight of the apartment building, in a scheme that includes 25 or more units with two or more bedrooms; and*
- *within play areas (200–400 sq. metres) for older children and young teenagers, in a scheme that includes 100 or more apartments with two or more bedrooms"*

3.4 Project Ireland 2040 - National Planning Framework

The Department of Housing Planning and Local Government, on behalf of the Government, has prepared and published the National Planning Framework (NPF) under Project Ireland 2040 which is the overarching policy and planning framework for the social, economic and cultural development of our country. The aim of the NPF is to guide high-level strategic planning and development so the growth of our population is achieved sustainably in economic, social and environmental terms.

The NPF considers *"the quality of our immediate environment, our ability to access services and amenities, such as education and healthcare, shops and parks, the leisure and social interactions available to us and the prospect of securing employment, all combine to make a real difference to people's lives."*

Whilst the NPF does not provide specific guidance on the infrastructure required Chapter 6 provides a Hierarchy of Settlements and Related Infrastructure that details the services and facilities necessary within settlements of different size to serve their populations (Figure 3-2).

Figure 3-2: Hierarchy of Settlements and Related Infrastructure

The following objectives of the NPF are of relevance to the Social Infrastructure Report.

National Policy Objective 30

Local planning, housing, transport/ accessibility and leisure policies will be developed with a focus on meeting the needs and opportunities of an ageing population along with the inclusion of specific projections, supported by clear proposals in respect of ageing communities as part of the core strategy of city and county development plans.

National Policy Objective 31

Prioritise the alignment of targeted and planned population and employment growth with investment in:

- *A childcare/ECCE planning function, for monitoring, analysis and forecasting of investment needs, including identification of regional priorities.*
- *The provision of childcare facilities and new and refurbished schools on well located sites within or close to existing built-up areas, that meet the diverse needs of local populations.*
- *The expansion and consolidation of Higher Education facilities, particularly where this will contribute to wider regional development, and*
- *Programmes for life-long learning, especially in areas of higher education and further education and training where skills gaps are identified.*

3.5 Eastern and Midland Regional Assembly Regional Spatial & Economic Strategy 2019-2031

The Eastern and Midland Regional Spatial and Economic Strategy (E&MRSES) is a strategic plan and investment framework to shape the future development of the Eastern and Midland Region to 2031 and beyond.

Section 9.4 details healthy Placemaking which aims to *"Improve both physical and social infrastructure to create places that are healthy and attractive to live, work, visit and invest in"*

The following objectives of the E&MRSES are relevant to this Social Infrastructure Report.

> ***RPO 9.13****: Local authorities and relevant agencies shall ensure that new social infrastructure developments are accessible and inclusive for a range of users by adopting a universal design approach and provide for an age friendly society in which people of all ages can live full, active, valued and healthy lives.*
>
> ***RPO 9.20****: Support investment in the sustainable development of the Region's childcare services as an integral part of regional infrastructure to include:*
>
> - *Support the Affordable Childcare Scheme.*
> - *Quality and supply of sufficient childcare places.*
> - *Support initiatives under a cross Government Early Years Strategy.*
> - *Youth services that support and target disadvantaged young people and improve their employability.*
>
> ***RPO 9.21****: In areas where significant new housing is proposed, an assessment of need regarding schools' provision should be carried out in collaboration with the Department of Education and Skills and statutory plans shall designate new school sites at accessible, pedestrian, cycle and public transport friendly locations.*

3.6 Age Friendly Principles and Guidelines for the Planning Authority (2021)

This document, coordinated by Age Friendly Ireland, aims to inform local authorities and ensure future development plans and public policy are designed with consideration for Ireland's ageing population.

> *Objective: To ensure consistency in policy across the council policy arena. Reference around provision for nursing homes / step down facilities/independent living units and where these should be located; the appropriate size; etc., in line with national policy should be highlighted along with the urban realm guidelines of Age Friendly Ireland.*

The Proposed Development includes a 100-bed nursing home. The proposed inclusion of the nursing home as part of this Proposed Development takes into consideration the aging population of the area. The average population of people aged 65 years and over in the Clontarf local Electoral Area is higher than the State average of people aged 65 years and over.

3.7 Play here, Play there, Play everywhere, Dublin City Play Plan 2012–2017, Dublin City Development Board

Dublin City Council developed the Dublin City Play Plan, the mission of which is to adopt a city-wide coordinated approach to provide high quality inclusive play opportunities for children and young people. Of relevance to the Social Infrastructure Report are the following Key Actions.

> *Chapter 2 KA 6: Engage families and communities in facilitating and celebrating children's play.*
>
> *Chapter 3: KA 7 Work with children and young people to support, defend and lobby for their right to play and to be able to play within reach of their own homes.*

The Proposed Development features a creche facility with a dedicated play space for the children attending. The Landscape Plan and Master Plan also include for natural play areas.

According to the Dublin City Council Development Plan and detailed in Section 3.1 of this report, the lands are zoned as Z15. A specific requirement of the Z15 zoning is that 25% of the lands must be allocated to open space and/or community facilities. The Landscape Design Statement has included 33.79% of the developable area as open space. These areas will be suitable for recreational and amenity purposes and provide an area for play for the children and young people residing in the Proposed Development (Hawkins Brown, 2022).

4 Approach & Methodology

A desk-based approach was undertaken to collate baseline information and undertake analysis of existing social infrastructure in the area. Digital mapping and satellite systems were used to identify services in the area along with published databases of services.

Census data from the Central Statistics Office (CSO) and the electoral divisions (ED's) surrounding the site were also analysed to determine the demographics of the area to obtain a profile of the area. The 2022 Census of Ireland was held on Sunday the 3rd of April 2022. The preliminary results were released on the 23rd of June 2022 however the main results will be published over several months starting in April 2023. The preliminary 2022 census results have been reviewed however they do not contain the required region-specific information for the purpose of this Social Infrastructure Report. As such, the more robust and complete 2016 census result have been used in this assessment.

The Proposed Development was then assessed, and an estimated profile based upon unit mix and local profile is created to approximate the social impact requirement and the effect of the development upon existing capacity.

The capacity of the social infrastructure identified within the area of the Proposed Development is assessed and any shortfall in the area identified has informed the uses within the Proposed Development.

4.1 Profile of the Area

The Site of the Proposed Development is located within the Clontarf Local Electoral Area (LEA). This LEA is made up of 16 electoral divisions: Beaumont D, Beaumont E, Beaumont F, Clontarf East A, Clontarf East B, Clontarf East C, Clontarf East D, Clontarf East E, Clontarf West A, Clontarf West B, Clontarf West C, Clontarf West D, Clontarf West E, Drumcondra South A, Grace Park and Harmonstown B. An analysis of the CSO Census Statistics for 2011 and 2016 for the Clontarf LEA was completed and is shown in Table 4-1. CSO Census Statistics for the 2022 Census are not published to date.

Table 4-1 Population changes in the Electoral Divisions within the Study Area

Electoral Divisions	2011	2016	Percentage Change in Population
Beaumont D	2,149	2,135	-0.7
Beaumont E	2,001	2,051	2.5
Beaumont F	3,437	3,590	4.5
Clontarf East A	3,301	3,438	4.2
Clontarf East B	6,759	7,107	5.1
Clontarf East C	3,113	3,183	2.2
Clontarf East D	2,673	2,766	3.5
Clontarf East E	1,675	1,791	6.9
Clontarf West A	3,436	3,658	6.5
Clontarf West B	2,316	2,411	4.1
Clontarf West C	3,366	3,659	8.7
Clontarf West D	2,066	2,297	11.2
Clontarf West E	2,324	2,468	6.2
Drumcondra South A	4,571	5,622	23.0
Grace Park	5,670	5,806	2.4
Harmonstown B	2,684	2,758	2.8
Total no. of Persons	**51,541**	**54,740**	**6.2**

As the electoral divisions are small areas, a representative sample of population from one electoral division would not be a representative sample of the age demography of the area. An analysis of the CSO Census Statistics for 2011 and 2016 for the Clontarf LEA was completed and is shown in Table 4-2. This table breaks down the age profile of the area and details the percentages of population in each age bracket. The table also shows data from 2011 as a comparison of population fluctuation in the area.

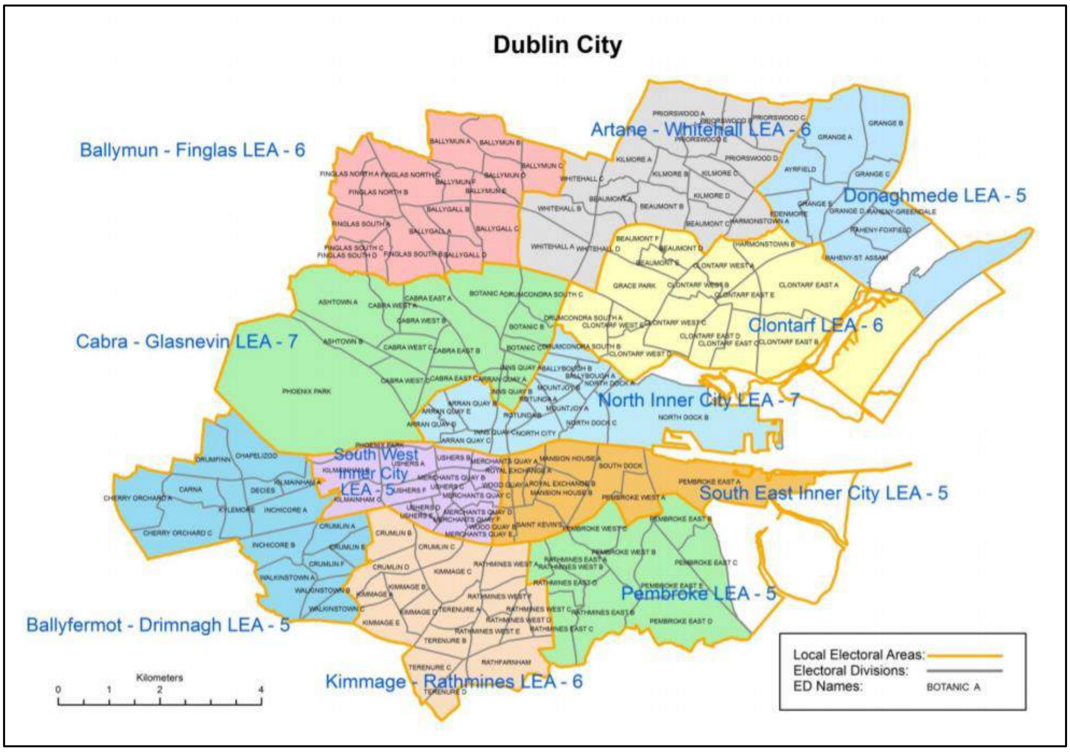


Figure 4-1: Local Electoral Area Boundary (Source Local Electoral Area Boundary Committee No. 2)

Table 4-2: Age Profile of the Clontarf Local Electoral Area

	0-4 years		5-12 years		13-18 years		19-24 years		25-44 years		45-64 years		65-69 years		70 years +	
	2011	2016	2011	2016	2011	2016	2011	2016	2011	2016	2011	2016	2011	2016	2011	2016
Beaumont D	74	99	195	120	207	162	212	219	495	538	751	611	99	188	116	198
Beaumont E	117	128	140	167	112	95	179	156	505	524	455	417	168	128	325	436
Beaumont F	195	194	305	306	253	239	269	357	980	1,003	861	831	162	216	412	444
Clontarf East A	202	209	332	360	233	235	189	231	812	802	819	922	114	134	600	545
Clontarf East B	431	496	603	661	515	482	466	511	1,919	1,984	1,777	1,841	273	333	775	799
Clontarf East C	165	163	324	294	229	236	211	227	759	736	845	856	141	180	439	491
Clontarf East D	156	134	226	279	195	176	189	203	652	643	722	797	116	120	417	414
Clontarf East E	110	110	163	192	106	141	113	104	399	419	434	462	64	86	286	277
Clontarf West A	219	207	363	346	198	278	256	209	978	1,022	886	1,086	85	120	451	390
Clontarf West B	149	141	181	193	125	132	174	144	729	748	582	635	114	132	262	286
Clontarf West C	213	183	214	281	157	176	215	236	1,404	1,481	782	843	110	136	271	323
Clontarf West D	126	151	107	158	75	89	196	167	879	988	411	478	59	67	213	199
Clontarf West E	157	163	184	220	155	147	162	149	655	766	564	588	76	91	371	344
Drumcondra South A	255	253	289	294	232	212	486	537	1,865	2,135	960	1,542	132	247	352	402
Grace Park	263	276	466	471	454	393	549	526	1,512	1,622	1,542	1,454	247	342	637	722
Harmonstown B	151	192	276	263	184	222	221	190	754	784	656	742	64	79	378	286
Total No. of Persons	**2,983**	**3,099**	**4,368**	**4,605**	**3,430**	**3,415**	**4,087**	**4,166**	**15,297**	**16,195**	**13,047**	**14,105**	**2,024**	**2,599**	**6,305**	**6,556**
Total Percentage	**5.8**	**5.7**	**8.5**	**8.4**	**6.7**	**6.2**	**7.9**	**7.6**	**29.7**	**29.6**	**25.3**	**25.8**	**3.9**	**4.7**	**12.2**	**12.0**

Table 4-2 shows that the age range of population has relatively similar for the Clontarf LEA for all ages between the 2011 Census and 2016 Census, with a slight increase of population (1.2%) for people ages 65-69 years.

As evident from Table 4-3, the population ranging between 25 and 44 years in the Clontarf LEA comprise 29.6% of the overall population of the area. This is comparable to the State average of 29.5%. Children ranging from 0-4 years in the Clontarf LEA comprise 5.7%, slightly lower than the State average of 7%. Young people ranging from 5-24 years make up 22.2% of the population of Clontarf LEA, which is lower than the national average of 26.4%.

The population ranging between 45 and 64 years in the Clontarf LEA comprise 25.8% of the population of the Clontarf LEA, higher than the national average of 23.8%.

Table 4-3: Age Profile of People in Clontarf LEA, Dublin City Council and the State

Age Range	Clontarf LEA		Dublin City		Ireland	
	No. of People	% Of People	No. of People	% Of People	No. of People	% Of People
0-4 years	3099.0	5.7	30683	5.5	331515	7.0
5-24 years	12186.0	22.3	125795	22.7	1251489	26.3
25-44	16195.0	29.6	207338	37.4	1406291	29.5
45-64	14105.0	25.8	118383	21.3	1135003	23.8
65-69	2599.0	4.7	20984	3.8	211236	4.4
70+	6556.0	12.0	51371	9.3	426331	9.0
Total no. of people	**54740.0**		**554554**		**4761865**	

4.2 Human Health

Health, as defined by the World Health Organization (WHO), is "*a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*". The Healthy Ireland Framework 2013-2025 defines health as ‘everyone achieving his or her potential to enjoy complete physical, mental and social wellbeing. Healthy people contribute to the health and quality of the society in which they live, work and play’. This framework also states that health is much more than an absence of disease or disability, and that individual health, and the health of a country affects the quality of everyone’s lived experience.

Health is an essential resource for everyday life, a public good and an asset for health and human development. A healthy population is a major asset for society and improving the health and wellbeing of the nation is a priority for Government. Healthy Ireland Framework 2013-2025 is a collective response to the challenges facing Ireland’s future health and wellbeing.

Table 4-4 shows that the majority of people in Clontarf LEA (87.8%) have self-identified themselves in the 2016 Census as having ‘very good health’ or ‘good health’.

Table 4-4: Health Status of Clontarf LEA

Health Status of Clontarf LEA	Very good	Good	Fair	Bad	Very bad	Not stated
Total Number of People	33,651	14,123	4,375	724	164	1,391
Total Percentage of People	61.8	25.9	8.0	1.3	0.3	2.6

5 Existing Infrastructure and Capacity Assessment

This Social Infrastructure Report assesses the existing infrastructure in the Study Area and the capacity of this infrastructure to accommodate the Proposed Development and associated population increase in the area as a result.

A total of 10 categories have been assessed in Section 5.1 to 5.11. The following sections show there is sufficient provision of social infrastructure in the vicinity of the subject site (c. 2 km radius) to support the Proposed Development.

5.1 Education

5.1.1 Primary Schools

There are a number of primary schools in the Study Area which include a mix of school types catering for boys, girls and co-education / mixed. Table 5-1 and Figure 5-1 detail the existing primary schools in the Study Area.

Table 5-1: Number of primary schools within the Study Area

No.	Name	Enrolment	Type	Distance from site	Capacity
19308J	St Brigid's Boys National School	329	Boys	0.4	Not Available
17730I	Greenlane's National School	286	Mixed	1.3	Number of places being made available in junior infants - 56
17148D	Belgrove Girls School	432	Girls	1.3	Number of places being made available in junior infants - 75
20525B	Killester Raheny Clontarf Educate Together National School	18	Mixed	1.4	Junior Infants – 26 children. Other Class Groups – Subject to capacity
19309L	Scoil Neasáin	249	Mixed	1.6	Number of places being made available in junior infants - 32
17978V	Naiscoil Ide	377	Mixed	1.7	Not Available
17977T	Scoil Aine Convent Senior	347	Mixed	1.7	Not Available
17976R	Scoil Assaim Boys Seniors	297	Boys	1.8	Not Available

18360G	St Brendan's National Catholic School	163	Boys	1.8	Number of places being made available in Second Class – 40+. Number of places being made available in 3rd to 6th Class – Dependent on availability
17732M	Scoil Ciaran's National School	130	Boys	2	Not Available
18361I	Scoil Chaitríona Cailíní	191	Girls	2	Number of places being made available in Second Class - 48
18362K	Scoil Chaitríona Infants	221	Mixed	2	Number of places being made available in Junior Infants - 80
20064O	Our Lady of Consolation National School	300	Mixed	2.1	Number of places being made available in junior infants - 75
Total		**3,340**			

Figure 5-1: Map of primary schools in the Study Area (red) in relation to the Proposed Development (yellow star)

5.1.2 Post Primary Schools

There are a number of post primary schools in the Study Area which include a mix of school types catering for boys, girls and co-education / mixed. Table 5-2 and Figure 5-2 detail the existing post primary schools in Study Area. Schools located outside the Study Area have been noted which are outside the 2km boundary but are accessible by car and public transport and thus are considered relevant to the study. The capacity of each school is listed for the academic year 2022 to 2023 unless stated otherwise.

Table 5-2: Post primary schools in the Study Area

No.	Name	Enrolment	Type	Distance from site	Capacity
60290B	St Pauls College	630	Boys	0.1	Number of places being made available in 1st year – 120
60791A	St Marys Secondary School	327	Girls	1.1	Number of places being made available in 1st year – 90 (2021/2022)
60300B	Manor House School	687	Girls	1.9	Number of places being made available in 1st year – 150
60750J	Holy Faith Secondary School	655	Girls	1.9	Not Available
60550B	Chanel College	548	Boys	2.4	Number of places being made available in 1st year – 120
60471F	St. David's C.B.S.	469	Boys	2.6	Number of places being made available in 1st year – 96 (2021/2022)
60871V	Mercy College Coolock	416	Girls	2.8	Not Available
60291D	Árdscoil La Salle	182	Mixed	2.9	Number of places being made available in 1st year – 96
Total		**3,259**			

Figure 5-2: Map of post-primary schools in the Study Area (red) in relation to the Proposed Development (yellow star)

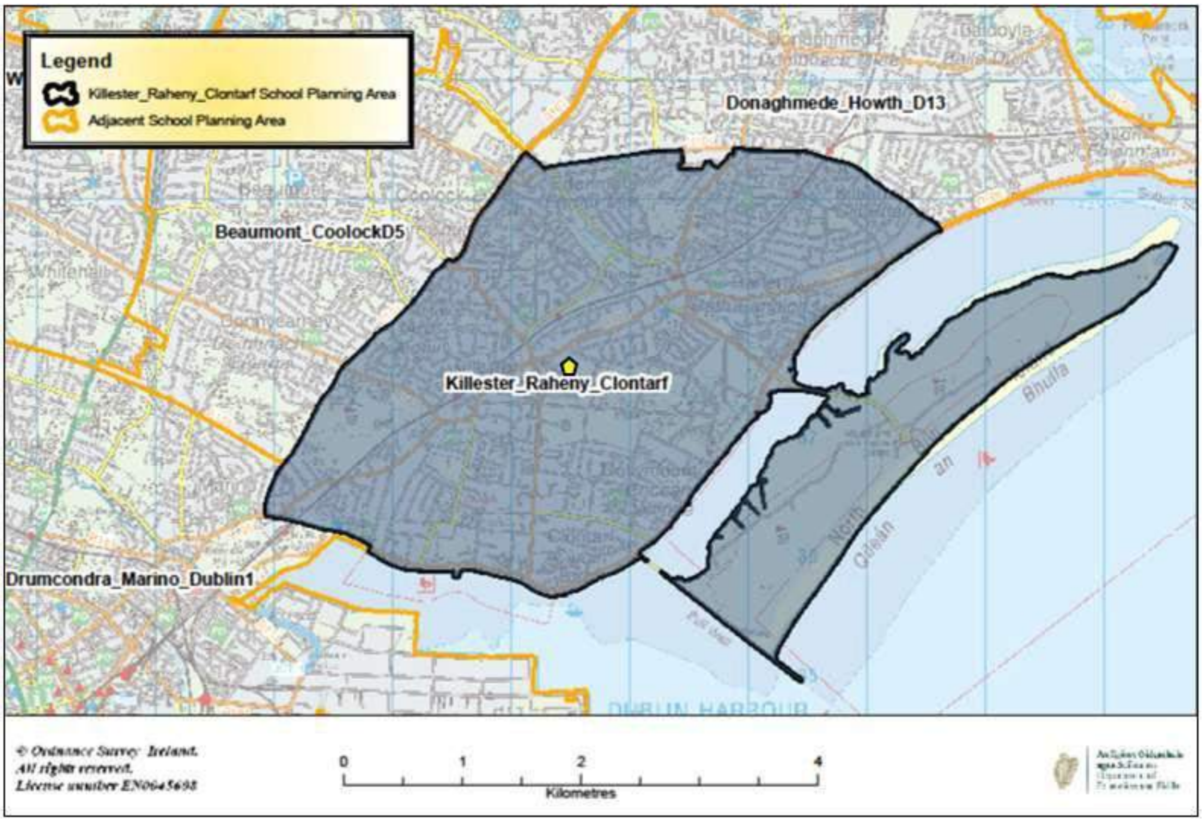
5.1.3 Department of Education and Skills New Schools List

The Department of Education and Skills produced a New Schools List (2019 – 2022) for both primary and post primary schools which includes any new schools proposed for School Planning Areas. This list, along with the relevant Patronage Assessment Reports, have been reviewed as part of this Social Infrastructure Report.

The Proposed Development is located in the Killester_Raheny_Clontarf School Planning Area. Based on the demographic analysis of this area, it was determined that there was a net requirement for 5 classrooms in the School Planning Area. 1 no. primary school was proposed; the Killester Raheny Clontarf Educate Together National School which was established in 2019 and has been included as part of the existing primary schools in the study area (Table 5-1). This is an 8-classroom school thereby satisfying the requirement of the School Planning Area in terms of primary school places. No other schools were proposed which demonstrates that there is no further requirement for new primary schools in the area.

No post primary schools were proposed in the Killester Raheny Clontarf School Planning Area which also demonstrates that there is no further requirement for new post primary schools in the area. The existing schools, assessed in Tables 5-1 and 5-2 are sufficient to address the educational needs of the Study Area.

There is 1 no. primary school and 1 no. post-primary school proposed just outside the Study Area, approximately 5km away from the Proposed Development in the Donaghmede_Howth_D13/Baldoyle/Stapolin School Planning Area. The Stapolin Educate Together National School was established in 2019 to meet the requirements of the school planning area and was not included in this assessment as it lies outside the Study Area. As of March 2022, the establishment date of the proposed post primary school has been deferred.



5.1.4 Third level Education

There are no third level education facilities in the Study Area however the site is accessible to a number of third level institutions in the surrounding area including;

- Marino Institute of Education 4.0 km
- Dublin City University 5.2 km
- St Patricks Teaching College 5.9 km
- Technological University Dublin 7.5 km
- Trinity College Dublin 5.5km
- Dublin Institute for Advanced Studies 8.8 km
- National College of Art and Design 8.3 km

5.2 Childcare

Overall, there are 27 no. existing childcare facilities in the Study Area using the latest Tulsa Early Years Inspectorate data. The Study Area was previously defined as being within a 2km radius of the Proposed Development however facilities outside this radius have been noted which are outside the boundary which are accessible by car and thus are considered relevant to the study.

Table 5-3: Childcare Facilities with the Study Area

No.	Name	Type	Distance	No. Of Children Service Can Accommodate
1	Karaville Montessori & Childcare	Full Day, Part Time, Sessional	0.2	28 Full Day & 36 Sessional
2	Seafield Montessori	Part Time, Sessional	1.1	20
3	Little Squirrels Montessori	Sessional	1.4	22
4	Buzzy Bees Montessori School	Part time	1.5	44
5	Gabriel's Playschool	Full Day	1.5	100
6	Little Bees Montessori	Childminder	1.5	6
7	The Montessori Circle Clontarf	Part Time	1.5	44
8	Little Acorns Montessori	Sessional	1.6	22
9	Little Stars Montessori	Sessional	1.7	22
10	Raheny Montessori (Raheny GAA)	Sessional	1.8	22
11	TNN Creches Ltd T/A Tír na nÓg Too	Sessional	1.8	22
12	It's a Small World Montessori School	Sessional	1.9	33
13	TNN Creche Ltd	Full Day, Part Time, Sessional	2.1	40
14	Casa dei Bambini Montessori	Part Time, Sessional	2.1	25
15	Parkmore Day Nursery	Full Day	2.5	23
16	St. Lawrence Creche	Full Day, Part Time, Sessional	2.5	45
17	An Cuan Dor	Part time	2.6	39
18	Garden of Eden	Full Day	2.6	90
19	The Rookery Creche and Montessori	Full Day, Part Time, Sessional	2.6	45
20	Maywood Montessori	Sessional	2.7	15
21	Our World Montessori	Sessional	2.8	15
22	Castle Creche	Full Day	2.8	50
23	Little Blossoms Crèche	Full Day	3.1	33
24	Drumnigh Montessori Primary School	Part time, sessional	3.2	66
25	Grange Park Creche	Full Day	3.3	23
26	One Step Ahead	Sessional	3.4	42
27	Merryvale Montessori School	Sessional	3.8	22

The 2020 Sustainable Urban Housing: Design Standards for New Apartments Guidelines (as amended) state, with regard to childcare provision, that:

"One-bedroom or studio type units should not generally be considered to contribute to a requirement for any childcare provision and subject to location, this may also apply in part or whole, to units with two or more bedrooms."

The Proposed Development consists of 580 no. residential units which is made up of 272 no. 1 bed units, 248 no. 2 bed units and 60 no. 3 bed units. By discounting the 272 no. 1 bed units as per the 2018 Sustainable Urban Housing: Design Standards for New Apartments Guidelines, there are a total of 308 units requiring childcare services.

In accordance with the guidance in "Childcare Facilities - Guidelines for Planning Authorities" the total number of childcare spaces required to be provided is 20 spaces per 75 units. As outlined above, when 1-bedroom residential units are discounted the number of residential units that will potentially require childcare services is 308. This would require the Proposed Development to provide childcare facilities for 82 children. The proposed creche will cater for c. 85 children which satisfies the requirement under the "Childcare Facilities - Guidelines for Planning Authorities".

There are a large number of childcare facilities / providers in close proximity to the Proposed Development (Table 5-3). The Proposed Development also includes a creche which will accommodate 85 children. From the above assessment it has been demonstrated that there is sufficient capacity within the Study Area and the Proposed Development to accommodate the increased demand generated by the Proposed Development.

5.3 Nursing Home

Within the Study Area there are 3 nursing homes; Sacred Heart Residence, Raheny House Nursing Home and Raheny Community Nursing Unit located 0.14km, 1.3 km and 1.8km from the Proposed Development site respectively. There are also 3 nursing homes located just outside the Study Area; Nazareth House, Clontarf Private Nursing Home (Silver Stream Healthcare Group) and St. Gabriel's Nursing Home all located 3.2km away.

The Clontarf LEA has an ageing population with the percentage of people aged 65-69 years and 70 years and over higher than the national average (Table 5-4). According to the Central Statistics Office 2016 Census data, the number of retired people in the area is also above the state average with 19% of people being retired compared with the state average of 15%. The Proposed Development includes a 100-bed nursing home which will introduce new capacity to the Study Area. The nursing home in the Proposed Development has been designed to function independently from the residential scheme, however the architecture aims to unite the blocks with a common material palette and details to promote inclusivity and provide a quality living environment for its residents.

Table 5-4: Population of people aged 65 years and over in the Study Area compared with the state averages

Age Range	Study Area		Ireland	
	No. of People	% Of People	No. of People	% Of People
65-69 years	2,599	4.7	211,236	4.4
70 years and over	6,556	12.0	426,331	9.0

5.4 Transport

The Study Area is well served by public transport, cycle infrastructure and pedestrian walkways. A Traffic and Transport Assessment has been prepared by Waterman Moylan from which the following information has been extracted.

5.4.1 Bus

The Proposed Development is served by four bus stops with the local area. The nearest bus stops are to the north of the development on R105 Howth Road. Bus Stop 709 serves buses traveling away from the City Centre and serves the bus routes 6, H1, H2, H3 while Bus Stop 606 serves buses travelling towards the City Centre and serves the bus routes 6, H1, H2, H3. Bus Stop 709 is approximately 400m (c. 5-minute walk) away from the Proposed Development entrance and Bus Stop 606 is 450m (c. 6-minute walk) away.

There two bus stops near the Proposed Development on Vernon Avenue these are the Bus Stop 7607 and Bus Stop 1651, and both stops serve the 104 Bus route in opposite directions. Bus Stop 709 is approximately 400m (c. 5-minute walk) away from the Proposed Development entrance and Bus Stop 606 is 450m (c. 6-minute) away.

Table 5-5: Frequency of Bus Services (Traffic and Transport Assessment, Waterman Moylan, June 2022)

Bus No.	Route	Weekday Frequency	Saturday Frequency	Sunday Frequency
6	Howth Station towards Abbey Street Lower	30 - 60 mins	60 mins	60 mins
	Abbey Street Lower toward Howth Station	30 - 60 mins	60 mins	60 mins
H1	Baldoyle towards Abbey Street Lower	15 mins	20 mins	15 – 30 mins
	Abbey Street Lower towards Baldoyle	15 mins	20 mins	15 – 30 mins
H2	Malahide towards Abbey Street Lower	30 mins	40 mins	60 mins
	Abbey Street Lower towards Malahide	30 mins	40 mins	60 mins
H3	Howth Summit towards Abbey Street Lower	30 mins	40 mins	60 mins
	Abbey Street Lower towards Howth Summit	30 mins	40 mins	60 mins
104	Clontarf Station towards DCU	60 mins	-	-
	DCU towards Clontarf Station	60 mins	-	-

5.4.2 Rail

The Proposed Development is also served by the Harmonstown Dart Station and Killester Dart Station. This provides access to several areas in North and South Dublin. It is approximately 800m (c. 10-minutes walking) from the Proposed Development to Harmonstown Dart Station and 950m (c. 12-minutes walking) to Killester Dart Station.

The frequency of rail services from Harmonstown Dart Station, which is the closest stop to the Proposed Development, is detailed in Table 5-6.

Table 5-6: Frequency of Rail Services from Harmonstown Dart Station

Direction	Time of Week	Frequency
Newry/Howth-Dublin-Bray/Gorey	Monday to Friday	06:15 to 00:07 approximately every 10 to 20 minutes
	Saturday	07:00 to 00:10 approximately every 10 to 15 minutes
	Sunday	09:15 to 00:01 approximately every 10 to 30 minutes
Gorey/Bray - Dublin - Howth/Newry	Monday to Friday	06:32 to 23:59 approximately every 10 to 20 minutes
	Saturday	06:33 to 23:58 approximately every 10 to 15 minutes
	Sunday	09:52 to 00:05 approximately every 20 to 30 minutes

5.4.3 Pedestrian Facilities

The surrounding pedestrian network provides pathways both sides of the road and pedestrian crossings where necessary. The existing facilities along Sybil Hill Road have pedestrian pathways separated by grass verges either side of the road there is also pathways though St. Anne’s Park to the West of the Proposed Development.

Along the Howth Road there is no grass verge between the pedestrian pathways and the road, however, there are bus lanes for the majority of the road. There are also several signalised pedestrian crossings available to cross the road.

5.4.4 Cycling Facilities

There are cycle lanes surrounding the Proposed Development situated along Howth Road to the north of the site. This cycle lane continues into the city centre and north towards Howth.

The Greater Dublin Area Cycle Network Plan (GDA) proposes to expand the cycle network to provide new connections between zones in the Greater Dublin Area. Directly North of the Proposed Development is a primary road which continues towards the city centre. There will be new secondary routes to the west and south of the development that connect to two Greenways, these are the Santry River Greenway which leads to the North and the East Coast Trail which travels south towards the city centre.

5.5 Sport, Recreation and Open Space

Recreational and open spaces are an essential part of creating and promoting healthy and social communities. The Study Area is well served by sports clubs, parks, gardens and public walks.

The most notable amenities in the direct vicinity of the Proposed Development are located within St. Anne's Park. The park is the second largest municipal park in Dublin. As well as extensive walks and green areas, the park contains numerous sporting facilities, including extensive GAA and soccer playing fields, tennis and golf. The park also contains non-sport amenities. Bisected by a small river, the park features an artificial pond and a number of follies, a large rose garden, a fine collection of trees with walks, a playground, cafe and recreational areas. The park also hosts markets on some weekends.

The Proposed Development is located 1.13km from North Bull Island at the area known as Dollymount. This island contains the amenity of Dollymount Strand as well as two golf courses. The island is also famous for its wildlife, and the lagoon and mudflats between the island and the mainland is a favourite location for birdwatching.

The Proposed Development is in close proximity to the seafront, with a promenade running continuously from Alfie Byrne Road to the wooden bridge at Dollymount. The seafront is highly popular with runners, walkers, sailors and cyclists.

Table 5-7 details some of the remaining existing sports and recreation spaces.

Table 5-7: Sports, Recreation and Open Spaces in the Study Area

Type	Facility
Sports Centres	Clontarf GAA St. Vincent's GAA St Annes Tennis Courts Clontarf Rugby Club St Pauls Artane Football Club Clontarf Yacht & Boat Club Clontarf Junior Swimming Club St. Pauls Karate Club Killester Tae Kwon-Do Club
Golf Courses	The Royal Dublin Golf Club St. Annes Golf Club Clontarf Golf Club
Parks, Playgrounds and Gardens	St. Annes Park St. Annes Park Playground St. Annes Dog Park Edenmore Playground Fairview Park Playground Raheny Rose Garden St Annes Walled Garden Allotment Chinese Suzhou Garden Millennium Arboretum McAuley Park Mayfield Park
Open Spaces	Dollymount Strand Clontarf Promenade North Bull Island
Other	The Yoga Lounge River Holistic Centre Scoil Rince Cill Easra Performers Ireland Ellie Cleary Dance Academy

The site has been left as unused grasslands since November 2017. The previous use of the site was open space associated with the adjacent St. Paul's College however these lands were not deemed necessary for the long-term operation of the school and were sold to the applicant in 2015. The Proposed Development will retain the existing open space use of the site in the form of 6 playing pitches which will be taken charge of by Dublin City Council and managed accordingly. This will ensure the continuation of playing pitches on the lands for public community use.

5.6 Public Safety

In an event where emergency services are required it is important that medical services, garda stations, fire stations or coast guard rescue are located nearby. The services relating to public safety within the Study Area are listed below.

- Killbarrack Fire Station
- Clontarf Hospital
- St Joseph's Hospital Raheny
- Beaumont Hospital
- Clontarf Garda Station
- Raheny District Garda Station
- Coolock Garda Station
- Irish Coast Guard Unit (Howth 9km and Dun Laoghaire 5km)

5.7 Health and Wellbeing

There are a wide range of health and wellbeing facilities in the Study Area which are detailed in Table 5-8.

Table 5-8: health and Wellbeing Services in the Study Area

Type	Facility
Medical Centre	Clontarf Medical Centre Vernon Medical Centre Raheny Medical Centric health The Avenue Family Practise
Pharmacy	Brookwood Pharmacy Allcare pharmacy Evelyn Brady Pharmacy Magners Pharmacy Pharmacy O'Regan Clontarf Pharmacy Foleys of Clontarf
Dental	Clinical Dental Technicians Association Ireland Raheny Dental Centre SOS Dental O'Connor's Dental Practice Raheny Orthodontics Howth Road Dental Maypark Dental Practice Daragh Fagan Dental Surgery
Physiotherapy	Lisa Kernan & Associates (physiotherapy and hydrotherapy) Brookwood Physiotherapy & Pilates Clinic Susan Quin Physiotherapy Raheny D3 Physio Dublin North Physiotherapy Clinic Clontarf Physiotherapy & Sports Injury Clinic

5.8 Art and Culture

The following arts and cultural facilities have been identified in the Study Area which provide a variety of uses to the community.

- ODEON Coolock and The Plex cinemas are located 2.9 km from the site
- The Viking Theatre
- Raheny Piano School
- Derrada Drama

5.9 Religious and Faith Institutions

Religious institutes and places of worship are an important provision in communities. Raheny is a long-established town in County Dublin and has a range of religious facilities. The majority of religious institutions within the Study Area are Christian places of worship however there are Jewish, Muslim and Hindu places of worship outside the Study Area which are accessible by car or public transport.

- St. Gabriel's Parish Church (Dollymount) 1.6km
- Clontarf Parish, Church of St. John the Baptist 1.5km
- St Brigid's Church, Killester 1.4km
- All Saints' Church 1.4km
- Our Lady of Mercy Catholic Church 1.4km
- Raheny Parish Church 1.7km
- Our Lady of Consolation 2.4km
- Dublin City Masjid (City Mosque) 5.7km
- Sultan Abdülmecit Mosque / Education Centre 6.1km
- FAIZAN-E-MADINAH (Dublin) 5.6km
- Dublin ISKCON Temple (Hindu) 6.3km
- Synagogue House, Rathmines 10.5km

5.10 Retail

The Study Area is well served by convenience stores, supermarkets and other retail services.

Artane Shopping Centre is located just outside the Study Area (2.7km from the Proposed Development), features 21 shops / units and is 84,961sqq ft in size. The shopping centre includes a pharmacy, credit union, several clothing stores, a Tesco supermarket, post office and other food stores. Other retail services include SuperValu Raheny, SuperValu Killester, Centra Killester, Centra Rosemount and Applegreen Killester.

A mix of other retail uses were recorded in the Study Area including;

- Bank
- Credit Union
- Hardware store
- Flower shop

- Pharmacy
- Beauty Clinic
- Coffee Shops
- Restaurant, Café and Fast Food
- Clothing Store
- Barbers and Hairdresser
- Off-Licence

5.11 Community Support & Amenities

Raheny has a strong network of community groups and clubs, which are voluntary groups. These local community groups include the Raheny Heritage Society, Tidy Village Group, Raheny Drama and Variety Group, Raheny Toastmasters, Raheny St. John Ambulance Division, Raheny Order of Malta Unit, Raheny Community First Responders and some church-related groups, such as the local conference of the Society of St. Vincent de Paul.

With a strong sense of community in nearby Clontarf, there is a wide variety of community groups that are extremely active including Foroige Youth Club, Clontarf Hockey Club, Coast Road Runners, Clontarf Parish Tennis Club, St. Pauls Karate Club, Clontarf Junior Swimming Club, Metropolitan School of Dance and various Baby Toddler Playgroups.

The St. Anne's Residents' Association (SARA), with some allied bodies, operates a community hall on All Saints' Drive, while the Grange Woodbine Association has hall facilities on Station Road. Clontarf Residents' Association is located in Clontarf East.

Raheny and Clontarf has various girl guides and scout organisations. Raheny Scout Group, a unit of Scouting Ireland, meet at their den on the banks of the Santry River, opposite the Church of Our Lady Mother of Divine Grace on the Howth Road. Raheny Guides, also known as Buion an Leanbh Prague of the Catholic Guides of Ireland, have been in existence since 1966, meeting weekly. The Cygnets (age 5–7) meet in the CARA Hall and the Brigins (age 6–10), Guides (age 10–16) and Rangers (age 14–19) meet in Scoil Aine School Hall. Clontarf has a longstanding Clontarf Scout Troop, which was established in 1931. Clontarf also has two Boys' Brigade companies - the 12th, attached to Clontarf Church of Ireland, and the 39th, attached to the Presbyterian parish, and a Girls' Brigade company (5th Company Clontarf Presbyterian) attached to Clontarf & Scots Presbyterian Church.

The community library based in Raheny assists and facilitates several other groups in the area including conversation exchange group (where people can practice language skills with native speakers through conversation), creative writers' group, adult book club, film club, GIY (Grow it Yourself) Group, knitting circle and whist group. Children's activities include a children's book club, a children's creative writing group and a toddler group.

The library also provides useful facilities to the local residents, including free broadband and wireless internet service, self-service printing/scanning, photocopying, Microsoft Office suite available, study space, children's learning zone, garden, citizen's information centre, large print book collection, daily newspapers as well as application forms for motor tax, passport etc. and a community noticeboard / information. The nearby Marino Library also offers these services. There are also several Post Offices in the area (Raheny, Harmonstown, Killester, Vernon Avenue, Brookwood Rise).

The creche facility as part of the Proposed Development will offer the ECCE scheme which provides state funded childcare to all children within the eligible age range prior to commencing primary school. The proposed creche and the ECCE scheme represents an important community amenity as it provides parents and children access to important educational services regardless of their financial or employment status.

6 CONCLUSION

The purpose of this Social Infrastructure Report is to determine the capacity of the area surrounding the Proposed Development to facilitate the future residents. The Study Area consisted of an approximate 2km radius around the Proposed Development and included the suburbs or Raheny, Clontarf, Artane and Killester taking in areas of Dublin 3 and Dublin 5.

The majority of the Clontarf Local Electoral Area population in 2016 was of working age (19-64 years old) (63%) with 20% aged 0-18 and the remaining 17% aged 65 years and over.

The majority of people aged 15+ were at work (60.6%) and 11% of people were pupils or at school.

This Social Infrastructure Report has identified the level of existing social infrastructure within an approximate 2km Study Area of the Proposed Development and the ability of this infrastructure to support the future residents. The Study Area is well served by existing education, childcare, nursing home. Sports / recreation, retail, religious institutes and medical facilities.

In addition to the existing facilities, the Proposed Development will provide 580 no. residential units along with a 100-bed nursing home and a creche facility with capacity for 85 children. The creche will offer the ECCE scheme which provides state funded childcare prior to commencing primary school. These new uses will add to the capacity of the existing services and facilities in the area.

Taking into account the social infrastructure in the area it is considered that the future population of the Proposed Development will be supported by the existing social infrastructure along with the additional creche and nursing home facilities as part of the Proposed Development.

The analysis of the existing infrastructure capacity in this Social Infrastructure Report deems the Social Infrastructure of the area to be suitable to accommodate the characteristics of the Proposed Development.

7 References

Central Statistics Office (2016)

Dublin City Development Plan 2016–2022

Early Childhood Care and Education Programme (ECCE), Department of Children, Equality, Disability, Integration and Youth (July, 2022) Available at: https://www.gov.ie/en/publication/2459ee-early-childhood-care-and-education-programme-ecce/

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Guidelines for Planning Authorities on Sustainable Residential Development in Urban Areas (2009)

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Patronage Assessment Report (Killester_Raheny_Clontarf), Department of Education and Skills (2019)

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Sustainable Urban Housing: Design Standards for New Apartments - Guidelines for Planning Authorities (2020)

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Appendix C Amplitude Acoustics Letter

Friday, 29 July 2022

Project number: D220724
Reference: D220724PL1_R0

Shaun Thorpe
Marlet
O'Connell Bridge House,
27/28 D'Olier Street,
Dublin 2
D02 RR99
Ireland

Dear Shaun,

Foxlands
Acoustic Consultancy

I can confirm that Amplitude Acoustics have been engaged as the Acoustic Consultants on Foxlands. As part of the post planning pre construction acoustic design Amplitude will be undertaking site measurements, an inward noise impact assessment, operational noise assessment and construction noise and vibration assessment this is likely to include the following:

1 Inward Noise Impact and Vibration Screening

- Undertake baseline noise survey with an attended and unattended noise survey.
- Develop a three-dimensional computational noise model of the updated site layout including proposed buildings and external amenity areas.
- Review one (1) set of architectural documentation and the existing and proposed constructions—in particular the roof & ceiling, walls, doors and windows.
- Based on the predicted traffic noise levels at the façade, and the proposed construction details of the buildings, determine the internal noise levels within the development and compare with:
    - Local County Council Noise Action Plan
    - BS 8233:2014
    - ProPG 2017
- Undertake vibration screening assessment from rail vibration.
- If required, provide advice and guidance on suitable constructions to achieve the internal noise criteria and external amenity noise levels.
- Provide guidance on any further measures required for vibration control following the screening assessment.

2 Construction Noise and Vibration

- Predict construction noise levels at the facades of the closest noise-sensitive locations to the site associated with the proposed works. (Proposed construction schedule and likely equipment to be provided by the client)
- Source noise levels will be obtained from BS 5228: Part 1: 2008+A1:2014.
- Assess the noise impact of the proposed construction activity in accordance with BS 5228:2009 Noise Control on Construction and Open Sites.
- Vibration impact will be assessed BS 5228 Part 2:2009 Vibration Control on Construction and Open Sites.

3 Operational Noise

- Review the noise sources introduced by the development including (i) traffic generated on-site (ii) mechanical services (information on noise sources to be provided by client to Amplitude)
- Where source information is available, predict the noise impact of the proposed development on the nearby residential receivers with regard to the existing background noise levels in accordance with on *BS 4142:2014 Methods for rating and assessing industrial and commercial sound.* Note: All predictions will be conducted in accordance with the guidance contained in ISO 9613: Acoustics – Attenuation of sound outdoors – Part 2: General method of calculation.
- Provide noise mitigation advice where predicted noise levels exceed the environmental noise criteria.
- Prepare a report outlining the above in a suitable format for submission to the relevant authority and design team.

Please let me know if you have any questions on the above.

Yours sincerely,

James Cousins BSc (Hons) Pg Cert (Const Law) Pg Dip (IOA) MIEI MIOA
Associate Director
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Appendix D Habitat Map

Legend:

Site Boundary
Badger Sett & Mound Area

Linear Habitats

BL1 Old stone wall
FW4 Ditch
WL2 Treelines

Habitats

BL3 Built land
GA2 Amenity Grassland
WD1 Mixed BL Woodland
GS2 Dry Meadows
WD5 Scattered trees/Park
WS1 Scrub

Google Hybrid

Project:

Proposed Mix Use Development on lands east of St Paul's College, Sybil Hill Road, Raheny, Dublin 5

Client:

Raheny 3 Limited Partnership

Title:

Habitat Map

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Drawn By: LG	**Projection:** IRENET95 / Irish Transverse Mercator
Checked: JD	
Date: 07/07/2022	**Scale @ A4:** 1:2232

Notes:

Site boundaries shown are for illustration purposes only and do not represent legal or exact boundaries

Enviroguide CONSULTING

Appendix E Badger Assessment Report

A Badger Assessment of Lands Proposed for Development at Foxlands, Adjoining St. Paul's School and St. Anne's Park, Clontarf

Brian Keeley BSc. Hons in Zool.

August 2022

Introduction

Most of Ireland's mammals enjoy protection under the Wildlife Act (1976) and the more recent updating of this legislation (Wildlife (Amendment) Act 2000, S.I. No. 94 of 1997, S.I. No. 378 of 2005, European Communities (Natural Habitats) (Amendment) Regulations, 2005) and consolidated by S.I. No. 477 of 2011 European Communities (Birds And Natural Habitats) Regulations 2011. In conjunction with the enactment of the Habitats Directive into Irish legislation, all native mustelid species and bat species are protected with further protection given to otters and lesser horseshoe bats.

Determining the mammal fauna of an area may involve a high level of assessment if the aim of the survey is to catalogue all mammals but this is too detailed for the aim of creating mitigation for a proposed construction project. This assessment is specific to the presence of ground mammals within lands proposed for the construction of housing and all associated structures and surfaces. The survey undertaken within the site allows a targeting of mitigation measures to the appropriate or most efficient sites to prevent accidental death or injury and to determine if it would be possible to provide safe passage across long-established routes through a new development.

Fieldwork for the current report on badger occupancy was carried out by Brian Keeley, an ecologist with over a quarter of a century of fieldwork experience.

This report addresses the main issues that would affect the badger fauna of the immediate area considered in this assessment and created by construction within the lands concerned.

Construction activities and subsequent occupancy of the housing proposed and the associated infrastructure may create a number of significant short-term and long-term risks for resident badger populations, in addition to impacts upon other vertebrates and invertebrates. The proposal may involve the removal of key features of the surrounding environment and of the habitats of badgers and other mammal species, such as existing tracks and more significantly badger dwellings. The most damaging operation is the potential for the destruction of badger dwellings (setts) during the vegetation clearance and early earthworks. The clearance of hedgerow or scrub and trees poses the risk of the removal of the badgers' home burrow and the associated burrows (all of which are known as setts) that are used seasonally or occasionally throughout the year.

In winter, this is especially risky if the sett is not identified before tree felling or hedgerow removal operations, as this is the time when badger cubs are born. In the classification used in this report, setts are considered to fall into four categories, which are best elaborated by longterm studies but can be interpreted to a relatively good accuracy in terms of status based on basic observations. Setts may be under threat from construction if they lie directly in the line of a proposed building. Setts outside of this land take area may also be threatened with damage from the normal activities of the heavy plant equipment required to build the project. For example, if a badger sett entrance were located outside of the land take of a site but led to a system of tunnels that lay under the working area of the heavy plant, there is a clear risk that the tunnels would be crushed under the repeated movement of equipment.

These tunnels may occasionally go as deep as two metres underground but are also liable to surface to shallower depth to avoid rocky substrate or water. Thus, badger setts may be affected by the immediate impact upon them from the excavation and removal of the soil within which they are established or by the indirect destruction of tunnels that lie under the construction corridor of the road. Badger sett classification is dealt with in the Appendices to this report.

Methodology

Badgers

The survey for the presence of badgers within the sett identified and investigated by Enviroguide in December 2021 (10th December with filming in February 2022 and a geophysical investigation in April 2022) was undertaken between July 1st and August 3rd 2022 and involving examining all hedgerow, scrub, mounds, and other areas where setts were possible from ditches, drains, dense vegetation to suitable slopes and banks. A motion-activated camera was installed on July 18th and remained in place and recorded up to August 3rd 2022.

In addition to the proposed development footprint, adjoining lands in St. Anne's Park were examined. All gateways, tracks, fording points etc were checked for badger prints. Barbed wire was checked for snagged hairs of this species.

Survey constraints

The date was not ideal for identifying features such as badger latrines but as the key focus of this assessment was the level of activity and nature of the sett, the timing for the badger survey was perfect. The height and density of vegetation was a hindrance to access but did not affect the success of the assessment's central aim.

Results of the assessment of the lands for badgers

Badgers

There are two badger setts within the footprint of the proposal. There is a substantial main sett within the footprint that is accessed by two enormous entrances and a third less active entrance in addition to a number of lesser entrances. The main entrance for the sett is well trampled and the soil outside is compacted from badger activity at the sett entrance and from entry and exit. There are large volumes of cast-out bedding and very obvious paths leading from the sett. This includes paths towards St. Anne's Park, towards the neighbouring sett and into the Foxlands site, The camera installed at the sett entrance recorded the presence of three badger cubs (weaned) and two adults. In all, five badgers are present within the sett. The sett is a breeding main sett and the badgers successfully bred in 2022. The sett is connected by a clear path to an annexe sett with two obvious entrances of which one is the more active and the main entry point for badgers.

Paths lead throughout the scrub on the mound and from here into St. Anne's Park as well as to the rear of the mound and through the rest of the lands at Foxlands. A path runs along the perimeter wall in an eastern direction before exiting again into St. Anne's Park (see photos).

A badger emerged from the sett entrance at 19.00 hours on August 3rd while the sett was being assessed before immediately returning to the sett.

Potential Impacts from The Proposed Construction

Loss of two badger setts

Two badger setts would be lost through direct damage and disturbance. One of these is a substantial main sett that is an active breeding sett and the second is a directly connected and utilised annexe sett.

In addition to this, there is a risk of badger injury or death during sett excavation where a proper exclusion procedure is not undertaken.

Loss of commuting corridor

There will be a loss of unfettered movement for badgers and a loss of vegetation from the site including the removal of mature trees and grassland (former sports pitches and associated lands). Walls and fencing may affect free movement of badgers through the site in addition to human presence, pet dogs and other disturbances. This is a long-term to permanent severe negative impact for the local badgers.

Loss of feeding area

There will be an impact upon the feeding activity of badgers through the introduction of the housing. Foraging in areas that will be close to human activity is likely to be hampered or abandoned. This is a long-term to permanent slight negative impact for badgers.

Increased Disturbance from humans and dogs

The presence of humans within a currently unoccupied site and the associated introduction of dogs will lead to increased disturbance for the resident badgers. This will reduce or even remove the ability of badgers to forage successfully within the site going forward and at worst would lead to injury from dog attack.

Cumulative impacts of the above

There is a loss of foraging area through the space taken up by the housing and all associated infrastructure and through the loss of scrub and grassland within the site.

There is a loss of tree cover that will affect badgers by reducing feeding and commuting areas. This is unlikely to have a direct impact on the status of this species, but it is contributory in a minor way to an overall diminution in habitat availability in this area of Dublin. The presence of St. Anne’s Park will sustain areas of feeding while there will be the loss of the breeding sett and adjoining sett.

Proposed Mitigation

Construction of artificial sett in adjoining lands

The loss of the setts may be partially countered by the construction of a main sett within the site or nearby lands. It is proposed that one of two options for the location of an artificial sett are available. There is an amenity area towards the north-eastern corner of the site within which a 15 metre X 15 metre area should be earmarked for the incorporation of an artificial sett with associated scrub to prevent disturbance from residents and passersby. Secondly, there is a highly suitable area to the rear of The Meadows within St. Anne’s Park that would be close to the existing setts but outside of the development area (see final image in Appendices for suggested locations). This is Dublin City Council lands and this sett could only be constructed with the permission of Dublin City Council. The sett would be accessed by six entrances and would require a minimum of six chambers to accommodate a breeding group of badgers.

Construction of the artificial sett must not place existing setts in danger. All construction equipment must remain a minimum of 30 metres (up to 50 metres where there is potential for chambers or tunnels) from all existing (naturally constructed) sett entrances during the operation.

Exclusion and Excavation of Setts With NPWS Approval

Exclusion of the existing setts must be undertaken with NPWS approval and would be supervised by a badger specialist and must include monitoring of the procedure to ensure that badgers have fully evacuated the sett prior to excavation. A badger specialist must supervise excavation. Should a badger be discovered during this operation, NPWS must be advised immediately and all excavation must cease until it is agreed with NPWS that it may continue.

No exclusion shall commence in advance of the completion of the artificial sett.

No heavy plant within 30 metres of a badger sett

As there is the possibility that tunnels would be destroyed by movement of heavy plant over the ground above them, it is essential that no heavy plant cross within 30 metres of a sett entrance (where there is potential for chambers or tunnels beyond this, a 50 metre distance should be observed). This will ensure that setts are not damaged and that badgers are not inadvertently crushed during construction.

No light plant within 20 metres of a badger sett

In the interim distance of 20 metres to 30 metres from the setts, it is safe for light plant to operate within the 20 metre to 30 metre zone from each sett entrance. This may be sufficient for sett construction.

Time of year of construction operations

Timing of construction shall avoid disturbance to the setts during the period December to July as this is a breeding sett.

No illumination of badger setts

All lighting shall avoid illumination of the setts or any alternative setts installed within adjoining lands.

IMPACTS AFTER MITIGATION

There will be substantial changes to the badger use of the site. This will see a loss of two setts including the breeding sett and neighbouring sett and significant disruption to the foraging area. It is proposed that the artificial sett may provide an alternative to the main sett and this would see a loss of an annexe sett in addition to considerable disruption through the removal of the two setts. There are opportunities for continued foraging with St. Anne's Park. The loss of feeding will be moderate and may not affect the conservation status of badgers.

Badgers will be disrupted by the construction and occupancy of housing but with proper mitigation implementation should be free to forage and commute in the surrounding area and through the site.

The removal of the two setts may affect the potential for badgers to exploit the surrounding area to the same degree as the current situation.

Appendix

Badger sett classification

Using the most traditional description of badger ecology, the basic sett type within which badgers are typically present throughout the year is the main sett. This is almost always the sett within which cubs are born. Bedding outside the entrance to these setts often identifies their use as such and paw prints and dung pits or latrines nearby also assist in their categorisation. There are typically several entrances to a main sett, some of which may be disused. Paths leading from the main sett are often very easy to trace for some distance.

Annexe setts are similar in construction to main setts and are typically accessed by several entrances. They are often discernibly connected to a main sett by well-worn paths, which is within 150 metres of the annexe sett. Badgers do not necessarily use this type of sett throughout the year, and they may be inactive at the time of any short-term study.

Subsidiary setts are again not always active throughout the year. There may be several entrances to the sett, and they are not clearly associated with any other sett.

The last type of sett, the outlier sett, may only have one entrance and has no path leading to it. This type of sett is only sporadically used and may even be in areas subject to flooding or seasonally unsuitable to badger use. These setts may be overlooked if they have remained inactive for several weeks and this may be true of such setts in early winter during which time this survey was carried out.

Badger family including three cubs July 2022


16 ℃ 60 ℉ 26/07/2022 05:20:19 0775


16 ℃ 60 ℉ 26/07/2022 05:17:04 0769


13 °C 55 °F 26/07/2022 05:04:23 0727


19 °C 66 °F 25/07/2022 04:59:20 0683


17 ℃ 62 ℉ 20/07/2022 21:01:34 0135


17 ℃ 62 ℉ 20/07/2022 04:49:28 0117

Badger sett as seen from St. Anne's Park

Tracks from the extensive sett entrances

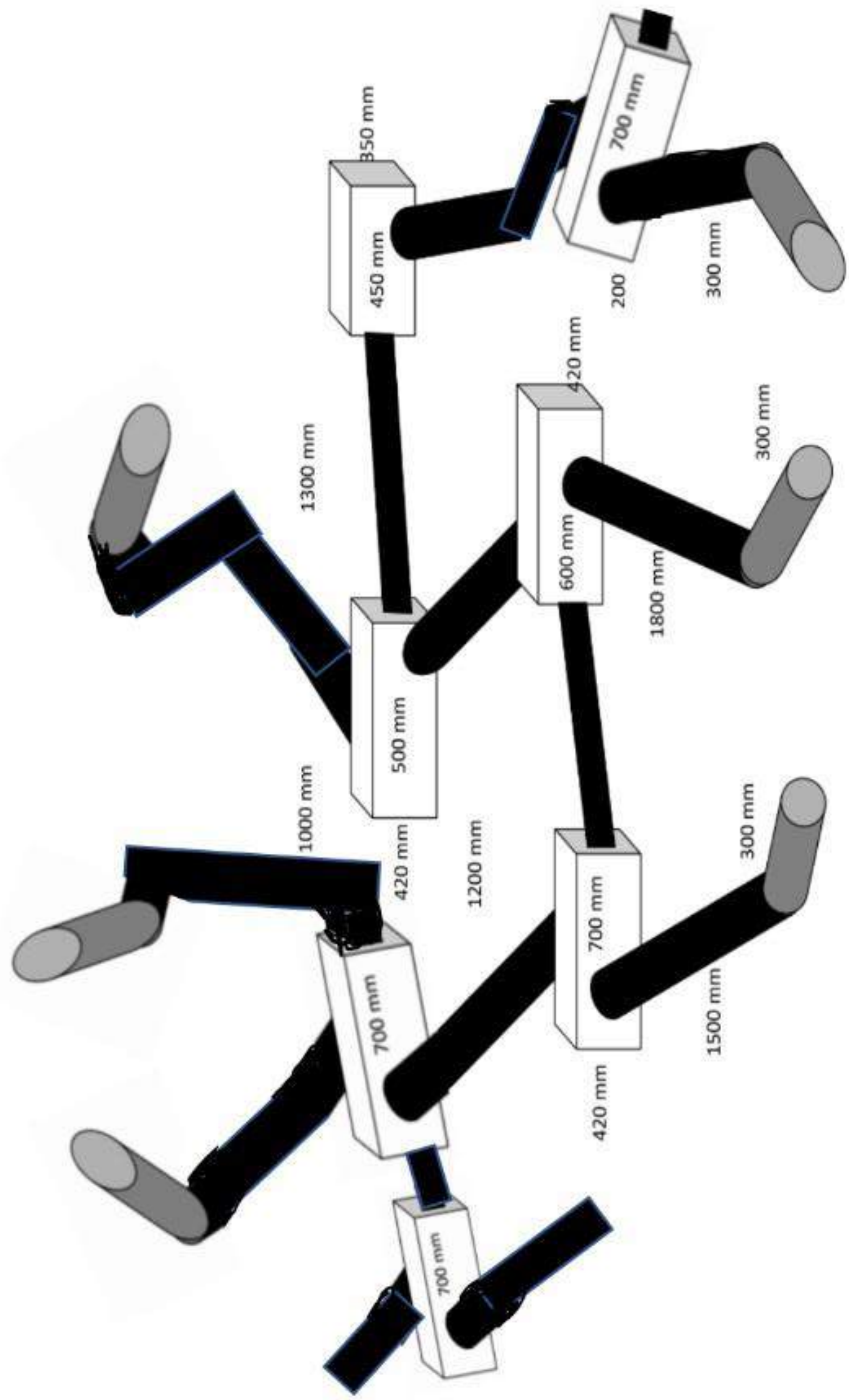
Sett entrances

Bsdger pw prints in loose soil and tracks leading under the perimeter fence into the Park

Annexe sett entrance

Badger tracks and foraging in June 2022

Badger tracks and signs in July (left) and August (right) 2022



Schematic representation of an artificial sett design with 7 chambers and 6 entrances. Three open tunnels would allow expansion of the sett following occupation

Approximate badger setts location (grey arrow in (a) and in white oval in (b)), badger tracks (white arrows) and proposed area for artificial sett (blue area in (a) and yellow oval outside of the site in (b))

Appendix F Bat Activity Maps & Bat Survey Metadata

Legend:

Site Boundary
Moderate-high value treelines (foraging and commuting)
Route Walked

Species Records

Nyctalus leisleri
Pipistrellus pipistrellus
Pipistrellus pygmaeus

Project:

Mixed-use development on lands east of St Paul's College, Sybil Hill Road, Raheny, Dublin 5

Client:

Raheny 3 Limited Partnership

Title:

Bat activity map (07/09/2021)

Enviroguide CONSULTING

Drawn By: BT	Projection: IRENET95/Irish Transverse Mercator
Checked: LG	
Date: 10/08/2022	Scale @ A4: 1:2401

Notes:

Site boundaries shown are for illustration purposes only and do not represent legal or exact boundaries

Legend:

- Site Boundary
- Moderate-high value treelines (foraging and commuting)
- Moderate value treelines (foraging and commuting)
- Route Walked
- Potential Bat Roost Structure
- Potential Bat Roost Trees

Species Records

- Nyctalus leisleri
- Pipistrellus nathusii
- Pipistrellus pipistrellus
- Pipistrellus pygmaeus
- Pipistrellus spec.
- Plecotus auritus

Project:

Mixed-use development on lands east of St Paul's College, Sybil Hill Road, Raheny, Dublin 5

Client:

Raheny 3 Limited Partnership

Title:

Bat activity map (26/07/2022)

Enviroguide CONSULTING

Drawn By: BT	Projection: IRENET95/Irish Transverse Mercator
Checked: LG	
Date: 10/08/2022	Scale @ A4: 1:2401

Notes:

Site boundaries shown are for illustration purposes only and do not represent legal or exact boundaries

Bat Detector Metadata from BatExplorer 2.1 for dusk transect activity surveys on 7th of September 2021 and 26th of July 2022.

