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Environmental Impact Assessment Report

Mixed Use Development - Opera Site, Limerick

Limerick City and County Council

March 2019

Prepared for:

Limerick City and County Council

Prepared by:

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1 Introduction

1.1 Proposed Development

The ‘Opera Site’ is located at the northern end of Limerick’s Georgian Quarter and measures c. 2.35 hectares. The Opera Site application proposes the redevelopment of an existing city block located on the south side of the River Abbey at the confluence with the River Shannon, adjacent to the Hunt Museum and east of Arthur’s Quay Shopping Centre. The site is bounded by Rutland Street and Patrick Street to the west, Ellen Street to the south, Michael Street to the east and Bank Place to the north.

Currently the Opera Site is a brownfield site at the heart of Limerick City Centre. The overall urban block is largely vacant and underutilised but has retained a number of active uses. The objective for the proposed development is to bring this key site back to full and productive use and make a major contribution to strengthening the city centre.

There are 3 No. buildings within the site included on the Record of Protected Structures. The Town Hall, Rutland Street, was built in 1805 and is currently vacant and in a state of serious disrepair. The Granary, Michael Street, is one of the earliest known multiple storey warehouses to be built in Limerick, dating from the late 1700s.The Bruce House Doorway, on Rutland Street, is a carved limestone Venetian door case, dated 1806, re-assembled on the façade of an infill neo-Georgian building, c. 1990.

A further 8 No. buildings on the site are included on the National Inventory of Architectural Heritage (NIAH). A number of these are vacant and in various stages of dereliction, despite a significant amount of remedial works undertaken by the Council in recent years to preserve their structural stability and architectural integrity.

The site is also host to the former Cahill May Roberts Building, fronting Bank Place, some existing and unused warehousing/workspace buildings at Bogue’s Yard and Watch House Lane. The southeast corner of the site currently includes a surface car park with approximately 100 No. spaces.

It is proposed to develop the ‘Opera Site’, as a mixed-use scheme, primarily office, supported by a range of retail & non-retail services, including; residential apart-hotel, civic/cultural uses (including a City Library in the existing Town Hall), cafes, bars, restaurants, and 3 No. new public plazas with including public realm improvements.

Existing heritage/protected buildings will be re-furbished and all the newer twentieth century buildings and later additions to existing heritage structures will be demolished. This includes the refurbishment of No. 9 Ellen St. to provide for a bar/restaurant/ café, refurbishment of the existing City Hall to provide for a new City Library and refurbishment of 12 No. Georgian terraced houses at Ellen Street, Patrick Street and Rutland Street. The existing Granary Building will be retained in office/restaurant/licenced premises uses.

The new build elements proposed for the scheme includes the following:

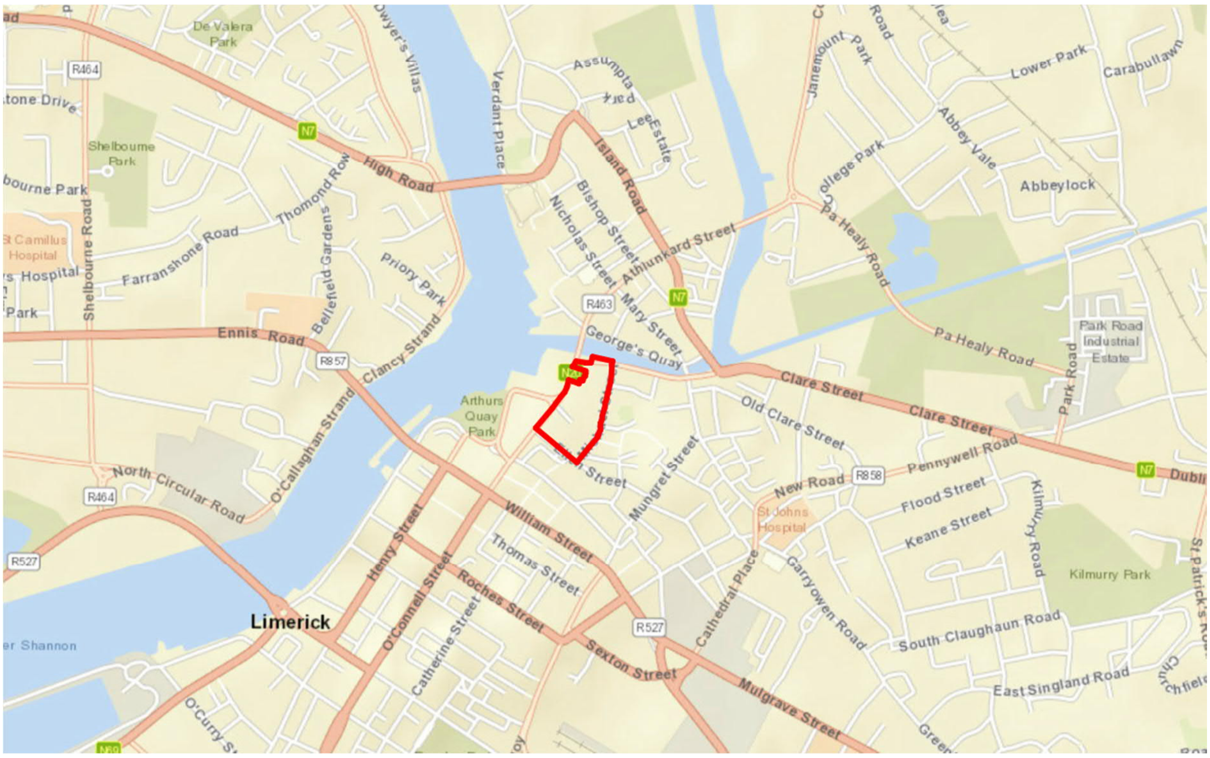
- A new office building on the corner of Michaels Street which will provide retail, café/bar/restaurant at the ground floor;
- An apart-hotel on the corner of Patrick Street and Ellen Street;
- A new City Library in the existing Town Hall with a café/restaurant in the basement.
- Office space will be provided to the rear in a new building;
- A new ‘landmark’ office building fronting onto Bank Place;
- Parking for the entire project in a new underground car park; and

- A new public square in the form of a plaza at the centre of the site. This will provide a new pedestrian east-west link between Michael Street and Patrick Street. A new north-south pedestrian link will connect an enhanced public space on Bank Place with the new civic plaza.

These are described in more detail in Chapter 3, ‘Description of the Proposed Development’.

This Environmental Impact Assessment Report (herein referred to as an EIAR) has been compiled on behalf of Limerick City and County Council.

Figure 1.1 – Site Location Map (Site Outlined in Red)



1.2 Planning Process for the Proposed Project

1.2.1 Need for an Environmental Impact Assessment

The general background to the requirement for Environmental Impact Assessment (herein referred to as EIA) for certain types and scales of development is set out in the EIA Directives (2011/92/EU and 2014/52/EU); the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (the majority of which came into operation in September 2018), the Planning and Development Acts 2000 (as amended) and the Planning and Development Regulations 2001 – 2018. This EIAR report is prepared in accordance with the 2011 EIA Directive 92011/92/EU), as amended by the 2014 EIA Directive.

The EIA Directives list those projects for which an EIA is mandatory (Annex I) and those projects for which and EIA may be required (Annex II). The project proposed is not listed under Annex I EIA Directives. The considerations for sub-threshold development are set out in the Planning and Development Regulations 2001 – 2018.

Chief Executive Order No. CE 2017/077 was prepared by Conn Murray (Chief Executive of Limerick City and County Council), which determined that Limerick City and County Council seek consent from An Bord Pleanála under Section 175 of the Planning and Development Act 2000 (as amended) in respect of the proposed development and the Regulations made thereunder [Environmental Impact

Assessment of certain development carried out by or on behalf of local authorities]. (See Appendix 1.A).

1.2.2 Section 175 of the Planning and Development Act 2000 (as amended)

This EIAR has been prepared pursuant to Section 175 of the Planning and Development Act, 2000 as amended ('The Act'), Part 10 Planning and Development Regulations 2001 -2018 and any other applicable legislation and guidance.

Section 175 of the Act provides for environmental impact assessment of certain development carried out by or on behalf of local authorities.

Under Section 175 of the Act, Proposed development in respect of which an environmental impact assessment report has been prepared by a local authority shall not be carried out unless the Board has approved it with or without modifications.

1.3 EIAR Methodology

1.3.1 Format of the EIA Report

An EIAR's purpose is to consider and assess likely significant effects (direct and indirect) on the receiving environment arising from the construction and operation of the proposed development as part of the EIA approval process. It is prepared on behalf of Limerick City and County Council [as the developer of the EIA].

The methodology adopted for the preparation of this EIAR comprised a systematic analysis of the impacts and/or effects of the proposed development in relation to the existing environment. The completion of the EIAR was an iterative process, linking into the design process.

The 'Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessments (August 2018), and, the European Commission Guidance on the preparation of the Environmental Impact Assessment Report have been considered in the preparation of this EIAR.

A Non-Technical Summary of the EIAR is provided separately (Volume I).

The figures not imbedded in the document are available in Volume III, along with the appendices cited.

The proposed development is wholly within the Republic of Ireland and will not result in any transboundary effects.

1.3.2 Description of Effects

The quality, magnitude and duration of potential effects are defined having regard to the criteria provided in the EPA Draft 'Guidelines on the information to be contained in Environmental Impact Assessment Reports' (2017). See Table 1.1 below.

Table 1.1 Description of Effects as per EPA Guidelines (Draft, 2017)

Effect Characteristic	Term	Description
Quality	Positive	A change which improves the quality of the environment
	Neutral	A change which does not affect the quality of the environment
	Negative	A change which reduces the quality of the environment
Significance	Imperceptible	An impact capable of measurement but without noticeable

Effect Characteristic	Term	Description
		consequences
	Not significant	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
	Slight	An effect that alters the character of the environment in a manner consistent with existing and emerging trends
	Moderate	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
	Significant	An effect which, by its character, magnitude, duration or intensity significantly alters the majority of ta sensitive aspect of the environment
	Profound	An impact which obliterates sensitive characteristics
Duration of Effects	Momentary Effects	Effects lasting from seconds to minutes
	Brief Effects	Effects lasting less than a day
	Temporary Effects	Effects lasting less than a year
	Short-Term Effects	Effects lasting one to seven years
	Medium-term Effects	Effects lasting seven to fifteen years
	Long-term Effects	Effects lasting fifteen to sixty years
	Permanent Effects	Effects lasting over sixty years
	Reversible Effects	Effects than can be undone, for example through remediation or restoration
Probability of Effects	Likely Effects	The effects that can reasonably be expected to occur as a result of the planned project if all mitigation measures are properly implemented
	Unlikely Effects	The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented
Type of Effects	Indirect Effects	Impacts on the environment, which are not a direct result of the project, often produced away from the project site or because of the complex pathway
	Cumulative	The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.
	'Do Nothing'	The environment as it would be in the future should no development of any kind be carried out
	'Worst case' Effects	The effects arising from a project in the case where mitigation measures substantially fail
	Indeterminable	When the full consequences of a change in the environment cannot be described
	Irreversible	When the character, distinctiveness, diversity, or reproductive capacity of an environment is permanently lost
	Residual	Degree of environmental change that will occur after the proposed mitigation measures have taken effect
	Synergistic	Where the resultant impact is of greater significance that the sum of its constituents

1.3.3 Difficulties Encountered

There were no significant difficulties in compiling the specified information for this EIA Report. Any issues encountered during the assessment are indicated in the individual chapters.

1.3.4 Contributors to the EIA Report

This EIAR has been prepared by AECOM, TPA and various specialist sub-consultants on behalf of Limerick City and County Council.

Table 1.2 includes the relevant EIAR specialists and their qualifications, as well as their respective inputs.

In accordance with EIA Directive 2014/52/EU, we confirm that experts involved in the preparation of this EIAR are qualified and competent in their respective fields. Each has proven expertise in the relevant field concerned, thus ensuring that the information provided herein is complete and of high quality. A short bio for each team member is included in Section 1.3.5.

Table 1.2: EIAR Team – Roles and Responsibilities Including Qualifications

EIAR Team - Roles and Responsibilities Including Qualifications

	Company
EIA Project Management	**Barry Sheridan – AECOM**
Engineering Design	**Civils – Emma McKendrick** **Structural - Enda Hoey**
Architectural Design	**Sara Pearson – AECOM**

EIAR Chapter No.	Chapter Title	Company Name	Person Responsible	Qualification
Chapter 1	Introduction	TPA – Town Planning Consultants	Laura Finn	BA (Hons)TP, Dip ERM, Dip EIA Mgmt., MIPI
Chapter 2	Background/ Site Location and Context	TPA, Town Planning Consultants	Laura Finn	BA (Hons)TP, Dip ERM, Dip EIA Mgmt., MIPI
Chapter 3	Description of the Proposed Development	AECOM	Sara Pearson	BArch (Hons), AdDip, RIBA, ARB
		TPA, Town Planning Consultants	Laura Finn	BA (Hons)TP, Dip ERM, Dip EIA Mgmt., MIPI
Chapter 4	Examination of Alternatives	AECOM	Barry Sheridan	BA MOD (ENV SCIENCE) HDiP Env Eng, MIOA
		Coady Architects	Tomas Sexton	DipArch (Hons), BArch (Hons), RIAI, (PSDP)
		TPA, Town Planning Consultants	Laura Finn	BA (Hons)TP, Dip ERM, Dip EIA Mgmt., MIPI
Chapter 5	Statutory and Public Consultations	TPA, Town Planning Consultants	Laura Finn	BA (Hons)TP, Dip ERM, Dip EIA Mgmt., MIPI
Chapter 6	Population and Human Health	AECOM	Dave Widger	BSc (Hons), MSc (Econ)
Chapter 7	Land, Soils & Geology and Groundwater	AECOM	David Mullan	BSc (Hons) in Earth Science
			Edel O Hannelly	BA (Mod) Hons in Natural Science, MSc Hydrogeology
Chapter 8	Water	AECOM	Emma McKendrick	BEng CEng MICE MIEI
Chapter 9	Air Quality and Climate	AECOM	Gary Gray	PhD in Environmental Sciences, BSc (Hons) Combined Sciences, MIEnvSc, MIAQM
			Andy Brown	PhD Environmental Chemistry, BSc Chemistry
Chapter 10	Noise and Vibration	AECOM	Alf Maneylaws	BSc (Hons) Mechanical Engineering, MSc Applied Acoustics, MIOA
Chapter 11	Solar Shadow and Wind Analysis			

Chapter 12	Landscape and Visual	AECOM	Joerg Schulze	Dipl. – Ing. (FH) LA, MILI
Chapter 13	Traffic and Transport	AECOM	Eoin O Mahony	Bachelor of Engineering BE (Hons) University College Cork 2002, Chartered Engineer CEng Engineers Ireland
Chapter 14	Waste Management	AECOM	David Mullan	BSc (Hons) in Earth Science
			Edel O Hannelly	BA (Mod) Hons in Natural Science, MSc Hydrogeology
Chapter 15	Material Assets	AECOM	Mary Maguire	BSc (Hons) MSc Csci MIES PIEMA
Chapter 16	Biodiversity	AECOM	Robert Fennelly Dr Emma Boston Dr Eleanor Ballard	B.A Mod (Hons) MSc CEcol MCIEEM BSc (Hons), PhD MRSB MCIEEM B.Sc.(Hons), DPhil. PgDip, CEnv MCIEEM
Chapter 17	Archaeology and Cultural Heritage	IACI	Faith Bailey	MA, BA (Hons), MCIfA
Chapter 18	Architectural Heritage	JCA	Jessie Castle	BA MUBC
Chapter 19	Inter-Relationship Between Factors, Residual Impacts and Cumulative Impact Assessment	AECOM – input from each specialist	Mary Maguire	BSc (Hons) MSc CSci MIES PIEMA
Chapter 20	Mitigation & Monitoring	AECOM	Mary Maguire	BSc (Hons) MSc CSci MIES PIEMA

1.3.5 Team- bios

Name: Barry Sheridan

Title: Associate Director, Environment and Planning

Qualifications: BA MOD (ENV SCIENCE) HDiP Env Eng PIEMA, MIOA

Input: Lead Verifier, AECOM

Barry Sheridan is the AECOM lead verifier for the Opera Site. He is an Associate Director within the Environment & Planning Ireland Group and has over 16 years' experience in a variety of areas within the environmental management, impact assessment, licensing and auditing fields. Barry is full member of the Institute of Environmental Management and Assessment, and the Institute of Acoustics (IOA). His key areas of expertise include: Environmental Impact Assessment Co-ordination and Management (IEMA), Environmental Compliance and Noise & Vibration Impact Assessment and Mitigation. He has worked with AECOM since 2014 and prior to this worked with a number of private sector consultancies in Ireland.

Name: Mary Maguire

Title: Principal Environmental Scientist

Qualifications: BSc (Hons) MSc CSci MIES PIEMA

Input: Project Management and Chapters 15,19,20

Mary is a Principal Consultant with over 14 years' professional experience working for clients in the private and public sector. She is a practitioner member of the Institute of Environmental Assessment and Management and a full member of the Institute of Environmental Sciences, through which she holds Chartered Scientist status. She has managed environmental impact assessments for a range of civil, infrastructural and renewable energy developments throughout the island of Ireland.

She has experience in all stages of impact assessment, including screening, scoping and environmental report production as part of the EIA / EIAR processes. She has managed extensive project teams across a range of disciplines and used this oversight to ensure that emerging issues are either managed through the design process or mitigated as part of project implementation.

Name: Enda Hoey

Title: AECOM Project Manager

Qualifications: N BScEng, DipStructE, Dip Proj Man, MIEI

Input: Responsible for Structural Engineering Design

Enda has been involved in a full spectrum of projects including Commercial, Office, Industrial, Educational, Recreational Facilities, Residential, Refurbishment, Roads and Bridges. During his career Enda has accumulated experience on projects performing roles from design and resident engineer through to Project Director. This experience has enabled Enda to bring leadership to the delivery of Civil and Structural Consultancy on many projects from concept stage through to completion on site.

Name: Sara Pearson

Title: Principle Architect

Qualifications: BArch (Hons), AdDip, RIBA, ARB

Input: Architectural Lead

Sara is a Principal Architect with over 18 years' experience of public and private sector projects in both the UK and Ireland. She has led a number of large-scale projects as architect and design lead, and she has a deeply held interest in high quality, socially inclusive architecture, with special reference to sustainable design.

Name: Dave Widger

Title: Regional Director

Qualifications: BSc (Hons), MSc (Econ)

Input: Chapter 6

Dave Widger has significant experience in health impact assessment in Ireland and the UK. Dave has worked with a range of private and public sector clients including central government, regional development agencies, regional partnerships and local authorities.

Name: Laura Finn

Title: Senior Planner, TPA Planning Consultants

Qualifications: BA (Hons)TP, Dip ERM, Dip EIA Mgmt., MIPI

Input: Chapters 1, 2 & 5, EIAR Review

Laura is a qualified Town Planner who has recently joined the team at Tom Phillips + Associates, having previously worked for Marlet Property Group Ltd. as Senior Planning Manager. Laura commenced her Planning career in Fingal County Council as a graduate planner and then moved to the private sector becoming Director of Planning in KSA Planning Consultants. Laura has over 20 years' experience managing various types of large-scale developments through the planning process including the preparation of EIA Reports.

She has a Diploma in Environmental Resource Management and a Diploma in Environmental Impact Assessment Management from UCD.

Name: Tomas Sexton

Title: Architectural Director, Coady Architects

Qualifications: DipArch (Hons), BArch (Hons), RIAI, (PSDP)

Input: Chapter 4

Tomas is an Architectural Director with Coady Architects. He has 19 years' experience of working on a wide range of urban masterplanning projects. He is the technical specialist for the master planning elements of Chapter 4.

Name: Robert Murphy

Your Title: Associate Director, AECOM

Qualifications: BSc. (Hons), MSc, MCIBSE CEng

Input: Responsible for the solar shading analysis modelling for Chapter 11

Robert is an Associate Director with AECOM. He has experience working in a wide range of sectors within multi-disciplinary engineering teams. Robert is a technical specialist in solar and wind modelling studies.

Name: Alf Maneylaws

Title: Acoustics Associate, AECOM

Qualifications: BSc (Hons) Mechanical Engineering, MSc Applied Acoustics, MIOA

Input: Technical Review – Chapter 10 Noise and Vibration

Alf Maneylaws is an Associate with AECOM and has over 25 years' experience in environmental assessment and industrial noise control. He provides services across a broad range of areas within the noise and vibration field, with particular expertise in assessments for commercial / mixed use developments, complex industrial sites and major transport schemes.

He is expert in the use of a range of noise prediction packages, including the environmental noise modelling software SoundPLAN, which implements a range of methodologies for road, rail, industrial and construction noise.

He has developed experience in dealing with public concerns, having attended numerous public exhibitions for major road schemes for which he provided noise impact assessments. He has appeared as expert witness for f road schemes. He has also appeared as expert witness for a bottom ash processing facility and for two energy from waste facilities.

Name: Ruth Sargent

Title: Senior Acoustic Consultant, AECOM

Qualifications: BSc (Hons) Environmental Science, MSc Environmental Management, PGDip Institute of Acoustics Diploma in Acoustics and Noise Control, MIOA

Input: Chapter 10 Noise and Vibration

Ruth has spent 14 years working on noise and vibration related projects. She has gained a wide range of practical experience in Environmental acoustics and vibration in a consultancy role. Ruth is a Corporate Member of the Institute of Acoustics. The majority of Ruth's experience relates to the provision of noise and vibration impact assessments to support planning applications and full Environmental Impact Assessments. These include large residential and mixed-use schemes, power related developments and quarry/waste/sewage treatment facilities.

She is experienced in the use of environmental noise modelling software SoundPLAN, which implements a range of methodologies including Calculation of Road Traffic Noise (CRTN), Calculation of Railway Noise (CRN), BS 5228 and ISO 9613-2.

Name: David Mullan

Title: Associate Director, Environmental Liability Solutions

Qualification: BSc (Hons) in Earth Science

Input: Chapters 7, 14, 15 & 17

David has a BSc (Hons) in Earth Science from University College Cork. David has eighteen years of experience working in contaminated land assessments and environment site assessment; and has worked with AECOM, through its legacy company URS Ireland Limited since 2002. David has worked on numerous brownfield redevelopment projects across Ireland, including provision of contaminated land assessment and remediation expertise for Capital Dock, Sir John Rogerson's Quay, Dublin 2; and, development and implementation of a groundwater and soil management plan during construction of a new brewery on the Diageo St. James' Gate site (an EPA licensed site), including classification of soil for disposal to off-site waste facilities.

Name: Edel O Hannelly

Title: Principal Contaminant Hydrogeologist, AECOM Ireland Limited

Qualifications: BA (Mod) Hons in Natural Science, MSc Hydrogeology

Input: Chapters 7 & 15

Edel O'Hannelly is a Principal Contaminant Hydrogeologist working with AECOM Ireland Limited. Edel has a BA (Mod) Hons in Natural Science from Trinity College Dublin, moderating in geography; and an MSc in Hydrogeology from the University of East Anglia. Edel is a member of the International Association of Hydrogeologists and has twenty years' experience working in contaminated land assessment and environmental site assessment with AECOM through its legacy companies Dames & Moore and URS Ireland Limited. Edel is responsible for contaminated soil and groundwater investigation, risk assessment and remediation projects throughout Ireland. She has managed many projects involving soil and groundwater investigation and monitoring for a range of organic and inorganic contamination issues and also has experience in environmental auditing and environmental due diligence assessment.

Name: Emma McKendrick

Title: Associate Director, Chartered Civil Engineer, AECOM

Qualifications: BEng CEng MICE MIEI

Input: Chapter 8, Responsible for Civil Engineering Design

Emma McKendrick is a Chartered Civil Engineer with over 28 years' experience. Originally from Belfast, Emma studied at Edinburgh University and remained in Scotland for 20 years. In 2006 she relocated to Limerick.

Emma joined AECOM in 2017, prior to that she was at senior management level in PUNCH Consulting for 7 years. Emma has been responsible for the technical delivery of a wide range of projects from inception to handover in Ireland, UK, Libya and Saudi Arabia. Emma has significant experience in the undertaking hydrological assessments for mixed use developments such as this.

Name: Eoin O Mahony

Title: Regional Director, Chartered Transportation Engineer, AECOM Transportation Group

Qualifications: Bachelor of Engineering BE (Hons) University College Cork 2002, Chartered Engineer CEng Engineers Ireland

Input: Chapter 13

Eoin is a Regional Director within AECOM's Transportation Group and has 16 years' post graduate experience. He graduated from University College Cork with a BE (Hons) in 2002. He is a member of the Chartered Institute of Highways and Transportation and holds the title of Chartered Engineer from Engineers Ireland. His areas of expertise include traffic engineering and transport planning. His experience includes assessing the transports impacts of development projects, designing junctions and streets, and developing strategies to influence travel behaviour. His experience includes all project stages from planning through to implementation. He has worked with AECOM since 2005.

Name: Jessie Castle

Title: Senior Conservation Consultant

Qualifications: Bachelor of Arts (History of Art and Architecture, Russian (TCD), Master of Urban and Building Conservation (UCD) (BA MUBC)

Input: Chapter 18

Jessie is an architectural historian and building conservation consultant with twenty years' postgraduate experience (Bachelor of Arts (History of Art and Architecture, Russian (TCD) 1995, Master of Urban and Building Conservation (UCD) 1998).

Jessie joined Jack Coughlan Associates, RIAI Grade 1 Conservation Architects, in 2001. Jessie's role in JCA involves the research and recording of historic structures, providing conservation advice on the significance and appropriate redevelopment of historic and protected structures, and the preparation of conservation reports for planning.

Jessie also regularly prepares Architectural Heritage Impact Assessments for individual buildings of architectural significance, and Cultural Heritage chapters of EIS reports for large-scale developments. She has undertaken additional further education on the subject of historic interiors, at the University of York, the Dublin Civic Trust and the National Museum, Copenhagen and is currently a Visiting Research Fellow in the School of Humanities and Social Science at Liverpool John Moores University.

Name: Joerg Schulze

Title: Principal Landscape Architect, AECOM

Qualifications: Dipl. – Ing. (FH) LA, MILI

Input: Chapter 12

Joerg is a Principal Landscape Architect with over 15 years' professional experience working for clients in the private and public sector. He has a track record in developing and managing landscape and visual impact assessments of large commercial, residential, infrastructural, renewable energy, tourism and civic developments throughout the island of Ireland. He has extensive experience in all stages of the planning, design, tender and implementation process, contract management and as consultant for Part 8 and EIA / EIAR processes. His masterplanning experience includes advice on mitigation measures to minimise landscape and visual impacts, the preparation of detailed mitigation planting schemes and general landscape design within proposed development sites to facilitate staff, visitor, tourism and/or local community requirements.

As part of the LVIA process, Joerg is also an expert in developing constraints studies, site suitability assessments, feasibility studies and associated mapping. He has prepared residential visual impact assessments, manages the production of photomontages and the preparation of ZTV/TVI mapping. He has been supervising site works and required maintenance periods for mitigation planting schemes.

Joerg is a regular expert witness at Oral Hearings/Public Inquiries. He is an experienced team leader and works closely with other disciplines. He undertakes stakeholder engagements, consultations with communities and planning authorities, and has organised and participated in public workshops.

Name: Steven Walker

Title: GIS Consultant, AECOM

Qualifications: MSc Planning and Development, BSc Geography with Extended Studies in Europe (French)

Input: Graphics for Various Chapters

Steven is a Graduate GIS Consultant, who joined AECOM in May 2018 to provide geospatial support in a variety of projects. In his role, Steven consolidates, manipulates, analyses and visualises spatial datasets, within a range of sectors, from local to global scales. Steven studied at Queen's University Belfast for his BSc in Geography with Extended Studies in Europe (French) and MSc RICS accredited course in Planning and Development. During his university career, he expanded his knowledge and expertise in various GIS techniques. Steven is part of the Geospatial & Data Services team and is based in the Dublin office.

Name: Garry Gray

Title: Technical Director – Air Quality

Qualifications: PhD in Environmental Sciences, BSc (Hons) Combined Sciences, MIEnvSc, MIAQM

Input: Chapter 9 – Air Quality and Climate

Garry operates as a Technical Director for AECOM's Air Quality Practice and is a full member of both the Institute of Environmental Sciences and the Institute of Air Quality Management. Garry has 16 years of experience at AECOM, undertaking and reporting air quality and climate impact assessments as part of Environmental Impact Assessments (EIA) for a wide range of development types within Ireland and internationally. Prior to employment with AECOM, Garry completed a PhD in Environmental Science and lectured in the assessment of air pollution at University level for 12 years.

Name: Andy Brown

Title: Air Quality Consultant

Qualifications: PhD Environmental Chemistry, BSc Chemistry

Input: Chapter 9 – Air Quality and Climate

Andy has extensive academic experience, completing a PhD on the topic of air pollution and effects on health. Since joining AECOM's specialist Air Quality Practice team in 2018, Andy has utilised his skills in atmospheric dispersion modelling for the benefit of a number of mixed-use development schemes within the context of EU legislation using a wide range of tools.

Name: Robert Fennelly

Title: Ecologist Consultant, AECOM

Qualifications: BSc, MSc, Dip CEcol MCIEEM.

Input: Chapter 16 - Biodiversity

Robert is a Chartered Ecologist and Principal Ecologist at AECOM. Robert has 11 years' professional experience as an ecological consultant, and EIA practitioner

Name: Dr. Emma Boston

Title: Ecologist Consultant, AECOM

Qualifications: BSc (Hons), PhD MRSB MCIEEM

Input: Chapter 16 – Biodiversity, Chapter 16 was checked by Emma (and in the case of reporting on bats also originated).

Emma is also Principal Ecologist at AECOM and has over 14 years' experience in research and conservation, and 2.5 years' experience of EIA.

Name: Dr. Eleanor Ballard

Title: Ecologist Consultant, AECOM

Qualifications: B.Sc. (Hons), DPhil. PgDip, CEnv MCIEEM

Input: Chapter 16 – Biodiversity, Overall Approval of Chapter

Dr. Eleanor Ballard is a Chartered Environmentalist with 11 years' experience as an EIA practitioner, and 20 years providing biodiversity inputs to planning.

Name: Faith Baily

Title: Associate Director, Senior Archaeologist & Cultural Heritage Consultant

Qualifications: MA, BA (Hons), MCIfA

Input: Chapter 18

Faith is an Associate Director and Senior Archaeologist and Cultural Heritage Consultant with IAC Ltd who is responsible for the compilation of Chapter 18 (Archaeology & Cultural Heritage). She holds an MA in Cultural Landscape Management (archaeology and built heritage) and a BA in single honours archaeology from the University of Wales, Lampeter. She is a licence eligible archaeologist, a member of the Chartered Institute of for Archaeologists and has over 16 years' experience working in the commercial archaeological and cultural heritage sector. Faith joined IAC in 2004 and in her capacity as Senior EIAR Archaeologist and cultural heritage consultant, she has been responsible for the production and delivery of a large number of archaeological and built heritage desk top assessments, EIAR, master plans, LAP/SEA and management plans associated with all sectors of development in the Republic and Northern Ireland.

2 Background / Site Location and Context

2.1 Introduction

This chapter provides a summary of the background to the Proposed Development namely, the need for the Proposed Development and how it evolved through relevant planning policy.

2.2 Project Boundaries

The Opera site comprises an urban block located in Limerick's historic City Centre, situated on the south side of the River Abbey at the confluence with the River Shannon, adjacent to the Hunt Museum and Arthur's Quay Shopping Centre. The site is largely in public ownership.

The site is located at the northern end of Limerick's Georgian Quarter and its perimeter composed of largely intact Georgian terraces to Ellen St., Patrick St. and Rutland St. There are a number of existing buildings on the site with varying levels of heritage value. These include 3 no. structures listed on the Record of Protected Structures, and a further 8 no. structures which are included on the National Inventory of Architectural Heritage (NIAH). A number of the existing buildings are currently vacant. Frontage to Bank Place comprises the northern end of the Granary Building, a 1960s building formerly occupied by Cahill May Roberts, and a terrace of three Georgian buildings at 7-9 Bank Place which are currently not part of the development site ownership.

This Opera Site is a brownfield site located in the heart of Limerick City Centre in the functional area of Limerick City and County Council. The site occupies the majority of a city block bounded to the west by Patrick Street and Rutland Street, to the north by Bank Place, to the east by Michael Street and to the south by Ellen Street. Figure 2.1 shows the proposed development site in the context of the surrounding area.

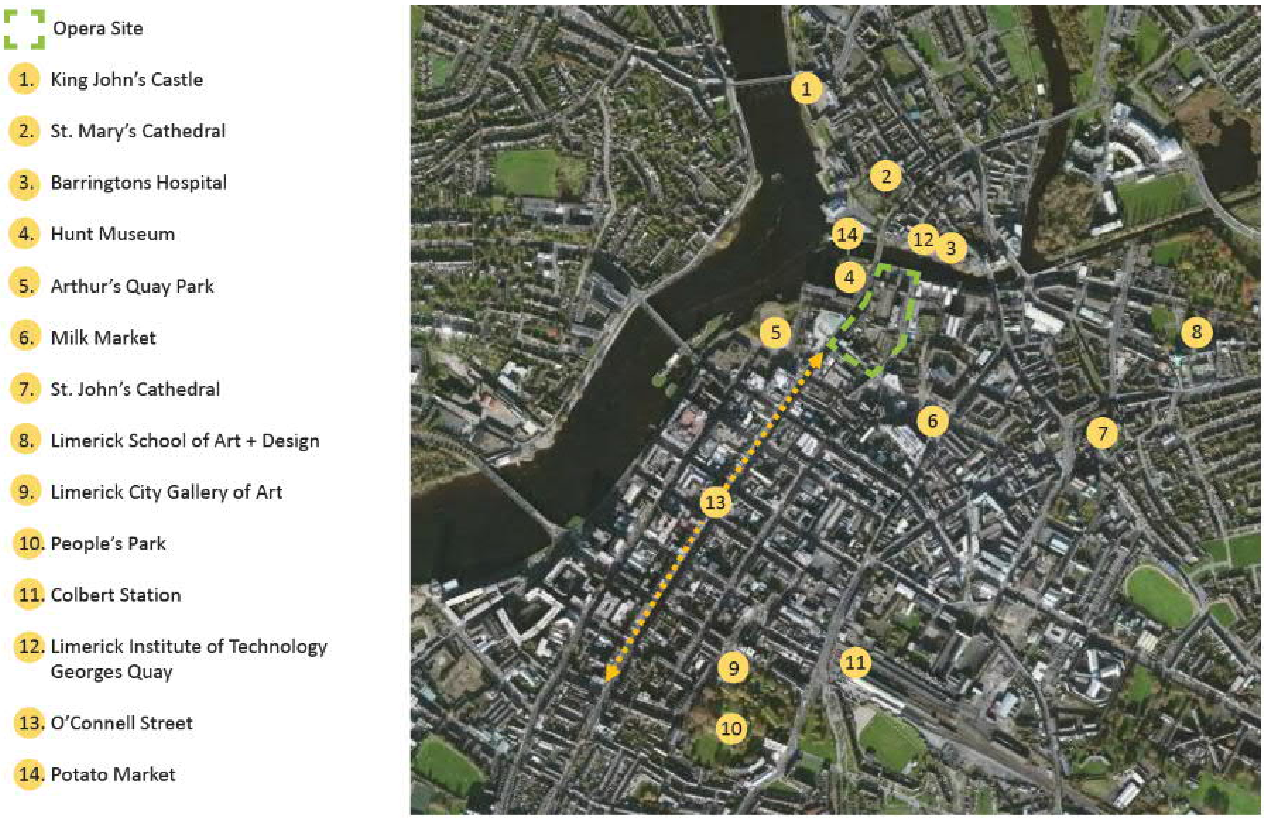


Figure 2.1 Site Context Map (Opera Site Hatched with Green Line)

2.3 Current Site Layout

The current site layout is shown in Figure 2.2 below.