Recording	Timestamp	Species Text	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Latitude [WGS84]	Longitude [WGS84]
7th of September 2021									
2180003	07/09/2021 18:48	*Nyctalus leisleri*	20.9	22.4	19.6	18	393	53.37488	-6.19025
2180004	07/09/2021 18:48	*Nyctalus leisleri*	22.4	25.2	21.4	15	272	53.37504	-6.19041
2180005	07/09/2021 18:52	*Nyctalus leisleri*	22	23	20.5	9.1	481	53.37547	-6.19187
2180006	07/09/2021 18:54	*Nyctalus leisleri*	22.6	24.1	21.7	15	291	53.37526	-6.19084
2180007	07/09/2021 18:54	*Nyctalus leisleri*	22.1	23	21.4	13.3	475	53.37525	-6.19079
2180008	07/09/2021 18:54	*Nyctalus leisleri*	22.7	23.3	21.5	16.9	431	53.37526	-6.19078
2180009	07/09/2021 18:54	*Nyctalus leisleri*	22.5	23.5	21.5	14	430	53.37524	-6.19073
2180010	07/09/2021 18:54	*Nyctalus leisleri*	21.8	22.7	21	17.9	302	53.37524	-6.19074
2180011	07/09/2021 18:54	*Nyctalus leisleri*	22.6	23.7	21.6	10.3	316	53.37523	-6.19072
2180012	07/09/2021 18:55	*Nyctalus leisleri*	22.2	22.8	21.3	7	390	53.37523	-6.19073
2180013	07/09/2021 18:56	*Nyctalus leisleri*	21.8	23.2	18.9	9.9	200	53.37502	-6.1902
02180014_1	07/09/2021 18:56	*Nyctalus leisleri*	22.1	22.8	20.7	16	266	53.37499	-6.19014
02180014_2	07/09/2021 18:56	*Nyctalus leisleri*	22	23.2	20.5	18	232	53.37499	-6.19014
2180015	07/09/2021 19:00	*Nyctalus leisleri*	24.8	26.4	22.9	3.8	179	53.37401	-6.18743
2180016	07/09/2021 19:00	*Nyctalus leisleri*	23.6	24.1	22.2	11.2	428	53.37341	-6.18748

Recording	Timestamp	Species Text	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Latitude [WGS84]	Longitude [WGS84]
2180017	07/09/2021 19:00	*Nyctalus leisleri*	23.3	24	22.5	8.8	338	53.37337	-6.18749
2180019	07/09/2021 19:16	*Nyctalus leisleri*	20.5	21.3	19.6	11.1	147	53.37221	-6.18764
2180020	07/09/2021 19:28	*Pipistrellus pygmaeus*	55.5	79.7	54.4	6	80	53.37451	-6.18774
2180021	07/09/2021 19:29	*Pipistrellus pygmaeus*	55.8	65.3	55	5	80	53.37448	-6.18768
2180022	07/09/2021 19:31	*Pipistrellus pipistrellus*	48.5	55.9	47.8	3	75	53.37343	-6.18746
2180023	07/09/2021 19:31	*Pipistrellus pipistrellus*	48	57.1	47.3	5	100	53.37342	-6.18749
2180024	07/09/2021 19:31	*Pipistrellus pipistrellus*	49	61.4	48	3	80	53.37342	-6.1875
2180025	07/09/2021 19:31	*Pipistrellus pipistrellus*	48.1	57.8	47.6	4	90	53.37341	-6.18748
2180026	07/09/2021 19:32	*Pipistrellus pipistrellus*	48.4	61.7	47.8	4	90	53.37336	-6.18747
2180027	07/09/2021 19:32	*Pipistrellus pygmaeus*	48.4	77	47.6	5	90	53.37334	-6.18748
2180028	07/09/2021 19:34	*Pipistrellus pygmaeus*	55.6	63.1	54.9	3	70	53.37217	-6.1876
2180029	07/09/2021 19:36	*Pipistrellus pygmaeus*	52.2	58.9	51.6	3	76	53.372	-6.1894
2180030	07/09/2021 19:37	*Pipistrellus pygmaeus*	55.1	76.3	54.1	4	85	53.37208	-6.19087
2180031	07/09/2021 19:45	*Nyctalus leisleri*	24	24.4	23.3	2.7	0	53.37416	-6.18724
2180032	07/09/2021 19:54	*Nyctalus leisleri*	24.8	26.4	24	8.8	222	53.37194	-6.18756
2180033	07/09/2021 19:55	*Nyctalus leisleri*	24	24.8	23.6	13.9	0	53.37195	-6.18798
2180034	07/09/2021 19:55	*Pipistrellus pipistrellus*	48.5	77.4	47.7	4	85	53.37196	-6.18805

Recording	Timestamp	Species Text	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Latitude [WGS84]	Longitude [WGS84]
2180035	07/09/2021 19:56	*Nyctalus leisleri*	24	25.1	23.3	3.2	0	53.3719	-6.18869
02180036_1	07/09/2021 19:56	*Pipistrellus pygmaeus*	52.9	66.6	51.5	5	90	53.37199	-6.18962
02180036_2	07/09/2021 19:56	*Pipistrellus pygmaeus*	52.6	67.9	51.7	5	90	53.37199	-6.18962
2180038	07/09/2021 19:57	*Nyctalus leisleri*	24.8	27.3	23.9	8.7	517	53.37211	-6.1908
2180039	07/09/2021 19:57	*Nyctalus leisleri*	24.8	26.4	24.1	7.5	349	53.37212	-6.19084
2180041	07/09/2021 19:58	*Nyctalus leisleri*	24	24.4	24	6.4	0	53.37218	-6.19189
26th July 2022									
2180007	26/07/2022 21:46	*Nyctalus leisleri*	20.8	21.2	20.3	12.2	396	53.37358	-6.19179
2180008	26/07/2022 21:53	*Pipistrellus pipistrellus*	46.8	59.7	45.6	4	90	53.37357	-6.19176
2180009	26/07/2022 21:53	*Pipistrellus pipistrellus*	48.4	72.8	47.4	4	94	53.37358	-6.19175
2180010	26/07/2022 21:54	*Pipistrellus pipistrellus*	46.1	59.7	45.3	6.2	190	53.37356	-6.19175
2180011	26/07/2022 21:54	*Pipistrellus pipistrellus*	46.5	54.8	45.2	4	94	53.37357	-6.19175
2180012	26/07/2022 21:57	*Pipistrellus nathusii*	42	48.5	39.9	5	96	53.37357	-6.19178
2180013	26/07/2022 21:57	*Pipistrellus pipistrellus*	44.8	50.7	43.7	6	96	53.37356	-6.19177
2180014	26/07/2022 21:57	*Pipistrellus pipistrellus*	44.7	48.4	43.9	6	100	53.37357	-6.19177
2180015	26/07/2022 21:57	*Pipistrellus pipistrellus*	45.3	54.9	44.1	8	95	53.37357	-6.19177
2180016	26/07/2022 21:58	*Pipistrellus pipistrellus*	45.7	53.2	44.5	4.9	263	53.37357	-6.19178

Recording	Timestamp	Species Text	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Latitude [WGS84]	Longitude [WGS84]
2180017	26/07/2022 21:58	*Pipistrellus pipistrellus*	45.8	50.3	44.6	4	100	53.37357	-6.19178
2180018	26/07/2022 21:59	*Pipistrellus pipistrellus*	46.6	51.9	45.4	3	70	53.37357	-6.19178
2180019	26/07/2022 21:59	*Pipistrellus pipistrellus*	46.2	54.8	44.9	3	94	53.37357	-6.19178
2180020	26/07/2022 21:59	*Pipistrellus pipistrellus*	45.5	54.9	44.1	5	90	53.37357	-6.19176
2180021	26/07/2022 21:59	*Pipistrellus pipistrellus*	45.4	51.8	43.4	5	100	53.37356	-6.19172
2180022	26/07/2022 21:59	*Pipistrellus pipistrellus*	44.4	49.8	43.9	3	122	53.37356	-6.19172
2180023	26/07/2022 21:59	*Pipistrellus pipistrellus*	46.2	56	45	3	90	53.37356	-6.19173
2180024	26/07/2022 21:59	*Pipistrellus pipistrellus*	45.2	69.5	44.4	3	90	53.37356	-6.19173
2180025	26/07/2022 22:00	*Pipistrellus pygmaeus*	56.3	61.9	54.3	4.8	67	53.37355	-6.19178
2180027	26/07/2022 22:17	*Pipistrellus pipistrellus*	46.2	54.6	45.7	4	84	53.37362	-6.19121
2180028	26/07/2022 22:18	*Pipistrellus pipistrellus*	45.4	53.9	44.7	6	90	53.37383	-6.19139
2180029	26/07/2022 22:19	*Pipistrellus pipistrellus*	50.7	63.2	49	3	190	53.37398	-6.19157
2180031	26/07/2022 22:26	*Pipistrellus pipistrellus*	45	48.6	44.3	6	176	53.37418	-6.19118
2180032	26/07/2022 22:27	*Pipistrellus pygmaeus*	53.8	68.5	53.1	6	90	53.37417	-6.19119
2180033	26/07/2022 22:30	*Pipistrellus pipistrellus*	47.6	73.9	46.1	5	95	53.37421	-6.19124
2180038	26/07/2022 22:35	*Nyctalus leisleri*	22.9	23.6	22.1	11.2	297	53.3743	-6.19107
02180040_1	26/07/2022 22:35	*Pipistrellus pygmaeus*	59.6	69.9	57.8	3	170	53.3743	-6.19106

Recording	Timestamp	Species Text	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Latitude [WGS84]	Longitude [WGS84]
02180040_2	26/07/2022 22:35	*Pipistrellus pipistrellus*	49.4	55	48	5	361	53.3743	-6.19106
2180041	26/07/2022 22:37	*Nyctalus leisleri*	27.9	29.3	26.8	8	466	53.3744	-6.19098
2180042	26/07/2022 22:37	*Nyctalus leisleri*	23	23.8	22.4	8.7	437	53.37441	-6.19098
2180043	26/07/2022 22:37	*Plecotus auritus*	31.7	40.6	26.7	4	142	53.37449	-6.19091
2180044	26/07/2022 22:42	*Pipistrellus spec.*	50.2	59	49.5	3	85	53.37464	-6.19093
02180045_1	26/07/2022 22:43	*Pipistrellus pygmaeus*	57.9	59.2	57.3	6	170	53.37465	-6.19094
02180045_2	26/07/2022 22:43	*Nyctalus leisleri*	25.1	25.9	24.4	10.7	0	53.37465	-6.19094
2180046	26/07/2022 22:43	*Nyctalus leisleri*	24.7	25.4	23.6	13.3	334	53.37464	-6.19095
2180047	26/07/2022 22:43	*Nyctalus leisleri*	23.9	24.5	23.1	13.3	350	53.37464	-6.19095
2180049	26/07/2022 22:44	*Nyctalus leisleri*	25.5	26.4	24.1	8.7	334	53.37464	-6.19099
2180052	26/07/2022 22:48	*Nyctalus leisleri*	25.5	27.4	24.9	10.1	358	53.37464	-6.1908
2180053	26/07/2022 22:48	*Nyctalus leisleri*	27.6	28.7	25.5	5.1	342	53.37464	-6.1908
2180054	26/07/2022 22:48	*Nyctalus leisleri*	24.5	25.8	23.6	10.6	385	53.37464	-6.1908
2180056	26/07/2022 22:49	*Nyctalus leisleri*	26.9	28.5	25.6	7	110	53.37464	-6.19078
2180057	26/07/2022 22:49	*Nyctalus leisleri*	26.6	28.1	25.4	5.9	399	53.37465	-6.19077
2180058	26/07/2022 22:49	*Nyctalus leisleri*	26.5	27.8	24.6	3.9	499	53.37465	-6.19077
2180063	26/07/2022 23:02	*Nyctalus leisleri*	22.2	22.8	21.5	11.3	396	53.37419	-6.18779

Recording	Timestamp	Species Text	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Latitude [WGS84]	Longitude [WGS84]
2180064	26/07/2022 23:03	*Nyctalus leisleri*	22.8	23.3	22	12.8	281	53.37416	-6.18772
2180065	26/07/2022 23:11	*Nyctalus leisleri*	22.7	23.4	21.9	14.7	498	53.37247	-6.1878
2180066	26/07/2022 23:14	*Pipistrellus pipistrellus*	44.5	54.2	43.1	6	170	53.37214	-6.18809
2180067	26/07/2022 23:16	*Nyctalus leisleri*	24.5	25.5	23.6	13.3	390	53.37219	-6.1884
2180068	26/07/2022 23:16	*Nyctalus leisleri*	22.1	22.7	21.2	16.5	614	53.37219	-6.18841
2180069	26/07/2022 23:17	*Nyctalus leisleri*	24	24.4	23.3	9.6	0	53.37219	-6.18841
2180070	26/07/2022 23:21	*Pipistrellus pipistrellus*	46.4	59.9	45.7	5	180	53.37227	-6.18952
2180071	26/07/2022 23:47	*Pipistrellus spec.*	52.1	54.4	51.4	5.7	171	53.37434	-6.19139

Appendix G Amphibian Report

Amphibian Report
For the Proposed "Foxlands" Development at St. Anne's Park, Clontarf East, Raheny, Dublin 5
DRAFT

Rob Gandola – Herpetological Surveys

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Tel:+353868629113

Executive Summary

This amphibian report has been prepared by R Gandola on behalf of Enviroguide Consulting as part of a planning application for a proposed residential development “Foxlands” on lands at St. Anne’s Park, Clontarf East, Raheny, Dublin 5. This report refers to the amphibian surveys and assessment of the wetland and associated terrestrial habitats undertaken in St. Anne’s Park over the survey period.

The proposed “Foxlands” development site at Raheny is situated within St. Anne’s Park in a suburban part of north Dublin encompassing parts of Clontarf, Killester, Artane and Raheny. The site is approximately 6.7ha in area and consists of former playing fields that have succeeded into rank grassland.

Breeding populations of both the common frog, *Rana temporaria* and the smooth newt, *Lissotriton vulgaris*, are locally extinct in St. Anne’s Park, with the last observed naturally occurring tadpoles of common frog encountered in 2016. The smooth newt has been lost to the park for a number of decades. The status of both species in urban gardens in the immediate vicinity is unknown, however it is likely that common frogs do occupy some of these properties. The habitat available for *L. vulgaris* (the Duck Pond) in its current condition is marginal at best and unlikely to be used. A number of Annex IV listed species also use the Duck Pond for foraging. There is also a small population, consisting of multiple age classes and sizes, of the critically endangered European eel, *Anguilla anguilla*, inhabiting the Duck Pond. The remaining open ditches to the north of Belgrove park and Mount Prospect Avenue are not suitable for native amphibians.

The proposed development is unlikely to have any direct impacts on common frogs or smooth newts as they are not known to occur on the site. Appropriate containment and surface water drainage plans need to be in place as a spillage/pollution event to the Naniken stream could have a catastrophic effect on the Duck Pond and resident wildlife.

LICENCE

All surveys and handling of wildlife was conducted under licence from the National Parks and Wildlife Service No. C05/2021

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THINGS TO CONSIDER WHEN READING THIS REPORT

1. Unless explicitly stated, it would be inappropriate to use the data in this report to infer the total population size of a species detected i.e., any figure provided for a given species is likely to be an underestimate. Tadpole counts are only indication of the presence of a breeding population and can be highly variable from year to year depending on a wide range of factors.

2. Regarding the requirement of licensing for deliberate disturbance, destruction or modification of a known breeding and foraging habitat of a species protected under the Wildlife Act 1976 (2000 & amendments), but not an Annex IV (EU Habitats Directive) listed species, a derogation license is **not** necessary, and a possible exemption also exists:

"*S23.7 (c)- Notwithstanding subsection (5) of this section, it shall not be an offence for a person— while constructing a road or while carrying on any archaeological operation, building operation or work of engineering construction, or while constructing or carrying on such other operation or work as may be prescribed, [to] unintentionally to kill or injure such an animal or unintentionally to destroy or injure the breeding place or resting place] of such an animal".* While this contradicts S23.5 (d) of the Wildlife Act – it remains a grey area that is yet to be tested in court (pers. com NPWS, July 2022).

Nevertheless, best practice dictates that where a known breeding habitat is to be disturbed or lost entirely for a protected amphibian species (as in the case for *R. temporaria* and *L. vulgaris*), then mitigation measures in the form of habitat enhancement, the provision of substitute and or compensatory wetland habitat(s), or other features that would be considered "net gain" for the species should be incorporated into the final landscape design. However, the retention of ponds that have been present in the landscape over long periods of time, and therefore of historical value, should be a priority with incorporation into the development masterplan and restoration works included as part of a biodiversity net gain strategy.

1. INTRODUCTION

1.1 BACKGROUND

As part of a planning application for a proposed development, R Gandola was commissioned by Enviroguide Consulting Ltd. to carry out amphibian surveys of the proposed development site at lands east of St Paul's College, Sybil Hill Road, Raheny, Dublin 5. The aim of these surveys was to provide an assessment on the occupancy, distribution and habitat use of any amphibian populations present on the proposed development site.

The common frog (*Rana temporaria*) and the smooth newt (*Lissotriton vulgaris*) comprise the native amphibian species of County Dublin. The common frog is a widespread across the county and inhabits a wide array of habitats, both terrestrial and aquatic, including urban gardens, amenity greenspaces and wetlands (Reid et al. 2013). The smooth newt, while also widely distributed tends to prefer habitats in proximity to more permanent vegetated pools and ponds, where they must return to breed. Their distribution and site occupancy within Dublin is not well known.

The proposed development site at "Foxlands" does not contain any wetland features suitable for breeding for either native amphibian species. Foraging habitat may exist within the mature hedgerows, woodlands and nearby riparian corridor with other parts of St. Anne's Park offering some suitable breeding and foraging areas namely, the Model Gardens, allotments, pitch and putt course, and other woodland environs. etc.). There is widespread connectivity between these habitats within St. Anne's Park.

Based on the results of the amphibian surveys and overall wetland assessment, the potential impacts of any development on resident species are detailed in Section 4 of this report. Recommendations are also made in relation to mitigation of any impacts to ensure the persistence of native species at this site.

1.2 STATEMENT OF AUTHORITY

All surveying and report writing was conducted by R Gandola. He has an MSc in Ecology from Bangor University, Wales and a BSc (hons) Zoology from UCD. He provides training and professional advice to Local and National Authorities, heritage rangers, eNGOs, and community groups in Ireland and Northern Ireland, and regularly carries out surveys and implements monitoring projects on their behalf. He also holds the position of Senior Scientific Officer for the Herpetological society of Ireland.

1.3 CONSERVATION AND LEGAL STATUS OF AMPHIBIANS AND REPTILES (HERPETOFAUNA) IN IRELAND

Both amphibian species included in this assessment are protected under the Wildlife Act and amendments (1976, 2000) whereby it is an offence to kill, to deliberately disturb during breeding, rearing, hibernation or migration, or to damage a breeding site or resting place. In Northern Ireland, native herpetofauna are also protected under the Wildlife Order (1985). The common frog, *Rana temporaria*, is also protected under international legislation (EU Habitats Directive 92/43/EEC [Article 17 / Annex V]). Both species are listed as being of "Least Concern" on the Irish Red List.

2. METHODOLOGY

2.1 SURVEY AREA

The proposed "Foxlands" development is pursuing planning permission for lands east of St Paul's College, Sybil Hill Road, Raheny, Dublin 5. The site is currently zoned as "Z15 - institutional use". However, this has been a contentious issue with multiple previous attempts in the last 5yrs to develop the site ending in Judicial Reviews and overturning of planning permission(s). The site is approximately 6.7ha in area which can roughly be divided into one "main section" with an associated "access corridor section" (Fig. 1). The main section is predominately amenity grassland (GA2), with some with some linear treeline habitat elements (WL2) along the northwest, north, east and south boundaries of the site. There is a small block of mixed broadleaf woodland (WD1) at the northwest boundary. The access corridor is composed mostly of buildings and artificial surfaces (BL3), grassy verges (GS2), and agricultural grassland (GA1) and some linear treelines (WL2) to the west and south. The habitats surveyed within the wider St. Anne's Park comprised of man-made open water features in the Model Garden, Duck Pond, and City Farm (not visible on the map) (FL8) and drainage ditches (FW4) – one of which drains into a tributary of the Naniken River within a copse of mixed broadleaf woodland (WD1), and the other drains the lands from Mount Prospect Avenue, north to the Red Stables and eastwards through the lower park to the south lagoon at North Bull Island (Fig. 2).

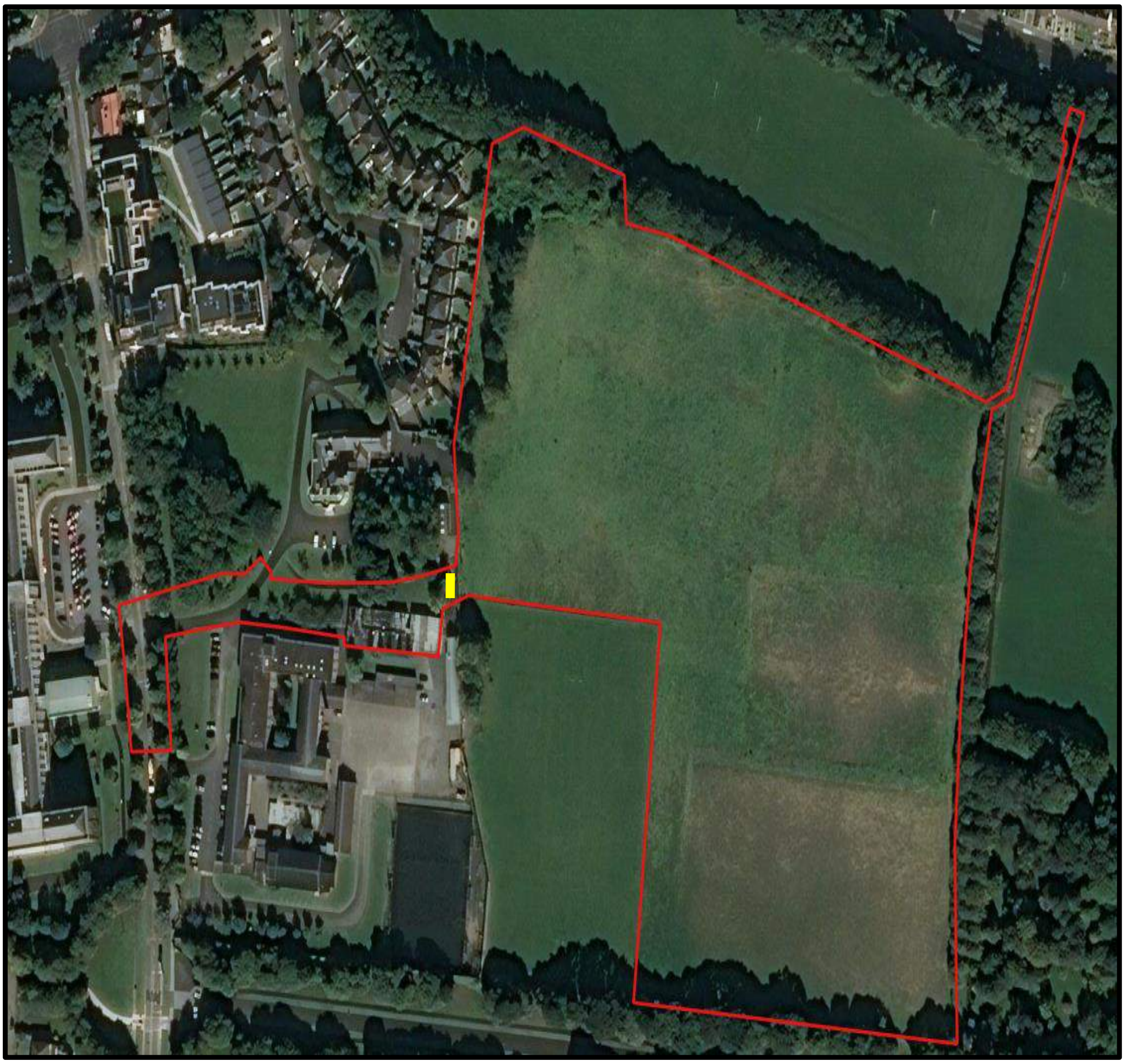

Fig. 1 Boundary map of the proposed "Foxlands" development site at St. Anne's Park, Raheny, Dublin 5 exhibiting the extensive amenity grasslands that dominate the site. The yellow bar shows the division of the "main section" from the "access corridor section" for the purposes of this report.

Fig. 2. A map indicating surveyed wetland areas with potential suitability for amphibians and the location of the proposed "Foxlands" development (outlined in red).

2.2 DESKTOP STUDY

A comprehensive search of all relevant and publicly accessible databases (NBDC, iNaturalist, etc.), grey literature, and other sources was conducted prior to the onset of surveys. Search criteria was limited to a 2km from the proposed development site and restricted to the last 10 years. This limitation is based on realistic dispersal capabilities of the species being surveyed and the availability of dispersal corridors in this area. The ponds and other key features present on the site are compared to historical maps available through the OSI Geohive to determine if they have any historical significance.

2.3 FIELD SURVEYS

Standard survey methods appropriate for detecting amphibians e.g., visual encounter searches via torch lighting and dip netting, were employed (Griffiths et al. 1996; NRA guidelines (2009); Sewell et al. 2013). Submerged funnel traps were not deployed during these surveys as (i) the water bodies were sufficiently shallow and/or clear to permit conclusive visual encounter surveys combined with dip net sampling; and (ii) the surveys were undertaken at a suboptimal time for detection of adult newts and their larvae, or frog tadpoles, particularly in waterbodies that contain multiple species of fish that are known to prey on native amphibians, their eggs, and larvae. Any natural or artificial refugia present near the waterbodies were inspected (e.g., wood stumps). Visual encounter surveys and dip netting surveys were conducted at each pond except from the ditch north of Belgrove Park. An incident whereby foul water/sewerage had entered the ditch via an inlet from the western side of the park rendering dip netting an unhygienic endeavour. All visual encounter surveys were conducted during periods of suitable weather (warm, calm, and humid without mist/very light rain). All sightings of a focal species or other deemed relevant, were recorded on a Garmin 60CSx GPS unit or suitably equipped smart phone. Given the timing of the surveys, common frog spawn counts and breeding effort estimation were not possible. However, in this case, the proposed development has no areas of standing water nor other wetland habitats. Therefore, any estimation of frog spawn counts would be conducted at the nearest possible waterbody outside of the proposed development footprint. In this case that would be the Model Garden ponds, some 700m meters away from the eastern boundary of the proposed development, and the last known breeding site for common frogs in the park in 2016 (R Gandola/HSI, pers obs.)

3. RESULTS

3.1 SURVEY AREAS

The proposed development site does not have any habitat suitable for either native amphibian species that could potentially inhabit the area apart from some potential foraging habitat within the linear treelines or some copse of mixed woodland. The Model Garden has two ponds, of which, the western most is the last known site of common frog reproduction within the park. Both ponds offer suitable habitat for both the common frog, and to a lesser extent, the smooth newt. The City Farm ponds are small but are likely to offer suitable habitat for breeding common frogs as they can be unfussy with the wetlands in which they spawn where other options are limited. The Duck Pond is thought to have been installed at some point between 1897 and 1913 as it appears on the Historic 25inch OSi map for the area. The Duck Pond offers some habitat for native amphibians and is the last known site of breeding smooth newts in the park (1960's). However, this pond does contain multiple fish species and has been stocked in the recent past, making it less than ideal for amphibians. The ditch to the north of Belgrove Park is a typical over-shaded woodland ditch. While it retains water, is it is also subject to foul water inputs and therefore of very limited use for native amphibians who like open, shallow, warm water. The ditch that drains the area from Mount Prospect Avenue to the south lagoon may offer suitable breeding habitat for the common frog near to its entry point into the park at certain times of year. However, this ditch tends to be regularly overgrown and was dry during the survey visits.

3.2 DESKTOP STUDY

A total of three (n = 3) historical records were discovered within a 2km radius of the proposed development. Records from west of the Sybill Hill Road were not deemed to be important to this assessment as the road is likely to pose a significant barrier to dispersal as is the housing estate habitat which would need to be navigated in order to reach the park. A single record from North Bull Island was not retained as the causeway road and the Howth Road between the island and the Parklands are likely to be major barriers to outwards dispersal from the island. It is likely that common frogs occupy more gardens in close vicinity to the park than is currently known.

3.3 FIELD SURVEYS

Surveying took place on two occasions during periods of warm and humid, calm weather on **8th July 2022 and 10th July 2022**. On both occasions surveys began at 21:30. Supplementary surveys were conducted during daylight hours on **16th July** and **17th July 2022**, respectively as access to the Model Gardens was not possible at night.

Model Garden

Although ample suitable habitat exists for both species in the ponds and immediate area, neither species of amphibian were detected through dip. The pond life here is dominated by water slaters (*Asellus aquaticus*), Leeches (*Eropdella sp.*), pond skaters (*Gerris lacustris*), lesser water boatmen (*Corixa sp.*) and Mayfly (Ephemeroptera: *Cloeon sp.*). These ponds have undergone restoration works in recent years, are likely to still be maturing, and are likely to return to their former levels of biodiversity richness over time.

Duck Pond

Neither species of native amphibian were detected using the duck pond or were encountered in a number of suitable terrestrial habitats in the immediate vicinity of the pond. Other wildlife encountered using the pond was an adult hawker dragonfly (*Aeshna sp.*), seen "hawking" over the pond surface on 8/7/22. Twenty Swifts (*Apus apus*) were counted foraging above the pond. Breeding mallards (*Anas platyrhynchos*), moorhen (*Gallinula chloropus*), coots (*Fulica atra*), Little grebe (*Tachybaptus ruficollis*) and brown rats (*Rattus norvegicus*) were also seen active in the pond. Approximately 20 little egrets (*Egretta garzetta*) were also counted coming into roost in the heronry near to the duck pond.

Torching resulted in the detection of no fewer than 14 individuals of the critically endangered European eel (*Anguilla anguilla*) of multiple size and age classes (e.g., elvers, yellow eels, and silver eels; see Appendix 1) on the 08/07/2022 and 19 individuals on 13/07/2022. Two individuals of the three-spined stickleback (*Gasterosteus aculeatus*) were also captured by netting with many more individuals seen by torchlight.

An unidentified damselfly nymph (Odonata) and *Cloeon sp.* of Mayfly were also detected in the pond edge among some floating algae, as were Ramshorn snails (Planorbidae), pond snails (*Lymnaea sp*.), leeches (*Eropdella sp.)* and water slaters (*Ascellus aquaticus*) were amongst the most common species obtained by dip netting. Four bat species were detected foraging over the pond using a Magenta Bat 5 heterodyne detector. The species were identified as Common pipistrelle (*P. pipistrellus*), Soprano pipistrelle (*P. pygameus*), Leisler's bat (*Nyctalus leisleri*), and Daubenton's bat (*Myotis daubentonii*).

The Eurasian otter (*Lutra lutra*) has also been seen foraging in this pond (pers obvs. June 2020). At least one other bat species has also previously been detected foraging over this pond during the summer months (pers obvs); Brown long-eared bat (*Plecotus auritus*),

City Farm

Volunteer staff at the City Farm indicated that frog spawn had been introduced to the City Farm ponds by another volunteer from an unknown source location. This spawn had been allowed to develop naturally and the froglets had been allowed to emerge and disperse into the adjoining allotment area and wider park. This may result in recolonization of the park by this species

4. IMPACT ASSESSMENT

4.1 POTENTIAL DETRIMENTAL IMPACTS

Destruction and Disturbance of breeding & foraging habitats

The development of "Foxlands" is highly unlikely to have any detrimental impact on common frogs or newts as there are no suitable breeding habitats available to them within the footprint of the proposed development. The majority of potential foraging areas form the boundaries the site and therefore impact is likely to be minimal. However, no observations of any amphibian using these linear habitats have been recorded to date suggesting that the habitat is of poor suitability for amphibians.

Accidental mortality & population decline

It is unlikely that any clearance works will pose a risk of killing or injuring frogs and newts as they do not occupy the proposed development site. Even so, care must be taken that works do not create more favourable features for amphibians in the process of clearance or construction e.g., flooded excavations etc.

4.2 MITIGATION MEASURES FOR AMPHIBIANS

Prior to the initiation of works, an appropriate exclusion barrier(s) should be installed around the boundary line to exclude any amphibians that may be cryptically using the area. This may be combined with other beneficial and necessary mitigation works (e.g., the installation of a silt trap fence line to protect the Naniken River etc.). Caution should be taken at all times to mitigate the chances of a negative interaction with amphibians that may unexpectedly be encountered on site.

Irrespective of whether both, one, or neither amphibian species are resident near or on the proposed site, **t**he proposed landscape masterplan has included nature friendly SuDs to deal with surface water and pluvial flooding events in the form of rain gardens and a subterranean attenuation tank (see Appendix 2). On-site attenuation of surface run-off will not only assist in alleviating pressure on the local surface water drainage network and overflows to the Naniken River, but they will also conform to best practice of incorporating functioning SuDs features of high amenity value into the landscape, that will also be of benefit to local wildlife populations. In parts of the development where surface level gully pot type drains are required, then recessed kerbs and "amphibian ladders" should be installed as another wildlife friendly measure. These additional features provide all wildlife an opportunity to avoid or escape falling into the surface water drainage system.

5. RECOMMENDATIONS

- Retention of a suitably qualified and licenced Ecological Clerk of Works during the construction phase
- Employ the precautionary principle for cryptic wildlife when undertaking clearance and construction works
- Installation of exclusion barriers and/or temporary landscaping to divert amphibians/other wildlife away from the works and protect the Naniken River
- Initiate works in the middle of the site and work outwards with controlled clearance of areas i.e., sequentially rather than all at once.

6. CONCLUSION

The proposed "Foxlands" development is unlikely to have any direct impacts on common frogs or smooth newts as they are not known to occur on the site. However, an appropriate containment and surface water drainage and management plan is of utmost importance as any spillage/pollution/contamination event into the Naniken River could have a catastrophic effect on the Duck Pond and the wildlife which use it for foraging, some of which are either critically endangered (European eels) or protected under the EU Habitats Directive (Annex IV) e.g., bat species and Eurasian otter).

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APPENDIX 1

A1.1 Video still of critically endangered European eels of multiple size classes and ages dip netted from the Duck Pond at St. Anne’s Park, Raheny, Dublin 5.

Appendix 2

A2.1 The proposed landscape masterplan map for "Foxlands".

Appendix H Naniken Freshwater Survey Report

FRESHWATER ECOLOGY SURVEY OF THE NANIKEN STREAM

FOR

A MIXED USE DEVELOPMENT

AT

LANDS EAST OF ST PAUL'S COLLEGE, SYBIL HILL ROAD, RAHENY, DUBLIN 5

ON BEHALF OF

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DOCUMENT CONTROL SHEET

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00	Draft	Dr Siobhán Atkinson *Senior Ecologist*	Liam Gaffney *Senior Ecologist*	-	-
01	Final	Dr Siobhán Atkinson *Senior Ecologist*	Liam Gaffney *Senior Ecologist*	Jim Dowdall *Director*	19/08/2022

REPORT LIMITATIONS

Synergy Environmental Ltd. t/a Enviroguide Consulting (hereafter referred to as “Enviroguide”) has prepared this report for the sole use of Raheny 3 Limited Partnership in accordance with the Agreement under which our services were performed. No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by Enviroguide.

The information contained in this Report is based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by Enviroguide has not been independently verified by Enviroguide, unless otherwise stated in the Report.

The methodology adopted and the sources of information used by Enviroguide in providing its services are outlined in this Report.

The work described in this Report is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

All work carried out in preparing this report has used, and is based upon, Enviroguide’s professional knowledge and understanding of the current relevant national legislation. Future changes in applicable legislation may cause the opinion, advice, recommendations or conclusions set-out in this report to become inappropriate or incorrect. However, in giving its opinions, advice, recommendations and conclusions, Enviroguide has considered pending changes to environmental legislation and regulations of which it is currently aware. Following delivery of this report, Enviroguide will have no obligation to advise the client of any such changes, or of their repercussions.

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Unless otherwise stated in this Report, the assessments made assume that the site and facilities will continue to be used for their current or stated proposed purpose without significant changes.

The content of this report represents the professional opinion of experienced environmental consultants. Enviroguide does not provide legal advice or an accounting interpretation of liabilities, contingent liabilities or provisions.

If the scope of work includes subsurface investigation such as boreholes, trial pits and laboratory testing of samples collected from the subsurface or other areas of the site, and environmental or engineering interpretation of such information, attention is drawn to the fact that special risks occur whenever engineering, environmental and related disciplines are applied to identify subsurface conditions. Even a comprehensive sampling and testing programme implemented in accordance with best practice and a professional standard of care may fail to detect certain conditions. Laboratory testing results are not independently verified by Enviroguide and have been assumed to be accurate. The environmental, ecological, geological, geotechnical, geochemical and hydrogeological conditions that Enviroguide interprets to exist between sampling points may differ from those that actually exist. Passage of time, natural occurrences and activities on and/or near the site may substantially alter encountered conditions.

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1 INTRODUCTION

1.1 Background

Enviroguide Consulting was commissioned by Raheny 3 Limited Partnership to undertake a biological assessment of the Naniken Stream in the vicinity of the Proposed Development (Foxlands) at St. Paul's College, Sybil Hill, Raheny, Dublin 5. The assessment comprised a physical habitat walk over survey of the length of the Naniken stream from where it enters St. Anne's Park to where it outflows into Dublin Bay. A macro-invertebrate sample was collected and assessed to determine the biological water quality (Q Rating) of the stream. This report details the findings of the assessment.

1.2 Evidence of Technical Competence and Experience

Synergy Environmental Ltd., T/A Enviroguide Consulting, is wholly Irish Owned multi-disciplinary consultancy specialising in the areas of the Environment, Waste Management and Planning. All of Enviroguide's consultants carry scientific or engineering qualifications and have a wealth of experience working within the Environmental Consultancy sectors, having undergone extensive training and continued professional development.

Enviroguide Consulting as a company remains fully briefed in European and Irish environmental policy and legislation. Enviroguide employees are highly qualified in their field. Professional memberships include the Chartered Institution of Wastes Management (CIWM), the Irish Environmental Law Association and Chartered Institute of Ecology and Environmental Management (CIEEM).

Dr Siobhán Atkinson is a Senior Ecologist at Enviroguide Consulting and is responsible for carrying out freshwater surveys. Siobhán has a B.Sc. (Hons) in Environmental Biology and a Ph.D. in Freshwater Biology from University College Dublin, and extensive experience in Geographic Information Systems (GIS), desktop research, literature review and reporting, as well as practical field and laboratory experience including environmental DNA analysis, freshwater macroinvertebrate sampling, and identification, physical river habitat surveys, fish sampling and processing and terrestrial habitat surveying.

Siobhán has prepared Ecological Impact Assessments (EcIA), Stage I and Stage II Appropriate Assessment Reports, Habitat Surveys and Invasive Species Surveys and input and reviewed Ecological and Environmental assessments for several EIA Reports. Siobhán is the first author of several publications relating to barriers to riverine connectivity in Ireland.

2 METHODOLOGY

2.1 Desk Study

A desktop study was carried out to collate and review available information, datasets and documentation sources pertaining to the River Naniken. The desktop study relied on the following sources:

- Information on species records and distributions, obtained from the National Biodiversity Data Centre (NBDC) at www.maps.biodiversityireland.ie ;
- Information on waterbodies, catchment areas and hydrological connections obtained from the Environmental Protection Agency (EPA) at www.gis.epa.ie ;
- Information on bedrock, groundwater, aquifers and their statuses, obtained from Geological Survey Ireland (GSI) at www.gsi.ie ;
- Satellite imagery and mapping obtained from various sources and dates including Google, Digital Globe, Bing and Ordnance Survey Ireland;
- Dublin City Otter Survey (Macklin et al., 2019).

2.2 Field Survey

2.1.1 Walkover Survey

A walkover survey of the length of the Naniken stream from where it enters St. Annes Park to where it outflows into Dublin Bay was undertaken on the 24th September 2021. The aim of the walkover survey was to undertake a general physical habitat assessment of the river channel and riverbanks and fisheries habitat assessment, taking into account the following features:

- Channel morphology and flow types,
- Substrate
- Barriers to connectivity
- Bank structure and stability
- Bank and bank top vegetation
- Adjacent land use

2.1.2 Biomonitoring

A biological water quality assessment of the Naniken was undertaken using benthic macroinvertebrates as bioindicators. Benthic macroinvertebrates are an excellent tool for water quality assessment as they exhibit differential responses to physical and chemical changes in their environment. Macroinvertebrate community diversity declines in the presence of pollution, and sensitive species are progressively replaced by more tolerant forms as pollution increases. As such, macroinvertebrates provide a realistic record of prevailing water quality conditions.

The Quality Rating (Q) System (Toner et al, 2005) is the standard biotic index which is used by the Irish EPA and was used to assess biological water quality at each site. The EPA Q-value classification is on a five-point scale, Q1- Q5, with intermediate scores obtainable, e.g. Q3-4. Q1 represents the poorest water quality whereas Q5 represents pristine/unpolluted water. Q-values are based on the proportions of five 'Indicator Groups' of macroinvertebrates, with different pollution tolerances: Group A, the sensitive forms, Group B, the less sensitive forms, Group C, the tolerant forms, Group D, the very tolerant forms and Group E, the most tolerant forms (Toner et al., 2005). The scheme mainly reflects the effects of organic pollution (i.e. deoxygenation and eutrophication).

Q-values are related to four Water Quality Classes (Unpolluted, Slightly Polluted, Moderately Polluted and Seriously Polluted) and to Water Framework Directive (WFD) water status as outlined in Table 1.

TABLE 1. THE Q-VALUE AND CORRESPONDING WFD STATUS AND POLLUTION GRADIENT.

Q-value Score	WFD Status	Pollution Gradient	Quality Class
Q5	High	Unpolluted	Class A
Q4-5	High	Unpolluted	Class A
Q4	Good	Unpolluted	Class A
Q3-4	Moderate	Slightly polluted	Class B
Q3	Poor	Moderately polluted	Class C
Q2-3	Poor	Moderately polluted	Class C
Q2	Bad	Seriously polluted	Class D
Q1-2	Bad	Seriously polluted	Class D
Q1	Bad	Seriously polluted	Class D

Class A waters are those in which problems relating to existing or potential beneficial uses are unlikely to arise and they are, therefore, regarded as being in a 'satisfactory' condition. Classes B, C and D are to a lesser or greater extent 'unsatisfactory' in this regard. For example, the main characteristic of Classes B and C waters is eutrophication which may interfere with the amenity, abstraction or fisheries potential. In Class D waters excessive organic loading leads to deoxygenation and may produce 'sewage fungus' growths, and as a consequence most beneficial uses are severely curtailed or eliminated (Toner et al., 2005).

The sampling method adopted was that applied by the Irish EPA in the national river monitoring programme (Feeley et al., 2020). The ideal timeframe for carrying out biomonitoring is between June to September when flows are likely to be relatively low and water temperatures highest. Surveys during this period are likely to coincide with the worst conditions to be expected in those reaches affected by waste inputs. River macroinvertebrates were collected on the 24th of September 2021 for this assessment. The sampling site location is indicated in Figure 1.

Using an FBA (Freshwater Biological Association) pond net (1mm mesh), a semi-quantitative, 2-minute kick-sample was collected from the riverbed. The sample was collected from faster flowing riffle/run habitat. A further one-minute stone-wash was undertaken (Feeley et al., 2020). To minimize disturbance, sampling was carried out in a downstream to upstream direction. Bankside habitat assessments, visual estimates of the percentage of flow and substrate types and the percentage of riparian shading was carried out. A once-off measurement of pH and conductivity was undertaken using a probe.

Live macroinvertebrate samples were sorted on the riverbank on a white tray using a head torch. Taxa were preserved in 70% Industrial Methylated Spirits (IMS) and identified by microscope. An EPA Q-value classification was assigned to each sample by recording the taxa present at a suitable taxonomic resolution and their categorical relative abundance.

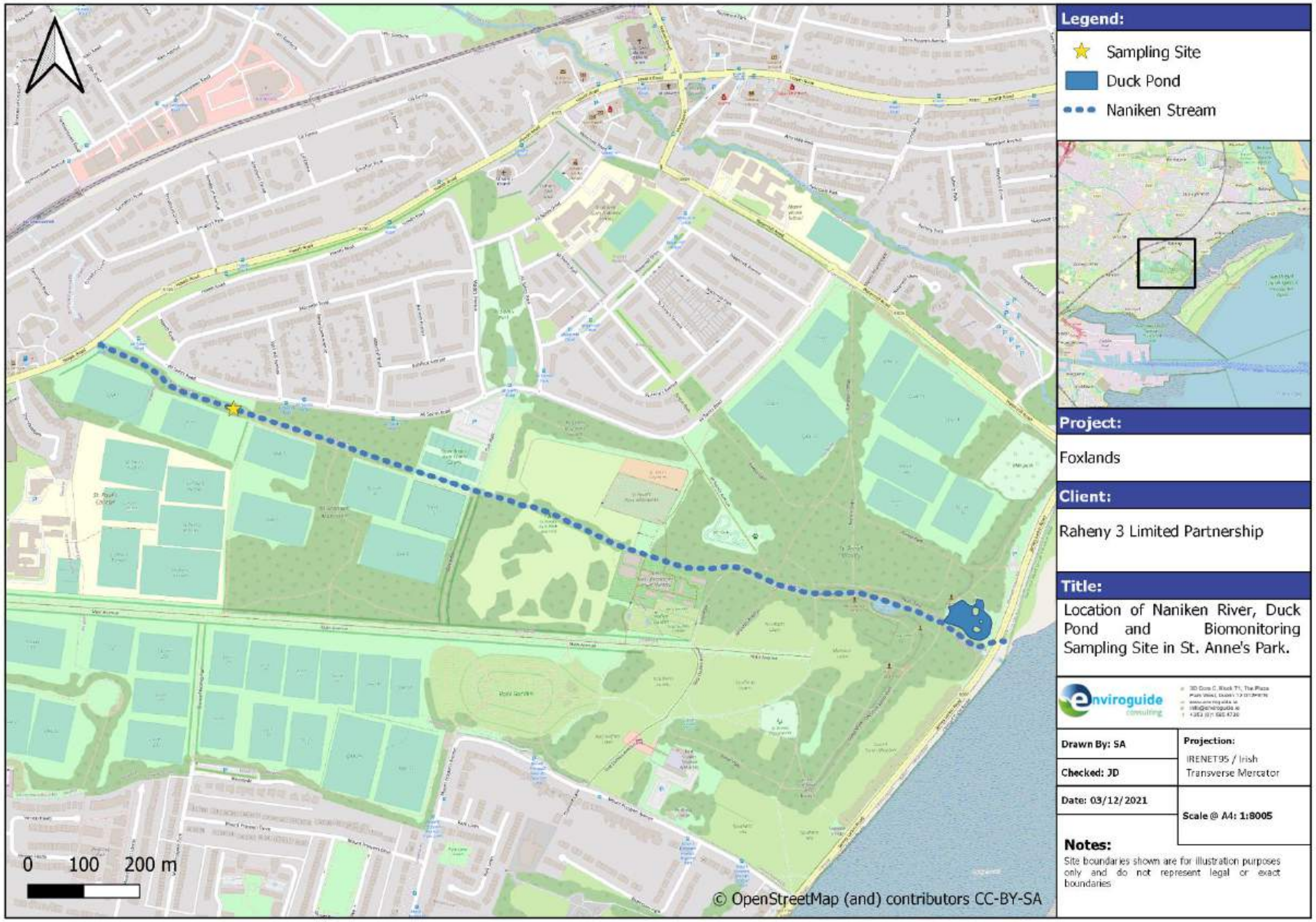

FIGURE 1. LOCATION OF NANIKEN RIVER, DUCK POND AND BIOMONITORING SAMPLING SITE.

PLATE 1. PHOTOGRAPHS OF THE NANIKEN RIVER SHOWING (A) THE RIVER AT HOWTH ROAD CULVERT, (B) CHANNELISED AND STRAIGHTENED SECTION OF THE RIVER, (C) BANK EROSION, (D) PERCHED CULVERT (E) MODIFIED RIVER CHANNEL AT THE DUCK POND INLET (F) THE DUCK POND AND (G) HERON FEEDING ON THE DUCK POND.

3 RESULTS

3.1 Desk Study

The Naniken River is a small river located on the north side of Dublin city within St. Anne's Park, Raheny. It enters St. Anne's Park from a culvert on the R105 (Howth Road) and flows eastwards for approximately 1.7 km through the park before discharging into Raheny Strand and Dublin Bay.

The river is located within the terrestrial buffer zone of Dublin Bay Biosphere. There are no EPA monitoring stations on this river (EPA, 2021). The river is underlain by limestone till and is situated on a locally important aquifer (LI) (GSI, 2021). Groundwater vulnerability in the area is *Low* (GSI, 2021).

Relevant records of relevant freshwater fauna from the National Biodiversity Data Centre tetrad associated with the river are shown in Table 2. Common Frog, dragonflies, invasive reptiles (Red-eared Terrapin and Yellow-bellied Slider) and waterfowl[1] were recorded.

TABLE 2. NATIONAL BIODIVERSITY DATA CENTRE RECORDS FOR FRESHWATER SPECIES.

Taxon	Date of Last Record	Title of Dataset	Designation
Common Frog (*Rana temporaria*)	24/02/2018	Amphibians and reptiles of Ireland	Protected Species: EU Habitats Directive Annex V Protected Species: Wildlife Acts
Common Hawker (*Aeshna juncea*)	18/09/2019	Dragonfly Ireland 2019 to 2024	
Migrant Hawker (*Aeshna mixta*)	17/08/2019	Dragonfly Ireland 2019 to 2024	
Red-eared Terrapin (*Trachemys scripta*)	08/06/2013	Local BioBlitz Challenge 2013	Invasive Species EU Regulation No. 1143/2014
Yellow-bellied Slider (*Trachemys scripta scripta*)	25/02/2012	National Invasive Species Database	
Common Moorhen (*Gallinula chloropus*)	08/06/2013	Local BioBlitz Challenge 2013	
Eurasian Teal (*Anas crecca*)	31/12/2011	Bird Atlas 2007 - 2011	Wildlife Acts EU Birds Directive Annex II
Mallard (*Anas platyrhynchos*)	08/06/2013	Local BioBlitz Challenge 2013	Wildlife Acts EU Birds Directive Annex II & Annex III
Northern Shoveler (*Anas clypeata*)	07/03/2018	Birds of Ireland	Wildlife Acts EU Birds Directive Annex II & Annex III
Eurasian Wigeon (*Anas penelope*)	31/12/2011	Bird Atlas 2007 - 2011	Wildlife Acts EU Birds Directive Annex II & Annex III
Eurasian Spoonbill (*Platalea leucorodia*)	13/03/2013	Rare birds of Ireland	
Great Cormorant (*Phalacrocorax carbo*)	08/06/2013	Local BioBlitz Challenge 2013	Wildlife Acts
Grey Heron (*Ardea cinerea*)	08/06/2013	Local BioBlitz Challenge 2013	

[1] Only those considered to potentially utilise the Naniken River and Duck Pond are shown.

Little Egret (*Egretta garzetta*)	08/06/2013	Local BioBlitz Challenge 2013	Wildlife Acts EU Birds Directive Annex I
Herring Gull (*Larus argentatus*)	31/12/2011	Bird Atlas 2007 - 2011	Wildlife Acts
Lesser Black-backed Gull (*Larus fuscus*)	31/12/2011	Bird Atlas 2007 - 2011	Wildlife Acts
Common Gull (*Larus canus*)	08/06/2013	Local BioBlitz Challenge 2013	Wildlife Acts
Black-headed Gull (*Larus ridibundus*)	31/12/2011	Bird Atlas 2007 - 2011	Wildlife Acts

3.2 Physical Habitat

The Naniken exhibits signs of poor hydromorphological condition. The stream has been channelised and straightened in the past, and numerous weirs, bridges and perched culverts fragment the river throughout its length (Plate 1). Bank erosion was evident throughout the river and is likely exacerbated by human access to the riverbanks. The riverbanks are very steep in places (2-3m high), and this, coupled with trees along the banks, has resulted in heavy shading throughout the river. The channel substrate was scoured in places (in particular downstream of perched culverts and weirs) on the day of survey, whereas the channel was heavily silted in the slower flowing sections. It appears historic modifications to the river channel have limited its ability to function naturally (e.g. it has limited potential to respond to changes in sediment supply and hydrology). The channel substrate is typically comprised of cobbles, gravel, sand and silt, and is embedded in places. The dominant flow types comprised of riffle, run and glide habitat which was quite shallow. The water was turbid on the day of survey.

The mouth of the river has been rerouted and modified to facilitate water inputs into the Duck Pond. A sluice gate directs river water into the pond, and river water which does not enter the pond follows an artificial concrete channel which ultimately outfalls into Dublin Bay via one-way sluice flaps. Excess pond water is returned to the Naniken via a culvert outlet just upstream of James Larkin Road.

As noted by Macklin et al. (2019), within and west of the Pitch and Putt Course, the river flows primarily through linear blocks of mature, semi-natural broadleaf woodland (WD1) in a parkland and amenity grassland (GA2) landscape. The river flows through more extensive broadleaved woodland habitat (WD1) east of the Pitch and Putt Course. Tree species recorded along the river included Ash *Fraxinus excelsior*, Lime *Tilia* sp., Willow *Salix* spp., Sycamore *Acer pseudoplatanus*, Horse Chestnut *Aesculus hippocastanum*, Hawthorn *Crataegus monogyna*, Cherry *Prunus* sp., Elder *Sambucus nigra*, Alder *Alnus glutinosa*, beech *Fagus sylvatica* and yew *Taxus baccata*.

Unsurprisingly, the hydromorphological status of the Naniken (based on the River Habitat Assessment Technique - RHAT) was assessed as being “bad” and “poor” by Macklin et al. (2019).

The Duck Pond is an artificial pond (FL8). It was heavily silted on the day of survey, with patches of emergent vegetation noted along the margins of the pond and islands within it. An extensive duckweed *Lemna* sp. ‘carpet’ covered large areas of the pond, and filamentous algae was noted within it (Figure 2).

FIGURE 2. DUCKWEED 'CARPET' WITHIN THE DUCK POND.

3.3 Biomonitoring

The Naniken River was assigned a Q-value of 3, corresponding with a WFD status of “poor” and a pollution gradient of “moderately polluted”. The biomonitoring sample was collected from riffle/glide habitat. Substrate at the sampling site was comprised of 40% sand, 20% cobble, 20% gravel and 20% silt. The sampling site was heavily shaded due to the mature woodland on both sides of the river.

Conductivity and pH were indicative of the soil and geology in the area with slightly high pH (7.6) and high conductivity (555 µS/cm).

TABLE 3. BENTHIC INVERTEBRATE SPECIES RECORDED AT THE NANIKEN, AND CORRESPONDING Q-VALUE.

Taxon	Q-Class	Abundance
Ephemeroptera		
Baetis rhodani/atlanticus	C	56
Crustacea		
Gammarus dubeni	C	46
Asellus aquaticus	D	49
Gastropoda		
Potamopyrgus antipodarum	C	6
Sphaeriidae	D	16
Oligochaeta		
Lumbriculidae	n/a	4
Platyhelminthes	C	3
Diptera		

Taxon	Q-Class	Abundance
Chironomidae indet	C	3
Ceratopogoniidae	n/a	1
Simulidae	C	2
Total Abundance		186
Richness		10
Frequency of Occurrence Class C Taxa		64%
Frequency of Occurrence Class D Taxa		36%
Q-Value		3

3.4 Fisheries Potential

3.1.1 Salmonids

Given the poor physical condition, heavily modified and fragmented nature, and moderately polluted status of the Naniken river, it is not considered to have salmonid (Brown trout *Salmo trutta* and Salmon *S. salar*) potential.

3.1.2 European Eel

The Naniken River could support European Eel *Anguilla anguilla*, however the one-way sluice flaps at the river outlet, as well as the many barriers within the river, would likely impact their distribution and abundance. European Eel are tolerant of moderately polluted water, however, the current biological status of the Naniken river is not conducive to a healthy eel population. It is noted that eel have been recorded within the Duck Pond. However, given the apparent high level of eutrophication in this pond (evidenced by high algal and macrophyte growth), it is unlikely that a healthy eel population could be sustained in it.

3.1.3 Other Fish Species

The Naniken River is likely to support more pollution tolerant fish species such as 3-Spined Stickleback *Gasterosteus aculeatus* and Minnow *Phoxinus phoxinus*.

3.5 Terrestrial Fauna

No Otter signs were recorded within or adjacent to the stream during the walk over survey carried out. This finding is in-keeping with the Dublin City Otter survey, which also did not detect any Otter signs along the Naniken (Macklin et al., 2019). An active mammal burrow was recorded on the river bank within the upper reaches of the Naniken river in St. Annes Park. Given the absence of Otter signs along the river, and the size and shape of the burrow, it is likely that it is a Fox *Vulpes vulpes* den Figure 3.

FIGURE 3. MAMMAL BURROW ON THE BANKS OF THE NANIKEN IN ST. ANNES PARK.

4 DISCUSSION & CONCLUSIONS

The physical habitat assessment and macroinvertebrate biomonitoring indicates that the Naniken River is currently impacted. This is most likely due to historic modifications to the river channel, human related disturbance and surrounding urban land use.

The river is unlikely to support salmonid fish populations but may support the critically endangered European Eel and other fish species such as Minnow and 3-spined Stickleback. As noted previously, European Eel have been recorded within the Duck Pond. Although affected by eutrophication, this pond also provides an important habitat for a range of freshwater fauna including invertebrates, amphibians and waterfowl – many of which are protected by national and international legislation. This river also functions as an important ecological corridor.

Mitigation measures will be required to ensure no pollutants are discharged into the Naniken river (and consequently the Duck Pond) during the Construction Phase of the Proposed Development. Sustainable Urban Drainage Systems (SuDS) should be incorporated into the project design to ensure all surface water from the Site during the Operational Phase is appropriately treated and attenuated prior to discharge from the Site.

Provided SuDS are incorporated into the Project design, and standard best practice mitigation measures are implemented throughout the Construction Phase of the Proposed Development as per relevant guidelines (e.g. Inland Fisheries Ireland guidance document '*Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*'), no negative impacts on the Naniken River and Duck Pond should arise as a result of the Proposed Development.

5 REFERENCES

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Appendix I Site Investigation Report

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GROUND INVESTIGATIONS IRELAND LTD

DEVELOPMENT AT ST PAULS RAHENY

GROUND INVESTIGATION REPORT

DOCUMENT CONTROL SHEET

Engineer	OCSC
Project Title	St Paul's Raheny
Project No	5228-07-15
Document Title	Ground Investigation Report

Rev.	**Status**	**Author(s)**	**Reviewed By**	**Approved By**	**Office of Origin**	**Issue Date**
B	Final	C Finnerty	F McNamara	F McNamara	Dublin	30th October 2015

St Paul's Raheny –Ground Investigation Report

Appendices

1.0 Preamble

On the instructions of OCSC Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd., between September and October 2015 at the site at St Paul's College in Raheny in North Dublin.

2.0 Overview

2.1 Background

It is proposed to construct a residential development with associated access roads and car parking at the proposed site and develop some playing pitches. The site is currently in use as playing fields for St Paul's College. The proposed development consists of a mix of residential buildings with multi-storey over basement proposed over a portion of the site with the remaining area containing two/three storey residential dwellings.

2.2 Purpose and Scope

The purpose of the site investigation was to investigate subsurface soil conditions by means of cable percussion boreholes. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 10 No. Cable Percussion boreholes to a maximum depth of 8.0m BGL
- Standpipe installations and groundwater monitoring
- Laboratory testing
- Report with recommendations

3.0 Subsurface Exploration

3.1 General

During the ground investigation a programme of cable percussion boring was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during drilling.

3.2 Cable Percussion Boreholes

Ten Cable Percussion Boreholes were drilled using a Dando 2000 drilling rig with regular insitu testing and sampling undertaken to facilitate the production of geotechnical logs and laboratory testing.

The standard method of boring in soil for site investigation is known as the Cable Percussion method. It consists of using a Shell in non cohesive soils and a clay cutter in cohesive soils, both operated on a wire cable. Very hard soils, boulders and other hard obstructions are broken up by chiselling and the fragments removed with the Shell. Where ground conditions made it necessary, the borehole was lined with 200mm diameter steel casing. While the use of the Cable Percussion method of boring gives the maximum data on soil conditions, some mixing of laminated soil is inevitable. For this reason thin lenses of granular material may not be noticed.

Disturbed samples were taken from the boring tools at suitable depths, so that there is a representative sample at the top of each change in stratum and thereafter at regular intervals down the borehole until the next stratum was encountered. The disturbed samples were then sealed and sent to the laboratory where they were visually examined to confirm the description of the relevant strata.

Standard Penetration Tests were carried out in the boreholes. The results of these tests, together with the depths at which the tests were taken are shown on the accompanying borehole records. The test consists of a thick wall sampler tube, 50mm external diameter, being driven into the soil by a monkey weighing 63.5kg and with a free drop of 760mm. For gravels and glacial till the driving shoe was replaced by a solid 60º cone.

The Standard Penetration Test number referred to as the ‘N’ value is the number of blows required to drive the tube 300mm, after an initial penetration of 150mm. The number gives a guide to the consistency of the soil and can also be used to estimate the relative strength/density at the depth of the test and also to estimate the bearing capacity and compressibility of the soil.

The Cable Percussion borehole logs are provided in Appendix 2 of this Report.

The above notes outline the procedures used in this site investigation and are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:1999 + A2:2010.

3.3 Laboratory Testing

Samples were selected from the boreholes for a range of geotechnical classification testing to provide information for the proposed design. The environmental testing, including Waste Acceptance Criteria (WAC) was carried out by OCSC and is discussed under the cover of a separate report.

The results of the geotechnical laboratory testing are included in Appendix 3 of this Report.

4.0 Ground Conditions

4.1 Ground Conditions

The ground conditions encountered during the investigation are summarised below with reference to insitu and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered were consistent across the site and are generally consisted of;

- Made Ground
- Cohesive Deposits

Made Ground Deposits: Made Ground deposits were encountered beneath the ground surface or Topsoil and were present to a depths of between 0.8 and 1.5m BGL in the boreholes. These deposits were described generally consisted of *brown/grey sandy gravelly CLAY.*

Cohesive Deposits: Stiff brown cohesive deposits were present below the Made Ground deposits in the boreholes and were typically described as brown *sandy gravelly CLAY with occasional cobbles.* This stratum was present to a depth of up to 2.3m BGL and was underlain by a *stiff to very stiff black slightly sandy gravelly CLAY with occasional cobbles and boulders* to a maximum depth of 8.0m BGL.

4.2 Groundwater

The groundwater strikes were generally not encountered during the investigation in the cohesive deposits. We would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the time of year, tidal influence, rainfall, nearby construction and other factors. For this reason standpipes were installed in BH1, BH2, BH3, BH6 and BH9 to allow the equilibrium groundwater level to be determined. The groundwater monitoring is included in Appendix 6 of this Report.

5.0 Recommendations and Conclusions

5.1 General

The recommendations given and opinions expressed in this report are based on the findings as detailed in the exploratory hole records. Where an opinion is expressed on the material between exploratory hole locations, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for conditions which have not been revealed by the exploratory holes. Limited information has been provided on the proposed building, excavations and loading and assumptions have been made based on discussions on site and the nature of the development.

5.2 Foundations

An allowable bearing capacity of 150kN/m^2 is recommended for the stiff brown cohesive deposits below the made ground depths of 0.80 – 1.50m BGL. An allowable bearing capacity of 300kN/m^2 is recommended for deeper foundations based on the stiff black cohesive deposits in the vicinity of the proposed basement.

5.3 Excavations

Excavations in the areas where deeper Made Ground deposits were encountered may require to be appropriately battered or the sides supported due to the variable strength of these deposits. Reference should be made to the OCSC environmental report and the testing completed to inform the disposal of any material to be excavated.

5.4 External Pavement

The proposed access roads and car parking are proposed to be founded on the firm to stiff cohesive deposits or on compacted imported fill material depending on the final level of the proposed roads. CBR testing should be undertaken prior to or at the time of construction to verify the design assumptions and the proposed pavement make up. An average value of 2.0% would be recommended for outline design on the firm to stiff cohesive deposits with pavement options presented for less than 2%, 5.0% and 10.0% where verified during the construction phase.

The recommendations provided in this report should be verified in the design of the proposed buildings, using the full details of the loading conditions and taking into consideration the allowable tolerable settlements/movements that the building can accommodate. The founding strata should be inspected and verified by a suitably qualified engineer prior to construction of the building foundations.

Appendix 1: Site Location Plan


HOWTH ROAD
BH1
BH2
BH3
BH10
BH4
BH7
BH5
BH6
BH8
BH9

Appendix 2: Cable Percussion Borehole Records

Project Name: St. Paul's Raheny

Hole ID: BH1

Client:	New Generation	Co-ordinates:	720366.38 / 737591.04
Consultant:	OCSC	Elevation:	24.852
Location:	Raheny	Project no.	5228-07-15
Start date: 28/09/2015	End date: 29/09/2015	Drilled by:	F McArdle
Type of drilling: CP	Hole diameter: 200 mm	Logged by:	James Dunn

Strata Description	Depth	Level (mOD)
TOPSOIL	0.10	24.75
MADE GROUND comprising brown sandy gravelly Clay FILL	1.00	23.85
Stiff brown sandy gravelly CLAY with occassional cobbles	2.30	22.55
Stiff black sandy gravelly CLAY with occassional cobbles and boulders	5.50	19.35
Obstruction: Presumed Boulder	5.60	19.25
End of Borehole at 5.60 m		

Samples / tests Type	Depth	Result
SPT-C	0.50	N=21
B+T	0.50	
SPT-C	1.00	N=15
B+T	1.00	
SPT-C	2.00	N=20
B+T	2.00	
SPT-C	2.50	N=29
SPT-C	3.00	N=41
B+T	3.00	
SPT-C	4.00	50/300mm
B+T	4.00	
SPT-C	5.10	N=40
B+T	5.10	

Water Depth	Date
5.00	
5.60	29/09/2015

Remarks:
Chiselling from 3.6m to 3.8m BGL for 30 mins, from 4.7m to 4.8m BGL for 60 mins from 4.8m to 5.1m BGL for 35mins and from 5.5m to 5.6m BGL for 30mins
50mm standpipe with flush cover installed. Slotted with gravel response zone from 1.0m to 5.6m BGL and sealed from 0.0m to 1.0m BGL

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

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Project Name: St. Paul's Raheny

Hole ID: BH2

Client:	New Generation	Co-ordinates:	720501.93 737565.25
Consultant:	OCSC	Elevation:	22.489
Location:	Raheny	Project no.	5228-07-15
Start date: 30/09/2015	End date: 01/10/2015	Drilled by:	F McArdle
Type of drilling: CP	Hole diameter: 200 mm	Logged by:	James Dunn

Strata Description

Strata Description	Depth	Level (mOD)
TOPSOIL	0.20	22.29
MADE GROUND comprising brown sandy gravelly Clay FILL	0.80	21.69
Stiff brown sandy gravelly CLAY with occassional cobbles	2.20	20.29
Stiff black sandy gravelly CLAY with occassional cobbles and rare boulders	8.00	14.49
End of Borehole at 8.00 m		

Samples / tests

Type	Depth	Result	Water Depth	Date
SPT-C B+T	0.50 0.50	N=33		
SPT-C B+T	1.00 1.00	N=22		
SPT-C B+T	2.00 2.00	N=36		
SPT-C B+T	3.00 3.00	N=41		
SPT-C B+T	4.00 4.00	N=43		
SPT-C B+T	5.00 5.00	N=39		
SPT-C B+T	6.00 6.00	50/300mm		
SPT-C B+T	7.00 7.00	N=47		
SPT-C B+T	8.00 8.00	N=46		

Remarks:

50mm standpipe with flush cover installed. Slotted with gravel response zone from 2.0m to 5.0m BGL and sealed from 0.0m to 2.0m BGL

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

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Project Name: St. Paul's Raheny

Hole ID: BH3

Client:	New Generation	Co-ordinates:	720600.88 737513.70
Consultant:	OCSC	Elevation:	21.943
Location:	Raheny	Project no.	5228-07-15
Start date: 30/09/2015	End date: 01/10/2015	Drilled by:	F McArdle
Type of drilling: CP	Hole diameter: 200 mm	Logged by:	James Dunn

Strata Description	Legend	Depth	Level (mOD)	Samples / tests Type	Samples / tests Depth	Samples / tests Result	Water Depth	Date
TOPSOIL		0.10	21.84					
MADE GROUND comprising brown/grey sandy gravelly Clay FILL				SPT-C B+T	0.50 0.50	N=23		
				SPT-C B+T	1.00 1.00	N=29		
Stiff brown sandy gravelly CLAY with occassional cobbles		1.50	20.44	SPT-C	1.50	N=18		
Stiff black sandy gravelly CLAY with occassional cobbles and rare boulders		2.00	19.94	SPT-C B+T	2.00 2.00	N=46		
				SPT-C B+T	3.00 3.00	N=37		
				SPT-C B+T	4.00 4.00	N=37		
				SPT-C B+T	5.00 5.00	N=42		
Stiff grey sandy slightly gravelly CLAY		6.00	15.94	SPT-C B+T	6.00 6.00	50/300mm		
				SPT-C B+T	7.00 7.00	50/300mm		
							7.80 8.00	02/10/2015
End of Borehole at 8.00 m		8.00	13.94	B+T	8.00			

Remarks:
50mm standpipe with flush cover installed. Slotted with gravel response zone from 2.0m to 5.0m BGL and sealed from 0.0m to 2.0m BGL

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

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Project Name: St. Paul's Raheny

Hole ID: BH4

Client:	New Generation	Co-ordinates:	720484.56 737484.02
Consultant:	OCSC	Elevation:	23.349
Location:	Raheny	Project no.	5228-07-15
Start date: 29/09/2015	End date: 30/09/2015	Drilled by:	F McArdle
Type of drilling: CP	Hole diameter: 200 mm	Logged by:	James Dunn

Strata Description	Depth	Level (mOD)	Samples / tests Type	Samples / tests Depth	Samples / tests Result	Water Depth	Date
TOPSOIL	0.10	23.25					
MADE GROUND comprising brown/grey sandy gravelly Clay FILL with cobbles			SPT-C B+T	0.50 0.50	N=23		
			SPT-C B+T	1.00 1.00	N=17		
Stiff brown sandy gravelly CLAY with occassional cobbles	1.40	21.95					
			SPT-C B+T	2.00 2.00	N=33		
Stiff black sandy gravelly CLAY with occassional cobbles and rare boulders	2.20	21.15					
			SPT-C B+T	3.00 3.00	N=38		
			SPT-C B+T	4.00 4.00	N=38		
			SPT-C B+T	5.00 5.00	N=43		
			SPT-C B+T	6.00 6.00	N=45		
			SPT-C B+T	7.00 7.00	N=45		
End of Borehole at 8.00 m	8.00	15.35	SPT-C B+T	8.00 8.00	N=48		

Remarks:
Chiselling from 4.7m to 4.9m BGL for 30mins
Borehole backfilled on completion

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

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Project Name: St. Paul's Raheny

Hole ID: BH5

Client:	New Generation	Co-ordinates:	720591.52 737402.83
Consultant:	OCSC	Elevation:	22.407
Location:	Raheny	Project no.	5228-07-15
Start date: 02/10/2015	End date: 05/10/2015	Drilled by:	F McArdle
Type of drilling: CP	Hole diameter: 200 mm	Logged by:	James Dunn

Strata Description	Depth	Level (mOD)	Sample Type	Sample Depth	Result	Water Depth	Date
TOPSOIL	0.20	22.21					
MADE GROUND comprising brown/grey sandy gravelly Clay FILL with cobbles			SPT-C B+T	0.50 0.50	N=20		
			SPT-C B+T	1.00 1.00	N=21		
	1.30	21.11					
Stiff grey/brown sandy gravelly CLAY with occassional cobbles			SPT-C B+T	2.00 2.00	N=24		
	2.20	20.21					
Stiff black sandy gravelly CLAY with occassional cobbles and rare boulders			SPT-C	2.50	N=46		
			SPT-C B+T	3.00 3.00	N=43		
			SPT-C B+T	4.00 4.00	N=49		
			SPT-C B+T	5.00 5.00	N=38		
			SPT-C B+T	6.00 6.00	N=37		
			SPT-C B+T	7.00 7.00	N=45		
	8.00	14.41	SPT-C B+T	8.00 8.00	N=40		
End of Borehole at 8.00 m							

Remarks:
Borehole backfilled on completion

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

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Project Name: St. Paul's Raheny

Hole ID: BH6

Client: New Generation
Consultant: OCSC
Location: Raheny
Start date: 08/10/2015 | End date: 08/10/2015
Type of drilling: CP | Hole diameter: 200 mm

Co-ordinates: 720466.04 737407.03
Elevation: 23.223
Project no. 5228-07-15
Drilled by: F McArdle
Logged by: James Dunn

Strata Description	Legend	Depth	Level (mOD)	Samples / tests Type	Samples / tests Depth	Samples / tests Result	Water Depth	Date
TOPSOIL		0.10	23.12					
MADE GROUND comprising brown sandy gravelly Clay FILL with cobbles				SPT-C B+T	0.50 0.50	N=21		
				SPT-C B+T	1.00 1.00	N=17		
		1.30	21.92					
Stiff brown sandy gravelly CLAY with occassional cobbles				SPT-C B	1.50 1.50	N=21		
				SPT-C B+T	2.00 2.00	N=32		
		2.30	20.92					
Stiff black sandy gravelly CLAY with occassional cobbles and boulders				SPT-C	2.50	N=33		
				SPT-C B+T	3.00 3.00	N=35		
				SPT-C B+T	4.00 4.00	N=40		
				SPT-C B+T	5.00 5.00	N=39		
				SPT-C B+T	6.00 6.00	N=42		
				SPT-C B+T	7.00 7.00	N=45		
		7.80	15.42					
Obstruction: Presumbed Boulder		7.90	15.32					

End of Borehole at 7.90 m

Remarks:
Chiselling from 7.8m to 7.9m BGL for 60mins
50mm standpipe with flush cover installed. Slotted with gravel response zone from 2.0m to 5.6m BGL and sealed from 0.0m to 2.0m BGL

KEY
B Bulk disturbed sample.
D Small disturbed sample
U Undisturbed sample
SPT-S Standard Penetration Test, split spoon.
SPT-C Standard Penetration Test, solid cone.
▽ Groundwater strike
▼ Water level 20mins after strike.