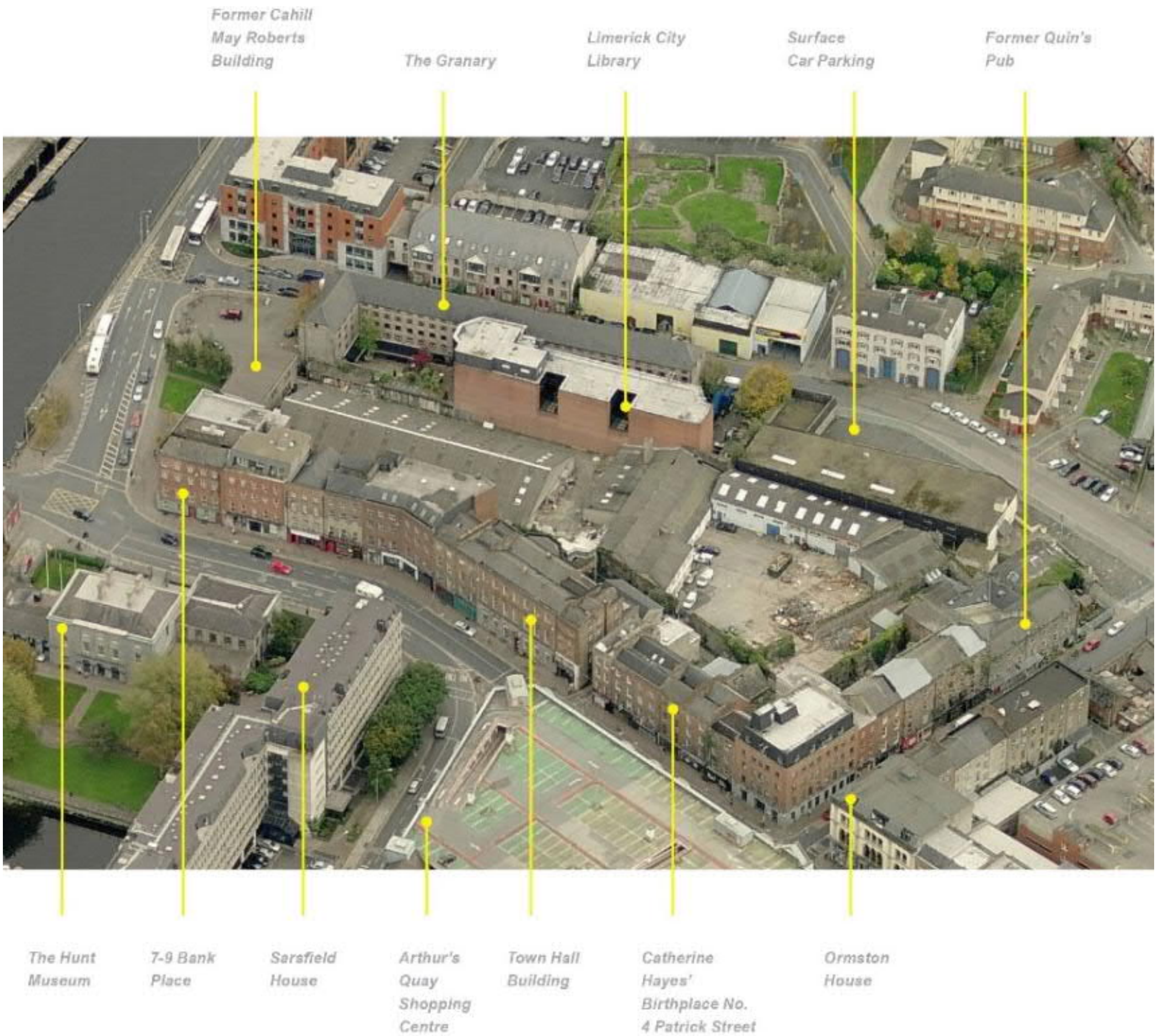


Figure 2.2 Current Site Layout – Aerial view of Opera Site

2.4 The Need for the Proposed Project

The Proposed Development of the Opera Site will transform the prominent brownfield site within Limerick City Centre in line with Limerick 2030: An Economic and Spatial Plan for Limerick (Limerick 2030 Plan) adopted as Variation No. 4 of the Limerick City Development Plan. The proposed development will assist in the achievement of a comprehensive redevelopment of the Opera Site to serve as a catalyst to the economic, social and physical renaissance of Limerick City Centre. The development will provide an appropriate quantum of development to provide adequate capacity to rejuvenate the Opera Site and adjoining areas.

The proposed development has been based on the Design Brief which was prepared for the site in order to fulfil the requirements of the Limerick 2030 Plan.

In line with the Design Brief the proposed development for the site seeks to provide “A New Business Offer” for the City, tying into the heart of the City’s shopping offer. The Plan envisages a business-led mixed-use solution for this Site including significant office development and a range of supplementary uses.

The re-development of the site will also provide for public realm and permeability requirements for the site and links with other City Centre projects.

Figure 2.3 Network of Existing and Proposed Urban Spaces (Extract from Design Brief, pg. 45)

2.5 Project Objectives

The Limerick 2030 Plan envisages a business-led, mixed-use solution for this Site to animate this Quarter and create a destination within the City Centre. The Proposed Development will provide for the rejuvenation of the Opera Site by providing the following in line with the Design Brief for the site:

- Reinstatement of full perimeter street edge;
- Protection, renovation and reuse of existing historic buildings;
- Removal of poor quality and derelict structures and elimination of vacancy;
- Activate ground floor uses and provide a desirable destination;
- Enhancement of public realm to perimeter streets;
- Provide a new public square within the block;
- Permeability through the block to provide strengthened connections to Arthur's Quay and waterfront to the west, and to Milk Market and Colbert Station to the east;
- Improved public space at Bank Place;
- Provide a tall building on the site addressing the Abbey River at Bank Place;
- Increase activity on the site with significant new building; and,
- Removal of poor-quality structures.

2.6 Area Surrounding the Proposed Project

The site, on the northern edge of the city central core, is surrounded by a varied mix and intensity of uses. General City Centre mixed-use and retail are predominant to the south and west of the site, significant office and cultural use are to the north west and north east of the site, with a mix of office and residential along Michael Street to the east.

The site has a mixed history with a reflective range of uses, influenced by the nature of structures on site and the character of the surrounding streets. Small retail and non-retail service uses, occupy many of the ground level Georgian structures, with infill offices and warehouses within the centre of the site, and a vacant plot used for parking to Michael Street.

To the south of the site the traditional street and building pattern remains largely intact, while to the east the pattern has changed following comprehensive redevelopment programmes of the 1980s. Patrick Street retains its role as the main entry to the city core, linking the medieval quarter of King's Island to the main thoroughfare of O'Connell Street. Secondary streets at right angles to the River Shannon intersect the main route to form the distinctive grid iron pattern. Narrow lanes or bows further sub-divide the grid to provide a network of inter-connected routes that are a distinctive feature of the city centre.

The site itself is characterised by a compact perimeter block form of predominantly 3 to 5 storey buildings and the 4 storey warehouse structure of the Granary building with later library addition. The centre of the site contains single storey warehouses also. Surrounding streets are predominately 4 storeys, defined by the historic Georgian structures, with individual buildings varying from this: Sarsfield House is 7 storeys and the former Custom House (Hunt Museum) is 2 to 3 storey. On Michael Street, adjacent offices are 5 storey and residential buildings are 3 to 4 storey. To the north east, Charlotte's Quay is lined with predominantly 4-6 storey buildings and there is a visual relationship to St. Mary's Cathedral on elevated ground across the river to the north.

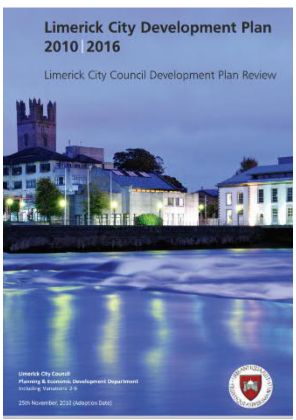
In the wider city context there is a variety of building heights that can be categorised into 3 broad groups:

- Up to 4-6 storey is the predominant height of buildings in the older city core;
- Taller 5-9 storey newer buildings have developed throughout the city and 5 to 6 storey often integrate within the older core areas, in particular at corner and deeper sites, where setback of upper floors is possible; 7-9 storey buildings are mostly to the western side of O'Connell street and along the riverside edges; and
- Tall buildings (up to 18 storeys) have been developed at important nodal river crossing points, as focal points and city landmarks.

2.7 Policy Context

2.7.1 Local Planning Policy

2.7.1.1 The Limerick City Development Plan 2010-2016



The Limerick City Development Plan sets out Limerick City Council's policies for the development of Limerick City to 2016 and beyond. The vision of the Plan is for Limerick City to continue to grow as the centre of economic, social and cultural development for the Mid-West Region. For this to be realised Limerick City must be a cohesive and sustainable community of people; where natural surroundings and important resources are protected; where cultural and built heritage is safeguarded; where opportunities exist that allow people to live and work in a safe environment with excellent public infrastructure and services together with ample cultural and leisure facilities. This Plan outlines Limerick City Council's policies for improving the social, economic, cultural and environmental health of the City both through direct action and in conjunction with other stakeholders i.e. the State, private and community sectors. It is based on three fundamental and interrelated goals, which underlie all the policies contained in the Plan;

- Goal 1: To promote and provide for the sustainable development of Limerick City enabling it to fulfil its role as a National Gateway City.
- Goal 2: To promote social inclusion and to facilitate equality of access to employment, education, transport, suitable housing, social and cultural activities, whether by direct provision (e.g. social housing) or by facilitating others to provide the service (e.g. education).
- Goal 3: To provide for a high quality natural and built environment and improved quality of life for those living and working in Limerick City and also for those visiting the City.

(Limerick City Development Plan 2010-2016, Pg.1.2 & 1.3)

This Development Plan underlines that "one of the most important aspects in defining the urban form of the Opera Site will be the successful retention and restoration of buildings on Rutland/Patrick Street and Ellen Street".

This proposal recognises the important of the existing historical building stock and seeks to retain and refurbish a large number of the original buildings on the site, supplementing them where appropriate with new build intervention.

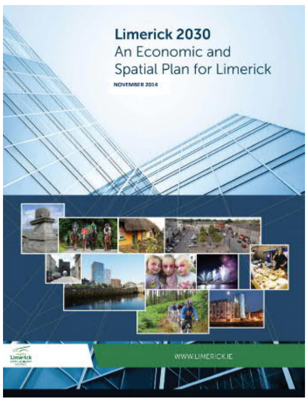
The Opera Site is identified as a c. 2.35-hectare site within the heart of Limerick city, and has been identified as an opportunity not only to provide much needed accommodation, but also to challenge and inform the scale of future development in the city centre.

The Limerick City Development Framework supports the use of increased scale on the site, and states "In order to optimise the potential of the city centre, and to accommodate the range and scope of uses envisaged, it will be necessary to develop a building form that will be larger in scale than its immediate surroundings".

Policy CC.1 of the Development Plan states that it is policy of the Planning Authority to secure the goals and objectives set out in Limerick 2030.

2.7.1.2 Limerick 2030 - An Economic and Spatial Plan for Limerick (2013)

The Plan seeks to deliver a new Vision for Limerick:



"Limerick will become a major economic force in the Irish and European economy, a leading centre for commercial investment – both foreign direct investment and endogenous business growth, capitalising on the strength of its higher education institutions (HEIs), the skills of its workforce and it's environmental and heritage attributes. The City Centre will be at the heart of this economic force – an attractive magnet for retail, leisure, residential, commercial, educational and cultural growth. Growth will benefit all citizens across the City, County and Mid-West Region.

There are 3 elements to the Plan. The first is an Economic Strategy which identifies how Limerick needs to be positioned in order to best take advantage of economic opportunities in order to build a stronger local economy through the creation of employment and the attraction of investment. The second element is a Spatial Plan focussed on revitalising and redeveloping Limerick City Centre and the final element is a Marketing Plan which aims to use Limerick's unique and positive attributes to change perceptions of how Limerick is viewed.

The Plan identifies the Opera Site as "a critically important site" with an urgent need to bring it back into full and productive use, making a major contribution to strengthening the city centre, and it also recognises the site as one of the main city centre transformational projects.

The proposed development is a sensitive regeneration of Opera Site resulting in a variety of mixed-use refurbishment opportunities combined with integrated modern new build commercial units.

In accordance with Limerick 2030 An Economic and Spatial Plan for Limerick and for the Opera Site, the proposals main aims are summarised as follows:

- Contribute to a vibrant City Centre economy with a new mix of economic uses and ensuring the City Centre is at the heart of the region's future, acting as both a "shop window" for Limerick and a positive enabler of 'quality of life' factors so important to investors.
- Restore the existing Georgian streetscapes at Rutland Street, Patrick Street, Michael Street, Ellen Street, and promote the Spatial Plan's desire to 'capture the rich heritage, protecting and enhancing it where appropriate and complementing it with a world class design for any new development";
- Provide a positive architectural addition to Limerick City with appropriate treatment of this sensitive and important location, which is fitting in terms of materiality and quality of detailing and finish.
- Create a world class office campus for the city with supporting facilities, which will become a major economic force in the Irish and European economy, and a leading centre for commercial investment.
- Provide a new high-quality public realm, linking the city to Abbey River. As identified in the Spatial Plan, 'the site is a critical part of the public realm strategy with the proposed public square forming part of a new formal integrated network of such areas providing accessibility, connectivity and legibility across the city'.

The Opera Site is described as 'A new business offer' in the Spatial Plan under Section 4.3. The plan states on page xvi;

'This Plan reflects the important business role of the City Centre by encouraging business uses in several locations across the City Centre. The Opera Site is a major opportunity site for new business activity – tying into the heart of the City's shopping offer.'

Figure 2.4 Photomontage of potential new commercial offices on the Opera Site (Extract from Limerick 2030 Plan, pg. xvi)

2.7.1.3 Design Brief, Opera Site, Limerick City, Prepared by Limerick City and Council, April 2018

The purpose of this non-statutory Design Brief is to set out Limerick City & County Council's planning approach to the redevelopment of a prominent brownfield site within the City Centre and to fulfil a requirement of Limerick 2030: An Economic and Spatial Plan for Limerick (Limerick 2030 Plan), adopted as Variation No. 4 of the Limerick City Development Plan:

"Put in place a detailed design brief for the site - defining public access, public realm, height, density, conservation, etc. requirements."

(Limerick 2030 Plan - Action Point 19e.)

This Design Brief describes the provisions of the Limerick 2030 Plan and sets out a list of development parameters for the site having regard to the provisions of that Plan and an appraisal of the sites setting and context. The Brief is intended to help guide the development process and to inspire the highest possible standards, whilst reducing uncertainty and improving efficiency of the planning and development process.

It is envisaged that the conservation, public realm and urban design strategies set out in the Design Brief will further refine planning policy to deliver a business-led mix of uses to ensure that this important new quarter will be a vibrant and successful addition to the City Centre. Its intent is to redress one of the primary structural challenges identified for Limerick City Centre and to develop the Opera Site both as an attraction in its own right and a stimulus to the continued development of the commercial core.

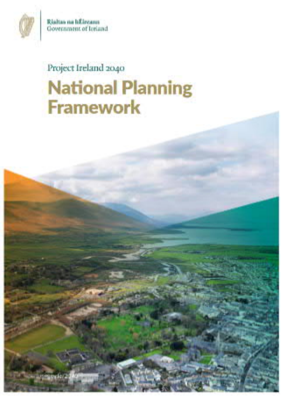
"The vacant Opera Site represents a significant void in the historic fabric."

(Limerick 2030 Plan, Section 5.16; City Centre Strengths and Challenges.)

2.7.2 National Policy Guidance

2.7.2.1 Project Ireland 2040 National Planning Framework

Project Ireland 2040 is the overarching policy and planning framework for the social, economic and cultural development of Ireland. It includes a detailed capital investment plan for the period 2018 to 2027, the National Development Plan 2018-2027, and the 20-year National Planning Framework 2040.



The purpose of the National Planning Framework is to enable all parts of Ireland, whether rural or urban, to successfully accommodate growth and change, by facilitating a shift towards Ireland's regions and cities other than Dublin, while also recognising Dublin's ongoing key role.

The National Planning Framework sets nine goals known as the National Strategic Outcomes:

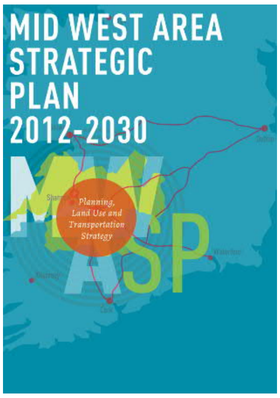
- Compact Growth: Carefully managing the sustainable growth of compact cities, towns and villages will add value and create more attractive places in which people can live and work.

- Enhanced Regional Accessibility: A co-priority is to enhance accessibility between key urban centres of population and their regions. This means ensuring that all regions and urban areas in the country have a high degree of accessibility to Dublin, as well as to each other.
- Strengthened Rural Economies and Communities: Rural areas play a key role in defining identity, in driving economy and high-quality environment and must be a major part of Ireland's strategic development to 2040.
- Sustainable Mobility: In line with Ireland's Climate Change mitigation plan, there is a need to progressively electrify mobility systems moving away from polluting and carbon intensive propulsion systems to new technologies such as electric vehicles and introduction of electric and hybrid traction systems for public transport fleets, such that by 2040 cities and towns will enjoy a cleaner, quieter environment free of combustion engine driven transport systems.
- A Strong Economy, supported by Enterprise, Innovation and Skills: This will depend on creating places that can foster enterprise and innovation and attract investment and talent. It can be achieved by building regional economic drivers and by supporting opportunities to diversify and strengthen the rural economy, to leverage the potential of places. Delivering this outcome will require the coordination of growth and place making with investment in world class infrastructure, including digital connectivity, and in skills and talent to support economic competitiveness and enterprise growth.
- High-Quality International Connectivity: This is crucial for overall international competitiveness and addressing opportunities and challenges from Brexit through investment in ports and airports in line with sectoral priorities.
- Enhanced Amenities and Heritage: This will ensure that cities, towns and villages are attractive and can offer a good quality of life. It will require investment in well-designed public realm, which includes public spaces, parks and streets, as well as recreational infrastructure. It also includes amenities in rural areas, such as national and forest parks, activity-based tourism and trails such as greenways, blueways and peatways. This is linked to and must integrate with built, cultural and natural heritage, which has intrinsic value in defining the character of urban and rural areas and adding to their attractiveness and sense of place.
- Transition to a Low Carbon and Climate Resilient Society: The National Climate Policy Position establishes the national objective of achieving transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050. This objective will shape investment choices over the coming decades in line with the National Mitigation Plan and the National Adaptation Framework. New energy systems and transmission grids will be necessary for a more distributed, renewables-focused energy generation system, harnessing both the considerable on-shore and off-shore potential from energy sources such as wind, wave and solar and connecting the richest sources of that energy to the major sources of demand.
- Sustainable Management of Water, Waste and other Environmental Resources: Ireland has abundant natural and environmental resources such as water sources that are critical to environmental and economic wellbeing into the future. Conserving and enhancing the quality of these resources will also become more important in a crowded and competitive world as well as our capacity to create beneficial uses from products previously considered as waste, creating circular economic benefits.
- Access to Quality Childcare, Education and Health Services: Good access to a range of quality education and health services, relative to the scale of a region, city, town, neighbourhood or community is a defining characteristic of attractive, successful and competitive places. Compact, smart growth in urban areas and strong and stable rural communities will enable the enhanced and effective provision of a range of accessible services.

2.7.3 Regional Policy Guidance

2.7.3.1 The Mid-West Area Strategic Plan (MWASP)

The Mid-West Area Strategic Plan (MWASP) aims to help to provide strategic direction for important planning issues in the region, including revitalisation of Limerick City, effective implementation of the Regional Planning Guidelines, development of enterprise and employment, and delivery of infrastructural requirements.



Some of the key objectives include;

- Prioritise investment in the region, through a fusion of land use and transportation policies within the context of a defined settlement hierarchy as provided in the Regional Planning Guidelines;
- Strengthen the role of Limerick City and its Environs (Metropolitan city) as the core economic driver for the Region;
- Strengthen the Limerick/Shannon Gateway and Ennis (Hub Town) in terms of population growth, and as complementary centres for both employment and population growth, with a better balance between the two;
- Promote balanced regional development throughout the region through the development of well-defined hierarchies of settlements that envisages stronger roles for Nenagh, Newcastle West, Thurles, and to a lesser extent Roscrea, which will support the development of a series of rural economic nodes, and their immediate hinterland;
- Change the way Limerick is portrayed and viewed, to promote the prioritisation of support for the region by development agencies and to improve the cost competitiveness of the region;
- Acknowledge that the Mid West region has a strong rural population of c. 54% of the region, with a strong agricultural sector. The Region requires the development of a strong urban core with rural development nodes, good access to markets and amenities, which in turn will facilitate the growth of the rural hinterland, and lead to a positive impact on rural development and, settlement, with economic and job creation opportunities; and,
- Assist in the streamlining of the regional corporate governance structure to provide a better platform for the Limerick Metropolitan Area to achieve its potential.

2.7.3.2 Other policy, guidance and data sources

The following list includes other relevant policy and guidance documents that will inform the Environmental Impact Assessment:

- Shannon Development Regional Strategy 2008-2010;
- St. Mary's Park and Kings Island Framework Strategy; and,
- Limerick Hinterland Report (2015).

2.8 References

Government of Ireland (2018) *Project Ireland 2040 National Planning Framework,* available online at, http://npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf accessed November 2018.

Limerick City and County Council (2013) *The Mid-West Area Strategic Plan*, available online at, https://www.limerick.ie/sites/default/files/mid_west_area_strategic_plan_2012-2030.pdf, accessed November 2018.

Limerick City and County Council (2010), *Limerick City Development Plan*

2010- 2016 available online at https://www.limerick.ie/sites/default/files/limerick_city_development_plan_2010-2016_as_varied_1-5_print_0.pdf , accessed November 2018.

Limerick City and County Council (2014) *Limerick 2030 - An Economic and Spatial Plan for Limerick*, available online at, https://www.limerick.ie/sites/default/files/media/documents/2017-11/Limerick%202030%20-%20An%20Economic%20and%20Spatial%20Plan%20for%20Limerick.pdf accessed November 2018.

3 Description of the proposed development

3.1 Introduction

This chapter provides a detailed description of the project together with details of the existing environment.

3.1.1 Site Characteristics

As outlined in Chapter 2 of this EIAR, the subject site comprises a c. 2.35 ha parcel of land located at the northern end of Limerick's Georgian Quarter. The subject site occupies the majority of a city block and is bound to the west by Patrick Street and Rutland Street, to the north by Bank Place, to the east by Michael Street, and to the south by Ellen Street. A cluster of 4 no. buildings to the North West corner of the block are in separate ownership and do not form part of the proposed development site.

A variety of existing building structures dating from the 18th to the 20th century is located on the subject site. The perimeter of the site bounding Rutland Street, Patrick Street and Ellen Street is comprised largely of terraced buildings dating from the Georgian period. Twentieth century interventions along these street frontages include Nos. 6/7 Rutland Street and the building on the corner of Patrick Street and Ellen Street. Further twentieth century structures on the subject site include industrial, warehousing and workspace buildings located towards the centre of the site at Bogues Yard and Watch House Lane, and the former Cahill May Roberts office building at the north of the site, fronting Bank Place. A surface carpark with c.100 spaces is located to the south-east corner of the site.

In terms of heritage designations, there are three Protected Structures / Features located on the subject site; the former Town Hall on Rutland Street (RPS 014) and the Granary on Michael Street (RPS 272); and a doorway at No. 6 Rutland Street (RPS 317). The protected structures, referenced above, are also recorded on the National Inventory of Architectural Heritage (NIAH), together with some 5 no. additional buildings on the subject site including; a range of existing terraced Georgian houses along Rutland Street, Patrick Street and Ellen Street, which are interspersed by Twentieth Century interventions on the corner of Patrick Street/Ellen Street (6, 7/8 Patrick Street) and at 6 and 7 Rutland Street. The development site also includes various Twentieth Century Industrial/ warehousing/ workspace buildings, primarily located towards the centre of the site at Bogues Yard and Watch House Lane, and north of the site at the former Cahill May Roberts building, fronting Bank Place. A surface carpark with c.100 spaces is located to the south-east corner of the site.

The majority of the buildings on site are currently vacant including the 20th century buildings to the north and at the centre of the site and the buildings which form the perimeter of the site along Rutland Street, Patrick Street and Ellen Street. The late 18th century stone Granary Building which occupies much of the site's perimeter to Michael Street is currently occupied by a restaurant and bar/ nightclub at lower ground floor level. Office uses are accommodated on upper levels, whilst Limerick City Library is located in a 3-storey modern extension to the rear of the building. A surface car park at the south-east corner of the site is currently in operation, however it is not considered that this is an appropriate use given the site's prominent city centre location. Figure 2.2 shows an aerial view of the proposed development site.

The main re-development relates to demolition of all the Twentieth Century buildings and later additions to the rear of existing heritage structures, which is accompanied by new-build elements and proposed renovation and adaptive re-use of the Protected Structures and the majority of other structures of heritage value within the site. The combined re-development comprises a total gross floor area of c.45,170sq m exclusive of ancillary basement and car parking.

3.1.2 Summary of the Proposed Development

The proposed development relates principally to the demolition of all structures which are not designated as being of heritage value, the subsequent construction of new-build elements to the centre, north, south east and south west of the site, and the renovation and adaptive re-use of structures featured on the Record of Protected Structures and the National Inventory of Architectural Heritage. The combined re-development comprises a floor area of c.45,170 sq m over ancillary basement.

The proposed development comprises a mixed-use scheme consisting of primarily office uses. Additional uses proposed also include a range of retail / non-retail services uses, café/restaurant/bar uses, apart-hotel use, civic/cultural uses (including the City Library), residential use. Further elements of the proposed development include the provision of a significant quantum of open space, associated public realm works and the provision of additional routes to enhance the site's overall permeability. The development also includes environmental improvement works to the adjacent public streets.

3.1.3 Description of Works

The proposed development comprises the demolition of the following:

- Existing industrial/warehouse/workspace buildings at Bogues Yard and Watch House Lane towards the centre of the site;
- The former Cahill May Roberts office building fronting Bank Place;
- Modern additions/extensions to the rear of the Granary Building (a Protected Structure) and to the rear of heritage structures fronting onto Rutland Street, Patrick Street and Ellen Street, respectively;
- The existing Ellen Street surface car park;
- Nos. 6 & 7 Rutland Street[1], Nos. 6 & 7/8 Patrick Street, and No. 3 Ellen Street; and
- The structure adjoining to the south of the former Town Hall (In order to facilitate widening of the existing east-west access route into the site).

The proposed development also comprises the construction of a number of new build elements, repair and restoration of heritage assets and the provision of public realm enhancements including new open spaces and access routes. Given the size of the proposed development, the areas of the proposed works have been categorised into individual parcels and assigned numbers for ease of reference (see Figure 3.1).

[1] The doorway currently located within the façade of No. 6 Rutland Street does not form a part of the demolition works.

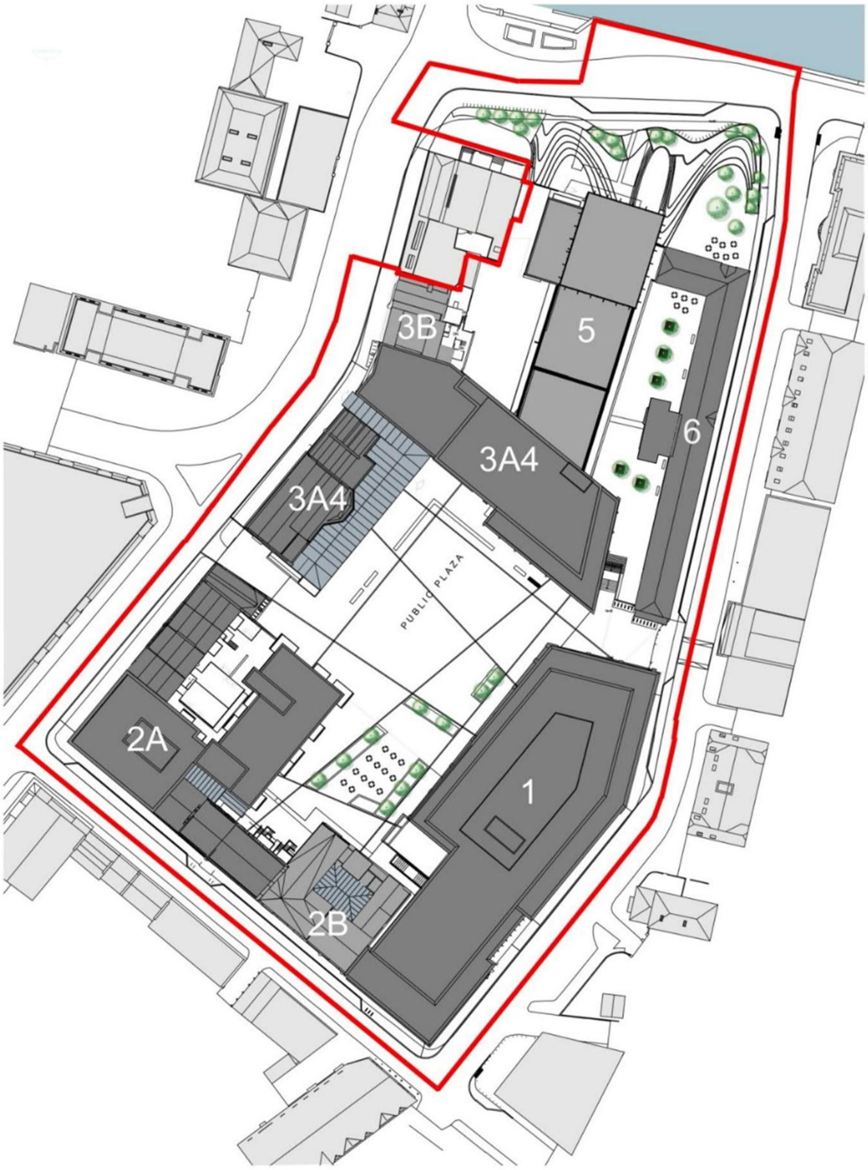


Figure 3.1: Numbered Building Parcels on the Subject Site

The development comprises a mixed-use scheme of primarily office uses, supported by a range of retail / non-retail services, café/restaurant, licenced premises, apart-hotel, civic/cultural uses (including the City Library), residential use, open spaces, access routes and ancillary areas. The development also includes environmental improvement works to the adjacent public streets.

Details of proposed development comprise the construction of:

- A new 6-storey office building on the corner of Michael Street and Ellen Street (Parcel 1) replacing the existing car park, the proposed new building ranges in height from 4-6 storeys with roof level plant and comprises office, retail and restaurant/café/bar uses at ground floor level and office use on upper levels, providing c. 12,654sq m office use and c. 1,390sq m non-office uses (excluding basement accommodation);
- An apart-hotel on the corner of Patrick Street and Ellen Street (Parcel 2A) replacing No. 6-8 Patrick Street and No. 3 Ellen Street) of 5 storeys with roof level plant and extending to the rear from ground floor level to 4th floor level including a café/bar/restaurant at ground floor. Nos. 4–6 Ellen Street are to be refurbished and modified as required, with retail at ground and basement floor levels of c. 1,366.9m². Upper levels, will comprise apart-hotel units, linked by bridge access

from the new apart-hotel building, providing a total floor area for the apart-hotel (including new build and refurbished areas) of c. 5,151 sq. m;

- Refurbishment and modification of No. 9 Ellen Street (Parcel 2B) for the provision of bar/restaurant/café uses at all floor levels, comprising 1,260sq m excluding basement;
- A new City Library within the exiting Town Hall and adjoining structures (Parcel 3A & 3A4) comprising renovation and adaption of the Town Hall (a Protected Structure) and No. 8/9 Rutland Street, replacement of building extensions to the rear with a full height glazed atrium, and connection with new-build structures replacing 6 & 7 Rutland Street, extending and stepping-up to the rear over 4/5 no. floor levels with roof plant (providing a total floor space of c. 4,515 sq m including renovation and new-build areas). A café/restaurant is also proposed at the basement level of the library (c. 446sq m). The new-build structure to the rear is split, providing for commercial office floor space over 4-5 storeys (Parcel 3A4 providing c. 2,981sq m);
- Refurbishment and adaptive re-use of 9 no. Georgian terraced houses (3no. NIAH) at Nos. 7-8 Ellen Street, Nos. 1-5 Patrick Street and Nos. 4-5 Rutland Street, respectively, to provide for retail use at ground and basement levels (comprising a total of 1,014 sq m retail floor space) and residential use on upper levels (c. 1,367sq m). A total of 16 no. residential units are proposed; 3 no. 1 bed apartments, 9 no. 2 bed apartments, 1 no. 2 bed townhouses, 1no. three bed townhouse and 2 no. 4 bed townhouses. Private open space is proposed to be provided in new balconies to the rear or ground/podium level private gardens as appropriate.
- To the north of the site fronting Bank Place, is a proposed landmark building. This building is principally 14-storeys with a 15 storey element providing for enclosed plant.[2]
- The existing 4-storey Granary Building (a Protected Structure) is proposed to be retained in office use (c. 2,303sq m) and restaurant/licenced premises use (580sq m), with the addition of a circulation core to the rear in place of the former (modern) library structure (providing a total floor space of c. 2,883 sq m).
- A significant new public square/plaza is proposed at the centre of the site (c. 4,013sq m) linked by east-west connections to Michael Street/Patrick Street, to the south via the existing archway connecting to Ellen Street (under no. 7 Ellen Street), and to the north via a new north-south public space to the rear of the Granary Building (‘the Granary Courtyard’, c. 778sq m), which links with an enhanced public space at Bank Place (c. 1,775sq m).
- A basement car park, accessed from Michael Street, will be provided with parking for 155 no. cars and 311 no. secure bicycle spaces, together with shower and changing facilities and ancillary plant, attenuation, storage, refuse management and associated areas.
- The proposed development also includes environmental improvement works to the adjacent public streets, hard and soft landscaping changes, signage and flagpoles, lighting, change in level, substations, diversion of underground services, set-down areas, and all related site development and excavation works above and below ground.
- The Bruce House Doorway, Rutland Street (a protected Structure) will be relocated to the internal gable of No. 8 Rutland Street within the new library building atrium.

3.2 Proposed Development

3.2.1 Architectural Vision

The proposed development of the ‘Opera Site’ presents a unique opportunity to regenerate Limerick’s City Centre and strengthen its importance as the trading and civic heart of the city and wider region. The proposed redevelopment will restore the architectural heritage of a historic area of the city, create a dynamic business and enterprise hub, and lead to the development of vibrant civic and leisure spaces.

[2] This building is generally described throught the EIAR as either a 14 storey, 11-14 storey or as a 14 storey + plant building.

This architectural vision for the site will deliver on the spatial and economic ambitions of the Limerick 2030 Plan for Limerick City:

> *"Limerick will become a major economic force in the Irish and European economy, a leading centre for commercial investment – both foreign direct investment and endogenous business growth, capitalising on the strength of its higher education institutions (HEIs), the skills of its workforce and it's environmental and heritage attributes. The City Centre will be at the heart of this economic force – an attractive magnet for retail, leisure, residential, commercial, educational and cultural growth. Growth will benefit all citizens across the City, County and Mid- West Region."*

(Source: Limerick 2030 Plan, Section 2.0 Vision)

The site's redevelopment will repair and reinvigorate the existing Georgian buildings by repurposing them to accommodate a mixture of residential, retail and civic uses. The commitment to restore and reinvigorate these buildings is of particular benefit to the city given the building's heritage value and the city's identity as a significant Georgian City.

In addition to the proposed development's commitment to strengthen the city's architectural heritage, the development will also provide a significant opportunity to provide modern office spaces of high architectural quality within the centre of the historic city. Thereby ensuring that market demands for large, energy efficient office space can be satisfied at the heart of the city and thus encouraging a strong business district for the north city core to flourish.

A new public square, improved access points from Rutland Street and Ellen Street and enhanced public realm improvements along the site's existing boundaries will provide attractive connections both into and through the site. The increased permeability of the site will ensure that it is a fully connected part of the city, whilst the provision of quality open spaces will make it a pedestrian destination.

The new public square will have a significant cultural and civic function, owing to the proposed location of the new City Library within the adjoining former Town Hall, and will as such provide a unique space for events, markets and social activities.

At the north of the site, a new tall building acts as a beacon and identifies the site's nodal position in the city at the confluence of the Shannon and Abbey rivers.

This multi-faceted approach to the site's rejuvenation will deliver the Limerick 2030 Plan's vision for the site:

"The Opera Site will be revived through a new, more intensive collection of activities focused on commercial, civic and public sector offices, an Innovation Hub, higher education facilities and supplementary retail/leisure uses. This is also an opportunity site for the location of higher education facilities components, with teaching, research and commercialisation facilities, should agreement be reached on this matter. Delivery cannot wait for this to be resolved. The potential exists to create active use at ground floor level. A new setting will include high quality pedestrian-oriented streets, strengthened connections to and through Arthur's Quay to the Waterfront and a new managed public space within the Site itself."

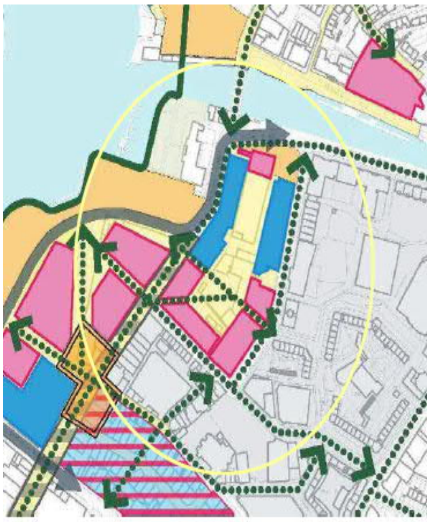


Figure 3.2: Zone Plan (Source: Source: Limerick 2030 Plan, Sub Section 6.91 – Vision, the Opera Site)

3.2.2 Policy Framework and Design Brief

In 2018, a comprehensive review of the development of the Opera Site was undertaken to consider the rejuvenation of the site within the city and develop a masterplan for its appropriate re-development.

The Limerick City Development Plan 2010-2016 is the statutory development plan currently in place for the development of Limerick City. Limerick 2030: An Economic and Spatial Plan for Limerick (Nov 2014) was formally adopted as Variation No. 4 of the Limerick City Development Plan 2010-2016 in January 2015. This identifies the Opera Site as presenting a major opportunity for a new business and innovation centred mixed-use re-development, and mandates 'the preparation of a detailed master-plan for the development of the Opera Site'.

A Design Brief for the Opera Site was developed in response to the Limerick 2030 Plan to further define development parameters for the site and to help guide and refine the preparation of the Masterplan. This was submitted in April 2018 to Limerick City & County Council, following a public consultation period.

The Design Brief provides for the following, in summary:

- Redevelopment of the Opera Site to the requirements of the Limerick 2030 Plan.
- Restoration and repair of buildings of conservation value and maximise significant new build opportunity.

- Encourage a variety of uses and active street frontages in association with the business-led mixed-use development.
- Provide an appropriate quantum of development of the site, which achieves 45,200 sq m of floor space envisaged in the Limerick 2030 Plan.
- Provide an appropriate quantum of open space, envisaged in the Limerick 2030 Plan, including inter alia, a 3,700 sq m internal square, a stronger gateway at Bank Place (1,100 sq m) and high quality surrounding streets to provide a safe, animated and inviting public realm.
- Provide a new landmark development at Bank Place in the range of 12-16 storeys, demarcating the important nodal river crossing point to the City core from Kings Island, with other new build structures in the indicative range of 5-6 storeys.
- Indicative site coverage of 50% - 60% and a Plot Ratio range of 2.5 – 3.0.
- Promote high quality architectural design for all new developments in the Opera Site, while respecting the receiving environment as per best practice guidance.
- Promote viable development in accordance with the principle of proper planning and sustainable development of the Opera Site.

A detailed masterplan was developed and completed in December 2018 to guide the development of the Opera Site in response to the Design Brief. The masterplan provides a comprehensive response to the objectives for development of the Opera Site, established in the Limerick 2030 Plan and the Design Brief, including:

- Site characteristics and urban context;
- Conservation and built heritage;
- Site constraints and opportunities;
- Development strategy;
- Urban design, open space and land use;
- Building height and massing;
- Public realm and landscape;
- Transport, access and parking; and
- Phasing implementation and delivery.

This Project Description describes the design of each part of the development in greater detail, based on the principles established in the masterplan.

3.2.3 Urban Context

As stated in Section 3.1.1, the subject site forms the majority of an entire city block at the northern end of Limerick's Georgian quarter.

The perimeter of the block to the south, west and north west is characterised by largely 4 storey brick buildings dating mainly from the Georgian period. The late 18th century Granary building, a four storey stone building, comprises the north east and eastern portions of the site.

Modern interventions are located on the remainder of the site; a 1960's office block to the north (Cahill May Roberts Building), a 3 storey modern extension at the rear of the Granary currently housing Limerick City Library, a surface car park to the south east and 20th century industrial and warehousing buildings at the centre of the site.

The general surrounding environment is characterised by mixed-use development including retail, offices, leisure, institutional and community facilities, and residential uses. A variety of building heights compose the surrounding environment: the predominantly 4-storey Georgian terraced streetscape of the perimeter streets, 4-6 storey office buildings on Michael Street and Charlottes Quay, 3-4 storey residential buildings to Michael Street, the 7-storey Sarsfield House to the west, the 7-storey 'Euro Carpark' multi-storey carpark with residential above to the east of the site, and the 2-3 storey stand-alone historic structure of the Hunt Museum.

3.2.4 Conservation and Built Heritage

The location of the Opera Site is an area of particular importance in the historic development of Limerick City Centre. After Limerick was declared in 1760 to be no longer a fortress, it underwent a period of rapid expansion southwards of the city centre. George's Quay was constructed and lined with fine townhouses, and a new bridge on the site of the present Matthew Bridge was commenced. From the mid-18th century, the Georgian quarter of Newtown Pery was developed, and during the 1760s the Custom House (now the Hunt Museum), Lock Quay and Charlotte's Quay were completed. Rutland Street played an important role in this period of rapid development, linking the new bridge from King's Island and the Quays to either side of the Abbey River to Patrick Street. It was lined with an impressive sweep of redbrick terraces with the fine civic buildings of the Custom House and the Town Hall at either end.

The streets of Georgian Limerick represent a unique example of 18th and 19th century town planning in Ireland that remains to a large extent intact. The hierarchy of streets and buildings with fixed proportions and ordered symmetry forms a notable townscape heritage that gives Georgian Limerick a special sense of place.

Bank Place formed part of a once grand development of Georgian terraces along Charlotte's Quay facing the Abbey River, of which the terrace of three buildings at Nos. 7-9 Bank Place survive. The urban space is larger today than recorded in the1888-1913 25 inch OS Map.

The Hunt Museum, originally the Custom House, is described by the NIAH as probably the most important mid eighteenth century classical building in Limerick City. Whilst its principal frontispiece with arcaded wings faces the River Shannon to the west, the setting of the Hunt Museum also relates to Bank Place visually on approach from west along the river and from across the bridge to the north.

The block form of the Opera Site remains largely intact to its west and south perimeter, and to the original extent of Michael Street along the length of the Granary Building. A narrow alleyway punctuates the terrace between the former Town Hall on Rutland Street and No. 1 Patrick Street, and the carriage arch at No. 7 Ellen Street also gives access to the rear of the terraces at a mid-block location off the street. To the east of Rutland Street, beyond Michael Street, much of the medieval pattern of Irishtown remained in place as the Georgian city developed, and today retains a more informal arrangement of narrow streets and smaller buildings. The current alignment of the southern end of Michael Street dates from the second half of the 20th century.

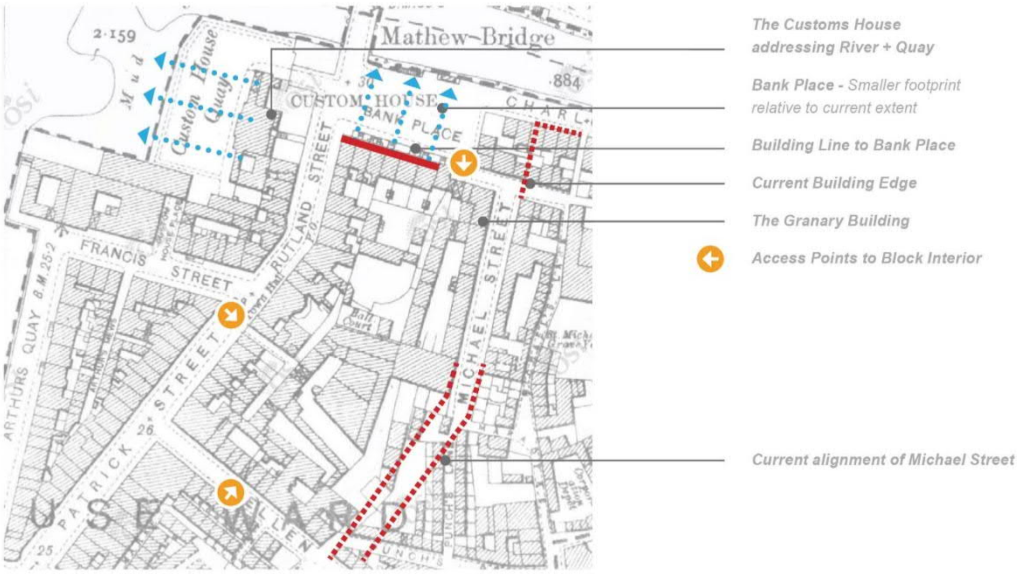


Figure 3.3: Historic Block Form, Access Points and Aspect of Key Buildings (Source: 1888-1913 25 inch Ordnance Survey Map)

Detailed inspections and evaluations of all existing buildings have been carried out. The resultant conservation design approach is summarised below:

- The Opera Site was developed in the mid-late 18th Century and is the entrance to the Georgian city from the north;
- Each building has been inspected and assessed in terms of its condition and the extent of remaining significant fabric;
- Buildings have been categorised (4 categories) in terms of their significance to guide the architectural design approach for the development and to ensure the protection of the special character of each building;
- The site includes a number of protected structures and buildings listed on the National Inventory of Architectural Heritage, including: the Town Hall Building, the Granary Building, the birthplace of Catherine Hayes at No. 4 Patrick Street, Nos. 7-9 Bank Place, an original doorway at No. 6 Rutland Street, and a number of other Georgian buildings of high significance;
- Other buildings are in poor condition or do not retain original or important interiors. These buildings have scope for higher levels of intervention;
- The appropriate approach is to retain the Georgian character of the streetscape;
- Significant interiors would be retained, while other buildings would be fully refurbished internally;
- Strong conservation approach with suitable new uses proposed for the historic buildings;
- Provide a focus on the Town Hall, one of the most significant historic structures on the site;
- A suitable relocation for the doorway and surround currently located at No. 6 Rutland Street should be found and incorporated into publicly accessible building on the site;
- Various public uses at ground floor levels ensuring the viability of the street; and,
- Continuation of the original use of residential to the upper floors of Georgian houses follows best conservation practice and ensures round the clock occupation on the site and should aspire to serve as an exemplar project for the treatment of other Georgian structures in the city.

An evaluation and a heritage impact assessment have been completed and is included as part of this EIAR, please refer to Chapter 18.

3.2.5 Site Constraints and Opportunities

The Design Brief identified constraints and opportunities for the development of the site, which informed the master planning strategy, illustrated in Figure 3.4.

The most significant constraint is the retention of the heritage buildings and the varied condition of the building fabric and remaining features, their height and varying floor levels. It is also noted that 7-9 Bank Place is not in the control of Limerick City and County Council; nevertheless, the masterplan included consideration of these structures within the overall city block.

The opportunities of the site re-development include: protection, renovation and re-use of existing historic buildings, establishment of active street frontage and an appropriate built edge to the vacant areas of the site, improved public realm and a new urban space, removal of poor quality structures, increased activity on the site with significant new buildings, and an opportunity for a tall building on the site addressing the Abbey River at Bank Place.

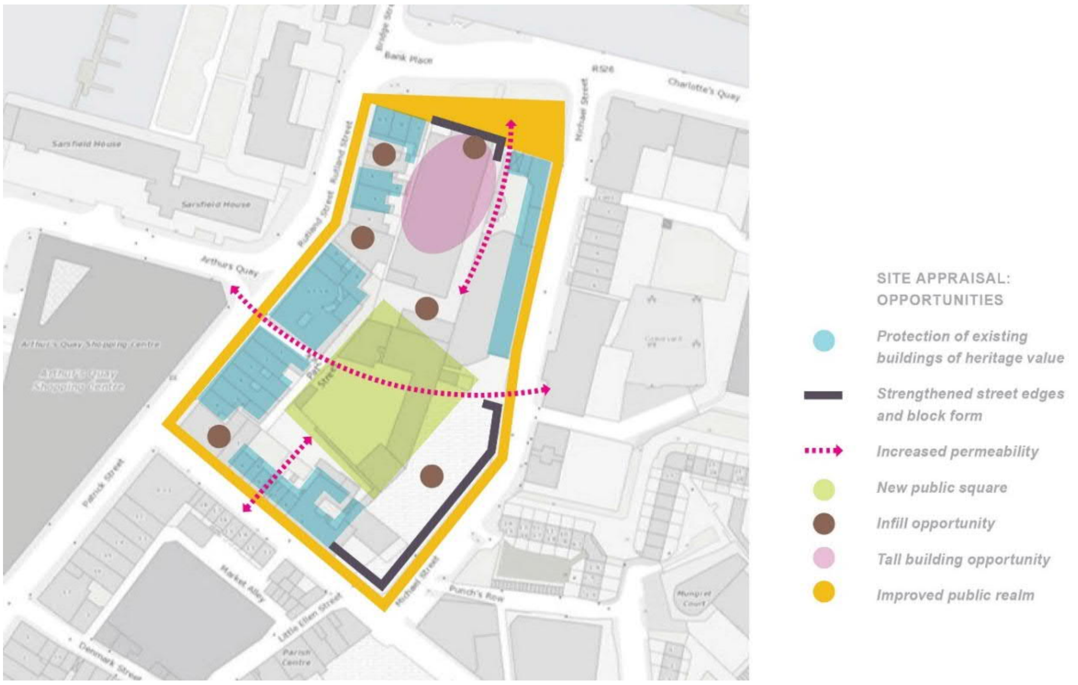


Figure 3.4: Site Opportunities

3.2.6 Development Strategy

The existing buildings were examined to assess their heritage importance, condition and potential for re-use/adapted use. The potential for the existing buildings to positively contribute to the fulfilment of the objectives for the project was also considered.

This resulted in a conservation-led approach which sought to retain buildings of conservation value where possible (Figure 3.5), ensure the accommodation of appropriate uses, and also ensure that the setting within the re-development of the site was given proper consideration.

Structures of little or no heritage value, of very poor condition, or of little spatial merit were identified for removal in order to facilitate new interventions on the site. The removal of these structures also ensures that adequate spaces and settings are provided for appropriate uses such as civic, commercial and residential in both the retained and new buildings.

Opportunities to position new public spaces, to provide an appropriate setting for proposed civic centres of importance such as the former Town Hall building, also informed the development strategy.

Figure 3.5: Buildings of Heritage Value for Retention

The development strategy for the site proposes to reinstate traditional urban edges, create high quality public open spaces and provide increased connection routes which will dramatically improve the permeability of both the site and the wider urban area. These proposed interventions thus complement the design objectives set out in the 2018 Design Brief, prepared by Limerick 2030 (see Figure 3.6).

The design evolution of the site layout is described in more detail under Chapter 4 – Alternatives of this EIAR, to explain the design process and decisions taken in developing the proposed solution.

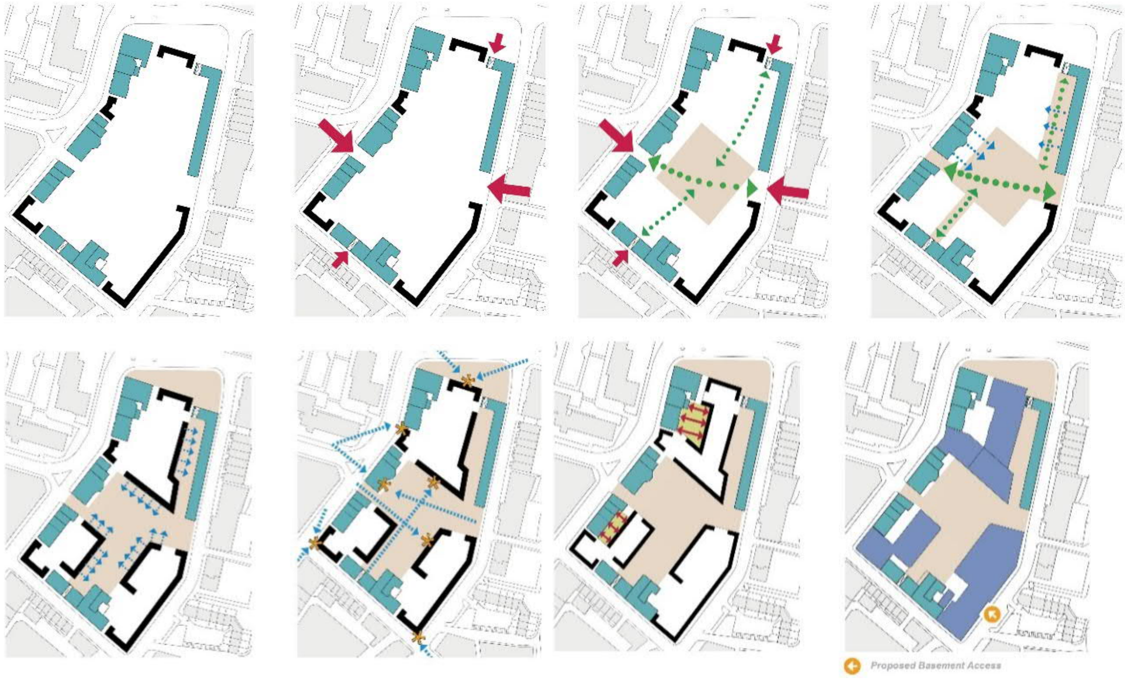


Figure 3.6: Development Strategy, Reinstatement of Urban Edges, Creation of Spaces and Permeability

3.2.7 Building Form and Urban Spaces

The proposed public square forms the centre piece of this development, providing a space for urban life to flourish and acting as an artery through which residents, workers and tourists alike can access the range of uses facing onto it.

In particular, the proposed square provides a suitable setting for the historically and architecturally significant Town Hall building. The proposal to locate the city's new central library within the Town Hall building also ensures that the proposed public square is anchored by a significant civic function which will attract users from across the city and establish the square as a vibrant and dynamic space for the city as a whole.

The re-development of Bank Place, including an upgraded and enlarged public plaza and the proposal to locate the scheme's landmark tower at this location, establishes a strong identity for the scheme and also highlights the importance of this location as a nodal point in the city between the medieval core to the north of the Abbey River and the Georgian centre to the south.

The proposed public square at the centre of the development and the enlarged public plaza at Bank Place ensure that permeable, attractive spaces are created which facilitate easier access to surrounding streets and provide spaces to linger and appreciate the bustling activity generated by the proposed civic, social, residential and commercial uses within the scheme. These spaces also strengthen the attractiveness of the area as a whole and complement existing high profile destinations such as the Hunt Museum and the Milk Market.

The building forms within the development also provide a variety of floor plates in terms of scale and size, which exhibit active and attractive perimeter frontages. These forms ensure functional spaces are provided across the site which are flexible and can sustain a range of uses.

Service access and basement parking access is best positioned on Michael Street which is easily accessible, lightly trafficked, and has sufficient site frontage to best accommodate it.

3.2.8 Urban Design and Open Space

The proposed development presents a significant opportunity to connect the Opera Site block to the riverside route along the Shannon, from the former docks to Arthur's Quay, and crossing the Abbey River, to Merchant's Quay and St. John's Castle (Figure 3.7).

These spaces can provide nodal points connecting pedestrian routes and surrounding city lanes, to enrich the pedestrian experience and attractiveness of the city centre.

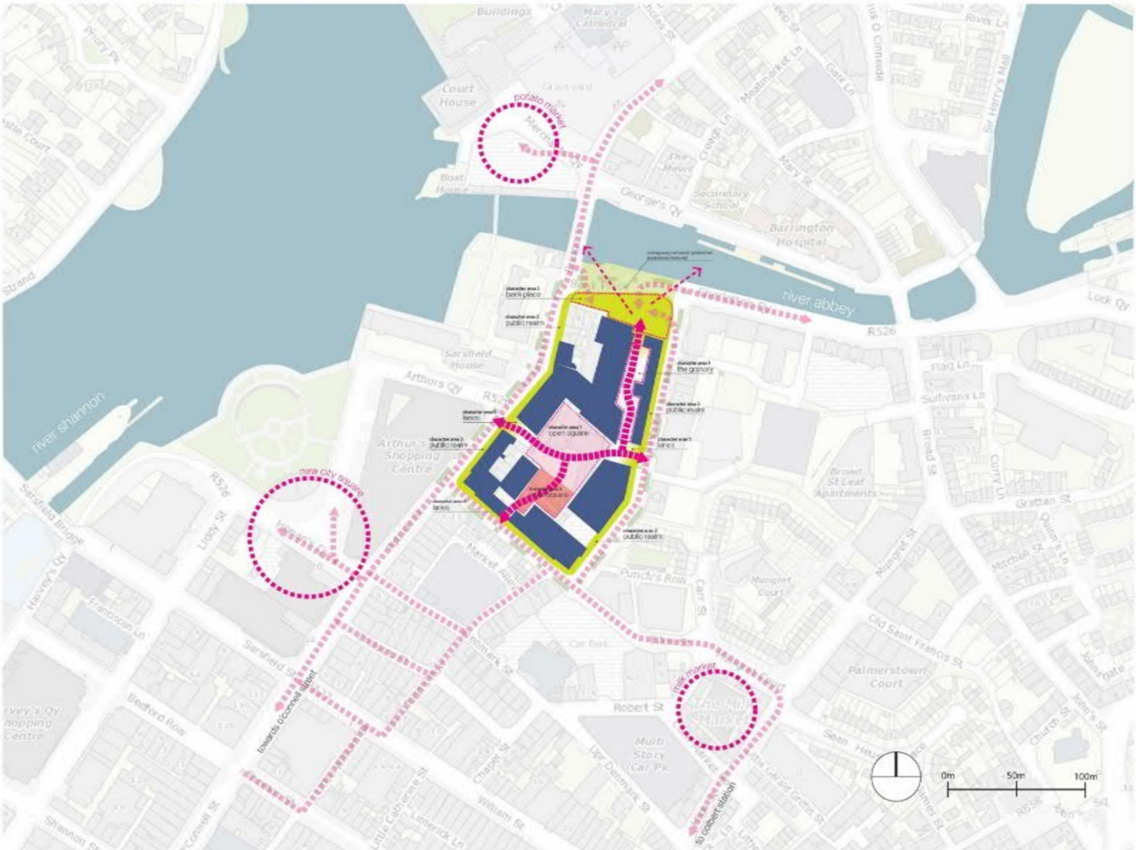


Figure 3.7: Links to Future and Existing Public Spaces

3.2.9 Building height and massing

The building height and massing of the proposed development, and of each individual building, has been considered carefully in order to ensure that the potential for new build opportunities on this large brownfield city centre site is maximised and to ensure that the site's context is respected, and the proposed buildings sit comfortably within the existing environment.

The proposed building form and heights reflect the masterplan vision for the subject site to provide new buildings which range in height from 4 to 6 storeys with a tall building stepping from 11 to 14 storeys.

This approach to heights is outlined within the guidance set by the 2018 Design Brief for the wider block:

"*A general height of 5 to 6 storeys is considered appropriate for new buildings on the site save for the provision of a landmark structure………the suitable height for a tall building on the Opera Site is likely to be in the range of 12-16 storeys*"

The heights of each new building were informed by the parameters set in the 2018 Design Brief for the wider block, and by examining their visual impact on the surrounding streetscape, the existing buildings within the area and the proposed new public spaces contained within the development. The building forms and heights were also assessed in terms of shadowing and sunlight impacts.

Arising from these assessments, specific heights for each building (including roof plant) were determined.

The alternatives assessed are described in detail in Chapter 4 – Alternatives of this EIAR.

In conclusion, the visual assessment of the building heights resulted in the following recommendations:

- South East Commercial Quarter: Overall recommended height is 6 storeys + plant, with 4 storeys to the corner of Ellen Street and Michael Street, rising to 5 towards Granary with a setback 6-storey element.
- South West Residential Quarter: A 5-storey building to the corner of Ellen Street and Patrick Street, with a 4-storey (+ plant) rear block within site behind the existing terraced houses on Patrick Street.
- North West Civic and Cultural Quarter: 4-storey infill is recommended to Rutland Street, with a setback fifth storey as the building extends to the north side of the internal square.
- North East Commercial Quarter: A height of 14-storey (+ plant) with a 'shoulder' of an 11-storey element is recommended for the tall building to Bank Place, in a simple form with consideration of slenderness in its external expression (Figures 3.8 - 3.9).

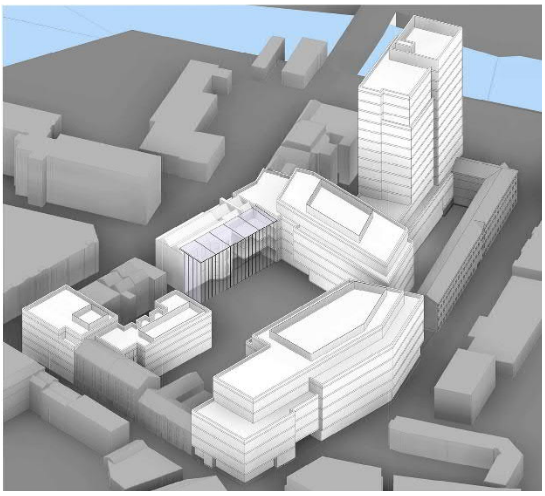


Figure 3.8: View from South of Massing Model

Figure 3.9: View from East of Massing Model

3.2.10 Land Use

The Design Brief established a mix of uses for the development of this site, with an emphasis on commercial use to the north, and the possibility of residential uses to the south.

The mix of uses proposed for the site has been further examined and refined to complement surrounding uses. The existing buildings to be retained have been assessed in terms of their size, layout, history, condition, and location, to ensure that the most appropriate use is assigned to each building.

This, along with the urban design of the city block and the creation of a new central square with access points in each direction, has established four quarters:

1. A civic and cultural quarter to the north-west;
2. A commercial quarter to the north-east;
3. A commercial quarter to the south-east; and
4. A residential quarter to the south-west.

Retail and bar/ restaurant uses are to be dispersed throughout the site at ground floor level to ensure active street frontage and a vibrant public realm.

The architectural proposal for the re-development of the Opera Site is a responsive approach to the challenges and opportunities of the site, to deliver the vision and objectives of the Limerick 2030 Plan and the Design Brief for the site, compliant with the development parameters established by the masterplan.

The proposed development:

- retains, restores and provides sustainable use of the existing buildings of conservation value;
- inserts new buildings to accommodate increased activity on site and enliven this part of the city;
- creates new public spaces and enhances existing streets and spaces to enrich the experience and enjoyment of the public realm;
- connects to surrounding city destinations and cultural attractions, contributing to the city's vibrancy; and,
- landmarks this location as an important nodal point in the city and renews the city's business district.

3.2.10.1 Plot Ratio

The Design Brief outlines an indicative plot ratio of 2.5 - 3.0 for the overall Opera Site (including Bank Place and Nos. 7-9 Bank Place). The proposed development represents a plot ratio of approximately 2.6.

3.2.10.2 Site Coverage

This development proposal, including Bank Place, represents approximately 56% site coverage, which falls within the range of 50 - 60% established in the Design Brief.

3.2.10.3 Mix of Uses

The mix of uses envisaged in this masterplan is in compliance with the Design Brief as a business-led mixed-use development. Table 3.1 provides a summary of uses.

Table 3.1 : Summary of Uses (Including Retail Basements sq m)

SUMMARIES BY PARCEL	Retail	Residential	Office	Cultural	Rest/ Café/ Bar	Aparthotel	Other	Totals
PARCEL 1	960.00	0.00	12,654.00	0.00	430.00	0.00	54.00	14,098.00
PARCEL 2A	1,013.80	1,366.90	0.00	0.00	0.00	4,710.60	0.00	7,091.30
PARCEL 2B	0.00	0.00	0.00	0.00	999.30	0.00	0.00	999.30
PARCEL 3A&4 (Town Hall and 8+9)	0.00	0.00	2,581.00	4,147.80	250.00	0.00	0.00	6,978.8
PARCEL 3B	444.22	511.80	0.00	0.00	0.00	0.00	0.00	956.02
PARCEL 5 (Tall building, Bank Place)	0.00	0.00	12,331.00	0.00	0.00	0.00	0.00	12,331.00
PARCEL 6 (Granary)	0.00	0.00	2,135.51	0.00	579.90	0.00	0.00	2,715.41
TOTAL	2,418.02	1,878.70	29,407.30	4,147.80	2,259.20	4,710.60	54.00	45,169.83
	5.35%	4.16%	65.76%	9.18%	5.00%	10.43%	0.12%	100.00%

3.3 Architectural Design

This development includes a number of new build interventions to the site, whose mass and scale has been developed sympathetically with its surrounding historical context. The overarching approach is to gently step the massing of the new build up from the existing 4- 5 storey buildings at Ellen Street through 4- 6 storey buildings around the new public plaza, and ultimately to a 14-storey tower at Bank Place.

Table 3.2: Overview of Parcels

Parcel Number	New or Retained	Building description	Total Gross floor areas (incl basements) (m²)
1	New	Office building over five storeys with retail space and restaurant/café/bar accommodation provided at street level. Built as part of Phase 2.	14,098.00
2A	Retained/New	1-5 Patrick Street and 4-8 Ellen Street, a combination of refurbishment of existing Georgian accommodation to bring it into use as retail space with residential accommodation in the upper storeys. This residential refurbishment will take place over three existing storeys. Parcel 2A also includes an aparthotel over four storeys. The Parcel will be built in Phase 2.	7,531.30
2B	Retained	9 Ellen Street. An existing building will be refurbished across three storeys to provide accommodation for a licensed bar and restaurant.	1,1260.30
3A+4	Retained/New	8-9 Rutland Street and the Town Hall, which will include accommodation of the new library and refurbishment and modernisation of the existing buildings for civic uses. The existing building is 3-4 storeys high and the proposed new build part of the library is proposed at 3 storeys high. It is also proposed to provide a restaurant/café/bar. The remaining new build accommodation provides office accommodation over four floors.	8,138.19
3B	Retained	4-5 Rutland Street, will become a refurbishment of existing Georgian four storey buildings, where retail is provided on the ground floor and residential accommodation is provided on the three storeys above.	956.02
5	New	14 storey office accommodation (will result in the demolition of 2 existing buildings).	13,264.00
6	Retained	The Granary building will retain the existing four storeys and refurbish the ground floor as food and beverage provision with the upper levels as offices.	2,882.36
Basement Parking Area	New	An underground basement will be provided beneath Opera Square.	3,352.00
Basement Plant Areas	New	Plant areas to service the accommodation above.	2,906.34

The Opera Site is a 2.35 hectare site within the heart of Limerick city, and gives a fantastic opportunity not only to provide much needed accommodation, but also to challenge and inform the scale of future development in the city centre.

The Limerick City Development Framework (2014) supports the use of increased scale on the site, and states “In order to optimise the potential of the city centre, and to accommodate the range and scope of uses envisaged, it will be necessary to develop a building form that will be larger in scale than its immediate surroundings”;

However, it also states that “The relationship between the existing and new will need to be carefully considered in the proposed architectural treatment to ensure that the scale of development does not overwhelm the surroundings, while achieving a contemporary design that reinforces the regeneration objectives for the city”, and it is important that he existing buildings read as equal partners within the overall scale and mass of any proposal.

This proposal includes a number of new build interventions to the site, whose mass and scale has been developed sympathetically with its surrounding historical context. The overarching approach is to gently step the massing of the new build up from the existing 4-5 storey buildings at Ellen Street through 4-6 storey buildings around the new public plaza, and ultimately to a 14-storey tower at Bank Place.

3.3.1 Materials

The materials used across the site’s existing building stock are comprised of a variety of different colours, tones and textures (Figure 3.10). A large amount of these materials will be retained and integrated into the proposed development. In addition, a complementary palette of new materials is also proposed which will instil a sense of modernity, quality and personality to each of the new buildings.

In those buildings which constitute infill interventions along the existing traditional streetscape, the dominant material used is traditional brick, selected from a palette of grey, brown, blue and red to reflect the tones of existing materials on the site. The fenestration of these streetscape facades reflects the strong rhythm and proportions of the existing window arrangements, however modern detailing and setbacks clearly express the contemporary design components.

New build elements contained within the scheme will utilise a mixture of brick, glass and metal to express a clear contemporary voice for the development whilst also ensuring that the surrounding context is respected.

Figure 3.10: Existing Materials Palette

3.3.2 Parcel 1

3.3.2.1 Building Summary

Parcel 1 is located at the corner of Ellen Street and Michael Street, extending to the Granary Building to the north and is largely occupied at present by a surface car park. It is proposed to provide a new 4-6 storey office building with a floor area of approximately 16,147 sq m at this location.

The proposed Parcel 1 building constitutes a simple and clean form capable of providing large format flexible office floor plates on upper levels and active retail and restaurant uses at ground level.

The building is primarily 5 storeys in height with a 6th floor setback. At the south and south eastern elevations, the building is four storeys in height reflecting the more sensitive context of Ellen Street.