GROUND INVESTIGATIONS IRELAND
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Project Name: St. Paul's Raheny

Hole ID: BH7

Client:	New Generation	Co-ordinates:	720347.86 737449.43
Consultant:	OCSC	Elevation:	23.972
Location:	Raheny	Project no.	5228-07-15
Start date: 09/10/2015	End date: 09/10/2015	Drilled by:	F McArdle
Type of drilling: CP	Hole diameter: 200 mm	Logged by:	James Dunn

Strata Description	Depth	Level (mOD)
TOPSOIL	0.20	23.77
MADE GROUND comprising brown/grey sandy gravelly Clay FILL with cobbles	0.90	23.07
Stiff brown sandy gravelly CLAY with occassional cobbles	2.20	21.77
Stiff black sandy gravelly CLAY with occassional cobbles and rare boulders	8.50	15.47
End of Borehole at 8.50 m		

Samples / tests Type	Depth	Result	Water Depth	Date
SPT-C B+T	0.50 0.50	N=20		
SPT-C B+T	1.00 1.00	N=17		
SPT-C B+T	2.00 2.00	N=30		
SPT-C B+T	3.00 3.00	N=36		
SPT-C B+T	4.00 4.00	N=38		
SPT-C B+T	5.00 5.00	N=37		
SPT-C B+T	6.00 6.00	N=41		
SPT-C B+T	7.00 7.00	50/180mm		
SPT-C B+T	8.00 8.00	N=45		

Remarks:

Chiselling from 7.4m to 7.6m BGL for 30mins
Borehole backfilled on completion

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

GROUND INVESTIGATIONS IRELAND

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Project Name: St. Paul's Raheny — Hole ID: BH8

Client:	New Generation	Co-ordinates:	720443.89 737307.54
Consultant:	OCSC	Elevation:	22.279
Location:	Raheny	Project no.	5228-07-15
Start date: 06/10/2015	End date: 06/10/2015	Drilled by:	F McArdle
Type of drilling: CP	Hole diameter: 200 mm	Logged by:	James Dunn

Strata Description	Legend	Depth	Level (mOD)	Samples / tests Type	Samples / tests Depth	Samples / tests Result	Water Depth	Date
TOPSOIL		0.20	22.08					
MADE GROUND comprising brown/grey sandy gravelly Clay FILL with cobbles and fragments of plastic				SPT-C B+T	0.50 0.50	N=25		
				SPT-C B+T	1.00 1.00	N=20		
Stiff grey brown sandy gravelly CLAY with occassional cobbles		1.20	21.08					
				SPT-C B+T	2.00 2.00	N=18		
				SPT-C	2.50	N=23		
Stiff black sandy gravelly CLAY with occassional cobbles and rare boulders		3.00	19.28	SPT-C B+T	3.00 3.00	N=28		
				SPT-C B+T	4.00 4.00	N=37		
				SPT-C B+T	5.00 5.00	N=38		
				SPT-C B+T	6.00 6.00	N=38		
				SPT-C B+T	7.00 7.00	N=45		
End of Borehole at 8.00 m		8.00	14.28	SPT-C B+T	8.00 8.00	50/300mm		

Remarks:
Borehole backfilled on completion

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

GROUND INVESTIGATIONS IRELAND
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Project Name: St. Paul's Raheny

Hole ID: BH9

Client:	New Generation	Co-ordinates:	720588.42 737295.98
Consultant:	OCSC	Elevation:	21.421
Location:	Raheny	Project no.	5228-07-15
Start date: 05/10/2015	End date: 06/10/2015	Drilled by:	F McArdle
Type of drilling: CP	Hole diameter: 200 mm	Logged by:	James Dunn

Strata Description	Depth	Level (mOD)	Samples / tests Type	Depth	Result	Water Depth	Date
TOPSOIL	0.10	21.32					
MADE GROUND comprising brown/grey sandy gravelly Clay FILL with cobbles			SPT-C B+T	0.50 0.50	N=19		
Stiff brown sandy gravelly CLAY with occassional cobbles	1.00	20.42	SPT-C B+T	1.00 1.00	N=18		
			SPT-C B+T	2.00 2.00	N=15		
Firm to stiff black slightly silty gravelly CLAY with occassional cobbles	2.20	19.22					
			SPT-C B	2.50 2.50	N=14		
Stiff black sandy gravelly CLAY with occassional cobbles and rare boulders	3.00	18.42	SPT-C B+T	3.00 3.00	N=28		
			SPT-C B+T	4.00 4.00	N=37		
			SPT-C B+T	5.00 5.00	N=41		
			SPT-C B+T	6.00 6.00	N=37		
			SPT-C B+T	7.00 7.00	N=38		
End of Borehole at 8.00 m	8.00	13.42	SPT-C B+T	8.00 8.00	N=38		

Remarks:
50mm standpipe with flush cover installed. Slotted with gravel response zone from 2.0m to 5.0m BGL and sealed from 0.0m to 2.0m BGL

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

GROUND INVESTIGATIONS IRELAND

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Project Name: St. Paul's Raheny

Hole ID: BH10

Client:	New Generation	Co-ordinates:	720389.97 737509.16
Consultant:	OCSC	Elevation:	24.554
Location:	Raheny	Project no.	5228-07-15
Start date: 07/10/2015	End date: 07/10/2015	Drilled by:	F McArdle
Type of drilling: CP	Hole diameter: 200 mm	Logged by:	James Dunn

Strata Description	Legend	Depth	Level (mOD)	Samples / tests Type	Samples / tests Depth	Samples / tests Result	Water Depth	Date
TOPSOIL		0.10	24.45					
MADE GROUND comprising brown/grey sandy gravelly Clay FILL with cobbles				SPT-C B+T	0.50 0.50	N=14		
				SPT-C B+T	1.00 1.00	N=12		
Stiff brown sandy gravelly CLAY with occassional cobbles		1.50	23.05	SPT-C B	1.50 1.50	N=18		
				SPT-C B+T	2.00 2.00	N=29		
Stiff black sandy gravelly CLAY with occassional cobbles and rare boulders and gravell lenses from 8.0m to 8.1m BGL		2.30	22.25					
				SPT-C B	2.50 2.50	N=17		
				SPT-C B+T	3.00 3.00	N=30		
				SPT-C B+T	4.00 4.00	N=37		
				SPT-C B+T	5.00 5.00	N=40		
				SPT-C B+T	6.00 6.00	N=39		
				SPT-C B+T	7.00 7.00	N=43		
							7.70	
				SPT-C B+T	8.00 8.00	50/180mm	8.00	07/10/2015
Obstruction: Presumed Boulder		8.10	16.45					
		8.20	16.35					

End of Borehole at 8.20 m

Remarks:
Chiselling from 8.1m to 8.2m BGL for 30mins
Borehole backfilled on completion

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

GROUND INVESTIGATIONS IRELAND
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Appendix 3: Laboratory Testing

National Materials Testing Laboratory Ltd.

SUMMARY OF TEST RESULTS

			Particle			Index Properties		Bulk	Cell	Undrained Triaxial Tests		Shear Strength	
BH/TP	Depth	Moisture	Density	<425um	LL	PL	PI	Density	Presssure	Compressive	Strain at	Cu	Mode of
No	m	%	Mg/m3	%	%	%	%	Mg/m3	kPa	Stress kPa	Failure %	kPa	Failure
BH5	2.50	12.3		59.8	30	15	15						
BH5	5.60	11.0		58.7	28	15	13						
BH5	8.00	8.6		57.5	28	14	14						
BH7	1.00	14.5		64.2	31	17	14						
BH7	4.00	13.3		57.3	28	15	13						
BH9	0.50	22.9		48.9	55	30	25						
BH9	1.00	14.5		58.8	34	18	16						
BH9	2.00	13.3		62.3	30	16	14						

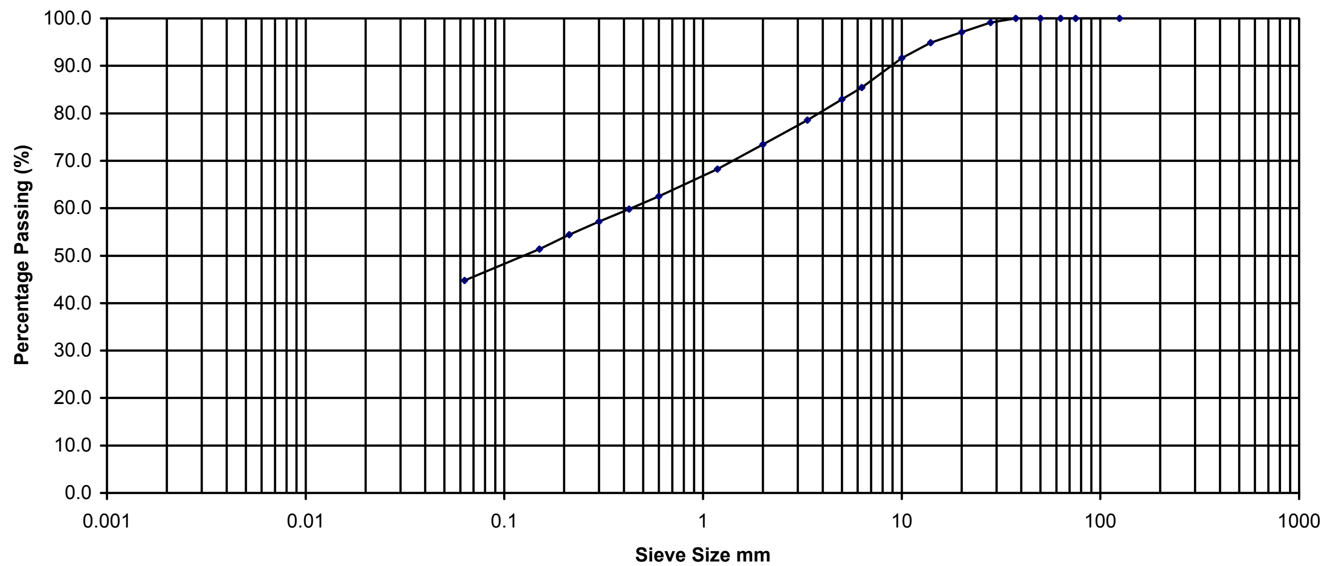
NMTL	Notes :	Job ref No.	NMTL 1489	Table
	1. All BS tests carried out using preferred (definitive) method unless otherwise stated.	Location	St Paul's Rahney	

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	99.1
20.000	97.1
14.000	94.9
10.000	91.6
6.300	85.4
5.000	82.9
3.350	78.5
2.000	73.4
1.180	68.3
0.600	62.5
0.425	59.8
0.300	57.2
0.212	54.4
0.150	51.4
0.063	44.8

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
0.0	44.8			28.6			26.6			0.0	0.0

Sample Description: Dark grey slightly gravelly slightly sandy SILT/CLAY.

Project: St Paul's Rahney

Project No.	NMTL 1489		
BH/TP No.	BH5		
Sample No.	B		
Depth	2.50m		

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	22/10/2015

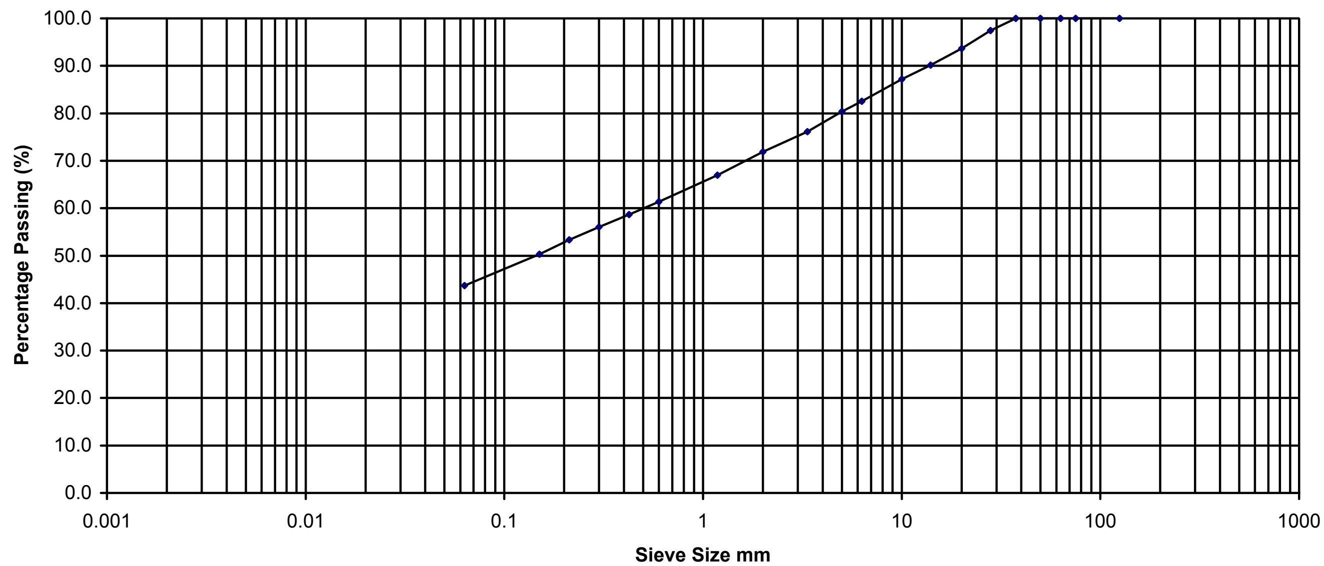
NM TL Ltd

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	97.5
20.000	93.7
14.000	90.1
10.000	87.2
6.300	82.5
5.000	80.4
3.350	76.1
2.000	71.8
1.180	67.0
0.600	61.3
0.425	58.7
0.300	56.1
0.212	53.3
0.150	50.3
0.063	43.7

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Percentage Particle Size

Clay	Silt (Fine / Medium / Coarse)	Sand (Fine / Medium / Coarse)	Gravel (Fine / Medium / Coarse)	Cobbles	Boulder
0.0	43.7	28.2	28.2	0.0	0.0

Sample Description	Dark grey slightly gravelly slightly sandy SILT/CLAY.	Project No.	NMTL 1489
		BH/TP No.	BH5
Project	St Paul's Rahney	Sample No.	B

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	22/10/2015	Depth	5.60m

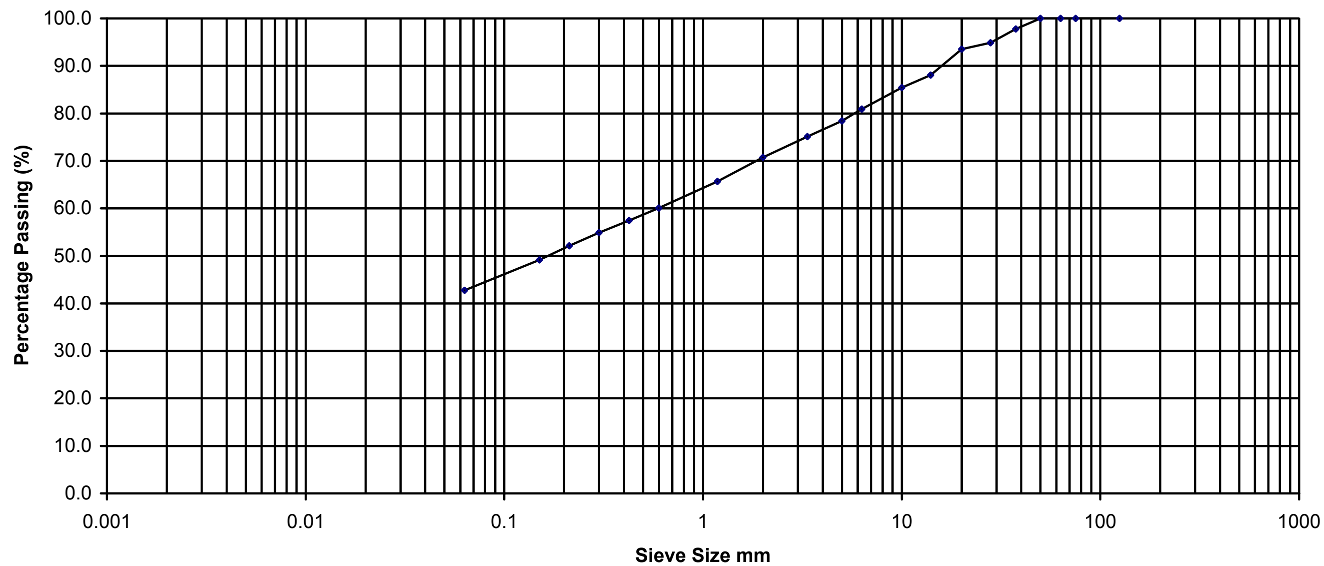
NM TL Ltd

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	97.8
28.000	94.9
20.000	93.5
14.000	88.1
10.000	85.5
6.300	80.9
5.000	78.4
3.350	75.1
2.000	70.7
1.180	65.7
0.600	60.1
0.425	57.5
0.300	54.9
0.212	52.2
0.150	49.2
0.063	42.8

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Percentage Particle Size

Clay	Silt (Fine Medium Coarse)	Sand (Fine Medium Coarse)	Gravel (Fine Medium Coarse)	Cobbles	Boulder
0.0	42.8	28.0	29.3	0.0	0.0

Sample Description Dark grey slightly gravelly slightly sandy SILT/CLAY.

Project St Paul's Rahney

Project No.	NMTL 1489
BH/TP No.	BH5
Sample No.	B
Depth	8.00m

NM TL Ltd

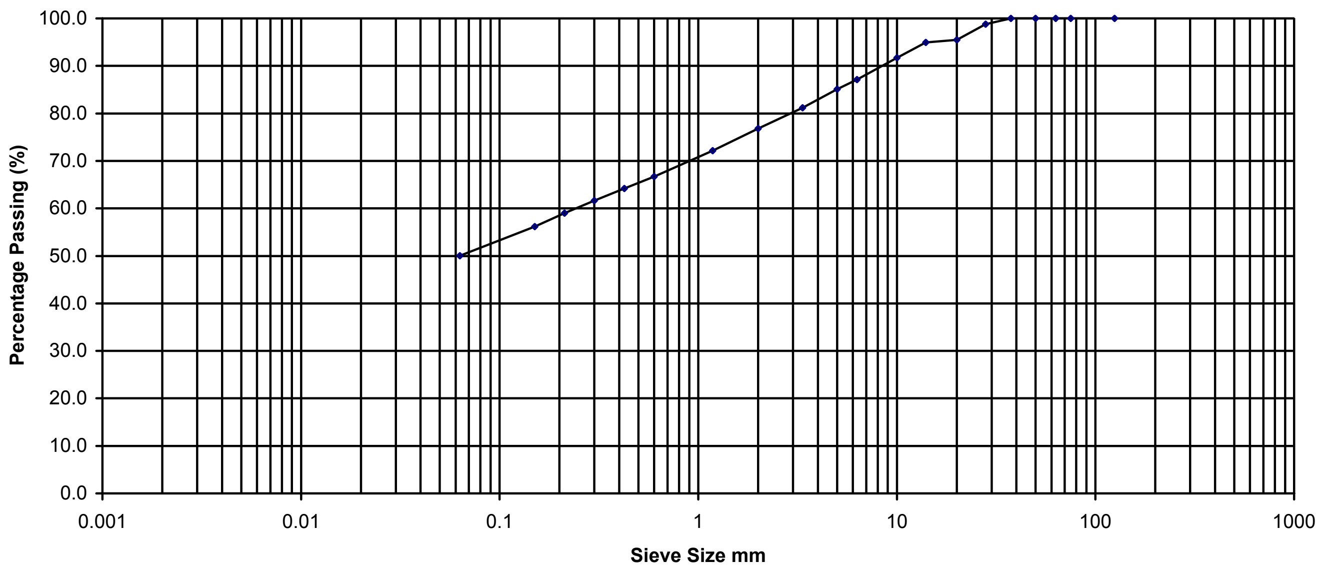
Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	22/10/2015

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	98.8
20.000	95.5
14.000	95.0
10.000	91.7
6.300	87.2
5.000	85.1
3.350	81.2
2.000	76.8
1.180	72.1
0.600	66.7
0.425	64.2
0.300	61.6
0.212	59.0
0.150	56.2
0.063	50.1

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
0.0	50.1	26.7	23.2	0.0	0.0

Sample Description Dark grey slightly gravelly slightly sandy SILT/CLAY.

Project St Paul's Rahney

Project No.	NMTL 1489
BH/TP No.	BH7
Sample No.	B
Depth	1.00m

NM TL Ltd

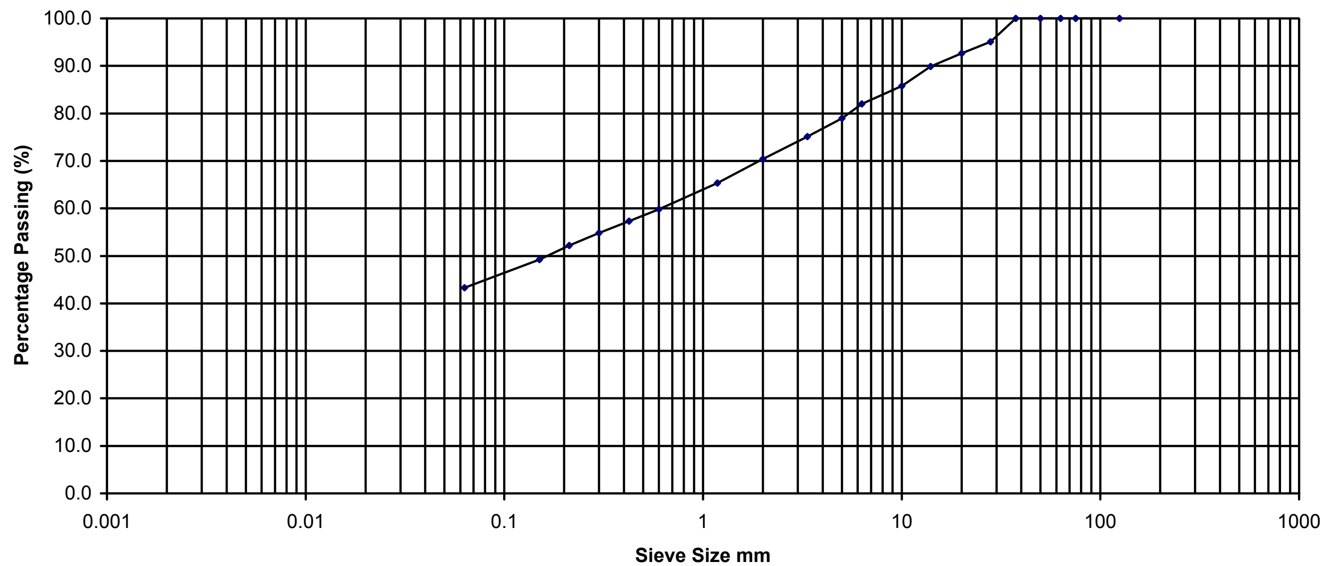
Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	22/10/2015

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	95.1
20.000	92.7
14.000	89.9
10.000	85.8
6.300	82.0
5.000	78.9
3.350	75.1
2.000	70.4
1.180	65.3
0.600	59.8
0.425	57.3
0.300	54.8
0.212	52.2
0.150	49.2
0.063	43.3



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
0.0	43.3			27.1			29.6			0.0	0.0

Sample Description: Dark grey slightly sandy slightly gravelly SILT/CLAY.

Project: St Paul's Rahney

Project No.	NMTL 1489
BH/TP No.	BH7
Sample No.	B
Depth	4.00m

NM TL Ltd

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	22/10/2015

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	77.3
28.000	70.8
20.000	69.2
14.000	66.3
10.000	64.7
6.300	61.7
5.000	60.6
3.350	58.4
2.000	56.1
1.180	53.5
0.600	50.5
0.425	48.9
0.300	46.9
0.212	44.9
0.150	42.5
0.063	37.6

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
0.0	37.6	18.5	43.9	0.0	0.0

Sample Description: Brown slightly sandy gravelly SILT/CLAY.

Project: St Paul's Rahney

Project No.	NMTL 1489
BH/TP No.	BH9
Sample No.	B
Depth	0.50m

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	22/10/2015

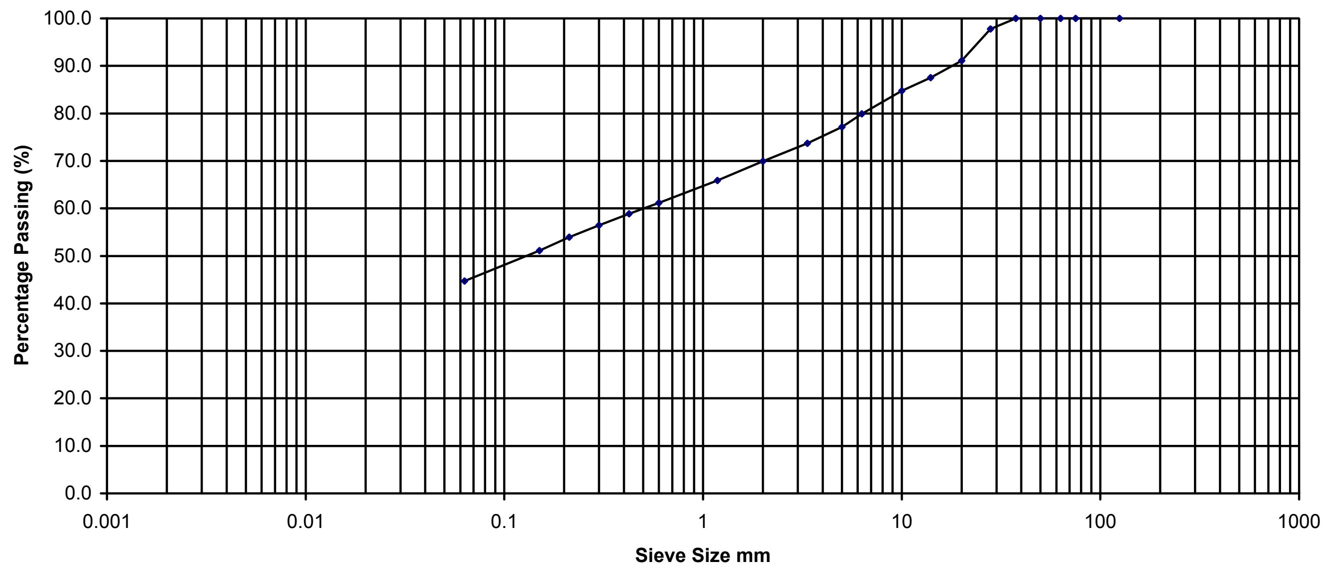
NM TL Ltd

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	97.8
20.000	91.1
14.000	87.5
10.000	84.7
6.300	79.9
5.000	77.1
3.350	73.7
2.000	69.9
1.180	65.9
0.600	61.1
0.425	58.8
0.300	56.5
0.212	54.0
0.150	51.1
0.063	44.7

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
0.0	44.7	25.2	30.1	0.0	0.0

Sample Description	Brown slightly sandy slightly gravelly SILT/CLAY.	Project No.	NMTL 1489
		BH/TP No.	BH9
Project	St Paul's Rahney	Sample No.	B

NM TL Ltd

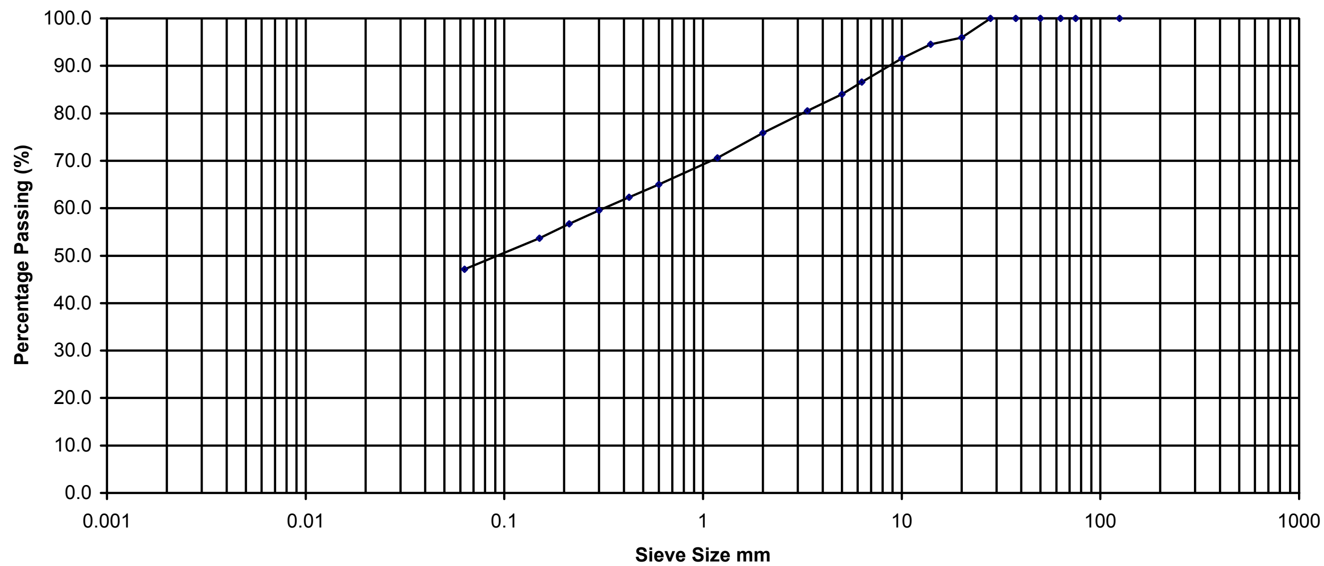
Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	23/10/2015	Depth	1.00m

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	96.0
14.000	94.5
10.000	91.6
6.300	86.6
5.000	84.0
3.350	80.5
2.000	75.8
1.180	70.6
0.600	65.0
0.425	62.3
0.300	59.6
0.212	56.7
0.150	53.7
0.063	47.1

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
0.0	47.1			28.7			24.2			0.0	0.0

Sample Description Brown/dark brown slightly gravelly slightly sandy SILT/CLAY.

Project St Paul's Rahney

Project No.	NMTL 1489
BH/TP No.	BH9
Sample No.	B
Depth	2.00m

NM TL Ltd

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	23/10/2015

Jones Environmental Laboratory

Registered Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Deeside, CH5 2UA. UK

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

Tel: +44 (0) 1244 833780
Fax: +44 (0) 1244 833781

O'Connor Sutton Cronin & Assoc. Ltd
9 Prussia Street
Dublin 7
Ireland

Attention :	Cian O'Hora
Date :	14th October, 2015
Your reference :	
Our reference :	Test Report 15/14318 Batch 1
Location :	St Pauls
Date samples received :	6th October, 2015
Status :	Final report
Issue :	1

Eleven samples were received for analysis on 6th October, 2015 of which eleven were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Where Waste Acceptance Criteria Suite (EC Decision of 19 December 2002 (2003/33/EC)) has been requested, all analyses have been performed using the relevant EN methods where they exist.

Compiled By:

Bruce Leslie
Project Co-ordinator

Client Name:	O'Connor Sutton Cronin & Assoc. Ltd	**Report :**	**Solid**
Reference:			
Location:	St Pauls	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Cian O'Hora		
JE Job No.:	15/14318		

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1	2	3	4	5	6	7	8	9	10			
Sample ID	BH1	BH1	BH2	BH2	BH2	BH2	BH3	BH4	BH4	BH4			
Depth	0.00-1.00	1.00-2.00	0.50	1.00	2.00	3.00	0.50	0.00-1.00	1.00-2.00	2.00-3.00			
COC No / misc													
Containers	T	T	T	T	T	T	T	T	T	T			
Sample Date	28/09/2015	28/09/2015	30/09/2015	30/09/2015	30/09/2015	30/09/2015	01/10/2015	03/10/2015	03/10/2015	03/10/2015			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015			
Antimony	<1	4	3	4	2	2	-	3	2	2	<1	mg/kg	TM30/PM15
Arsenic #	6.9	13.0	20.0	13.2	10.9	8.6	-	16.1	10.0	10.6	<0.5	mg/kg	TM30/PM15
Barium #	135	72	132	69	131	107	-	124	102	100	<1	mg/kg	TM30/PM15
Cadmium #	1.5	1.3	2.2	2.7	3.2	1.5	-	2.7	1.7	1.7	<0.1	mg/kg	TM30/PM15
Chromium #	28.0	33.2	60.6	31.4	34.0	34.0	-	58.0	30.0	28.4	<0.5	mg/kg	TM30/PM15
Copper #	20	25	33	22	27	22	-	36	23	24	<1	mg/kg	TM30/PM15
Lead #	15	19	48	18	18	22	-	59	19	19	<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Molybdenum #	2.6	6.1	4.9	7.7	4.5	2.9	-	3.7	3.7	4.1	<0.1	mg/kg	TM30/PM15
Nickel #	22.0	39.5	49.7	36.2	47.6	35.2	-	49.6	37.3	35.1	<0.7	mg/kg	TM30/PM15
Selenium #	<1	6	2	1	3	3	-	2	2	1	<1	mg/kg	TM30/PM15
Zinc #	49	62	109	67	91	63	-	101	75	70	<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	<0.03	0.05	<0.03	<0.03	0.04	0.16	0.06	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.05	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.05	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	0.02	<0.02	<0.02	0.03	0.07	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	99	106	95	101	99	102	106	103	95	101	<0	%	TM4/PM8
Mineral Oil >C8-C10	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	mg/kg	TM5/PM16
Mineral Oil >C10-C12	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM16
Mineral Oil >C12-C16	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM16
Mineral Oil >C16-C21	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM16
Mineral Oil >C21-C40	<10	87	<10	<10	<10	132	<10	<10	<10	<10	<10	mg/kg	TM5/PM16
Mineral Oil >C8-C40	<45	87	<45	<45	<45	132	<45	<45	<45	<45	<45	mg/kg	TM5/PM16

Jones Environmental Laboratory

Client Name: O'Connor Sutton Cronin & Assoc. Ltd
Reference:
Location: St Pauls
Contact: Cian O'Hora
JE Job No.: 15/14318

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1	2	3	4	5	6	7	8	9	10	LOD/LOR	Units	Method No.
Sample ID	BH1	BH1	BH2	BH2	BH2	BH2	BH3	BH4	BH4	BH4			
Depth	0.00-1.00	1.00-2.00	0.50	1.00	2.00	3.00	0.50	0.00-1.00	1.00-2.00	2.00-3.00			
COC No / misc													
Containers	T	T	T	T	T	T	T	T	T	T			
Sample Date	28/09/2015	28/09/2015	30/09/2015	30/09/2015	30/09/2015	30/09/2015	01/10/2015	03/10/2015	03/10/2015	03/10/2015			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015			
TPH CWG													
Aliphatics													
>C5-C6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C6-C8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C12 #	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM16
>C12-C16 #	<4	<4	<4	<4	<4	<4	-	<4	<4	<4	<4	mg/kg	TM5/PM16
>C16-C21 #	<7	<7	<7	<7	<7	<7	-	<7	<7	<7	<7	mg/kg	TM5/PM16
>C21-C35 #	<7	87	<7	<7	8	132	-	<7	<7	<7	<7	mg/kg	TM5/PM16
>C35-C40 #	<7	<7	<7	<7	<7	<7	-	<7	<7	<7	<7	mg/kg	TM5/PM16
Total aliphatics C5-40	<26	87	<26	<26	<26	132	-	<26	<26	<26	<26	mg/kg	TM5/TM36/PM12/PM16
>C6-C10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10	<10	<10	<10	17	-	<10	<10	<10	<10	mg/kg	TM5/PM16
>C25-C35	<10	76	<10	<10	<10	115	-	<10	<10	<10	<10	mg/kg	TM5/PM16
Aromatics													
>C5-EC7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC7-EC8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC8-EC10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC12	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM16
>EC12-EC16	<4	<4	<4	<4	<4	<4	-	<4	<4	<4	<4	mg/kg	TM5/PM16
>EC16-EC21	<7	<7	<7	<7	<7	<7	-	<7	<7	<7	<7	mg/kg	TM5/PM16
>EC21-EC35	<7	32	<7	<7	<7	55	-	<7	<7	<7	<7	mg/kg	TM5/PM16
>EC35-EC40	<7	<7	<7	<7	<7	<7	-	<7	<7	<7	<7	mg/kg	TM5/PM16
Total aromatics C5-40	<26	32	<26	<26	<26	55	-	<26	<26	<26	<26	mg/kg	TM5/TM36/PM12/PM16
Total aliphatics and aromatics(C5-40)	<52	119	<52	<52	<52	187	-	<52	<52	<52	<52	mg/kg	TM5/TM36/PM12/PM16
>EC6-EC10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC25	<10	<10	<10	<10	<10	<10	-	<10	<10	<10	<10	mg/kg	TM5/PM16
>EC25-EC35	<10	32	<10	<10	<10	53	-	<10	<10	<10	<10	mg/kg	TM5/PM16
MTBE	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM31/PM12
Benzene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM31/PM12
Toluene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM31/PM12
Ethylbenzene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM31/PM12
m/p-Xylene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM31/PM12
o-Xylene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM31/PM12
PCB 28 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 52 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 118 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 138 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 153 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 180 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
Total 7 PCBs #	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	ug/kg	TM17/PM8

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Client Name: O'Connor Sutton Cronin & Assoc. Ltd
Reference:
Location: St Pauls
Contact: Cian O'Hora
JE Job No.: 15/14318

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1	2	3	4	5	6	7	8	9	10			
Sample ID	BH1	BH1	BH2	BH2	BH2	BH2	BH3	BH4	BH4	BH4			
Depth	0.00-1.00	1.00-2.00	0.50	1.00	2.00	3.00	0.50	0.00-1.00	1.00-2.00	2.00-3.00			
COC No / misc													
Containers	T	T	T	T	T	T	T	T	T	T			
Sample Date	28/09/2015	28/09/2015	30/09/2015	30/09/2015	30/09/2015	30/09/2015	01/10/2015	03/10/2015	03/10/2015	03/10/2015			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015			
Natural Moisture Content	9.7	8.9	17.7	12.5	10.6	8.2	13.4	22.3	10.7	10.9	<0.1	%	PM4/PM0
% Dry Matter 105°C	85.9	86.9	85.4	89.6	88.8	89.6	85.5	79.7	88.9	87.7	<0.1	%	NONE/PM4
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	-	<0.3	<0.3	<0.3	<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.0516	-	<0.0015	-	-	-	0.0027	0.0224	-	-	<0.0015	g/l	TM38/PM20
Chromium III	28.0	33.2	60.6	31.4	34.0	34.0	-	58.0	30.0	28.4	<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.50	1.03	1.20	0.44	0.53	0.53	2.27	2.02	0.34	0.38	<0.02	%	TM21/PM24
pH #	8.65	-	8.50	-	-	-	8.36	8.56	-	-	<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1051	0.1036	0.1056	0.1003	0.1011	0.1003	0.105	0.1133	0.1007	0.1022		kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		kg	NONE/PM17

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Client Name: O'Connor Sutton Cronin & Assoc. Ltd
Reference:
Location: St Pauls
Contact: Cian O'Hora
JE Job No.: 15/14318

Report : **Solid**

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	11												
Sample ID	BH4												
Depth	3.00-4.00												
COC No / misc													
Containers	T												
Sample Date	03/10/2015												
Sample Type	Soil												
Batch Number	1												
Date of Receipt	06/10/2015										LOD/LOR	Units	Method No.
Antimony	2										<1	mg/kg	TM30/PM15
Arsenic #	10.0										<0.5	mg/kg	TM30/PM15
Barium #	121										<1	mg/kg	TM30/PM15
Cadmium #	2.0										<0.1	mg/kg	TM30/PM15
Chromium #	33.4										<0.5	mg/kg	TM30/PM15
Copper #	25										<1	mg/kg	TM30/PM15
Lead #	20										<5	mg/kg	TM30/PM15
Mercury #	<0.1										<0.1	mg/kg	TM30/PM15
Molybdenum #	4.2										<0.1	mg/kg	TM30/PM15
Nickel #	39.8										<0.7	mg/kg	TM30/PM15
Selenium #	9										<1	mg/kg	TM30/PM15
Zinc #	86										<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04										<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03										<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05										<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04										<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03										<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04										<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03										<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03										<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06										<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02										<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07										<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04										<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04										<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04										<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04										<0.04	mg/kg	TM4/PM8
Coronene	<0.04										<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<0.22										<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64										<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05										<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02										<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	99										<0	%	TM4/PM8
Mineral Oil >C8-C10	<5										<5	mg/kg	TM5/PM16
Mineral Oil >C10-C12	<10										<10	mg/kg	TM5/PM16
Mineral Oil >C12-C16	<10										<10	mg/kg	TM5/PM16
Mineral Oil >C16-C21	<10										<10	mg/kg	TM5/PM16
Mineral Oil >C21-C40	<10										<10	mg/kg	TM5/PM16
Mineral Oil >C8-C40	<45										<45	mg/kg	TM5/PM16

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Jones Environmental Laboratory

Client Name: O'Connor Sutton Cronin & Assoc. Ltd

Report : **Solid**

Reference:

Location: St Pauls

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Contact: Cian O'Hora

JE Job No.: 15/14318

Please see attached notes for all abbreviations and acronyms

J E Sample No.	11												
Sample ID	BH4												
Depth	3.00-4.00												
COC No / misc													
Containers	T												
Sample Date	03/10/2015												
Sample Type	Soil												
Batch Number	1											LOD/LOR	Units	Method No.
Date of Receipt	06/10/2015												
TPH CWG													
Aliphatics													
>C5-C6	<0.1										<0.1	mg/kg	TM36/PM12
>C6-C8	<0.1										<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1										<0.1	mg/kg	TM36/PM12
>C10-C12#	<0.2										<0.2	mg/kg	TM5/PM16
>C12-C16#	<4										<4	mg/kg	TM5/PM16
>C16-C21#	<7										<7	mg/kg	TM5/PM16
>C21-C35#	<7										<7	mg/kg	TM5/PM16
>C35-C40#	<7										<7	mg/kg	TM5/PM16
Total aliphatics C5-40	<26										<26	mg/kg	TM5/TM36/PM12/PM16
>C6-C10	<0.1										<0.1	mg/kg	TM36/PM12
>C10-C25	<10										<10	mg/kg	TM5/PM16
>C25-C35	<10										<10	mg/kg	TM5/PM16
Aromatics													
>C5-EC7	<0.1										<0.1	mg/kg	TM36/PM12
>EC7-EC8	<0.1										<0.1	mg/kg	TM36/PM12
>EC8-EC10	<0.1										<0.1	mg/kg	TM36/PM12
>EC10-EC12	<0.2										<0.2	mg/kg	TM5/PM16
>EC12-EC16	<4										<4	mg/kg	TM5/PM16
>EC16-EC21	<7										<7	mg/kg	TM5/PM16
>EC21-EC35	<7										<7	mg/kg	TM5/PM16
>EC35-EC40	<7										<7	mg/kg	TM5/PM16
Total aromatics C5-40	<26										<26	mg/kg	TM5/TM36/PM12/PM16
Total aliphatics and aromatics(C5-40)	<52										<52	mg/kg	TM5/TM36/PM12/PM16
>EC6-EC10	<0.1										<0.1	mg/kg	TM36/PM12
>EC10-EC25	<10										<10	mg/kg	TM5/PM16
>EC25-EC35	<10										<10	mg/kg	TM5/PM16
MTBE	<5										<5	ug/kg	TM31/PM12
Benzene	<5										<5	ug/kg	TM31/PM12
Toluene	<5										<5	ug/kg	TM31/PM12
Ethylbenzene	<5										<5	ug/kg	TM31/PM12
m/p-Xylene	<5										<5	ug/kg	TM31/PM12
o-Xylene	<5										<5	ug/kg	TM31/PM12
PCB 28#	<5										<5	ug/kg	TM17/PM8
PCB 52#	<5										<5	ug/kg	TM17/PM8
PCB 101#	<5										<5	ug/kg	TM17/PM8
PCB 118#	<5										<5	ug/kg	TM17/PM8
PCB 138#	<5										<5	ug/kg	TM17/PM8
PCB 153#	<5										<5	ug/kg	TM17/PM8
PCB 180#	<5										<5	ug/kg	TM17/PM8
Total 7 PCBs#	<35										<35	ug/kg	TM17/PM8

Client Name: O'Connor Sutton Cronin & Assoc. Ltd
Reference:
Location: St Pauls
Contact: Cian O'Hora
JE Job No.: 15/14318

Report : **Solid**

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

											LOD/LOR	Units	Method No.
J E Sample No.	11												
Sample ID	BH4												
Depth	3.00-4.00												
COC No / misc													
Containers	T												
Sample Date	03/10/2015												
Sample Type	Soil												
Batch Number	1												
Date of Receipt	06/10/2015												
Natural Moisture Content	11.9										<0.1	%	PM4/PM0
% Dry Matter 105°C	89.0										<0.1	%	NONE/PM4
Hexavalent Chromium #	<0.3										<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	-										<0.0015	g/l	TM38/PM20
Chromium III	33.4										<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.65										<0.02	%	TM21/PM24
pH #	-										<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1008											kg	NONE/PM17
Mass of dried test portion	0.09											kg	NONE/PM17

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Jones Environmental Laboratory

Client Name:	O'Connor Sutton Cronin & Assoc. Ltd	**Report :**	**CEN 10:1 1 Batch**
Reference:			
Location:	St Pauls	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Cian O'Hora		
JE Job No.:	15/14318		

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1	2	3	4	5	6	7	8	9	10			
Sample ID	BH1	BH1	BH2	BH2	BH2	BH2	BH3	BH4	BH4	BH4			
Depth	0.00-1.00	1.00-2.00	0.50	1.00	2.00	3.00	0.50	0.00-1.00	1.00-2.00	2.00-3.00			
COC No / misc													
Containers	T	T	T	T	T	T	T	T	T	T			
Sample Date	28/09/2015	28/09/2015	30/09/2015	30/09/2015	30/09/2015	30/09/2015	01/10/2015	03/10/2015	03/10/2015	03/10/2015			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015			
Dissolved Antimony #	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.015	0.012	<0.003	<0.003	0.011	0.051	<0.003	<0.003	0.005	0.004	<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	0.15	0.12	<0.03	<0.03	0.11	0.51	<0.03	<0.03	0.05	0.04	<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.035	0.037	0.013	0.021	0.029	0.020	0.006	0.011	0.029	0.028	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.35	0.37	0.13	0.21	0.29	0.20	0.06	0.11	0.29	0.28	<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	0.027	<0.003	<0.003	<0.003	0.028	<0.003	<0.003	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	<0.03	0.27	<0.03	<0.03	<0.03	0.28	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	<0.003	<0.003	0.004	0.004	<0.003	0.004	0.005	0.004	0.005	0.004	<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	<0.03	0.04	0.04	<0.03	0.04	0.05	0.04	0.05	0.04	<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	0.00028	0.00006	<0.00001	0.00001	0.00029	0.00007	0.00003	0.00002	<0.00001	mg/l	TM61/PM38
Mercury Dissolved by CVAF #	<0.0001	<0.0001	0.0028	0.0006	<0.0001	<0.0001	0.0029	0.0007	0.0003	0.0002	<0.0001	mg/kg	TM61/PM38
Phenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM26/PM0
Fluoride	<0.3	<0.3	0.3	<0.3	<0.3	0.3	0.5	0.5	<0.3	<0.3	<0.3	mg/l	TM27/PM0
Fluoride	<3	<3	3	<3	<3	<3	5	5	<3	<3	<3	mg/kg	TM27/PM0
Chloride	1.1	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.4	<0.3	<0.3	<0.3	mg/l	TM27/PM0
Chloride	11	<3	<3	<3	<3	<3	<3	4	<3	<3	<3	mg/kg	TM27/PM0
Sulphate	3.59	16.54	0.28	0.52	4.67	29.70	0.32	0.82	0.50	0.61	<0.05	mg/l	TM27/PM0
Sulphate	35.9	165.5	2.8	5.2	46.7	296.8	3.2	8.2	5.0	6.1	<0.5	mg/kg	TM27/PM0
Mass of raw test portion	0.1051	0.1036	0.1056	0.1003	0.1011	0.1003	0.105	0.1133	0.1007	0.1022		kg	NONE/PM17
Leachant Volume	0.885	0.887	0.885	0.89	0.889	0.889	0.885	0.877	0.889	0.887		l	NONE/PM17
Eluate Volume	0.65	0.75	0.83	0.83	0.85	0.6	0.8	0.75	0.85	0.83		l	NONE/PM17
Dissolved Organic Carbon	3	2	7	4	3	3	7	6	4	4	<2	mg/l	TM60/PM0
Dissolved Organic Carbon	30	20	70	40	30	30	70	60	40	40	<20	mg/kg	TM60/PM0
Total Dissolved Solids #	75	119	71	97	80	149	56	180	107	98	<10	mg/l	TM20/PM0
Total Dissolved Solids #	750	1191	710	970	800	1489	560	1800	1070	980	<100	mg/kg	TM20/PM0

Client Name:	O'Connor Sutton Cronin & Assoc. Ltd
Reference:	
Location:	St Pauls
Contact:	Cian O'Hora
JE Job No.:	15/14318

Report : **CEN 10:1 1 Batch**

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	11										LOD/LOR	Units	Method No.
Sample ID	BH4												
Depth	3.00-4.00												
COC No / misc													
Containers	T												
Sample Date	03/10/2015												
Sample Type	Soil												
Batch Number	1												
Date of Receipt	06/10/2015												
Dissolved Antimony #	<0.002										<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02										<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025										<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025										<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.017										<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	0.17										<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005										<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005										<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015										<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015										<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007										<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07										<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005										<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05										<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.043										<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.43										<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002										<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02										<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003										<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	<0.03										<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	0.003										<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	0.03										<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001										<0.00001	mg/l	TM61/PM38
Mercury Dissolved by CVAF #	<0.0001										<0.0001	mg/kg	TM61/PM38
Phenol	<0.01										<0.01	mg/l	TM26/PM0
Phenol	<0.1										<0.1	mg/kg	TM26/PM0
Fluoride	0.3										<0.3	mg/l	TM27/PM0
Fluoride	3										<3	mg/kg	TM27/PM0
Chloride	<0.3										<0.3	mg/l	TM27/PM0
Chloride	<3										<3	mg/kg	TM27/PM0
Sulphate	3.38										<0.05	mg/l	TM27/PM0
Sulphate	33.8										<0.5	mg/kg	TM27/PM0
Mass of raw test portion	0.1008											kg	NONE/PM17
Leachant Volume	0.889											l	NONE/PM17
Eluate Volume	0.63											l	NONE/PM17
Dissolved Organic Carbon	3										<2	mg/l	TM60/PM0
Dissolved Organic Carbon	30										<20	mg/kg	TM60/PM0
Total Dissolved Solids #	94										<10	mg/l	TM20/PM0
Total Dissolved Solids #	940										<100	mg/kg	TM20/PM0

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All solid results are expressed on a dry weight basis unless stated otherwise.

Mass of sample taken (kg)	0.1051	Dry Matter Content Ratio (%) =	85.9
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.885
Particle Size <4mm =	>95%	Eluate Volume (l)	0.65

JEFL Job No	**15/14318**	**Landfill Waste Acceptance Criteria Limits**		
Sample No	**1**			
Client Sample No	**BH1**			
Depth/Other	**0.00-1.00**			
Sample Date	**28/09/2015**	**Inert**	**Stable Non-reactive**	**Hazardous**
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	0.50	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<45	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	0.15	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.35	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	11	800	15000	25000
Fluoride	<3	10	150	500
Sulphate as SO4	35.9	1000	20000	50000
Total Dissolved Solids	750	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	30	500	800	1000

Mass of sample taken (kg)	0.1036	Dry Matter Content Ratio (%) =	86.9
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.887
Particle Size <4mm =	>95%	Eluate Volume (l)	0.75

		Landfill Waste Acceptance Criteria Limits		
JEFL Job No	**15/14318**			
Sample No	**2**			
Client Sample No	**BH1**	**Inert**	**Stable Non-reactive**	**Hazardous**
Depth/Other	**1.00-2.00**			
Sample Date	**28/09/2015**			
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	1.03	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	87	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	0.12	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.37	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	0.03	0.06	0.7	5
Selenium	0.27	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	<3	800	15000	25000
Fluoride	<3	10	150	500
Sulphate as SO4	165.5	1000	20000	50000
Total Dissolved Solids	1191	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	20	500	800	1000

Mass of sample taken (kg)	0.1056	Dry Matter Content Ratio (%) =	85.4
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.885
Particle Size <4mm =	>95%	Eluate Volume (l)	0.83

		Landfill Waste Acceptance Criteria Limits		
JEFL Job No	**15/14318**			
Sample No	**3**			
Client Sample No	**BH2**			
Depth/Other	**0.50**			
Sample Date	**30/09/2015**			
Batch No	**1**	**Inert**	**Stable Non-reactive**	**Hazardous**
Solid Waste Analysis				
Total Organic Carbon (%)	1.20	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<45	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	0.0028	0.01	0.2	2
Molybdenum	0.13	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	0.04	4	50	200
Chloride	<3	800	15000	25000
Fluoride	3	10	150	500
Sulphate as SO4	2.8	1000	20000	50000
Total Dissolved Solids	710	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	70	500	800	1000

Mass of sample taken (kg)	0.1003	Dry Matter Content Ratio (%) =	89.6
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.89
Particle Size <4mm =	>95%	Eluate Volume (l)	0.83

		Landfill Waste Acceptance Criteria Limits		
JEFL Job No	**15/14318**			
Sample No	**4**			
Client Sample No	**BH2**			
Depth/Other	**1.00**			
Sample Date	**30/09/2015**	**Inert**	**Stable Non-reactive**	**Hazardous**
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	0.44	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<45	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	0.0006	0.01	0.2	2
Molybdenum	0.21	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	0.04	4	50	200
Chloride	<3	800	15000	25000
Fluoride	<3	10	150	500
Sulphate as SO4	5.2	1000	20000	50000
Total Dissolved Solids	970	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	40	500	800	1000

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Mass of sample taken (kg)	0.1011	Dry Matter Content Ratio (%) =	88.8
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.889
Particle Size <4mm =	>95%	Eluate Volume (l)	0.85

		Landfill Waste Acceptance Criteria Limits		
JEFL Job No	**15/14318**			
Sample No	**5**			
Client Sample No	**BH2**			
Depth/Other	**2.00**			
Sample Date	**30/09/2015**	**Inert**	**Stable Non-reactive**	**Hazardous**
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	0.53	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<45	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	0.11	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.29	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	<3	800	15000	25000
Fluoride	<3	10	150	500
Sulphate as SO4	46.7	1000	20000	50000
Total Dissolved Solids	800	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	30	500	800	1000

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All solid results are expressed on a dry weight basis unless stated otherwise.

Mass of sample taken (kg)	0.1003	Dry Matter Content Ratio (%) =	89.6
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.889
Particle Size <4mm =	>95%	Eluate Volume (l)	0.6

JEFL Job No	**15/14318**	**Landfill Waste Acceptance Criteria Limits**		
Sample No	**6**			
Client Sample No	**BH2**	**Inert**	**Stable Non-reactive**	**Hazardous**
Depth/Other	**3.00**			
Sample Date	**30/09/2015**			
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	0.53	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	132	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	0.51	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.20	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	0.28	0.1	0.5	7
Zinc	0.04	4	50	200
Chloride	<3	800	15000	25000
Fluoride	<3	10	150	500
Sulphate as SO4	296.8	1000	20000	50000
Total Dissolved Solids	1489	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	30	500	800	1000

Mass of sample taken (kg)	0.105	Dry Matter Content Ratio (%) =	85.5
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.885
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

		Landfill Waste Acceptance Criteria Limits		
JEFL Job No	**15/14318**			
Sample No	**7**			
Client Sample No	**BH3**			
Depth/Other	**0.50**	**Inert**	**Stable Non-reactive**	**Hazardous**
Sample Date	**01/10/2015**			
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	2.27	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<45	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	0.0029	0.01	0.2	2
Molybdenum	0.06	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	0.05	4	50	200
Chloride	<3	800	15000	25000
Fluoride	5	10	150	500
Sulphate as SO4	3.2	1000	20000	50000
Total Dissolved Solids	560	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	70	500	800	1000

Mass of sample taken (kg)	0.1133	Dry Matter Content Ratio (%) =	79.7
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.877
Particle Size <4mm =	>95%	Eluate Volume (l)	0.75

		Landfill Waste Acceptance Criteria Limits		
JEFL Job No	**15/14318**			
Sample No	**8**			
Client Sample No	**BH4**			
Depth/Other	**0.00-1.00**			
Sample Date	**03/10/2015**	**Inert**	**Stable Non-reactive**	**Hazardous**
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	2.02	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<45	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	0.0007	0.01	0.2	2
Molybdenum	0.11	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	0.04	4	50	200
Chloride	4	800	15000	25000
Fluoride	5	10	150	500
Sulphate as SO4	8.2	1000	20000	50000
Total Dissolved Solids	1800	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	60	500	800	1000

Mass of sample taken (kg)	0.1007	Dry Matter Content Ratio (%) =	88.9
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.889
Particle Size <4mm =	>95%	Eluate Volume (l)	0.85

		Landfill Waste Acceptance Criteria Limits		
JEFL Job No	**15/14318**			
Sample No	**9**			
Client Sample No	**BH4**			
Depth/Other	**1.00-2.00**			
Sample Date	**03/10/2015**			
Batch No	**1**	**Inert**	**Stable Non-reactive**	**Hazardous**
Solid Waste Analysis				
Total Organic Carbon (%)	0.34	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<45	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	0.05	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	0.0003	0.01	0.2	2
Molybdenum	0.29	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	0.05	4	50	200
Chloride	<3	800	15000	25000
Fluoride	<3	10	150	500
Sulphate as SO4	5.0	1000	20000	50000
Total Dissolved Solids	1070	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	40	500	800	1000

Mass of sample taken (kg)	0.1022	Dry Matter Content Ratio (%) =	87.7
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.887
Particle Size <4mm =	>95%	Eluate Volume (l)	0.83

		Landfill Waste Acceptance Criteria Limits		
JEFL Job No	**15/14318**			
Sample No	**10**			
Client Sample No	**BH4**			
Depth/Other	**2.00-3.00**			
Sample Date	**03/10/2015**	**Inert**	**Stable Non-reactive**	**Hazardous**
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	0.38	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<45	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	0.04	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	0.0002	0.01	0.2	2
Molybdenum	0.28	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	0.04	4	50	200
Chloride	<3	800	15000	25000
Fluoride	<3	10	150	500
Sulphate as SO4	6.1	1000	20000	50000
Total Dissolved Solids	980	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	40	500	800	1000

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Mass of sample taken (kg)	0.1008	Dry Matter Content Ratio (%) =	89.0
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.889
Particle Size <4mm =	>95%	Eluate Volume (l)	0.63

		Landfill Waste Acceptance Criteria Limits		
JEFL Job No	**15/14318**			
Sample No	**11**			
Client Sample No	**BH4**			
Depth/Other	**3.00-4.00**			
Sample Date	**03/10/2015**	**Inert**	**Stable Non-reactive**	**Hazardous**
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	0.65	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<45	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	0.17	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.43	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	0.03	4	50	200
Chloride	<3	800	15000	25000
Fluoride	3	10	150	500
Sulphate as SO4	33.8	1000	20000	50000
Total Dissolved Solids	940	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	30	500	800	1000

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Client Name: O'Connor Sutton Cronin & Assoc. Ltd **Matrix : Solid**
Reference:
Location: St Pauls
Contact: Cian O'Hora

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
15/14318	1	BH1	0.00-1.00	1	EPH	Sample received in inappropriate container
15/14318	1	BH1	1.00-2.00	2	EPH	Sample received in inappropriate container
15/14318	1	BH2	0.50	3	EPH	Sample received in inappropriate container
15/14318	1	BH2	1.00	4	EPH	Sample received in inappropriate container
15/14318	1	BH2	2.00	5	EPH	Sample received in inappropriate container
15/14318	1	BH2	3.00	6	EPH	Sample received in inappropriate container
15/14318	1	BH4	0.00-1.00	8	EPH	Sample received in inappropriate container
15/14318	1	BH4	1.00-2.00	9	EPH	Sample received in inappropriate container
15/14318	1	BH4	2.00-3.00	10	EPH	Sample received in inappropriate container
15/14318	1	BH4	3.00-4.00	11	EPH	Sample received in inappropriate container

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

JE Job No.: 15/14318

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 (UKAS) accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS) accredited - UK.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 15/14318

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.				
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	TM005: Modified USEPA 8015B. Determination of solvent Extractable Petroleum Hydrocarbons (EPH) including column fractionation in the carbon range of C10-35 into aliphatic and aromatic fractions by GC-FID. TM036: Modified USEPA 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C5-10 by headspace GC-FID.	PM12/PM16	CWG GC-FID			AR	Yes
TM17	Modified US EPA method 8270. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified USEPA 8163. Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes

JE Job No: 15/14318

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM27	Modified US EPA method 9056.Determination of water soluble anions using Dionex (Ion-Chromatography).	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM20	Extraction of dried and ground samples with deionised water in a 2:1 water to solid ratio for anions. Extraction of as received samples with deionised water in a 2:1 water to solid ratio for ammoniacal nitrogen. Samples are extracted using an orbital shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM20	Extraction of dried and ground samples with deionised water in a 2:1 water to solid ratio for anions. Extraction of as received samples with deionised water in a 2:1 water to solid ratio for ammoniacal nitrogen. Samples are extracted using an orbital shaker.	Yes		AR	Yes

JE Job No: 15/14318

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM60	Modified USEPA 9060. Determination of TOC by calculation from Total Carbon and Inorganic Carbon using a TOC analyser, the carbon in the sample is converted to CO2 and then passed through a non-dispersive infrared gas analyser (NDIR).	PM0	No preparation is required.			AR	Yes
TM61	Modified US EPA methods 245.7 and 200.7. Determination of Mercury by Cold Vapour Atomic Fluorescence.	PM38	Samples are brominated to reduce all mercury compounds to Mercury (II) which is analysed using method TM061.	Yes		AR	Yes
TM73	Modified US EPA methods 150.1 and 9045D. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
NONE	No Method Code	NONE	No Method Code			AR	Yes
NONE	No Method Code	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.			AR	

Appendix - Methods used for WAC (2003/33/EC)

Leachate tests	
10l/kg; 4mm	I.S. EN 12457-2:2002 Specified particle size; water added to L/S ratio; capped; agitated for 24 ± 0.5 hours; eluate settled and filtered over 0.45 µm membrane filter.
Eluate analysis	
As	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ba	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cd	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cr total	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cu	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Hg	I.S. EN 13370 rec. EN 1483 (CVAAS)
Mo	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ni	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Pb	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Sb	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Se	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Zn	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Chloride	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Fluoride	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Sulphate	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Phenol index	I.S. EN 13370 rec. ISO 6439 (4-Aminoantipyrine spectrometic methods after distillation)* (BY HPLC - Jones Env)
DOC	I.S. EN 1484
TDS	I.S. EN 15216
Compositional analysis	
TOC	I.S. EN 13137 Method B: carbonates removed with acid; TOC by combustion.
BTEX	GC-FID
PCB7**	I.S. EN 15308 analysis by GC-ECD.
Mineral oil	I.S. EN 14039 C10 to C40 analysis by GC-FID.
PAH17***	I.S. EN 15527 PAH17 analysis by GC-MS
Metals	I.S. EN 13657 - Aqua regia digestion: EN ISO 11885 (ICP-OES)
Other	
Dry matter	I.S. EN 14346 sample is dried to a constant mass in an oven at 105 ± 3 °C; Method B Water content by direct Karl-Fischer-titration and either volumetric or coulometric detection.
LOI	I.S. EN 15169 Difference in mass after heating in a furnace up to 550 ± 25 °C.
ANC	CEN/TS 15364 Determined by amouns of acid or base needed to cover the pH range

Notes:
*If not suitable due to LOD, precision, etc., any other suitable method can be used, e.g. AFS, ICP-MS
**PCB-28, PCB-52, PCB-101, PCB-118, PCB-138, PCB-153 and PCB-180

***Naphthalene, Acenaphthylene, Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)perylene, Benzo(a)pyrene, Chrysene, Coronene, Dibenzo(a,h)anthracene, Fluorene, Fluoranthene, Indeno(1,2,3-c,d)pyrene, Phenanthrene and Pyrene.

Appendix 4: Groundwater Monitoring

GROUNDWATER MONITORING

St Pauls Raheny

BOREHOLE	DATE	GROUNDWATER		Comments
		m BGL	m OD	
BH1	19/10/2015	1.08	23.772	
BH2	19/10/2015	1.79	20.699	
BH3	19/10/2015	2.17	19.773	
BH6	19/10/2015	Dry	-	
BH9	19/10/2015	2.40	19.021	

Appendix J Surface Water Sampling Laboratory Reports

City Analysts Limited,
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Email:
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www.cityanalysts.ie

Customer

Muriel Ennis

Enviroguide Consulting
Unit 3D, Block 71c
The Plaza
Parkwest
Dublin 8

Certificate Of Analysis

Job Number: 19-53505

Issue Number: 1

Report Date: 5 April 2019

Site: Not Applicable

PO Number: Not Supplied

Date Samples Received: 07/03/2019

Please find attached the results for the samples received at our laboratory on 07/03/2019.

Should you have any queries regarding the report or require any further services, we would be happy to discuss your requirements. For additional information about the company please log-on to our website at the above address.

Thank you for choosing City Analysts Limited. We look forward to assisting you again.

Authorised By: S. Reynolds **Authorised Date:** 5 April 2019

Shane Reynolds
Laboratory Manager

Notes:

Results relate only to the items tested.
Information on methods of analysis and performance characteristics is available on request.
Any opinions or interpretations indicated are outside the scope of our INAB accreditation.

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Certificate Of Analysis

Customer

Muriel Ennis

Enviroguide Consulting
Unit 3D, Block 71c
The Plaza
Parkwest
Dublin 8

Report Reference: 19-53505

Report Version: 1

Site: Not Applicable

Sample Description: SW1

Date of Sampling: 07/03/2019

Sample Type: Surface

Date Sample Received: 07/03/2019

Lab Reference Number: 431227

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D3000#	08/03/2019	Ammonia as N	0.256	mg/l	-
D/D1003#	07/03/2019	CBOD5	3	mg/l O2	-
D/D3001#	13/03/2019	Cadmium	< 0.2	ug/l	-
D/D3006	07/03/2019	Chlorine, Free	< 0.010	mg/l	-
D/D3000#	08/03/2019	Chloride	42.744	mg/l	-
D/D3001#	13/03/2019	Chromium	1.2	ug/l	-
*U	-	Chromium VI	< 0.020	mg/l	-
*U	-	Chromium III	< 0.020	mg/l	-
D/D1009#	08/03/2019	COD	9	mg/l O2	-
D/D3011#	07/03/2019	Conductivity @ 20℃	600.0	uS/cm @20℃	-
D/D3001#	13/03/2019	Copper	3.1	ug/l	-
D/D3015#	08/03/2019	Fluoride	0.3	mg/l	-
D/D3001#	13/03/2019	Hardness as CaCO3	341.135	mg/l	-
D/D3001#	13/03/2019	Lead	2.2	ug/l	-
D/D3001#	13/03/2019	Nickel	1.6	ug/l	-
EW188#*	-	Arsenic - Total	0.9	ug/L	-
DEAFULT*U	-	Total Cyanide Low	< 10.0000	ug/L	-
D/D3000#	08/03/2019	Orthophosphate as P	0.115	mg/l	-

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Note:
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Parkwest
Dublin 8

Report Reference: 19-53505

Report Version: 1

Site: Not Applicable

Sample Description: SW1

Date of Sampling: 07/03/2019

Sample Type: Surface

Date Sample Received: 07/03/2019

Lab Reference Number: 431227

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1041#	07/03/2019	PH	7.84	pH Unit	-
D/D1049#	08/03/2019	Total Suspended Solids	< 2	mg/l	-
D/D3001#	13/03/2019	Zinc	10.2	ug/l	-

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Note:
PV Value is the parametric value, taken from European Communities, (Drinking Water) Regulations, 2014. S.I. No. 122 of 2014 and relates only to drinking water samples.
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Customer

Muriel Ennis

Enviroguide Consulting
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Parkwest
Dublin 8

Report Reference: 19-53505

Report Version: 1

Site: Not Applicable

Sample Description: SW2

Date of Sampling: 07/03/2019

Sample Type: Surface

Date Sample Received: 07/03/2019

Lab Reference Number: 431228

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D3000#	08/03/2019	Ammonia as N	0.163	mg/l	-
D/D1003#	07/03/2019	CBOD5	2	mg/l O2	-
D/D3001#	13/03/2019	Cadmium	< 0.2	ug/l	-
D/D3006	07/03/2019	Chlorine, Free	< 0.010	mg/l	-
D/D3000#	08/03/2019	Chloride	48.961	mg/l	-
D/D3001#	13/03/2019	Chromium	1.1	ug/l	-
*U	-	Chromium VI	< 0.020	mg/l	-
*U	-	Chromium III	< 0.020	mg/l	-
D/D1009#	12/03/2019	COD	10	mg/l O2	-
D/D3011#	07/03/2019	Conductivity @ 20℃	620.0	uS/cm @20℃	-
D/D3001#	13/03/2019	Copper	5.6	ug/l	-
D/D3015#	08/03/2019	Fluoride	0.3	mg/l	-
D/D3001#	13/03/2019	Hardness as CaCO3	349.416	mg/l	-
D/D3001#	13/03/2019	Lead	2.1	ug/l	-
D/D3001#	13/03/2019	Nickel	1.1	ug/l	-
EW188#*	-	Arsenic - Total	1.0	ug/L	-
DEAFULT*U	-	Total Cyanide Low	< 10.0000	ug/L	-
D/D3000#	08/03/2019	Orthophosphate as P	0.048	mg/l	-

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Parkwest
Dublin 8

Report Reference: 19-53505

Report Version: 1

Site: Not Applicable

Sample Description: SW2

Date of Sampling: 07/03/2019

Sample Type: Surface

Date Sample Received: 07/03/2019

Lab Reference Number: 431228

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1041#	07/03/2019	PH	7.95	pH Unit	-
D/D1049#	08/03/2019	Total Suspended Solids	< 2	mg/l	-
D/D3001#	13/03/2019	Zinc	11.6	ug/l	-

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Muriel Ennis

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Unit 3D, Block 71c
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Dublin 8

Certificate Of Analysis

Job Number: 19-54627

Issue Number: 1

Report Date: 29 April 2019

Site: Not Applicable

PO Number: Not Supplied

Date Samples Received: 04/04/2019

Please find attached the results for the samples received at our laboratory on 04/04/2019.