The ground floor will consist of the following elements:

- The ground floor will be recessed in parts to broaden the footpath at entrances to retail and restaurants, and to provide safe outward swing fire egress doors and zones for natural ventilation of the basement below.
- The basement car park entrance and service elements including a substation will be located along the Michael Street ground floor elevation.
- The majority of the ground floor will provide retail and restaurant uses to ensure an active streetscape and to provide support uses for the office workers. Each unit will have dual frontage to increase their presence, with service areas set within the depth of the respective units.
- The entrance to the offices will be from the new square to establish its central role to the development. A generous lobby area will provide suitable reception facilitates for multi-tenancy and provide direct access to a central core with separate routes to the external for safe egress.

The upper floor plates are planned for full flexibility, with a central core for vertical circulation, service risers and toilet provision. An additional egress stair and lift will be provided to satisfy horizontal fire travel distance limitations. The office floors and floor-to-floor heights provide for raised floors and ceiling zones to achieve Grade A office accommodation, which is required to meet market requirements.

3.3.2.2 Design

The Parcel 1 building has been designed to provide simple and efficient office space layouts which satisfy the modern office requirements of the large commercial tenants which it is hoped will occupy the building. The building has also been designed to maximise active street frontage around its perimeter by locating active restaurant/retail uses at ground floor level. The street lines of both Michael Street and Ellen Street are also reinstated and as such the building repairs the current fragmented morphology of the site.

In response to its massing, plan form, and the plot structure of its immediate environment, the building is expressed as two masonry elements: a 4-storey volume to the corner of Ellen Street and Michael Street, and a deeper 5-storey volume following the kinked building line of Michael Street and addressing the public square. These elements are punctuated on both street and square sides by a lighter glazed treatment above an access zone archway.

The form and façade treatment of the building above this archway will be articulated where the building steps up in height from the smaller scale urban grain of Ellen Street to provide a varied massing, and also signals the location of this entrance from Michael Street.

To the north of the building at the entrance to the public square, the elevational base treatment steps up to create a two-storey base in order to highlight this location as a gateway into the scheme. This treatment wraps around to the western elevation of the building fronting onto the square where a vertical recess in the façade plane articulates the main entrance into the office space on upper levels. In addition, further recesses and glazing along Michael Street above the basement ramp access and to the north towards the entrance into the public square provides further variety and legibility (Figure 3.11).

Retail and restaurant uses are proposed at ground floor level in order to maximise the activation of street frontages and relationship to the public realm. A small retail unit is proposed to the corner of Ellen Street and Michael Street. A larger retail unit is proposed to face the northern part of the Michael Street façade, extending along its kinked length around to the public square, and with entrances to each of these three facades. This corner location is ideally suited to a retail unit, to serve both the development and the wider community to the east.

At the western elevation fronting onto the public square, a generous entrance lobby serving the office building will be located at the proposed new public square. This location was chosen in order to ensure lively daytime activity and sense of presence to this new urban space, and to provide direct amenity for the building users. A steel and glass canopy has been incorporated to the western façade of Parcel 1 over the car park ramp to prevent winds travelling down the building and into the under croft. The entrance has been positioned on axis with the primary pedestrian access to the square from Rutland Street.

A restaurant/café is proposed with significant presence to the south-western part of the public square, where there is an opportunity for outdoor seating and a relationship with other restaurant and bar uses at this part of the site. This restaurant extends through the width of the block to Michael Street where it has another entrance and allows for day-time and night-time overlooking of the ramp and pedestrian access archway.

An arcaded ground floor is proposed to the north-west face of the building to the public square and to its Michael Street frontage, forming sheltered arcades with an increased sense of generosity at interfaces with the public realm.

The setting back of the upper two floors will provide the opportunity for a generous south-west facing roof terrace at fourth floor level and a roof terrace will wrap around the perimeter of the fifth floor. Both terraces will add greatly to the amenity of the office accommodation. At roof level, a set-back louvered enclosure is proposed to screen rooftop air handling plant. A photovoltaic array is proposed at roof level to the south of the building and will be screened visually by the parapet which also serves as a guarding for maintenance access.

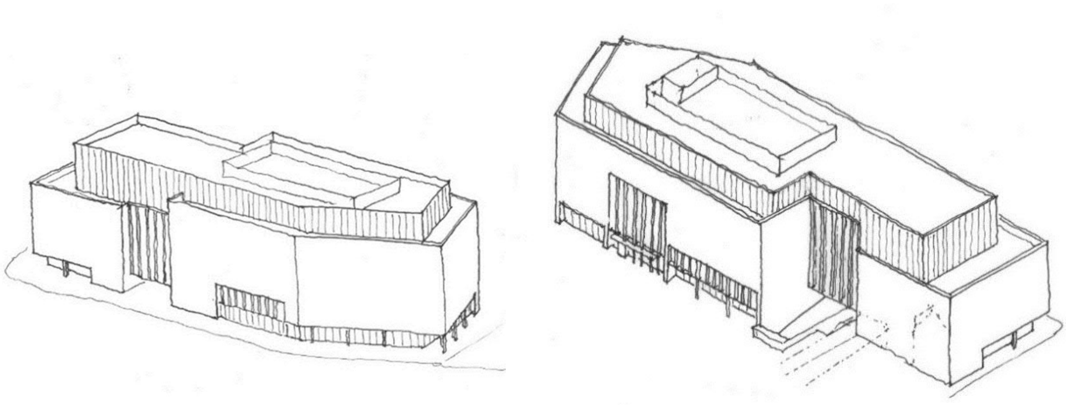


Figure 3.11: Parcel 1 Massing Sketch

3.3.2.3 Materials

To the north of the Parcel 1 site, extending along Michael Street to Bank Place, the Granary presents a coursed rubble façade with brickwork window surrounds. As such, a predominantly brick façade was considered the correct choice of material to complete and repair the urban grain and complement the existing streetscape. The intended brick is of a grey/ buff colour, similar to the directly adjacent stone buildings, and harmonious with the variety of brick colours around the site.

Furthermore, large floor to ceiling height windows are proposed to provide sufficient daylight to the office floor levels. Pressed metal reveals to these windows are proposed as a contemporary take on the plastered window reveals within brickwork facades, typical of the Georgian buildings in the area.

An arrangement of two wider windows per structural bay provides high levels of daylight which distinguishes the building as a modern intervention. The rhythm of the windows will be broken at corner junctures where a higher proportion of brick is proposed. This is further broken down at the transition to the smaller scale and grain of Ellen Street with a more playful and irregular arrangement of brick and window façade treatment. Windows have also been introduced to provide overlooking of the pedestrian route and car park ramp from ground floor restaurant and from office levels above.

Brick clad piers extend to ground level around the perimeter of the building, and a simple glazed façade is proposed to the shopfronts and café/ restaurants at ground floor level. A double height order is presented to these piers at the northern end of the Michael Street elevation and the north elevation of the building facing the Granary Building.

A high quality glazing system with a vertical emphasis and fritted treatment at floor levels is proposed to the setback upper levels of the building, extending to form a parapet and guarding at roof level. This façade treatment extends to the recessed break between the brick volumes from first floor level upwards, above the car park entrance and pedestrian route. To Michael Street, a series of vertical metal fins will be applied to the glazing at this location, which, along with a canopy at first floor level, clearly signals the entrance to the car park and the pedestrian route from Michael Street.

The principal entrance to the office building will be similarly marked by means of a wide three-storey break in the brick façade. Here, recessed glazing with vertical metal fins and a canopy will announce the entrance to the office reception foyer from the new square.

3.3.3 Parcel 2A

3.3.3.1 Design

1-5 PATRICK STREET AND 4-8 ELLEN STREET

The design proposes that the Georgian terraces, which line the corner of 1-5 Patrick Street and 4-8 Ellen Street, will be sensitively refurbished to provide 13no. apartments. The apartments are laid out in such a way as to respect the historic proportions of the buildings where possible, creating spacious accommodation in a variety of unit sizes. The apartments will also benefit from private and communal open spaces to the rear, protected from the public areas around the plaza.

In addition, a new build Aparthotel will be located at the corner of Patrick Street and Ellen Street. This building will provide 57 hotel apartments, 6 of which are located in 4 & 5 Ellen Street and directly accessed from a glazed atrium within the main body of the hotel.

At ground floor, the existing buildings provide opportunities for small scale retail offerings which will support the broader development and create an active and interesting street frontage.

A main access to the apart-hotel is located on the corner of Patrick Street and Ellen Street, with access to the bar and restaurant available directly from the new public plaza. Access to the existing buildings will be retained on Patrick Street and Ellen Street, and rear access to these buildings will be through a gated laneway to the rear. All retail units also have access directly to the existing basements.

The Patrick Street and Ellen Street Elevations of the new build element of Parcel 2A will be finished in pale cream stone. At the ground floor, this building has a strong colonnade which reflects the height and proportions of the existing adjacent shop fronts, and the uniform rhythm of the fenestration above reflects the Georgian streetscape.

Within the new public plaza, the apartments and hotel apartments will be served by balconies which look out onto the public square, and sliding screens give further definition and greater privacy.

The rear Patrick Street elevation of the existing Georgian terrace lead out into private open spaces, glimpses of which could be seen from the plaza. This façade will be sympathetically restored using salvage materials from the site, as described in Chapter 18 of this EIAR.

3.3.4 Parcel 2B

3.3.4.1 Design

9 ELLEN STREET

No. 9 Ellen Street, or Quinn's as it is known locally, will be refurbished to provide a bar and restaurant which will serve both Ellen Street and the Plaza. The internal courtyard will be retained with a new glazed roof to provide cover and a new glazed circulation link will allow the building to meet current building control requirements without impacting on the historical structure of the building.

Access will be available to the rear of the building, adjacent to the basement access ramp for servicing and deliveries.

The proposal is to retain the majority of this handsome stone building, but where works are required to remove older returns at the rear, appropriate or salvaged materials from the site will be used in the alteration and repair of this building.

Framless glazing will be used in the original ground floor door openings and a fully-glazed stair core is proposed at the rear of building.

3.3.5 Parcel 3A4

3.3.5.1 Design

TOWN HALL AND NOS. 8 & 9 RUTLAND STREET

The Town Hall is a protected structure on the site and provides an important focal point for the new plaza. The proposed development combines the site of Nos. 8 & 9 Rutland Street with the original body of the Town Hall and provides a new build extension into the plaza to create a new city library for Limerick, which will have aspects onto both Rutland Street and the Plaza (Figure 3.12).

The design will be achieved by removing later returns and additions to the rear of the buildings and adding a highly glazed, triple height extension which faces onto the Plaza. This will produce an animated space which can also showcase the existing rear façade of the historic buildings. Carefully detailed lightweight bridges from the plaza to the main building will add to the high quality feel of this space, and ensure minimum intervention is required at the rear elevation. Furthermore, the existing external brick faces of the Town Hall will be refurbished with appropriate materials, as described in the Chapter 18 of this EIAR.

The design for the new library will provide a rich blend of historic and contemporary architecture, and a spectacular setting for an important public amenity. In addition, it will also create an elegant symmetry to the rear elevation, attractively balanced by the large central bay window.

The Library building has two main entrances. The first is from Rutland Street via the glazed infill replacing the existing buildings, and the second is on the new Public Plaza directly into the full height atrium. A further access has also been developed on the gable end of the atrium which will allow direct access into the lower ground café/restaurant. The original front door of the Town Hall will also be retained to be used as an access for special exhibitions or special occasions.

Figure 3.12: Axonometric View of the Rear of the Town Hall and Parcel 3A4

A new build infill element to the north of the former Town Hall building projects from Rutland Street into the public square. This building will accommodate both a portion of the new library and separate office uses.

Library uses will be located at the Rutland Street side of the building, which will be finished in local blue llimestone. One of the Library's two main access points will be located along Rutland Street. This entrance will be set within a contemporary angled façade with deep feature windows. This angled design is intended to reflect the angled turn in the street at this location. The contemporary approach here juxtaposes modern and old reflecting Limerick as a growing, changing city which also acknowledges its rich history.

As the building steps out, and internally, the use changes from library to office accommodation. The elevational treatment also changes to uniformed runs of buff brick piers and infill sections framing areas of curtain walling. The brick colours chosen across the new build elements have been selected to complement the variety of brickwork found within the tapestry of the site, whilst providing a subtle contrast to individual parcels.

3.3.6 Parcel 3B

3.3.6.1 Design

4 & 5 Rutland Street

It is proposed that the original heart of this pair of Georgian properties will be retained, in addition to the older return on No. 5 Rutland Street. The ground floor use is proposed as retail, sufficient to accommodate small scale support to the surrounding office accommodation, and in the upper floors three generous two-bedroom residential apartments have been provided.

A significant amount of historic fabric remains intact at No. 5 Rutland Street, including elements of the shopfront, and the design allows for minimal intervention in this property. As part of the proposed development, No. 4 will be retained in its entirety and any necessary repairs or external refurbishment carried out using salvage from the site where possible. The works will also include provision for bat boxes and bat tiles to house existing bat populations on the site.

3.3.7 Parcel 5

A new 14-storey tower is proposed at the north end of the site. The height of the tower reflects the ambitions set out in the Design Brief and creates an important statement at Bank Place, addressing the Abbey River and the Shannon beyond, whilst respecting the scale of the existing historic city (Figure 3.13).

The front elevation of the tower is flanked to the left by the Granary building and to the right by an existing Georgian terrace. The scale of these buildings, and the Hunt Museum on the opposite side of Rutland Street, demanded a careful exploration of the elevational treatment and massing of the new tower, whilst an assessment of the project's visual impact from further afield demonstrates that the scheme will achieve a delicate balance between consideration for the existing buildings and a requirement for an ambitious and modern landmark for Limerick City.

The resulting design is simple and elegant, emphasising the slender form of the three key masses which make up this building.

Figure 3.13: Bank Place Elevation

The main elevation of Parcel 5 will face directly onto Bank Place and the Abbey River.

The building mass has been developed to ensure that the building forms are simple and elegant, and the materials chosen reflect this concept. The main tower will be glazed with full length vertical fins, accentuating the height and slenderness of the form. To the rear, the second main form will also be glazed, but shading is provided by aluminium brise soleil which will help differentiate it from the adjoining tower. A third smaller stone-clad tower sits to the right hand side as viewed from Bank Place, and the fenestration here reflects the proportions of the adjacent existing Georgian terraces.

At the lower levels of Bank Place, a frameless glazing ‘shop front’ identifies the public access and waiting areas within the building, and at the Granary courtyard (eastern elevation) a three-story limestone plinth will form the base of the building, tying the mass to the Granary building. The window openings at higher level will be further expressed through the use of a contrasting bronze infill panel.

A solid stone plinth punctuated with window openings at first floor level will run along the length of Parcel 5, aligning with the eaves of the Granary building, creating an enclosed and intimate public space.

The elevation of the tower above is highly glazed to reduce the impact of the building’s overall height and mass on the courtyard and the existing neighbouring buildings (Figure 3.14).

The floor levels of the upper and lower ground floors have also been managed to ensure that the building's main entrance fully addresses Bank Place, dropping to the south to meet the existing Granary Courtyard levels.

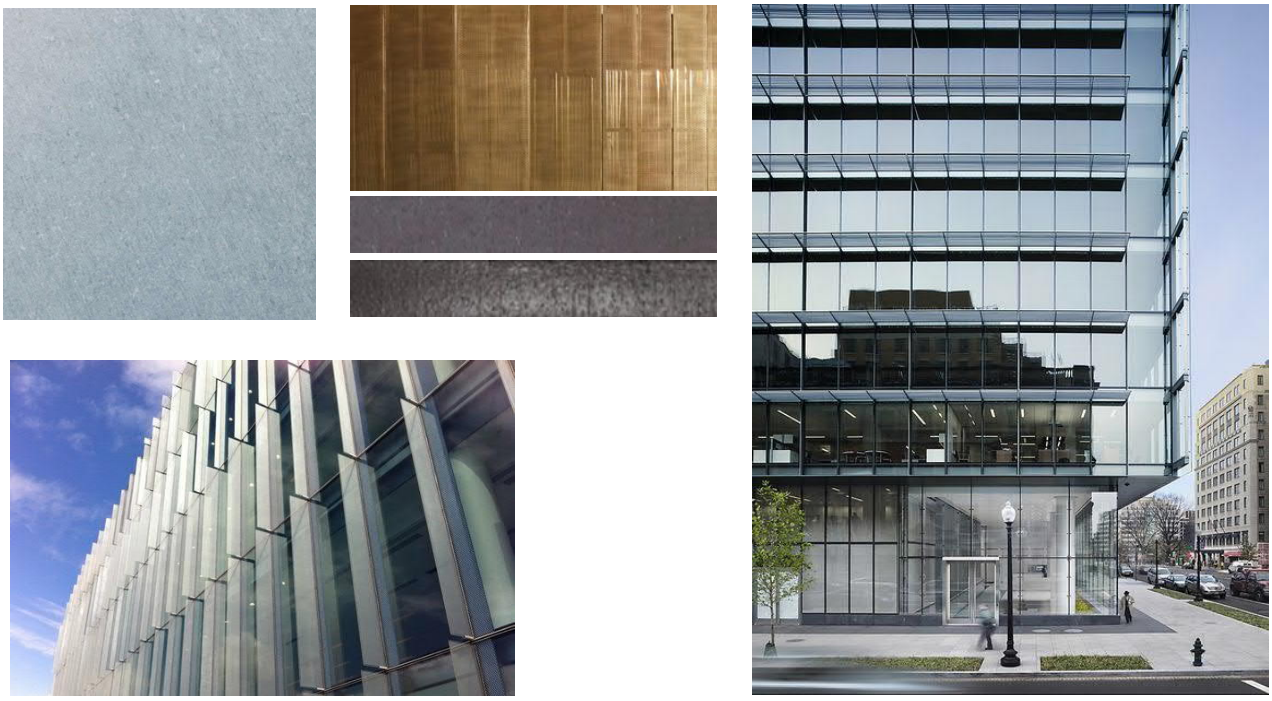


Figure 3.14: Palette and Precedent Images

3.3.8 Parcel 6

The Granary building is a protected structure. Existing uses within the building include offices, the city library and a restaurant and nightclub at the lower ground floor. The proposed development provides for the demolition of the existing modern library extension (to the rear (west) of the building) and the introduction of two new elegant circulation cores. The current uses will be maintained at lower ground with office accommodation provided above (Figure 3.15).

Figure 3.15: Granary Courtyard Elevation

Following the removal of the existing library extension, the rear façade of the granary will be reinstated using appropriate materials as set out in Chapter 18 of this EIAR.

The main vertical circulation, lost with the removal of the existing extension, will be replaced with a simple glazed box which will provide for a stair core, two lifts and toilets, with minimum interference to the original face of the building. A second 2-storey glazed stairwell will also be required on the southern gable of the building to provide fire escape from the upper ground floor.

3.3.9 Basement

3.3.9.1 Vehicle and Bicycle Access

The single entrance to the basement for the whole of the Project Opera development will be located two thirds of the way along the façade of Parcel 1 to Michael Street. This has been advised as the optimum location by AECOM Traffic engineers and separates vehicular traffic from the eastern entrance to the public square.

In line with best practice, a dedicated pedestrian and shallow-stepped bicycle stairway will be provided in conjunction with the vehicular ramp. A barrier will be provided at the base of the entrance ramp to manage access and allow cars to queue along the length of the ramp itself. Both vehicular and pedestrian entrances will be secured at night by a roller shutter or gates along the building line to Michael Street.

Bicycle parking will be provided both at basement level and within the public realm at street level; an internal bicycle store for public use will also be provided at the ground floor of Parcel 1 in addition to the private bicycle stores. This is proposed within the building envelope and accessed off the pedestrian route from Michael Street to the Plaza. In addition, office buildings will offer changing, showers and drying space for staff.

The existing buildings will be predominately serviced from the street; however, some additional service yard area has been provided within the scheme at basement level. Parcel 5 will be serviced from ground level with access from Bank Place.

3.3.9.2 Public Realm

The parameters upon which the brief for the public realm has been developed were; the site, its context and the related policy. A Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis was used to inform the design of the public realm. The SWOT provided the foundation for the design objectives set out for the public realm.

In order to create a successful urban place, it was considered critical to ensure that a variety of land uses were included in the scheme and active frontages were maximised.

To this end, the proposed development provides a range of varied uses including civic, retail, restaurant, commercial and residential in order to ensure that the public realm surrounding the Opera site and within the site itself is vibrant and bustling during both the day and evening.

The building forms proposed also maximise active frontages in key public realm areas such as Bank Place, the central plaza and the surrounding streetscapes. This too ensures that residents, workers and tourists alike are drawn into the area by visibly animated spaces which provide both a function for those patronizing them and also act as an attraction for those who simply want to linger in an energetic and dynamic urban space.

Of equal importance is how the scheme physically stitches into the immediate context with particular focus on the northern gateway into the site from Bank Place. Bank Place aims to provide continuity to the variety of existing and proposed built forms on the northern edge of this city block.

The proposals create a series of public spaces which respond positively to the site's context and offer high quality public space which can play a central role in the success of public activity.

3.3.9.3 Central Plaza

Pivotal to the development's success is the Central Plaza; a public arena that provides a multi-functional platform for social congregation and public interaction, while allowing for ease of movement both into and through it.

The new public Plaza (Figure 3.16) will include a contemporary design and include the following features and elements:

- A large mirror pool water feature;
- Raised planters including small trees and seating edges and incorporating feature lighting;
- Space for café seating and activity to spill out from adjoining buildings;
- A simple but contemporary pallet of materials. Silver grey and light buff coloured flame-textured granite paving has been selected to achieve the contemporary high quality character of this space; and
- Furniture includes a series of pigmented concrete planters and brightly-painted stainless steel cycle racks.

The Central Plaza will be a lively space adjoined by a series of active uses, including the Library and Café uses. The design of the Plaza allows for activity to spill out from adjoining buildings, with areas defined for café seating and benches provided for informal social space.

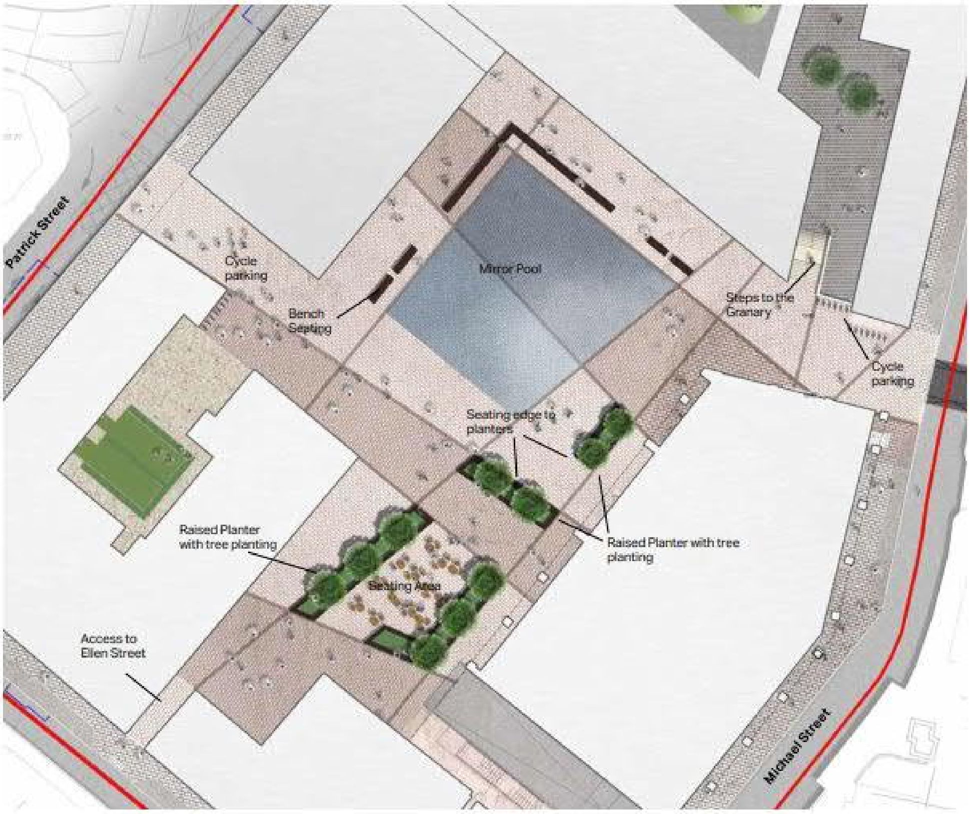


Figure 3.16: Central Plaza

3.3.9.4 Bank Place

The public realm design for Bank Place incorporates the need to respond to the space's historic fabric, as well as its future functions.

The design uses granite sett stone paving which will be in-keeping with the character of the retained historic building fabric and the site heritage. This will be combined with sinuous geometry that allows the design to accommodate the complex level changes across the site.

Step-free access will be provided from the public pavement to the existing and proposed buildings with levels to existing properties on the corner of Rutland Street and Bank Place and the retained Granary Building.

Usable public space will be created by terracing between the levels with a series of steps which will be worked seamlessly into the design geometry. These spaces provide the potential for public activity and for the adjoining café use within the Granary building to spill out into this space with café seating. There is also mixed canopy planting in exposed areas. Bank Place includes large swathes of holm oak species in raised planters which are cleared stemmed to 2m. This is further supplemented by Pine trees in hardstanding.

Furniture has been selected to suit the contemporary character of the space and includes low in-situ pigmented concrete platers, and brightly coloured stainless steel bicycle racks.

3.3.9.5 The Granary

Accessed from an archway from Bank Place, the Granary space is a unique space, to be discovered as a surprise. In comparison to the other public spaces, this is a quieter courtyard that offers the potential for outside dining to the adjoining restaurant. Its character is true to the site heritage with robust, industrial materials. Granite set paving will provide a simple finish, in-keeping with the adjoining stone Granary Building.

Trees and shade-tolerant planting are included through the centre of the space within planter boxes and timber benches provide additional seating through the space. Evergreen species are also proposed to be set out within the Granary Courtyard. Materials in the Granary Courtyard include granite sets as with Bank Place, with Corten steel planter pots to reflect the industrial heritage character along with chunky, robust timber benches provide opportunities for informal seating.

3.3.9.6 Roof Gardens

There will be two rooftop gardens included within the new development, and a number of external terraces on Parcel 1. The larger of the two rooftop gardens will be located on the main building adjacent to Granary courtyard (Parcel 5). It is proposed to include a balance of soft and hard landscape components, to create an aesthetically-pleasing and usable space.

Species of low-growing ornamental grasses have been selected to create a tufted and mounded planting scheme. Within the rolling rooftop topography, a composite timber deck will run through the space, providing the main access paths through the garden.

The second rooftop garden is a smaller space located on the building in the south-west corner of the site. This is a private amenity space for residential units on Patrick Street. These spaces include areas of artificial lawn, framed by raised planters.

The numerous external terraces on Parcel 1 will be laid with pavers throughout. It is anticipated the full fit out of these terraces will include pre-fabricated planters with specimen planting included.

3.4 Building Services

Different electrical, gas and telecoms providers may be available and have infrastructure on the site or in the area. Each utility provider shall therefore be contacted in turn to determine plant locations, relocation requirements and future provisions to the new buildings.

While the parcels will be built in phases, there will be a requirement to get services into each parcel, so they can perform their function. All of the proposed parcels on the Opera site will have a plant room at the basement or ground floor levels and the approach to integrating building services within each building parcel.

Each building will be served by dedicated main plant which will be located on the ground and basement floors. Both mega volt (MV) and main low volt (LV) electrical distribution centres and transformers will be located on the basement level. Four ESB substation will be provided at ground level. The four ESB substations will provide the site with 11kV (+/- 6%) of electricity.

Services will be routed horizontally from the basement plant areas at high level within the car park to the base of the risers. Office distribution services will be extended from the risers into ceiling voids and routed as necessary as part of the office fit-out works.

Access to services in ceiling voids will be required for maintenance of mechanical and electrical equipment. All vertical risers will be accessed through doors or removable access panels.

A dedicated main low voltage electrical distribution centre will be provided in the basement of each building parcel. Two sub-distribution centres will be provided to power the buildings. Sub-main cabling would be provided from the sub-distribution centres to serve mechanical plant, lighting and small power distribution boards and other fixed equipment in the areas of the buildings being occupied.

In the case of all parcels, there is space for renewables included in the design and as such, the full design requirements associated with connecting these facilities to the electrical network will be developed at detailed design stage.

To bring power supplies to desks, a dedicated centre will be provided in the floors electrical riser for small power outlets, socket outlets and fixed equipment. Power cables will be installed direct onto floor slabs, routed between the floor tile supports.

While the proposed uses for each of the parcels are known, the requirements for types of telecommunications equipment that would be used by each block tenant are not. As a result, each parcel has been designed to include space for a comms room, trunking for cabling, cabinets to house cable terminations and equipment and cabling. Thereby the tenant can tailor this system to their needs.

In addition to getting power and telecommunications into the parcels, there is also a requirement to heat the buildings. Combined heat and power units will be used to provide heat in the office accommodation and in addition to this, cooking facilities in the residential units. Connections will be made from the existing gas infrastructure which surrounds the proposed development area.

An existing 350mm diameter combined sewer crosses the site. It is proposed to provide a new 450 mm diameter foul sewer in Michael Street which will intercept the existing combined flow and allow the combined sewer within the site to be decommissioned. This new foul sewer will divert flows around the site and discharge to the existing combined sewer on Bank Place, which in turn discharges to an existing foul interceptor sewer located under the Abbey River. Within the proposed development, a separate foul water drainage network will be provided to serve all new buildings. This network will discharge foul flows to the diverted foul sewer in Michael Street and to the existing 600mm diameter combined sewer on Bank Place.

Within the site, a separate storm water drainage network will be provided to serve the proposed development. This network will collect, attenuate and treat runoff generated within the development. Existing gullies which currently discharge to the combined sewer in Michael Street will be diverted to a proposed surface water sewer. Surface water run-off collected by this sewer will discharge via a petrol interceptor and integrated silt trap to the Abbey River through a proposed new outfall in the quay wall.

There is an existing 9" diameter cast iron Irish Water water main running on all streets surrounding the site. Sections of the existing 9" diameter cast iron mains on Ellen Street and Rutland Street are to be upgraded to a 250mm diameter HDPE at the request of Irish Water. It is proposed that each building will be served by an individual service connection from existing 9" diameter water mains on Bank Place, Michael Street and Patrick Street. 2 no additional fire hydrants and a sluice valve will be provided within the Public Plaza. The new water supply connection serving the development will incorporate a bulk water meter and individual water meters will be installed upon the water supply to the individual buildings.

3.5 Construction Phasing

3.5.1 Sequence of Works

The sequence of structural works would be as follows:

- Condition schedules and baseline monitoring surveys. Survey monitoring would be required at all stages through to project completion;
- Install temporary works to buildings to be retained;
- Demolish structures to be removed;
- Commence the repair works to the retained structures;
- The proposed foul and storm water sewers in Michael Street will be laid and commissioned to allow the existing combined sewer crossing the site to be diverted;
- Install earthworks support to the basement perimeter;
- Excavate basement area;

- Construct new basement;
- Construct new buildings;
- Complete the development service connections; and
- Complete public realm and landscaping.

3.5.2 Phasing of Construction Works

The development is separated into phases, given it size and demand for completion of plots at various stages in the programme. The phasing is discussed in the context of the enabling works elements and then the new build elements.

3.5.3 Enabling works

This phase of the works includes:

- Condition schedules and baseline monitoring surveys;
- Install temporary works to buildings to be retained;
- Demolish structures to be removed;
- Commence the repair works to the retained structures;
- Install earthworks support to the basement perimeter;
- Excavate basement area; and
- Provide a new surface and wastewater sewers at Michaels St. and connections to the existing combined sewer network.

The repair works to all the existing retained structures will proceed as part of the enabling works while the interfaces of the new build to the existing structures would not be complete in this phase.

3.5.4 Conservation works to Existing Structures

3.5.4.1 Monitoring of Existing and Neighbouring Structures

There are existing structures to be retained on site, along with adjacent and neighbouring structures to the proposed development. Baseline condition schedules of the buildings to be retained and neighbouring structures will be necessary, along with surveys to monitor level and alignment of these structures before during and after construction.

It will be necessary to monitor vibrations continuously at predetermined locations on the site before and during the critical construction periods. Chapter 10 (Noise and vibration) contains information about vibration trigger levels by which corrective action of cessation of construction activity would be required.

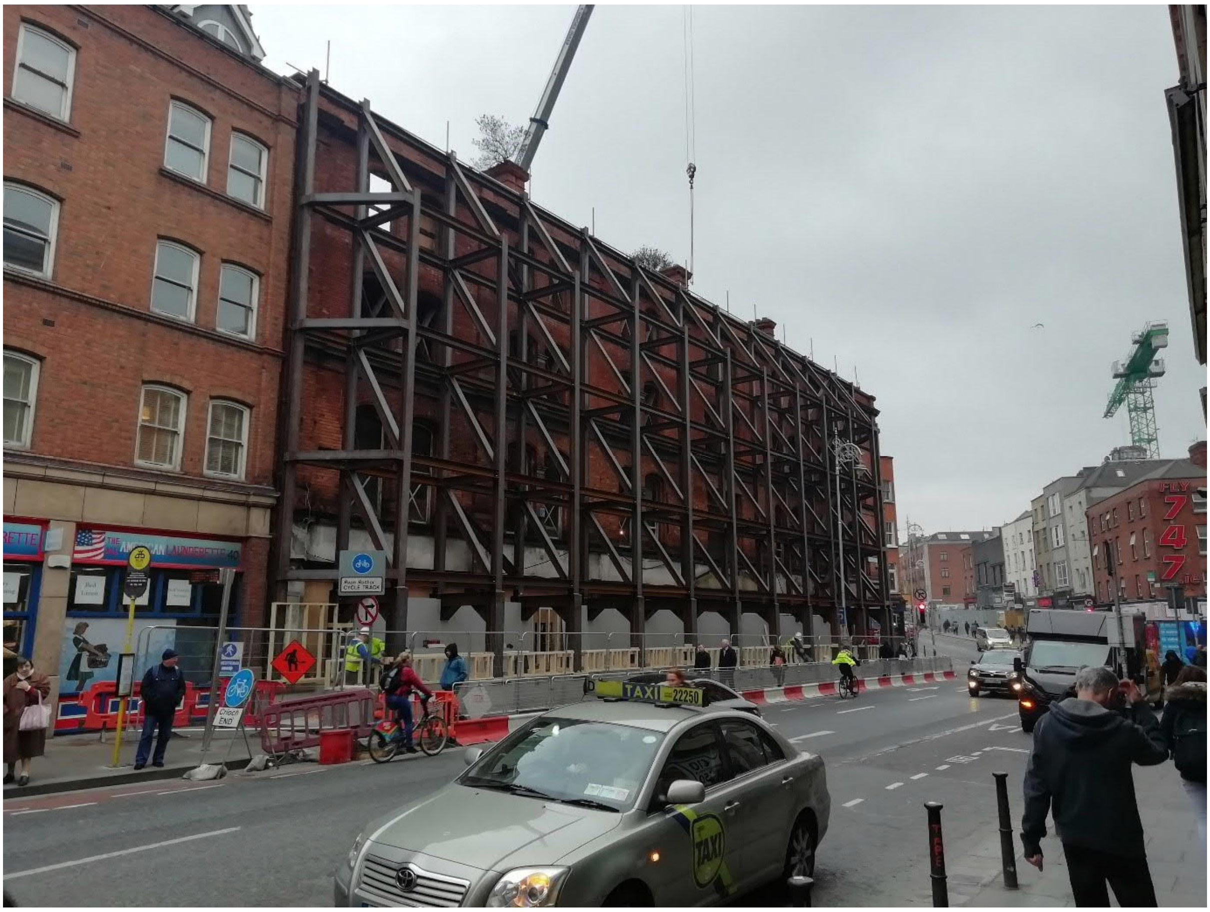
3.5.5 Temporary works

Prior to commencement of any works on-site, the existing structures to be retained will be re-assessed and any necessary temporary works designed. Braced frames at floor levels with a system of walers will be required to tie the building elevations to return and party walls at floor and eaves levels. This would provide restraint to walls and mimic floor plate diaphragm action to resist lateral loads.

Various loadbearing members such as roof trusses, arches, timber beams, and loadbearing walls will require vertical support while remedial and alteration works are being carried out. Such works will be required to bear on suitable foundations which would not have an adverse impact on the existing structures, basements, coal bunkers or adjacent structures.

In areas where exiting buildings are to be demolished, which are adjacent structures either within the site boundary or under separate ownership, a suitable temporary works assessment and if necessary propping will be required. The temporary propping installed would be to recreate the support which those adjacent structures may have relied upon from buildings which are to be removed. These temporary bracing and propping works will be installed, either in advance of any demolition works, or in a top-down sequence as building demolition proceeds.

Figure 3.17: Example of Load Bearing Support Frame Required for Heritage Buildings During



Construction

3.5.6 Permanent Works

The existing buildings to be retained are in varying condition structurally and in most cases have been exposed to the effects of water ingress. Remedial structural works will be required to all structures to be retained. These permanent works would be designed in conjunction with a practical sequence of temporary works and the requirement of the conservation architects and local authority conservation officer. The Architectural Heritage Report (Appendix 18.A) by JCA Architects outlines the nature of the conservation works to each of the retained buildings.

These permanent structural works would be designed for the appropriate like-for-like replacement and reversible interventions. The purpose of the permanent works is to protect and conserve the existing buildings and their notable features for future generations.

3.6 Demolition of Existing Structures

3.6.1 Isolation from Retained Structures

The structures which are to be demolished will require isolation from the adjoining structures which would remain post demolition. In the cases of ground-bearing slabs or floor slabs on party walls, this is necessary to reduce the pathways for demolition-related vibration or forces to reach the structures to be retained.

Demolition using hand held tools will be necessary at critical interfaces and Method Statements for the demolition works will be agreed between the design team and contractor.

3.6.2 Weathering of Exposed Gables

In all cases, exposed gables would be repaired and restored to an extent which would prevent water ingress.

3.6.3 Disposal of Demolition Material

It is a requirement that all construction waste is separated and sorted. Where possible, material would be salvaged for re-use in the conservation works to the retained structures.

Material would be recycled or re-used on-site, with unsuitable material being disposed off-site in suitably licenced facilities.

3.6.4 Basement Construction

The design of the development contains a basement to facilitate car parking, storage, shower and welfare facilities and plant areas. The construction of the basement is considered with regard to the existing structures and services to be retained. During the basement construction, monitoring of the adjacent structure and vibration levels would continue. The basement will result in approximately 40,000m^3 of material being removed to appropriately licensed landfill sites. Chapter 7 contains information about the composition of this material and how it would be disposed of.

3.6.5 Temporary Earthworks Support

The basement would be constructed to the rear of the retained structures, and to excavate the basement safely temporary earthworks support would be required. These temporary earthworks support would be required to resist loads from the existing buildings to maintain their stability and ensure the basement excavation does not adversely affect the adjacent structures or services.

The method of earthworks support recommended is a secant piled wall about the perimeter of the basement. The site investigations indicate that rock is expected to be encountered at 3-4m below existing ground level. To install stable piles and reduce water ingress into the basement excavation, the piles would be bored into the rock for a minimum of 2.5m using a rotary boring piling rig. The piles would be installed with a 1.2m clearance to existing structures to facilitate piling rig access. Figure 3.18 depicts typical secant piles, in elevation and section.

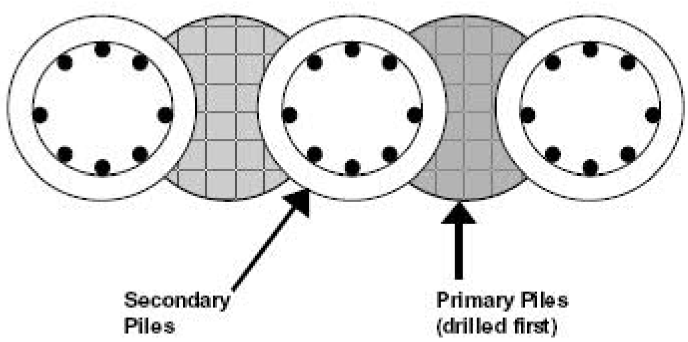


Figure 3.18: Sample Secant Piles Construction

3.6.6 Permanent Basement Construction

The permanent basement will be constructed with a reinforced concrete basement slab, retaining walls and podium slab and suitable measures to resist water and gas ingress. A Grade 2 basement construction is anticipated with additional internal drained cavity construction in welfare and other areas which may be classed as habitable. A detailed contractor method statement will be required in advance of any works.

3.6.7 New Build Structures

The new build structures of the various parcels may be constructed for example in concrete frame, steel frame with slim floor construction, or castellated steel beam with composite concrete deck.

The structural frame of the new building which abuts the existing buildings will be independent of the existing structure to avoid significant load transfer onto the existing structures.

The construction of the new build structures will be broken into two distinct phases (Figure 3.19). The development of the Opera Site will proceed from the northern end at Bank Place with suitable basement access provided through Phase 2.

The completion of Phase 1 would conclude the works adjacent to the nearest residential neighbours on Rutland Street at the north-western corner of the site.

Figure 3.19: Phasing of New Build Structures above Podium Level

Phase 2 construction works will follow on from Phase 1, completing the development to the southern end of the site.

3.7 Environmental Features of the Proposed Development

3.7.1 Site Orientation

The Opera Site masterplan has been developed through an iterative process which has helped ensure that, wherever possible, adverse effects on the townscape and visual amenity are designed-out, and the opportunity for beneficial effects is maximised.

3.7.2 Drainage Design

The drainage system has been assessed and designed to minimise effects on water quality to the foul water drainage system and storm water system, and the effects of flooding.

3.7.3 Foul Water

All foul water from the Opera Site will discharge to the existing Irish Water combined sewer network. This is to ensure that where water contaminated with detergents enters the drainage system, it is collected in the combined sewer network.

3.7.4 Storm Water

The proposed storm water drainage system will result in an outfall into a Natura 2000 site (Lower Shannon SAC), however it has been designed to ensure there would be no increase in water levels or flow rates downstream of the proposed outfall. The system includes an attenuation tank which would store run-off when the inflow rate exceeds 9.7 l/s, which is the greenfield runoff rate from an equivalent greenfield site. The system also includes a Class I Bypass Hydrocarbon Separator to remove hydrocarbons which may be suspended in runoff. To minimise sediment build-up within the storm water drainage network, trapped inlets would be used at all points of entry, and key manholes will have sumps to collect material. A regular maintenance regime, including monitoring, will be put in place to remove any excess build-up of material.

On behalf of LCCC, Limerick Twenty Thirty will establish a maintenance company that will be responsible for the maintenance and monitoring of all infrastructure installed as part of the development. This includes the surface water drainage, gullies and petrol interceptor on Michael Street. Future third party Connection to the infrastructure in Michael Street will only be permitted if the same undertaking can be given with regards maintenance and monitoring.

Limerick Twenty Thirty will be responsible for funding of the company and should units be sold (or resold) or leased (or subsequently lease), the sale shall incorporate a legal obligation on each unit owner to fund this management company on a pro rata basis.

3.7.5 Flood Defences

The design incorporates super-elevated entrance/exists for the development as a mitigation measure to prevent any flood waters entering the main structure or the underground structure. In case of emergency, there is vehicular access for Fire and Ambulance services to the building via Rutland Street, Patrick Street and Ellen Street (westbound), as these roads are outside the areas identified as being at risk of flooding by the CFRAM project.

The proposed finished floor level for new buildings within the Opera Site is 5.32m OD (Malin). This level includes a climate change and land movement allowance of 600mm and is above the 1-in-200 year return period coastal flood event level. In addition, all critical infrastructure within the buildings would be at a minimum level of 5.16m OD (Malin). All existing buildings to be retained are located within Flood Zone C.

3.7.6 Lighting

The lighting design has been prepared in accordance with the latest guidance on lighting mitigation for bats (BCT and ILP, 2018).

The lighting specification proposed at Bank Place on the northern boundary of the Opera Site, where it borders Abbey River, has a maximum Kelvin value of 3000, low-pressure sodium lights in preference to high pressure sodium lights or mercury lamps, and will have luminaires mounted on the horizontal with an upward light ratio of 0%.

3.7.7 Design Features for Birds and Bats

A 'bat brick' (to the specification of "Habibat Bat Box - Custom Brick Facing" or equivalent) and a ‘bat tile' (to the specification of Habibat Bat Access slate or equivalent) have been included in the design of Nos. 4 & 5 Rutland Street respectively, which is located close to the existing roost site in 9 Rutland Street.

One swift brick with starling barrier (to the specification of 16S Schwegler Swift Box (with Starling Barrier) or equivalent) has been incorporated into the design of the façade of No. 5 Rutland Street.

On the top of Parcel 5, green strobes which flash once every 2-3 seconds would be installed to repel birds.

3.7.8 Planting Designs

In the areas of planting within the Plaza, it is proposed that native Alder trees and some flowering plants would be included to provide nectar for bees and insects.

4 Examination of Alternatives

4.1 Introduction

The Limerick City Development Plan 2010-2016 incorporates Limerick 2030: An Economic and Spatial Plan for Limerick (Limerick 2030 Plan), which was formerly adopted as Variation No. 4 of the Plan on 26th January 2015.

A central component of the Plan is to achieve the comprehensive redevelopment of the Opera Site and provide “A New Business Offer” for the City, tying into the heart of the City’s shopping offer. The Plan envisages a business-led mixed-use solution for this Site including significant office development and a range of supplementary uses.

The Limerick City Development Plan 2010-2016 incorporates Limerick 2030: An Economic and Spatial Plan for Limerick (Limerick 2030 Plan), which was formerly adopted as Variation No. 4 of the Plan on 26th January 2015.

This forms the core vision for the proposed development and examinations of alternatives through the design process.

4.2 Plan Led Alternatives

In 2018 a review of the development of the Opera Site was undertaken to consider the rejuvenation of the site within the city and develop a masterplan for its redevelopment. A Design Brief for the Opera Site was developed in response to the Limerick 2030 Plan to further define development parameters for the site. This was submitted in April 2018 to LCCC following a public consultation period.

The specific characteristics for the site’s redevelopment established in the Design Brief, that influence the key design decisions and consideration of alternatives, include:

- Sensitive re-use, restoration and repair of buildings of conservation value, whilst enabling and maximising significant new build opportunity.
- Encourage a variety of supplementary land uses in association with the business-led mixed-use solution for this Site and to improve the City Block’s vibrancy by creating an attractive urban environment with active street frontages.
- Circa 45,200 sq m of development, including new build and renovation and extension of existing structures to be retained.
- Circa 25,00 – 30,000 sq m (55%-66%) to comprise office floor space.
- A new internal square of circa 3,700 sq m and a stronger gateway at Bank Place and high-quality surrounding streets.
- A new landmark development at Bank Place in the range of 12-16 storeys.
- Other new build opportunities in the range of 4-6 storeys subject to detailed assessment.
- A site coverage of approximately 50%-60% to accommodate appropriate public realm, with a plot ratio of 2.5 to 3.0 to achieve appropriate scale and massing of the city centre site.

The key issues in the consideration of alternatives which informed the architectural design were:

- Site layout and response to urban context;
- Building height and massing;
- Land uses; and,
- Parking and basement access.

4.3 Site layout

The site layout for the redevelopment of the Opera Site is a direct response to the existing urban context, the existing characterisations and the objectives established in the 2030 Plan and Design Brief for the site.

The adopted Limerick 2030 Plan has a strong focus on rejuvenation of the city's street scape and creating a destination with a new active public square, without competing with the main retail core south of the site.

The objective of the Plan is to provide a business-led mixed-use scheme that will animate this quarter and create a destination within the City Centre, bringing footfall to surrounding streets, public spaces and shops.

The design brief identified several opportunities to achieve this including:

- A new managed public space within the redeveloped Opera Site with strong connections to the network of squares/ plazas across the City (O'Connell Street, Potato Market, King's Island, enhancement of Bank Place, Colbert Station);
- High quality pedestrian-oriented streets;
- A high-quality walkable environment around the Opera Site, a key hub between Irish Town and Arthur's Quay, including upgrades to Rutland and Patrick Street, Ellen Street and Michael Street;
- A gateway onto Limerick's shopping core from the north, including streetscape investment that reflects the quality of new buildings along the Opera Site's western frontage;
- Activated streets/ uses to draw pedestrians up from O'Connell Street;
- Stronger pedestrian links to the Hunt Museum and King's Island to the north;
- A new pedestrian connection from Michael Street to Patrick Street crossing a new 'internal' public space that offers a quieter, interior courtyard space for occupiers and visitors;
- A new entrance on the corner of Ellen Street and Patrick Street, opposite Arthur's Quay to draw people into this Site; and,
- A high-quality landscape setting for the public space at Bank Place that addresses the Canal and Charlotte's Quay.

  (Design Brief, section 2.5 Public Realm and Permeability)

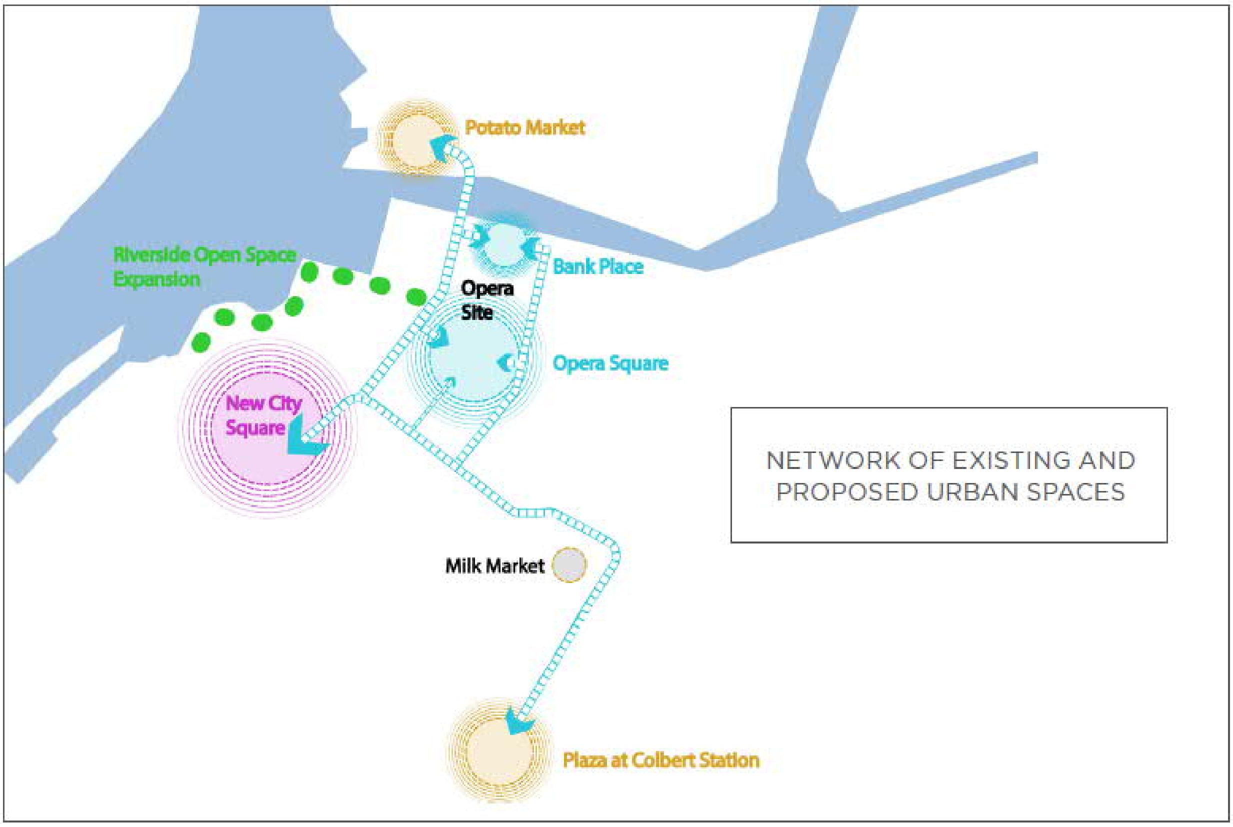


Figure 4.1 Network of Existing and Proposed Urban Spaces

The heritage appraisal of the existing buildings on site in the masterplan report, Section 4.0 Conservation and Built Heritage, identifies buildings of conservation value, including protected and non-protected buildings, which merit retention and refurbishment.

Modern infill buildings were assessed for their suitability for retention. All were found to be of an age and spatial quality that did not merit their retention, which would otherwise limit the opportunity for new buildings to meet the objectives of the Design Brief.

The starting point of the design strategy was to retain and refurbish the buildings of conservation value, maintaining their former retail use at street level, to improve and activate the streetscape, improve footfall and make a more attractive experience for pedestrians.

New infill building opportunity was identified to replace removed buildings and to enclose the site where currently vacant at the surface carpark to the south east corner.

Existing site entrances were retained and enhanced, appropriate for entry to a new important public square, with linkages in each direction to ensure good connectivity to surrounding streets and create desire lines through the site, linking surrounding destinations. Figures 4.1 and 4.2 illustrate these issues.

The Masterplan Report describes the evolution of the site layout in more detail in 'Section 6.0 Development Strategy'.

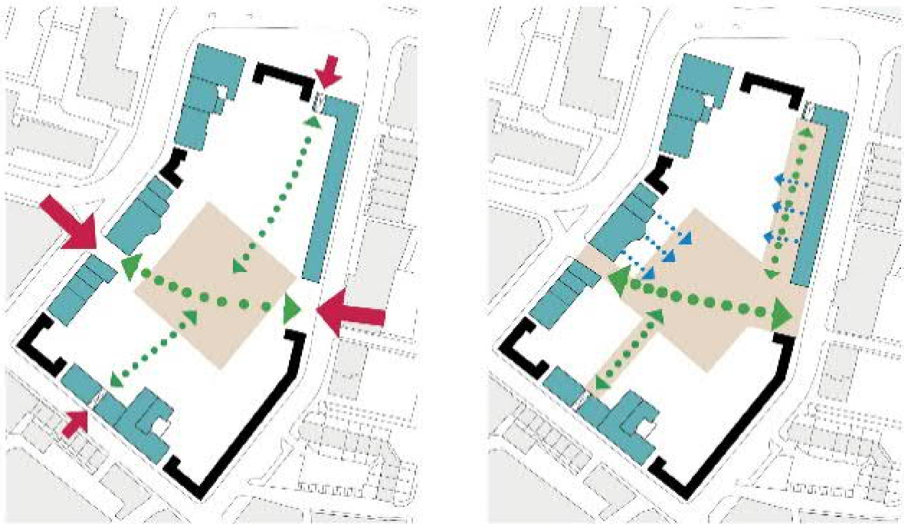


Figure 4.2 Establishment of a strong perimeter edge to the street and formation of internal spaces and relationships to important buildings

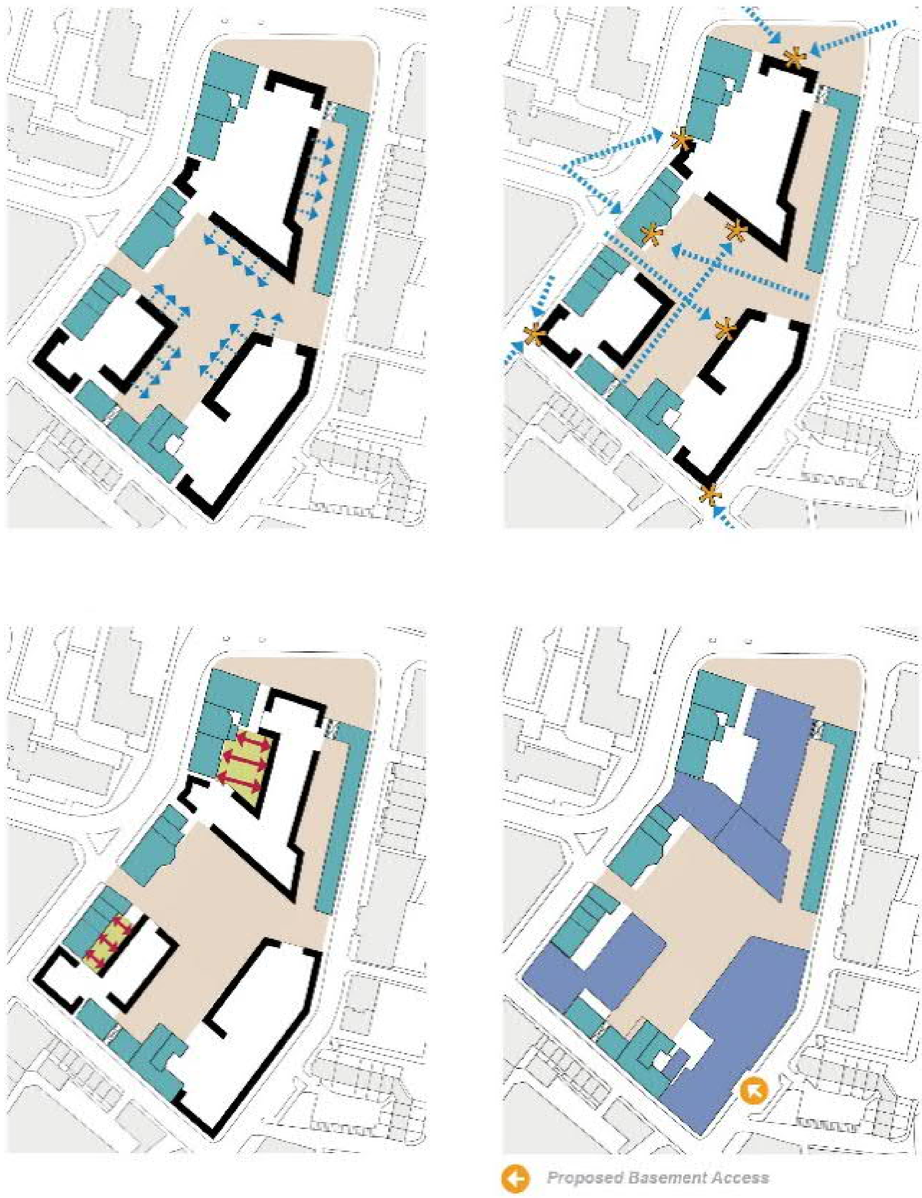


Figure 4.3 Establishment of internal building edges to enclose the internal square, visual axis, separation to residential uses and established development footprint

The Design Brief, in section 4.2.4 *Permeable Urban Grain*, suggests that opening the street corner would weaken the street corner, which currently forms a perimeter edge to the block, also evident in the 1840 OS Map, and favours the use of the existing archway at No 6 Ellen Street. This location is also closer to the junction with the pedestrianised Little Ellen Street to the south of the development site.

The use of the existing archway along Ellen Street brings footfall along the street, improves opportunity for linkage to adjacent pedestrian streets and allows a built form to hold the corner at Ellen and Patrick street, to provide a visual signature for the development from O'Connell Street.

A further secondary pedestrian access point from Michael Street, at the south east corner in conjunction with the vehicular access to the basement, was added during the detail design to improve pedestrian permeability into the internal square and the desire line towards the Milk Market.

A key focus for the scheme was to retain and refurbish the buildings of conservation value, maintaining their former retail use at street level, to improve and activate the streetscape, improve footfall and make a more attractive experience for pedestrians. This has been achieved in the proposed layout. This focus was then key in informing the shape of the alternatives considered for other constituent elements of the proposed development. This required to be sympathetic to the core conservation requirement which anchors the development, while maximising appropriate utilisation of the remaining available space within the site, and helping to revitalise the entire city block.

The layout as described above and depicted in Figure 4.3 meets the balance of fulfilling the design brief, without introducing significant environmental impacts such as causing any traffic and transport issues with regard to pedestrian access and/or Health and safety concerns and maintains the character of the block while improving pedestrian access through the site and to surrounding streets.

4.4 Building height and massing

The Design Brief established a general height range of 5-6 storeys as appropriate for new buildings on the site and a height range of 12-16 storeys for a landmark tall building to the northern side of the site at Bank Place.

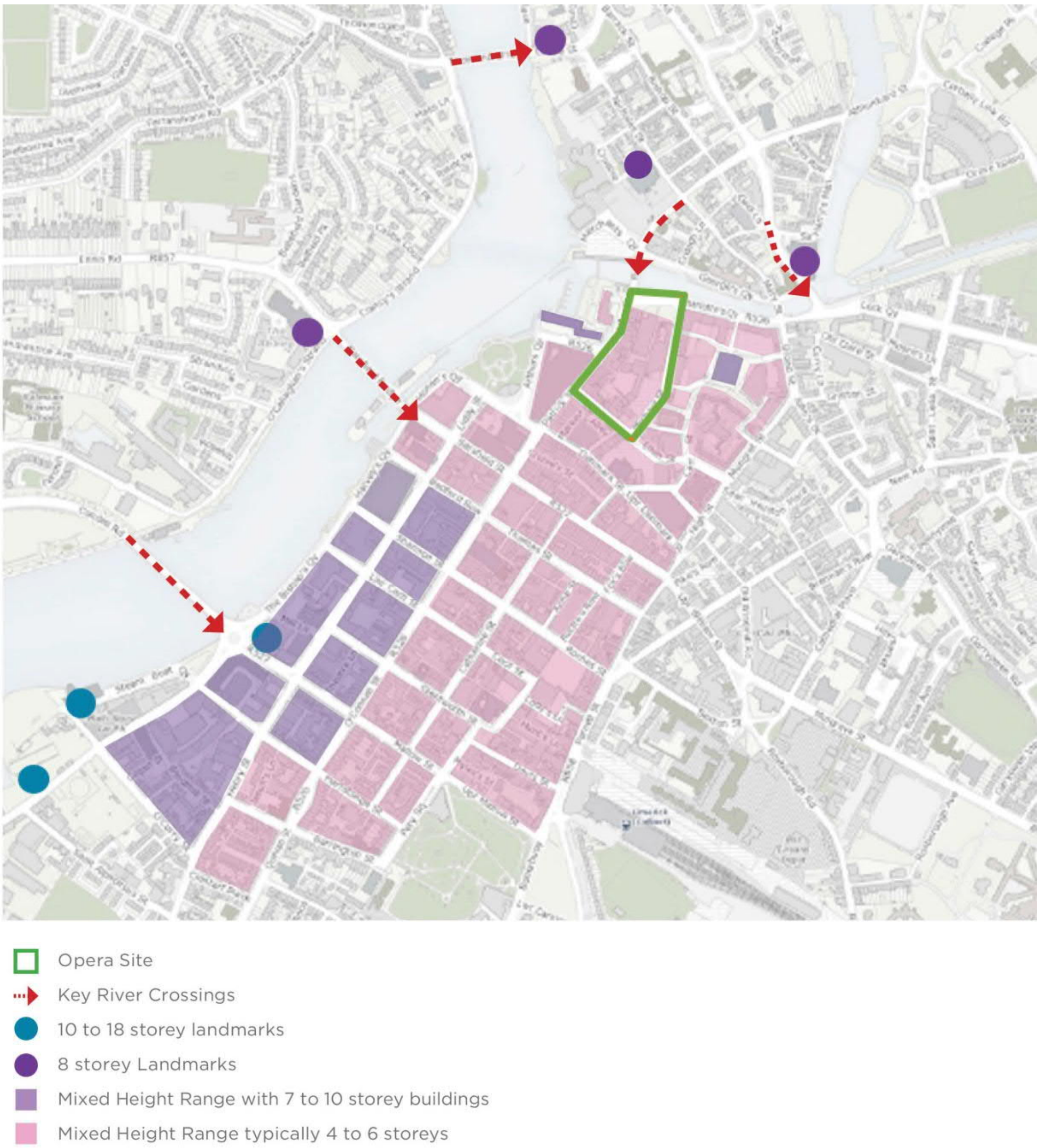


Figure 4.4 City Building Heights (Source: Masterplan, Opera Site, Limerick City)

Section 9.0 *Building Height and Massing*, of the masterplan assessed building heights of each new building, within the parameters set in the Design Brief, to examine the visual impact on the surrounding street scape, within the site in the new public spaces and on the existing building context (Figure 4.4).

The building forms and heights were also assessed for their overshadowing impact and sunlight penetration into the urban spaces.

The most important element of the study was the height of the tall building. The Design Brief examined the city and the immediate context to establish the range of heights to be considered for the tall building.

The lower height of 12 storeys was established to be distinctive above the range of taller buildings between 7-10 storeys, west of O'Connell Street and some individual buildings close to the site.

The upper height of 16 storeys was established to be slightly lower than comparative tall buildings in Limerick city, due to the adjacency of protected structures.

The tall building form was split to provide a composition of forms with stepped heights, to provide a visual variety and a vertical slenderness appropriate to an elegant tall building.

3 alternative heights were considered:

- 12 storeys with a lower element of 10 storeys (2 storey step)
- 14 storeys with a lower element of 11 storeys (3 storey step)
- 16 storeys with a lower element of 12 storeys (4 storey step)

In each alternative a full storey height of plant space is allowed for in the main element. Alternatives of 13 and 15 storeys provided imperceptible differentiation to these heights.

Fig. 55: View A from North side of river towards 13 storey building to Bank Place

Fig. 56: View A from North side of river towards 15 storey building to Bank Place

Fig. 57:View A from North side of river towards 16 storey building to Bank Place

Figure 4.5: View of Alternative Heights from George's Quay Towards Bank Place (height to width ratio highlighted)

Fig. 64: View D from O'Connell St. to north east with 13 storey building to Bank Place. Lack of visual prominence as landmark building

Fig. 65: View D from O'Connell St. to north east with 15 storey building to Bank Place. Clear distinction to general building height, vertical emphasis appropriate as city landmark

Fig. 66:View D from O'Connell St. to north east with 16 storey building to Bank Place. Provides additional visual prominence and landmarking

Figure 4.6: View of Alternative Heights from O'Connell Street Towards Patrick Street

The masterplan concluded that the 14-storey height building provided the most successful balance of providing:

- A visible landmark from the North and the South of the site; 12 storeys did not provide sufficient presence on the important vista from O'Connell Street, appearing as a higher roof profile rather than a distinctive landmark; and

A slender, elegant tall building form in particular to Bank Place; 12 storeys appeared insufficiently tall at a 3:1 ratio, 14 storeys is more elegant at close to 4:1 ratio, 16 storeys unnecessarily taller and has a greater impact on the adjacent protected structures.

The chosen alternative in the context of building height is principally a matter of interest to Landscape and Visual impact and to Architectural heritage assessments of the proposed scheme.

With regard to landscape and visual impact, the proposed development will transform the existing site from a place with mainly vacant and derelict structures to a new city quarter with a range of buildings at various heights, whilst also providing new permeability through the quarter and public open spaces within the site. The retention and refurbishment of a number of historic buildings along the edge of the site will anchor the proposed development within its urban context. The highest direct townscape effects will arise from the density and height of the proposed development elements resulting in a Very High magnitude of townscape change.

The proposed development will considerably alter existing views, particularly due to introduction of the 14-storey tower, which will exceed the height of adjacent buildings. The development will become a prominent focus in these close distance views but also a new anchor in the overall townscape. The stepped down tower to the west and south of the main tower softens the overall proposed height and helps to connect better to the adjacent existing buildings.

From an Architectural Heritage viewpoint, the proposed 14 storeys building considerably exceeds the ridgelines of the historic buildings in this area. It should be noted that the historic setting of the surviving buildings to Bank Place has been changed considerably since their construction, with a number of Georgian terraced houses now demolished and replaced by 20th century buildings.

To mitigate against the potential visual impact of the height of the proposed building, the proposed 11-14 storey building is designed with a solid base, with increased levels of glazing to the upper levels. This solid base continues to the courtyard between it and the Granary building, reflecting the height of the historic building it faces across this outdoor space.

The main core of this proposed building is expressed as two individual forms having a more highly glazed element to the rear, which helps to emphasise the tower to Bank Place as a more slender element.

The masterplan visual study concluded the specific height for each building, which included allowance for roof top plant space, with the following conclusion:

- South East Commercial Quarter: Overall recommended height is 6 storeys + plant, with 4 storeys to the corner of Ellen St and Michael St rising to 5 towards Granary with a setback 6 storey element.
- South West Residential Quarter: A 5 storey building to the corner of Ellen St. and Patrick St with a 4 storey (+ plant) rear block within site behind the existing terraced houses on Patrick St.
- North West Civic and Cultural Quarter: 4 storey infill is recommended to Rutland St with a setback fifth storey as the building extends to the north side of the internal square.
- North East Commercial Quarter: A height of 14 storey (+ plant) with a ‘shoulder’ of an 11-storey element is recommended for the tall building to Bank Place, in a simple form with consideration of slenderness in its external expression.

Figure 4.7: Suggested Height Range in Local Context

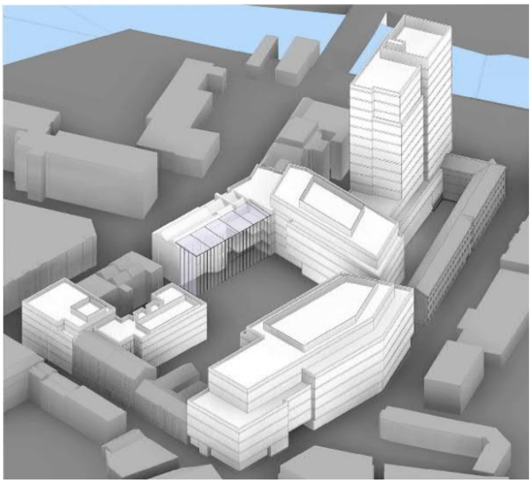


Figure 4.8: View from South of Massing Model

Figure 4.9: View from East of Massing Model

4.5 Land Uses

The Design Brief reiterated the Limerick 2030 Plan objective for:

"….a quantum of 25-30,000 sq m of office space out of a total potential floorspace of 45,200 sq m which suggests an indicative 60:40 split between quantum of office and non-office uses."

Other 'non-office uses' were identified for the northern and southern halves of the site:

- Northern: cultural uses in support of office use; and
- Southern: retail, restaurant, cafe, medical, residential and hotel use, in support of office.

The mix of uses proposed for the site has been further examined and refined to complement surrounding uses. The existing buildings to be retained have been assessed in terms of their size, layout, history, condition, and location, to ensure that the most appropriate use is assigned to each building.

This along with the urban design of the city block and the creation of a new central square with access points in each direction has established four quarters:

1. A civic and cultural quarter to the north west;
2. A commercial quarter to the north east;
3. A commercial quarter to the south east; and
4. Residential quarter to the south west.

Retail and bar/ restaurant uses are to be dispersed throughout the site, primarily at ground floor level, to ensure active street frontage and a vibrant public realm.