Should you have any queries regarding the report or require any further services, we would be happy to discuss your requirements. For additional information about the company please log-on to our website at the above address.

Thank you for choosing City Analysts Limited. We look forward to assisting you again.

Authorised By: S. Reynolds **Authorised Date:** 29 April 2019

Shane Reynolds
Laboratory Manager

Notes:

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Parkwest
Dublin 8

Report Reference: 19-54627

Report Version: 1

Site: Not Applicable

Sample Description: SW1

Date of Sampling: 04/04/2019

Sample Type: Surface

Date Sample Received: 04/04/2019

Lab Reference Number: 434422

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D3000#	05/04/2019	Ammonia as N	0.288	mg/l	-
D/D1003#	04/04/2019	CBOD5	< 2	mg/l O2	-
D/D3001#	17/04/2019	Cadmium	< 0.2	ug/l	-
D/D3006	05/04/2019	Chlorine, Free	< 0.010	mg/l	-
D/D3000#	05/04/2019	Chloride	34.099	mg/l	-
D/D3001#	17/04/2019	Chromium	< 0.9	ug/l	-
*U	-	Chromium VI	< 0.020	mg/l	-
*U	-	Chromium III	< 0.020	mg/l	-
D/D1009#	05/04/2019	COD	8	mg/l O2	-
D/D3011#	04/04/2019	Conductivity @ 20℃	495.0	uS/cm @20℃	-
D/D3001#	17/04/2019	Copper	7.2	ug/l	-
D/D3015#	05/04/2019	Fluoride	0.4	mg/l	-
D/D3001#	17/04/2019	Hardness as CaCO3	230.386	mg/l	-
D/D3001#	17/04/2019	Lead	4.4	ug/l	-
D/D3001#	17/04/2019	Nickel	1.3	ug/l	-
EW188#*	-	Arsenic - Total	< 1.0	ug/L	-
DEAFULT*U	-	Total Cyanide Low	< 0.7000	ug/L	-
D/D3000#	05/04/2019	Orthophosphate as P	0.146	mg/l	-

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Note:
PV Value is the parametric value, taken from European Communities, (Drinking Water) Regulations, 2014. S.I. No. 122 of 2014 and relates only to drinking water samples.
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Parkwest
Dublin 8

Report Reference: 19-54627

Report Version: 1

Site: Not Applicable

Sample Description: SW1

Date of Sampling: 04/04/2019

Sample Type: Surface

Date Sample Received: 04/04/2019

Lab Reference Number: 434422

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1041#	04/04/2019	PH	7.91	pH Unit	-
D/D1049#	05/04/2019	Total Suspended Solids	< 2	mg/l	-
D/D3001#	17/04/2019	Zinc	15.2	ug/l	-

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Note:
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Parkwest
Dublin 8

Report Reference: 19-54627

Report Version: 1

Site: Not Applicable

Sample Description: SW2

Date of Sampling: 04/04/2019

Sample Type: Surface

Date Sample Received: 04/04/2019

Lab Reference Number: 434423

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D3000#	05/04/2019	Ammonia as N	0.144	mg/l	-
D/D1003#	04/04/2019	CBOD5	< 2	mg/l O2	-
D/D3001#	17/04/2019	Cadmium	< 0.2	ug/l	-
D/D3006	05/04/2019	Chlorine, Free	< 0.010	mg/l	-
D/D3000#	05/04/2019	Chloride	35.624	mg/l	-
D/D3001#	17/04/2019	Chromium	< 0.9	ug/l	-
*U	-	Chromium VI	< 0.020	mg/l	-
*U	-	Chromium III	< 0.020	mg/l	-
D/D1009#	05/04/2019	COD	10	mg/l O2	-
D/D3011#	04/04/2019	Conductivity @ 20℃	506.0	uS/cm @20℃	-
D/D3001#	17/04/2019	Copper	3.4	ug/l	-
D/D3015#	05/04/2019	Fluoride	0.4	mg/l	-
D/D3001#	17/04/2019	Hardness as CaCO3	230.136	mg/l	-
D/D3001#	17/04/2019	Lead	4.6	ug/l	-
D/D3001#	17/04/2019	Nickel	1.8	ug/l	-
EW188#*	-	Arsenic - Total	1.1	ug/L	-
DEAFULT*U	-	Total Cyanide Low	< 0.7000	ug/L	-
D/D3000#	05/04/2019	Orthophosphate as P	0.075	mg/l	-

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Note:
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Customer

Muriel Ennis

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The Plaza
Parkwest
Dublin 8

Report Reference: 19-54627

Report Version: 1

Site: Not Applicable

Sample Description: SW2

Date of Sampling: 04/04/2019

Sample Type: Surface

Date Sample Received: 04/04/2019

Lab Reference Number: 434423

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1041#	04/04/2019	PH	8.14	pH Unit	-
D/D1049#	05/04/2019	Total Suspended Solids	< 2	mg/l	-
D/D3001#	17/04/2019	Zinc	11.5	ug/l	-

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Note:
PV Value is the parametric value, taken from European Communities, (Drinking Water) Regulations, 2014. S.I. No. 122 of 2014 and relates only to drinking water samples.
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TVC - Total viable count
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Customer

Muriel Ennis

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Unit 3D, Block 71c
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Parkwest
Dublin 8

Certificate Of Analysis

Job Number: 19-56085

Issue Number: 1

Report Date: 11 June 2019

Site: Not Applicable

PO Number: Not Supplied

Date Samples Received: 14/05/2019

Please find attached the results for the samples received at our laboratory on 14/05/2019.

Should you have any queries regarding the report or require any further services, we would be happy to discuss your requirements. For additional information about the company please log-on to our website at the above address.

Thank you for choosing City Analysts Limited. We look forward to assisting you again.

Authorised By: S. Reynolds **Authorised Date:** 11 June 2019

Shane Reynolds
Laboratory Manager

Notes:

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Dublin 8

Report Reference: 19-56085

Report Version: 1

Site: Not Applicable

Sample Description: SW1

Date of Sampling: 14/05/2019

Sample Type: Surface

Date Sample Received: 14/05/2019

Lab Reference Number: 438617

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D3000#	15/05/2019	Ammonia as N	1.270	mg/l	-
D/D1003#	15/05/2019	CBOD5	2	mg/l O2	-
D/D3001#	16/05/2019	Cadmium	0.3	ug/l	-
D/D3006	14/05/2019	Chlorine, Free	0.020	mg/l	-
D/D3000#	15/05/2019	Chloride	36.478	mg/l	-
D/D3001#	16/05/2019	Chromium	1.1	ug/l	-
*U	-	Chromium VI	< 0.020	mg/l	-
*U	-	Chromium III	< 0.020	mg/l	-
D/D1009#	14/05/2019	COD	11	mg/l O2	-
D/D3011#	14/05/2019	Conductivity @ 20℃	526.0	uS/cm @20℃	-
D/D3001#	16/05/2019	Copper	3.8	ug/l	-
D/D3015#	17/05/2019	Fluoride	0.4	mg/l	-
D/D3001#	16/05/2019	Hardness as CaCO3	249.329	mg/l	-
D/D3001#	16/05/2019	Lead	2.2	ug/l	-
D/D3001#	16/05/2019	Nickel	1.6	ug/l	-
DEAFULT*U	-	Total Cyanide Low	< 9.0000	ug/L	-
EW188#*	-	Arsenic - Total	< 1.0	ug/L	-
D/D3000#	15/05/2019	Orthophosphate as P	0.096	mg/l	-

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Note:
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Customer

Muriel Ennis

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Unit 3D, Block 71c
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Dublin 8

Report Reference: 19-56085

Report Version: 1

Site: Not Applicable

Sample Description: SW1

Date of Sampling: 14/05/2019

Sample Type: Surface

Date Sample Received: 14/05/2019

Lab Reference Number: 438617

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1041#	14/05/2019	PH	7.64	pH Unit	-
D/D1049#	15/05/2019	Total Suspended Solids	2	mg/l	-
D/D3001#	16/05/2019	Zinc	13.1	ug/l	-

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Dublin 8

Report Reference: 19-56085

Report Version: 1

Site: Not Applicable

Sample Description: SW2

Date of Sampling: 14/05/2019

Sample Type: Surface

Date Sample Received: 14/05/2019

Lab Reference Number: 438618

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D3000#	15/05/2019	Ammonia as N	0.618	mg/l	-
D/D1003#	15/05/2019	CBOD5	< 2	mg/l O2	-
D/D3001#	16/05/2019	Cadmium	0.4	ug/l	-
D/D3006	14/05/2019	Chlorine, Free	< 0.010	mg/l	-
D/D3000#	15/05/2019	Chloride	35.882	mg/l	-
D/D3001#	16/05/2019	Chromium	< 0.9	ug/l	-
*U	-	Chromium VI	< 0.020	mg/l	-
*U	-	Chromium III	< 0.020	mg/l	-
D/D1009#	14/05/2019	COD	10	mg/l O2	-
D/D3011#	14/05/2019	Conductivity @ 20℃	632.0	uS/cm @20℃	-
D/D3001#	16/05/2019	Copper	3.5	ug/l	-
D/D3015#	17/05/2019	Fluoride	0.4	mg/l	-
D/D3001#	16/05/2019	Hardness as CaCO3	247.782	mg/l	-
D/D3001#	16/05/2019	Lead	2.7	ug/l	-
D/D3001#	16/05/2019	Nickel	< 0.5	ug/l	-
EW188#*	-	Arsenic - Total	1.2	ug/L	-
DEAFULT*U	-	Total Cyanide Low	< 9.0000	ug/L	-
D/D3000#	15/05/2019	Orthophosphate as P	0.066	mg/l	-

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Note:
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Dublin 8

Report Reference: 19-56085

Report Version: 1

Site: Not Applicable

Sample Description: SW2

Sample Type: Surface

Date of Sampling: 14/05/2019

Date Sample Received: 14/05/2019

Lab Reference Number: 438618

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1041#	14/05/2019	PH	7.65	pH Unit	-
D/D1049#	15/05/2019	Total Suspended Solids	< 2	mg/l	-
D/D3001#	16/05/2019	Zinc	8.5	ug/l	-

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Note:
PV Value is the parametric value, taken from European Communities, (Drinking Water) Regulations, 2014. S.I. No. 122 of 2014 and relates only to drinking water samples.
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Customer

Muriel Ennis

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The Plaza
Parkwest
Dublin 8

Certificate Of Analysis

Job Number: 19-58097

Issue Number: 1

Report Date: 22 July 2019

Site: Not Applicable

PO Number: Not Supplied

Date Samples Received: 27/06/2019

Please find attached the results for the samples received at our laboratory on 27/06/2019.

Should you have any queries regarding the report or require any further services, we would be happy to discuss your requirements. For additional information about the company please log-on to our website at the above address.

Thank you for choosing City Analysts Limited. We look forward to assisting you again.

Authorised By: S. Reynolds **Authorised Date:** 22 July 2019

Shane Reynolds
Laboratory Manager

Notes:

Results relate only to the items tested.
Information on methods of analysis and performance characteristics is available on request.
Any opinions or interpretations indicated are outside the scope of our INAB accreditation.
This test report shall not be reproduced except in full or with written approval of City Analysts Limited.

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Dublin 8

Report Reference: 19-58097

Report Version: 1

Site: Not Applicable

Sample Description: SW1

Date of Sampling: 27/06/2019

Sample Type: Surface

Date Sample Received: 27/06/2019

Lab Reference Number: 444595

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D3000#	02/07/2019	Ammonia as N	0.102	mg/l	-
D/D1003#	27/06/2019	CBOD5	4	mg/l O2	-
D/D3001#	01/07/2019	Cadmium	< 0.2	ug/l	-
D/D3006	28/06/2019	Chlorine, Free	< 0.010	mg/l	-
D/D3000#	02/07/2019	Chloride	32.097	mg/l	-
D/D3001#	01/07/2019	Chromium	< 0.9	ug/l	-
*U	-	Chromium VI	< 0.020	mg/l	-
*U	-	Chromium III	< 0.020	mg/l	-
D/D1009#	28/06/2019	COD	28	mg/l O2	-
D/D3011#	28/06/2019	Conductivity @ 20℃	575.0	uS/cm @20℃	-
D/D3001#	01/07/2019	Copper	< 2.0	ug/l	-
D/D3015#	29/06/2019	Fluoride	0.5	mg/l	-
D/D3001#	01/07/2019	Hardness as CaCO3	291.779	mg/l	-
D/D3001#	04/07/2019	Lead	< 1.7	ug/l	-
D/D3001#	01/07/2019	Nickel	0.8	ug/l	-
EW188#*	-	Arsenic - Total	< 1.0	ug/L	-
DEAFULT*U	-	Total Cyanide Low	< 0.7000	ug/L	-
D/D3000#	02/07/2019	Orthophosphate as P	< 0.025	mg/l	-

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Note:
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The Plaza
Parkwest
Dublin 8

Report Reference: 19-58097

Report Version: 1

Site: Not Applicable

Sample Description: SW1

Date of Sampling: 27/06/2019

Sample Type: Surface

Date Sample Received: 27/06/2019

Lab Reference Number: 444595

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1041#	28/06/2019	PH	8.11	pH Unit	-
D/D1049#	01/07/2019	Total Suspended Solids	2	mg/l	-
D/D3001#	01/07/2019	Zinc	6.6	ug/l	-

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Note:
PV Value is the parametric value, taken from European Communities, (Drinking Water) Regulations, 2014. S.I. No. 122 of 2014 and relates only to drinking water samples.
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Dublin 8

Report Reference: 19-58097

Report Version: 1

Site: Not Applicable

Sample Description: SW2

Date of Sampling: 27/06/2019

Sample Type: Surface

Date Sample Received: 27/06/2019

Lab Reference Number: 444596

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D3000#	02/07/2019	Ammonia as N	0.083	mg/l	-
D/D1003#	27/06/2019	CBOD5	< 2	mg/l O2	-
D/D3001#	01/07/2019	Cadmium	0.3	ug/l	-
D/D3006	28/06/2019	Chlorine, Free	< 0.010	mg/l	-
D/D3000#	02/07/2019	Chloride	30.953	mg/l	-
D/D3001#	01/07/2019	Chromium	< 0.9	ug/l	-
*U	-	Chromium VI	< 0.020	mg/l	-
*U	-	Chromium III	< 0.020	mg/l	-
D/D1009#	28/06/2019	COD	26	mg/l O2	-
D/D3011#	28/06/2019	Conductivity @ 20℃	570.0	uS/cm @20℃	-
D/D3001#	01/07/2019	Copper	< 2.0	ug/l	-
D/D3015#	29/06/2019	Fluoride	0.4	mg/l	-
D/D3001#	01/07/2019	Hardness as CaCO3	289.799	mg/l	-
D/D3001#	04/07/2019	Lead	< 1.7	ug/l	-
D/D3001#	01/07/2019	Nickel	1.1	ug/l	-
EW188#*	-	Arsenic - Total	< 1.0	ug/L	-
DEAFULT*U	-	Total Cyanide Low	< 0.7000	ug/L	-
D/D3000#	02/07/2019	Orthophosphate as P	0.068	mg/l	-

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Note:
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The Plaza
Parkwest
Dublin 8

Report Reference: 19-58097

Report Version: 1

Site: Not Applicable

Sample Description: SW2

Date of Sampling: 27/06/2019

Sample Type: Surface

Date Sample Received: 27/06/2019

Lab Reference Number: 444596

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1041#	28/06/2019	PH	8.11	pH Unit	-
D/D1049#	01/07/2019	Total Suspended Solids	< 2	mg/l	-
D/D3001#	01/07/2019	Zinc	5.6	ug/l	-

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Note:
PV Value is the parametric value, taken from European Communities, (Drinking Water) Regulations, 2014. S.I. No. 122 of 2014 and relates only to drinking water samples.
For queries on results, please contact us within two weeks of the report date to ensure that we can accommodate your query as samples cannot be stored indefinitely.
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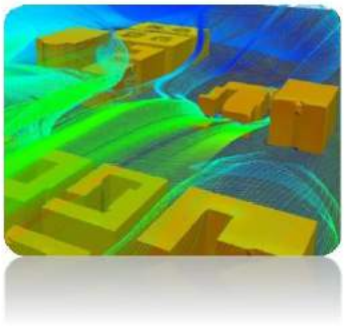
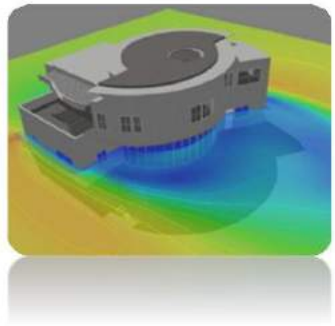
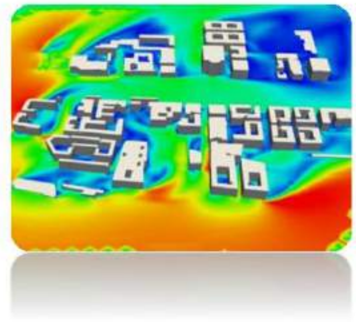
Appendix K Computational Fluid Dynamics (CFD) Model

WIND AND MICROCLIMATE MODELLING

Mixed Use Residential Development

at lands to the East of St. Pauls College,
Sybil Hill Road, Dublin 5

Prepared by: B-Fluid Ltd.| Buildings Fluid Dynamics Consultants

For: Raheny 3 Limited Partnership

B-Fluid
Buildings Fluid Dynamics

Document Reference		
Project Name	WIND AND MICROCLIMATE MODELLING Mixed Use Residential Development St. Pauls College, Sybil Hill Road, Dublin 5	
Project Ref.	$W\_2109255$	
Site location	Lands to the East of St. Pauls College, Sybil Hill Road, Dublin 5	
CFD Study by	B-Fluid Ltd.	
Engineers	Dr. Cristina Paduano CFD Modelling Specialist CEng MIEI, PhD. Mech Eng., MEng. Aerospace Eng.	
	Dr. Patrick Okolo CFD Modelling Specialist CEng MIEI, PhD., MEng. Mech Eng.	Dr. Arman Safdari CFD Modelling Specialist PhD. MEng, MSc. Mech.Eng.
Report issued on	August 31, 2022	

B-Fluid
Buildings Fluid Dynamics

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Contents

1. EXECUTIVE SUMMARY

B-Fluid Limited has been commissioned by 'Raheny 3 Limited Partnership' to carry out a Wind and Micro-climate Modelling Study for the proposed Mixed Use Residential Development at lands to the East of St. Pauls College, Sybil Hill Road, Dublin 5. Figure 1.1 shows an isometric view of the proposed development.

Figure 1.1: Proposed Mixed Use Residential Development

Wind microclimate studies identify the possible wind patterns around the existing environment and the proposed development under mean and peak wind conditions typically occurring in Dublin. A wind microclimate assessment is performed through advanced Computational Fluid Dynamics (CFD) which is a numerical method used to simulate wind conditions and its impact on the development and to identify areas of concern in terms of downwash/funneling/downdraft/critical flow accelerations that may likely occur. The Advanced CFD numerical algorithms applied here are solved using high performance computing cluster.

The results of this analysis are utilized by the design team to configure the optimal layout for the proposed Mixed Use Residential Development to achieve accounting for the use of each areas/building (i.e. comfortable and pleasant for potential pedestrian) and not to introduce any critical wind impact on the surrounding areas and on the existing buildings.

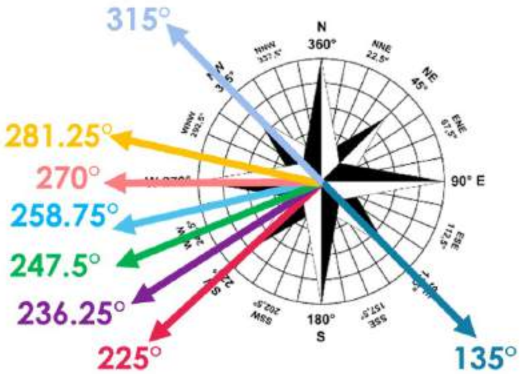
This technical report describes the wind microclimate study performed and rationals of the methodology and assumptions that B-Fluid Ltd. has adopted for this analysis.

For the purpose of performing an elaborate wind microclimate study, 18 different wind scenarios and directions have been modeled as shown in Table 1.1 in order to take into account all the relevant wind directions in Dublin. In particular, a total of 18 compass directions on the wind rose are selected. For each direction, the reference wind speed is set to the 5% exceedance wind speed for that direction, i.e. the wind speed that is exceeded for over 5% of the time whenever that wind direction occurs.

This technical report focuses on reporting the 8 worst case and most relevant wind speeds with cardinal directions, which are the speeds and directions showing the most critical wind speeds relevant to the development. The modelled scenarios reported in this study are presented in Figure 1.2.

DUBLIN WIND SCENARIOS AND DIRECTIONS		
Velocity (m/s)	Direction (deg)	Frequency
5.601	225	11.233
4.626	135	6.849
5.847	236.25	6.792
6.049	258.75	6.747
6.034	247.5	6.689
5.888	270	5.662
4.994	315	4.338
5.503	281.25	3.904
4.974	292.5	3.436
5.357	213.75	3.288
4.736	123.75	3.105
4.406	146.25	2.751
5.101	303.75	2.648
5.246	112.5	2.500
4.121	157.5	2.386
4.581	101.25	2.340
4.169	45	2.180
3.558	90	2.135

Table 1.1: Summary of The 18 Wind Scenarios Modelled for Proposed Development



Velocity (m/s)	Direction (°)	Frequency
5.601	225	11.233
4.626	135	6.849
5.847	236.25	6.792
6.049	258.75	6.747
6.034	247.5	6.689
5.888	270	5.662
4.994	315	4.338
5.503	281.25	3.904

Figure 1.2: Summary of 8 Wind Scenarios Reported

A qualitative and quantitative summary of the wind microclimate modelling study performed for the proposed Mixed Use Residential Development shows that:

- The wind profile around the existing development environment was built using the annual average meteorology data collected at Dublin Airport Weather Station. In particular, the local wind climate was determined from historical meteorological data recorded 10 m above ground level at Dublin Airport.
- The prevailing wind directions for the site are identified as West, South-East and West-South-West, with magnitude of approximately 6m/s.
- The proposed Mixed Use Residential Development has been designed in order to produce a high-quality environment that is attractive and comfortable for pedestrians of all categories. To achieve this objective, throughout the design process, the impact of wind has been considered and analysed, in the areas where critical patterns were found, the appropriate mitigation measures were introduced.
- As a result of the final proposed and mitigated design, wind flow speeds at ground floor are shown to be within tenable conditions. Some higher velocity indicating minor funnelling effects are found between block D and G and the corners of block A, B, C and G. However, these areas can be utilised for the intended use such as short-term sitting, walking and strolling.
- Area between Block A and Block D is suitable for short-term sitting instead of long-term sitting due to flow acceleration between the Blocks.
- Courtyard on Block D is well protected and good shielding is achieved. Therefore, it can be used for all activities including long-term sitting.
- Small areas of Courtyard on Block G are suitable for short term sitting instead of

long-term sitting, however the majority of the area is appropriate for long term sitting.

- Tree planting all around the development has been utilised, with particular attention to the corners of the Blocks has positively mitigated any critical wind effects.
- Regarding the balconies, higher velocities are found for some directions, only on some of the balconies (mostly on the South and West sides of the blocks). However, these velocities are below the threshold values defined by the acceptance criteria and therefore are not critical for safety.
- The proposed development does not impact or give rise to negative or critical wind speed profiles at the nearby adjacent roads, or nearby buildings. Moreover, in terms of distress, no critical conditions were found for “Frail persons or cyclists” and for members of the ”General Public” in the surrounding of the development.
- The proposed development does not impact or give rise to negative or critical wind speed profiles at the nearby adjacent roads, or nearby buildings.

2. PROJECT DESCRIPTION

2.1 INTRODUCTION

B-Fluid Limited has been commissioned by 'Raheny 3 Limited Partnership' to carry out a Wind and Micro-climate Modelling Study for the proposed Mixed Use Residential Development at lands to the East of St. Pauls College, Sybil Hill Road, Dublin 5.

Figure 2.1 shows an isometric view of the proposed development with locations of its Blocks.

Figure 2.1: Proposed Mixed Use Residential Development

The following paragraphs detail all the project information used throughout the study, together with results of the assessment carried out.

2.2 DESCRIPTION OF DEVELOPMENT

The proposed development consists of the construction of a residential and nursing home development set out in 7 no. blocks, ranging in height from 4-7 storeys to accommodate 580 no. apartments, residential tenant amenity spaces, a crèche and a 100 bed nursing home. The site will accommodate car parking spaces, bicycle parking spaces, storage, services and plant areas at both basement and podium level. Landscaping will include extensive communal amenity areas, and a significant public open space provision on the east and south of the site. The proposed application includes all site landscaping works, green roofs, substations, boundary treatments, lighting, servicing, signage, surface water attenuation facilities and associated and ancillary works, including site development works and services above and below ground. For a full description of the proposed development please refer to the Statutory Notices.

Figure 2.2 shows the position of the development site in 3D model.

Figure 2.2: The proposed Mixed Use Residential 3D Model South View

2.3 EXTENTS OF ANALYSED AREA

The proposed Mixed Use Residential Development will be situated at lands to the East of St. Pauls College, Sybil Hill Road, Dublin 5. The Existing Environment site is shown in Figure 2.3. The area considered for the existing environment and proposed development are represented in Figure 2.4.

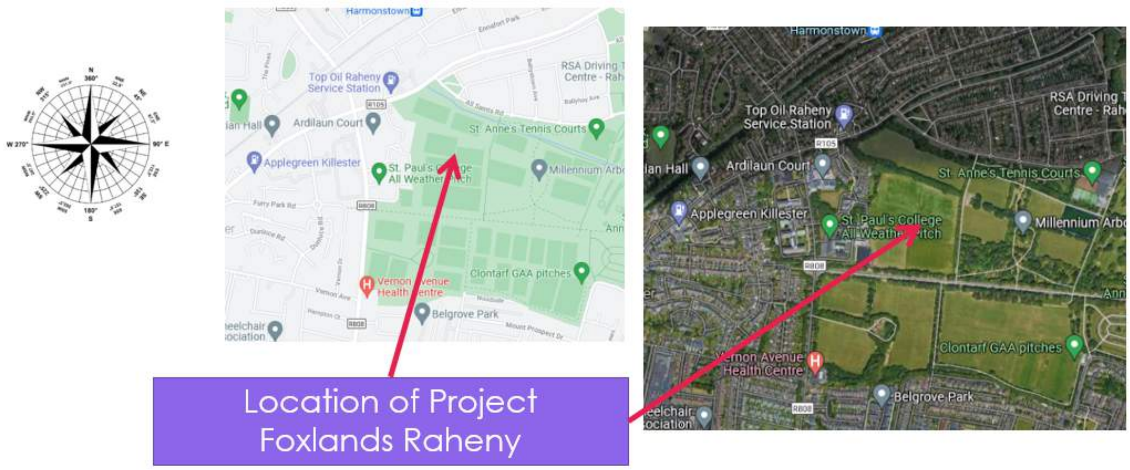


Figure 2.3: The proposed Mixed Use Residential Development Site Location and Existing Environment

Figure 2.4: Extents of Analysed Existing Environment Around the proposed Mixed Use Residential Development

2.4 OBJECTIVE OF THE WIND MICROCLIMATE STUDY

The CFD wind model is adopted to identify areas of concern in terms of critical flows and areas where the pedestrian safety and comfort could be compromised. Pedestrian Wind Comfort and Safety Studies are conducted to predict, assess and, where necessary, mitigate the impact of the development on pedestrian level wind conditions. The objective is to maintain comfortable and safe pedestrian level wind conditions that are appropriate for the season and the intended use of pedestrian areas. Pedestrian areas include sidewalks and street frontages, pathways, building entrance areas, open spaces, amenity areas, outdoor sitting areas, and accessible roof top areas among others.

2.4.1 National Policies

According to the 'Urban Development and Building Heights, Guidelines for Planning Authorities (Government of Ireland, December 2018)' document, specific impact assessment of the micro-climatic effects should be performed for 'buildings taller than prevailing building heights in urban areas'. (In the same guidance, standard buildings height is considered 6-8 storeys. Above this height, buildings are considered 'taller' for Dublin standards.)

Usually, the recommended approach to wind microclimate studies is based on the building height, as presented in Figure 2.5 and prescibed by the Wind Microclimate Guidelines for Developments in the City of London (August 2019).

Building Height	Recommended Approach to Wind Microclimate Studies
Similar or lower than the average height of surrounding buildings **Up to 25m**	Wind studies are not required, unless sensitive pedestrian activities are intended (e.g. around hospitals, transport hubs, etc.) or the project is located on an exposed location
Up to double the average height of surrounding buildings **25m to 50m**	Computational (CFD) Simulations **OR** Wind Tunnel Testing
Up to 4 times the average height of surrounding buildings **50m to 100m**	Computational (CFD) Simulations **AND** Wind Tunnel Testing
High Rise **Above 100m**	**Early Stage Massing Optimization:** Wind Tunnel Testing OR Computational (CFD) Simulations **Detailed Design:** Wind Tunnel Testing **AND** Computational (CFD) Simulations to demonstrate the performance of the final building design

Figure 2.5: Recommended Approach to Wind Microclimate Studies based on Building Height, as prescribed by the Wind Microclimate Guidelines for Developments in the City of London (August 2019)

Good wind microclimate conditions are necessary for creating outstanding public spaces. Adverse wind effects can reduce the quality and usability of outdoor areas, and lead to safety concerns in extreme cases.

Computational fluid dynamics (CFD) tools can create high quality output that provide a good understanding of fundamental flow features. The CFD models must include a detailed three-dimensional representation of the proposed development.

Maximum cell sizes near critical locations (e.g. entrances, corners, etc.) must be 0.3m or smaller. Sufficient cells should be also used between buildings with a minimum of 10 across a street canyon. However, the cell size of buildings away from the target can be larger to allow for modelling efficiency. The CFD models should represent all surrounding buildings that are within 400m from the centre of the site. Other taller buildings outside of this zone that could have an influence on wind conditions within the project site should be included for wind directions where they are upwind of the project site. The models must contain at least 3 prism layers below 1.5m height, to capture near-ground effects.

CFD analysis also reports conditions in areas away from the site where cumulative effects of a cluster of tall buildings could lead to adverse wind conditions.

3. STUDY METHODOLOGY

3.1 STUDY METHODOLOGY

The methodology adopted for the wind microclimate analysis of the proposed development is outlined as follows;

The following sections give details on the methodology utilized.

- Perform a wind desktop study of the existing environment.
- Perform computational wind microclimate analysis of the proposed development within the existing environment.

3.2 WIND IMPACT ASSESSMENT ON BUILDINGS

3.2.1 PLANETARY BOUNDARY LAYER AND TERRAIN ROUGHNESS

Due to aerodynamic drag, there is a wind gradient in the wind flow just a few hundred meters above the Earth's surface – "the surface layer of the planetary boundary layer".

Wind speed increases with increasing height above the ground, starting from zero, due to the no-slip condition. In particular, the wind velocity profile is parabolic. Flow near the surface encounters obstacles that reduce the wind speed, and introduce random vertical and horizontal velocity components. This turbulence causes vertical mixing between the air moving horizontally at one level, and the air at those levels immediately above and below it. For this reason, the velocity profile is given by a fluctuating velocity along a mean velocity value. Figure 3.1 shows the wind velocity profile, as described above.

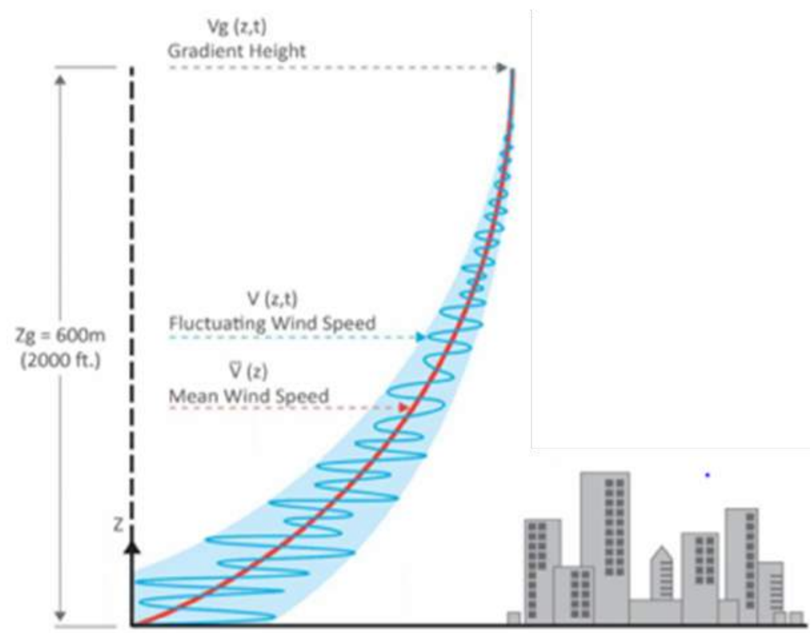


Figure 3.1: Wind Velocity Profile

Two effects influence the shape of the wind speed profile:

- Contours of the terrain: a rising terrain such as an escarpment will produce a fuller profile at the top of the slope compared with the profile of the wind approaching the slope.

- Aerodynamic 'roughness' of the upstream terrain: natural roughness in the form of woods or man-made roughness in the form of buildings. Obstructions near the ground create turbulence and friction, lowering the average wind speed. The higher the obstructions, the greater the turbulence and the lower the windspeed. As a general rule, windspeed increases with height.

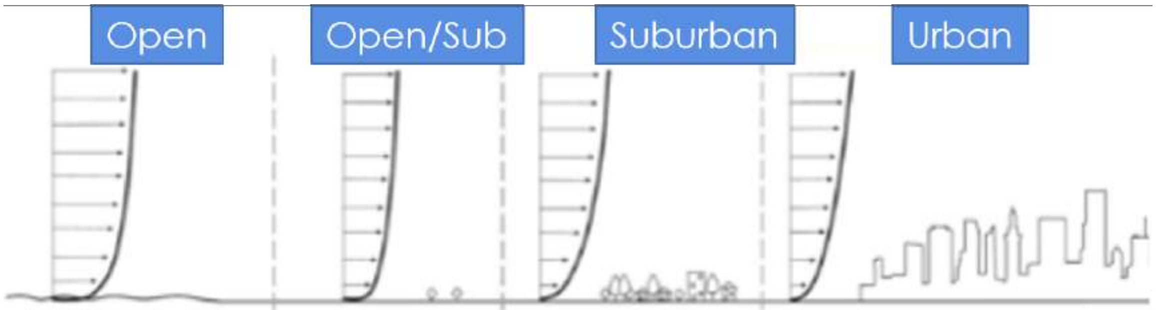


Figure 3.2: Wind Velocity Profile for different terrains

In order to assess the wind conditions in a particular area, it is important to know (Figure 3.3):

- Weather conditions in the area
- Location and orientation of the site
- Buildings distribution in the area
- Flow patterns at the building

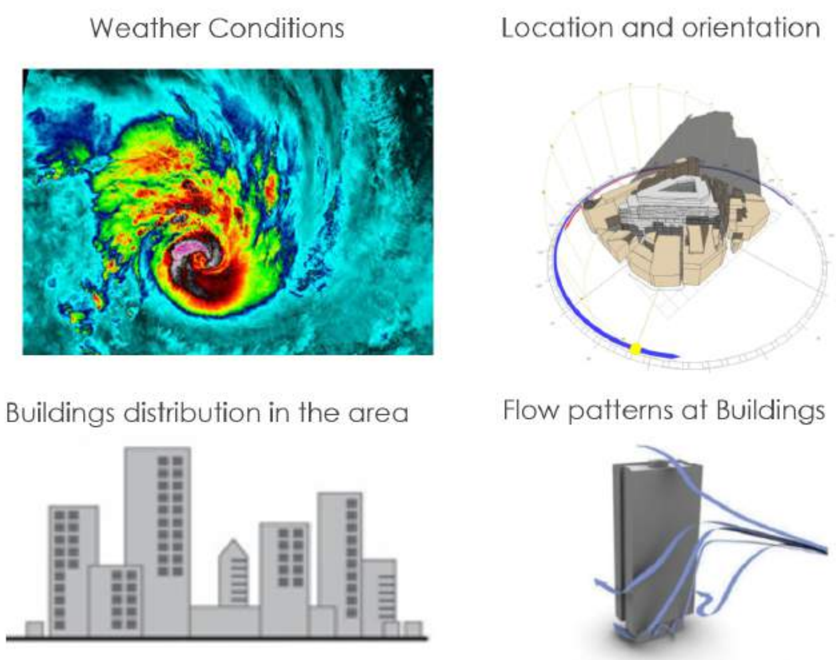


Figure 3.3: Parameters to know for Wind Conditions Assessment

Moreover, it is important to understand key flow features (Figure 3.3):

- Broad Building Face creates “DOWNWASH”
- Low Building Upwind Increases Wind Effects
- Gaps Between Buildings Increases Wind Velocity
- Low Building Upwind Increases Wind Effects

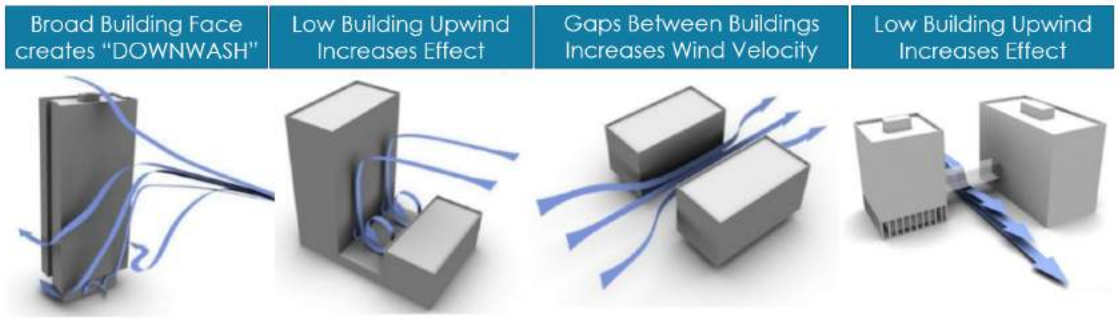


Figure 3.4: Parameters to know for Wind Conditions Assessment

3.3 ACCEPTANCE CRITERIA

3.3.1 PEDESTRIAN COMFORT AND LAWSON CRITERIA

Pedestrian Wind Comfort is measured in function of the frequency of wind speed threshold exceeded based on the pedestrian activity. The assessment of pedestrian level wind conditions requires a standard against which measured or expected wind velocities can be compared.

Only gust winds are considered in the safety criterion. These are usually rare events, but deserve special attention in city planning and building design due to their potential impact on pedestrian safety. Gusts cause the majority of cases of annoyance and distress and are assessed in addition to average wind speeds. Gust speeds should be divided by 1.85 and these ”gust equivalent mean” (GEM) speeds are compared to the same criteria as for the mean hourly wind speeds. This avoids the need for different criteria for mean and gust wind speeds.

The following criteria are widely accepted by municipal authorities as well as the international building design and city planning community:

- DISCOMFORT CRITERIA: Relates to the activity of the individual.
  Onset of discomfort:
  - Depends on the activity in which the individual is engaged and is defined in terms of a mean hourly wind speed (or GEM) which is exceeded for 5% of the time.

- DISTRESS CRITERIA: Relates to the physical well-being of the individual.
  Onset of distress:
  - ‘Frail Person Or Cyclist’: equivalent to an hourly mean speed of 15 m/s and a gust speed of 28 m/s (62 mph) to be exceeded less often than once a year. This is intended to identify wind conditions which less able individuals or cyclists may

find physically difficult. Conditions in excess of this limit may be acceptable for optional routes and routes which less physically able individuals are unlikely to use.

- ‘General Public’: A mean speed of 20 m/s and a gust speed of 37 m/s (83 mph) to be exceeded less often than once a year. Beyond this gust speed, aerodynamic forces approach body weight and it rapidly becomes impossible for anyone to remain standing. Where wind speeds exceed these values, pedestrian access should be discouraged.

The above criteria set out six pedestrian activities and reflect the fact that calm activity requires calm wind conditions, which are summarised by the Lawson scale, shown in Figure 3.5. Lawson scale assesses pedestrian wind comfort in absolute terms and defines the reaction of an average person to the wind. Each wind type is associated to a number, corresponding to the Beaufort scale, which is represented in Figure 3.6. Beaufort scale is an empirical measure that relates wind speed to observed conditions at sea or on land. A 20% exceedance is used in these criteria to determine the comfort category, which suggests that wind speeds would be comfortable for the corresponding activity at least 80% of the time or four out of five days.

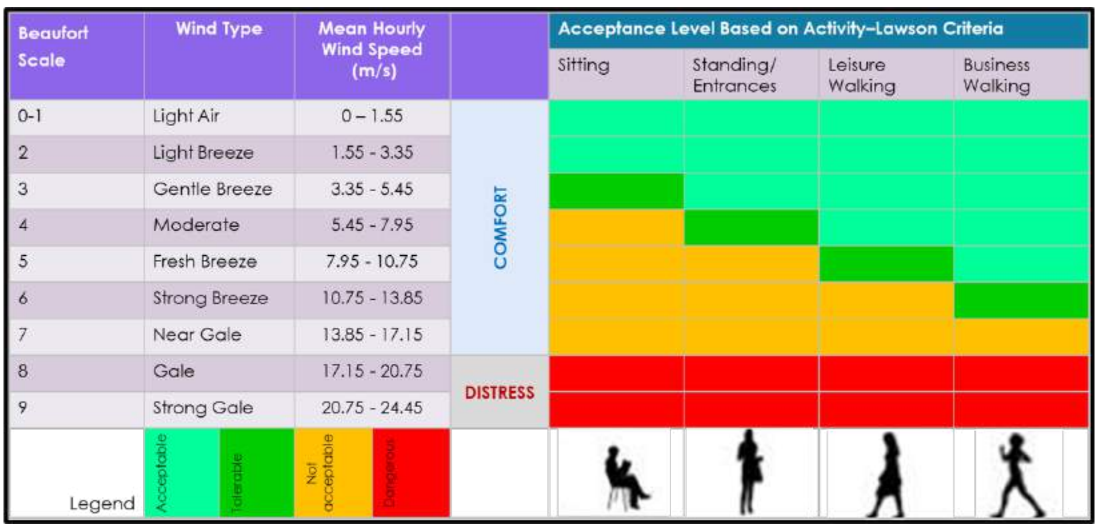
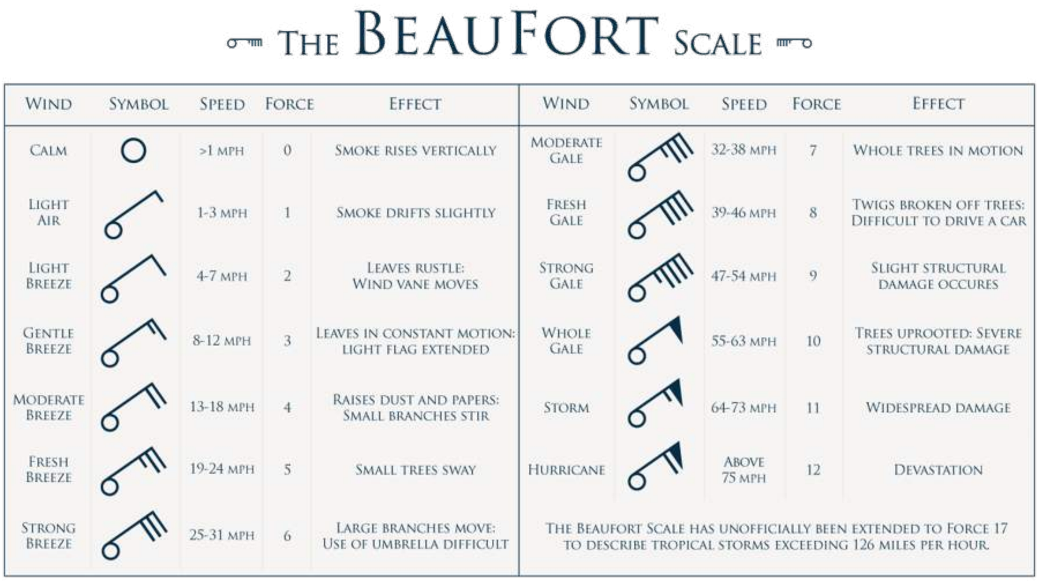


Figure 3.5: Lawson Scale



THE BEAUFORT SCALE

Wind	Symbol	Speed	Force	Effect	Wind	Symbol	Speed	Force	Effect
Calm		>1 mph	0	Smoke rises vertically	Moderate Gale		32-38 mph	7	Whole trees in motion
Light Air		1-3 mph	1	Smoke drifts slightly	Fresh Gale		39-46 mph	8	Twigs broken off trees: Difficult to drive a car
Light Breeze		4-7 mph	2	Leaves rustle: Wind vane moves	Strong Gale		47-54 mph	9	Slight structural damage occures
Gentle Breeze		8-12 mph	3	Leaves in constant motion: Light flag extended	Whole Gale		55-63 mph	10	Trees uprooted: Severe structural damage
Moderate Breeze		13-18 mph	4	Raises dust and papers: Small branches stir	Storm		64-73 mph	11	Widespread damage
Fresh Breeze		19-24 mph	5	Small trees sway	Hurricane		Above 75 mph	12	Devastation
Strong Breeze		25-31 mph	6	Large branches move: Use of umbrella difficult	The Beaufort scale has unofficially been extended to force 17 to describe tropical storms exceeding 126 miles per hour.				

Figure 3.6: Beaufort Scale

These criteria for wind forces represent average wind tolerances. They are subjective and variable depending on thermal conditions, age, health, clothing, etc. which can all affect a person's perception of a local microclimate. Moreover, pedestrian activity alters between winter and summer months. The criteria assume that people will be suitably dressed for the time of year and individual activity. It is reasonable to assume, for instance, that areas designated for outdoor seating will not be used on the windiest days of the year.

Weather data measured are used to calculate how often a given wind speed will occur each year over a specified area. Unless in extremely unusual circumstances, velocities at pedestrian level increase as you go higher from ground level.

A breach of the distress criteria requires a consideration of:

- whether the location is on a major route through the complex,
- whether there are suitable alternate routes which are not distressful.

If the predicted wind conditions exceed the threshold then condition are unacceptable for the type of pedestrian activity and mitigation measure should be implemented into the design.

For the scope of this report, a qualitative analysis is undertaken, therefore the flow pattern will be highlighted but it will not reflect the velocity magnitude developed.

Distress Criteria

In addition to the criteria for "discomfort" the Lawson method presents criteria for "distress". The discomfort criteria focus on wind conditions which may be encountered for hundreds of hours per year. The distress criteria require higher wind speeds to be met, but focus on two hours per year. These are rare wind conditions but with the potential for injury rather than inconvenience.

Figure 3.7 shows the hourly wind gust rose for Dublin, from 1990 to 2020. This will be necessary to assess how many hours per year on average the velocity exceed the threshold values.

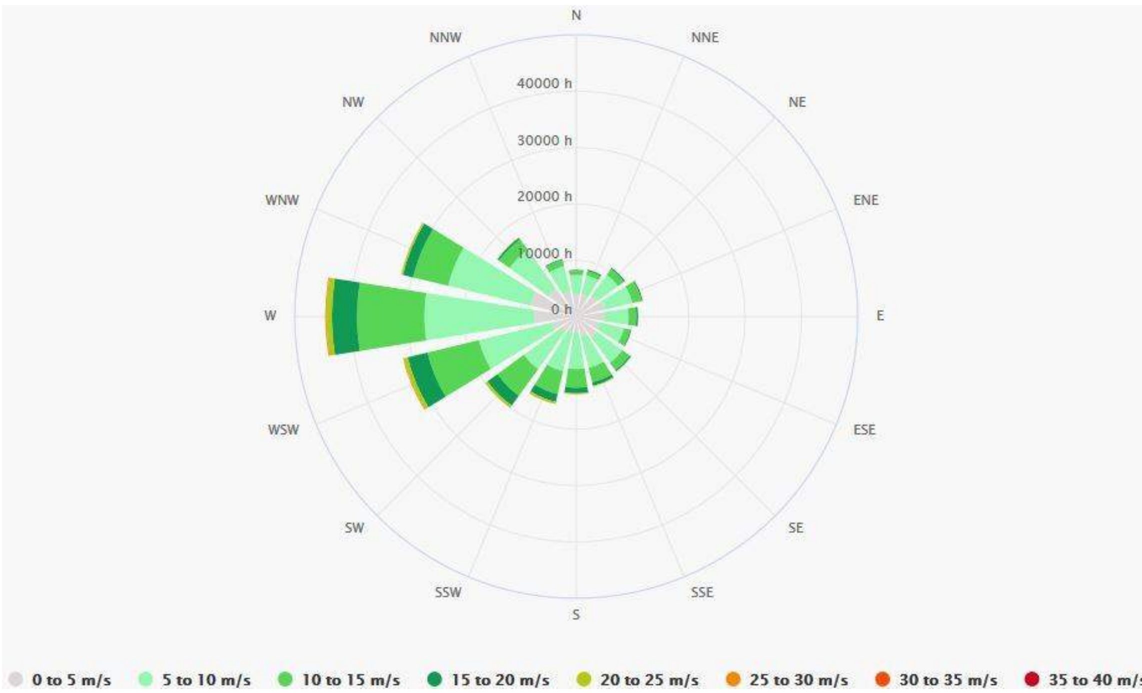


Figure 3.7: Hourly Dublin Wind Gust Rose

Distress for Frail Person or Cyclist

The criteria for distress for a frail person or cyclist is 15m/s wind occurring for more than two hours per year. Limiting the results from the above wind rose to the only values above 15m/s (as reported in Figures 3.8 and 3.9 respectively as cumulative hours and cumulative percentage), it is possible to see how many hours in 30 years the gust velocity of 15m/s is exceed at pedestrian level in each direction.

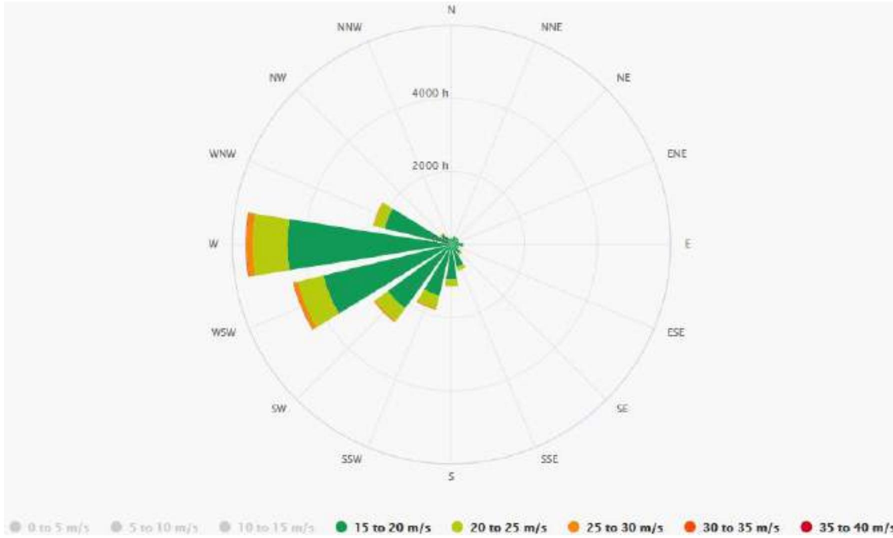


Figure 3.8: Hourly Dublin Wind Gust Rose - Cumulative hours when the velocity is above 15m/s

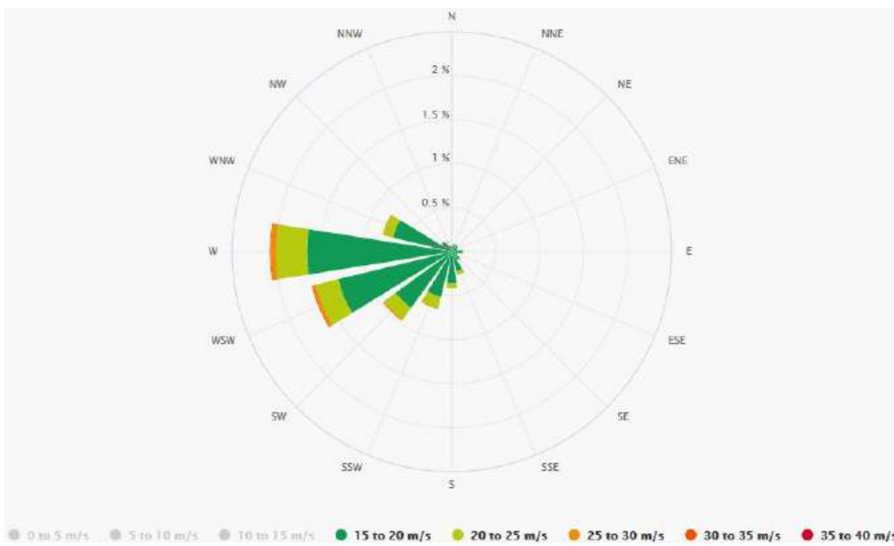


Figure 3.9: Hourly Dublin Wind Gust Rose - Cumulative percentage of time when the velocity is above 15m/s

A total of 2 hours per years corresponds to 0.02% in one year, which means 0.6% in 30 years. Looking at the wind roses above, it is possible to notice that a velocity of 15m/s was reached in Dublin only for the following directions (in increasing order of percentage) over the years 1990-2020:

1. West 270°
2. West-South-West 247.5°
3. South-West 225°

Distress for General Public

The criteria for distress for a member of the general population is 20m/s wind occurring for more than two hours per year. Limiting the results from the above wind rose to the only values above 20m/s (as reported in Figures 3.10 and 3.11 respectively as comulative hours and cumulative percentage), it is possible to see how many hours in 30 years the gust velocity of 20m/s is exceed at pedestrian level in each direction.

Figure 3.10: Hourly Dublin Wind Gust Rose - Cumulative hours when the velocity is above 20m/s

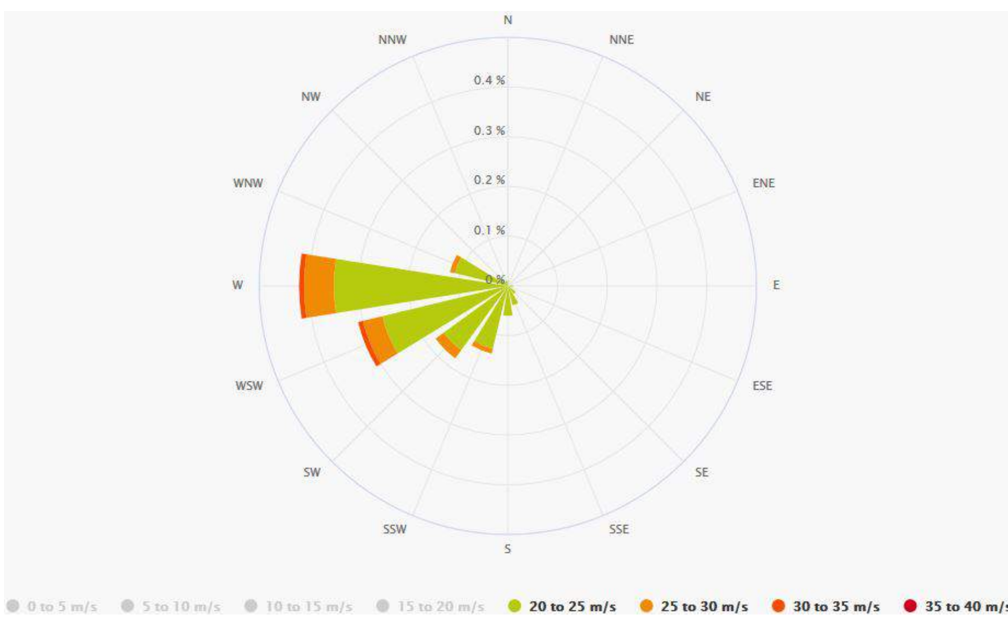


Figure 3.11: Hourly Dublin Wind Gust Rose - Cumulative percentage of time when the velocity is above 20m/s

A total of 2 hours per years corresponds to 0.02% in one year, which means 0.6% in 30 years. Looking at the wind roses above, it is possible to notice that a velocity of 20m/s was never reached in Dublin over the years 1990-2020.

3.4 MITIGATION MEASURES

As stated in the previous section, if the predicted wind conditions exceed the threshold, then condition are unacceptable for the type of pedestrian activity and mitigation measure should be accounted for.

Mitigation measures include:

- Landscaping: the use vegetation to protect buildings from wind
- Sculptural screening (solid or porous): to either deflect the wind or bleed the wind by removing its energy.
- Canopies and Wind gutters: horizontal canopies are used to deflect the wind and redirect the wind around the building and above the canopy.

In particular, it is possible to summarise the different flow features and the corresponding mitigation option as follows (Figures 3.12 and 3.13):

- **Downwash Effects**: when wind hits the windward face of a tall building, the building tends to deflect the wind downwards, causing accelerated wind speeds at pedestrian level and around the windward corners of the building. This can occur when Tall and wide building facades face the prevailing winds.
  Downdraft Effects: When the leeward face of a low building faces the windward face of a tall building, it causes an increase in the downward flow of wind on the windward face of the tall building. This results in accelerated winds at pedestrian level in the space between the two buildings and around the windward corners of the tall building.

  MITIGATION OPTIONS:
  - To mitigate unwanted wind effects it is recommended to introduce a base building or podium with a step back, and setting back a tower relative to the base building, the downward wind flow can be deflected, resulting in reduced wind speed at pedestrian level.
  - Landscaping the base building roof and tower step back, wind speeds at grade can be further reduced, and wind conditions on the base building roof can improve.

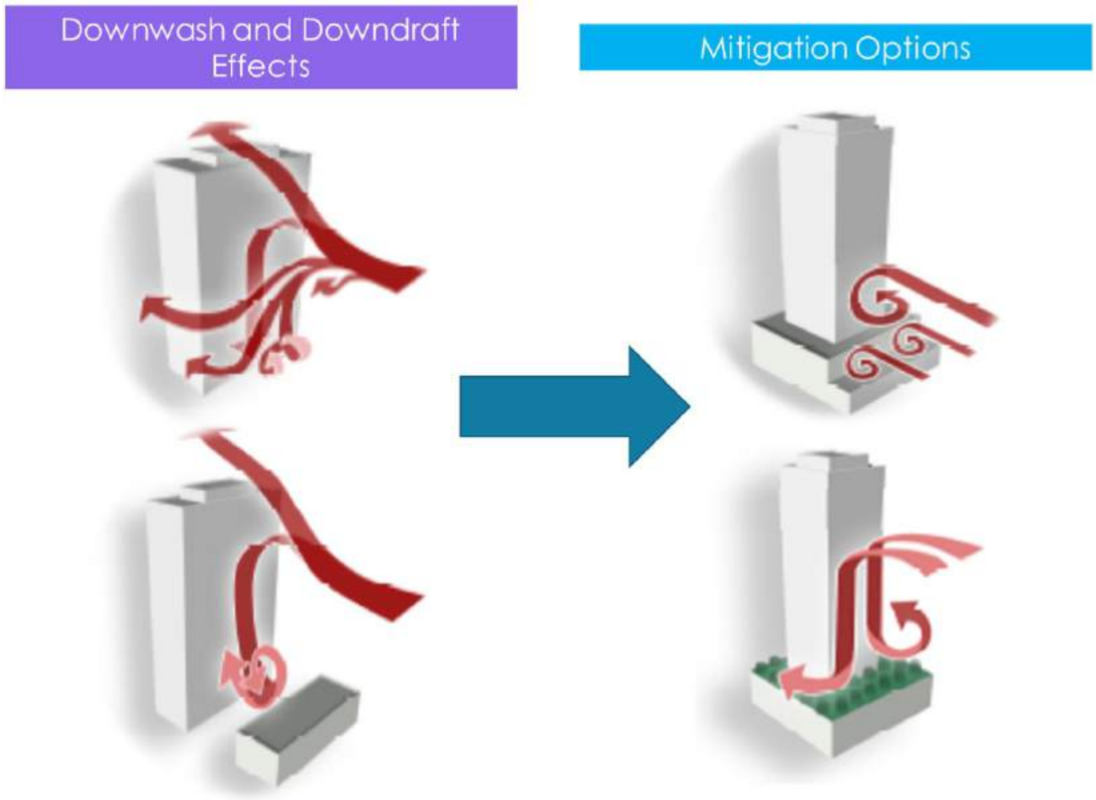


Figure 3.12: Mitigation Measures for Downwash and Downdraft Effects

- **Funneling Effects**: Wind speed is accelerated when wind is funneled between two buildings. This is referred to as the "wind canyon effect". The intensity of the acceleration is influenced by the building heights, size of the facades, building separation distance and building orientation. Similar effect can be noticed when a bridge is connecting two buildings, the wind passing below the bridge is accelerated, therefore pedestrians can experience high uncomfortable velocities of wind.

  MITIGATION OPTIONS:
  - A horizontal canopy on the windward face of a base building can improve pedestrian level wind conditions. Parapet walls around a canopy can make the canopy more effective.
  - Sloped canopies only provide partial deflection of downward wind flow.
  - A colonnade on the windward face of the base building provides the pedestrian with a calm area where to walk while being protected or a breeze walking space outside the colonnade zone.

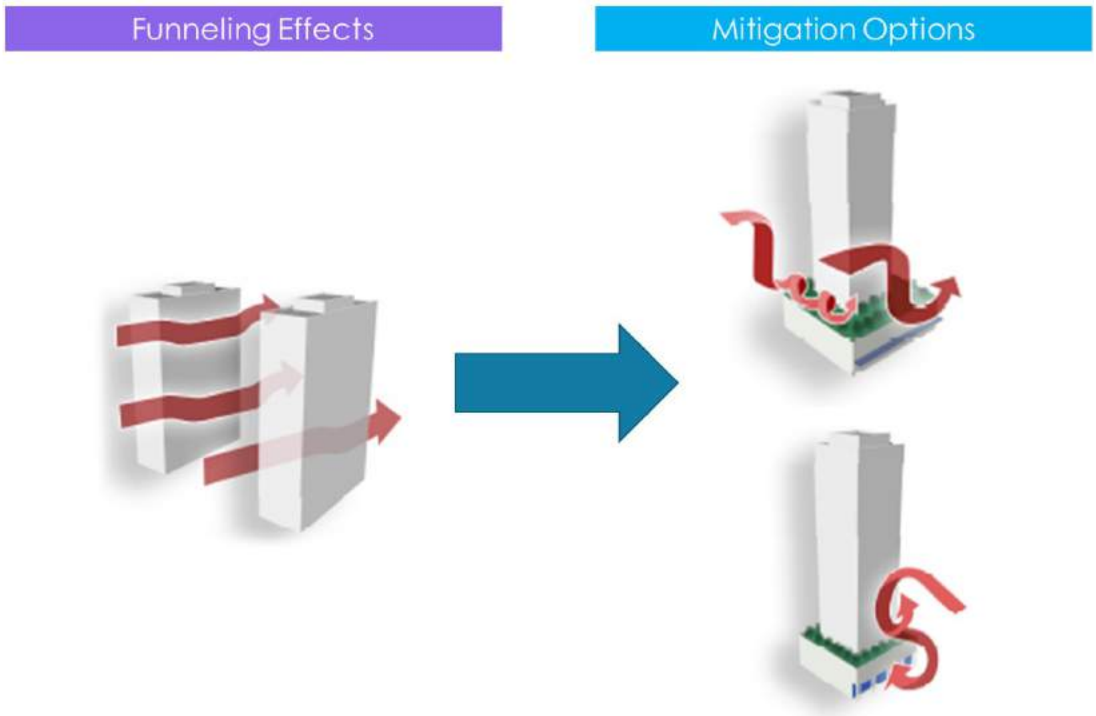


Figure 3.13: Mitigation Measures for Funnelling Effects

Landscape Trees Modelling (Using Porous Media)
Through CFD Modelling, it is possible to implement the effects of landscaping trees on the wind flowing through an urban environment. Urban landscape managers, local councils and architects can now observe and assess the effects of landscaping trees in their urban landscape models. The landscape trees are simulated as comprising effects of porous zones within the urban environments. This is an essential tool for accurately assessing the actual wind speed and pattern at a pedestrian level when landscape are available. Figure 3.14 shows a plan view of the proposed landscape which is also mitigating the wind flow approaching the development. The landscaping is implemented within the CFD model as shown in the figure 3.15

Figure 3.14: Plan View of the Mitigation Measures that will be implemented around the proposed Mixed Use Residential Development

Figure 3.15: Modelling Landscape Trees As Porous Zones

4. CFD MODELLING METHOD

4.1 CFD MODELLING METHOD

Computational Fluid Dynamics (CFD) is a numerical technique to simulate fluid flow, heat and mass transfer, chemical reaction and combustion, multiphase flow, and other phenomena related to fluid flows. CFD modelling includes three main stage: pre-processing, simulation and post-processing as described in Figure 4.1. The Navier-Stokes equations, used within CFD analysis, are based entirely on the application of fundamental laws of physics and therefore produce extremely accurate results providing that the scenario modelled is a good representation of reality.

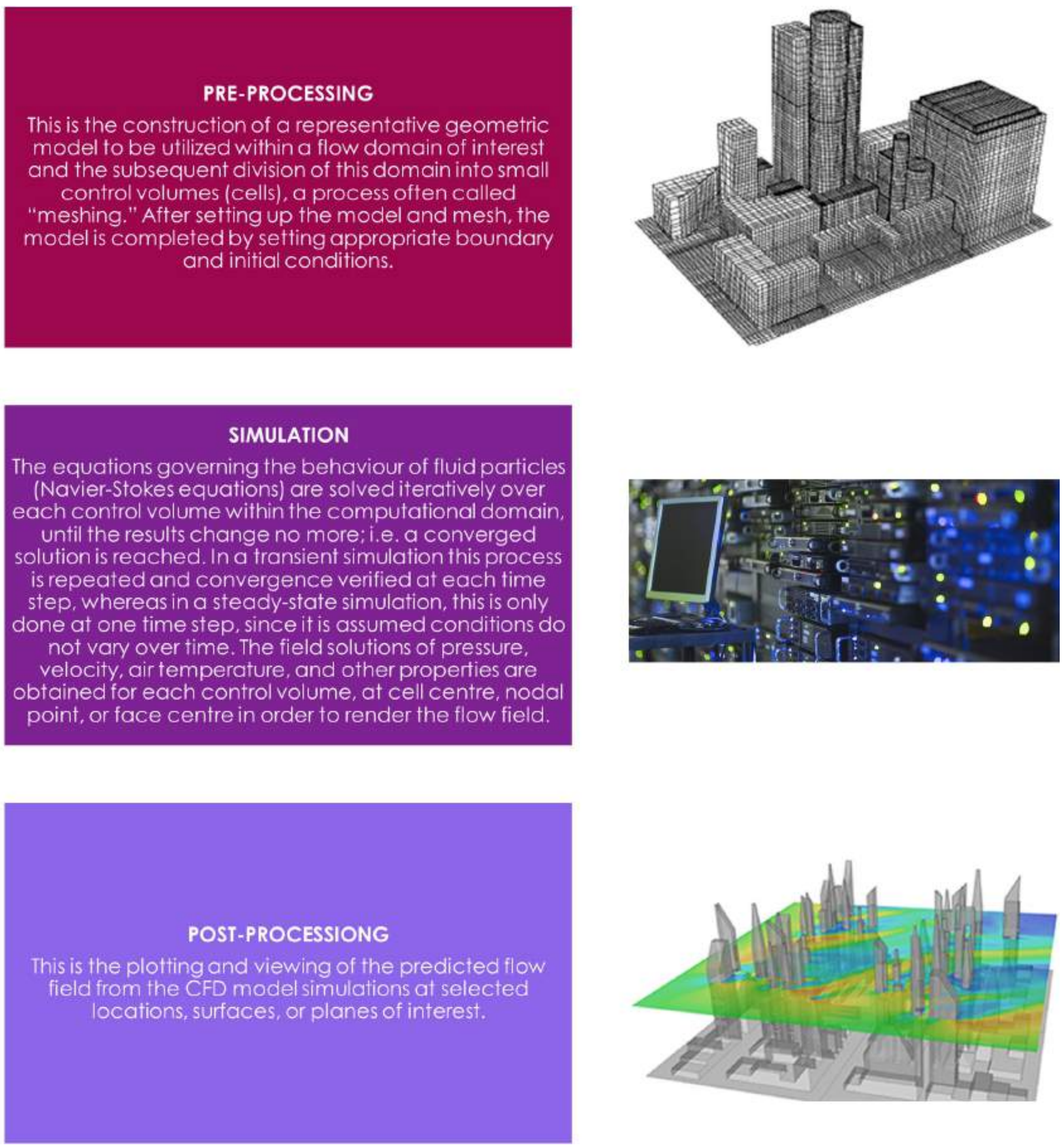


Figure 4.1: CFD Modelling Process Explanation

4.1.1 NUMERICAL SOLVER

This report employs OpenFoam Code, which is based on a volume averaging method of discretization and uses the post-processing visualisation toolkit Paraview version 5.5. OpenFoam is a CFD software code released and developed primarily by OpenCFD Ltd, since 2004. It has a large user base across most areas of engineering and science, from both commercial and academic organisations.