Figure 4.10: Land Use

4.5.1 Office use

The existing buildings being retained, except the Granary which currently accommodates office use, are not suited to modern office use due to their cellular layout, varied floor levels, load bearing capacity and the impact on the historic fabric to meet the service requirements for office use.

The upper floors of the Granary building are currently in office use. The use of the upper and lower floors will remain in office use. A new vertical stair and lift circulation will be located on site of the demolished library to improve the internal circulation of the office building. The upper floors provide circa 1,800 sq m of office accommodation.

In total this provides c. 29,701 sq m of office accommodation, which meets the requirement of the Design Brief and the specific requirements of the Limerick 2030 Plan, namely:

- 10,000 sq m Innovation Hub providing small business space for business 'graduating' from incubation facilities as the UL and LIT
- 10,000 sq m Public Sector Office (including the relocation of the Revenue Commissioners from Sarsfield House).
- 5,000-10,000 sq m to be available for letting by the IDA to potential FDI business(es).

Each of the office buildings are designed to allow flexibility of use as whole lettable buildings and as individual lettable floors for smaller enterprises. Parcel 1 has the largest floor plate, which is also designed to be subdivided to ensure flexibility in use.

The total floor area of the development is circa 45,170 sq m. Office accommodation of circa 29,700 sq m represents c. 66% of this with circa 14,470 sq m available for other support uses.

4.5.2 Non-Office Use - Cultural

Each of the remaining areas of the development, including existing and new buildings were examined for suitable uses for the nature of the building and its position in the site, in the context of the land use 'quarters' defined above.

The former Town Hall has a pivotal position within the development. Its frontage faces west towards the planned Arthur's Quay riverside park enhancement and its rear is centred on the new public square. This setting, its architectural prominence on the street, its former civic use and larger internal spaces makes an ideal setting for the new City Library. Its integration with part of Parcel 3A4 augments the existing building to meet the modern needs of a contemporary library. The City Library will be a cultural centre for the city, with its proximity to the Hunt Museum and the amenity of the new square, allow the square to host cultural events.

Numbers 8 and 9 Rutland Street are also part of the proposed library as part of the group of existing buildings with the former Town Hall and together contribute to the composition of existing buildings facing the new square. Together the existing buildings provide a new City Library, circa 4,514 sq m.

4.5.3 Non-Office Use - Residential

The upper floors of No.4 and 5 Rutland Street will remain in their existing use of retail at street level with 3 No. residential dwellings above.

All of the retained buildings on Patrick Street, No. 1, 2, 3, 4 and 5, and No. 7 and 8 Ellen Street, will remain in their existing use. Providing retail at street level with 16 No. residential dwellings above.

Numbers 4, 5 and 6 Ellen Street are proposed to be retained in residential use, to provide a 57 room aparthotel, with retail at street level.

The Opera Site and Parcel 2A, fronting on Patrick Street, is ideally suited for an aparthotel. Aparthotels are popular with business users, who may have a short-term contract in Limerick City for weeks or months and therefore. An aparthotel is considered to support the needs of the business led approach to the Opera Site. Furthermore, it would be a benefit to the traditional housing stock of the city, by avoiding displacement of much needed longer term residential dwellings in the city. The proposed Aparthotel provides 32 No. 1 bed apartments, 14 No. 2 Bed units and 11 accessible rooms with a total provision of 57 units. The ground floor level provides a small service and reception area for the Aparthotel.

Traditional residential apartments were also considered in this location, however their larger area and specific design requirements provided for a lower occupancy level, which was considered to be an inefficient use for this important city centre development site. A traditional apartment block would provide a smaller number of 1 and 2 bed apartments, with a reduced potential occupancy.

A small boutique hotel was also considered for this location. A hotel use requires a greater level of service areas, staff facilities and parking, which would be a challenge to provide on such a constrained site. An Aparthotel was preferred as it does not have the same level of service areas, does not require parking and has a positive benefit to other long-term residential capacity of Limerick City.

4.5.4 Non-Office Use – Retail and Food and Beverage

Number 9 Ellen Street is proposed to be refurbished as its former use as a licenced premises. It is suitable for use as a gastro pub/ restaurant and conveniently located at the junction of Little Ellen Street to draw on the existing vibrant food and beverage core to the south of the site.

The use of the ground floor of the Granary is retained as a licenced premises. Retail of various scales is provided to all of the existing Georgian buildings, and substantially to the street level of the new buildings to ensure a balanced distribution of active street frontage to all streets and spaces.

4.5.5 Non-Office Use – Educational and Medical

Educational and medical uses were also suggested for consideration in the Design Brief.

The Limerick 2030 Plan also noted that the office accommodation could allow for ‘Innovation Hub’ accommodation for UL and LIT.

Almost all of the new building accommodation is to be used for office and residential uses, which best meets the brief and ensures 24hr activity on the site. The mix of office accommodation is well suited to meet the needs of ‘Innovation Hub’ accommodation for UL and LIT related enterprises and is flexible to respond to the demand.

Medical uses were also considered on the site. This specialised use would need to be provided in new buildings. A significant facility would reduce the quantum of office accommodation to below the requirements of the Design Brief. A medical use would also require significant additional parking, set down and possible ambulance facilities, which would negatively impact the opportunity for pedestrian friendly, active street scape. The nearby George’s Quay currently provides a medical quarter. As the medical requirement in the area is considered to be addressed by Georges Quay, and the option of a multi-storey basement car park has been ruled out as discussed below due to the potential for significant environmental effect, the provision of a medical centre on site has been ruled out for similar reasons.

4.6 Basement Car Parking

The design intent for the site is a car fee pedestrian zone, with all parking below ground. The quantum of parking required for the development, circa 620 car spaces, would require a multi-level basement to accommodate all of the cars on site.

The potential for significant environmental impact in adding a multi-storey underground carpark to serve this need was a major factor in ruling out this alternative. This would have a greater impact on the constructability of the project in close proximity to protected structures and occupied buildings.

This would have significantly increased spoil removal quantum and associated noise, dust air and vibration impact in addition to significant addition of concrete and other raw materials to the project.

An assessment of the alternative parking approaches identified available capacity in the surrounding public multi storey car parks, which reduced the requirement for on-site parking to 155 cars. This parking requirement is provided in a single level basement and thus reducing the impact of its construction and avoiding the potential for the above mentioned potential environmental impacts.

4.7 Basement Access

The basement carpark access is provided under Parcel 1 on Michael Street, close to the corner with Ellen Street. Alternative locations were considered where new significant building would facilitate a ramped access: mid-way along Michael Street and Bank Place.

Access from Bank Place (red arrow) would result in an access approach across Bank Place, introducing vehicular movements across a space in conflict with the Design Brief's objective for its enhanced for pedestrian use. A ramp in the basement in this location would limit the basement area available to serve the tall building, complicate the structural design and impact negatively on the building's relationship to Bank Place at street level.

Access at midway along Michael Street (orange arrow) would introduce a ramp access along the edge of the parcel 1 building at the pedestrian access route into the new square from Michael Street. A vehicular ramp would provide an unattractive or blank edge to this pedestrian route which would be undesirable.

The proposed access point at the southern end of Michael Street (green arrow) is the most suitable entrance point, allowing a suitable approach on the quieter Michael Street and impacting least on the building useable layout. This location also provides an additional opportunity to introduce an additional pedestrian route into the site close to the corner of Michael Street and Ellen Street.

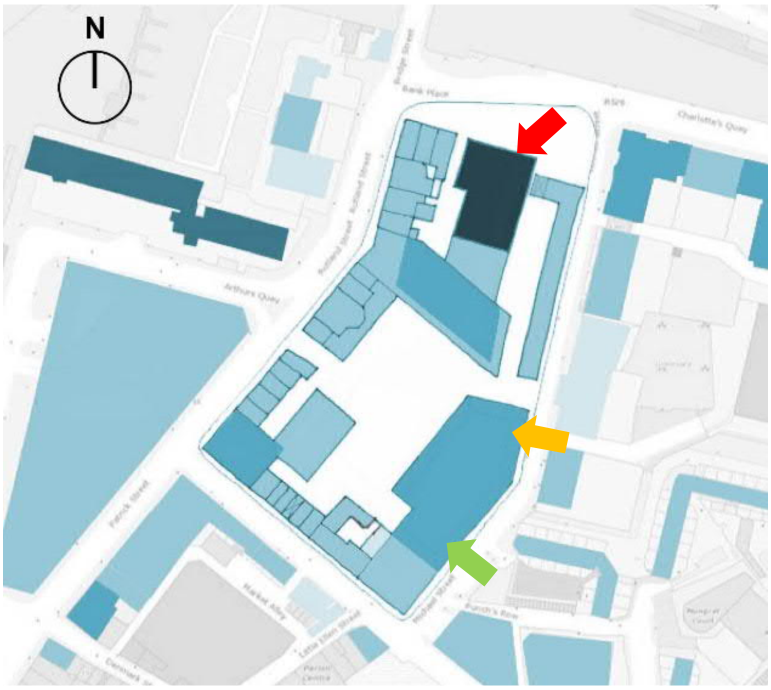


Figure 4.11: Basement Access

4.8 Do-Nothing Alternative

While there is economic activity on the existing Opera site, it is not at a level which would provide the level of economic stimulus required to bring the Opera site into “full and productive use”.

Limerick 2030 – An Economic and Spatial Plan for Limerick identifies the Opera site as “a critically important site” and therefore development must take place to strengthen the city centre and make the Opera site one of the main city centre transformative projects.

The driver to allow the Opera site to strengthen the city centre make a do nothing alternative unacceptable because it doesn’t allow for economic transformation of the site or restoration of the existing Georgian streetscape.

As outlined earlier in this Chapter, the re-development of the site has been a plan led approach, based on adopted plan-led policy.

4.9 Conclusion

The specific characteristics for the site’s redevelopment established in the Design Brief, as outlined in section 4.2 above, that influence the key design decisions and consideration of alternatives have been assessed in this chapter. Alternatives and options meeting the requirements of the Design Brief have been assessed culminating in the proposed development presented herein.

Numerous options, variations and alternatives as described above have evolved through the plan-led design iterations of the proposed development and alternatives have been considered and assessed. The main reasons for discounting of alternatives is that they do not meet the plan-led design brief and their potential for more significant adverse environmental impacts.

4.10 References

Limerick City and County Council (2018) *Design Brief Opera Site*, available online at https://www.limerick.ie/council/services/planning-and-property/development-plans/limerick-opera-site-design-brief, accessed November 2018.

Limerick City and County Council (2010)*, Limerick City Development Plan 2010- 2016* available online at*:* https://www.limerick.ie/sites/default/files/limerick_city_development_plan_2010-2016_as_varied_1-5_print_0.pdf , accessed November 2018.

Limerick City and County Council (2014) *Limerick 2030 - An Economic and Spatial Plan for Limerick*, available online at , https://www.limerick.ie/sites/default/files/media/documents/2017-11/Limerick%202030%20-%20An%20Economic%20and%20Spatial%20Plan%20for%20Limerick.pdf accessed November 2018.

Masterplan Opera Site, Limerick City (December 2018) available per comms.

5 Non-Statutory Consultations

5.1 Introduction

Limerick City and County Council Officials together with the design and EIAR team have carried out consultation in relation to the Proposed Development of the Opera Site with Council Members, members of the pubic, tenants on the site, local businesses, representative individuals, organisations and statutory bodies. The purpose of the consultation was to inform consultees of the Proposed Development and to provide them with an opportunity to offer feedback. It also enabled the project team to take account of issues raised and consider them as part of the design and process.

This chapter outlines the consultation activities undertaken in advance of the lodgement of the planning application for the Proposed Development.

5.2 Public and Stakeholder Consultation

Limerick City and County Council (LCCC) launched a non-statutory public consultation process on the Proposed Opera Site Development on 19th November 2018.

As part of this process, public consultation boards were displayed in 4 different locations as per below and four separate public information evenings were held, where the public were given the opportunity to discuss the proposals with the design team:

1. Limerick Twenty Thirty office in Patrick Street, Limerick;
2. Public information evening on Tuesday, 4 December 2018 between 5pm and 7pm;
3. Limerick City & County Council office - Merchant Quay;
4. Public information evening on Wednesday, 5 December 2018 between 5pm and 7pm;
5. Limerick City Library - The Granary, Michael Street, Limerick;
6. Public information evening on Thursday, 6 December 2018 between 5pm and 7pm;
7. Limerick City & County Council office - Dooradoyle, Limerick; and
8. Public information evening on Friday, 7 December 2018 between 5pm and 7pm.

Members of the public were invited to review the Proposed Project with the intention of obtaining views of the public and interested parties on the scheme.

Members of the public were asked to submit their suggestions and feedback by email or post to Limerick City and County Council by 12th December 2018.

Some 23 submissions were received from the public during the consultation period.

Invitations to the Workshops were publicised directly by LCCC and personal invitations were given out to adjoining tenants, businesses and adjoining residents surrounding the Opera site. Council Officials dropped a leaflet door to door to adjoining neighbours to invite them to the workshops. (See Copy of Invite Letter in Appendix 5.C, 5.G & 5.H)

The Proposed Development was publicised on LCCC website and Limerick 2030 Website for the duration of the consultation period. (See Appendix 5.A & 5.B)

In addition to the presentation boards, other presentation material that was displayed on the website included the Design Brief (April 2018) for the Opera Site (See Appendix 5.K) and a separate presentation of the proposed new City Library for Limerick. (See Appendix 5.I - 5.J)

Approximately 75 people attended the workshops representing a cross-section of interested parties in the city.

The consultation indicated that while there is widespread support for the development and regeneration of the site, people had specific issues with certain aspects of the scheme which will be outlined in Section 5.3 below.

In addition to a wider public consultation process, letters were sent to the following prescribed bodies/Stakeholders in November 2018 (See Appendix 5.D) and individual stakeholders were also met with including The Irish Georgian Society.

(See Appendix 5.E for copy of letters issued):

1. Yes to #Liveable Limerick;
2. Transport Infrastructure Ireland;
3. An Taisce, The National Trust for Ireland;
4. Irish Georgian Society (See submission in Appendix 5.M);
5. Irish Aviation Authority;
6. Environmental Health Service, HSE;
7. The Heritage Council;
8. Fáilte Ireland, Environmental Unit;
9. Planning System & Spatial Policy, Department of Housing, Planning & LG;
10. Development Applications Unit, Department of Culture, Heritage & The Gaeltacht (See submission in Appendix 5.L);
11. Gas Networks Ireland;
12. Inland Fisheries Ireland;
13. Planning Referrals, Forward Planning, Irish Water;
14. EirGrid Plc;
15. Fáilte Ireland (Limerick);
16. Southern Regional Assembly; and
17. Office of Public Works.

5.3 Consultation Feedback

Submissions on the basis of the Consultation Process including the Website, Public Display and Workshops were received from 23 consultees. Key points raised in the responses received are summarised by theme in Table 5.1 below:

Table 5.1 – Summary of Submissions Received Grouped by Theme

1 Issue: Welcome the Re-Development of the Site & Design

- Largely the submissions received were supportive of the re-development of the site.
- It was suggested that the development will transform a previously neglected area on one of Irelands premier boulevards
- It was felt that this site has been underutilised for a number of years and that the development will regenerate the area and improve the attractiveness of the City Centre.
- There was a large level of support for the proposed re-use of the Town Hall building for the new City Library.
- The large element of commercial proposed has led to concern regarding the viability of the scheme.
- It was felt that the development would enhance the existing commercial property stock in the city.
- It was suggested that the scheme be designed to avoid anti-social behaviour
- There was a number of suggestions that the design be opened up to architectural competition
- Suggested the need for a low-energy building, with sustainable construction techniques to create a healthy environment and that the Provision of Grade A/LEED Gold office space of scale in the city centre is to be widely welcomed.

2 Issue: Cultural Heritage

- The submissions welcome the sympathetic treatment of the Georgian Buildings along Rutland St. and The Granary.
- The Irish Georgian Society commended the approach taken to the conservation of the existing Georgian Buildings on the site and welcomed the library use proposed for the former Town Hall on Rutland St.
- Welcomed the library use proposed for the former Town Hall on Rutland St.
- There was some concern raised about the visual impact of the tall building on Bank Place on the Granary Building and The Hunt Museum.
- It was suggested that the Georgian portion of the site is phased up-front.

3 Issue: Proposed Mix of Uses and Night/Weekend Activity

- The provision of a new library within the Opera site welcomed.
- The cultural and entertainment amenities area and the new City Library in the Town Hall building welcomed.
- It was felt that more residential on the site would make the area more vibrant from 7am to midnight.
- A constant theme within the submissions is the idea of making Limerick a liveable city and to increase night-time and weekend activity in the area.
- The provision of active uses at ground floor such as retail and café use welcomed.
- Recommendations are also given for alternative cultural uses to include; multi-purpose events centre, sporting and recreational uses to enliven and enrich the area.
- A number of submissions stated that University of Limerick should be involved to provide educational facilities.
- It was felt that there was too much commercial on the site and queried the use of apart-hotel for satisfying housing need.

4 Issue: Proposed Building Height at Bank Place

- Concern was raised that the scale and bulk of the tall building was out of character with Limerick City,

5 Issue: Public Realm and Landscaping

- Overall it was felt that the scheme provides for quality public realm.

- New public square impressive and could become part of the social fabric of the inner city for people to gather if necessary.
- Welcomed the idea of Bank Place becoming a more animated space with cafes, bars etc.
- A suggestion is made for the inclusion of a cinema at the site as well as children's play areas, sporting facilities (such as soccer pitches, basketball courts, tennis courts, running track etc.), which would be available to both the occupiers and wider community. It is also suggested that the roofs of proposed buildings could be considered for provision of such facilities.
- There was a suggestion made by a number of stakeholders that the location of the entrance to the new Plaza should be located on the junction to Patrick St./Ellen St. to encourage more pedestrians through the plaza.
- It was suggested that the materials and finishes proposed for the public areas are well considered so that they can be easily maintained and will age well.
- It was felt that the new public realm should be all-weather with an emphasis on providing evening activity and public events.
- A suggestion was made that there should be a roof top garden on the new buildings and a further submission requesting bee-hives on roofs.
- Concern that public areas don't benefit from afternoon and evening light.
- Would like a boardwalk along the river to Thomond Bridge without interruption

5.4 EIAR Statutory Consultation

Limerick City and Council has forwarded copies of the consent application documents including this EIS to An Bord Pleanála. Hard and soft copies have also been circulated to the prescribed bodies as follows:

1. Minister for Housing, Planning & Local Government;
2. Minister for Communications, Climate Action and Environment;
3. Minister for Transport, Tourism and Sport, Department for Transport, Tourism and Sport;
4. Department of Culture, Heritage & the Gaeltacht, including the National Parks and Wildlife Services;
5. National Transportation Authority;
6. Transport Infrastructure Ireland;
7. CIE;
8. An Taisce – The National Trust of Ireland;
9. The Heritage Council;
10. Arts Council (An Chomhairle Ealaion);
11. Health Service Executive;
12. Health and Safety Authority;
13. Geological Survey of Ireland;
14. Environmental Protection Agency;
15. Fáilte Ireland;
16. Irish Water; and
17. Inland Fisheries.

The planning application will be placed on display for public consultation for a statutory period of at least six weeks from the date of lodgement of the application. Any person may make a submission or observation to An Bord Pleanála, 64 Marlborough Street, Dublin 1 in relation to the application during this period.

A copy of the consent application and each document accompanying the application including this Environmental Impact Assessment Report may be inspected free of charge, during normal office or opening hours at the following locations:

- An Bord Pleanála, 64 Marlborough Street, Dublin 1, D01 V902; and
- Limerick City and County Council, Dooradoyle Road, Dooradoyle, Limerick, V94 WV78.

All planning documents will also be available for download from the Limerick City and County Council website, i.e. https://www.limerick.ie/council/services/planning-and-property

6 Population and Human Health

6.1 Introduction

This chapter describes the potential effects of the construction and operation of the proposed development on Population and Human Health.

Where relevant, findings from other environmental topics (air quality, noise and vibration, traffic and landscape) are referenced to inform on the impacts on humans.

6.2 Methodology

The Department of Housing, Planning, Community and Local Government issued a circular letter (dated 15th May 2017, PL 1/2017) to planning authorities and An Bord Pleanála related to Advice on Administrative Provisions in Advance of Transposition.

Environmental Protection Agency (EPA) Guidelines

Due regard was had to the following EPA guidelines:

- EPA, Guidelines on the Information to be contained in Environmental Impact Statements, 2002; and
- EPA, Advice notes on Current Practice (in the preparation of Environmental Impact Statements), 2003.

The following Draft Guidance documents have also been consulted:

- Guidelines on the Information to be contained in Environmental Impact Assessment Reports, Draft May 2017; and
- Advice Notes for Preparing Environmental Impact Statements, Draft September 2015.

6.2.1 Population and Human Health Guidance

The assessment considers the effect on communities and their human health as a result of the proposed development and this will largely be undertaken within 200m of the proposed development.

Any significant community or human health considerations beyond 200m will also be assessed and referenced in this chapter. This includes consideration of the proposed development on the surrounding electoral division to identify where existing indicators of poor health have the potential to change as a result of the proposed scheme.

The assessment of human health has no consolidated significance criteria, therefore professional judgement has been applied to establish qualitative health and well-being effects.

The human health assessment is a qualitative rather than quantitative assessment, due to the diverse nature of health determinants and health outcomes which are assessed.

This qualitative assessment of the potential effects of the proposed scheme on human health considers the following health and well-being determinants which are considered to be the most relevant for the proposed development:

a) Access to healthcare services and other social infrastructure;
b) Access to open space and nature;
c) Air quality, noise and neighbourhood amenity;
d) Accessibility and active travel;
e) Access to work and training;
f) Social cohesion and neighbourhoods;
g) Crime Reduction and Lifetime Neighbourhoods; and,
h) Contaminated land.

This assessment considers the potential consequences for health and wellbeing from the construction and operation of the proposed development.

There are potentially effects on human health which are related to the impacts from other topics and these will be referenced where relevant.

There may be disruption during construction associated with traffic, demolition and construction works alongside associated noise and air quality impacts.

Findings from the Traffic and Transport Assessment (Chapter 13), Noise and Vibration impacts assessment (Chapter 10) and the Air Quality and Climate Assessment (Chapter 9) are also reviewed to determine whether there is potential for any health and well-being impacts.

Noise levels are not expected to cause any significant disruption during operation, but the topic findings will be reviewed to establish if there is potential for any health and well-being impacts.

Air quality impacts arising from the proposed development are reviewed to determine whether there is a potential for health and well-being impacts.

6.2.2 Criteria and Terminology

The EIA methodology set out in Section 3.7 and the EIA guidance (EPA 2017) above has been followed to assess effects on local communities. Specifically, the terminology and approach for sensitivity of receptors (Table 6.1), magnitude of impacts (Table 6.2) and significance of impacts (Table 6.3 and Table 6.4) have been employed and adapted with definitions of descriptors specific to this assessment topic.

Table 6.1: Environmental Sensitivity and Typical Descriptions

Value (Sensitivity)	Typical descriptors
Very High	Very high importance as directed by policy. An example may include social rented/affordable residential properties and schools.
High	High importance as directed by policy. An example may include residential properties, specific types of businesses and schools.
Medium	High or medium importance as directed by policy, regional scale. An example may include community facilities.
Low (or Lower)	Low or medium importance as directed by policy.
Negligible	Very low importance as directed by policy.

Table 6.2: Magnitude of Impact and Typical Description

Magnitude of impact	Typical criteria descriptors
Major	**Negative:** Loss of socio-economic resource / integrity of community resource / disruption to Non-Motorised Users (NMU) provision; severe damage to a community resource / (Adverse). An example may include loss of community facilities / major employment opportunities. **Positive:** Large scale or major improvement of community resource/ NMU provision quality; extensive restoration or enhancement; major improvement of community attribute quality (Beneficial). An example may include the provision of community facilities / major employment opportunities.
Moderate	**Negative:** Loss of socio-economic resource / but not adversely affecting the integrity; (Adverse). An example may include loss of some provision of economic activity. **Positive:** Benefit to, or addition of, key characteristics of socio-economic resource, features or elements; improvement of attribute quality (Beneficial). An example may include additional provision of economic/social activity.
Minor	**Negative** Some measurable change in attributes of socio-economic resource / minor loss of, or alteration to, one (maybe more) resource (Adverse). An example may include impact to economic activity/community facilities due to temporary construction activities during the construction phase. **Positive:** Minor benefit to, or addition to a socio-economic resource/ NMU provision; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	**Negative** Very minor loss or detrimental alteration to one or more resources provision (Adverse). **Positive:** Very minor benefit to or positive addition of one or more resource (s) / (Beneficial).
No change	No loss or alteration of resource; no observable impact. No impacts to community facilities or routes.

Table 6.3: Significance Categories

Significance category	Typical descriptors of effect
Very Large	These effects represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with receptors of material importance that are likely to suffer either a damaging impact and loss of resource integrity, or., a major change in a site or feature of local importance may enter this category. An example for socio-economics may be large scale job provision or the creation of an international tourist asset.
Large	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process. An example for socio-economics maybe a new economic activity in a regional / local area or the increased provision of business opportunities.
Moderate	These beneficial or adverse effects may be important but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor. An example for socio-economics maybe increased job provision or community facilities.
Slight	These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process but are important in enhancing the subsequent design of the project. An example for socio-economics maybe the provision of pedestrian walkways/cycle routes or diversification of the local economy on a minor scale.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

The significance of likely effects (adverse or beneficial) has been determined using the matrix presented in Table 6.4 below.

Table 6.4 Significance of Impact

		MAGNITUDE OF IMPACT				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
SENSITIVITY	**Very High**	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

The assessment entails firstly the identification of potential impacts to community and socio-economics receptors to scope the assessment. Then a review of the baseline data is undertaken to determine sensitivity of the receiving environment. This is followed by a qualitative consideration of potential impacts in terms of magnitude and a determination of the significance of the impact without mitigation or enhancement to reduce or enhance potential impacts. Mitigation or enhancement measures are then identified, and a determination as to the significance of residual impacts is undertaken.

As mentioned in the previous section, a qualitative assessment of human health has been undertaken.

Although the assessment of human health effects describes likely qualitative health outcomes, it is not possible to quantify the severity or extent of the effects which give rise to these impacts. As such, the potential health impacts during construction and operation are described, based on broad categories for the qualitative impacts identified.

It should be noted that in many cases, mitigation to reduce these impacts or measures to enhance certain benefits already form part of the proposed development and the assessment has considered these impacts as such.

Table 6.5: Human Health Impact Categories

Impact Category	Impact Symbol	Description
Positive	+	A beneficial impact is identified
Neutral	0	No discernible health impact is identified
Negative	-	An adverse impact is identified
Uncertain	?	Where uncertainty exists as to the overall impact

Baseline Sources

The following sources have been used to gather baseline information for Population and Human Health:

- A review of online maps of Limerick;
- Limerick Opera Site Design Brief (2018);
- Limerick 2030: An Economic and Spatial Plan for Limerick (2014);
- The Economic Data Profiling Report for Limerick 2018; and
- Irish Census 2016.

6.2.3 Plans and Policies

The Limerick 2030 Spatial Plan can be defined as follows:

> *"There are 3 elements to the Plan. The first is an Economic Strategy which identifies how Limerick needs to be positioned in order to best take advantage of economic opportunities in order to build a stronger local economy through the creation of employment and the attraction of investment. The second element is a Spatial Plan focussed on revitalising and redeveloping Limerick City Centre and the final element is a Marketing Plan which aims to use Limerick's unique and positive attributes to change perceptions of how Limerick is viewed."*

The Plan has addressed economic, social and physical features of the City and County as a whole. It has taken account of the Regeneration programmes, and uses much of the work that has already been completed or is underway as a starting point – though challenging and adjusting where it is appropriate to do so. It has involved extensive engagement with public, business and voluntary sector stakeholders, and allowed a clear vision for Limerick to be defined, drawing on Limerick's strengths and addressing challenges faced into the future.

> "*The Spatial Plan gives pedestrian and cycle activity greater prominence….putting the pedestrian first throughout the City Centre with wider pavements, wider crossing points….adopting the 'Smarter Travel' principles that have been formulated for the City Centre."*

The Spatial Plan supports and embraces Limerick's Smarter Travel concept. Limerick has been designated one of three Smarter Travel Demonstration Projects in Ireland which seeks to reduce car trips in the City and increase walking and cycling. The principal infrastructure components are a canal cycle and pedestrian route, a public station transport interface with enhanced cycle facilities, appropriate traffic management measures in favour of the pedestrians and cyclists and the provision of cycle parking facilities across the City Centre.

The proposed development will support the policies contained within the Limerick 2030 Plan by creating an employment base for the local area which will in turn strengthen community cohesion through an economically active workforce. The proposed pedestrian and cyclist facilities will ensure the idea of smart sustainable travel within Limerick is fully realised. The proposed development will also drive the retail sector in Limerick forward and meet the obligations of the Limerick 2030 Plan.

6.2.3.1 Limerick City Development Plan 2010 – 2016

There are a number of key elements and policies within the Limerick City Development Plan which relate to Population and Human Health. These are outlined below:

Strategic Employment Locations

> *"The City Council will support the further development of the City Centre as the primary strategic employment location in the region.*
>
> *The plan recognises the further potential that exists within the Docklands area, as well as suburban locations to provide substantial employment opportunities".*

City Centre

> *"The National Spatial Strategy places strong emphasis on development of the City Centre as the key driver of economic activity. Limerick City Centre as a Regional Gateway will continue as the focus for retail, cultural and commercial activity and has potential for significant expansion and intensification while recognising the need to respect the existing intrinsic historic character of the area in new development.*
>
> *The City Centre has seen significant development over the last 10 years, however the vitality of City Centres retail base has been undermined by developments outside of the centre and the difficulties associated with land assembly and conservation within the City Centre.*
>
> *The City Council have begun an ambitious programme of pedestrianisation of the Central area and the introduction of an inner orbital route which combined with green routes will facilitate easier access to the centre".*

Economic Development Strategy

Policy EDS.1

> *"It is the policy of Limerick City Council to co-operate with all agencies in the region to facilitate the implementation of the economic and investment strategy, in co-operation with other institutions and the private sector, placing particular emphasis on seeking to secure the economic development of the City"*

The proposed development complies with this policy as it will involve a number of key agencies and local businesses to ensure the development fits in with the existing local economic hubs within Limerick. As outlined in 2030 Plan, these proposals should tie in with the concept of 'A New City Square' and the cumulative proposals for Limerick City Centre & County.

Policy EDS.2

> *"It is the policy of Limerick City Council to facilitate the sustainable redevelopment of sites identified in the 2030 Economic and Spatial Plan for Limerick*"

The 2030 Economic and Spatial Plan for Limerick specifically mentions the proposed development throughout the Plan and specifically under the 'Enhancing the City Centre Retail Offer'.

Policy EDS.6

> *"It is the policy of Limerick City Council to facilitate the regeneration agency in accordance with an approved masterplan"*

The Limerick Regeneration Framework Implementation Plan (2013) Plan envisages one of the largest capital programmes and largest regeneration programme in the State. The Plan includes a €253m investment on physical, €30m on social and €10m on economic programmes. The proposed development forms part of these plans. The proposed development received €1,839,000 under the Urban Regeneration and Development Fund (URDF) in November 2018. The Urban Regeneration and Development Fund (URDF) was established to support more compact and sustainable development, through the regeneration and rejuvenation of Ireland's five cities and other large towns, in line with the objectives of the National Planning Framework and National Development Plan (NDP).

Policy EDS.8

> *"It is the policy of Limerick City Council to mobilise the potential of brownfield sites in the City."*

The proposed development complies with this policy as it is developing an existing under-utilised area of the city centre. As brownfield sites can potentially be associated with historic sources of contamination, an environmental site investigation and risk assessment of soil and groundwater beneath the site was conducted. A conservative approach was adopted assessing the suitability of soil and groundwater for residential development, which was also considered to be sufficiently protective of future commercial users of the site.

Policy EDS.9

> *"It is the policy of Limerick City Council to prepare plans for urban renewal and sustainable development for areas in need of renewal and regeneration especially urban renewal of the City Centre and to pursue the implementation of that plan with the utmost vigour".*

The 2030 Economic and Spatial Plan and the Limerick City Development Plan highlight the need for urban renewal and to eradicate economic and social blackspots across the city. The proposed development complies with this policy.

PolicyEDS.13

> *"It is the policy of Limerick City Council to facilitate and encourage the development of retail offices in the City Centre and to support the development of retail offices serving a local function in District, Neighbourhood and Local Centres commensurate with the service function of the centre".*

The proposed development will include retail development space which will drive Limerick's economic development plans for the city in compliance with this policy. The retail development will complement the existing retail spaces such as those at Arthur's Quay.

Policy EDS.14

> *"It is the policy of Limerick City Council to support the development of the City Centre as the primary location for higher order general office development in the City and Region".*

The proposed development will include high end office space which will form a central part of the regeneration proposals. The proposed development will comply with his policy.

Retail Policies

There are a number of retail policies which relate to the proposed development, namely the policies R1 – R6 which involve promoting Limerick as a leading city for retail services throughout Ireland when compared to cities such as Galway, Cork and Dublin.

The proposed development will comply with these policies as the proposals involve high end retail space which will help drive Limerick's economic goals.

Transportation Policies

Key transportation policies which relate to Population and Human Health include the following:

- Policy TR.2 Integrating Land Use & Transportation Policies;
- Policy TR.4 Transport Interchange/Hubs;
- Policy TR.9 Cycling & Walking; and
- Policy TR.10 Limerick City Inner Orbital Route & City Centre Pedestriansation.

These transportation policies will be met by the proposed development as the proposals involve pedestrian and cycling improvements which will encourage residents and commuters to use sustainable transport modes to improve their quality of life and promote healthy smart travel plans.

Regeneration Policies

- Policy RG.1

  "*It is the policy of Limerick City Council to support the implementation of the Limerick Regeneration Framework Implementation Plan in a coordinated and sustainable manner and to co-operate with other agencies in the Region to deliver the goals and objectives set out in the Plan*"

- Policy RG4:

  "It is the policy of Limerick City and County Council to secure the objectives as set out in the Economic Framework Strategy of the adopted Limerick Regeneration Framework Implementation Plan".

- Policy SC.1

  "It is the policy of Limerick City Council to support the Limerick City Development Board in the sustainable implementation of its economic, social and cultural strategy for the City".

- Policy SC.8

  "It is the policy of Limerick City Council to encourage the provision of a range of community facilities across the City, which cater for all age groups and various community activities"

- Policy SC.10

  "It is the policy of Limerick City Council to work in cooperation with relevant organizations to reduce the extent of social exclusion across the City"

- Policy LBR.12

  "Protection of open spaces, enhance recreational areas etc".

- Policy LBR.16

  "It is the policy of Limerick City Council to develop a network of high quality amenity walkway routes, particularly along waterways, linking existing parks and public open spaces and providing for strategic creation of new public open spaces"

The proposed development will support the policies contained within the Limerick City Development Plan by creating a strong, vibrant Limerick City Centre. The proposed development will regenerate this urban area, reducing social poverty and unemployment blackspots and at the same time providing long term secure employment opportunities for a skilled workforce. The proposed development can help to improve human health through its proposed pedestrian and cycling initiatives which improve quality of life for residents and commuters within Limerick City.

6.2.3.2 Mid-West Strategic Plan 2012-2030

> *"The MWASP sets out a series of economic, land-use and transport recommendations including a proposed transportation investment programme, a public transport feasibility report, spatial and economic strategies and recommendations to achieve balanced regional development and an enhanced quality of life for the citizens of the Mid-West region.*
>
> *The MWASP incorporates a bold and innovative approach to addressing existing transport problems in the City and Region, which in turn will provide a modern and efficient public transport solution necessary for the future development of the region. The investment proposals in this strategic plan are intended to support more sustainable land-use and development with sustainable populations in a number of identified urban centres".*

The proposed development complies with these core principles of the Mid-West Strategic Plan as there is expected to be increased economic activity through job creation opportunities, both immediately and in the longer term. This in turn is expected to ensure Limerick is the driver for change throughout the mid-west region and thus meeting the obligations contained within the Mid-West Strategic Plan 2012 – 2030.

6.3 Baseline Conditions

The Proposed Development is located at the northern end of Limerick's Georgian Quarter and has a site area of circa 2.35ha. The Site is bounded by Rutland and Patrick Street to the west and Ellen Street to the south, Michael Street to the east and Bank Place to the north.

As outlined in Chapter 2, the Site is currently occupied by a number of buildings that are either on the Record of Protected Structure, or are on the National Inventory of Architectural Heritage (NIAH) and some of the buildings are vacant and in a state of disrepair. There are also some unused warehousing/ workspace buildings at Bogue's Yard and Watch House Lane as well as a c.100 space car park on the south east corner of the site.

Chapter 3 presents the proposals for the site, the redevelopment of the site as a mixed-use site primarily comprising office space supported by a range of retail and non-retail services, cafes/restaurants, licenced premises, apart-hotel, civic/cultural uses (including the city library in the existing Town Hall), residential and open space.

Within this chapter demographic trends are considered at a county, city and local level. The census gathers data for the whole state as well as on a regional scale, and also includes small area population statistics for administrative areas such as counties, cities, towns and electoral divisions. Census information analysed for the purpose of this study included information on population, age profile, employment, social class and health.

6.3.1 Existing Social and Economic Indicators

Population

The site is located in the in Limerick's City Centre[3]. According to the 2016 Census the population for the Electoral Division (Common House) was 736, which is to be expected given the limited amount of residential development in the City Centre. There is a population of 94,182 for the settlement of Limerick City and Suburbs[4]. The proportion of the population living in Common House that is aged 65 and over (4%) is less than the average observed across the city (13%). By contrast, the proportion that are of working age (16-64) is 79% and is 12 percentage points higher than the average across the city (67%). 16% of the population within the Electoral Division is under the age of 16, 4 percentage points below the average for the City (20%).

Limerick is the third largest city in Ireland after Dublin (1.17m) and Cork (209K). Under the National Planning Framework, it is planned that half of the overall national growth in terms of population, employment and housing will be targeted at Ireland's five cities – Dublin, Cork, Limerick, Galway and Waterford. Currently, growth has been disproportionately focused on Dublin, and it is the objective of the Framework to redistribute growth in a more balanced manner, which would see each of the other cities grow by at least 50 per cent by 2040, to enhance their significant potential to become cities of scale. The Framework foresees the population of Limerick city reaching approximately 150,000 by 2040.

General Health

The 2016 Census asked people to rate their perception of their overall health. At a national level, 90% of people perceived their general heath to be Very Good or Good. Similarly, 89% of residents in Limerick City and County rated their health as either Very Good or Good. In comparison to these figures, the Common House Electoral Division in which the Proposed Development is located is generally in good health with 82% of the population perceiving their general health to be either Very Good or Good and with only 3% rating their health as either Bad or Very Bad[5].

According to the 2016 Census, 15% of total population in the country have a disability. The rate for Limerick City and County is also 15%.

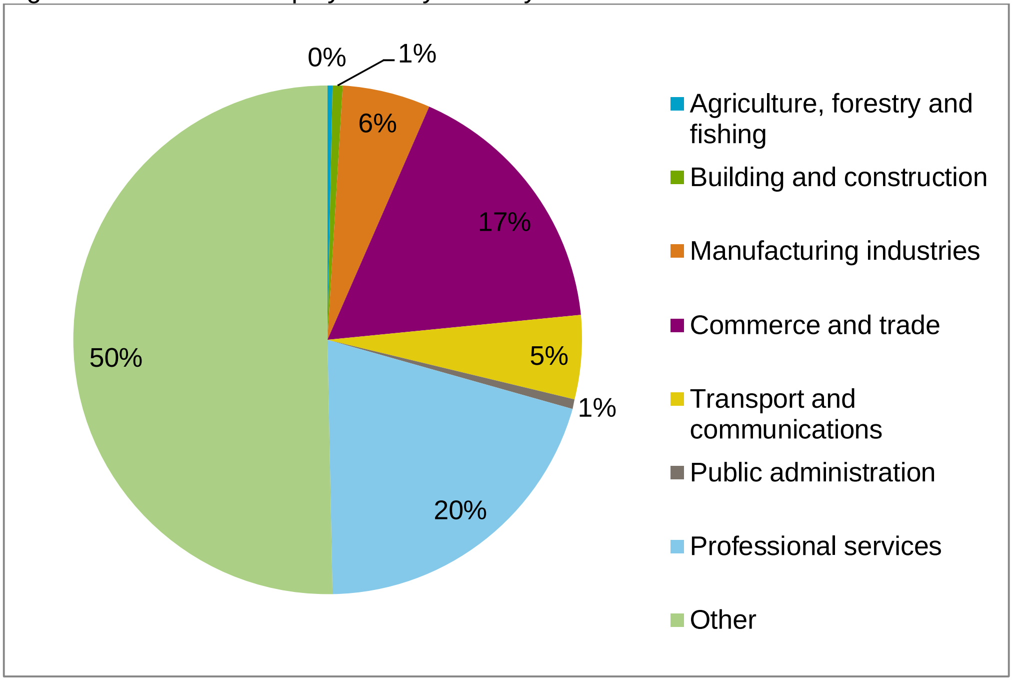
Commerce

As stated in the Economic Data Profiling Report (2016)[6], the three largest economic sectors in Limerick are Wholesale and Retail Trade, Construction, and Professional, Scientific and Technical Activities (41% of total active enterprises in total). In terms of employment, the key sectors are Human Health and Social Work (23% of all total employees in Limerick County. The Wholesale and Retail Trade sector represents approximately 13.8% of the total employment enterprises in Limerick County (lower than Cork, Dublin and Galway). The 2016 Census outlines that the industrial sectors of Professional Services and Commerce and Trade employ 20% and 17% of residents within the Common House Electoral Division respectively.[7]

Figure 6.1 below sets out the industry which residents of the Common House Electoral Division work in.

[3] Within the Census 2016 Electoral Division of Custom House.
[4] Irish Census 2016, Population aged 0 - 19 by sex and year of age, population aged 20+ by sex and age group
[5] Irish Census 2016, Population by general health and sex
[6] Economic Data Profiling Report (2016)- https://www.limerick.ie/sites/default/files/media/documents/2018-07/Economic%20Profiling%20Report%20for%20Limerick%20City%20and%20County.pdf
[7] Irish Census 2016, Persons at work by industry and sex

Figure 6.1: Resident Employment by Industry



Source: Census 2016, Persons at work by industry and sex

The city centres spatial plan, as outlined in Limerick 2030, has the ambition to create “a city centre that can attract new inward business investment and encourage the formation of new local business by providing high quality, flexible space”.

According to the report the level of office stock in Limerick has been increasing over the past number of years, there remains a shortage of large, high quality office space in Limerick city centre (Central Business District and adjoining areas). The Report further suggests that Limerick is the most affordable urban area in Ireland with regard to renting and buying residential property. It is also stated that office rents within Limerick City Centre were circa €215 per sq m in Q1 2017, these rents remain lower in comparison to other cities including Dublin, Cork and Galway. This makes the city more attractive and may be one of the reasons for large office demand within Limerick.

Incomes and Social Class

Limerick had the second highest income per person in 2014 in Ireland, outside of Dublin as stated by the Economic Data Profiling Report. Limerick does have a high proportion of low income areas, the Report suggests that the Pobal HP Deprivation Index for the city in 2016 was -10.8 and suggests that on average, the city is relatively disadvantaged. Out of the three Small Areas that make up the Custom House Electoral Division, two Small Areas have a Pobal HP index of -5.36 and -5.20 and are marginally below the average score. The remaining Small Area scores 4.64, which is marginally above the average score[8]. However, it should be noted that areas with low income are on the decrease due to ongoing regeneration activities.

Labour Market

The Economic Data Profiling Report states that almost 12,000 new jobs were created in Limerick County from 2012 – 2016. In Limerick City and suburbs, almost 8,000 net private jobs have been created in the same period. According to the Census 2016, 18% of the resident population within the Common House Electoral Division is considered to be unemployed compared to 52% of the

[8] Pobal HP Deprivation Index 2016- https://maps.pobal.ie/WebApps/DeprivationIndices/index.html

population being in work[9]. This is significantly higher than the level of unemployment for the Limerick City and Suburbs settlement (9%).

Commuting data for the city show as many as 22,000 workers commute daily into the city. The 2016 Census suggests that within the Common House Electoral Division 79% of the resident population journey time is less than 30 minutes in order to get to work, school or college with a small proportion of the population travelling for over an hour (3%).[10] This is in line with the wider settlement of Limerick City and Suburbs where 80% of journeys are under 30 minutes with only 3% of journeys taking more than an hour.

Education

The Economic Data Profiling Report states that almost 24,000 students were enrolled in third level institutions in Limerick. There were 10% of students enrolled in Natural Sciences, 8% in Mathematics and 17% in ICT and Engineering/Manufacturing across all of Limerick's educational third level institutions. The 2016 Census indicates that the Common House Electoral Division is generally well qualified with 66%[11] of the population being qualified to NFQ level 4[12] or above. This is slightly lower than the average for the settlement of Limerick City and suburbs (70%). Additionally, the share of residents within the Electoral Division that hold no qualifications (3%) is broadly in line with the average for the settlement of Limerick City and suburbs (2%).

The nearest mixed primary school (St Mary's Presentation Primary School) is located approximately 1km from the site with 221 pupils enrolled at school in 2011[13]. Additionally, there are also a number of similar primary schools located in close proximity to the proposed development. Gaelcholáiste Luimnigh is the closest secondary school to the site and is located approximately 500m from the site. According to the Department of Education and Skills Programme Evaluation Report from May 2017, 592 students were enrolled at the school[14].

Tourism

Tourism numbers from Fáilte Ireland indicate that Limerick is on a positive trend and the recent publication of 'Limerick 2030 Economic and Spatial Plan for Limerick' will ensure that tourism targets are delivered upon leading up to 2030 and beyond this date.

The 2030 Report states that there are around 380,000 overseas visitors to Limerick City and County each year. According the Economic Data Profiling Report, there has been an overall upward trend in the number of overseas visitors, with a 9% increase during 2015. The Hunt Museum has approximately 45,000 visitors per annum. According to Fáilte Ireland there were 27 hotels in Limerick in 2018, which together has 2,191 rooms and 5,222 beds[15].

There is an active festival and special events programme every year. Typical events include Limerick Youth Fest, Riverfest, Unfringed Festival, Cultural Night and the Fresh Film Festival.

6.3.2 Community Facilities

The main community facilities within 200m of the proposed development are outlined below (closest first) and are shown on Figure 6.2 - Community Facilities within 200m:

- Limerick City Library (within redline);

[9] Irish Census 2016, Population aged 15 years and over by principal economic status and sex
[10] Irish Census 2016, Population aged 5 years and over by journey time to work, school or college.
[11] Irish Census 2016, Population aged 15 years and over by sex and highest level of education completed.
[12] As outlined in Census 2016 questions in detail (http://census.ie/the-census-and-you/each-question-in-detail/)
[13] IrelandStats (https://www.irelandstats.com/school/maria-king-presentation-primary-rollnumber-20018h/)

[14] Department of Education and Skills Programme Evaluation Report, May 2017 (https://gcluimnigh.files.wordpress.com/2014/01/76101i_progeval_5471_20170719-1.pdf)
[15] Fáilte Ireland (http://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/3_General_SurveysReports/Accommodation-Capacity-in-Ireland-2018.pdf?ext=.pdf)

- Fab Lab Limerick (within redline);
- The Granary Building and associated community groups/events (within redline);
- Limerick Health Hub (within redline);
- Ormston House, Cultural Resource Centre (0 -10m south);
- The Hunt Museum (15m west);
- Arthur’s Quay Shopping Centre (use by community groups/charities) (15 – 20m west);
- ELI English Language Institute Limerick (22m south);
- St Michael’s Catholic Church (75m south);
- The Potato Market (90m north);
- Arthur’s Quay Park (100m west);
- The Milk Market (120m south east);
- Limerick Institute of Technology (100m north);
- Barrington’s Hospital (115m north east);
- Limerick City Marina (125m west); and,
- St Mary’s Cathedral (195m North).

Outside 200m (included due to relevance):

- Limerick Museum (over 200m south);
- Shannon Rowing Club (over 200m west); and,
- Limerick Boat Club (over 200m west).

Figure 6.2 Community Facilities within 200m

6.3.3 Bus and Train Services

The nearest train station is located over 500m south (Limerick (Colbert Railway Station)). The nearest bus stops and bus routes are located along Arthurs Quay to the west of the proposed development. These include Services 301, 323, 341, 345, 313 and 712-X. To the south of the proposed development, bus services which serve the William Street area include Services 303, 304, 305, 343 and 345. To the north along Bridge Street, George Quay and Mary Street Services 301 and 305 operate on a daily basis.

6.3.4 Cycle Routes, Footpaths and Walking Routes

There are no designated cycle routes within 200m of the proposed development. There is anecdotal evidence to suggest that existing roads are used as informal routes by cyclists on journeys between Patrick Street, Ellen Street, Michael Street and Rutland Street. There is an existing Coca Cola Bike Sharing Station (in partnership with the National Transport Authority and Limerick City and County Council) located at the Bank Place Junction adjacent to the Granary. There is also one located at Arthur's Quay to the west of the proposed development.

There are existing footpaths along Ellen Road, Michael's Street, Rutland Street, Patrick Street and Bank Place on both sides of the street. Further north, there are footpaths along Bridge Street, Charlotte's Quay and George Quay north of the river. The existing footpaths and bike station link into the City Centre and provide existing consumers with transport links throughout the city.

The closest walking routes are undesignated and are located within and around Limerick City. These include the Slí na Sláinte Walking Route to the south and the Three Bridges Walking Route. The

Three Bridges Route is a 3.6km walk beginning at Arthur's Quay Park, following a route along the banks of the River Shannon and passing some of Limerick's most iconic landmarks.

6.3.5 Areas of Open Space and Recreation

Arthur’s Quay Park is located approximately 100m to the west of the proposed development. The main areas of open space and recreation are located over 200m from the proposed development. These areas include O’Brien’s Park and Kilmurray Park (both over 500m away). There are no open areas which are zoned for recreation purposes within 200m of the proposed development.

6.4 Predicted Effects

6.4.1 Direct effects on job creation and retail during construction and operation

Sensitivity of the existing site is considered to be High due to its location and its importance as a project as outlined in numerous economic and area plans for Limerick.

There is the potential that any jobs created by the proposed development would enrich the local economy indirectly by providing capital to Limerick City through the service industry, particularly during the construction period.

The expected construction-related employment opportunities will last the duration of the construction period with the potential to employ local businesses and/or firms as appropriate. The estimated construction period is 4 years and 6 months. Outputs from the Transport Assessment indicate that during the peak construction period (Enabling and Phase 1) a maximum of 200 construction personnel will be employed on site.

The operational phase of the proposed development is expected to contribute significantly to the local employment sector on a long term basis. When estimating operational job creation, it is important to consider not just the gross effects of the Proposed Development but also net effects, which take into account leakage, displacement and multiplier effects.

Assuming a leakage of 50.9%, based on the 2016 Census for the Limerick City and Suburbs area, a low level of displacement and a 1.5 multiplier; it is estimated that a net employment potential relating to the existing site is 2,447. This is presented in Table 6.6 below.

Table 6.6 Total Potential Net Employment Generated by Existing Site

	Local	Regional	Total
Gross Direct Employment	1,068	1,107	2,175
Displacement	-267	-277	-544
Net Direct Employment	801	830	1,631
Indirect & Induced Employment	401	415	816
Total Net employment	**1,202**	**1,245**	**2,447**

These employment opportunities will ensure that the proposed development provides a positive contribution both to the local area and the wider economy. It is expected that the proposed development will be a contributor to the objective of ensuring Limerick is a leader within the retail sector and consequently providing long term, secure job opportunities.

6.4.2 Direct effects on the local community during construction and operation

There is potential for temporary disruption during construction for community groups/classes within the Granary and users of Limerick City Library. Temporary negative impacts in the form of diversions/alternative routes may also occur for pedestrians and cyclists (See construction traffic plan as part of the Traffic and Transport assessment (Chapter 13). Any negative impacts are expected to be short term and temporary in nature.

There are a number of proposed improvements for the scheme which will have benefits for the local community during the operational phase of the proposed development. Improvements are expected to include:

- High quality surrounding streets to provide a safe animated and inviting public realm that optimises the pedestrian experience and links surrounding areas;
- Overall improved public realm and increased permeability;
- Improved public space at Bank Place allowing easy connectivity to surrounding urban spaces and nodes: Merchant's Quay, Arthurs Quay, proposed new city square (2010 vision) and the Milk Market;
- A new pedestrian connection from Michael Street to Patrick Street crossing a new 'internal' public space that offers a quieter, interior courtyard space for occupiers and visitors;
- Bank Place area to be high quality pedestrian-orientated streets with pedestrian links to the Hunt Museum and King's Island to the north;
- Michael Street area to have high quality pedestrian streets with quiet enclaves, breakout and dining areas; and
- Secure bicycle parking facilities within the proposed basement carpark.

This impact is considered to be Moderate Beneficial in magnitude, leading to a significance of Moderate or Large Beneficial.

6.4.3 Indirect effects on the surrounding economy, society, transport and culture

The development of the existing site will improve the economic and social prosperity of the surrounding area of the proposed development. Other potential benefits of the proposed development include commercial linkages with existing businesses/retail industry throughout Limerick City Centre.

The proposed development will create a diverse economically active workforce which will allow further socio-economic benefits to emerge over time resulting in an increased quality of life for the surrounding community.

The proposed walking and cycling initiatives as part of the proposed development will help to ensure Limerick becomes a smart city with sustainable transport links for pedestrians and cyclists alike. This in turn will add to the quality of life and health of Limerick residents, shoppers and commuters.

The proposed development will also contribute to the social and cultural growth of Limerick City Centre. The proposed development has been earmarked as a kick-starter for growth and inner city regeneration and this also includes the potential for tourist related opportunities once the proposed development is completed. The proposed development will include cafés/restaurants, licenced premises, open spaces (including a new public square), retail spaces and an apart hotel. The nature of this development has the potential to have a positive impact on tourism in the area.

The proposed development is expected to invigorate and regenerate growth in Limerick City Centre and thus the magnitude of impact is considered to be Moderate Beneficial. The significance of this impact will be Moderate or Large Beneficial.

6.4.4 Human Health effects

The table below sets out the potential human health effects associated with the proposed development, the potential health impact is described in accordance with the criteria outlined in Section 6.2.2. The health determinants outlined in Table 6.7 below has been selected for assessment as they were deemed to be the most appropriate to assess for the proposed development.

Table 6.7 Human Health Assessment

Health Determinant	Effect	Human Health Rating	Proposed Mitigation (if any)
Access to work and training	The proposed development will provide a net floor area of circa. 29,700 sq m of commercial offices, 4,147 sq m of cultural, 2,418 sq m of retail, 2,259 sq m of restaurant/café/bar use and a 4,710 sq m 57 room aparthotel. Due to the provision of employment space, there will be a number of jobs created as a result. The Proposed Development will act as a driver for growth for Limerick and will be able to attract companies and provide employment opportunities.	n/a during construction + during operation	No mitigation required
Access to open space and nature	The Traffic and Transport assessment (Chapter 13) outlines that construction access will occur from R445 and Michael Street minimising the impact on more sensitive roads around the site. Michael Street is used to access classes/ groups at The Granary as well as the Limerick City Library and there may be some negative impacts for non-motorised users. These effects will be mitigated through the Construction Traffic Management Plan (See Traffic and Transport Chapter 13). The assessment concludes that there will be a negligible effect on local traffic, pedestrian and cycle delay and public transport. The proposed development has a number of public realm elements that will create some public spaces. The proposed development is expected to include a landscaped public plaza as well as improvements to the existing public realm area at Bank Place including feature trees with seating and planted terraces.	0 during construction + during operation	Construction Traffic Management Plan as outlined in Chapter 13
Air Quality, Noise and Neighbourhood Amenity	As outlined in the Noise and Vibration impacts assessment (Chapter 10) there will be no significant noise impacts resulting from construction of the proposed development. Assessments carried out for the operational phase suggest that there are negligible noise effects in terms of both traffic noise levels and internal noise levels within proposed offices. At some of the residential properties which are	0 during construction 0 during operation	Noise Mitigation as outlined in Chapter 10 Air Quality Mitigation measures as outlined in

Health Determinant	Effect	Human Health Rating	Proposed Mitigation (if any)
	part of the development noise levels are expected to exceed the recommended levels and as such appropriate mitigation has been included within the scheme design. The Air Quality and Climate Assessment (Chapter 9) has also outlined that during construction a series of best practice measures will be adopted to limit the generation of dust to protect residential properties in the vicinity of the site. The assessment findings suggest that there will be no in nitrogen dioxide and particulate matter concentrations as a result of construction traffic. Whilst there may be some increase in traffic in the operation phase that will result in increased annual mean concentrations of nitrogen dioxide and particulate matter concentrations, these will be well below Limit Values.		Chapter 9
Access to healthcare services and other social infrastructure	The Traffic and Transport assessment (Chapter 13) outlines that construction access will occur from R445 and Michael Street minimising the impact on more sensitive roads around the site. Michael Street is used to access classes/ groups at The Granary as well as the Limerick City Library (which will be moved off site during construction) and there may be some negative impacts for non-motorised users. These effects will be mitigated through the Construction Traffic Management Plan (See Traffic and Transport Chapter 13). The assessment concludes that there will be a negligible effect on local traffic, pedestrian and cycle delay and public transport. Whilst there is anticipated to be some form of residential accommodation being provided as a part of the proposed development, this is considered to be a fairly minor element of the development and it is likely that there will be no significant impacts on access to healthcare facilities and other social infrastructure. Due to the scale of housing set to come forward, it is not expected that this will create additional pressure on healthcare services and social infrastructure such as schools, in the vicinity of the site.	0 during construction 0 during operation	Construction Traffic Management Plan as outlined in Chapter 13
Accessibility and Active Travel	The Traffic and Transport assessment (Chapter 13) outlines that construction access will occur from R445 and Michael Street minimising the impact on more sensitive roads around the site. Michael Street is used to access classes/ groups at The Granary as well as the Limerick City Library and there may be some negative impacts for non-motorised users. These effects will be mitigated through the Construction Traffic Management Plan (See Traffic and Transport Chapter 13). The assessment concludes that there will be a negligible effect	0 during construction 0 during operation	Construction Traffic Management Plan as outlined in Chapter 13

Health Determinant	Effect	Human Health Rating	Proposed Mitigation (if any)
	on local traffic, pedestrian and cycle delay and public transport. The proposed development will provide high quality surround streets and an improved public realm that optimises the pedestrian experience as well as increases permeability. New pedestrian connections will also be provided along with secure cycle parking facilities within the proposed basement car park. Other public realm improvements are also being made to the wider area for those using walking routes adjacent to the river.		
Crime Reduction and Community Safety	The Construction Methodology and Phasing Management Plan states that public health and safety legislation and guidance will be complied with and the appointed Contractor must also be compliant with and implement all relevant Irish and EU safety, health and environmental legislation. This will ensure that safe construction practices are provided. The proposed development includes a number of different multi-use spaces. The proposed public plaza and other public spaces create areas for socialising and relaxing which are available for visitors. The central plaza will not be gated and will create a space which will offer greater natural surveillance. Public realm improvements will include tree planting and improved landscaping. High quality surrounding streets will provide a safe and inviting public realm for pedestrians and visitors.	0 during construction + during operation.	No Mitigation Required
Social Cohesion and Lifetime Neighbourhoods	The proposed development covers a relatively small area; however, proposals include a new pedestrian connection from Michael Street and Patrick Street that crosses a new public space, which is a quiet, internal courtyard. Proposals also include pedestrian links from Bank Place to the Hunt Museum and King's Island to the north. Public realm works will improve public spaces within the development, especially at Bank Place, which will allow easy connectivity to nearby urban spaces including Merchants Quay, Arthurs Quay, the proposed new site square and the Milk Market. Improvements to public spaces will improve access and participation of all parts of the community to interact and socialise in a safe space, removing feelings of isolation.	n/a during construction + during operation	No Mitigation Required
Contaminated Land	The Land, Soils, Geology and Groundwater assessment (Chapter 7) outlin.es the environmental site investigation and risk assessment that was conducted. Potential pollutant linkages were identified by	0 during construction + during operation.	No Mitigation Required

Health Determinant	Effect	Human Health Rating	Proposed Mitigation (if any)
	considering: the sources of contamination on site; pathways for those contaminants to migrate; and receptors of contamination at the end of a pathway. From a human health perspective, the following pathways were considered: • Vapour migration and inhalation; • Inhalation of dust; • Ingestion of soil and dust particles; and • Dermal contact. A potential risk to future site users was identified from PAHs and lead in made ground at the site. However, excavation of material for basement construction will remove a large proportion of made ground (the source). In addition, the site will be covered in buildings and hardstanding with some raised ornamental planting, thus, breaking potential pathways.		

The following principal health benefits to the residents of the proposed development and within the local community include:

- Job creation (through provision of employment floor space) which can potentially result in positive health impacts associated with increased income, the establishment of networks, job satisfaction and a sense of self-worth;
- Improvements in the environment and the provision of improved communal areas with a high amenity value, will result in increased social cohesion and encourage social interaction due to the removal of physical barriers; and
- Improvements to the public realm to improve and create high quality streets so that they are more connected and safer to use. These improvements will potentially result in higher levels of active travel in the area as improvements to the public realm will encourage more people to walk or cycle.

Potential adverse impacts are associated with accessibility issues during the construction works for those pedestrians and cyclists that want to access groups and classes at the Granary and who want to access the Limerick City Library.

6.5 Mitigation Measures

During construction, temporary signage and alternative route consideration (for pedestrians and cyclists) shall be provided pre construction. As the nature of the proposed development is a mixed use development with construction and operational phase jobs and major retail opportunities, no further mitigation measures are required.

The chapter on Mitigation sets out in detail the measure to be taken during the construction and operational phases.

6.6 Residual Impacts

6.6.1 Direct effects on job creation and retail during construction and operation

The main residual impact will be the creation of employment opportunities both during construction and within the operational phase of the proposed development. As outlined above, there are likely to be a maximum of 200 temporary jobs created during the peak construction period and 2,247 permanent jobs created during operation.

The significance of residual effects is thus taken to be Moderate or Large Beneficial.

6.6.2 Direct effects on local communities

The main residual impact for local communities during the operational phase of the proposed development will be the improvements to the public realm which comprise high quality and pedestrian orientated surrounding streets as well as improved public spaces. The significance of residual effects is thus taken to be Moderate or Large Beneficial.

6.6.3 Indirect effects on the surrounding economy, society, transport and culture

The main residual impact will be the improvement of the local economy as a result of the proposed development and the strengthening of the local community due to the presence of a stable employer and an economically active workforce in the surrounding Limerick area.

The residual impact for local communities during the operational phase of the proposed development will be the improvements to the public realm which comprise high quality and pedestrian orientated surrounding streets as well as improved public spaces.

The proposed development also has the potential to grow tourist related opportunities and attract large numbers of visitors to the area through the provision of an apart hotel alongside other retail and leisure services.

The significance of residual effects is thus taken to be Moderate or Large Beneficial.

6.7 Difficulties Encountered in Compiling Information

No difficulties were encountered during the assessment.

6.8 Cumulative Impacts

Cumulative impacts are largely in relation to air quality and noise and vibration impacts during the construction phase. These impacts are outlined in full in the respective chapters.

6.8.1 Planning Applications

A review of relevant planning applications within 1km was undertaken as part of the cumulative assessment. The proposed Rugby Centre of Excellence and the O’Connell Street Development will bring added visitors to Limerick and to the proposed development. This will have an overall positive impact for the propose development. No other planning applications will have any significant impact on the proposed development from a Population and Human Health perspective.

6.9 References

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7 Land, Soils & Geology and Groundwater

7.1 Introduction

This chapter of the EIAR assesses and evaluates the potential impacts of the proposed development, details of which are outlined in Chapter 3 – Description of the Proposed Development, on land, soils, geology and groundwater within the EIAR study area (i.e. within the planning application site boundary). In assessing potential and predicted impacts associated with construction and operational phases of the development, AECOM has considered both the importance of the attributes and the predicted scale and duration of likely impacts.

7.2 Methodology

7.2.1 Context

This assessment has been prepared having regard to the following guidance documents:

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, Draft August 2017, Environmental Protection Agency (EPA).
- Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements, 2013, Institute of Geologists of Ireland.

In addition, the Limerick City Development Plan 2010 - 2016 outlines strategic environmental assessment objectives with regard to soil and geology which are relevant to a project such as this. These strategic environmental objectives are:

1. Maintain soil quality and function;
2. Encourage reuse and recycling of soil/bedrock associated with developments; and
3. Give preference to the use and reuse of brownfield sites, rather than developing greenfield lands.

7.2.2 Contaminated land and risk assessment

With regard to contaminated land, this EIAR draws on an environmental site assessment (ESA) completed in 2017 (see Appendix 7.A). Included in that assessment was a generic quantitative risk assessment (GQRA) that adopted a risk-based approach for the assessment of analytical data. Analytical results for soil and groundwater at the site were screened against generic acceptance criteria (GAC) appropriate for human health (residential without home grown produce) or environmental / controlled water (groundwater or surface water). This is an approach AECOM considers consistent with the principles of human health protection in Irish EPA, UK DEFRA and UK Environment Agency guidance.

AECOM also considers this approach to be consistent with economic development strategy policy outlined in the Limerick City Development Plan 2010 – 2016: EDS 8, to mobilise the potential of brownfield sites in the city. While developing brownfield sites in preference to greenfield makes a positive contribution to soil conservation, investigation is necessary so that appropriate mitigation strategies can be implemented, and land is treated / remediated appropriately before development takes place.

As the proposed development is for mixed use, i.e. commercial and residential, a conservative approach was adopted. Assessing the suitability of soil and groundwater beneath the site for residential development was considered to be sufficiently protective of future commercial users of the site.

Pollutant linkages were identified by considering: the sources of contamination on site; pathways for those contaminants to migrate; and receptors of contamination at the end of a pathway.

From a human health perspective, the following pathways were considered:

- Vapour migration and inhalation;
- Inhalation of dust;
- Ingestion of soil and dust particles; and,
- Dermal contact.

Ingestion of home grown produce (fruit and vegetables) was not included as a potential pathway as there will be no domestic gardens at ground level.

An assessment of the human health and controlled water risks was made with reference to the significance and degree of the risk. This assessment is based on consideration of whether the source contamination can reach a receptor and, hence, whether it is of major or minor significance.

The 2017 risk assessment was undertaken with reference to BS10175:2001 and CIRIA Document C552: “Contaminated Land Risk assessment - A Guide to Good Practice.” The risk assessment was carried out by assessing the severity of the potential consequence, taking into account both the potential severity of the hazard and the sensitivity of the target, based on the categories given in Table 7.1 below.

Table 7.1 Potential Hazard Severity Definition

Category	Definition
Severe	Acute risks to human health, catastrophic damage to buildings/property, major pollution of controlled waters.
Medium	Chronic risk to human health, pollution of sensitive controlled waters, significant effects on sensitive ecosystems or species, significant damage to buildings or structures.
Mild	Pollution of non-sensitive waters, minor damage to buildings or structures.
Minor	Requirement for protective equipment during site works to mitigate health effects, damage to non-sensitive ecosystems or species.

The probability of an event takes into account both the presence of the hazard and target and the integrity of the pathway. Probability has been assessed based on the categories given in Table 7.2 below.

Table 7.2 Probability of Risk Definition

Category	Definition
High likelihood	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor.
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term.
Low likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable.

The potential severity of the risk and the probability of the risk occurring have been combined in accordance with the following matrix in order to give a level of risk for each potential hazard, as shown in the Table 7.3 below.

Table 7.3 Level of Risk for Potential Hazard Definition

Probability of Risk	Potential Severity			
	Severe	Medium	Mild	Minor
High	Very high	High	Moderate	Low / Moderate
Likely	High	Moderate	Low / Moderate	Low
Low	Moderate	Low / Moderate	Low	Very low
Unlikely	Low / Moderate	Low	Very low	Very low

7.3 Baseline Conditions

7.3.1 Site area description and land use

The site is located in Limerick city, the general site context is described in Chapter 2 – Background / Site Location and Context. In summary, the site is located in the commercial and historic heart of Limerick city, and currently is completely covered by buildings / hardstanding and is primarily used for commercial purposes.

The site and surrounding area of Limerick were extensively redeveloped from the former medieval layout during that mid-18th Century. Former uses of the site identified in the ESA include:

- A print work; and
- An automobile garage.

The ESA did not identify any potentially significant on-site sources of contamination. However, similar to many other city centre brownfield sites a number of general contaminative sources exist:

- Former coal cellars, yards, boilers and cellars;
- Former use for commercial and warehousing;
- Potential oil tanks and fuel lines;
- Potential made ground underlying the site; and
- Asbestos used in construction of buildings.

7.3.2 Topography

The mean elevation at the boundary of the site is in the region of 5 m above Ordnance Datum (OD).

There is a general downward slope from street level on Rutland Street along the western site boundary to the centre of the site which has a ground level elevation of circa 3.5 m OD.

Ground elevations at street level outside the site range from circa 6.5 m OD in the north-west corner of the site, to approximately 4.5 m OD in the north-east corner; and from 5.3 m OD in the south-west corner of the site, to approximately 4.8 m OD in the south-east corner.

To the north of the site the Abbey River flows from east to west, joining the River Shannon 100 m north-west of the site. At this point the River Shannon is tidal and forms the Lower River Shannon Estuary; flow in the Shannon is from north-east to south-west. The general topographic gradient of the wider area is from east to west toward the River Shannon, which is located 100 m beyond the western site boundary.

7.3.3 Soils and geology

7.3.3.1 Soils and subsoils

The Teagasc soil map on the Geological Survey of Ireland (GSI) public data viewer website indicates that the site is underlain by made ground, which in turn is underlain by marine / estuarine silts and clays.

Observations from site investigation works undertaken at locations across the EIAR study area and completed in 2017 are consistent with published data. The 2017 site investigation included the excavation of four trial pits and drilling of seven window sampling boreholes, six cable percussion boreholes and two rotary core holes. The site surface at all locations consisted of hardstanding to a depth of approximately 0.2 m below ground level (bgl); concrete was present at the majority of locations with tarmacadam at the remainder.