OpenFOAM CFD code has capabilities of utilizing a Reynolds Averaged Navier-Stokes (RANS) approach, Unsteady Reynolds Averaged Navier-Stokes (URANS) approach, Detached Eddy Simulation (DES) approach, Large Eddy Simulation (LES) approach or the Direct Numerical Simulation (DNS) approach, which are all used to solve anything from complex fluid flows involving chemical reactions, turbulence and heat transfer, to acoustics, solid mechanics and electromagnetics. Quality assurance is based on rigorous testing. The process of code evaluation, verification and validation includes several hundred daily unit tests, a medium-sized test battery run on a weekly basis, and large industry-based test battery run prior to new version releases. Tests are designed to assess regression behaviour, memory usage, code performance and scalability.

The OpenFOAM solver algorithm directly solves the mass and momentum equations for the large eddies that comprise most of the fluid's energy. By solving the large eddies directly no error is introduced into the calculation.

To reduce computational time and associated costs the small eddies within the flow have been solved using the widely used and recognised Smagorinsky Sub-Grid Scale (SGS) model. The small eddies only comprise a small proportion of the fluids energy therefore the errors introduced through the modelling of this component are minimal.

The error introduced by modelling the small eddies can be considered of an acceptable level. Computational time will be reduced by modelling the small eddies (compared to directly solving).

4.2 COMPUTATIONAL MESH

The level of accuracy of the CFD results are determined by the level of refinement of the computational mesh. Details of parameters used to calculate the computational mesh are presented in Table 4.1. Figure 4.2 shows the mesh utilised in the simulations.

The grid follows the principles of the 'Finite Volume Method', which implies that the solution of the model equations is calculated at discrete points (nodes) on a three-dimensional grid, which includes all the flow volume of interest. The mathematical solution for the flow is calculated at the center of each of these cells and then an interpolation function is used by the software to provide the results in the entire domain.

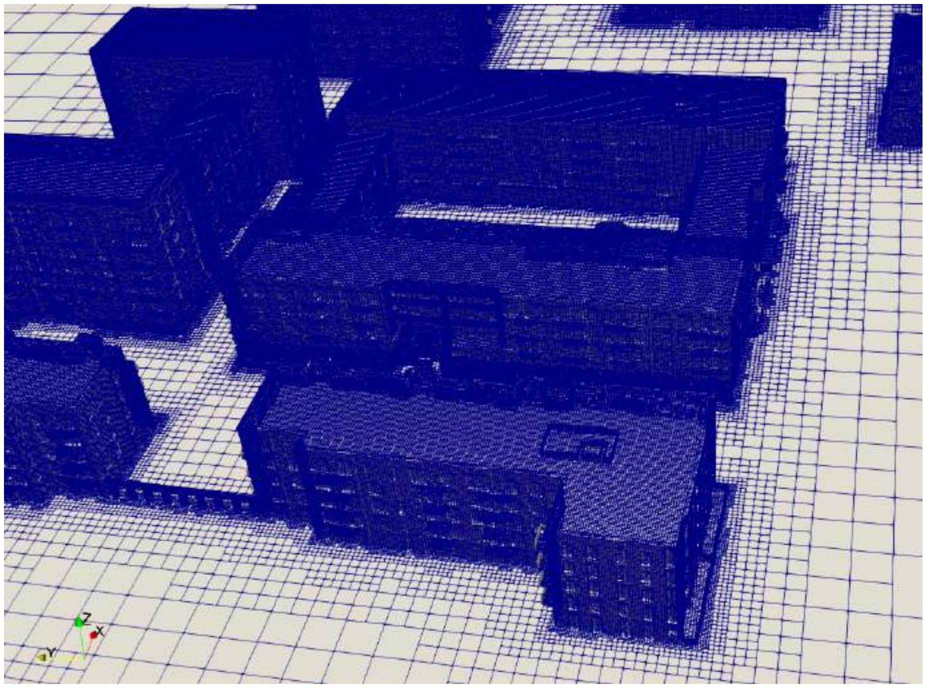


Figure 4.2: The proposed Mixed Use Residential Domain Computational Mesh Utilized

4.3 BOUNDARY CONDITIONS

A rectangular computational domain was used for the analysis. The wind direction were altered without changing the computational mesh. For each dimension, an initial wind velocity was set according to the weather data collected, in order to consider the worst case scenario (see Chapter 5). Surfaces within the model were specified as having 'no slip'. This condition ensures that flow moving parallel to a surface is brought to rest at the point where it meets the surface. all the other domain boundaries are set as "Open Boundaries".

PARAMETERS TO CALCULATE COMPUTATIONAL MESH	
Air Density ρ	$1.2kg/m^3$
Ambient Temperature (T)	$288K(approx.15C^{\circ})$
Gravity Acceleration (g)	$9.8m/s^2$
dx	0.5 m at the building 1m in the surroundings 2m elsewhere
Background Mesh ratio	1:1
Total mesh size	Approx. cells number = 10 million

Table 4.1: Paramenters To Calculate Computational Mesh

5. WIND DESKTOP STUDY

5.1 LOCAL WIND CONDITIONS

This analysis consider the whole development being exposed to the typical wind condition of the site. The building is oriented as shown in the previous sections. The wind profile is built using the annual average of meteorology data collected at Dublin Airport Weather Station. Figure 5.1 shows on the map the position of the proposed Mixed Use Residential Development and the position of Dublin Airport.

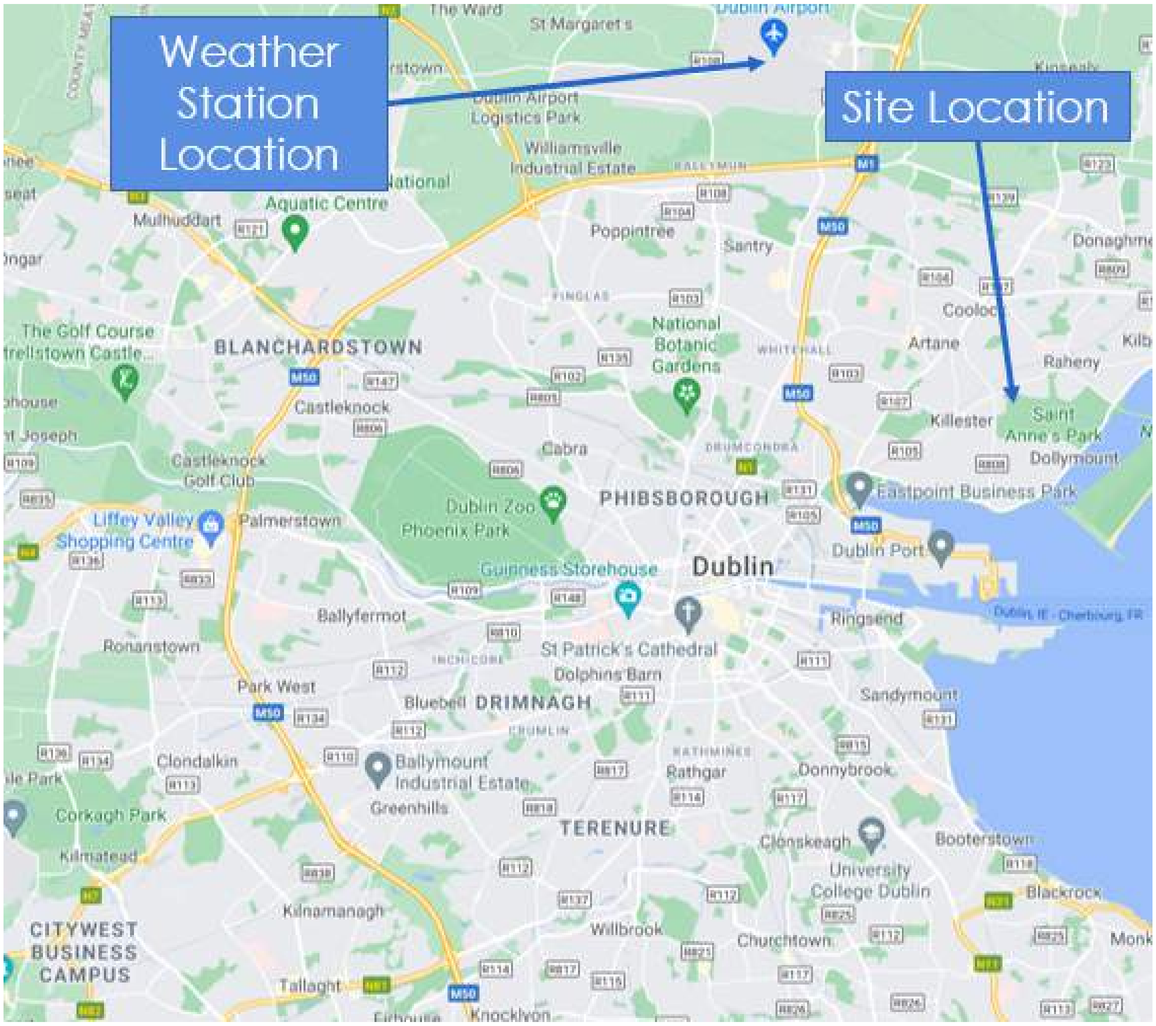


Figure 5.1: Map showing the position of the proposed Mixed Use Residential Development and Dublin Airport

Regarding the transferability of the available wind climate data following considerations have been made:

- *Terrain*: The meteorological station is located on the flat open terrain of the airport, whereas the development site is in an urban area with dense built-in structure with buildings of more than 20 m height in average and with some buildings even taller.

- *Mean Wind Speeds*: Due to the different terrain environment, the ground-near wind speeds (at pedestrian level) will be lower at the construction site compared to the meteorological station at the airport.

- *Wind Directions*: The landscape around the development site can in principle be characterized as flat terrain. Isolated elevations in the near area of the development should have no influence on the wind speed and wind directions. With respect to the general wind climate no significant influence is expected. Based on the above considerations it can be concluded that the data from the meteorological station at Dublin Airport are applicable for the desktop assessment of the wind comfort at the development site.

The assessment of the wind comfort conditions at the new development will be based on the dominating wind directions throughout a year (annual wind statistic).

As stated above, the local wind climate is determined from historical meteorological data recorded at Dublin Airport. The data set analyzed for this assessment is as follows:

- The meteorological data associated with the maximum daily wind speeds recorded over a 30 year period between 1990 and 2020 and,
- The mean hourly wind speeds recorded over a 10 year period between 1990 and 2020. The data is recorded at a weather station at the airport, which is located 10m above ground or 71mOD.

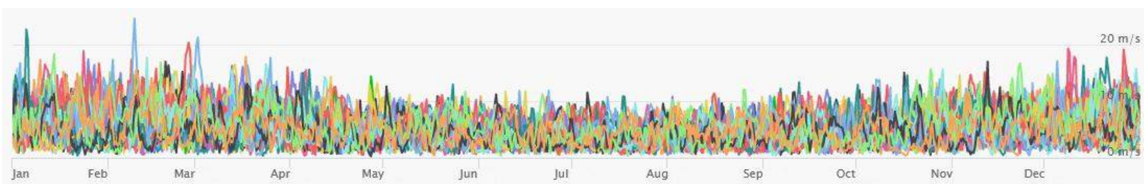


Figure 5.2: Local Wind Conditions - Wind Speed - 2017-2021

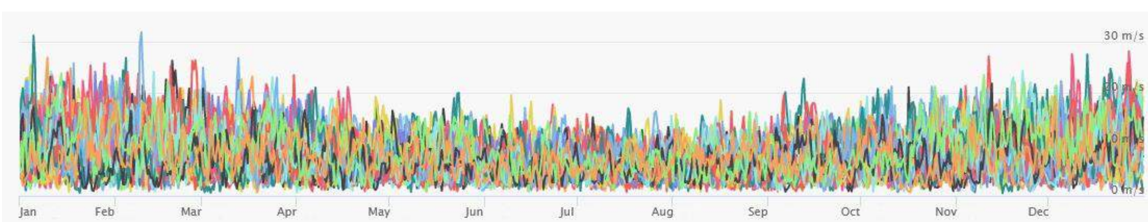


Figure 5.3: Local Wind Conditions - Wind Gust - 1990-2020

Figure 5.4, presenting the wind speed diagram for Dublin, shows the days per month, during which the wind reaches a certain speed. In Figure 5.5, the wind rose for Dublin shows how many hours per year the wind blows from the indicated direction, confirming how the predominant directions are West-South-West, West, South-East and South-West.

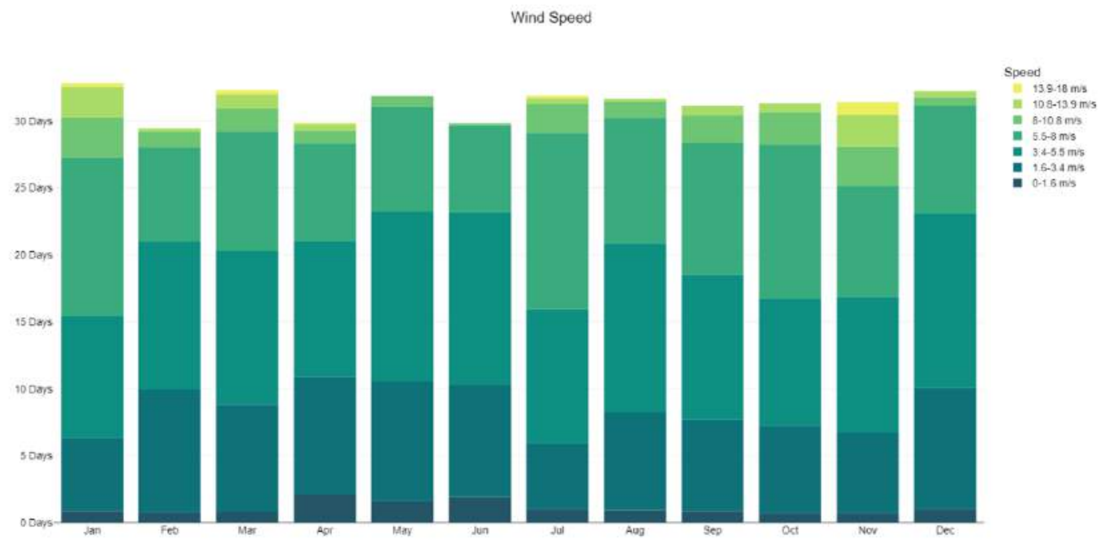


Figure 5.4: Dublin Wind Speed Diagram

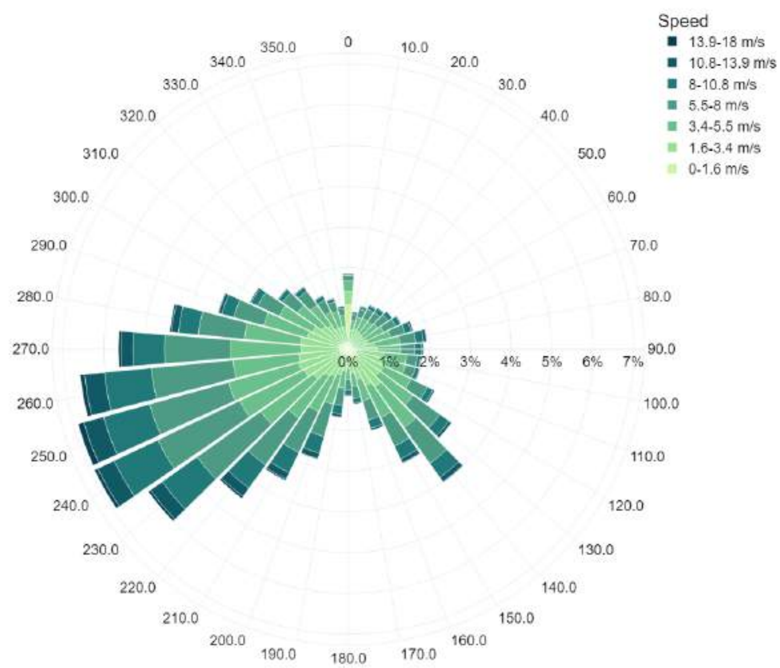


Figure 5.5: Dublin Wind Rose

Statistical analysis of the number of hours and magnitudes of wind is performed in order to indicate the pedestrian comfort and distress analysis as per Lawson Criteria. Each of the wind directions were interpolated to calculate the probability that a velocity threshold will be exceeded.

Based on the criterion of occurrence frequency, if the proposed site is exposed to a wind from a specific direction for more than 5 percent of the time, then the microclimate analysis should consider the impact of this wind (accounting for its direction and most frequent speed) on the local microclimate. In addition, seasonal changes were analysed in order to indicate the prevailing wind directions (Fig 5.6).

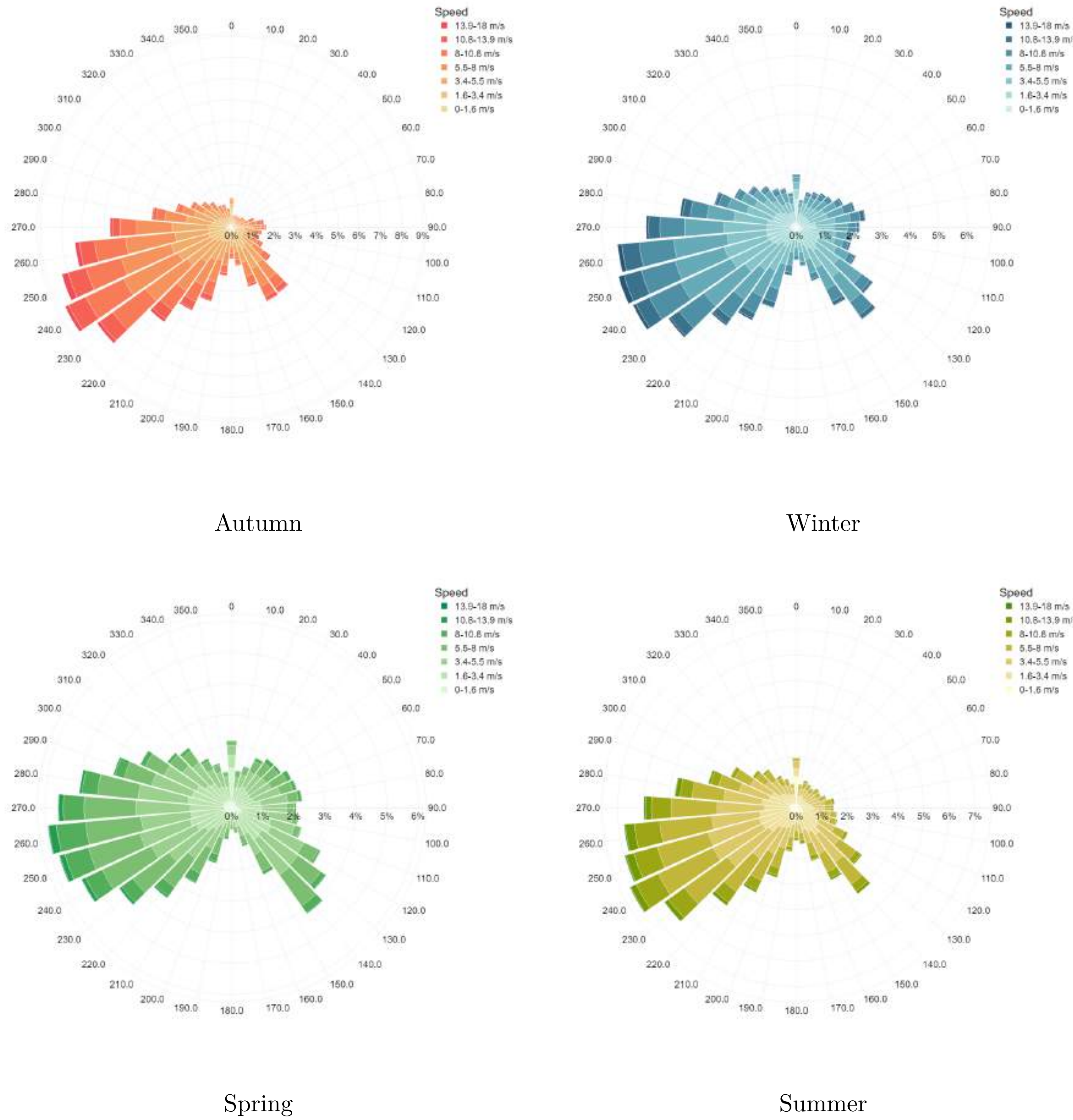


Figure 5.6: Wind speeds and wind directions at different seasons

5.1.1 TOPOGRAPHY and BUILT IN ENVIRONMENT

Figure 5.7 shows an aerial photograph of the terrain surrounding the construction site at the proposed Mixed Use Residential Development.

The area surrounding the site can be characterised as urban environment. Some shelter effect can be expected for wind approaching from directions within this sector. All the wind directions considered for this study are in this connection “urban winds” and no distinction will be made between them.

Figure 5.7: Built-in Environment Around Construction Site at the proposed Mixed Use Residential Development

5.1.2 OPEN AREA FUNCTIONS

The assessment of pedestrian wind comfort in urban areas focuses on activities people are likely to perform in the open space between buildings, which are in turn related to a specific function. For example the activity sitting a longer period of time is typically associated with the location of a street café or similar. Such combinations of activity and area can be grouped in four main categories:

A	Sitting for a long period of time; laying steady position; pedestrian sitting; Terrace; street cafe or restaurant; open field theatre; pool
B	Pedestrian standing; standing/sitting over a short period of time; short steady positions; Public park; playing field; shopping street; mall
C	Pedestrian walking; leisurely walking; normal walking; ramble; stroll Walkway; shopping street; mall
D	Objective business walking; brisk or fast walking; Car park; avenue; sidewalk; belvedere

Table 5.1: Main Categories for Pedestrian Activities

6. ANALYSIS OF CFD RESULTS

6.1 CFD RESULTS

It is of interest at this point to underline again the objectives of the CFD simulations performed. In particular:

- Pedestrian Wind Comfort and Safety Studies are conducted to predict, assess and, where necessary, mitigate the impact of the development on pedestrian level wind conditions.
- The objective is to maintain comfortable and safe pedestrian level wind conditions that are appropriate for the season and the intended use of pedestrian areas. Pedestrian areas include sidewalks and street frontages, pathways, building entrance areas, open spaces, amenity areas, outdoor sitting areas, and accessible roof top areas among others.

Results of the simulations carried out are detailed in the following Sections. The results present the parameters outlined in the acceptance criteria section described previously. Slices of the following parameters are collected throughout the simulation time and shown for steady state times:

- Flow Velocity
- Lawson Map

6.2 MICROCLIMATE ASSESSMENT OF PROPOSED DEVELOPMENT

This section aims to show wind patterns around the proposed development under mean and peaks wind conditions typically occurring in the area. A 3D view of the proposed development massing model in the domain is presented in Figures from 6.1 to 6.2.

Figure 6.1: 3D View of the Proposed Mixed Use Residential Development and Adjacent Buildings - Generic View

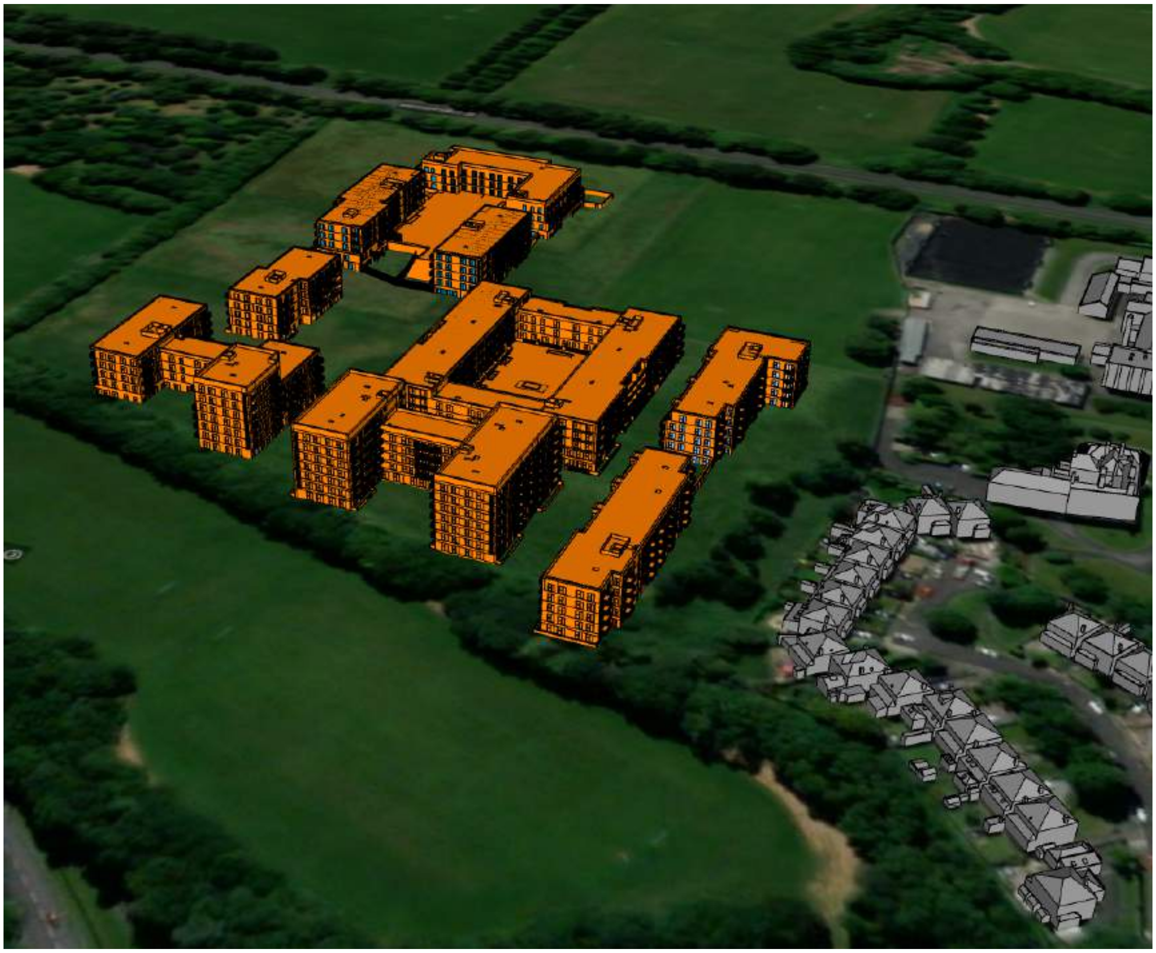


Figure 6.2: 3D View of the Proposed Mixed Use Residential Development and Adjacent Buildings - North Side View

The results present the parameters outlined within the acceptance criteria section described previously. The images within the following subsections show the flow velocity results obtained and maps to assess the pedestrian comfort in the area.

From the simulation results the following observations are pointed out:

- The proposed Mixed Use Residential Development has been designed in order to produce a high-quality environment that is attractive and comfortable for pedestrians of all categories. To achieve this objective, throughout the design process, the impact of wind has been considered and analysed, in the areas where critical patterns were found, the appropriate mitigation measures were introduced.
- As a result of the final proposed and mitigated design, wind flow speeds at ground floor are shown to be within tenable conditions. Some higher velocity indicating minor funnelling effects are found between block D and G and the corners of block A, B, C and G. However, these areas can be utilised for the intended use such as short-term sitting, walking and strolling.
- Area between Block A and Block D is suitable for short-term sitting instead of long-term sitting due to flow acceleration between the Blocks.
- Courtyard on Block D is well protected and good shielding is achieved. Therefore, it can be used for all activities including long-term sitting.
- Small areas of Courtyard on Block G are suitable for short term sitting instead of long-term sitting, however the majority of the area is appropriate for long term sitting.
- Tree planting all around the development has been utilised, with particular attention to the corners of the Blocks has positively mitigated any critical wind effects.
- Regarding the balconies, higher velocities are found for some directions, only on some of the balconies (mostly on the South and West sides of the blocks). However, these velocities are below the threshold values defined by the acceptance criteria and therefore are not critical for safety.
- The proposed development does not impact or give rise to negative or critical wind speed profiles at the nearby adjacent roads, or nearby buildings. Moreover, in terms of distress, no critical conditions were found for “Frail persons or cyclists” and for members of the ”General Public” in the surrounding of the development.

6.2.1 Flow Velocity Results - Ground Floor

Results of wind speeds and their circulations at pedestrian level of 1.5m above the development ground are presented in Figures 6.5 to 6.20 in order to assess wind flows at ground floor level of the proposed Mixed Use Residential Development.

Wind flow speeds are shown to be within tenable conditions. Some higher velocity indicating minor funnelling effects are found between block D and G and the corners of block A, B, C and G. However, these areas can be utilised for the intended use such as short-term sitting, walking and strolling. Therefore, it can be concluded that the wind speeds do not attain critical levels around the development.

Figure 6.4 shows an example of wind data mapped on surface, located at 1.5m above the ground. The scale used for all flow velocity results is set out in Figure 6.3. Red colors indicate critical values while blue colors indicate tenable conditions.

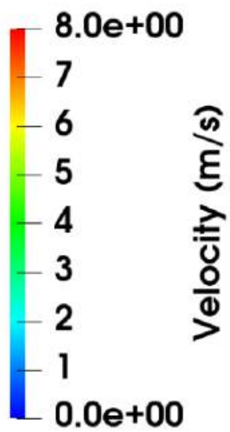


Figure 6.3: Velocity Colour Map

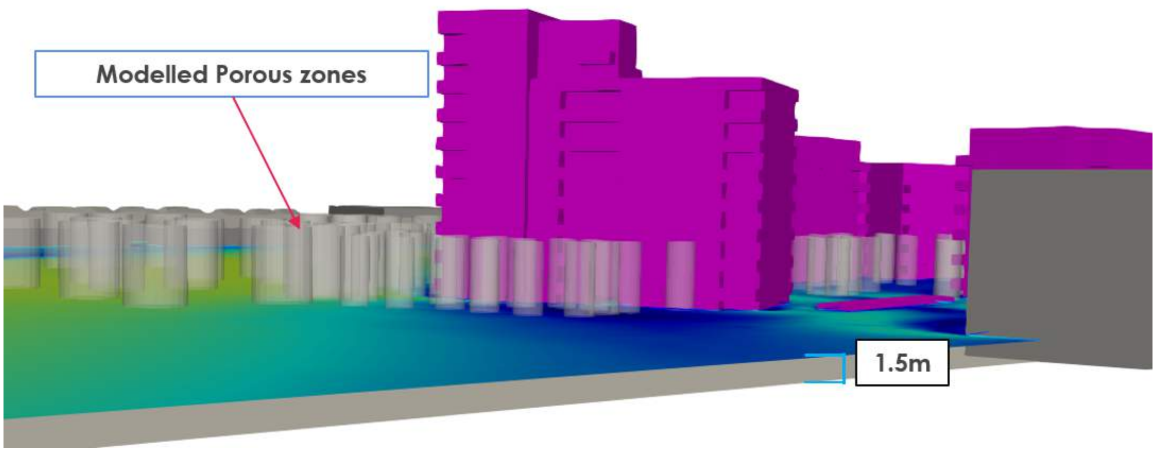


Figure 6.4: An example of wind data mapped on surface at 1.5m above the ground

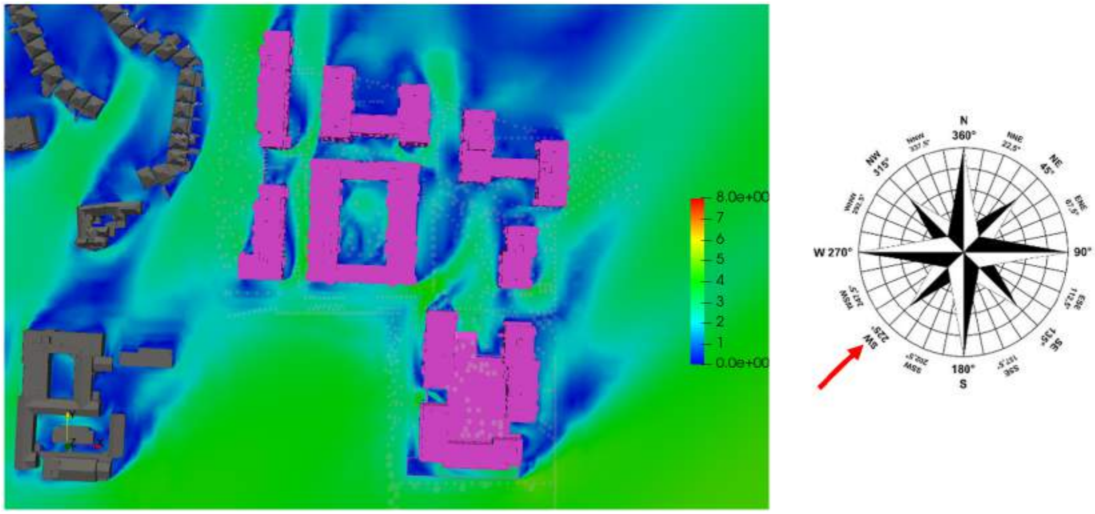


Figure 6.5: Ground Floor Level - Flow Velocity Results at Z=1.5m above the ground - Wind Direction: 225°

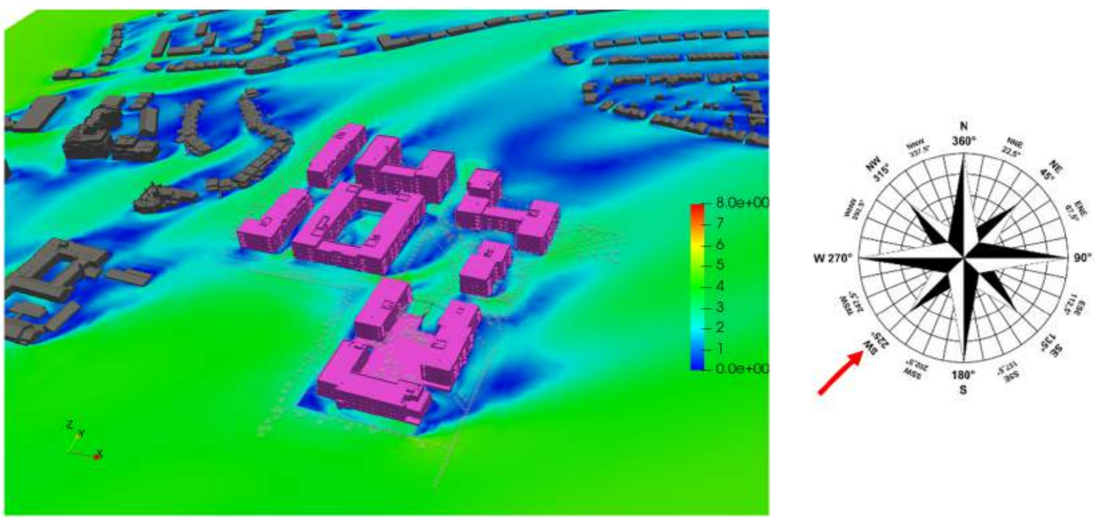


Figure 6.6: Wind Speed Results at 1.5m Above Development Ground Floor - 3D View - Wind Direction: 225°

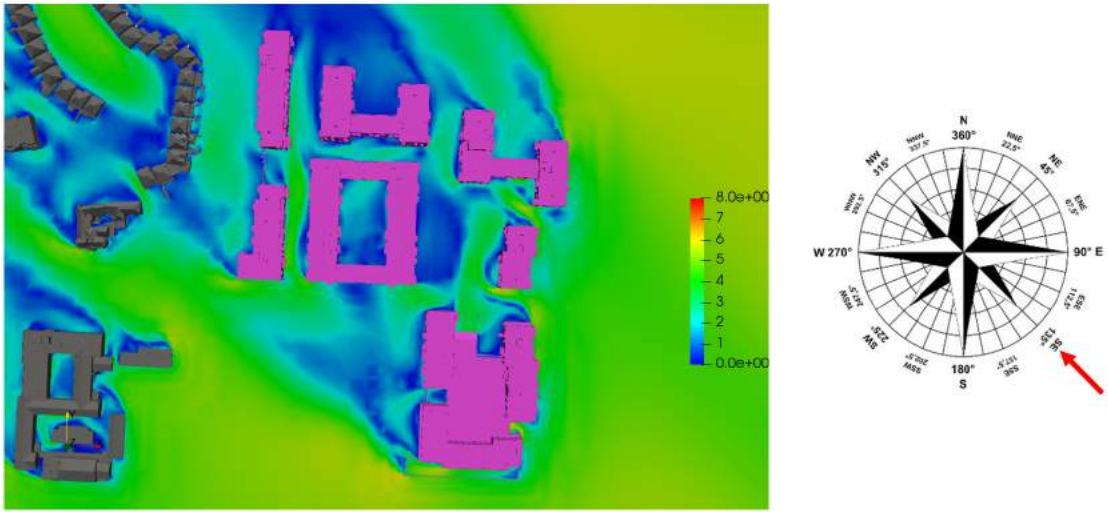


Figure 6.7: Ground Floor Level - Flow Velocity Results at Z=1.5m above the ground - Wind Direction: 135°

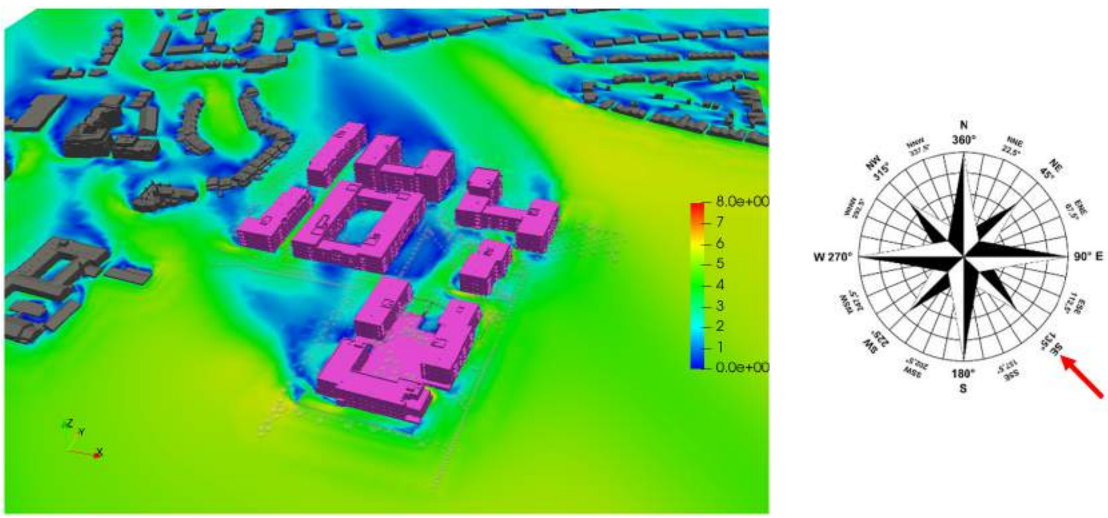


Figure 6.8: Wind Speed Results at 1.5m Above Development Ground Floor - 3D View - Wind Direction: 135°

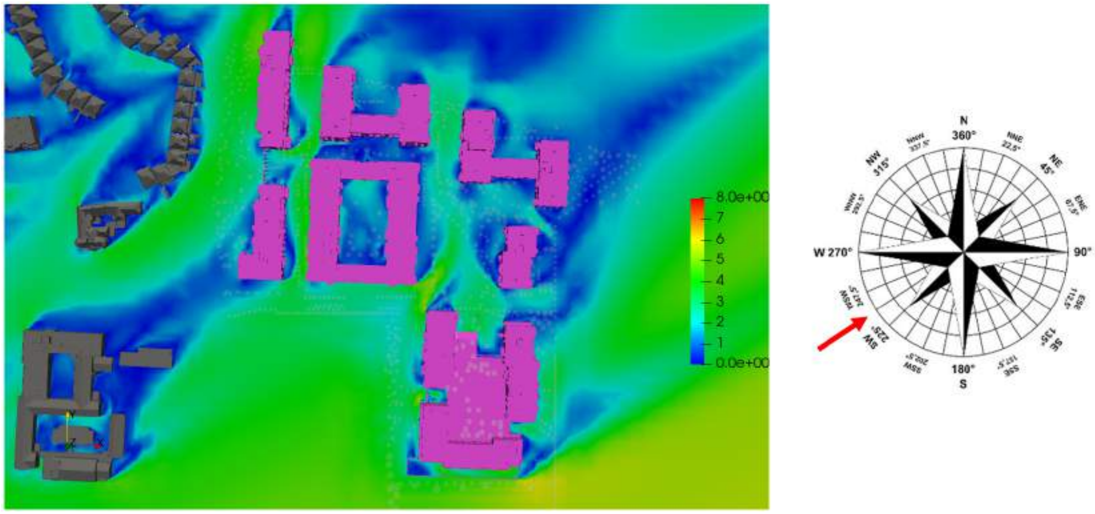


Figure 6.9: Ground Floor Level - Flow Velocity Results at Z=1.5m above the ground - Wind Direction: 236°

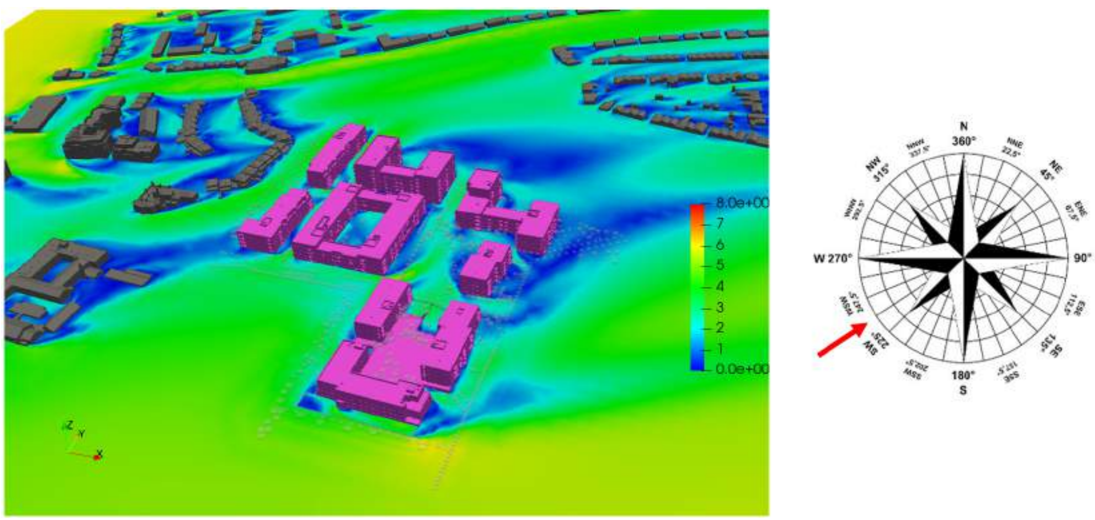


Figure 6.10: Wind Speed Results at 1.5m Above Development Ground Floor - 3D View - Wind Direction: 236°

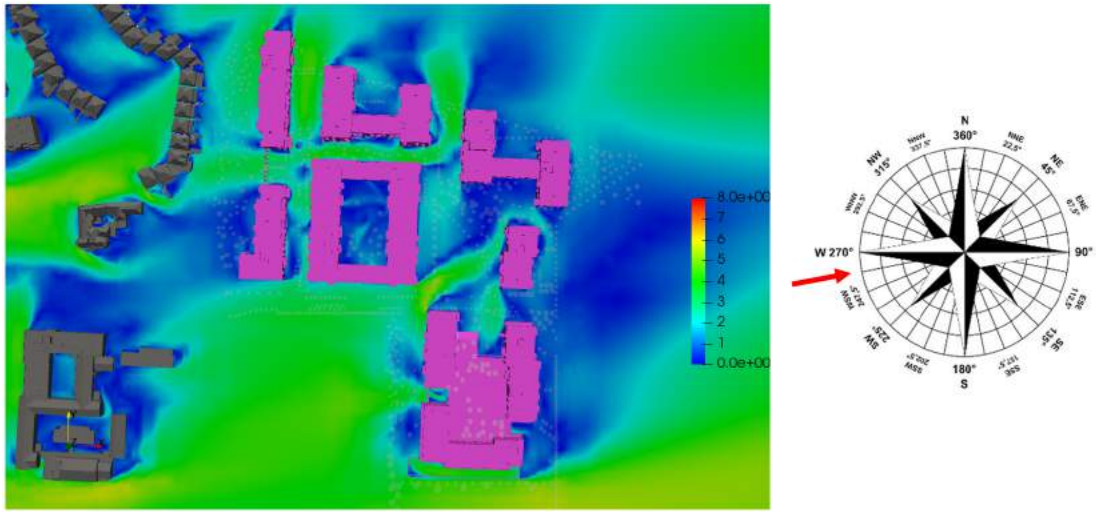


Figure 6.11: Ground Floor Level - Flow Velocity Results at Z=1.5m above the ground - Wind Direction: 258°

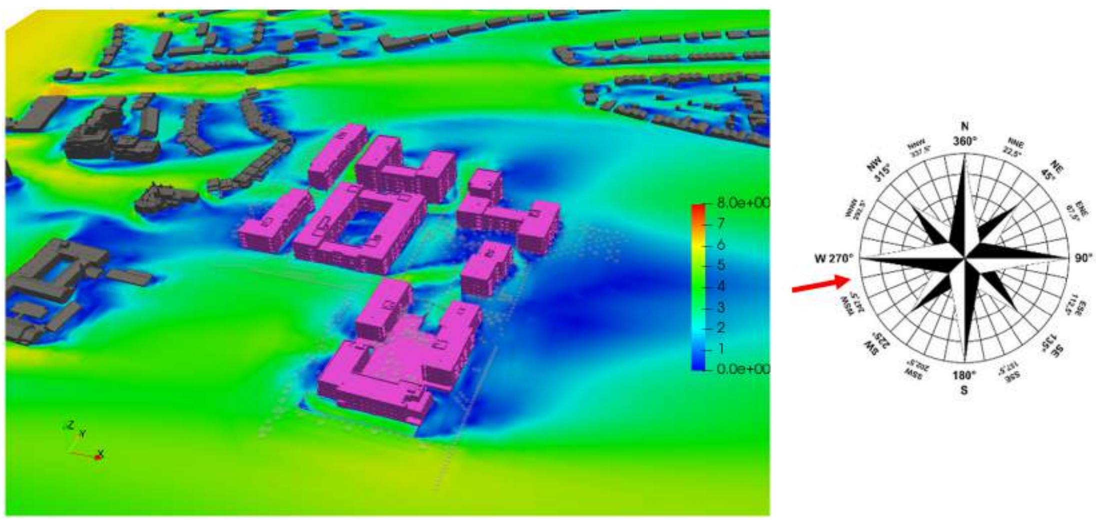


Figure 6.12: Wind Speed Results at 1.5m Above Development Ground Floor - 3D View - Wind Direction: 258°

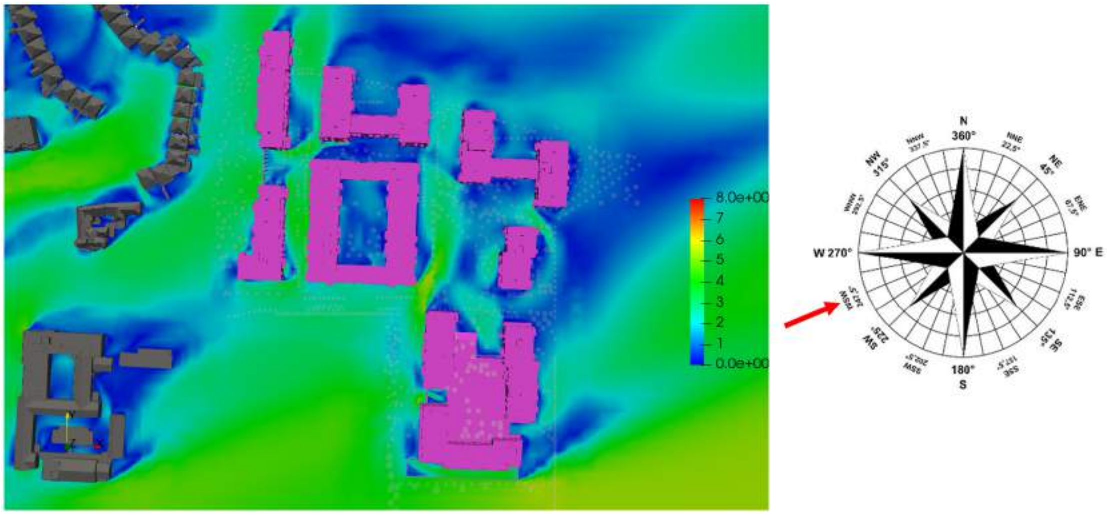


Figure 6.13: Ground Floor Level - Flow Velocity Results at Z=1.5m above the ground - Wind Direction: 247°

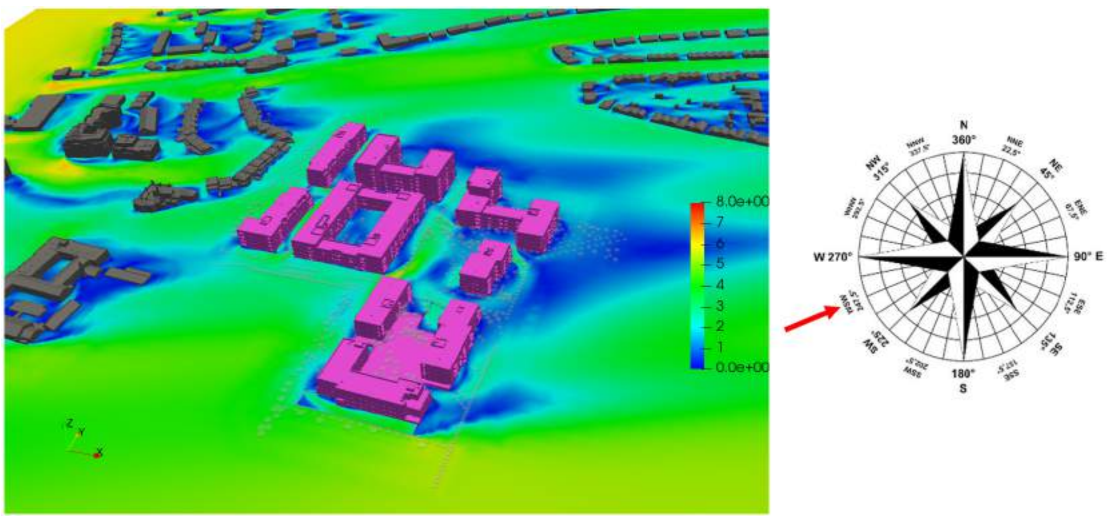


Figure 6.14: Wind Speed Results at 1.5m Above Development Ground Floor - 3D View - Wind Direction: 247°

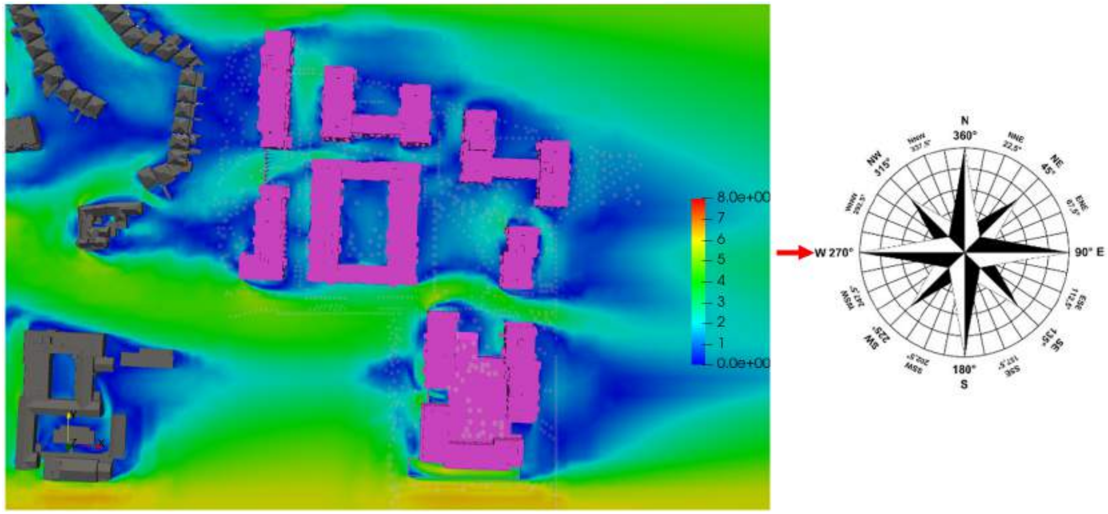


Figure 6.15: Ground Floor Level - Flow Velocity Results at Z=1.5m above the ground - Wind Direction: 270°

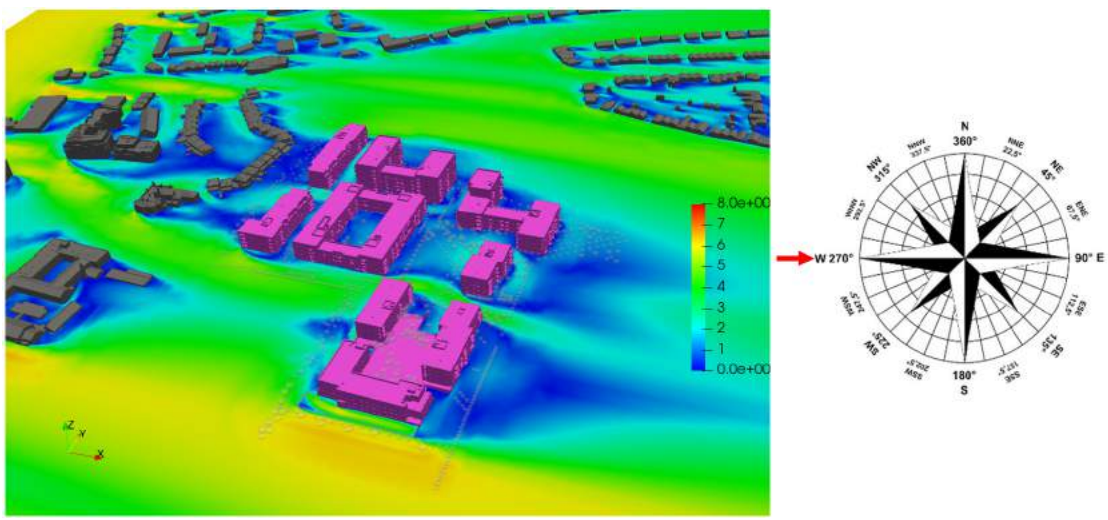


Figure 6.16: Wind Speed Results at 1.5m Above Development Ground Floor - 3D View - Wind Direction: 270°

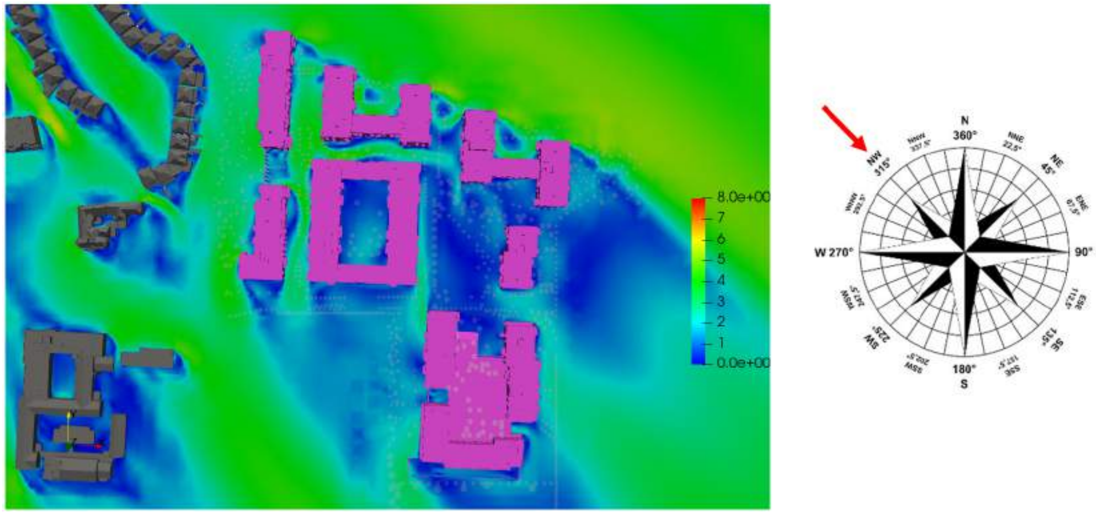


Figure 6.17: Ground Floor Level - Flow Velocity Results at Z=1.5m above the ground - Wind Direction: 315°

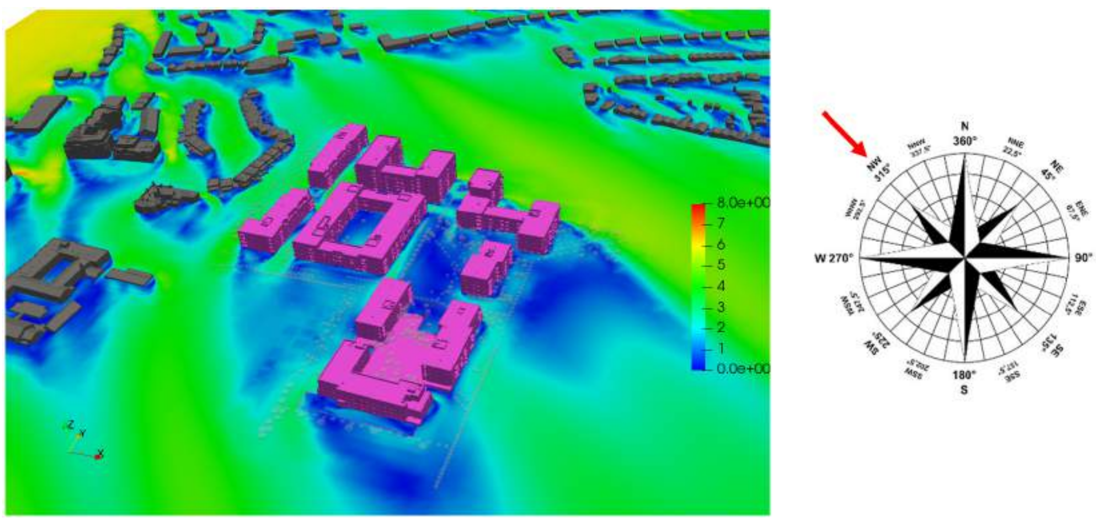


Figure 6.18: Wind Speed Results at 1.5m Above Development Ground Floor - 3D View - Wind Direction: 315°

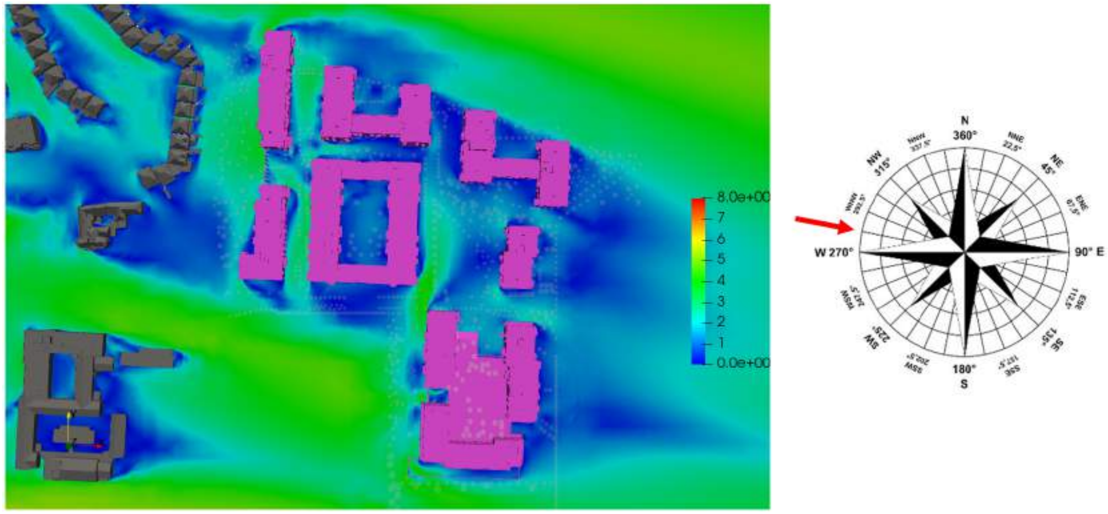


Figure 6.19: Ground Floor Level - Flow Velocity Results at Z=1.5m above the ground - Wind Direction: 281°

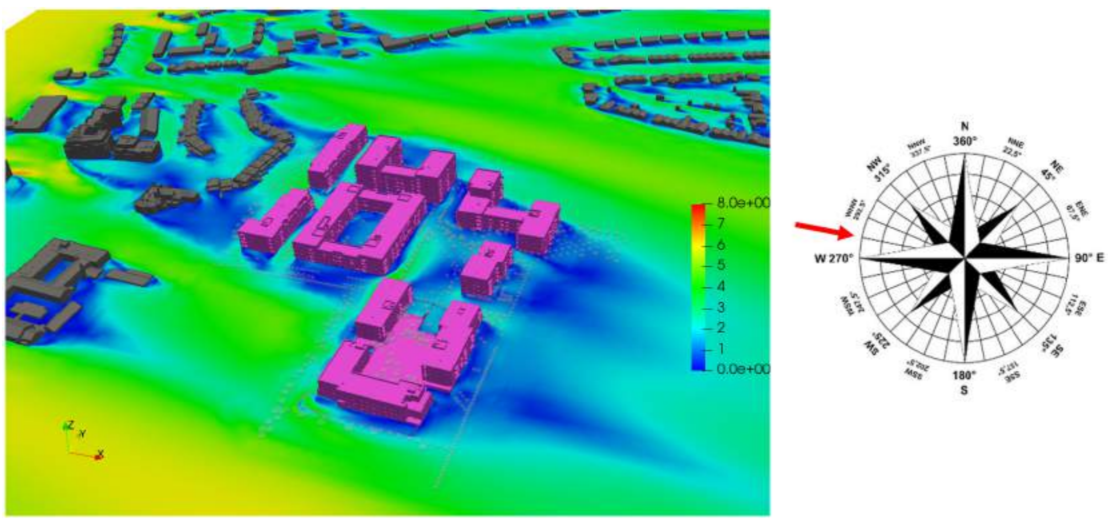


Figure 6.20: Wind Speed Results at 1.5m Above Development Ground Floor - 3D View - Wind Direction: 281°

6.2.2 Flow Velocity Results - Courtyard

Results of velocity at 1.5m above the Courtyard for development are presented in Figures 6.21 to 6.36, for wind assessment of the Courtyards of the proposed Mixed Use Residential Development.

Good shielding seems to be guaranteed in the internal courtyard on Block D and No major issues are found to be critical. however some higher velocities and recirculation effects are experienced at the West and South-East side of the courtyard on Block G.

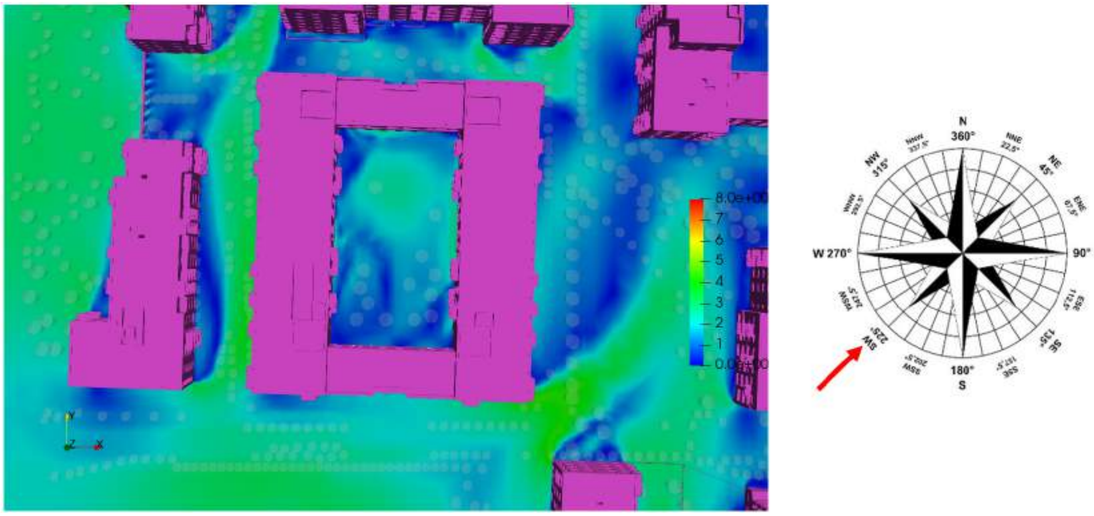


Figure 6.21: Courtyard Block D - Flow Velocity Results at Z=1.5m above the Courtyard - Wind Direction: 225°

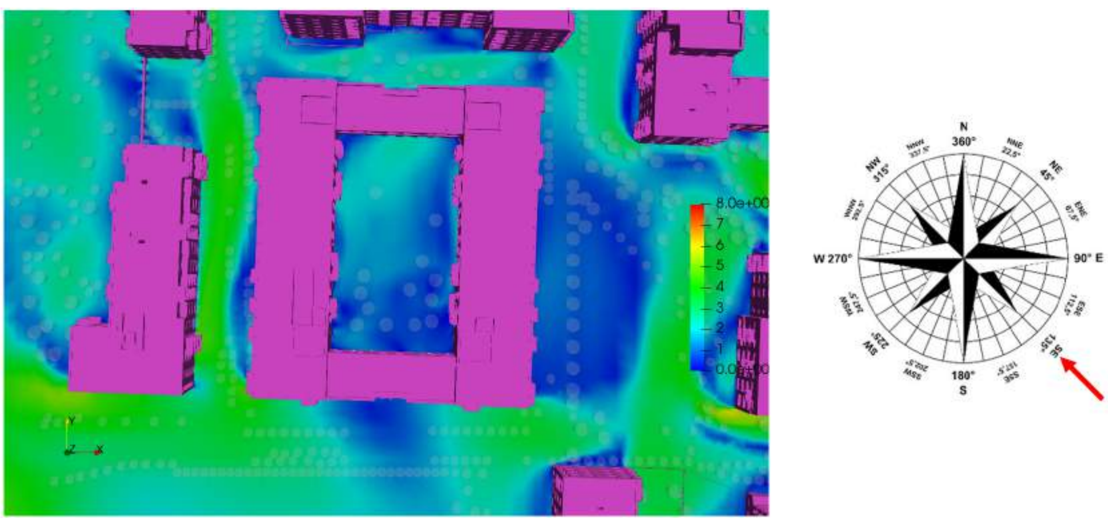


Figure 6.22: Courtyard Block D - Flow Velocity Results at Z=1.5m above the Courtyard - Wind Direction: 135°

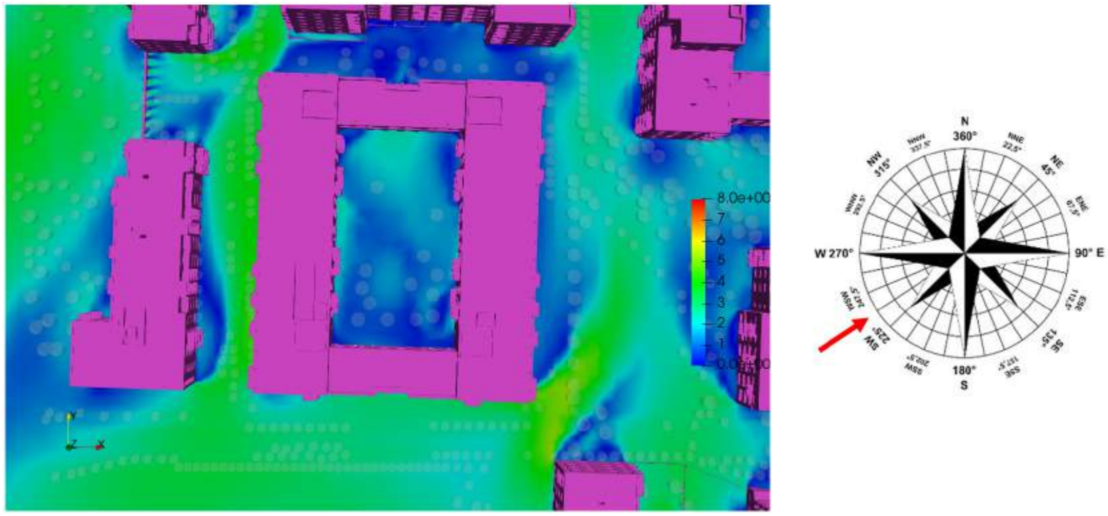


Figure 6.23: Courtyard Block D - Flow Velocity Results at Z=1.5m above the Courtyard - Wind Direction: 236°

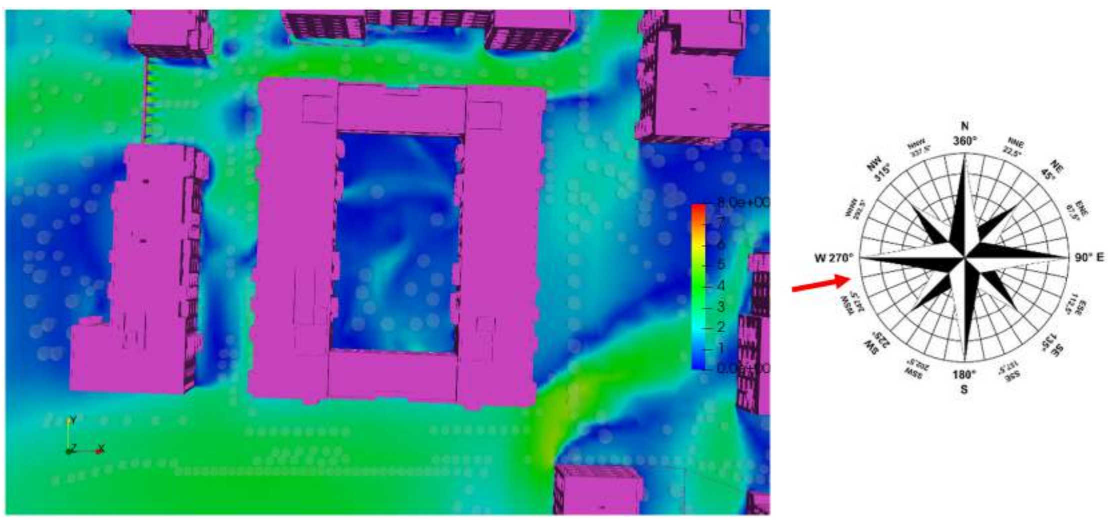


Figure 6.24: Courtyard Block D - Flow Velocity Results at Z=1.5m above the Courtyard - Wind Direction: 258°

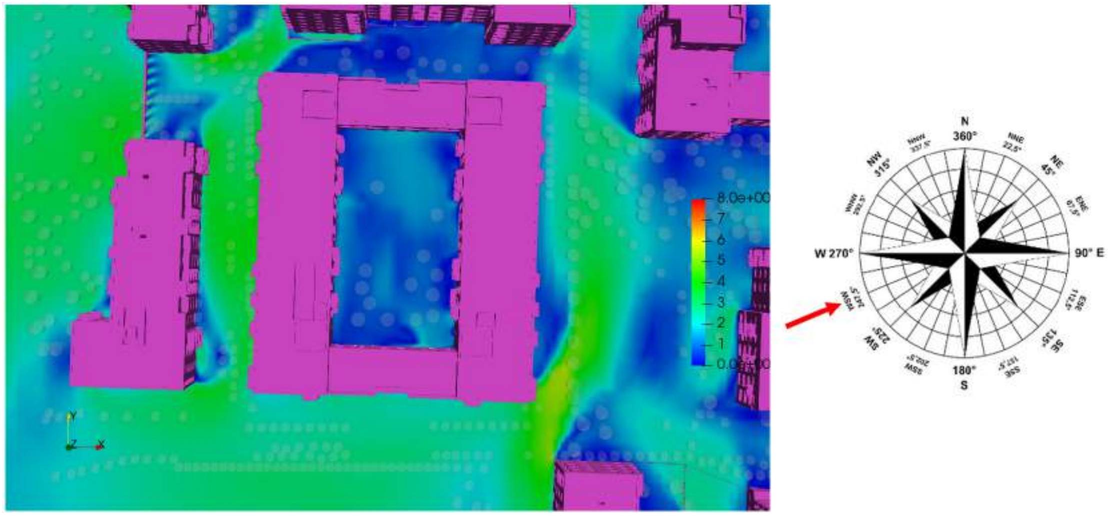


Figure 6.25: Courtyard Block D - Flow Velocity Results at Z=1.5m above the Courtyard - Wind Direction: 247°

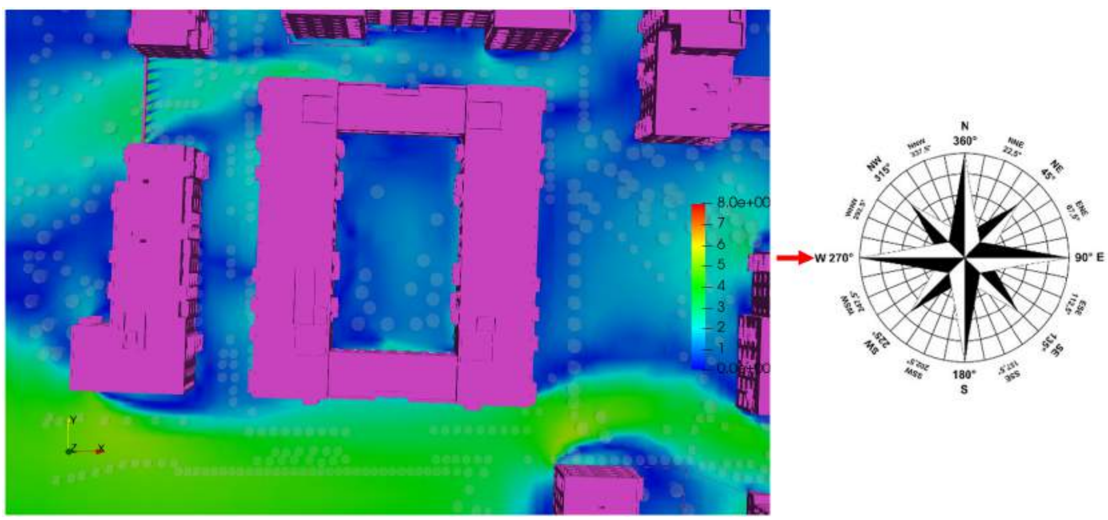


Figure 6.26: Courtyard Block D - Flow Velocity Results at Z=1.5m above the Courtyard - Wind Direction: 270°

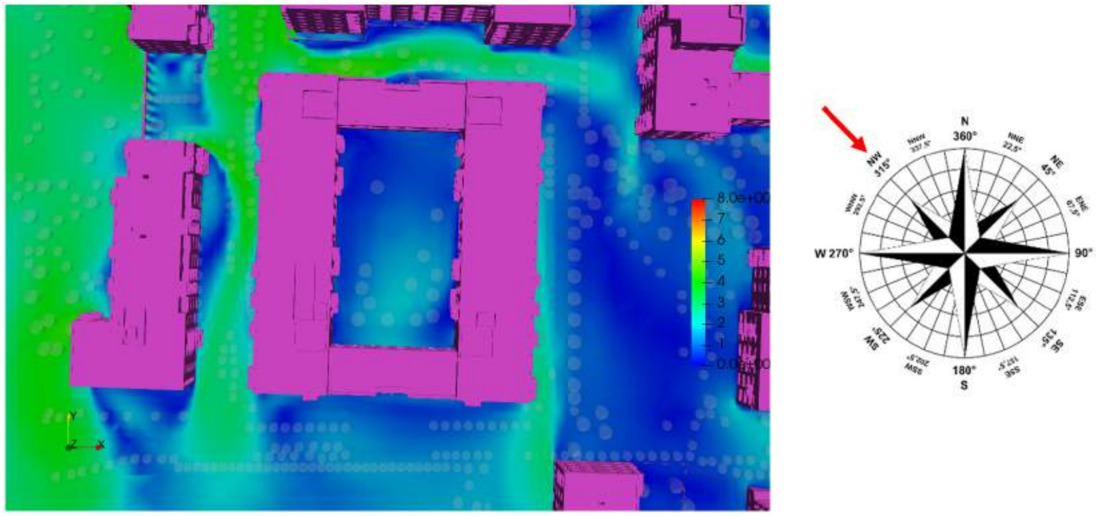


Figure 6.27: Courtyard Block D - Flow Velocity Results at Z=1.5m above the Courtyard - Wind Direction: 315°

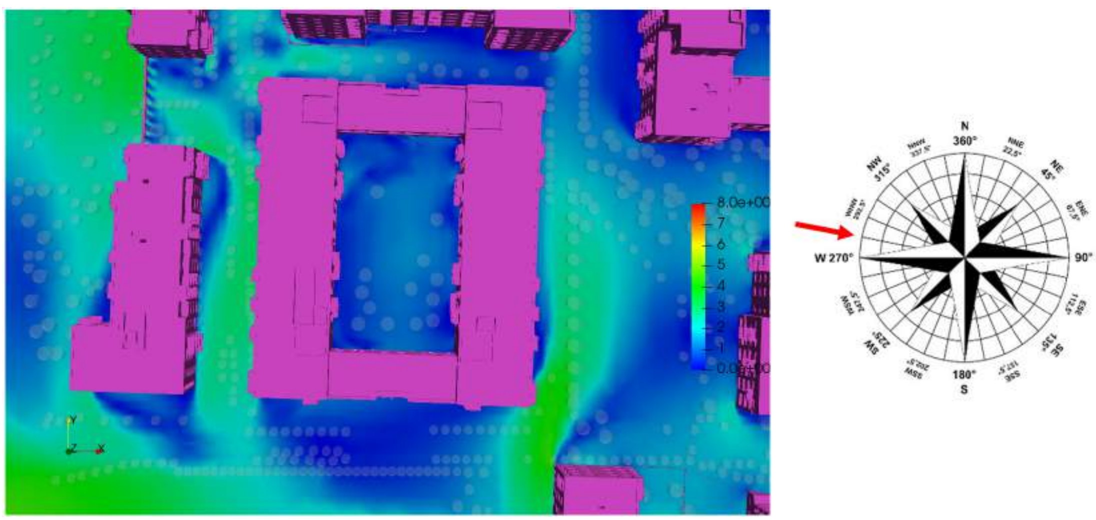


Figure 6.28: Courtyard Block D - Flow Velocity Results at Z=1.5m above the Courtyard - Wind Direction: 281°

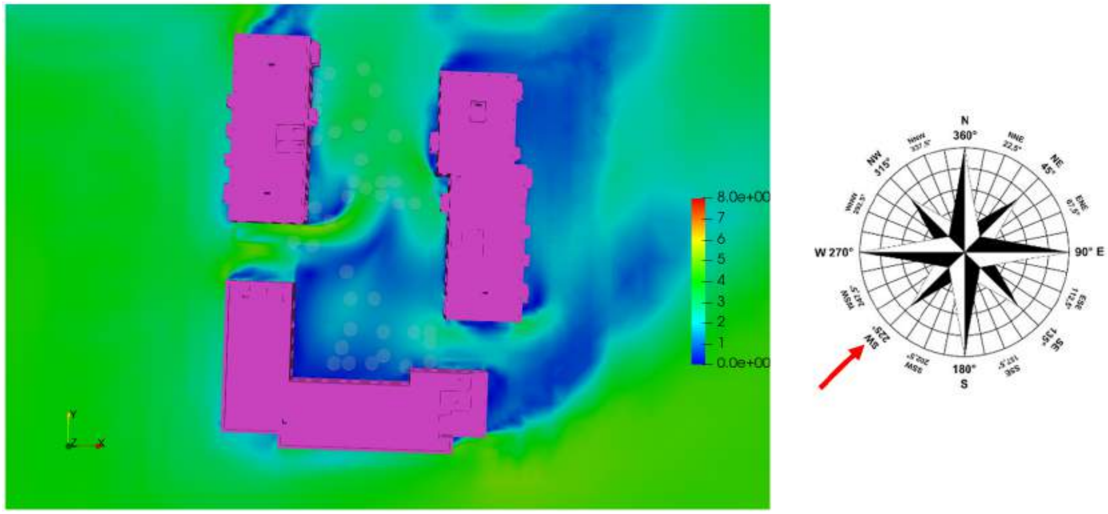


Figure 6.29: Courtyard Block G - Flow Velocity Results at Z=1.5m above the Courtyard - Wind Direction: 225°

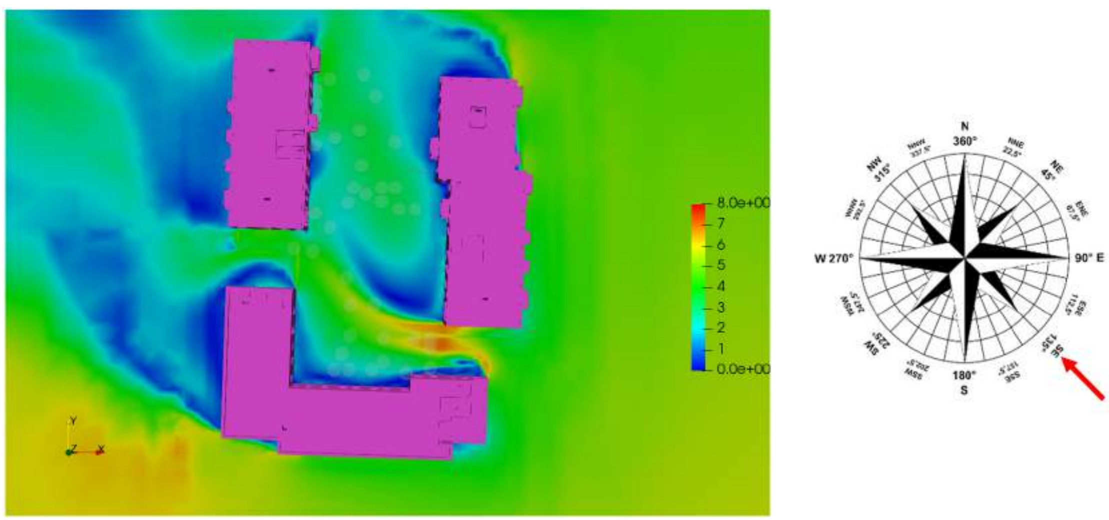


Figure 6.30: Courtyard Block G - Flow Velocity Results at Z=1.5m above the Courtyard - Wind Direction: 135°

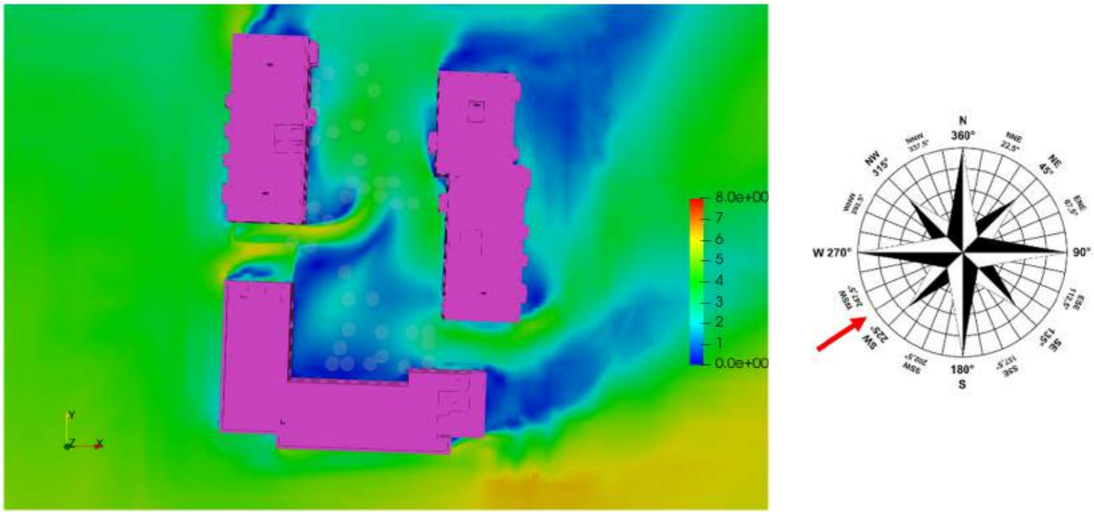


Figure 6.31: Courtyard Block G - Flow Velocity Results at Z=1.5m above the Courtyard - Wind Direction: 236°

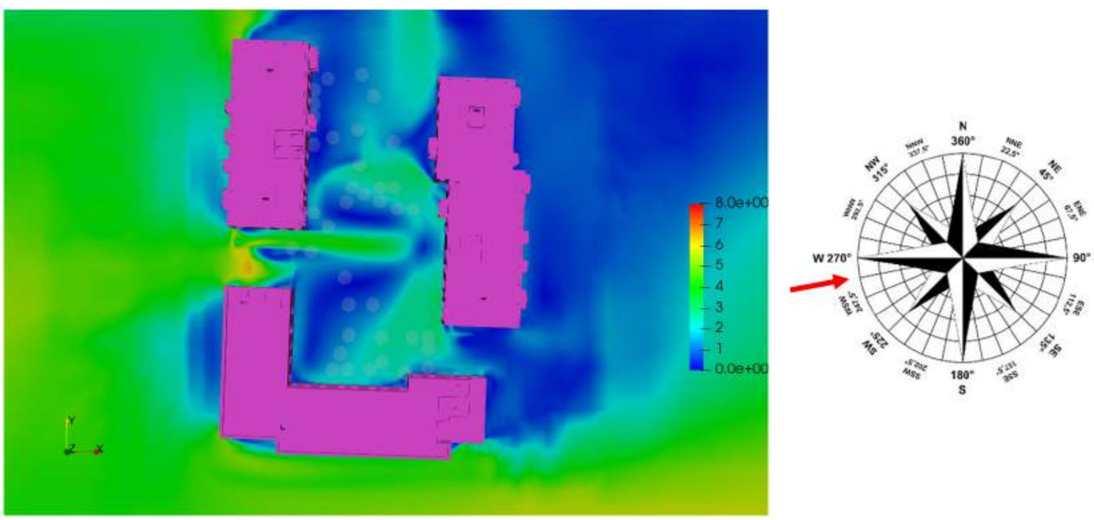


Figure 6.32: Courtyard Block G - Flow Velocity Results at Z=1.5m above the Courtyard - Wind Direction: 258°

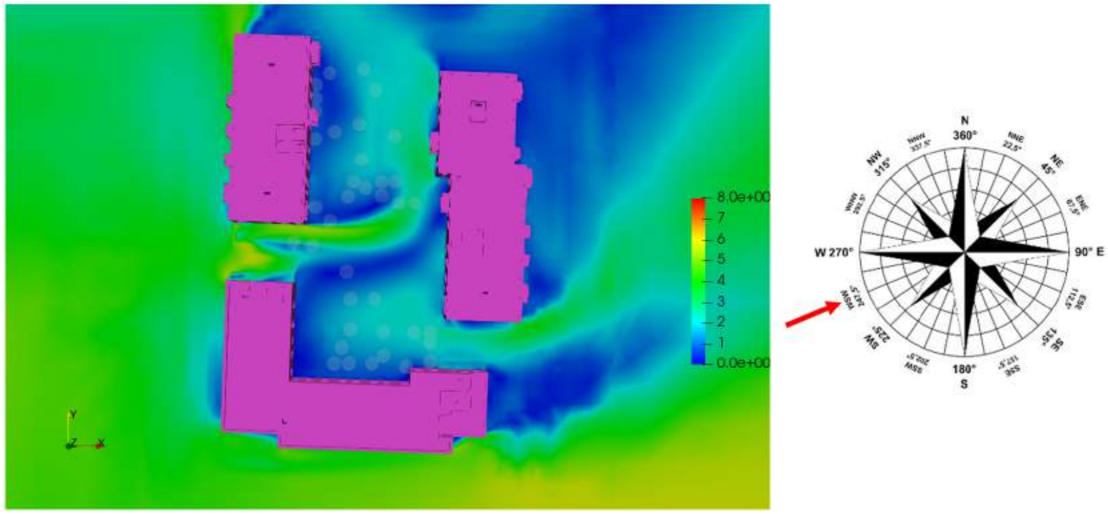


Figure 6.33: Courtyard Block G - Flow Velocity Results at Z=1.5m above the Courtyard - Wind Direction: 247°

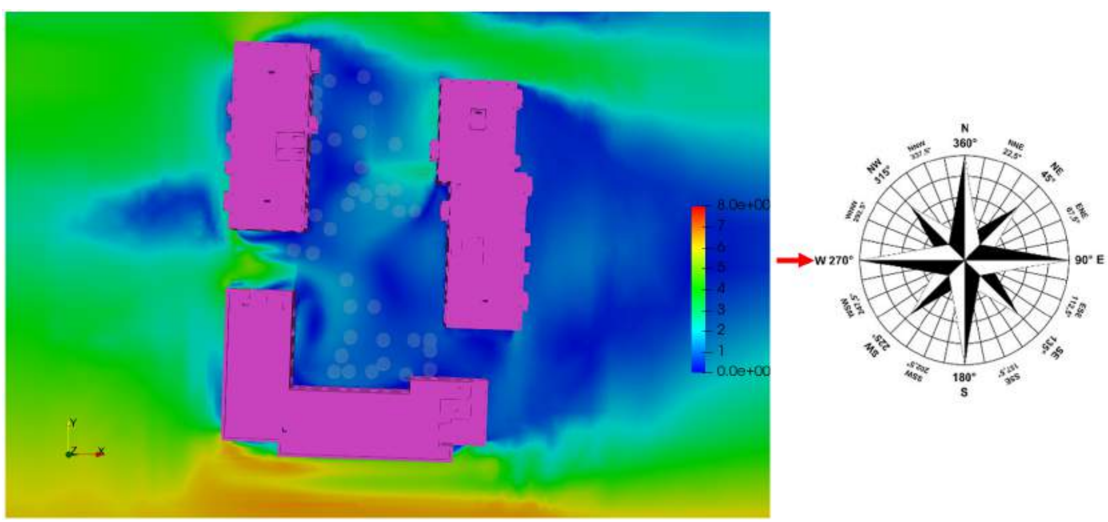


Figure 6.34: Courtyard Block G - Flow Velocity Results at Z=1.5m above the Courtyard - Wind Direction: 270°

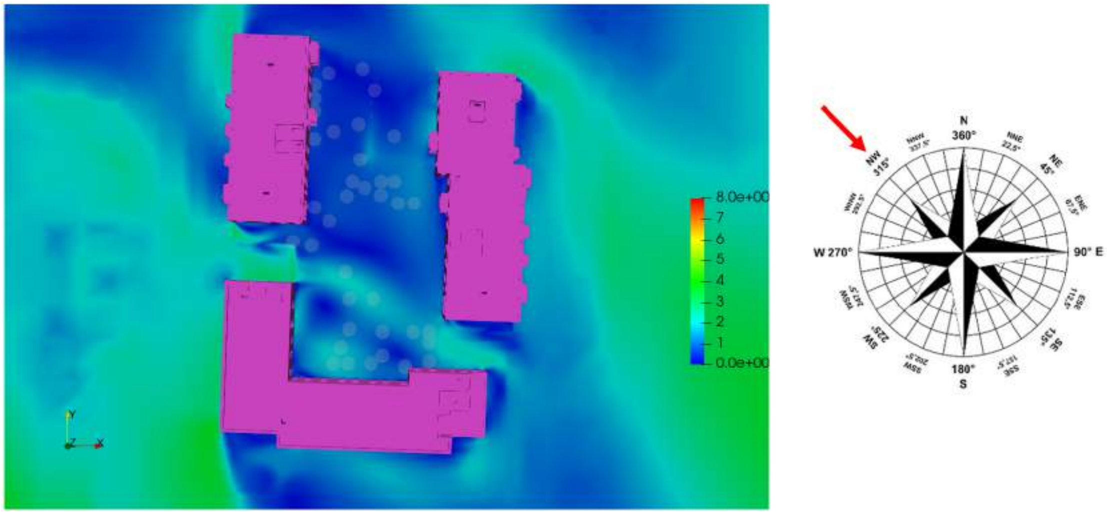


Figure 6.35: Courtyard Block G - Flow Velocity Results at Z=1.5m above the Courtyard - Wind Direction: 315°

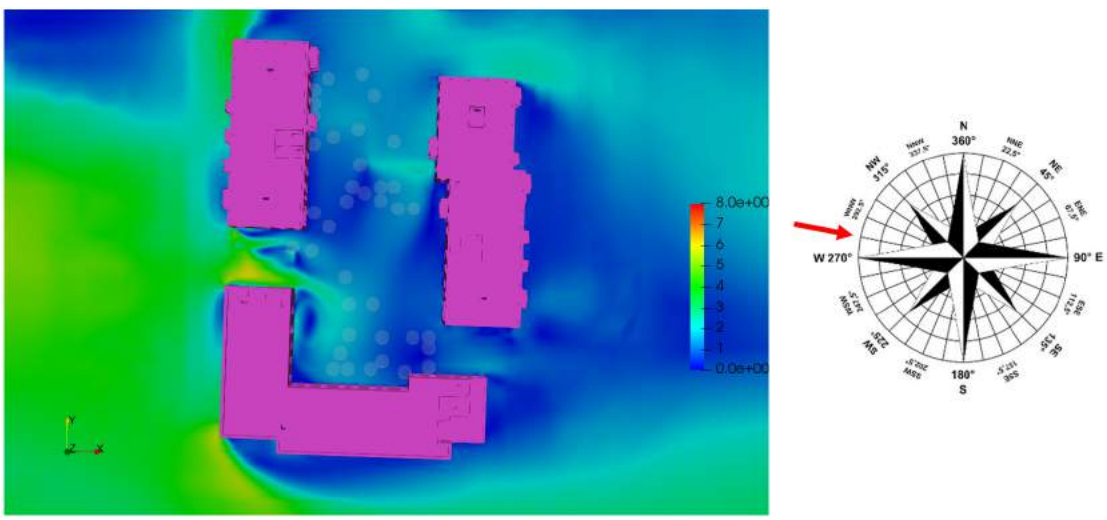


Figure 6.36: Courtyard Block G - Flow Velocity Results at Z=1.5m above the Courtyard - Wind Direction: 281°

6.2.3 Flow Velocity Results - Balconies

Results of velocity at slice location across the balconies are presented in Figures 6.37 to 6.52, for wind assessment of the balconies of the proposed Mixed Use Residential Development.

Higher velocities can be found for some directions, only on some of the balconies. However, these velocities are below the threshold values defined by the acceptance criteria and therefore are not critical for safety.

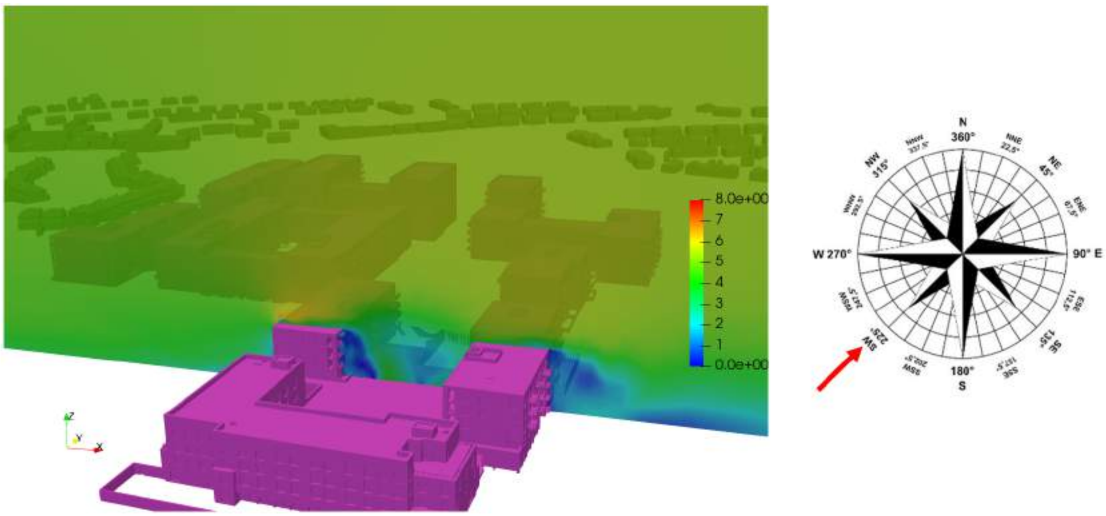


Figure 6.37: Flow Velocity Results of some balconies - Wind Direction: 225°

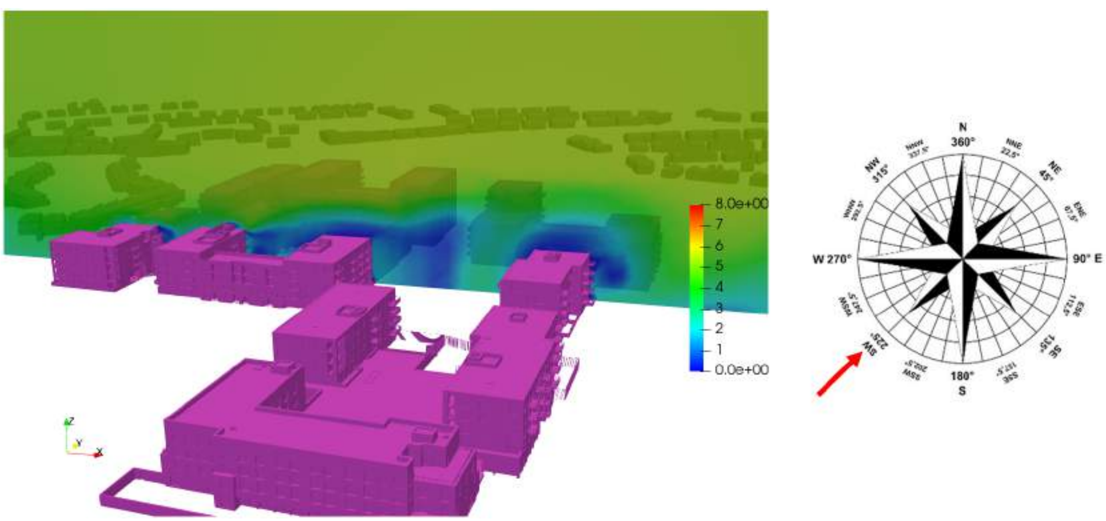


Figure 6.38: Flow Velocity Results of some balconies - Wind Direction: 225°

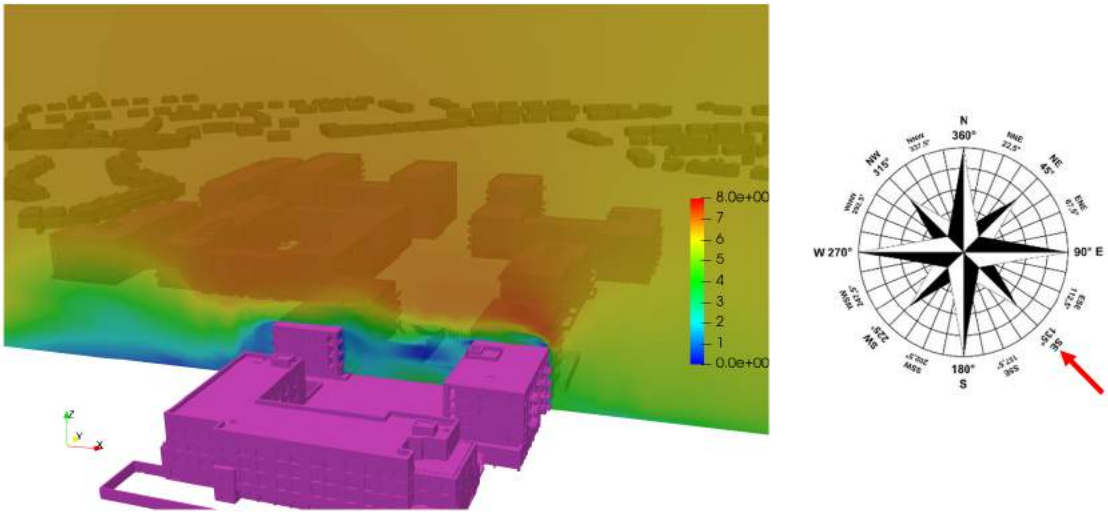


Figure 6.39: Flow Velocity Results of some balconies - Wind Direction: 135°

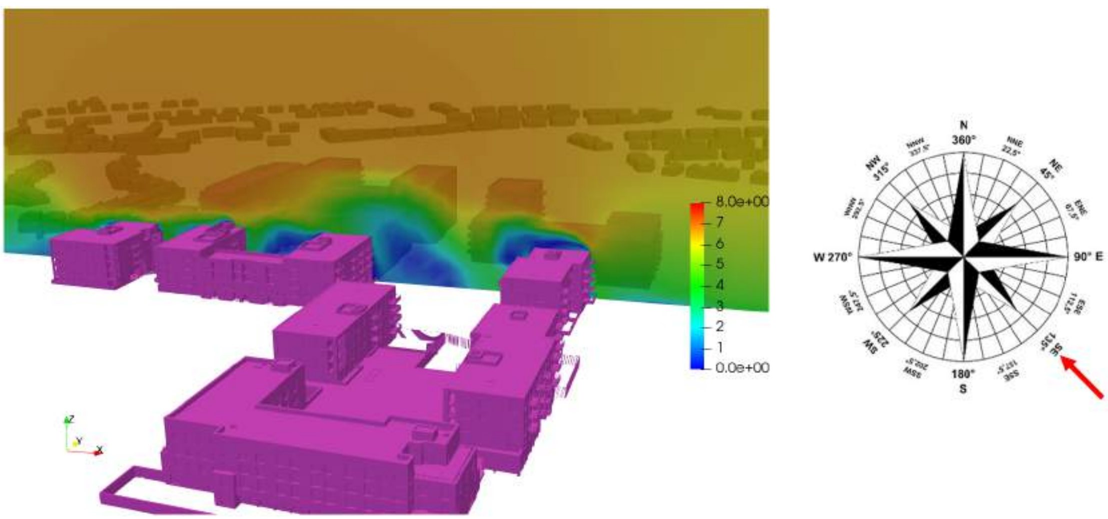


Figure 6.40: Flow Velocity Results of some balconies - Wind Direction: 135°

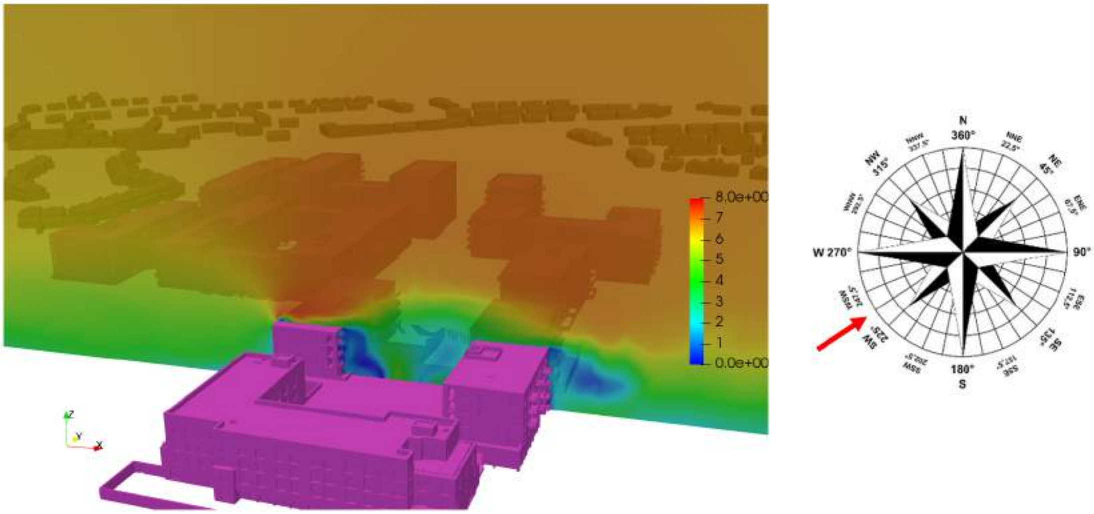


Figure 6.41: Flow Velocity Results of some balconies - Wind Direction: 236°

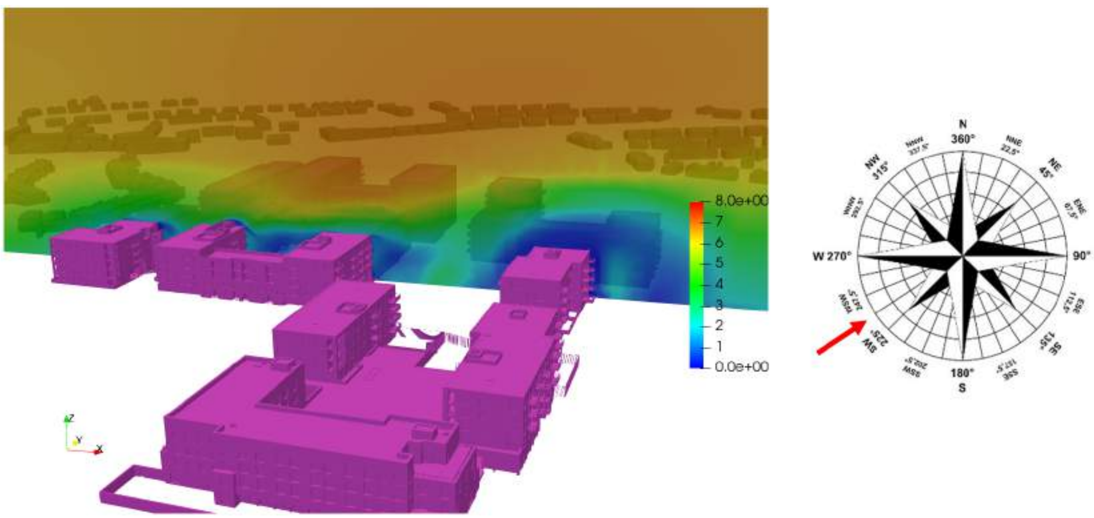


Figure 6.42: Flow Velocity Results of some balconies - Wind Direction: 236°

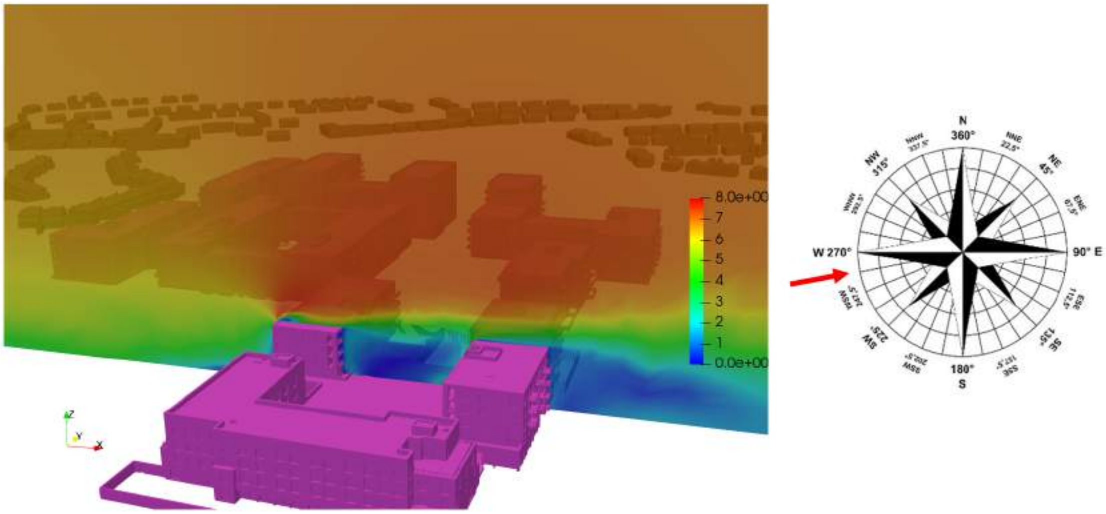


Figure 6.43: Flow Velocity Results of some balconies - Wind Direction: 258°

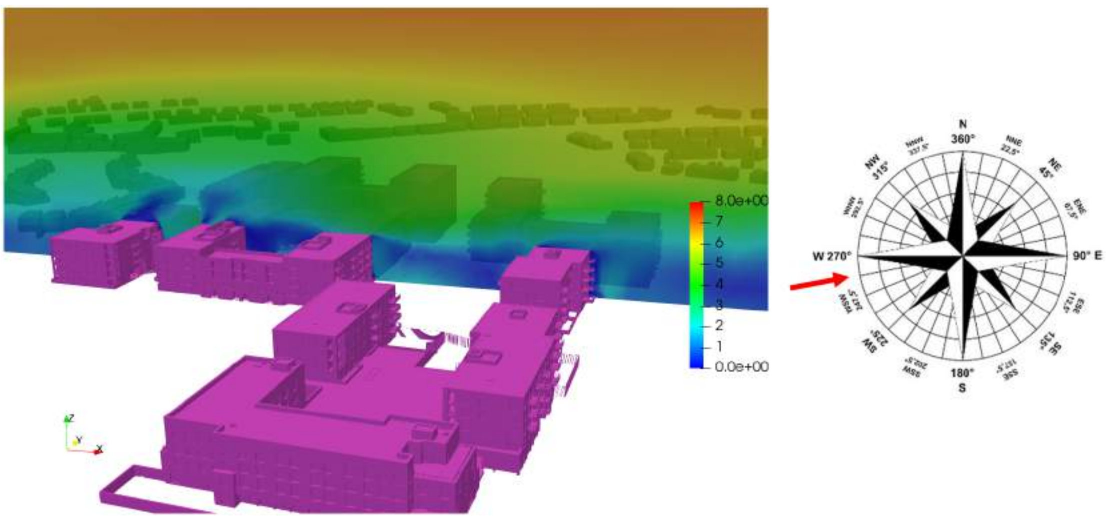


Figure 6.44: Flow Velocity Results of some balconies - Wind Direction: 258°

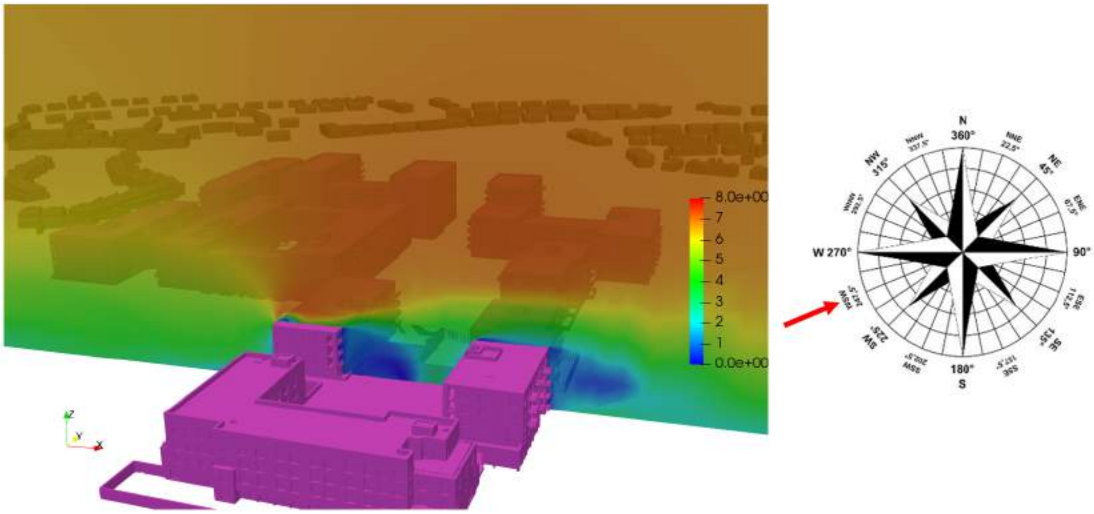


Figure 6.45: Flow Velocity Results of some balconies - Wind Direction: 247°

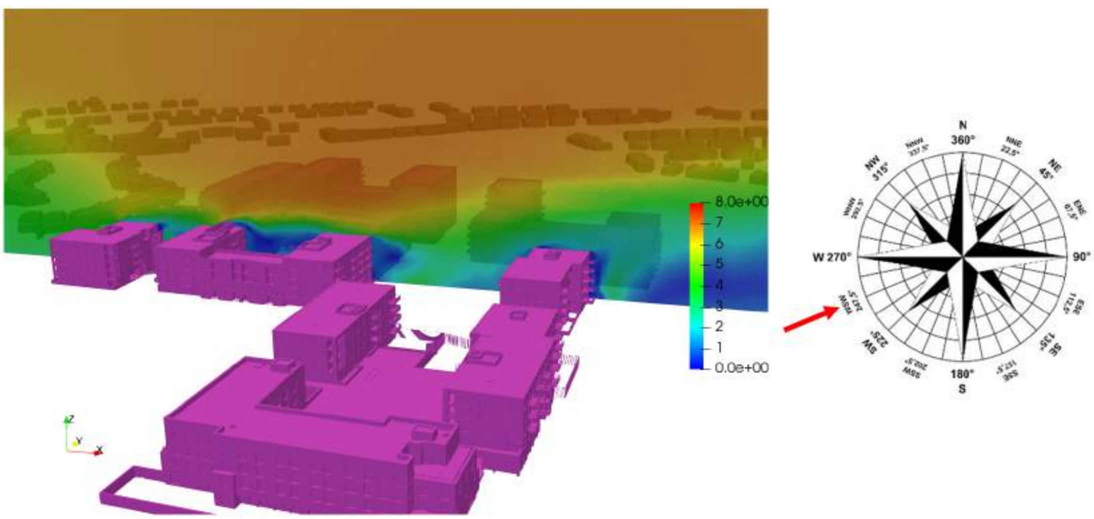


Figure 6.46: Flow Velocity Results of some balconies - Wind Direction: 247°

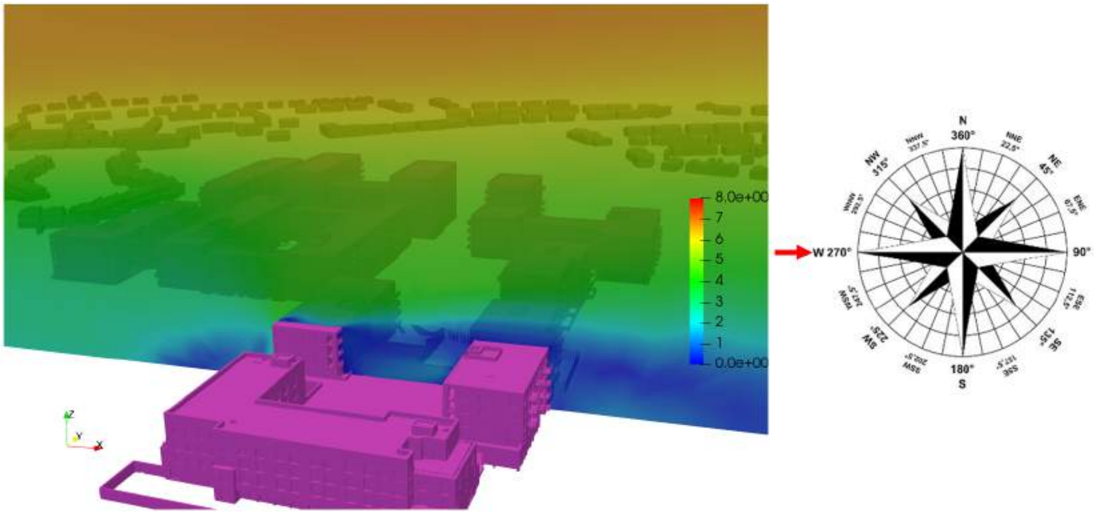


Figure 6.47: Flow Velocity Results of some balconies - Wind Direction: 270°

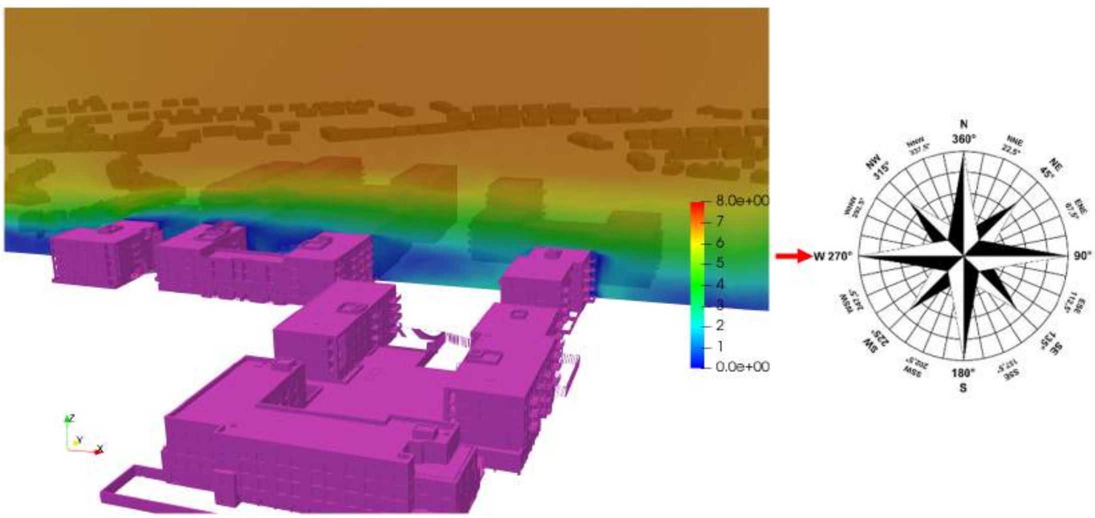


Figure 6.48: Flow Velocity Results of some balconies - Wind Direction: 270°

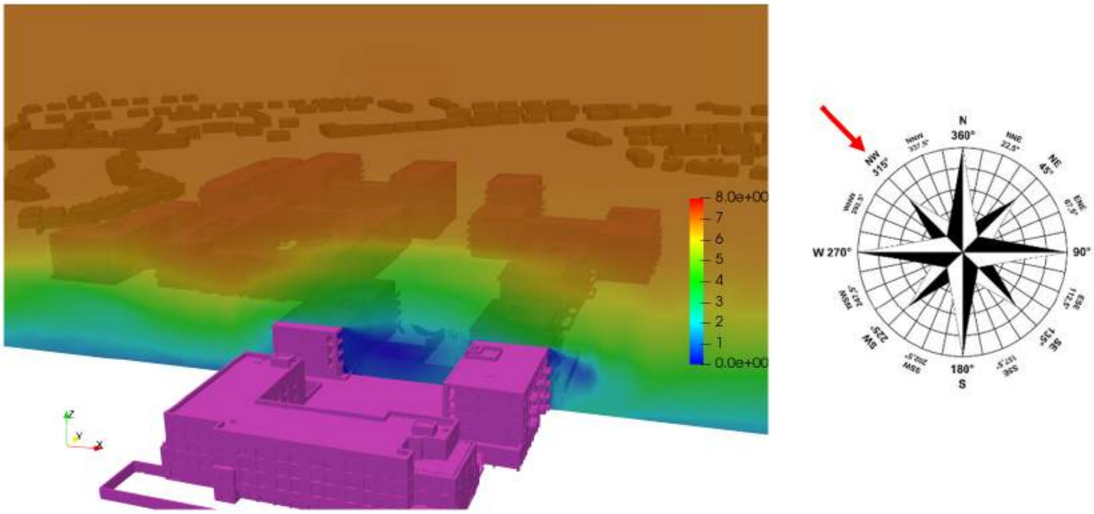


Figure 6.49: Flow Velocity Results of some balconies - Wind Direction: 315°

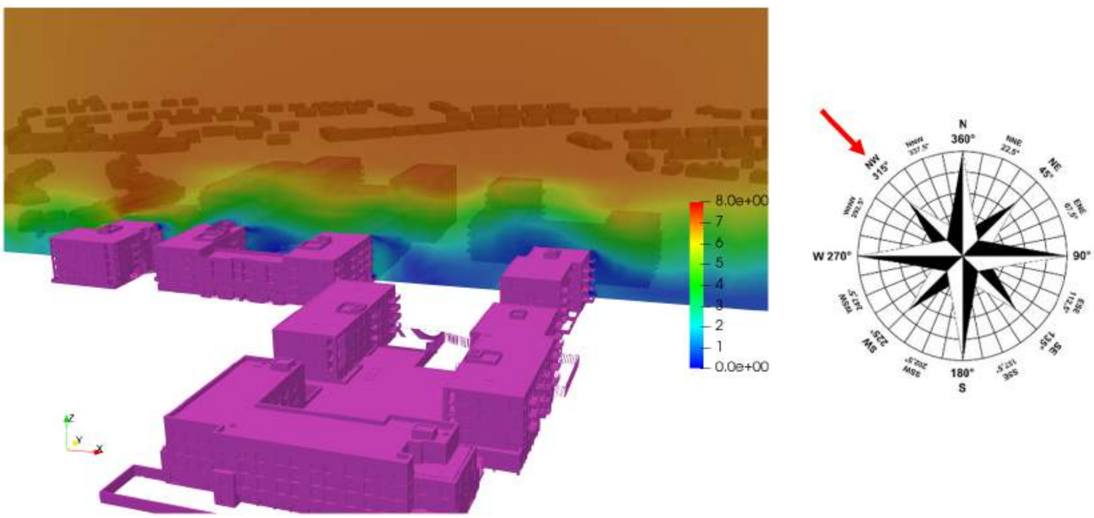


Figure 6.50: Flow Velocity Results of some balconies - Wind Direction: 315°

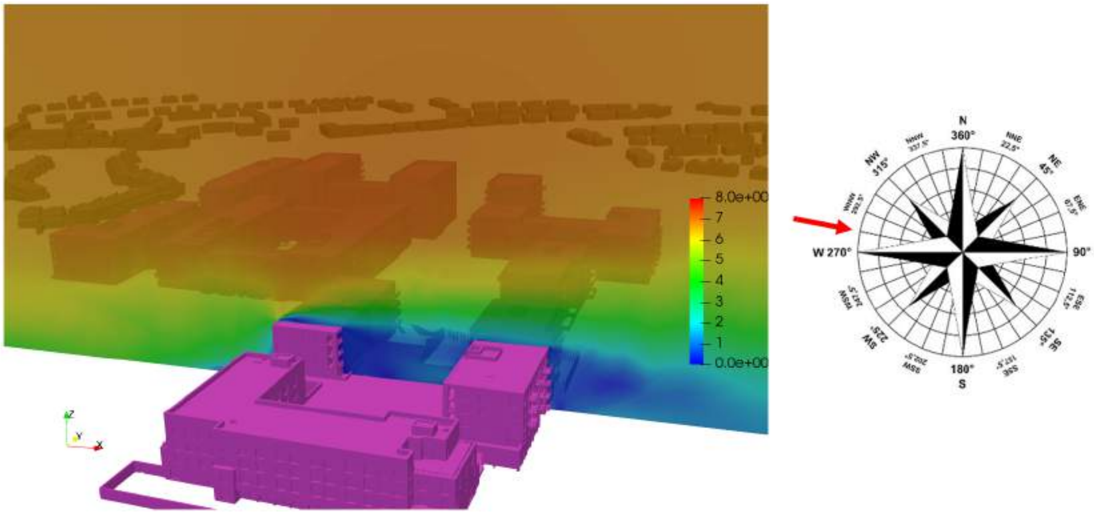


Figure 6.51: Flow Velocity Results of some balconies - Wind Direction: 281°

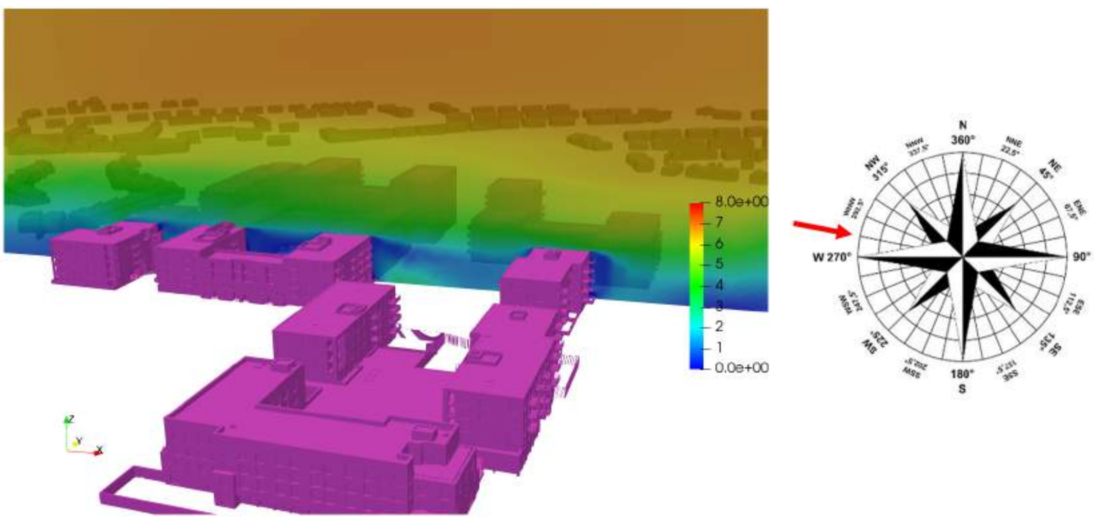


Figure 6.52: Flow Velocity Results of some balconies - Wind Direction: 281°

6.2.4 Pedestrian Comfort Assessment

This section aims to identify areas of the proposed Mixed Use Residential Development where the pedestrian safety and comfort could be compromised (in accordance with the Lawson Acceptance Criteria previously described). Pedestrian comfort criteria are assessed at 1.5m above ground level.

Discomfort Criteria

Figures from 6.54 to 6.55 show the Lawson comfort categories over the ground floor area around the proposed Mixed Use Residential Development. In all cases, the scale used is set out in Figure 6.53.

For the Lawson discomfort criteria, the onset of discomfort depends on the activity in which the individual is engaged and it is defined in terms of a mean hourly wind speed (or GEM) which is exceeded for 5% of the time. Depending on the wind direction, the suitability of the different areas can be assessed using the maps. It can be seen that the wind conditions range from "suitable for long term sitting" to "suitable for walking and strolling" and really rarely are only suitable for "business walking" or "unacceptable for pedestrian comfort".

The results shown in these maps show that there are no critical area which are unacceptable for pedestrian comfort. Some higher velocity indicating minor funnelling effects are found between block D and G and the corners of block A, B, C and G. However, these areas can be utilised for the intended use such as short-term sitting, walking and strolling (shown in the Lawson map).

Courtyard on Block D is well protected and good shielding is achieved. Therefore, it can be used for all activities including long-term sitting. Small areas of Courtyard on Block G are suitable for short term sitting instead of long-term sitting, however the majority of the area is appropriate for long term sitting.

Figure 6.53: Lawson Comfort Categories

Figure 6.54: Ground Floor - Lawson Discomfort Map - Top View

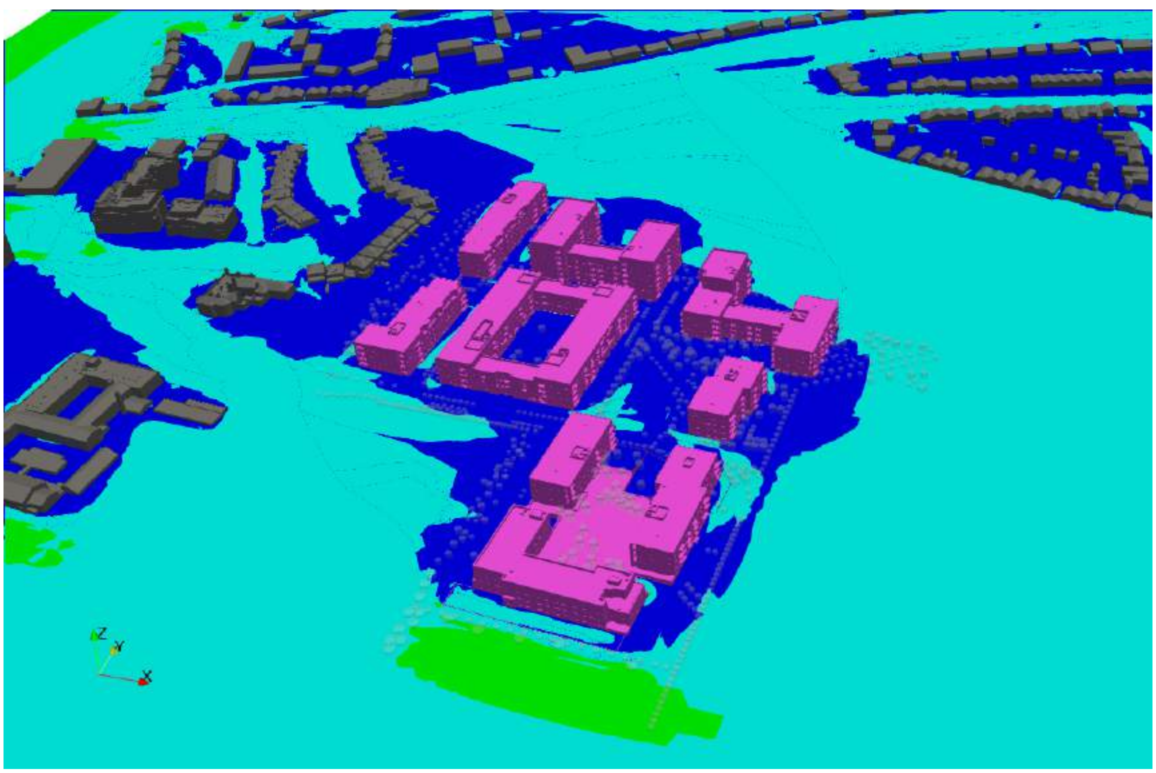


Figure 6.55: Ground Floor - Lawson Discomfort Map - 3D view

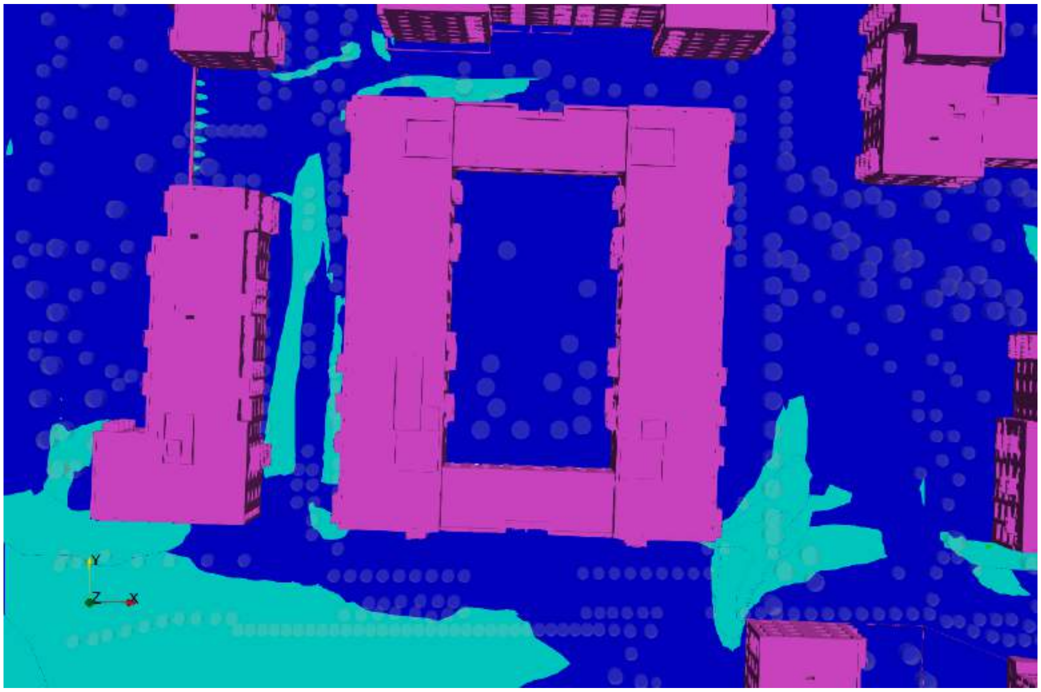


Figure 6.56: Courtyard Block D - Lawson Discomfort Map at Z=1.5m above the Courtyard

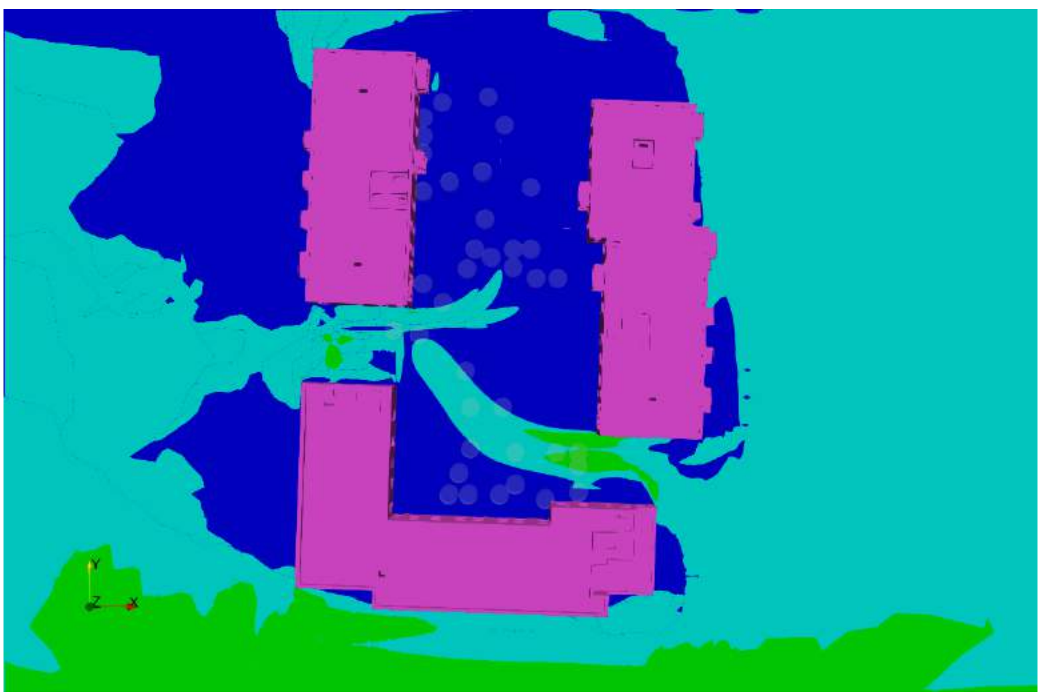


Figure 6.57: Courtyard Block G - Lawson Discomfort Map at Z=1.5m above the Courtyard

Distress Criteria

The criteria for distress for a frail person or cyclist is 15m/s wind occurring for more than two hours per year.

As explained above, a velocity of 15m/s was reached in Dublin only for the following directions (in increasing order of percentage) over the years 1990-2020:

1. West 270°
2. West-South-West 247.5°
3. South-West 225°

For this reason, it is of interest to show the distress results for these directions. Figure 6.59 below combines all the above directions together and shows the areas where the measured velocity is above 15 m/s. Figure 6.58 shows the scale used in this case. Results show that there are not critical areas where the velocity increases above 15 m/s, thus the criteria is always satisfied.

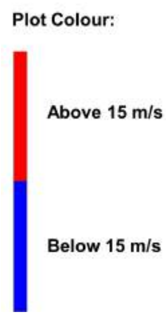


Figure 6.58: Lawson Distress Categories - Frail Person or Cyclist

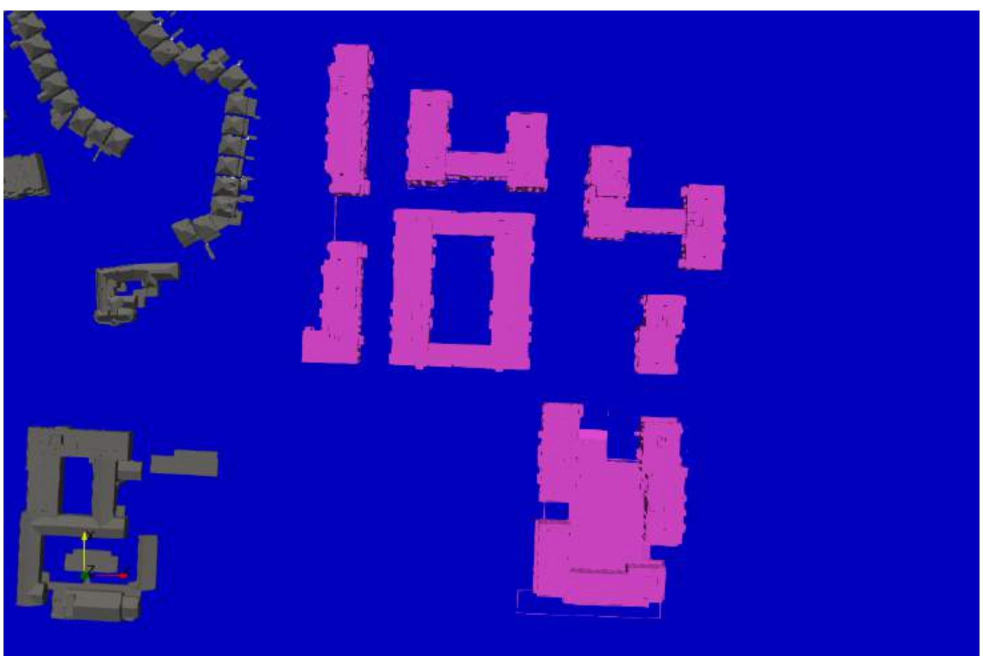


Figure 6.59: Lawson Distress Map - Frail Person or Cyclist

7. CONCLUSIONS

7.1 CONCLUSIONS and COMMENTS ON CFD WIND STUDY

This report presented the Wind Microclimate Modelling study performed for the proposed Mixed Use Residential Development, at lands to the East of St. Pauls College, Sybil Hill Road, Dublin 5. This study has been carried out to identify the possible wind patterns around the area proposed, under mean and peaks wind conditions typically occurring in Dublin, and also to assess impacts of the wind on pedestrian level comfort.

The results of this wind microclimate study are utilized by Raheny 3 Limited Partnership to configure the optimal layout for the proposed Mixed Use Residential Development for the aim of achieving a high-quality environment for the scope of use intended of each areas/building (i.e. comfortable and pleasant for potential pedestrian) and not to introduce any critical wind impact on the surrounding areas and on the existing buildings.

A qualitative and quantitative summary of the wind microclimate modelling study performed for the proposed Mixed Use Residential Development shows that:

- The wind profile around the existing development environment was built using the annual average meteorology data collected at Dublin Airport Weather Station. In particular, the local wind climate was determined from historical meteorological data recorded 10 m above ground level at Dublin Airport.
- The prevailing wind directions for the site are identified as West, South-East and West-South-West, with magnitude of approximately 6m/s.
- The proposed Mixed Use Residential Development has been designed in order to produce a high-quality environment that is attractive and comfortable for pedestrians of all categories. To achieve this objective, throughout the design process, the impact of wind has been considered and analysed, in the areas where critical patterns were found, the appropriate mitigation measures were introduced.
- As a result of the final proposed and mitigated design, wind flow speeds at ground floor are shown to be within tenable conditions. Some higher velocity indicating minor funnelling effects are found between block D and G and the corners of block A, B, C and G. However, these areas can be utilised for the intended use such as short-term sitting, walking and strolling.
- Area between Block A and Block D is suitable for short-term sitting instead of long-term sitting due to flow acceleration between the Blocks.
- Courtyard on Block D is well protected and good shielding is achieved. Therefore, it can be used for all activities including long-term sitting.
- Small areas of Courtyard on Block G are suitable for short term sitting instead of long-term sitting, however the majority of the area is appropriate for long term sitting.
- Tree planting all around the development has been utilised, with particular attention to the corners of the Blocks has positively mitigated any critical wind effects.
- Regarding the balconies, higher velocities are found for some directions, only on some of the balconies (mostly on the South and West sides of the blocks). However,

these velocities are below the threshold values defined by the acceptance criteria and therefore are not critical for safety.

- The proposed development does not impact or give rise to negative or critical wind speed profiles at the nearby adjacent roads, or nearby buildings. Moreover, in terms of distress, no critical conditions were found for “Frail persons or cyclists” and for members of the ”General Public” in the surrounding of the development.
- The proposed development does not impact or give rise to negative or critical wind speed profiles at the nearby adjacent roads, or nearby buildings.

Therefore, the CFD study carried out has shown that under the assumed wind conditions typically occurring within Dublin for the past 30 years:

- **The development is designed to be a high-quality environment for the scope of use intended of each areas/building (i.e. comfortable and pleasant for potential pedestrian).**
- **The development does not introduce any critical impact on the surrounding buildings, or nearby adjacent roads.**

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Appendix L Flood Risk Assessment

Flood Risk Assessment

Proposed Large Residential Development (LRD) at Foxlands, Raheny, Dublin 5

August 2022

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Client Name:	Raheny 3 Limited Partnership
Document Reference:	21-083r.002 Flood Risk Assessment
Project Number:	21-083

Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015 and BS EN ISO 14001: 2015)

Issue	Date	Prepared by	Checked by	Approved by
1	18 February 2022	Stephen Dent-Neville	Mark Duignan	Mark Duignan
2	1 July 2022	Stephen Dent-Neville	Mark Duignan	Mark Duignan
3	31 August 2022	Stephen Dent-Neville	Mark Duignan	Mark Duignan

Comments

Waterman Moylan
Engineering Consultants

Disclaimer

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1. Introduction

1.1 Context

This Flood Risk Assessment has been prepared by Waterman Moylan as part of the documentation in support of a planning application for a proposed mixed-use development at Foxlands in Raheny, Dublin 5.

This Flood Risk Assessment has been carried out in accordance with the *DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management* published in November 2009. This assessment identifies the risk of flooding at the site from various sources and sets out possible mitigation measures against the potential risks of flooding. Sources of possible flooding include coastal, fluvial, pluvial (direct heavy rain), groundwater and human/mechanical errors. This report provides an assessment of the subject site for flood risk purposes only.

1.2 Site Description

Raheny 3 Limited Partnership are applying for permission for development on lands east of St. Paul's College, Sybil Hill Road, Raheny, Dublin 5. The site is bounded to the north, east and south by St Anne's Park and to the west by residential development at The Meadows, Sybil Hill House (a Protected Structure) and St. Paul's College. Vehicular access to the site is from Sybil Hill Road.

The site location is indicated on the Figure below:

Figure 1 | *Site Location (Source: Google Maps)*

The site is a greenfield site. Topographic survey data indicates that the site falls generally from west to east, with a high point of approximately 25.5m OD Malin at the west of the site and a low point of approximately 21.4m OD Malin at the south-eastern corner of the site.

1.3 Proposed Development

The proposed development consists of the construction of a residential and nursing home development set out in 7 no. blocks, ranging in height from 4 to 7 storeys to accommodate 580 no. apartments, residential tenant amenity spaces, a crèche, and a 100-bed nursing home, as set out in the schedule of accommodation below:

Description		1-Bed	2-Bed	3-Bed	Total
Apartment Blocks	Block A	31	25	5	61
	Block B	44	26	-	70
	Block C	46	57	9	112
	Block D	56	58	22	136
	Block E	47	46	3	96
	Block F	23	9	4	36
Mixed-Use (Block G)	Apartments	25	27	17	69
	Nursing Home	100 Bedspaces			-
	Crèche	6 Classrooms			-
Total		**272**	**248**	**60**	**580**

Table 1 | *Schedule of Accommodation*

The site will accommodate car parking spaces, bicycle parking spaces, storage, services and plant areas at both basement and podium level. Landscaping will include extensive communal amenity areas, and a significant public open space provision on the east and south of the site. The proposed application includes all site landscaping works, green roofs, substations, boundary treatments, lighting, servicing, signage, surface water attenuation facilities and associated and ancillary works, including site development works and services above and below ground.

1.4 Guidelines and Resources

The Department of Environment, Heritage and Local Government (DEHLG) and the Office of Public Works (OPW) published the adopted version of the document “The Planning System and Flood Risk Management Guidelines for Planning Authorities” in November 2009.

These Guidelines provide guidance on flood risk and development. A precautionary approach is recommended when considering flood risk management in the planning system. The core principle of the guidelines is to adopt a risk-based sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for river and coastal flooding.

This approach is based on the identification of flood zones for river and coastal flooding. “Flood Zones” are geographical areas used to identify areas at various levels of flood risk. There are three flood zones defined:

- Flood Zone A: (high probability of flooding) is for lands where the probability of flooding is greatest (greater than 1% or 1 in 100 for river flooding and 0.5% or 1 in 200 for coastal flooding).
- Flood Zone B: (moderate probability of flooding) refers to lands where the probability of flooding is moderate (between 0.1% or 1 in 1,000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 and 0.5% or 1 in 200 for coastal flooding).

- Flood Zone C: (low probability of flooding) refers to lands where the probability of flooding is low (less than 0.1% or 1 in 1000 for both river and coastal flooding).

Once a flood zone has been identified, the guidelines set out the different types of development appropriate to each zone. Exceptions to the restriction of development due to potential flood risks are provided for through the use of the Justification Test, where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated. This recognises that there will be a need for future development in existing towns and urban centres that lie within flood risk zones, and that the avoidance of all future development in these areas would be unsustainable.

Planning Authorities are required to introduce flood risk assessment as an integral and leading element of their development planning functions. Volume 7 of the Dublin City Development Plan 2016-2022 provides a Strategic Flood Risk Assessment for the area, which was informed by the DEHLG/OPW 2009 Guidelines for Planning Authorities.

The following guidelines and resources were referred to in preparing this flood risk assessment:

- The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009 (DEHLG/OPW)
- Dublin City Development Plan 2016-2022, Volume 7: Strategic Flood Risk Assessment
- Fingal East Meath Flood Risk Assessment and Management Study (FEMFRAMS)
- The OPW's National Flood Hazard Map
- Geological Survey Ireland (GSI) datasets

1.5 Assessment Methodology

This Flood Risk Assessment report follows the guidelines set out in the Guidelines on the Planning Process and Flood Risk Management. The components to be considered in the identification and assessment of flood risk are as per Table A1 of the above guidelines:

- Tidal – flooding from high sea levels
- Fluvial – flooding from water courses
- Pluvial – flooding from rainfall / surface water
- Groundwater – flooding from springs / raised groundwater
- Human/mechanical error – flooding due to human or mechanical error

Each component will be investigated from a Source, Pathway and Receptor perspective, followed by an assessment of the likelihood of a flood occurring and the possible consequences.

1.5.1 Assessing Likelihood

The likelihood of flooding falls into three categories of low, moderate and high, which are described in the OPW Guidelines as follows:

Flood Risk Components	**Likelihood: % chance of occurring in a year**		
	Low	***Moderate***	***High***
Tidal	*Probability < 0.1%*	*0.5% > Probability > 0.1%*	*Probability > 0.5%*
Fluvial	*Probability < 0.1%*	*1% > Probability > 0.1%*	*Probability > 1%*
Pluvial	*Probability < 0.1%*	*1% > Probability > 0.1%*	*Probability > 1%*

Table 2 **|** *From Table A1 of "DEHLG/OPW Guidelines on the Planning Process and Flood Management"*

For groundwater and human/mechanical error, the limits of probability are not defined and therefore professional judgment is used. However, the likelihood of flooding is still categorized as low, moderate and high for these components.

From consideration of the likelihoods and the possible consequences a risk is evaluated. Should such a risk exist, mitigation measures will be explored, and the residual risks assessed.

1.5.2 Assessing Consequence

There is not a defined method used to quantify a value for the consequences of a flooding event. Therefore, in order to determine a value for the consequences of a flooding event, the elements likely to be adversely affected by such flooding will be assessed, with the likely damage being stated, and professional judgement will be used in order to determine a value for consequences. Consequences will also be categorized as low, moderate, and high.

1.5.3 Assessing Risk

Based on the determined 'likelihood' and 'consequences' values of a flood event, the following 3x3 Risk Matrix will then be referenced to determine the overall risk of a flood event.

		Consequences		
		Low	***Moderate***	***High***
Likelihood	**Low**	*Extremely Low Risk*	*Low Risk*	*Moderate Risk*
	Moderate	*Low Risk*	*Moderate Risk*	*High Risk*
	High	*Moderate Risk*	*High Risk*	*Extremely High Risk*

Table 3 **|** *3x3 Risk Matrix*

2. Sequential Test

2.1 General

A sequential approach to planning is a key tool in ensuring that a development, particularly any new development, is first and foremost directed towards land that is at low risk of flooding. The sequential approach is set out in “The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009” and is referred to in the Dublin City Council Development Plan 2016-2022, Volume 7: Strategic Flood Risk Assessment (SFRA). The sequential approach is illustrated in the Figure below:

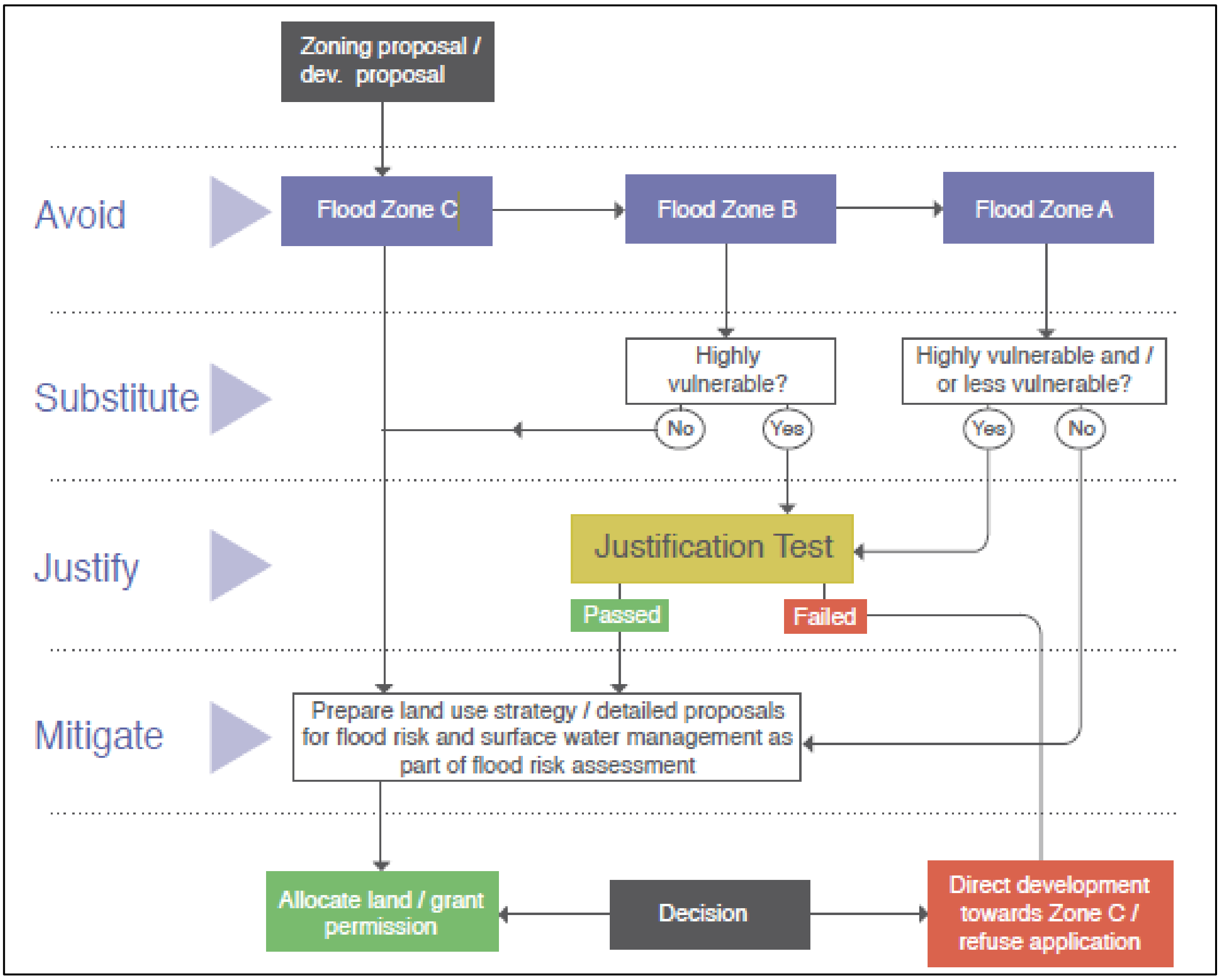


Figure 2 | *Sequential Approach (Extract from Dublin City Council Development Plan 2016-2022 SFRA)*

2.2 Establish Flood Zone

The first step of the sequential test is to establish the flood zone within which the site lies.

The subject site is in Flood Zone C, as it is outside the 1-in-1,000-year flood zone for both tidal and fluvial flooding – refer to Sections 3 and 4, below, for further information.

2.3 Establish Vulnerability Class

The next step is to establish the vulnerability class of the proposal. The Table below, taken from the OPW's "Planning and Flood Risk Management Guidelines for Planning Authorities, 2009" document, lists the vulnerability classes assigned to various land uses and types of development:

Vulnerability Class	Land Uses and Types of Development which include*:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and campong, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water-compatible development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).

*Uses not listed here should be considered on their own merits

Table 4 | *Vulnerability Classification of Different Types of Development*

The proposed development is a residential development, including a nursing home, and is therefore considered highly vulnerable development.

2.4 Assess Justification Test Requirement

The Table below outlines the matrix of vulnerability based on the Flood Zone:

Description	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

Table 5 **|** *Vulnerability Matrix*

Given that the subject site is within Flood Zone C, no justification test is required for the development.

3. Tidal Flooding

3.1 Source

Tidal flooding occurs when normally dry, low-lying land is flooded by seawater. The extent of tidal flooding is a function of the elevation inland flood waters penetrate, which is controlled by the topography of the coastal land exposed to flooding.

3.2 Pathway

The site is approximately 1.2km west of the nearest coastline at Dublin Bay, between North Bull Island and the mainland. The Dublin Coastal Protection Project indicated that the 2002 high tide event reached 2.95m OD Malin. The lowest proposed ground floor finished floor level is c.22m OD Malin, well above the historic high tide event.

Coastal Flood Extent Maps, developed as part of the Catchment Flood Risk Assessment and Management (CFRAM) Study, have been consulted as part of this assessment. These maps outline existing and potential flood hazard and risk areas which are being incorporated into a Flood Risk Management Plan. An extract of the CFRAM Coastal Flood Extents Map is shown in the Figure below:

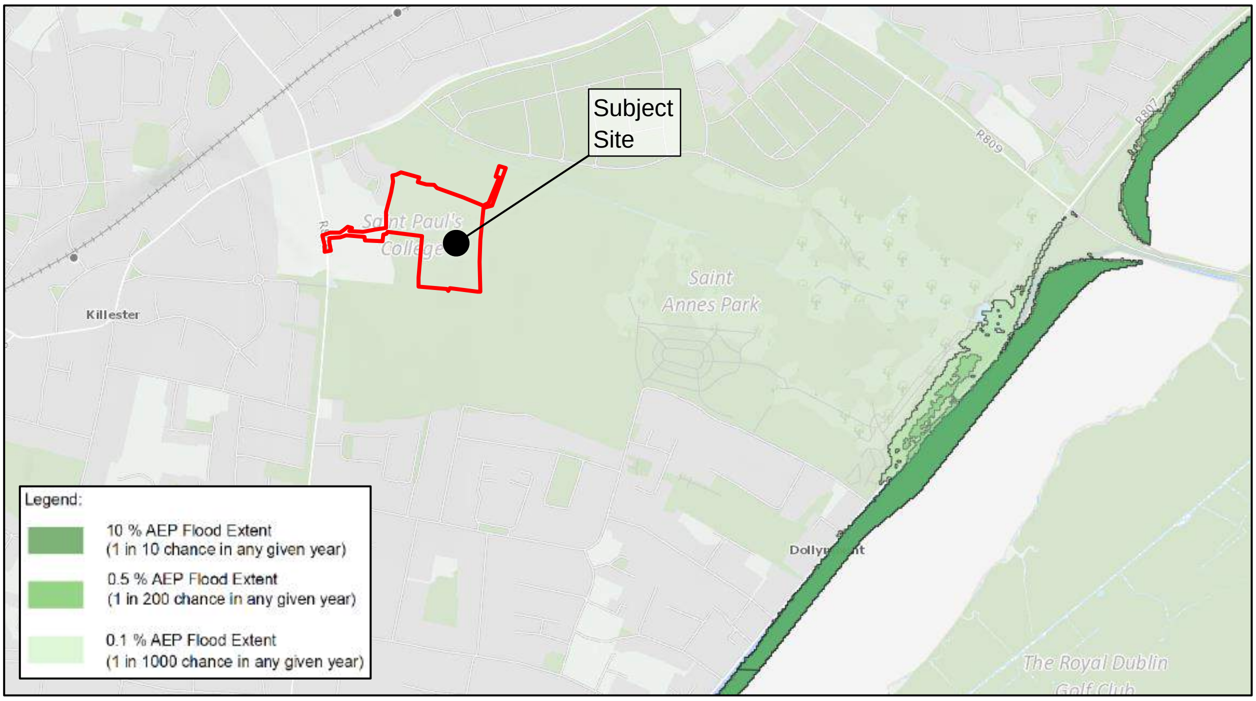


Figure 3 | *Extract of CFRAM Coastal Flood Extents Map*

High probability flood events, as shown in the above map, are defined as having approximately a 1-in-10 chance of occurring or being exceeded in any given year (10% Annual Exceedance Probability), medium probability flood events are defined as having an AEP of 0.5% (1-in-200 year storm), while low probability events are defined having an AEP of 0.1% (1-in-1,000 year storm). The map indicates that the subject development is not at risk of flooding for the 1-in-1,000 year event.

Given that the site is located 1.2km inland from the Irish Sea, that there is at least a 19m level difference between the subject lands and the high tide, and given that the site is outside of the 1-in-1,000 year tidal flood plain, it is evident that a pathway does not exist between the source and the receptor. A risk from tidal flooding is therefore extremely low and no flood mitigation measures need to be implemented.

4. Fluvial Flooding

4.1 Source

Fluvial flooding occurs when a river's flow exceeds its capacity, typically following excessive rainfall, though it can also result from other causes such as heavy snow melt and ice jams.

4.2 Pathway

The Naniken River flows approximately 100m north of the subject site, and the Santry River flows approximately 850m north of the subject site. Fluvial flood extent maps, developed as part of the Catchment Flood Risk Assessment and Management (CFRAM) Study and made available on the OPW's National Flood Information Portal, have been consulted as part of this assessment. These maps outline existing and potential flood hazard and risk areas which are being incorporated into a Flood Risk Management Plan. An extract of the map is shown in the Figure below:

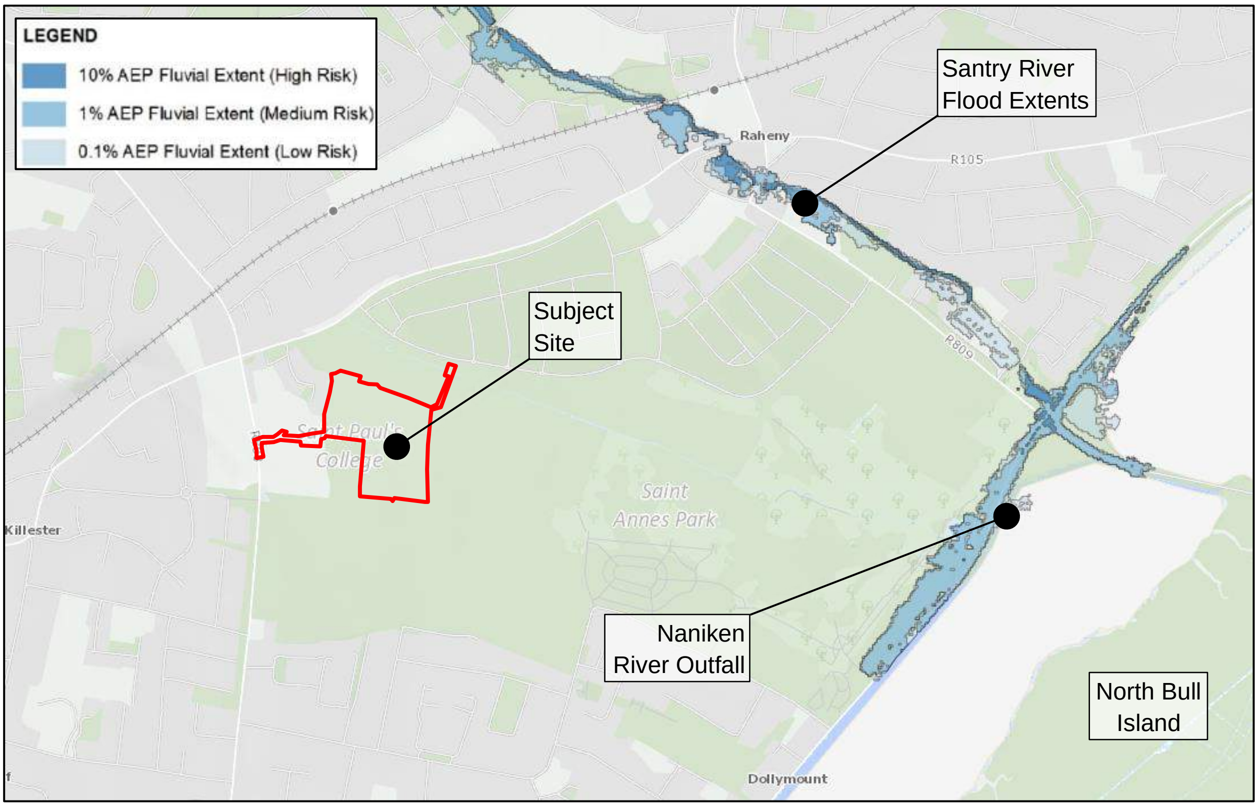


***Figure 4** | Extract of CFRAM Fluvial Flood Extents Map*

High probability flood events, as shown in the above map, are defined as having approximately a 1-in-10 chance of occurring or being exceeded in any given year (10% Annual Exceedance Probability), medium probability flood events are defined as having an AEP of 1% (1-in-100 year storm), while low probability events are defined having an AEP of 0.1% (1-in-1,000 year storm). The map indicates that the subject site is outside of the 0.1% AEP (1-in-1,000 year) flood plain.

The subject site is not within the flood plain of the Santry River. The Naniken River is small and the CFRAM Study does not include any flood information for it. However, adjacent to the site the Naniken has a bed level of c.18.375m OD Malin, with the typical water level less than 0.1m above the riverbed. The lowest point of the site is 21.4m OD Malin, more than 3m above the riverbed.

Furthermore, there is no history of flooding at the site. The OPW's National Flood Hazard Maps, extracted below, have been consulted to identify recorded instances of flooding in the vicinity of the site. The nearest recorded flood event occurred approximately 340m north of the site at Howth Road in June 1963, with no recent recorded flood events in the vicinity of the site.

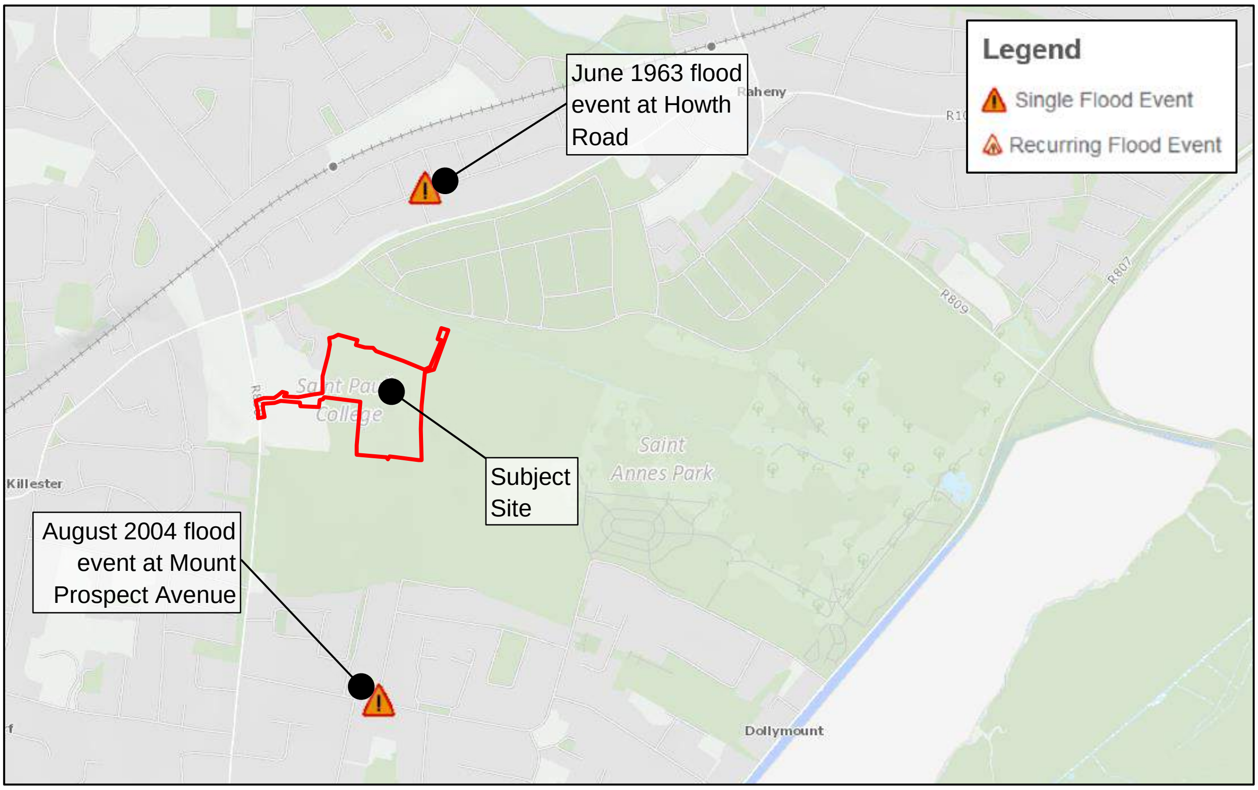


Figure 5 | *Extract from the OPW's Past Flood Events Map*

Given that the site is outside of the 1-in-1,000 year flood plain, that it is more than 3m above the nearest river and that there is no history of flooding, it is evident that a pathway does not exist between the source and the receptor. A risk from fluvial flooding is therefore extremely low and no flood mitigation measures need to be considered.

5. Pluvial Flooding

5.1 Source

Pluvial flooding occurs when heavy rainfall creates a flood event independent of an overflowing water body. Pluvial flooding can happen in any urban area, including higher elevation areas that lie above coastal and river floodplains.

5.2 Pathway & Receptors

During periods of extreme prolonged rainfall, pluvial flooding may occur through the following pathways:

	Pathway	Receptor
1	Surcharging of the proposed internal drainage systems during heavy rain events leading to internal flooding	Proposed development – properties and roads
2	Surcharging from the existing surrounding drainage system leading to flooding within the subject site by surcharging surface water pipes	Proposed development – properties and roads
3	Surface water discharging from the subject site to the existing drainage network leading to downstream flooding	Downstream properties and roads
4	Overland flooding from surrounding areas flowing onto the subject site	Proposed development – properties and roads
5	Overland flooding from the subject site flowing onto surrounding areas	Downstream properties and roads

Table 6 | *Pathways and Receptors*

5.3 Likelihood

The likelihood of each of the 5 pathway types are addressed individually as follows:

5.3.1 Surcharging of the proposed on-site drainage systems:

The proposed on-site surface water drainage sewers have been designed to accommodate flows from a 5-year return event, which indicates that on average the internal system may surcharge during rainfall events with a return period in excess of five years. Therefore, the likelihood surcharging of the on-site drainage system is considered high.

5.3.2 Surcharging from the existing surrounding drainage system:

The OPW's National Flood Hazard Maps, extracted in Section 3.2 above, have been consulted to identify recorded instances of flooding in the vicinity of the site. The nearest recorded flood event occurred approximately 340m north of the site at Howth Road in June 1963. The next closest event occurred approximately 620m south of the site in August 2004. There have been no recent recorded flood events in the vicinity of the site. With no history of flooding in the area due to surcharging, the likelihood of such flooding occurring is considered low.

5.3.3 Surface water discharge from the subject site:

Due to the increase in hard standing area as a result of the proposed development, there is an increased likelihood of surface water discharge from the site leading to downstream flooding. As such, the likelihood can be considered moderate.

5.3.4 Overland flooding from surrounding areas:

With no recorded flood events in the immediate area that could have an impact on the subject site, as per the OPW records referred to above, it is considered that there is a low likelihood of flooding from surrounding areas.

5.3.5 Overland flooding from the subject site:

Due to the increase in hard standing area as a result of the proposed development, there is an increased likelihood of overland flooding from the site leading to downstream flooding. As such, the likelihood can be considered moderate.

5.4 Consequence

Surface water flooding would result in damage to roads and landscaped areas, and could impact the basements and ground floor levels of buildings. The consequences of pluvial flooding are considered moderate.

5.5 Risk

The risk of each of the 5 pathway types is addressed individually as follows:

5.5.1 Surcharging of the proposed on-site drainage systems:

With a high likelihood and moderate consequence of flooding the site from surcharging the on-site drainage system, the resultant risk is high.

5.5.2 Surcharging from the existing surrounding drainage system:

With a low likelihood and moderate consequence of flooding the site from the existing surface water network, the resultant risk is low.

5.5.3 Surface water discharge from the subject site:

With a moderate likelihood and moderate consequence of surface water discharge from the subject site, the resultant risk is moderate.

5.5.4 Overland flooding from surrounding areas:

With a low likelihood and moderate consequence of overland flooding from the surrounding areas, the resultant risk is low.

5.5.5 Overland flooding from the subject site:

With a moderate likelihood and moderate consequence of overland flooding from the subject site, the resultant risk is moderate.

5.6 Flood Risk Management

The following are flood risk management strategies proposed to minimise the risk of pluvial flooding for each risk:

5.6.1 Surcharging of the proposed on-site drainage systems:

The risk of flooding is minimised with adequate sizing of the on-site surface water network and SuDS devices. Open grassed areas with low level planting and roadside trees act as soft scape and will significantly slow down and reduce the amount of surface water runoff from the site. Permeable paving at parking bays and private pathways will provide some treatment volume, with underlying perforated pipes connecting to the storm water sewer network. Green roofing will help to slow the runoff rate.

These proposed source and site control devices will intercept and slow down the rate of runoff from the site to the on-site drainage system, reducing the risk of surcharging.

Furthermore, a hydro-brake or similar approved flow control device will provide a runoff limited to the greenfield equivalent runoff rate, with excess storm water to be attenuated in an underground tank at the north-east of the site, with sufficient volume for the 1-in-100 year storm (accounting for a 20% increase due to climate change), to limit the runoff from the site and minimise the discharge rate into receiving waters.

As a result of these proposed measures, the likelihood of surcharging of the proposed on-site drainage systems is low.

5.6.2 Surcharging from the existing surrounding drainage system:

The risk of flooding due to surcharging of the existing surface water network is minimised with overland flood routing towards the open space at the east of the site.

The risk to the surrounding buildings is mitigated by setting finished floor levels at least 200mm above the adjacent road channel line.

5.6.3 Surface water discharge from the subject site:

Surface water discharge from the subject site is intercepted and slowed down through the use of source control devices, as described in Section 4.6.1 above, minimising the risk of pluvial flooding from the subject site. Surface water discharge from the site is restricted by a flow control device to the greenfield equivalent rate, with sufficient attenuation storage provided for the 1-in-100 year storm, accounting for a 20% increase due to climate change. As such, the rate at which surface water discharges from the subject site will not be increased as a result of the proposed development.

5.6.4 Overland flooding from surrounding areas:

The risk from overland flooding from surrounding areas is low. Overland flood routing and raised finished floor levels will provide protection for the proposed buildings, as described in Section 4.6.2 above. The proposed basement will be suitably tanked to prevent ingress of water.

5.6.5 Overland flooding from the subject site:

The risk of overland flooding from the subject site is minimised by providing SuDS features to intercept and slow down the rate of runoff from the site to the existing surface water sewer system, as described in Section 4.6.1 above. Sufficient attenuation is provided for the 1-in-100 year storm, accounting for a 20% increase due to climate change. Thus, even under extreme storm conditions, the surface water can be attenuated without causing flooding downstream.

5.7 Residual Risk

As a result of the design measures detailed above in Section 4.6, there is a low residual risk of flooding from each of the surface water risks.

6. Combined Pluvial and Fluvial

6.1 Source

Given that surface water from the proposed development will discharge to the Naniken River, there is a risk that during an extreme rainfall event the river level will rise enough that no surface water discharges from the site. It is therefore appropriate to consider the flood implications of an extreme rainfall event with little or no discharge.

6.2 Pathway

The pathway for a combined pluvial and fluvial event would be from surcharging of the proposed internal drainage system from the outfall surcharging back towards the site.

6.3 Receptor

The receptor for a combined pluvial and fluvial event would be St. Anne's Park along the drainage outfall (adjacent to pitch 3) and areas within the development from manholes surcharging.

6.4 Likelihood

Attenuation calculations carried out as part of the accompanying Engineering Assessment Report, and included in Appendix C of that report, identified the 12-hour 1-in-100-year storm as the critical storm.

This storm will generate 2,260.5m^3 of storm water runoff. Under typical circumstances, the discharge from the site over that 12-hour period would be 741.7m^3, via the proposed outfall to the Naniken River, with sufficient attenuation provided for the remaining 1,518.9m^3. However, if the river's water level were to significantly raise, such that no surface water could discharge from the site, the volume of rainwater would exceed the attenuation capacity of the development.

The surface water outfall to the Naniken River is proposed at an invert level of 18.64m OD Malin, with the typical water level in the river below this level. The outlet from the proposed attenuation has an invert level of 19.78m OD Malin, providing a hydraulic head of more than 1m between the attenuation and the outfall. Event during a storm event, the river's water level would need to rise significantly before surface water from the site would be unable to discharge. Thus, the likelihood is considered low.

6.5 Consequence

Surface water flooding would result in damage to roads and landscaped areas, and could impact the basements and ground floor levels of buildings. The consequences of a combined fluvial and pluvial flood event are considered moderate.

6.6 Risk

With a low likelihood and moderate consequences, the risk is considered moderate.

6.7 Flood Risk Management

An overprovision of attenuation storage is provided at the site. The required attenuation storage is to be provided in a detention basin with a below ground storage tank located in the open space between Blocks D and F, south of Block E. The detention basin has a volume of 340m^3, while the underlying attenuation tank has a volume of 1,620m^3, for a total storage volume of 1,960m^3, which exceeds the required volume of 1,518.9m^3.

The surface water outfall to the Naniken River is proposed at an invert level of 18.64m OD Malin. The previous manhole before the outfall has a cover level of 20.15m OD Malin, and the north-east corner of the site is at 21.76m OD Malin. Thus, if the entire attenuation provision were to fill and the surface water network begins to surcharge, the pipework and manholes can hold a significant volume of storm water before surcharging as far as the surface level. The approximately 800m of surface water drains, ranging in diameter from 225mm to 450mm, can provide approximately 52m^3 of additional storage in an extreme combined storm event, with the 30 no. proposed surface water manholes providing approximately an additional 64m^3 before storm water reaches the surface level.

Under these extreme circumstances, the level of the water in the drainage network would likely ensure some discharge to the Naniken River, whose water level is typically more than 3.5m below most of the subject site. A non-return valve is proposed at the Hydrobrake manhole to ensure no backflow of surface water to the site.

In the highly unlikely event that there is no discharge to the Naniken River whatsoever throughout the entirety of the 12-hour 1-in-100-year critical storm event, any storm water over and above the 1,960m^3 of attenuation and approximately 116m^3 of volume within the sewers and manholes would surcharge and overflow through gullies and manhole lids. The consequences of flooding due to surcharging of the existing surface water network is minimised with overland flood routing towards the open space at the east of the site. Along the route of the outfall sewer, the land falls towards the Naniken River so overland flood routing within the park would be towards the river.

6.8 Residual Risk

There is a low residual risk of flooding from a combined pluvial and fluvial event.

7. Groundwater

7.1 Source

Groundwater flooding occurs when the water table rises above the ground surface. This typically happens during periods with prolonged rainfall which exceeds the natural underground drainage system's capacity.

7.2 Pathway

The pathway for groundwater flooding is from the ground. Note that although groundwater flooding is typically considered to be when the water table rises above the ground surface, the basements, underground services and building foundations could also be affected by high water tables that do not reach the ground surface.

7.3 Receptor

The receptors for ground water flooding would be the basements, underground services and the ground floor of buildings.

7.4 Likelihood

Geological Survey Ireland (GSI) produces a wide range of datasets, including groundwater vulnerability mapping. From the GSI groundwater vulnerability map, extracted below, the site lies within an area with low groundwater vulnerability.

Figure 6 | *Extract of Groundwater Vulnerability Map*

With the site falling within an area with low groundwater vulnerability, the likelihood of groundwater rising through the ground and causing potential flooding on site during prolonged wet periods is low.

7.5 Consequence

The consequence of ground water flooding would be some minor temporary seepage of ground water through the ground around the proposed buildings. Underground services could be inundated from high water tables. Over time, groundwater could seep into the basement. Therefore, the consequence of ground water flooding occurring at the proposed development is considered moderate.

7.6 Risk

With a low likelihood and moderate consequences of flooding due to groundwater, the risk is considered low.

7.7 Flood Risk Management

Finished floor levels have been set above the road levels, as described in Section 4.6. This will ensure that any ground water in the vicinity of the building does not flood into the building.

The buildings' design will incorporate suitable damp proof membranes to protect against damp and water ingress from below ground level. To mitigate the risks of groundwater entering the basements they must be adequately waterproofed. Any penetrations through either of the basement's walls or slab must also be appropriately sealed to prevent ingress of groundwater.

It is proposed to install a granular blanket surrounding the basement structure, which will allow groundwater to seep around the basement, maintaining any long-term sub-surface perched water movement. This will minimise the effect that the proposed basement will have on the local water table, mitigating the risk to surrounding areas including other basements in the vicinity of the site.

In the event of ground water flooding on site, this water can escape from the site via the overland flood routing, as described in Section 4.6.

7.8 Residual Risk

There is a low residual risk of flooding from ground water.

8. Human/Mechanical Errors

8.1 Source

The subject site will be drained by an internal private storm water drainage system outfalling to the Naniken River. The internal surface water network is a source of possible flooding were it to become blocked.

8.2 Pathway

If the public drainage network in the vicinity of the site were to block this could lead to possible flooding within the private areas and basement levels. If the proposed internal drainage system blocks this could also lead to possible flooding within the private areas and basement levels.

8.3 Receptor

The receptors for flooding due to human/mechanical error would be the ground floor and basements of the buildings, with possible flooding at neighbouring buildings.

8.4 Likelihood

There is a high likelihood of flooding on the subject site if the surface water network were to become blocked.

8.5 Consequence

The surface water network would surcharge and overflow through gullies and manhole lids. It is, therefore, considered that the consequences of such flooding are moderate.

8.6 Risk

With a high likelihood and moderate consequence, there is a high risk of surface water flooding should the surface water network block.

8.7 Flood Risk Management

As described in Section 4.6, finished floor levels have been designed to be above the adjacent road network which will reduce the risk of flooding if the public surface water network (combined network) were to block. In the event of the surface water system surcharging, much of the surface water can still escape from the site by overland flood routing, as described in Section 4.6, without causing damage to the proposed buildings.

The surface water network (drains, gullies, manholes, AJs, attenuation system) will need to be regularly maintained and where required cleaned out. A suitable maintenance regime of inspection and cleaning should be incorporated into the safety file/maintenance manual for the development.

8.8 Residual Risk

As a result of the flood risk management outlined above, there is a low residual risk of overland flooding from human / mechanical error.

9. Conclusions and Recommendations

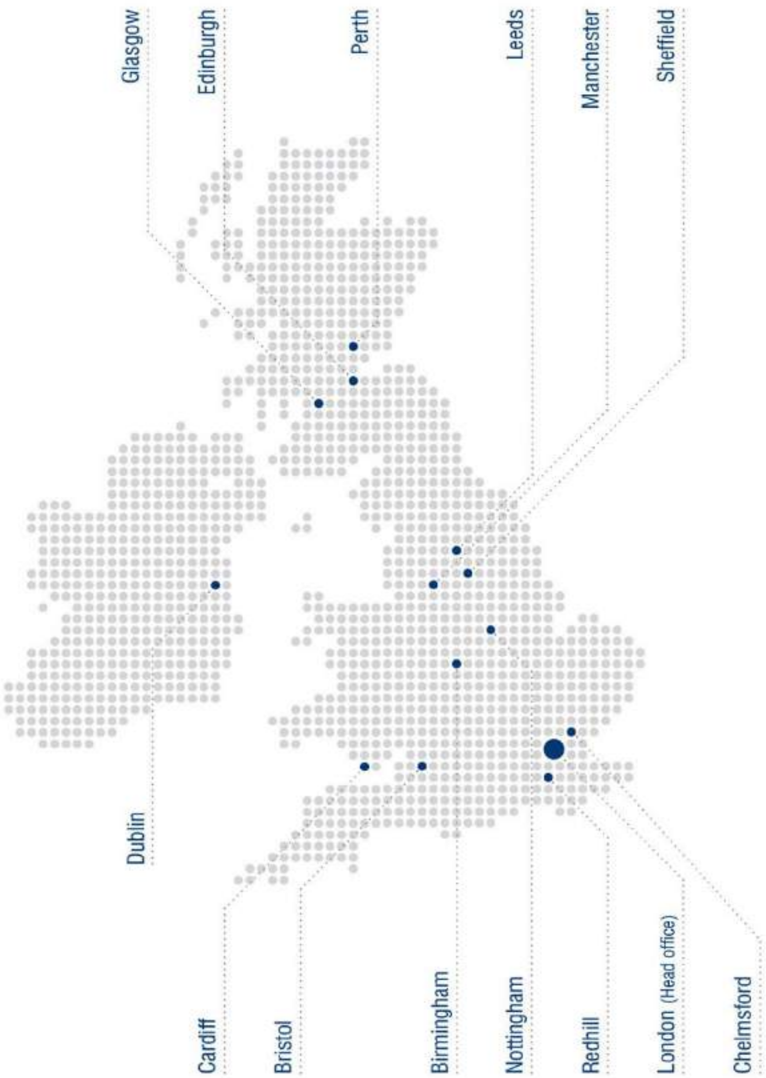
The subject lands have been analysed for risks from tidal flooding from the Irish Sea, fluvial flooding from the Naniken River and the Santry River, pluvial flooding, ground water and failures of mechanical systems. The table below presents the various residual flood risks involved:

Source	Pathway	Receptor	Likelihood	Consequence	Risk	Mitigation Measure	Residual Risk
Tidal	*Dublin Bay, west of North Bull Island*	*Proposed development*	*Extremely low*	*None*	*Negligible*	*None*	Extremely low
Fluvial	*Naniken and Santry Rivers*	*Proposed development*	*Extremely low*	*None*	*Negligible*	*None*	Extremely low
Pluvial	*Private & Public Drainage Network*	*Proposed development, downstream properties and roads*	*Ranges from low to high*	*High*	*Ranges from moderate to extremely high*	*Appropriate drainage, SuDS and attenuation design, setting of floor levels, overland flood routing*	Low
Combined fluvial and pluvial event	*Sewers surcharging due to minimal discharge to Naniken River*	*St. Anne's Park, proposed development*	*Low*	*Moderate*	*Moderate*	*Overprovision of attenuation, additional volume in surcharged pipes and manholes, non-return valve, overland flood routing*	Low
Ground Water	*Ground*	*Underground services, ground and basement levels of buildings*	*Low*	*Moderate*	*Low*	*Appropriate setting of floor levels, flood routing, damp proof membranes*	Low
Human/ Mechanical Error	*Drainage network*	*Proposed development*	*High*	*Moderate*	*High*	*Setting of floor levels, overland flood routing, regular inspection of SW network*	Low

Table 7 | *Summary of the Flood Risks from the Various Components*

As indicated in the above table, the various sources of flooding have been reviewed, and the risk of flooding from each source has been assessed. Where necessary, mitigation measures have been proposed. As a result of the proposed mitigation measures, the residual risk of flooding from any source is low.

UK and Ireland Office Locations



Appendix M GoCar Letter of Intent

Marlet Property Group
O'Connell Bridge House,
27/28 D'Olier Street,
Dublin 2
D02 RR99

01/07/2022

To Whom It May Concern,

This is a letter to confirm that GoCar intends to provide a car sharing service in the proposed development at Foxlands in Raheny, Dublin 5. GoCar representatives have discussed the project with representatives of Waterman Moylan, who are the Design engineers for this project and are excited to provide a car sharing service at the proposed location. GoCar would provide two (2) car sharing vehicles at the 581 residential unit development. While it is the intention for these vehicles to be used primarily by the residents of the development, the vehicles will be open for access to other GoCar members nearby.

GoCar is Ireland's leading car sharing service with over 60,000 members and over 860 cars and vans on fleet.
Car sharing is a sustainable community service. Each GoCar which is placed in a community has the potential to replace the journeys of up to 15 private vehicles. With the addition of Electric Vehicles and vans to the GoCar fleet it gives members the ability to choose from different vehicles depending on their journey needs.

The Department of Housing's Design Standards for New Apartments - Guidelines for Planning Authorities 2020 outline: "For all types of location, where it is sought to eliminate or reduce car parking provision, it is necessary to ensure... provision is also to be made for alternative mobility solutions including facilities for car sharing club vehicles."

By allowing multiple people to use the same vehicle at different times, car sharing reduces car ownership, car dependency, congestion, noise, and air pollution. It frees up land which would otherwise be used for additional parking spaces. Most GoCar users only use a car when necessary and walk and use public transport more often than car owners.

By having GoCar car sharing vehicles in a development such as this, the residents therein will have access to pay-as-you-go driving, in close proximity to their homes, which will increase usership of the service.

I trust that this information is satisfactory. For any queries, please do not hesitate to contact me.

Rob Montgomery
Revenue and Growth Manager
GoCar Carsharing Ltd
Mobile: 086 609 7096
E: robert.montgomery@gocar.ie

Appendix N TRIC Rates

Calculation Reference: AUDIT-561501-211102-1105

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 03 - RESIDENTIAL
Category : C - FLATS PRIVATELY OWNED

TOTAL VEHICLES

Selected regions and areas:

15	GREATER DUBLIN		
	DL	DUBLIN	1 days

This section displays the number of survey days per TRICS® sub-region in the selected set

Primary Filtering selection:

This data displays the chosen trip rate parameter and its selected range. Only sites that fall within the parameter range are included in the trip rate calculation.

Parameter: Total Bedrooms
Actual Range: 725 to 725 (units:)
Range Selected by User: 400 to 1080 (units:)

Parking Spaces Range: All Surveys Included

Parking Spaces per Dwelling Range: All Surveys Included

Bedrooms per Dwelling Range: All Surveys Included

Percentage of dwellings privately owned: All Surveys Included

Public Transport Provision:
Selection by: Include all surveys

Date Range: 01/01/13 to 23/10/20

This data displays the range of survey dates selected. Only surveys that were conducted within this date range are included in the trip rate calculation.

Selected survey days:
Friday 1 days

This data displays the number of selected surveys by day of the week.

Selected survey types:
Manual count 1 days
Directional ATC Count 0 days

This data displays the number of manual classified surveys and the number of unclassified ATC surveys, the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff, whilst ATC surveys are undertaking using machines.

Selected Locations:
Suburban Area (PPS6 Out of Centre) 1

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:
Residential Zone 1

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Secondary Filtering selection:

Use Class:
C3 1 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Population within 500m Range:
All Surveys Included
Population within 1 mile:
25,001 to 50,000 1 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:
500,001 or More 1 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:
0.6 to 1.0 1 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:
No 1 days

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:
No PTAL Present 1 days

This data displays the number of selected surveys with PTAL Ratings.

Covid-19 Restrictions Yes At least one survey within the selected data set was undertaken at a time of Covid-19 restrictions

LIST OF SITES relevant to selection parameters

1 DL-03-C-17 BLOCKS OF FLATS DUBLIN
FINGLAS ROAD
DUBLIN
FINGLAS
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Total Bedrooms: 725
Survey date: FRIDAY 23/10/20 Survey Type: MANUAL

This section provides a list of all survey sites and days in the selected set. For each individual survey site, it displays a unique site reference code and site address, the selected trip rate calculation parameter and its value, the day of the week and date of each survey, and whether the survey was a manual classified count or an ATC count.

TRIP RATE for Land Use 03 - RESIDENTIAL/C - FLATS PRIVATELY OWNED

TOTAL VEHICLES

Calculation factor: 1 TOTBED

BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. TOTBED	Trip Rate	No. Days	Ave. TOTBED	Trip Rate	No. Days	Ave. TOTBED	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	1	725	0.022	1	725	0.066	1	725	0.088
08:00 - 09:00	1	725	0.044	1	**725**	**0.124**	1	**725**	**0.168**
09:00 - 10:00	1	725	0.052	1	725	0.022	1	725	0.074
10:00 - 11:00	1	725	0.025	1	725	0.025	1	725	0.050
11:00 - 12:00	1	725	0.025	1	725	0.037	1	725	0.062
12:00 - 13:00	1	725	0.026	1	725	0.033	1	725	0.059
13:00 - 14:00	1	725	0.054	1	725	0.057	1	725	0.111
14:00 - 15:00	1	725	0.069	1	725	0.057	1	725	0.126
15:00 - 16:00	1	725	0.054	1	725	0.047	1	725	0.101
16:00 - 17:00	1	725	0.062	1	725	0.029	1	725	0.091
17:00 - 18:00	1	**725**	**0.083**	1	725	0.055	1	725	0.138
18:00 - 19:00	1	725	0.055	1	725	0.051	1	725	0.106
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.571			0.603			1.174

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

Parameter summary

Trip rate parameter range selected:	725 - 725 (units:)
Survey date date range:	01/01/13 - 23/10/20
Number of weekdays (Monday-Friday):	1
Number of Saturdays:	0
Number of Sundays:	0
Surveys automatically removed from selection:	0
Surveys manually removed from selection:	0

This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are show. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.

TRIP RATE for Land Use 03 - RESIDENTIAL/C - FLATS PRIVATELY OWNED
CARS
Calculation factor: 1 TOTBED
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. TOTBED	Trip Rate	No. Days	Ave. TOTBED	Trip Rate	No. Days	Ave. TOTBED	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	1	725	0.019	1	725	0.061	1	725	0.080
08:00 - 09:00	1	725	0.037	1	725	0.109	1	725	0.146
09:00 - 10:00	1	725	0.048	1	725	0.018	1	725	0.066
10:00 - 11:00	1	725	0.019	1	725	0.017	1	725	0.036
11:00 - 12:00	1	725	0.022	1	725	0.037	1	725	0.059
12:00 - 13:00	1	725	0.018	1	725	0.028	1	725	0.046
13:00 - 14:00	1	725	0.041	1	725	0.043	1	725	0.084
14:00 - 15:00	1	725	0.061	1	725	0.050	1	725	0.111
15:00 - 16:00	1	725	0.048	1	725	0.040	1	725	0.088
16:00 - 17:00	1	725	0.051	1	725	0.025	1	725	0.076
17:00 - 18:00	1	725	0.073	1	725	0.048	1	725	0.121
18:00 - 19:00	1	725	0.050	1	725	0.046	1	725	0.096
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.487			0.522			1.009

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

Calculation Reference: AUDIT-561501-211102-1138

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 05 - HEALTH
Category : F - CARE HOME (ELDERLY RESIDENTIAL)

TOTAL VEHICLES

Selected regions and areas:

12	CONNAUGHT		
	CS	SLIGO	1 days
15	GREATER DUBLIN		
	DL	DUBLIN	1 days
17	ULSTER (NORTHERN IRELAND)		
	DO	DOWN	1 days

This section displays the number of survey days per TRICS® sub-region in the selected set

Primary Filtering selection:

This data displays the chosen trip rate parameter and its selected range. Only sites that fall within the parameter range are included in the trip rate calculation.

Parameter: Number of residents
Actual Range: 16 to 99 (units:)
Range Selected by User: 16 to 99 (units:)

Parking Spaces Range: All Surveys Included

Public Transport Provision:
Selection by: Include all surveys

Date Range: 01/01/13 to 05/09/17

This data displays the range of survey dates selected. Only surveys that were conducted within this date range are included in the trip rate calculation.

Selected survey days:

Monday	1 days
Tuesday	1 days
Saturday	1 days

This data displays the number of selected surveys by day of the week.

Selected survey types:

Manual count	3 days
Directional ATC Count	0 days

This data displays the number of manual classified surveys and the number of unclassified ATC surveys, the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff, whilst ATC surveys are undertaking using machines.

Selected Locations:

Suburban Area (PPS6 Out of Centre)	1
Edge of Town	2

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:

Residential Zone	3

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Secondary Filtering selection:

Use Class:

C2	3 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Population within 500m Range:
All Surveys Included
Population within 1 mile:

1,001 to 5,000	1 days
5,001 to 10,000	2 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:

5,001 to 25,000	2 days
25,001 to 50,000	1 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

1.1 to 1.5	3 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

Yes	1 days
No	2 days

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:

No PTAL Present	3 days

This data displays the number of selected surveys with PTAL Ratings.

LIST OF SITES relevant to selection parameters

1	CS-05-F-01	NURSING HOME		SLIGO
	CHURCH HILL SLIGO Edge of Town Residential Zone			
	Total Number of residents:		99	
	Survey date: MONDAY		*27/04/15*	*Survey Type: MANUAL*
2	DL-05-F-01	NURSING HOME		DUBLIN
	MOUNT ANVILLE PARK DUBLIN GOATSTOWN Suburban Area (PPS6 Out of Centre) Residential Zone			
	Total Number of residents:		16	
	Survey date: TUESDAY		*05/09/17*	*Survey Type: MANUAL*
3	DO-05-F-01	CARE HOME		DOWN
	STRANGFORD ROAD DOWNPATRICK Edge of Town Residential Zone			
	Total Number of residents:		65	
	Survey date: SATURDAY		*20/06/15*	*Survey Type: MANUAL*

This section provides a list of all survey sites and days in the selected set. For each individual survey site, it displays a unique site reference code and site address, the selected trip rate calculation parameter and its value, the day of the week and date of each survey, and whether the survey was a manual classified count or an ATC count.

TRIP RATE for Land Use 05 - HEALTH/F - CARE HOME (ELDERLY RESIDENTIAL)

TOTAL VEHICLES

Calculation factor: 1 RESIDE

BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. RESIDE	Trip Rate	No. Days	Ave. RESIDE	Trip Rate	No. Days	Ave. RESIDE	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	3	60	0.283	3	60	0.061	3	60	0.344
08:00 - 09:00	3	60	0.094	3	60	0.144	3	60	0.238
09:00 - 10:00	3	60	0.122	3	60	0.056	3	60	0.178
10:00 - 11:00	3	60	0.233	3	60	0.122	3	60	0.355
11:00 - 12:00	3	60	0.172	3	60	0.156	3	60	0.328
12:00 - 13:00	3	60	0.083	3	60	0.189	3	60	0.272
13:00 - 14:00	3	60	0.217	3	60	0.178	3	60	0.395
14:00 - 15:00	3	60	0.194	**3**	**60**	**0.311**	3	60	0.505
15:00 - 16:00	3	60	0.183	3	60	0.139	3	60	0.322
16:00 - 17:00	3	60	0.094	3	60	0.200	3	60	0.294
17:00 - 18:00	3	60	0.089	3	60	0.139	3	60	0.228
18:00 - 19:00	3	60	0.083	3	60	0.150	3	60	0.233
19:00 - 20:00	**2**	**41**	**0.358**	2	41	0.247	**2**	**41**	**0.605**
20:00 - 21:00	2	41	0.049	2	41	0.210	2	41	0.259
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			2.254			2.302			4.556

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

Parameter summary

Trip rate parameter range selected:	16 - 99 (units:)
Survey date date range:	01/01/13 - 05/09/17
Number of weekdays (Monday-Friday):	2
Number of Saturdays:	1
Number of Sundays:	0
Surveys automatically removed from selection:	0
Surveys manually removed from selection:	0

This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are show. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.

TRIP RATE for Land Use 05 - HEALTH/F - CARE HOME (ELDERLY RESIDENTIAL)
CARS
Calculation factor: 1 RESIDE
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. RESIDE	Trip Rate	No. Days	Ave. RESIDE	Trip Rate	No. Days	Ave. RESIDE	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	3	60	0.272	3	60	0.050	3	60	0.322
08:00 - 09:00	3	60	0.078	3	60	0.128	3	60	0.206
09:00 - 10:00	3	60	0.100	3	60	0.033	3	60	0.133
10:00 - 11:00	3	60	0.211	3	60	0.106	3	60	0.317
11:00 - 12:00	3	60	0.122	3	60	0.106	3	60	0.228
12:00 - 13:00	3	60	0.072	3	60	0.178	3	60	0.250
13:00 - 14:00	3	60	0.194	3	60	0.156	3	60	0.350
14:00 - 15:00	3	60	0.172	3	**60**	**0.283**	3	60	0.455
15:00 - 16:00	3	60	0.172	3	60	0.139	3	60	0.311
16:00 - 17:00	3	60	0.089	3	60	0.189	3	60	0.278
17:00 - 18:00	3	60	0.078	3	60	0.122	3	60	0.200
18:00 - 19:00	3	60	0.083	3	60	0.150	3	60	0.233
19:00 - 20:00	2	**41**	**0.346**	2	41	0.235	2	**41**	**0.581**
20:00 - 21:00	2	41	0.037	2	41	0.198	2	41	0.235
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			2.026			2.073			4.099

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

Appendix O Public Transport Assessment

Waterman Moylan
Engineering Consultants

Public Transport Capacity Assessment

Proposed Large Residential Development (LRD) at Foxlands, Raheny, Dublin 5

August 2022

Waterman Moylan Consulting Engineers Limited

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Waterman Moylan
Engineering Consultants

Client Name: Raheny 3 Limited Partnership
Document Reference: 21-083r.008 Public Transport Capacity Assessment
Project Number: 21-083

Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015 and BS EN ISO 14001: 2015)

Issue	Date	Prepared by	Checked by	Approved by
1	31 August 2022	Luke Byrne	Stephen Dent-Neville	Mark Duignan

Comments

Waterman Moylan
Engineering Consultants

Disclaimer

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1. Introduction

1.1 Context

This Public Transport Capacity Assessment Report has been prepared by Waterman Moylan as part of the documentation in support of a planning application for a proposed Large Residential Development (LRD) at Foxlands in Raheny, Dublin 5.

1.2 Location

Raheny 3 Limited Partnership are applying for permission for development on lands east of St. Paul's College, Sybil Hill Road, Raheny, Dublin 5. The site is bounded to the north, east and south by St Anne's Park and to the west by residential development at The Meadows, Sybil Hill House (a Protected Structure) and St. Paul's College. Vehicular access to the site is from Sybil Hill Road.

The locations of the Dart Stations and bus stop surveyed as part of this report are indicated in Figure 1, below:

Figure 1 | *Location of the Development and Survey Locations*

1.3 Proposed Development

The proposed development consists of the construction of a residential and nursing home development set out in 7 no. blocks, ranging in height from 4 to 7 storeys to accommodate 580 no. apartments, residential tenant amenity spaces, a crèche, and a 100-bed nursing home, as set out in the schedule of accommodation below:

Description		1-Bed	2-Bed	3-Bed	Total
Apartment Blocks	Block A	31	25	5	61
	Block B	44	26	-	70
	Block C	46	57	9	112
	Block D	56	58	22	136
	Block E	47	46	3	96
	Block F	23	9	4	36
Mixed-Use (Block G)	Apartments	25	27	17	69
	Nursing Home	100 Bedspaces			-
	Crèche	6 Classrooms			-
Total		**272**	**248**	**60**	**580**

Table 1 | *Schedule of Accommodation*

The site will accommodate car parking spaces, bicycle parking spaces, storage, services and plant areas at both basement and podium level. Landscaping will include extensive communal amenity areas, and a significant public open space provision on the east and south of the site. The proposed application includes all site landscaping works, green roofs, substations, boundary treatments, lighting, servicing, signage, surface water attenuation facilities and associated and ancillary works, including site development works and services above and below ground.

1.4 Survey at Foxlands, Raheny 2022

The bus capacity survey at Foxlands, Raheny was carried out by Waterman Moylan personnel on Monday 25th July 2022. The Bus Capacity Survey was for Bus Stop 606 heading towards Dublin City Centre, the busiest bus stop within the area.

1.5 Covid 19

It was not apparent from the survey observations described later in this report that the existing bus and train services that will serve the transport needs of the subject site are experiencing diminished patronage as a result of the impacts of Covid-19.

The additional demand for bus services that will be generated by the proposed development will result in very low increases in passenger volumes on the public transport services. At the same time, a full *"return to normal"* level of commuting, post-Covid, is unlikely.

2. Existing Bus Services – Foxlands, Raheny

The proposed development is served by four bus stops with the local area. The nearest bus stops are to the north of the development on R105 Howth Road. Bus Stop 709 is served by buses travelling away from the City Centre, including bus routes 6, H1, H2, H3 while Bus Stop 606 is served by buses travelling towards the City Centre, including bus routes 6, H1, H2, H3. Bus Stop 709 is approximately 400m (c. 5-minute walk) away from the proposed development entrance and Bus Stop 606 is 450m (c. 6-minute walk) away.

These Bus Services are part of the BusConnects Network, Phase 1 of which was launched in June 2021. Phase 1 is the first BusConnects scheme to launch and is for the H-Spine network. The H spine branches are the primary driver of the new network, delivering fast and frequent services to the city centre. Services on H1 (from Baldoyle), H2 (from Malahide) and H3 (from Howth) will provide greater levels of service to these residents and the surrounding communities.

There are two bus stops on Vernon Avenue; namely Bus Stop 7607 (c.6-minute walk) and Bus Stop 1651 (c. 7-minute walk). Both stops are served by the 104 Bus route (in opposite directions).

Bus No.	Route	Weekday Frequency	Saturday Frequency	Sunday Frequency
6	Howth Station towards Abbey Street Lower	30 - 60 mins	60 mins	60 mins
	Abbey Street Lower toward Howth Station	30 - 60 mins	60 mins	60 mins
H1	Baldoyle towards Abbey Street Lower	15 mins	20 mins	15 – 30 mins
	Abbey Street Lower towards Baldoyle	15 mins	20 mins	15 – 30 mins
H2	Malahide towards Abbey Street Lower	30 mins	40 mins	60 mins
	Abbey Street Lower towards Malahide	30 mins	40 mins	60 mins
H3	Howth Summit towards Abbey Street Lower	30 mins	40 mins	60 mins
	Abbey Street Lower towards Howth Summit	30 mins	40 mins	60 mins
104	Contraf Station towards DCU	60 mins	-	-
	DCU towards Clontraf Station	60 mins	-	-

***Table 2** | Existing Bus Routes*

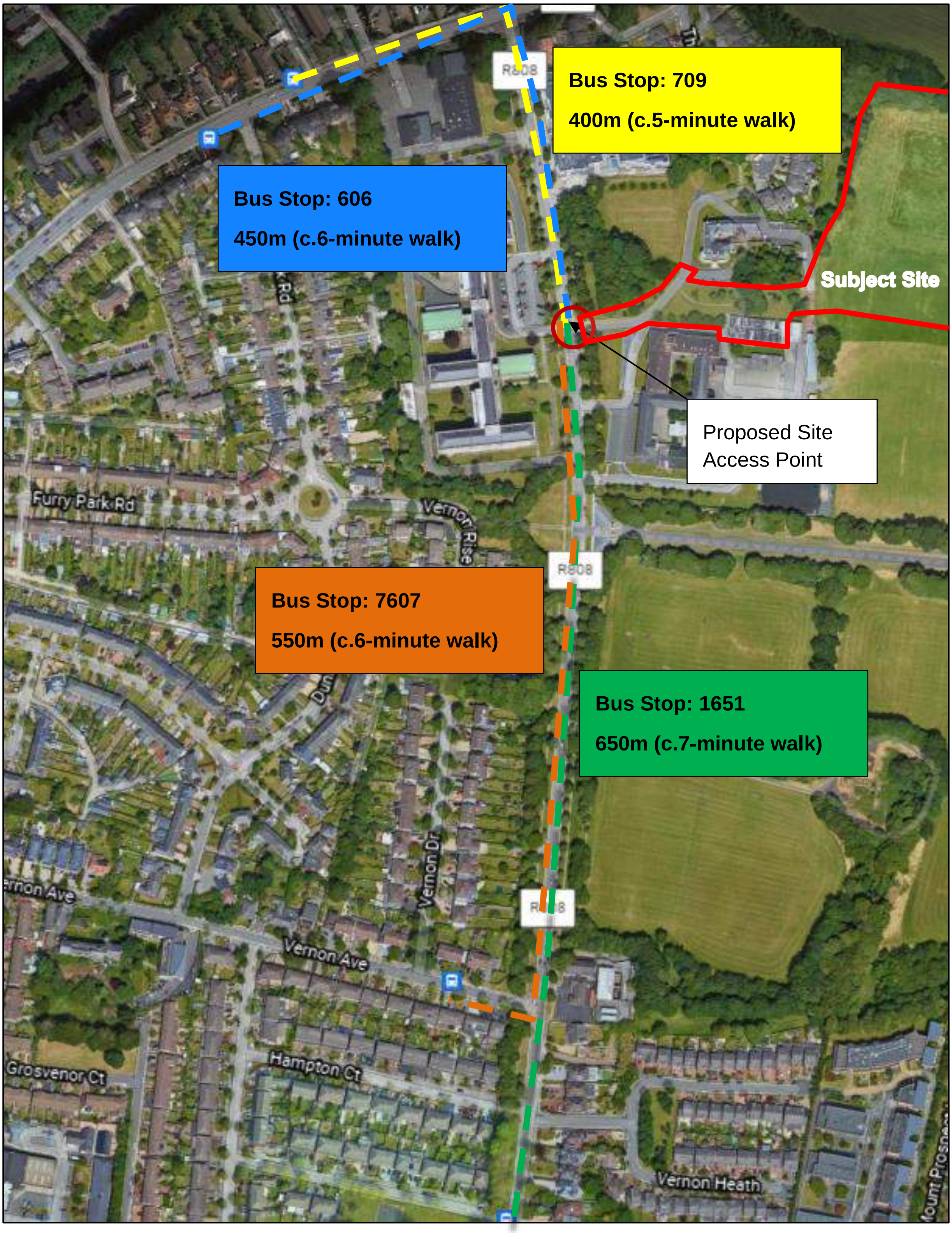


Figure 2 | *Existing Bus Stop Locations*

3. Existing Rail Services - Harmonstown and Killester Dart Station

The proposed development is also in close proximity to two Dart Stations: Harmonstown Dart Station and Killester Dart Station. This provides access to several areas in North and South Dublin. It is approximately 800m (c. 10-minutes walking) from the proposed development to Harmonstown Dart Station and 950m (c. 12-minutes walking) to Killester Dart Station. Figure 4 below shows the location of the dart dation relative to the proposed development.

There are 3 bicycle parking spaces available at Killester Station and no bicycle parking spaces at Harmonstown.

Figure 3 | *Location of the nearest Dart Station*

3.1 Dart Expansion Programme

The DART+ Programme aims to improve current rail services across Dublin City and Greater Dublin, by modernising and providing an electrified and more frequent and reliable rail service, enhancing capacity on the rail corridor. As part of the programme, the rail service between Drogheda and Dublin City Centre (via Malahide) is planned to be electrified with higher frequency. New rail frequency on the Malahide line has not been confirmed at the time of writing, however, significant increase in capacity is expected by purchase of new rolling stock.

4. Existing Modal Split

A full breakdown of the population is required for the modal split of the surrounding areas. Census 2016 was carried out by the Central Statistics Office on 24th April 2016.

With the objective to obtain information regarding ‘car ownership’ and ‘modal split for the journey to work, school or college’, the existing residential areas surrounding the proposed development. For the purpose of the 2016 survey, these areas have been divided in 4 Areas. These consulted Small Areas are illustrated in Figure 4.

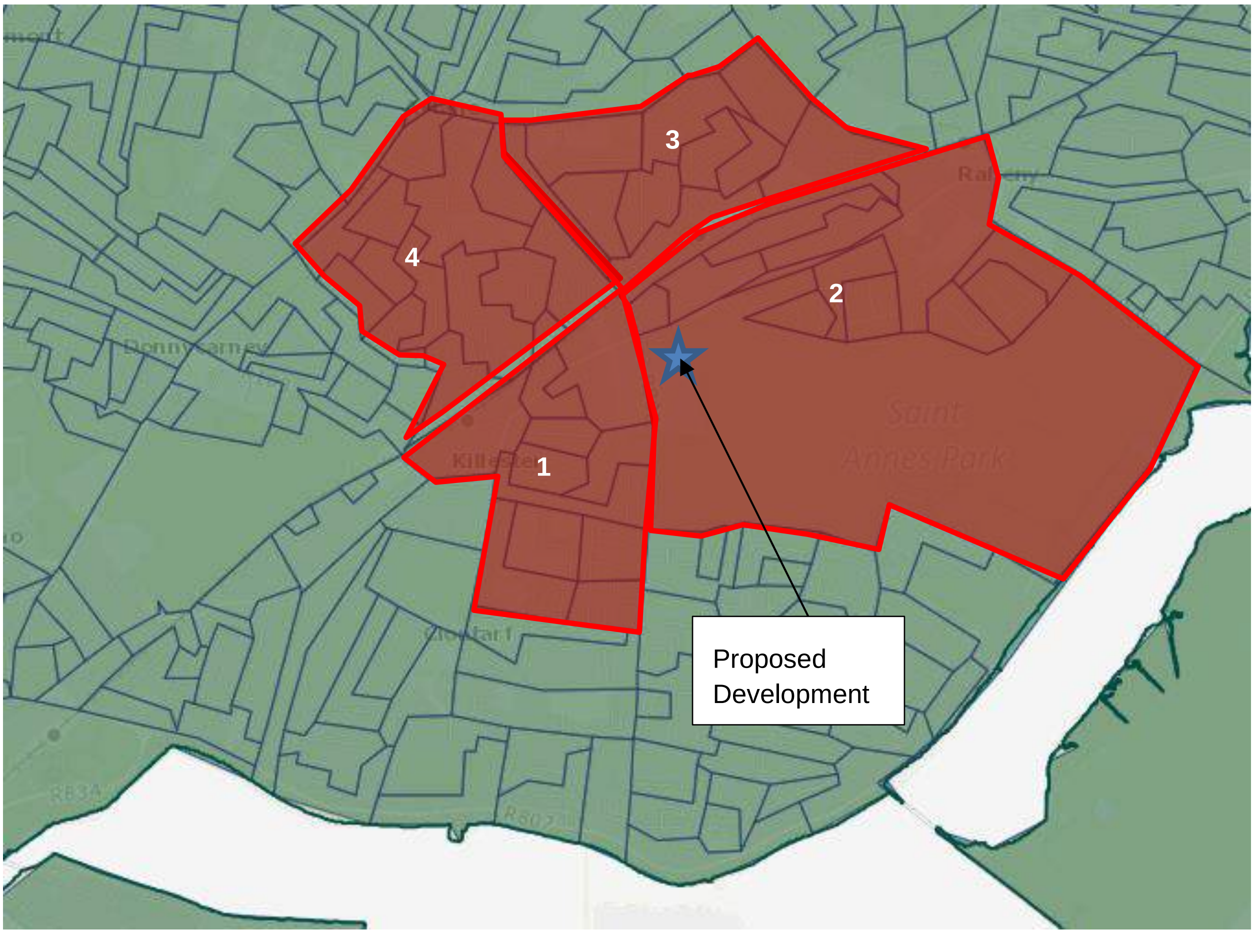


Figure 4 | *SapMap Areas*

The existing modal split for the journey to work by the residents at the Small Areas (Zones) as surveyed in Census 2016 is presented in Table 2

Area	*Pop.*	*Trip Attractor*	*Car Driver*	*Car Passenger*	*Train*	*Bus*	*Cycle*	*On Foot*	*Others or Not Stated*	*Total*
1	*2906*	*Work*	607	18	235	85	122	67	29	1163
			52%	2%	20%	7%	10%	6%	2%	100%
		College	17	187	76	77	58	206	5	626
			3%	30%	12%	12%	9%	33%	1%	100%
2	*3438*	*Work*	609	29	291	105	136	58	30	1258

			48%	2%	23%	8%	11%	5%	2%	100%
		College	20	152	77	110	47	328	10	744
			3%	20%	10%	15%	6%	44%	1%	100%
3	*3442*	*Work*	484	24	255	120	101	64	28	1076
			45%	2%	24%	11%	9%	6%	3%	100%
		College	12	155	52	89	51	220	19	598
			2%	26%	9%	15%	9%	37%	3%	100%
4	*2693*	*Work*	504	21	265	160	140	60	37	1187
			42%	2%	22%	13%	12%	5%	3%	100%
		College	13	138	43	80	69	123	23	489
			3%	28%	9%	16%	14%	25%	5%	100%
Total	*12,479*	*Work*	2204	92	1046	470	499	249	124	4684
			47%	2%	22%	10%	11%	5%	3%	100%
		College	62	632	248	356	225	877	57	2457
			3%	26%	10%	14%	9%	36%	2%	100%

***Table 3** | Existing Modal Split Census 2016*

The surveyed 'modal split for the journey to work, school or college' by the residents at the four consulted areas as surveyed in Census 2016 recorded that 57% of 12,479 population generated 7,141 trips for the journey to work, school or college. Work trips made up for 66% of trips generated in the area, some 49% were by car, 22% by Train, 10% by Bus, 11% by Bicycle, 5% On foot and 3% were others or not stated. College trips made up 34% of the trips generated in the area, some 29% were by car (26% of these were car passenger), 10% by Train, 14% by Bus, 9% by Bicycle, 36% by Foot, and 2% were others or not stated.

5. Bus Capacity

In order to assess the existing capacity of the existing buses available to the proposed development, the maximum capacity of each bus was found by assessing the current fleet of buses currently used by Dublin Bus.

The passenger capacities of the double deck buses in the current Dublin Bus fleet below reproduced from the Dublin Bus website are shown in Table 3. The passenger capacity of each bus including standing is some 87 passengers on the basis of the average capacity of the fleet of buses available at Dublin Bus.

However, for the purpose of this report, standing passengers have been excluded and the capacity of the double decker buses in operation with Dublin Bus and GoAhead on the various routes surveyed has been conservatively taken as an average of 67 seats.

Quantity	Manufacturer	Type	Fleet Code	Passenger Capacity
76	Volvo	B7TL with ALX400 bodywork	AV	91
70	Volvo	B9TLT (Euro 4) with Enviro500 bodywork	VT	119–124
192	Volvo	B7TL (Mk. II) with ALX400 bodywork	AX	91
97	Volvo	B9TL (Euro 4) with Enviro400 bodywork	EV	94
50	Volvo	B9TL (Euro 4) with Gemini bodywork	VG	88
160	Volvo	B9TL (Euro 5) with Gemini bodywork	GT	78–81
369	Volvo	B5TL (Euro 6) with Gemini 3 bodywork	SG	95

Table 4 | *Bus Capacity*

6. Dart Capacity

The train capacities used in Table 2 have been based on Appendix C from the NTA *Heavy Rail Census* 2019. Appendix C from the Census is reproduced as Table 4 below.

Appendix C: Train Capacity by Type

Train Type		Capacity	
4-DART	(4 car DART set)	700	- Seats + Standing Accommodation
6-DART	(6 car DART set)	1050	- Seats + Standing Accommodation
8-DART	(8 car dart set)	1400	- Seats + Standing Accommodation
2 x 2600	(2 car commuter rail car)	206 -	Seats + Standing Accommodation
2 x 2800	(2 car commuter rail car)	221	- Seats + Standing Accommodation
4 x 29000	(4 car Commuter railcar)	640	- Seats + Standing Accommodation
8 x 29000	(8 car Commuter railcar)	1280	- Seats + Standing Accommodation
1 x 3ICR	(3-car InterCity railcar)	190	- Seats
1 x 6ICR	(6-car Premier Class InterCity railcar)	376	- Seats
1 x 6HCR	(6-car High Capacity InterCity Railcar)	406	- Seats
7 x MkIV	(7 car Mk IV set)	348	- Seats
7 x DD	(7 car De Dietrich set)	358	- Seats

Table 5 | *Dart Capacity*

7. Bus Survey on Howth Road

The nearest bus stop to the subject site is the Bus Stop no. 606 on Howth Road travelling towards the city centre. The bus capacity survey was undertaken by Waterman Moylan on citybound services during the AM Peak between 07:00 and 09:00 on Monday 25th July 2022.

Time	Route	Passengers	Spare Capacity
7.02	H2	0	67
7.08	H1	7	60
7.19	H3	3	64
7.27	H1	13	54
7.29	H2	20	47
7.37	6	10	57
7.40	H1	27	40
7.50	H1	27	40
7.52	H3	34	34
8.08	H2	17	50
8.09	H1	34	34
8.11	6	13	54
8.19	H3	20	47
8.27	H1	20	47
8.37	H2	13	54
8.09	H1	10	57
8.50	6	0	67
8.52	H3	13	54
8.54	H1	10	57

Table 6 | *Bus Survey Results*

For the 15-minute interval survey in Table 6, it will be seen that the busiest period in terms of passenger's loadings occurs between 08:00 and 09:00.

The passenger numbers were relatively consistent after the hours 07:00 – 08:00 during the survey with hourly loadings of 141 – 278 per hour varying as follows:

- 7.00 – 8.00: 141 passengers per hour
- 7.15 – 8.15: 198 passengers per hour

- 7.30 – 8.30: 255 passengers per hour
- 7.45 – 8.45: 278 passengers per hour
- 8.00 – 9.00: 204 passengers per hour.

The loadings and spare capacity during the AM Peak Hour 07:00 – 08:00 are presented in Table 6. From Table 7, it will be seen that some 30% of the 670 seats on the 10 buses were occupied and 70% were spare.

Overall, between 07:00 and 09:00, the seats filled amounts to 32% of the total capacity and the empty seats amounted to 68% of the total capacity.

Period	No. of Buses	Passengers	Spare Capacity Seats
7.00 – 7.15	2	7	127
7.15 – 7.30	3	37	97
7.30 – 7.45	2	37	97
7.45 – 8.00	2	60	74
8.00 - 8.15	3	64	137
8.15 – 8.30	2	94	40
8.30 – 8.45	2	23	111
8.45 – 9.00	3	23	178
Total	19	345	861

Table 7 **|** *Bus Survey - 15 minute intervals*

Period	No. of Buses	Passengers	Spare Capacity Seats
8.00 - 8.15	3	64	137
8.15 – 8.30	2	94	40
8.30 – 8.45	2	23	111
8.45 – 9.00	3	23	178
Total	10	204	466

Table 8 **|** *Peak Hour Capacity*

A total of 466 seats are in spare capacity. This survey was completed outside the school year and therefore in order to get a more robust assessment 40% of the spare capacity has been removed. This 40% is based on the existing model split for the area extracted from the Small Areas Maps Census 2016. The spare capacity for bus services is 280 seats.

8. Dart Survey

8.1 Rail Travel – Census 2019

The National Heavy Rail Census was carried out by Iarnord Eireann in 2019 on behalf of the Natila Transport Authority (NTA). The final report published in July 2020 recorded ongoing annual increases in passenger numbers at all Dart Stations Station. These increases are likely to continue for a number of years into the future.

As part of this assessment, only the AM peak hour travelling towards the City Centre (Southbound) will be assessed. The majority of people will be travelling to the city centre for school or employment and the busiest Dart Stations are Connolly, Tara Street and Pearse Station which are further southbound to Harmonstown and Killester. The Dart Stations assessed are as follows:

- Malahide Station
- Portmarnock Station
- Clongriffin Station
- Howth Station
- Sutton Station
- Bayside Station
- Howth Junction/ Donaghmede Station
- Killbarack Station
- Rahney Station
- Harmonstown Station
- Killester Station

There are two separate routes for the Dart which begin at Malahide Station or Howth Station. Both routes connect at Howth Junction/Donaghmede Station as shown in the figure below. For the purposes of this assessment, each station will be assessed individually and based on the number of Darts that arrive within the AM peak hour.

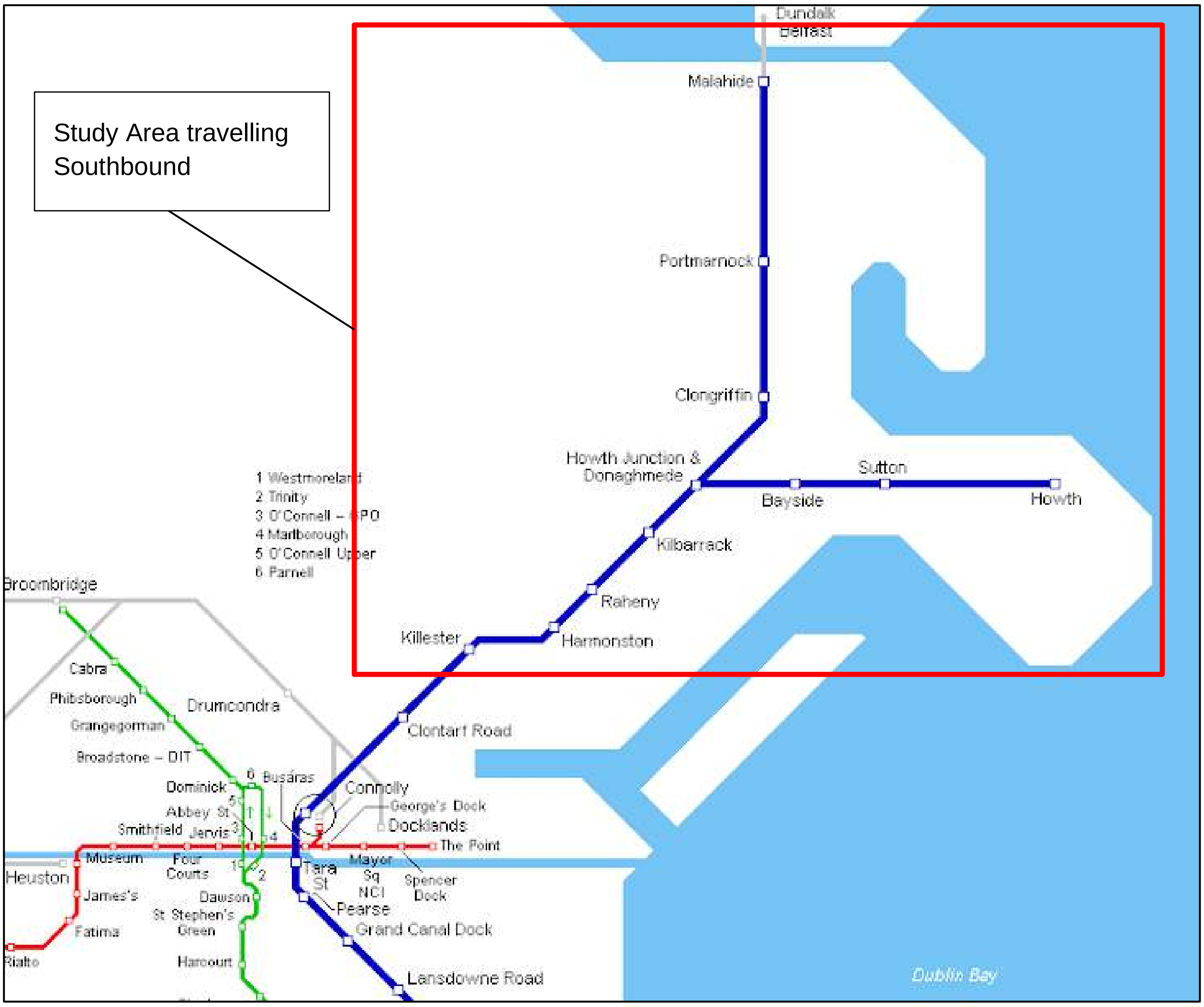


Figure 5 | *Dart Stations Assessed*

The results of the census for passengers' numbers per day at Harmonstown and Killester are presented in the tables below.

Station	Activity	2019	2018	2017	2016	2015	2014	2013
Malahide	Boardings	3456	3952	3324	2626	2604	2086	2177
	Alightings	3597	3629	3030	2158	2508	1992	2178
Portmarnock	Boardings	2121	1401	1981	1450	1191	1182	1186
	Alightings	1318	1289	1729	974	899	940	978
Clongriffin	Boardings	1640	1576	1296	1256	1013	830	767
	Alightings	1706	1431	1219	985	875	726	567
Howth	Boardings	1379	1805	1439	1240	1259	875	1073
	Alightings	1329	1625	1560	1138	1286	898	1225

Sutton	Boardings	931	1004	974	963	741	669	689
	Alightings	914	912	919	662	536	640	616
Bayside	Boardings	1329	1799	1502	1400	1403	1222	1156
	Alightings	1341	1211	1281	1250	1113	1091	1048
Howth Junciton	Boardings	1727	1886	2163	1818	1715	1613	1667
	Alightings	2015	2151	2169	2044	2179	1708	1836
Killbarack	Boardings	1663	1694	1516	1373	1368	1106	1043
	Alightings	1473	1663	1552	1331	955	1112	1072
Rahney	Boardings	2207	2417	2150	2024	1883	1758	1641
	Alightings	2131	2254	2089	2161	1789	1698	1493
Harmonstown	Boardings	1406	1609	1314	1396	1071	998	1011
	Alightings	1310	144	1284	1312	990	897	823
Killester	Boardings	2665	2347	2197	2225	1786	1595	1575
	Alightings	2052	2061	2024	2170	1547	1511	1386

***Table 9** | Daily Boarding and Alighting Numbers (2013 – 2019)*

Station	Activity	Southbound (2019)
Malahide	Boardings	2229
	Alightings	0
Portmarnock	Boardings	1538
	Alightings	47
Clongriffin	Boardings	1301
	Alightings	101
Howth	Boardings	1377
	Alightings	23
Sutton	Boardings	843
	Alightings	72
Bayside	Boardings	1160
	Alightings	133
Howth Junciton	Boardings	1124
	Alightings	425
Killbarack	Boardings	1340

	Alightings	339
Rahney	Boardings	1976
	Alightings	232
Harmonstown	Boardings	1262
	Alightings	145
Killester	Boardings	2391
	Alightings	252

Table 10 **|** *2019 Southbound - Passenger Numbers*

8.2 Daily Rail Passenger Numbers 2022

In order to calculate the Daily passengers for 2022, the census data from 2013 – 2019 was used to calculate a growth rate which can be applied to the 2019 passenger numbers. These growth rates were found using Table 7 above.

Station	Activity	Southbound (2022)
Malahide	Boardings	2790
	Alightings	0
Portmarnock	Boardings	2058
	Alightings	54
Clongriffin	Boardings	1936
	Alightings	188
Howth	Boardings	1545
	Alightings	24
Sutton	Boardings	970
	Alightings	87
Bayside	Boardings	1234
	Alightings	149
Howth Junciton	Boardings	1141
	Alightings	443
Killbarack	Boardings	1681
	Alightings	393
Rahney	Boardings	2268
	Alightings	274
Harmonstown	Boardings	1473
	Alightings	182

Killester	Boardings	3100
	Alightings	304

***Table 11** | 2022 - Southbound - Passenger Numbers*

8.3 Peak hour Rail Boardings 2022

The hourly profile surveyed during the Rail Census recorded that 17% of the overall daily passenger demand occurred during the AM peak hour.

The proportion of passenger numbers during the AM Peak Hour varies significantly with the location of the rail station whether the city centre or the Greater Dublin Area.

It was assumed that 25% of the daily boarding and alighting occur during the AM Peak hour. Based on these assumptions, the peak hour passenger numbers for the Stations in 2022 are presented in the table below.

Station	Activity	Southbound (AM Peak Hour)
Malahide	Boardings	698
	Alightings	0
Portmarnock	Boardings	514
	Alightings	14
Clongriffin	Boardings	484
	Alightings	47
Howth	Boardings	386
	Alightings	6
Sutton	Boardings	242
	Alightings	22
Bayside	Boardings	309
	Alightings	37
Howth Junciton	Boardings	285
	Alightings	111
Killbarack	Boardings	420
	Alightings	98
Rahney	Boardings	567
	Alightings	69
Harmonstown	Boardings	368

	Alightings	45
Killester	Boardings	775
	Alightings	76

***Table 12** | AM Peak Hour - Passenger Numbers*

8.4 Additional Rail Passengers – Capacity

Details of train capacity by type are set out in Appendix C of the National Rail Census 2019. Due to the large volume of passengers during the peak hour, the '8 car Dart set' is assumed to be used. This '8 car Dart set' has the capacity for 1,400 passengers both sitting and standing.

Based on the information given on the Irish Rail Website, during the hours of 6.50am to 8pm there is a Dart train every 10-minutes on the Howth to Bray section of the line and every 30 minutes on the Malahide to Greystones section of the line.

A breakdown of how many Dart trains will service each station is shown below.

Station	No. Of Darts within AM Peak Hour	Average No. of Passenger per Dart (Boarding – Alightings)
Malahide	2	349
Portmarnock	2	250
Clongriffin	2	55
Howth	6	63
Sutton	6	37
Bayside	6	45
Howth Junction	8	22
Killbarack	8	40
Raheny	8	62
Harmonstown	8	40
Killester	8	87

***Table 13** | No. of Darts per Station (AM peak Hour)*

Based on table 11 above the average number of passengers per Dart train can be calculated for the AM peak hour travelling southbound. This was done for two separated scenarios:

- Scenario 1: Howth Station to Killester Station
- Scenario 2: Malahide Station to Killester Station

The assessment will be based on the capacity of the '8 car Dart set' of 1400 and if the boardings per station greater than 1400 then the Dart is considered over capacity. The tables below show the results.

Scenario 1 – Howth to Killester			
Station	Boardings	Alightings	No. of Passengers per Dart
Howth	64	1	63
Sutton	40	4	100
Bayside	51	6	145
Howth Junction	36	14	167
Killbarack	53	12	207
Raheny	71	9	270
Harmonstown	46	6	310
Killester	97	9	398

Table 14 **|** *Scenario 1 - Dart Capacity Assessment*

Scenario 2 – Malahide to Killester			
Station	Boardings	Alightings	No. of Passengers per Dart
Malahide	349	0	349
Portmarnock	257	7	599
Clongriffin	60	6	654
Howth Junction	36	14	676
Killbarack	53	12	716
Raheny	71	9	778
Harmonstown	46	6	819
Killester	97	9	906

Table 15 **|** *Scenario 2 - Dart Capacity Assessment*

Based on the results shown in the tables above Harmonstown Station will have a spare capacity of 581 to 1090 between sitting and standing. Killester station will have a spare capacity of 494 to 1002 spaces. This spare capacity is over the 8 Dart Trains servicing each station during the AM peak hour.

To obtain a more robust assessment the minimum spare capacity will be used as part of the assessment. This is 581 spare capacities available for Harmonstown and 494 spare capacities available for Killester.

9. Assessment of Spare Capacity – Bus Services

9.1 Design Population

Based on the Irish Water Standard of 2.6 persons per unit, the expected population of the proposed development is some 1508 persons (580 x 2.6 persons / unit).

9.2 Modal Split – Bus

Target modal splits for various location around Dublin City Council areas in 2028 are set in the DCC Draft Development Plan 2022 – 2028. At the time of writing this, the DCC Development Plan 2022 - 2028 is set to become active in August 2022.

The Target Modal Split for DCC lands is outlined below.

- Walking: 13%
- Cycling: 13%
- Public Transport (bus, rail, LUAS): 57%*
- Private Vehicles (Car, taxi, goods, motorcycles): 17%

*The increase in public transport mode share anticipates the construction of major public transport infrastructure that is proposed to occur over the lifetime of the plan. The impact of public transport infrastructure projects on mode share is more likely to come into fruition during the lifespan of the following plan.

If these targets are applied to the design population, the number of residents travelling to work or education by bus, rail or LUAS is expected to be 861. Based on the existing model split it is assumed that 75% of these expected trips will use the DART Services and the remaining 25% will use Bus services. Therefore, 215 persons are expected to use the bus service.

9.3 Demand for Bus Services

Up to 215 of the residents at the proposed development can be expected to travel to work or education by bus. Based on the location of the proposed development, it is expected 80% of the trips will travel southbound towards the city centre with 50% travelling in the AM Peak Hour.

Based on these proportions, the expected demand for southbound services from the proposed development is 86 persons.

9.4 Bus Capacity

The average bus capacity has been taken at 67 seats per bus as Section 5.0 of this report.

9.5 Demand vs Capacity

Based on the survey earlier in this report, the spare capacity on inbound bus services to the City Centre during the AM Peak hour of 08:00 – 09:00 is 280 seats per hour (10 buses) as set out in Table 7.

From Table 7, it will be seen that the spare capacity during the AM Peak Hour 08:00 – 09:00 (280 seats) is some 42% of the overall capacity (670 seats). This spare capacity is particularly robust as is excludes standing passengers and Bus Eireann services.

In terms of spare capacity for the proposed development on the subject site, this spare capacity is significantly greater than the future additional demand of 86 passengers during the same period.

10. Assessment of Rail Capacity – Rail Services

10.1 Design Population

Based on the Irish Water Standard of 2.6 persons per unit, the expected population of the proposed development is some 1508 persons (580 x 2.6 persons / unit).

10.2 Modal Split – Rail

Target modal splits for various location around Dublin City Council areas in 2028 are set in the DCC Draft Development Plan 2022 – 2028.

The Target Modal Split for DCC lands is outlined below.

- Walking: 13%
- Cycling: 13%
- Public Transport (bus, rail, LUAS): 57%*
- Private Vehicles (Car, taxi, goods, motorcycles): 17%

*The increase in public transport mode share anticipates the construction of major public transport infrastructure that is proposed to occur over the lifetime of the plan. The impact of public transport infrastructure projects on mode share is more likely to come into fruition during the lifespan of the following plan.

If these targets are applied to the design population, the number of residents travelling to work or education by bus, rail or LUAS is expected to be 861. Based on the existing model split it is assumed that 75% of these expected trips will use the DART Services and the remaining 25% will use Bus services. Therefore, 612 persons are expected to use the bus service.

10.3 Demand for Rail Services

Up to 612 of the residents at the proposed development can be expected to travel to work or education by bus. Based on the location of the proposed development, it is expected 80% of the trips will travel southbound towards the city centre with 50% travelling in the AM Peak Hour.

Based on these proportions, the expected demand for southbound services from the proposed development is 245 persons.

10.4 Train Capacity

The capacity of the various railcars used on the Dart is presented in Table 4 of this report.

10.5 Demand vs Capacity

Based on the Rail Census 2019 surveys described earlier in this report, the spare capacity of inbound services to the City Centre (Southbound) during the AM Peak Hour 08:00 – 09:00 is 11,200 (8 Trains) as set out in Table 12.

In order to get a robust assessment, the demand vs capacity will take the minimum capacity value between both stations. From Table 13 and 14, taking the minimum capacity value, it will be seen that the spare capacity during the AM Peak Hour 08:00 – 09:00 (494 seats) is some 4.4% of the overall capacity (11,200).

In terms of spare capacity for the proposed development, this spare capacity is greater than the future additional demand of 245 passengers during the same period.

11. Conclusion

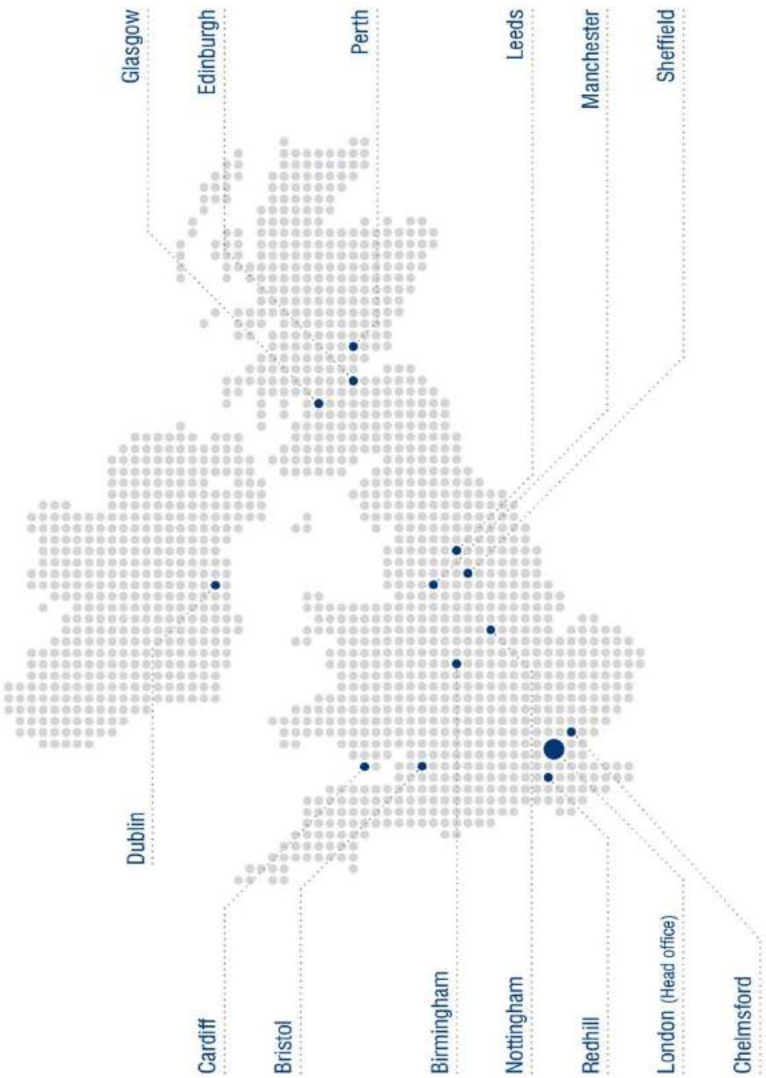
This public transport capacity assessment has been carried out by Waterman Moylan to assess the bus and train services that serve the subject site.

The assessment includes surveys of the current bus and rail usage, estimations of public transport use by residents of the completed development, application of appropriate growth factors, and an assessment to determine whether the existing transport network has capacity to cater for the proposed development.

Based on the assessment, as set out in the sections above, the is sufficient capacity in both the existing bus and rail networks to cater for the anticipated passenger journeys that will be generated by the proposed development.

Furthermore, proposed improvements to the public transport services, including the BusConnects project and the Dart Expansion Programme, as discussed in the Sections above, will enhance the transport options available to residents once implemented.

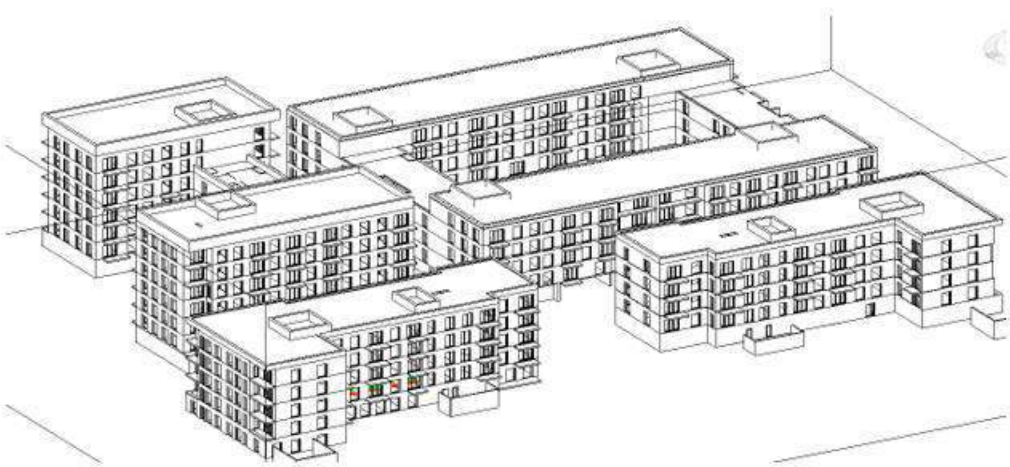
UK and Ireland Office Locations



Appendix P Mechanical and Electrical Utilities Report

Foxlands
Raheny

Lands east of St Paul's College
Sybil Hill Road
Raheny
Dublin 5



Raheny 3 Limited Partnership

M&E Utilities report
IN2 Project No. D2140
30th August 2022
Rev09

Revision History

Date	Revision	Description
24/11/2021	00	Initial issue for client review
13/12/2021	01	Planning Stage
13-05-2022	02	Planning Stage
27-05-2022	03	Planning Stage
08-07-2022	04	Planning Stage
25-07-2022	05	Planning Stage
02-08-2022	06	Planning Stage
16-08-2022	07	Planning Stage
29-08-2022	08	Amended with updated description of development
30-08-2022	09	Amended following design team comments

Registered Office:. Unit E, Mount Pleasant Business Park, Upper Mount Pleasant Avenue, Dublin 6

Company Registration No.: 466565

Table of Contents

1.0 Executive Summary

IN2 Engineering Design Partnership have been retained by Raheny 3 Limited Partnership to complete a Planning Stage Report for the proposed Residential development at Sybil Hill Road, Raheny, Co. Dublin.

The proposed development consists of the construction of a residential and nursing home development set out in 7 no. blocks, ranging in height from 4-7 storeys to accommodate 580 no. apartments, residential tenant amenity spaces, a crèche and a 100 bed nursing home. The site will accommodate car parking spaces, bicycle parking spaces, storage, services and plant areas at both basement and podium level. Landscaping will include extensive communal amenity areas, and a significant public open space provision on the east and south of the site. The proposed application includes all site landscaping works, green roofs, substations, boundary treatments, lighting, servicing, signage, surface water attenuation facilities and associated and ancillary works, including site development works and services above and below ground. For a full description of the proposed development please refer to the Statutory Notices.

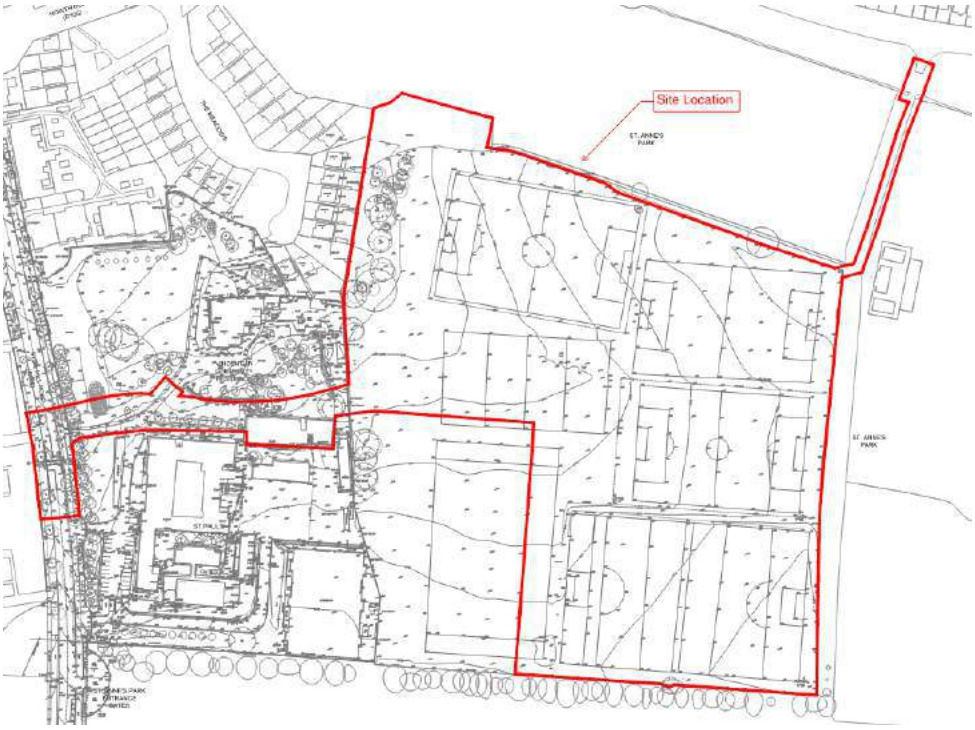


Fig 1.1 Site location & boundary (Indicative Only)

The existing infrastructure connections have been identified. The utility connections shall be decommissioned, isolated, and removed prior to the commencement of site construction.

New infrastructure connections have been considered in the design of the proposed residential development and there are no issues identified in preliminary analysis with infrastructure to supply the new development.

A comms frame room has been included in the basements for incoming telecoms connections to incoming telecoms service provider city network infrastructures this includes EIR and Virgin Media services.

The heating strategy for the apartments is a full electrical solution utilising electrically driven Exhaust Air Heat Pump and Air Source heat Pump plant. Therefore, no new natural gas connection is required for this development.

2.0 ESB Infrastructure

The site is well located with regards to ESB infrastructure. The ESB Networks drawing below indicates the network distribution capacity to Foxlands development.

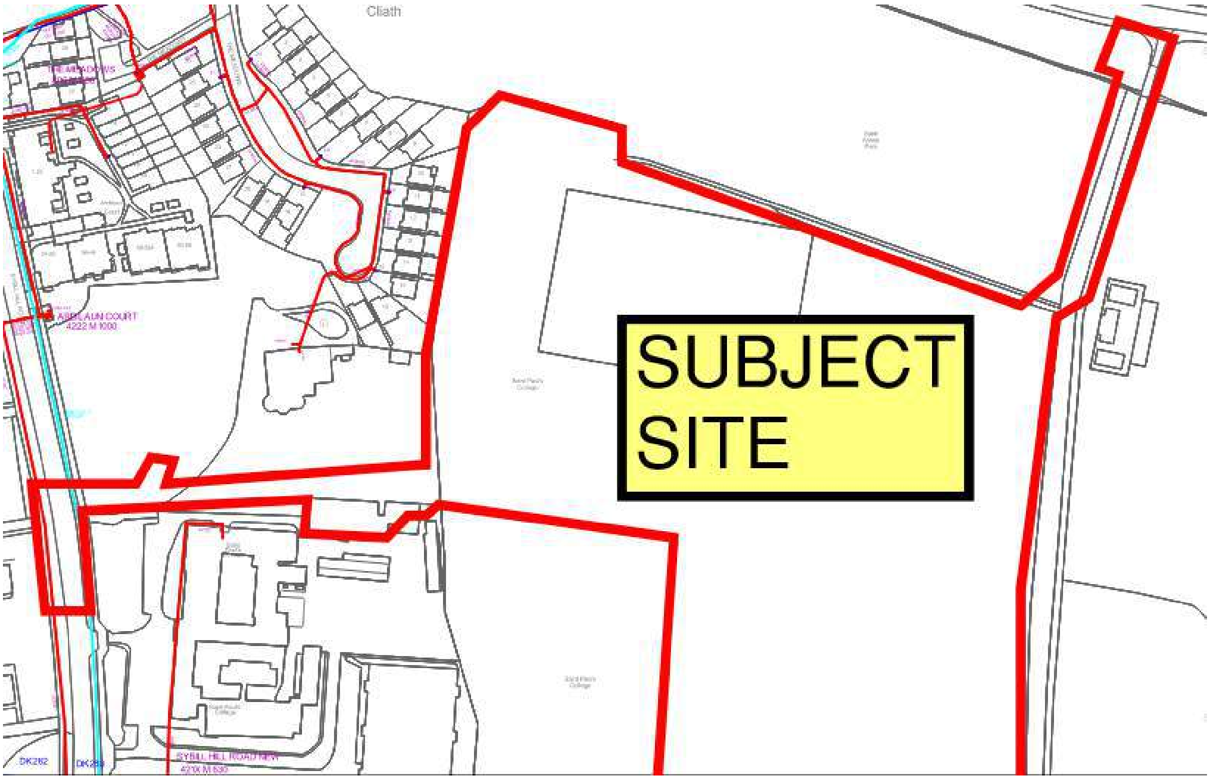


Fig 2.1 ESB Networks Map of Site Surrounds (Indicative Only)

Initial contact has been made with the ESB and there are currently no issues with the provision of the required power to the proposed development. There doesn't appear to be any cables traversing the site. There are 38kV and 20kV/10kV LV/MV underground cables on Sybil Hill road.

The power supply to support the new development has been discussed with utility provider, ESB Networks. The utility provider has raised no concerns providing power to the development. Only on planning application approval, can full formal application be made to ESB Networks. The proposed locations can be viewed in Figure 2.2 below.

Fig 2.2 Proposed location of new ESB sub-stations (Indicative Only)

3.0 Gas Infrastructure

The Gas Networks map for the surrounding area indicates buried natural gas pipework local to development to Sybil Road and neighbouring site. There appears to be no existing natural gas connection to the proposed site.

The utility strategy for the Foxlands residential development is to avail of a decentralised heating plant consisting of electrically driven exhaust air heat pumps located within the apartments and air source heat pumps for amenity spaces.

No natural gas supply is required for the development.

Fig 3.1 Gas Networks Map of Site Surrounds (Indicative Only)

4.0 Telecoms - EIR

EIR infrastructure indicates buried telecom network local to development to Sybil Road and Howth Road and neighbouring sites. There appears to be no existing telecom network connection to the proposed site.

The telecom network supply to support the new development has been discussed with utility provider, Eir. The utility provider has raised no concerns providing telecom services to the development at this stage. Only on full planning application approval, can full formal application be made to Eir.

It is proposed to provide a new Landlord comms room in the basements where all incoming telecoms providers shall terminate their incoming cables. A new fibre cable connection shall be provided to the development.

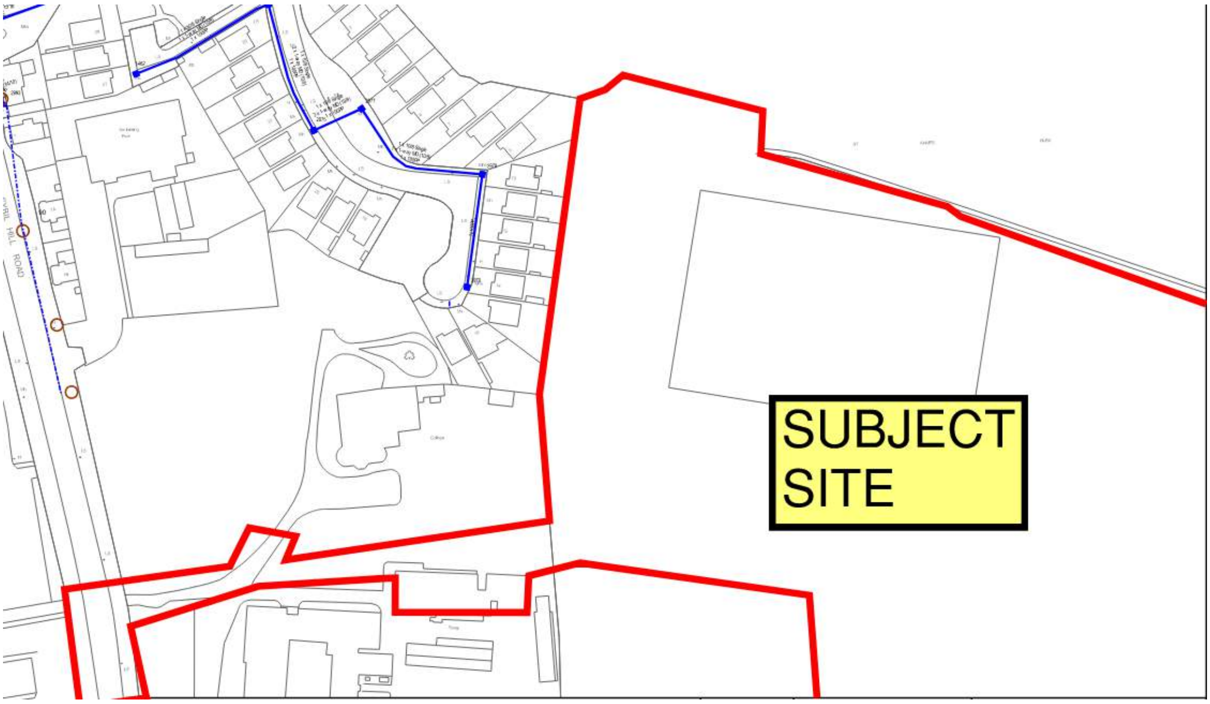


Fig 4.1 EIR Networks Map of Site Surrounds (Indicative Only)

5.0 Telecoms - Virgin Media

Virgin Media infrastructure indicates buried telecom network local to development to Sybil Road and Howth Road and neighbouring sites. There appears to be no existing telecom network connection to the proposed site.

The telecom network supply to support the new development has been discussed with utility provider, Virgin Media. The utility provider has raised no concerns providing telecom services to the development at this stage. Only on full planning application approval, can full formal application be made to Virgin Media.

It is proposed to provide new Landlord comms room in the basements where all incoming telecoms providers shall terminate their incoming cables. A new fibre cable connection shall be provided to development.

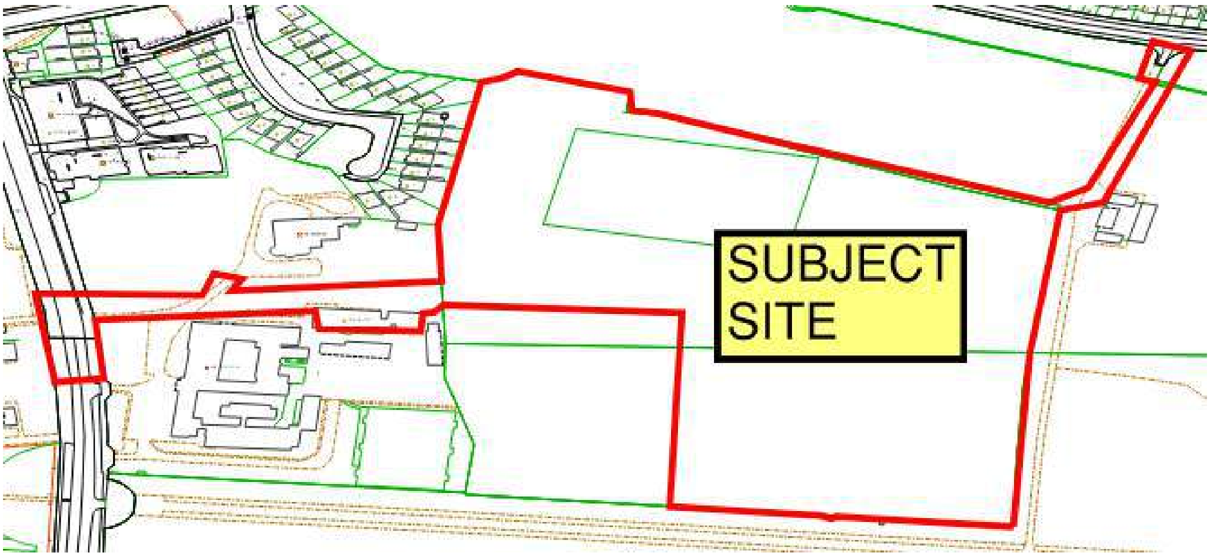


Fig 5.1 Virgin Media Networks Map of Site Surrounds (Indicative Only)

6.0 Electric Vehicles Infrastructure

The development will include Electric Vehicle (EV) charging points to 59 no. spaces of the parking spaces. There will be EV charging infrastructure, comprising cable ducting systems, cable ladders, cable trays, cable trunking systems, conduit, etc., provided to every parking space in compliance with Part L 2021 building regulation requirements.

The Car Parking Strategy provides for a total of **520 Car Parking spaces (59 EV spaces)**, as follows:

Description		Proposed Car Parking				
		Standard	*Accessible*	*EV*	*Dropoff*	**Total**
Apartment Blocks	Block A	41	2	7	1	51
	Block B	45	3	7	1	56
	Block C	75	5	9	-	89
	Block D	93	5	12	3	113
	Block E	64	4	8	-	76
	Block F	23	2	3	1	29
Mixed-Use (Block G)	Apartments	47	2	6	2	57
	Nursing Home	23	9	7	2	41
	Crèche	5	1	-	2	8
Total		**416**	**33**	**59**	**12**	**520**

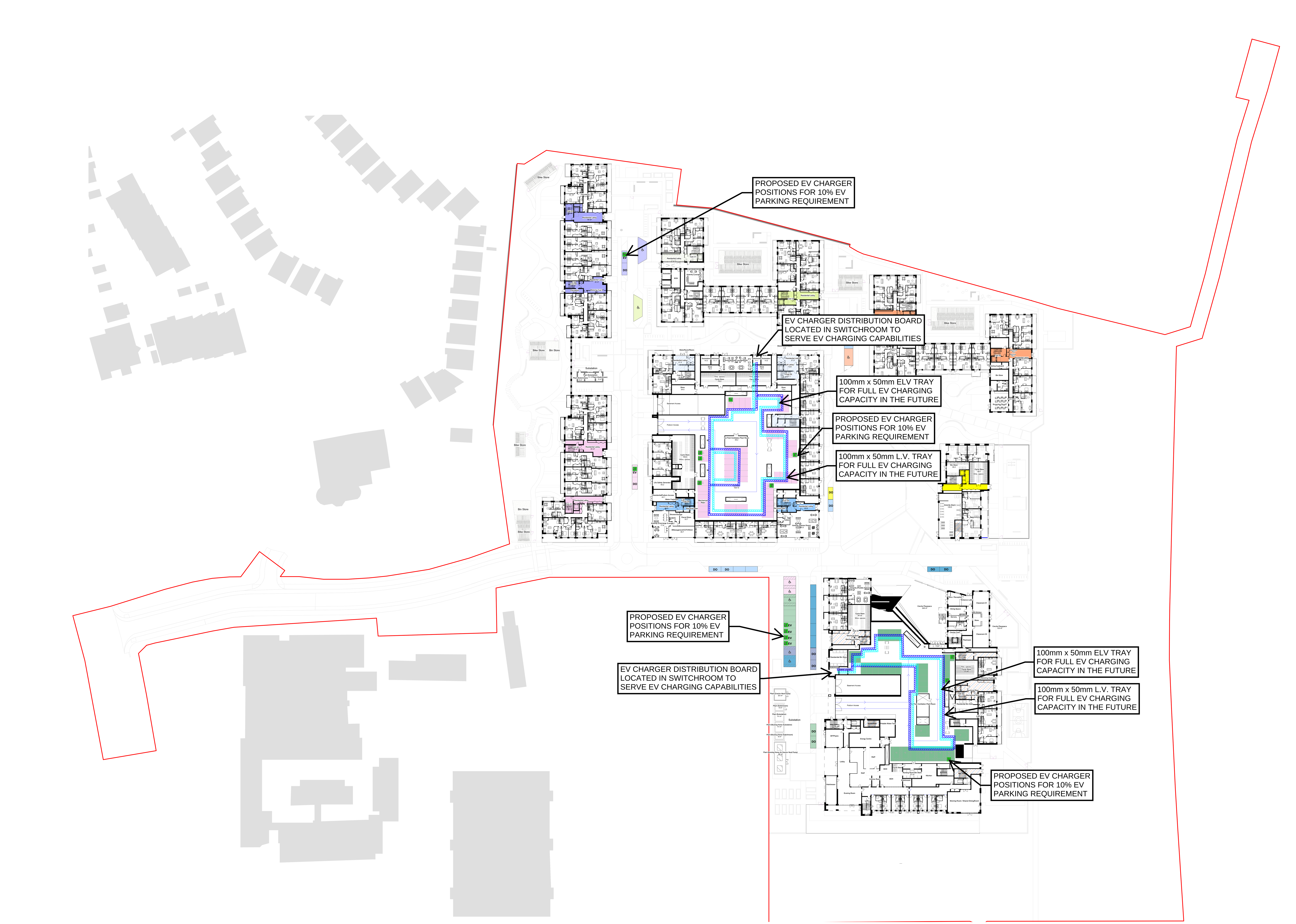
The infrastructure will be routed back to a dedicated EV charger boards with their own ESB Electricity Meter connection. The EV infrastructure will be adequately designed to meet the full capacity of all recharging points when installed and appropriately sized for EV charging point capacity. The ESB sub-stations have been sized to accommodate the electrical loads associated with the future provision of EV charging to all parking spaces.

The ducting infrastructure will be fit for purpose, capped as appropriate and clearly identified. Adequate space will be provided to accommodate all EV Charing point ducting connections and electrical supply equipment and will be adequately designed for maintenance access.

The complete EV infrastructure installations, including associated electrical equipment, etc. will be installed in accordance with the general wiring rules and safety requirements as outlined in the National Rules for Electrical Installations I.S. 10101:2020.

See the following drawings for a preliminary layout for the basement and podium EV infrastructure as listed below;

- D2140-IN2-01-00-DR-E-7001 EV LAYOUT
- D2140-IN2-01-B1-DR-E-7001 EV LAYOUT



DRAWING REFERENCE KEY

EV CHARGER

LV CABLE TRAY (SIZE AS INDICATED)

ELV CABLE TRAY (SIZE AS INDICATED)

IN2 DUBLIN
IN2 Engineering Design Partnership
Unit E&F, Mountpleasant Business Centre,
Mountpleasant Avenue Upper, D06 P5N8

t: +353 (0)1 496 0900
e: info@in2.ie
w: www.in2.ie

STATUS	DATE	DESCRIPTION	DRN	ENG	APP
P1-2	31-08-2022	PLANNING STAGE ISSUE	DS	LHC	JR
P1-1	02-08-2022	PLANNING STAGE ISSUE	DS	LHC	JR

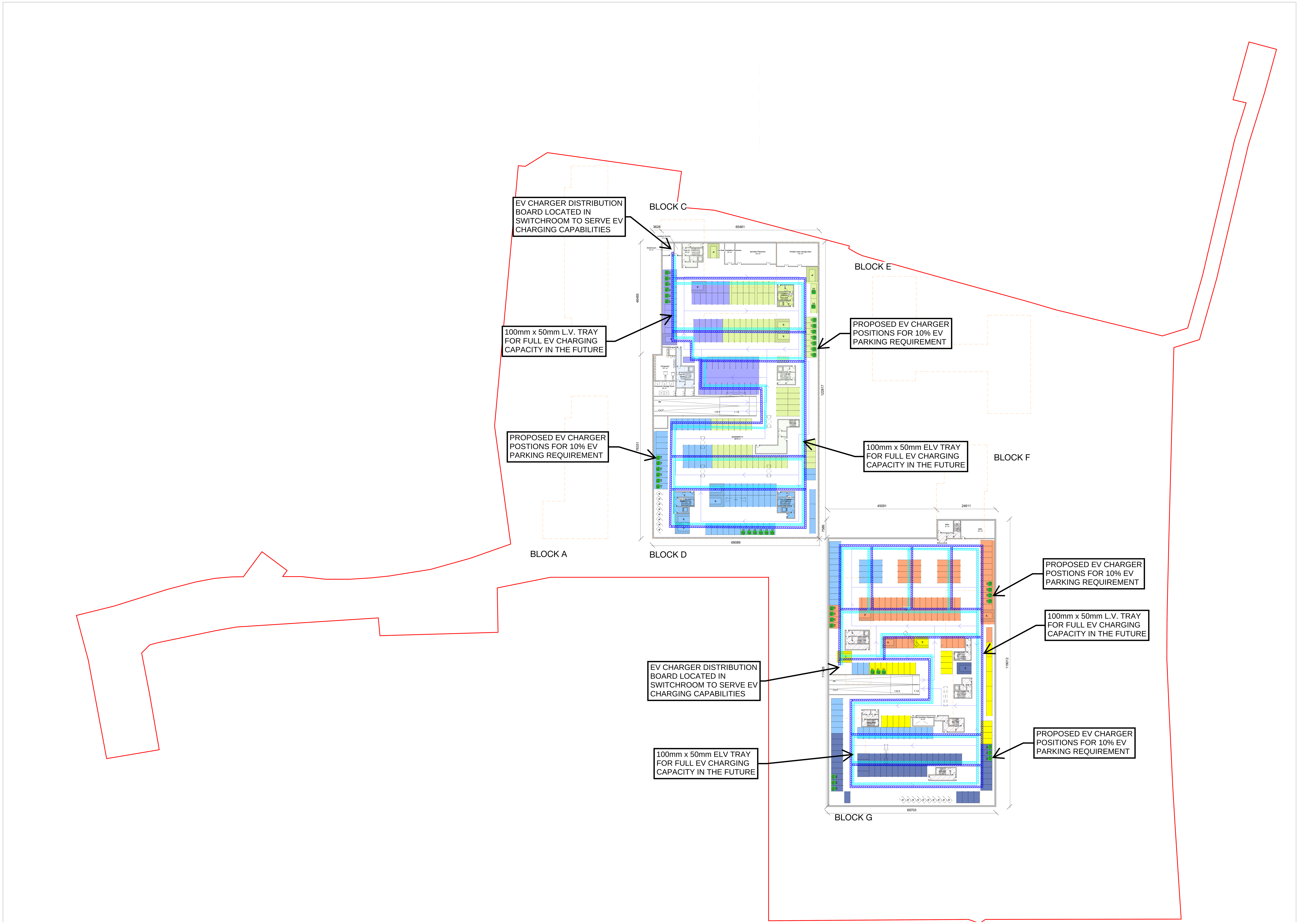
PROJECT
FOXLANDS RESIDENTIAL

CLIENT
MARLET PROPERTY GROUP

DRAWING TITLE
ELECTRICAL SERVICES INSTALLATION
PODIUM PLAN
ELECTRIC VEHICLE (EV) INFRASTRUCTURE LAYOUT

STATUS
P1-2

IN2 REF:	DRAWING No.	SCALE	SIZE
D2140	D2140-IN2-01-00-DR-E-7001	1: 500	A1



DRAWING REFERENCE KEY

EV CHARGER

LV CABLE TRAY (SIZE AS INDICATED)

ELV CABLE TRAY (SIZE AS INDICATED)

IN2 DUBLIN
IN2 Engineering Design Partnership
Unit E&F, Mountpleasant Business Centre,
Mountpleasant Avenue Upper, D06 P5N8

t: +353 (0)1 496 0900
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w: www.in2.ie

STATUS	DATE	DESCRIPTION	DRN	ENG	APP
P1-2	31-08-2022	PLANNING STAGE ISSUE	DS	LHC	JR
P1-1	02-08-2022	PLANNING STAGE ISSUE	DS	LHC	JR

PROJECT
FOXLANDS RESIDENTIAL

CLIENT
MARLET PROPERTY GROUP

DRAWING TITLE
ELECTRICAL SERVICES INSTALLATION
PODIUM PLAN
ELECTRIC VEHICLE (EV) INFRASTRUCTURE LAYOUT

IN2

STATUS
P1-2

IN2 REF:	DRAWING No.	SCALE	SIZE
D2140	D2140-IN2-01-B1-DR-E-7001	1: 500	A1

IN2 Engineering Design
Unit E&F
Mount Pleasant Business Park
Upper Mount Pleasant Avenue
Dublin 6
(01) 496 0900

info@in2.ie

Appendix Q Verified Views

Raheny 3 Limited Partnership
Foxlands (St Paul's) Raheny

Method Statement - Photo-montage production.

1. Photographs are taken from locations as advised by client with a full frame SLR digital camera and prime lens. The photographs are taken horizontally with a survey level attached to the camera. The photographic positions are marked (for later surveying), the height of the camera and the focal length of the image recorded.

2. In each photograph, a minimum of 3no. visible fixed points are marked for surveying. These are control points for model alignment within the photograph. All surveying is carried out by a qualified topographical surveyor using Total Station / GPS devices.

3. The photographic positions and the control points are geographically surveyed and this survey is tied in to the site topographical survey supplied by the Architect / client.

4. The buildings are accurately modelled in 3D cad software from cad drawings supplied by the Architect. Material finishes are applied to the 3D model and scene element are place like trees and planting to represent the proposed landscaping.

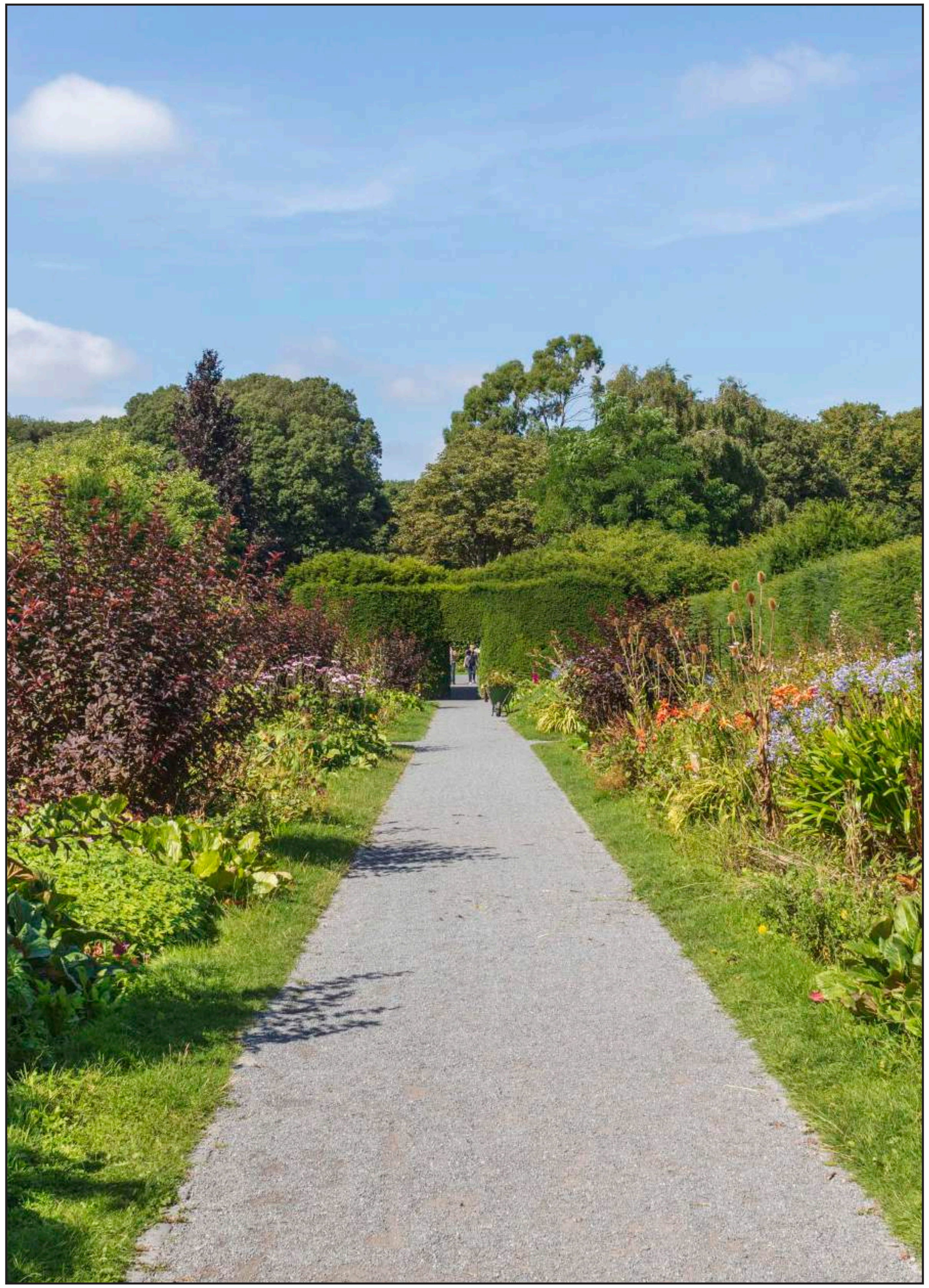
5. Virtual 3D cameras are positioned according to the survey co-ordinates and the focal length is set to match the photograph. Pitch and rotation are adjusted using the survey control points to align the virtual camera to the photograph. Lighting is set to match the time of day the photograph is taken.

6. The proposed development is output from the 3D software using this camera and the image is then blended with the original photograph to give an accurate image of what the proposed development will look like in its proposed setting.

7. In the event of the development not being visible, the roof line of the development will be outlined in red if re-quested.

8. The document contains:

a) Site location map with view locations plotted.
b) Photo-montage sheet with existing or proposed conditions.
c) Reference information including field of view/focal length, range to site / development, date of photograph.



View Location Map

This map is for view location purposes only. Please refer to Architects drawings for site layout and redline boundary.

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Existing	25/08/21	74°	24mm	500.2m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Proposed	25/08/21	74°	24mm	500.2m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Existing	25/08/21	74°	24mm	178.2m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Proposed	25/08/21	74°	24mm	178.2m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Existing	25/08/21	74°	24mm	206.4m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Proposed	25/08/21	74°	24mm	206.4m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Existing	25/08/21	74°	24mm	282.6m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Proposed	25/08/21	74°	24mm	282.6m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 5 Existing	25/08/21	74°	24mm	296.4m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 5 Proposed	25/08/21	74°	24mm	296.4m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 6 Existing	25/08/21	74°	24mm	104.6m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 6 Proposed	25/08/21	74°	24mm	104.6m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 7 Existing	25/08/21	74°	24mm	52.9m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 7 Proposed	25/08/21	74°	24mm	52.9m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 7a Existing	25/08/21	74°	24mm	52.9m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 7a Proposed	25/08/21	74°	24mm	52.9m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 8 Existing	25/08/21	74°	24mm	106.2m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 8 Proposed	25/08/21	74°	24mm	106.2m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 8a Existing	25/08/21	74°	24mm	106.2m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 8a Proposed	25/08/21	74°	24mm	106.2m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 9 Existing	25/08/21	74°	24mm	142.4m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 9 Proposed	25/08/21	74°	24mm	142.4m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 9a Existing	25/08/21	74°	24mm	142.4m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 9a Proposed	25/08/21	74°	24mm	142.4m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 10 Existing	25/08/21	74°	24mm	18.08m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 10 Proposed	25/08/21	74°	24mm	18.08m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 10a Existing	25/08/21	74°	24mm	18.08m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 10a Proposed	25/08/21	74°	24mm	18.08m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 10 Panoramic Existing	25/08/21			18.08m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 10 Panoramic	25/08/21			18.08m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 11 Existing	25/08/21	74°	24mm	285.11m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 11 Proposed	25/08/21	74°	24mm	285.11m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 12 Existing	25/08/21	74°	24mm	606.2m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 12 Proposed	25/08/21	74°	24mm	606.2m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 13 Existing	25/08/21	74°	24mm	139.9m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 13 Proposed	25/08/21	74°	24mm	139.9m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 13a Existing	25/08/21	74°	24mm	139.9m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 13 Proposed	25/08/21	74°	24mm	139.9m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 14 Existing	25/08/21	74°	24mm	5.01m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 14 Proposed	25/08/21	74°	24mm	5.01m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 15 Existing	25/08/21	74°	24mm	245.5m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 15 Proposed	25/08/21	74°	24mm	245.5m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 16 Existing	25/08/21	74°	24mm	151.4m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 16 Proposed	25/08/21	74°	24mm	151.4m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 17 Existing	25/08/21	74°	24mm	192.9m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 17 Proposed	25/08/21	74°	24mm	192.9m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 18 Existing	25/08/21	74°	24mm	469.3m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 18 Proposed	25/08/21	74°	24mm	469.3m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 19 Existing	25/08/21	74°	24mm	500.4m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 19 Proposed	25/08/21	74°	24mm	500.4m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 20 Existing	25/08/21	74°	24mm	841.17m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 20 Proposed	25/08/21	74°	24mm	841.17m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 21 Existing	25/08/21	74°	24mm	225.4m	Canon EOS 5DS

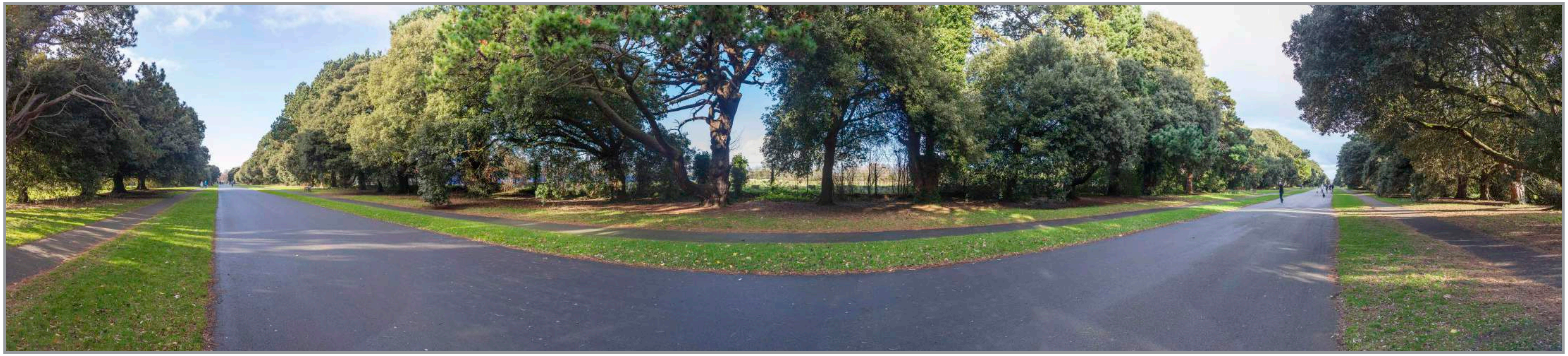
Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 21 Proposed	25/08/21	74°	24mm	225.4m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 22 Extg Panoramic	25/08/21			18.08m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 22 Prop Panoramic	25/08/21			18.08m	Canon EOS 5DS

Issue Date: 31 Aug 2022

digital dimensions
architectural visualisation