Beneath the hardstanding, made ground generally comprised dark brown, very sandy clay and rubble fill, which was present to a depth of approximately 1.6 m bgl. The natural soils underlying made ground consisted of firm to very stiff, brown, very gravelly clay with cobbles, and became stiffer with depth. At some locations soft, grey to black, sandy silt was encountered between made ground and the underlying clay. The generalised geologic profile is outlined in Table 7.4.

Table 7.4 Generalised Geologic Profile

Unit	Thickness Range (m)	Average Thickness (m)	Typical Depth (m bgl)	General Description
Hardstanding	0.1 – 0.5	0.2	0.0 m – 0.2 m	Concrete or tarmacadam hardstanding
Made Ground	0.7 – 2.5	1.6	0.2 m – 1.8 m	Made ground consisting of loose, dark brown very gravelly sandy CLAY with frequent cobbles. brick and builders' rubble fragments throughout
Silt	0.1 – 0.8	0.4	Sporadic in occurrence	Soft grey black sandy SILT
Clay	>1.4	>1.4	1.8 m - >3.2 m	Firm to very stiff brown very gravelly CLAY with cobbles
Limestone	Not determined	Not determined	Between 2.6 m and 5.2 m	Strong to very strong, thickly to thinly bedded, grey to black, fine grained LIMESTONE

Fragments of construction and demolition material were encountered within the made ground, including fragments of: brick, slate, cobbles and tiles. In addition, small amounts of ash were noted at a limited number of trial pit and borehole locations. However, apart from a slight hydrocarbon odour in one soil sample, physical evidence of contamination (i.e. colours, staining or hydrocarbon iridescence) was not observed. No asbestos containing material was noted in soils logged during the investigation.

7.3.3.2 Bedrock geology

Bedrock underlying the site is described by the GSI website as Dinantian Pure Bedded Limestones.

Two rotary cores were drilled during site investigation works in 2017. These rotary cores encountered bedrock at depths of 2.6 m and 5.2 m bgl beneath the EIAR study area. The bedrock was described as strong to very strong, thickly to thinly bedded, grey to black, fine grained limestone.

7.3.4 Groundwater

The bedrock aquifer underlying the site is classified by the GSI as a "Locally Important Aquifer – Bedrock which is Generally Moderately Productive." The assigned groundwater vulnerability is listed as between high and moderate on the GSI groundwater website. The site is not located within a public supply groundwater source protection zone.

A search of the GSI well database identified one well within 1 km of the site. This well is located approximately 600m to the east of the site and was reported to have been drilled in 1978 to a total depth of 73.2 m bgl, encountering bedrock at 15.2 m bgl. This well is reported to have been used for industrial supply (it is not known if the well is currently in use), with a yield of 288 m^3/d.

No other wells within a 1 km radius of the site were recorded on the GSI website. However, it is noted that a requirement to register wells with abstraction rates of 25 m^3/d or above with the EPA only came into effect on 16 November 2018, therefore, additional unrecorded wells may be present in the area.

During the 2017 site investigation, the moisture content of subsoils was found to increase with depth in the trial pits excavated, with water inflow to the base of one trial pit (at a depth of 2.55 m bgl) causing the sides to collapse.

A total of seven groundwater monitoring wells were installed, six of which were accessible at least once during monitoring conducted in May 2018. All of the monitoring wells are shallow and screened within subsoils, none extend into bedrock.

In May 2018, groundwater elevations across the EIAR study area were found to range between 1.82 m OD and 3.33 m OD, or between 0.97 m and 1.85 m bgl. The highest groundwater elevation was found to be in the south-eastern corner of the site with the direction of groundwater flow being to the north-west. This is consistent with the River Shannon being the expected focal point for groundwater discharge; the River Shannon is located 100 m beyond the western boundary of the site, and, together with its tributary the Abbey River (located 40 m north of the site) is classified as a Special Area of Conservation (SAC).

Groundwater level response to tidal fluctuations in the River Shannon is slight, in the region of millimetres to centimetres, see Appendix 7.B.

7.3.5 Contaminated land

7.3.5.1 Soils and subsoils

In 2017, assessment for the presence of ionisable volatile organic compounds (VOCs) in made ground and subsoils was undertaken in the field using a portable photo-ionisation detector (PID). PID results were generally very low (<5.0 parts per million (ppm)) with a maximum PID reading of 67.7

ppm recorded in a stratum with a slight hydrocarbon odour. The PID readings obtained did not identify a significant source of volatile organic contamination.

During the 2017 site investigation, samples of made ground and subsoil were collected and submitted for laboratory analysis. A broad-spectrum suite of potential contaminants was analysed for, including:

- Total petroleum hydrocarbons (TPHs), which are associated with hydrocarbon fuels;
- Polycyclic aromatic hydrocarbons (PAHs), which are associated with tars, fuels and ash;
- Metals, which are often associated with ash and fill in made ground;
- Polychlorinated biphenyls (PCBs), which are associated with oils in old electrical transformers; and
- Volatile and semi-volatile organic compounds (VOC and SVOCs), which, in addition to the above, can also be associated with degreasing, dry cleaning and painting activities etc.

In addition, selected samples were screened for the presence of asbestos fibres.

Leachate tests were run on samples of made ground and subsoil with the leachate generated also subject to laboratory analysis for a reduced suite of parameters.

Analytical results were assessed in terms of a GQRA and compared against GAC. The assessment concluded that concentrations of PAHs and lead in samples of made ground exceeded GAC protective of human health and, therefore, had the potential to impact future residents and commercial users of the site. The exceedances were identified in the following areas of the site:

- Phase 1: to the east of Parcel 5 (lead in made ground) and south of Parcel 4 (lead in made ground); and
- Phase 2: to the rear of Patrick St (lead in made ground), west of Bogue's Yard (lead in made ground) and south of Bogue's Yard (lead and PAHs in made ground).

The GAC for lead in soil that is protective of human health is 310 mg/kg. In comparison, detected concentrations of lead in soil above this mostly ranged between 360 mg/kg and 560 mg/kg with one result above this range at 2,600 mg/kg.

Of the suite of 16 PAHs analysed, just two exceeded their corresponding GAC protective of human health:

- Benzo(a)pyrene was detected at 3.9 mg/kg in one sample compared to its GAC of 3.2 mg/kg; and
- Dibenzo(ah)anthracene was detected at 0.6 mg/kg in the same samples compared to its GAC of 0.31 mg/kg.

With regard to GAC protective of controlled waters receptors, concentrations of metals in made ground and in leachate from made ground and subsoil, exceeded their corresponding GACs, indicating that metals in made ground and subsoil had the potential to impact groundwater in the bedrock aquifer beneath the site. However, analysis of that groundwater indicated that the potential risk posed is not being realised, see Section 7.3.5.2.

In addition:

- No VOCs, SVOCs or PCBs were detected above laboratory detection limits in any of the soil samples analysed.
- Trace concentrations of hydrocarbons (<75 mg/kg) were detected in five of the 23 soil samples analysed and did not exceed corresponding GAC.

- No asbestos containing material was identified by the laboratory in any of the soil samples analysed.

7.3.5.2 Groundwater

During the 2017 site investigation, samples of shallow groundwater were collected and submitted for laboratory analysis of a broad-spectrum suite of potential contaminants and general water quality parameters, including:

- TPHs;
- PAHs;
- Metals;
- VOC and SVOCs;
- Inorganics, major ions; and
- Chemical and biological oxygen demand.

Based on the analytical results, groundwater beneath the EIAR study area was considered not to be a source of risk to human health at the site or to controlled waters receptors. While leaching of metals from made ground and subsoil was found to be a potential risk to groundwater at the site, the analytical results for groundwater indicated that it does not contain metals at concentrations in excess of GAC protective of controlled water and, therefore, the potential risk posed by metals in made ground and subsoil is not being realised.

7.3.6 Conceptual site model (CSM)

7.3.6.1 Sources

Based on the results of the GQRA, a potential risk to human health was identified due to elevated PAHs in one soil sample and elevated lead concentrations in five soil samples. Where exceedances were encountered, they were associated with made ground which is located close to the site surface (from ground level to a depth of approximately 1.6 m bgl). A large portion of this made ground will be removed as part of the proposed redevelopment work but some may remain on site where excavation is shallow or not required.

The estimated area of the proposed basement across the site as a whole is circa 9,400 m^2. From available drawings and cross-sections, the maximum depth of the basement appears to be no more than 5 m bgl with ground floor level at 5.5 m above Ordnance Datum (OD). Consequently, the maximum volume of material to be removed is estimated as circa 45,000 m^3. However, there is some basement development currently on site. In addition, the ground elevation across Bogue's Yard through the middle of the site is in the region of 3.5 m OD. The bulk of excavation for new basement construction will be across the southern and eastern portion of the site, where current ground elevation is in the region of 5.0 m OD. Assuming an average of ~4.45 m to be excavated across the basement area as a whole (it may be less than 4.5 m in some areas and 5 m in others) gives a volume of ~40,000 m^3.

There is a potential for soils to impact controlled waters (i.e. the underlying groundwater and nearby surface waters) via leaching. Analytical results indicated a potential risk posed by soils to groundwater for a variety of metal parameters, including: arsenic, chromium, copper, mercury, lead and antimony. However, the assessment is based on leachates generated within a laboratory and, as elevated metal concentrations were not detected in samples of groundwater from beneath the site, the risk posed by leaching of metals from soils is not considered a significant source. As with human health risk, where exceedances were encountered they were principally associated with made ground which is located close to the site surface and a large portion of this made ground will be removed as part of the proposed redevelopment work.

Groundwater beneath the site is not considered to be a source of risk to human health as exceedances of the GAC were not detected.

Groundwater beneath the site is not considered to be a source of risk to controlled water receptors (Abbey River, River Shannon or groundwater) as, with the exception of potassium, exceedances of GAC protective of these receptors were not encountered.

7.3.6.2 Potential receptors

Receptors are defined by their potential for being adversely affected by a contaminant. For the purposes of the assessment, receptors were split into human health and environmental / controlled waters receptors.

The site is to be redeveloped for predominantly commercial use with some medium and high-density residential units. The on-site human health receptors are considered to be residential (without home grown produce) and commercial users.

Off-site receptors are also considered to be residential, due to the proximity of residential housing and apartments to the east and west of the site, and commercial.

Potential controlled waters receptors were identified given the environmental setting of the site and are summarised in Table 7.5 below.

Table 7.5 Controlled Water Receptors

Water Environmental Receptors	Present	Potable Supply	Description / Comments
Groundwater abstraction within 500 m of the site.	No	No	There are no known groundwater abstractions within 500 m of the site, the closest is 600 m to the east (up-gradient). The site and surrounding area are serviced by mains water supply.
Surface water body within 500 m of the site in direct hydraulic connection with groundwater from the site.	Yes	No	Abbey River located approximately 40 m north of the site and is tidal at this point, therefore, as a transitional water body it is not suitable for potable supply.
		No	River Shannon is located approximately 100 m west of the site and is tidal at this point, therefore, as a transitional water body it is not suitable for potable supply.
Groundwater in bedrock beneath the site.	Yes	Possible	The bedrock aquifer underlying the site is classified by the GSI as a “Locally Important Aquifer,” that is “moderately productive only in local zones.”
Groundwater in superficial deposits beneath the site.	Yes	No	The superficial deposits beneath the site consist of made ground and marine/estuarine silts and clays and are not considered to be an aquifer.

7.3.6.3 Potential pathways

Proposed future redevelopment of the site will include construction of a basement over the majority of the site and / or cover with building footprint, hard standing or imported fill materials over a large proportion of the remainder. Excavation and removal of made ground from across the site will reduce the potential risk posed by contaminants present in near surface soil and made ground.

In addition, the proposed development will itself limit the pathways for exposure of site users to any contamination contained within the underlying made ground / soil by removing potential pathways, including: soil and dust ingestion; dermal contact; and, inhalation of fugitive dust. Potential human health exposure pathways in these areas are, therefore, confined to the vapour migration pathway which is not considered significant as volatile contaminants were not identified at the site in excess of generic assessment criteria protective of human health (VOCs and SVOCs were below laboratory detection limits).

Certain areas of the site are earmarked for public plaza, pedestrian linkages, and communal open space. Ornamental planting in these areas will be in raised beds which will not allow contact with, or leave exposed, existing made ground; therefore, pathways, such as: soil and dust ingestion; dermal contact; and, inhalation of fugitive dust will not be viable.

A potential risk was identified through leaching of contaminants (principally metals) from soils at the site. However, as groundwater at the site did not contain contaminants of concern at concentrations in excess of GAC protective of controlled water, leaching is not considered a significant pathway. Furthermore, the presence of stiff clay beneath the site and cover of large areas of the site with buildings or hard standing during future development will restrict the potential vertical pathway for water moving beneath the site and limit rainfall percolation, consequently reducing further leachate generation. Excavation of made ground from across the site during the early stages of construction work will further reduce the risk posed by contaminants present in near surface soil and made ground.

7.3.6.4 CSM Summary

Based on the results of the GQRA, a potential risk to future site users was identified from PAHs and lead in made ground at the site. Basement excavation during proposed redevelopment will remove a large proportion of made ground (the source). In addition, the site will be covered in buildings and hardstanding with some raised ornamental planting, thus, breaking potential pathways.

Leaching of metals from made ground was found to be a potential risk to controlled waters, but groundwater at the site did not contain corresponding concentrations of metals in excess of GAC protective of controlled water, therefore, the potential risk posed by metals in made ground and subsoil is not being realised.

Excavation of made ground from across the site will reduce the risk posed by contaminants present in near surface soil and, as large areas of the site will be covered by buildings or hard standing during future development, this will serve to limit leachate generation and further reduce the risk posed by leachate to groundwater and surface water. Based on the results of the GQRA a very low risk to surface water and groundwater was identified.

7.4 Predicted Impacts

7.4.1 Construction phase

The construction phase as a whole will likely last a number of years and will be undertaken in two phases following enabling works:

- Enabling works, including demolition and site clearance;
- Phase 1 encompasses development of the northern site, Parcels 3A, 3B, 4, 5 and 6; and,
- Phase 2 encompasses development of the southern site, Parcels 1, 2A and 2B.

It is during enabling works and early stages of construction in each phase that potential impacts to land, soils, geology and groundwater would be more likely to occur in the absence of mitigation measures.

7.4.1.1 Excavation

To facilitate construction of the basement and foundations for the proposed redevelopment, the excavation and removal from site of made ground and subsoils from certain areas will be required. It is considered that the vast majority of excavated material will be removed from site for disposal rather than reused on site as the proposed basement will occupy a significant proportion of the site, estimated at circa 9,000 sq m in the schedule of accommodation. As outlined in Section 7.3.6.1, the volume of made ground and subsoils to be removed is likely be in the region of ~40,000 m^3.

The construction phase of the proposed development will impact on ground and geological conditions through drilling and installation of a secant pile wall to protect existing structures; stripping of existing hardstanding and subsoil; realignment of existing drainage channels; use of temporary access routes; roadway and path construction; excavation and laying of services; foundation excavation and construction; construction of hardstanding and paving; and landscaping of public open spaces.

Civil works for the proposed development will include the following activities:

- Preliminary works, including site clearance and demolition of designated structures, construction of site roads and establishment of site compound(s) and lay down areas;
- Set up site office and welfare units and connection of associated services;
- Drainage and service installation;
- Excavation of foundations and basement;
- Import of aggregate and fill materials;
- Segregation and stockpiling of excavated made ground and subsoil;
- Removal from site of excavated made ground and subsoil for disposal;
- Construction of new basement, buildings, pedestrian paths and public open spaces; and
- Landscaping and reinstatement.

Excavation and removal from site of made ground and subsoil will be a direct, permanent and irreversible impact of the proposed development at the local scale. Overall this impact will be of neutral quality. However, it is noted that excavation of made ground and subsoils will remove sources of PAHs and lead from site that could potentially impact future residents and commercial users of the site if viable pathways were created. Therefore, excavation and removal of made ground and subsoil could have a positive effect.

In addition, as this proposed development is on a brownfield site, it makes a positive contribution to soil conservation by reducing the possible development of greenfield sites.

Therefore, this is considered to be a medium impact on an environment of medium sensitivity and the overall significance of the impact is moderate and positive.

7.4.1.2 Importation of fill

In addition to the excavation and removal of made ground and subsoils from the site, it is expected that the importation of structural fill and aggregate for construction purposes, as well as top soil for landscaping, will also be required. The source of this fill material and top soil will be subject to careful selection and vetting in order to minimise transportation, ensure that it is of a reputable origin and that it is clean (i.e. will not cause contamination to the environment). The importation of this material will be a direct, permanent and irreversible impact of the development which will be imperceptible within the wider environment. Therefore, importation of fill, aggregate and top soil, is considered to be not significant on an environment of medium sensitivity and the significance of the impact is considered slight and positive.

7.4.1.3 Spills and Leaks

During construction of the proposed development, there is a risk of accidental pollution incidents occurring from the following sources:

- Spillage or leakage of stored oils and fuels;
- Spillage or leakage of oils and fuels from construction machinery or site vehicles; and
- Spillage of oil or fuel from refuelling machinery on site.

The proposed development is located within an area of moderate to high groundwater vulnerability, this vulnerability will be temporarily increased during construction through the removal of hardstanding; but groundwater is not used for potable supply in the vicinity of the site. During construction there is an increased potential that fuels or chemicals, if inappropriately handled or stored during construction, could potentially impact on groundwater quality in the area.

In the absence of mitigation, accidental spillage could potentially result in the impact of soils and groundwater underlying the proposed redevelopment site should contaminants migrate through the subsoils and impact underlying groundwater. In the absence of mitigation, this potential impact would be considered a direct, negative impact of temporary duration on a medium sensitivity environment, and of moderate significance.

7.4.1.4 Use of concrete

Lime and concrete (specifically, the cement component) are highly alkaline and any spillage during construction which migrates through subsoil could impact groundwater quality. The activities most likely to result in contamination of this kind include concreting during building construction, pipeline and drain construction.

In the absence of mitigation measures, the impact would be direct, negative and of temporary duration, given it is only associated with the construction programme, which is temporary in nature, on a medium sensitivity environment, and the significance of the impact would be moderate.

7.4.2 Operation phase

Once operational, the geology beneath the site will be protected from the elements. Subsoil will either be covered by surface hardstanding, building footprint or, in the case of landscaped areas, topsoil and raised planters, which will all protect against soil erosion.

There will be no direct discharges to soil or groundwater during the operational phase of the proposed development. Foul effluent and surface water will be discharged to the local authority sewer and surface water drainage network.

There will be no significant storage or use of hazardous materials during the operational phase that could adversely impact subsoil, groundwater or surface water in the vicinity of the site. Accidental losses of oil, petrol or diesel on roadways or in car parks could cause contamination if the oil, petrol or diesel entered the underlying soil and groundwater. However, the presence of surface hardstanding throughout trafficked areas would render this unlikely.

In the absence of mitigation measures, should accidental losses of oil, diesel, or petrol to ground occur, they would be considered direct, negative impacts of temporary duration, given that they would be confined to one-off releases. This would be considered a medium impact to a medium sensitivity environment, and the significance of the impact would be moderate.

During construction, excavation and removal from site of made ground and subsoil will have removed some, if not all, sources of PAHs and lead which, as identified in the 2017 GQRA, have the potential to pose a risk to future residents and commercial workers on site if viable pathways were present.

Where made ground and subsoil remain on site with concentrations of PAHs and lead in excess of GAC, completion of the proposed development will have rendered the potential risk unlikely, as:

- The site will be covered in buildings or hardstanding which would break potential source-pathway-receptor linkages; and
- Ornamental planting will be in raised beds which will not allow contact with, or leave exposed, existing made ground.

This removal of source and breaking of pathways is considered to be a direct, permanent and positive impact; a medium impact to a medium sensitivity environment and the significance of the impact is moderate.

7.5 Mitigation Measures

7.5.1 Construction phase

7.5.1.1 Construction Methodology and Phasing Management Plan (CMPP)

The Construction Methodology and Phasing Management Plan (CMPP) (which accompanies this application) establishes specific control measures to minimise the impact of construction works on the environment as part of the implementation of the mitigation measures to ensure that consistent standards of environmental protection are established and maintained throughout the project works.

During the early stages of construction, site clearance and excavation of made ground and subsoil to facilitate construction of basements, laying of foundations and realignment of drainage channels etc. will be undertaken.

7.5.1.2 Excavation

Controlling working practices will avoid repetitive handling of excavated made ground and subsoils, minimise vehicle movements, limit the size of stockpiles and will reduce the compaction and erosion of material and generation of dust. The location of plant and materials and the implementation of a construction traffic management plan will minimise compaction and erosion of soil.

If temporary storage of excavated made ground and subsoils is required it will be managed to prevent potential negative impact on the receiving environment and the stockpiled material will be covered and stored away from any surface water drains. It will be necessary to designate areas within the site where stockpiles will be established in order to facilitate the efficient transfer of material within the site. It will be necessary to position spoil and temporary stockpiles in locations which are at least 15 m distant from drainage systems.

All excavated materials will be inspected for signs of possible contamination, such as staining or strong odours. Should any unusual staining or odour be noticed, this made ground / subsoil will be segregated and samples analysed for the presence of possible contaminants in order to determine an appropriate disposal outlet. Excavated made ground and subsoil will be disposed to licensed / permitted waste management facilities, as appropriate for the waste classification of the material, see also Chapter 14.

Excavation shall be restricted in times of high winds and heavy rainfall to minimise the potential for dust generation or uncontrolled sediment movement. Good construction practices will also be used during the construction phase, such as wheel washers and dust suppression on site roads (to be captured within the proposed sustainable urban drainage system (SUDS), and at site access points.

7.5.1.3 Importation of fill

The source of aggregate fill material and topsoil imported to site will be selected and vetted in order to ensure that it is of a reputable origin and that it is “clean” (i.e. will not contaminate the environment).

7.5.1.4 Spills and leaks

Due to the presence of a locally important aquifer beneath the site, shallow groundwater, adjacent surface water bodies, the presence of surface water drainage and nearby rivers which are designated as an SAC, mitigation measures at the construction site will be employed in order to prevent spillages to ground of fuels, and to prevent consequent soil or groundwater quality impacts such that:

- No oils/fuels will be stored on the proposed development site for the purpose of refuelling on the site;
- General maintenance and refuelling of plant, will be restricted to impermeable bunded areas with a minimum 110% storage capacity and away from surface waters or areas where any spillages could easily reach surface water;
- Leaking or empty oil drums shall be removed from site immediately and disposed of via an appropriately licensed waste disposal contractor;
- All hazardous substances on-site shall be controlled within enclosed storage compounds that shall be fenced-off and locked when not in use to prevent theft and vandalism;
- Refuelling of plant and machinery shall take place at least 15 m away from drains or dewatering points using a mobile fuel bowser and restricted to designated areas on hard standing; only double-bunded fuel bowsers shall be used; vehicles shall not be left unattended during refuelling operations; road vehicles will not be refuelled at the site;
- Fixed plant shall be self-bunded; mobile plant shall be in good working order, kept clean, fitted with drip trays where appropriate and subject to regular inspection; water runoff from designated refuelling areas shall be channelled to an oil-water separator, or an alternative treatment system, prior to discharge;
- Spill kits and oil absorbent material shall be carried with mobile plant and located at vulnerable locations around the site to reduce risk of spillages entering the sub-surface or groundwater environment; booms shall be held on-site for works near drains or dewatering points; and
- Operatives will be trained in the proper handling of materials, the sensitive nature of the wider drainage system, and the consequences of accidental spillage.

7.5.1.5 Use of concrete

Measures for protection of soil and groundwater from wet concrete will include measures to prevent discharge of alkaline wastewaters or wash water to the surface water drainage system or to the underlying subsoil and groundwater, such that:

- Ready mixed concrete will be brought to the proposed development site by truck;
- Concrete pouring will take place within a designated area to prevent concrete runoff in soil and groundwater; and
- Washout of concrete transporting vehicles shall take place at an appropriate facility; off-site or where on-site wash out will be captured for disposal off-site.

7.5.1.6 Water quality management

Mitigation measures in the water quality management plan shall minimise impacts and monitor effects upon the water environment during construction.

Mitigation measures within the water quality management plan will include:

- Procedures for investigating environmental incidents and incident notification procedures;
- Assessment of earthworks that are likely to give rise to sediment-laden run-off, the routes this is likely to take, and the methods to prevent silt entering the Shannon and Abbey Rivers;
- Procedures for dewatering the site during construction works, including licensing requirements, monitoring requirements, discharge points and maintenance requirements of water treatment plant;
- Establishment of contingency measures to cater for impacts to unknown services underlying the construction site (for example, old sewers, culverts);
- How mud and dust will be controlled and the frequency for road cleaning and dust suppression required at different times of the year;
- How shallow groundwater and the bedrock aquifer will be protected from potential contamination through the implementation of measures to prevent impact from spills and leaks; and
- Identify whether shallow groundwater monitoring wells on site will be maintained and protected during construction works; decommissioned; or removed completely as part of excavation works, to prevent them from acting as direct pathways for contamination to enter the groundwater body beneath the site.

7.5.1.7 Training

Induction training shall be provided to site construction personnel to inform them of their responsibilities and liabilities with reference to water quality and contamination issues, for example, workshops prior to commencement of site works, environmental toolbox talks during the works, and by use of notice boards in site offices to display important information.

7.5.2 Operation phase

The operational phase of the development is unlikely to have any significant adverse impacts on the local geological / hydrogeological environment due to the environmental considerations incorporated into the design. These measures will seek to avoid or minimise potential effects, in the main through the implementation of best practice construction methods and adherence to all relevant legislation.

7.6 Residual Impacts

7.6.1 Construction phase

The magnitude of the potential residual impact during construction phase is, therefore, considered to be slight on an environment of medium sensitivity. As a result, the significance of the potential impact of the proposed development is considered to be slight (short-term and long-term) on the surrounding land, soils, geology and groundwater environment.

7.6.2 Operation phase

As this is a brownfield site, its development in preference to greenfield makes a positive, long-term contribution to soil conservation.

With regard to PAHs and lead detected in made ground and subsoils beneath the site, the removal of source by excavation and breaking of pathways through development of the site is considered to be a direct, permanent and positive impact; a medium impact to a medium sensitivity environment and the significance of the impact is moderate and positive.

7.7 Difficulties Encountered in Compiling Information

Much information regarding the site setting was publicly available from websites, see Section 7.9 References. In addition, site specific data were available from the site investigation conducted in 2017 and water level monitoring conducted in 2018. No difficulty was encountered in compiling information for this chapter.

7.8 Cumulative Impacts

Land, soils, geology and groundwater have an important interrelationship with surface water and the ecological environment, as a determinant of water chemistry, river flow regimes, water storage capacity and watercourse location. They also have an impact on water quality through the ability of subsoils and bedrock to filter potential pollutants. Potential ecological impacts could occur through the mishandling of soils or through the deposition of excavated soils in ecologically sensitive areas.

This chapter should be read in conjunction with Chapter 8 Hydrology, Chapter 14 Waste Management and Chapter 16 Biodiversity.

Given the potential risk to human health identified from PAHs and lead in made ground and subsoil beneath the site, Chapter 6 Population and Human Health is also related.

With regard to other planning applications and developments in Limerick city, there are no cumulative impacts from the perspective of land, soils, geology and groundwater as they can be assessed as standalone elements.

7.9 References

The following is a list of sources of information consulted for use in this chapter:

- Ordnance Survey of Ireland (OSI) website[16] for historical maps of 1:2,500 scale and 1:10,560 scale (1837 to 1913) and aerial photographs (1995, 2000, 2005 and 2012).
- Geological Survey of Ireland (GSI) website for Public Viewer and Groundwater Maps[17].
- EPA website[18] Map Viewer.
- Project Opera Environmental Site Assessment and Preliminary Soil Waste Classification, June 2017, AECOM.
- Project Opera Well Survey and Groundwater Level Monitoring, May 2018, AECOM.
- BS10175:2001.
- CIRIA Document C552: “Contaminated Land Risk assessment - A Guide to Good Practice.”
- Limerick City Development Plan 2010 – 2016.
- Limerick 2030 An Economic and Spatial Plan for Limerick.

[16] http://map.geohive.ie/mapviewer.html
[17] https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228
[18] https://gis.epa.ie/EPAMaps/

8 Water

8.1 Introduction

This chapter of the EIAR has been prepared by AECOM with input from the project team to assess potentially significant impacts upon the hydrological environment as a result of constructing and operating the Proposed Development.

The assessment considers the potential for non-conformance with the EU Water Framework Directive18 (WFD)[19] objectives including:

- The need for the avoidance and reduction of impacts on the water environment is taken fully into account in the environmental evaluation; and
- The selection of appropriate means of preventing any significant predicted impact is made through modification of the drainage design, choice of discharge location(s) and / or adoption of runoff treatment methods, with the objective of designing-out potential adverse environmental impacts.

It describes water, hydrology and flooding issues associated with the Proposed Development and should be read in conjunction with Chapter 7 Land, Soils & Geology and Groundwater and Chapter 16 Biodiversity, which pay particular attention to the potential for impacts upon the aquatic / riparian and hydrogeological environments respectively.

8.2 Methodology

This chapter has been prepared having regard to the EPA Draft guidance document 'Guidelines on the Information to be contained in Environmental Impact Assessment Reports, 2017[20], EPA guidance documents 'Guidelines on the Information to be contained in Environmental Impact Statements, 2002[21], 'Advice Notes on Current Practice in the Preparation of Environmental Impact Statements, 2003[22]

8.2.1 Sources of Information

In order to identify any environmental impacts for the proposed development with respect to hydrology, a desk top study has been completed using the following relevant information:

- EPA Wastewater Treatment Manuals 'Treatment Manuals for Small Communities, Business, Leisure Centres and Hotels'[23];
- Office of Public Works' (OPW) national flood hazard mapping (www.floodmaps.ie);
- OPW Shannon Catchment Flood Risk Assessment and Management (CFRAM) Study (www.cfram.ie);
- Environmental Protection Agency (www.epa.ie); and

[19] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for the Community action in the field of water policy
[20] EPA, (2017). EPA Guidelines on the information to be contained in Environmental Assessment Reports, Draft, August 2017; Environmental Protection Agency, Co. Wexford, Ireland
[21] EPA, (2002). EPA Guidelines on the information to be contained in Environmental Impact Statements; (March 2002); Environmental Protection Agency, Co. Wexford, Ireland
[22] EPA, (2003). EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements; Environmental Protection Agency, Co. Wexford, Ireland
[23] EPA, (1999), EPA, Wastewater Treatment Manuals 'Treatment Manuals for Small Communities, Business, Leisure Centres and Hotels; Environmental Protection Agency, Co. Wexford, Ireland

- Geological Survey of Ireland (GSI) (www.gsi.ie).

8.2.2 Statutory Regulation

8.2.2.1 Flood Risk

Flood risk management under the EU Floods Directive aims to minimise the risks arising from flooding to people, property and the environment. Minimising risk can be achieved through structural measures that block or restrict the pathways of floodwaters, such as river defences or non-structural measures that are often aimed at reducing the vulnerability of people and communities such as flood warning, effective flood emergency response, or resilience measures for communities or individual properties.

A Stage 2 Flood Risk Assessment has been undertaken having regard to The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009'. Section 8.4.4 outlines the flood risk to the proposed development.

8.2.2.2 Limerick City Council Development Plan

In preparing this EIAR Chapter, AECOM have taken cognisance of the LCCC Development Plan (2010 – 2016_Extended). Of particular relevance to this assessment is Chapter 12 Part II Water Services.

Policy WS.5 (Waste Water)

Policy WS.5 of the Development Plan identifies a number of Statutory and Policy documents that the wastewater policy in Limerick City & County is influenced and informed by. These include the following key objectives and policies:

- Have regard to the policy, national standards and guidelines, of not allowing the discharge of contaminants and greases to the City Council sewers.
- Sewers required to be taken in charge by Limerick City & County Council in the future shall be laid in public open space.
- Access Junction boxes shall be located on the public footpath on each separate supply to individual residences or business units.
- Have regard for the specifications and details as defined in the DEHLG 'Recommendations for Site Development Works for Housing Areas', National and Limerick City & County Council requirements in respect of discharges.

Policy WS.6/7 (Surface Water and Sustainable Urban Drainage System)

Policy WS.6 of the Development Plan identifies a number of Statutory and Policy documents that the surface water management policy in Limerick City & County is influenced and informed by. These include the following key objectives and policies:

- To cater for the future developments through public and private driven initiatives where discharge capacity permits.
- Control all discharges from future developments to a maximum of 4 l/sec/ha or Qbar (whichever is higher) in general areas around the City and in the areas which contribute to areas of restricted capacity, control all surface water discharges to 2 l/sec/ha through planning & development conditions.
- Control discharges of surface water into drainage systems where the receiving drainage system is at or nearing full capacity. The level of control may be as low as 2 l/sec/ha or no discharge.
- Monitor and control development areas of potential flooding, having regard to 'The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009', Limerick City Council requirements, current best practice and relevant technical documents.

- Provide an adequate surface water system in order to minimise the risk of flooding.
- To work in conjunction with other public bodies towards a sustainable programme of improvement for riverbanks, back drains, etc.

The Development Plan includes the parameters for a Hydraulic Analysis of the proposed storm water sewer network for any development as indicated:

- Rain Fall intensity: 60mm/hr
- Contributing areas: hard surfaces inclusive of roofs, roads, footpaths and any other hard standing area - 100% impermeable.
- Green areas or park land - 20% impermeable.
- Storm water drainage sewers shall be designed to cater for a storm return period of a 1:30 year storm without surcharge and to cater for a 1:100-year storm without flooding

The LCCC surface water objectives have been taken into account in the design of the surface water drainage for the proposed development.

Policy WS.7 of the Development Plan recognises the importance of Sustainable Urban Drainage Systems (SuDS) and states that it is council policy that all development proposals incorporate SuDS.

The LCCC sustainability drainage systems objectives have been taken into account for the proposed development. The scheme has been designed to promote sustainable drainage, with a view of reducing the impact of the surface water run-off generated by the proposed development on existing LCCC infrastructure.

Policy WS.8 (Flood Protection and Risk)

The Development Plan recognises the requirement to deliver designs that take flood risk and potential impacts into account. It is policy of LCCC that Applicants proposing development in an area where there is a flood risk shall:

- Provide a detailed study and modelling exercise of the catchments, Risk Assessment of whether the proposed development is likely to be affected by flooding (including for climate change), whether it will increase flood risk elsewhere and of the measures proposed to deal with these effects and risks in accordance with ‘The Planning System and Flood Risk Management Guidelines for Planning Authorities’, 2009.
- Satisfy the planning authority that any flood risk arising from the proposal will be successfully managed with the minimum environmental effect to ensure that the site can be developed and occupied safely.
- Comply with Limerick City Council planning authority requirements on finished floor levels.

8.2.3 Appraisal Methodology

The appraisal methodology considered a description of the impact i.e. the “quality” of the effects (i.e. whether it is adverse or beneficial), the “significance” of the effects (i.e. the magnitude of the effect in terms of the environment), the “probability” of the event occurring, and the “duration” of the effects (i.e. whether it is short or long term) and also considers the significance / sensitivity of the existing environment. Terminology for describing the quality, significance, extent, probability and duration of effects is set out in Section 3.7.3 of the EPA EIAR guidance.

A qualitative approach was used in this evaluation and Figure 8.1 taken from the EPA EIAR guidance shows how comparison of the character of the predicted impact to the sensitivity of the receiving environment can determine the significance of the impact.

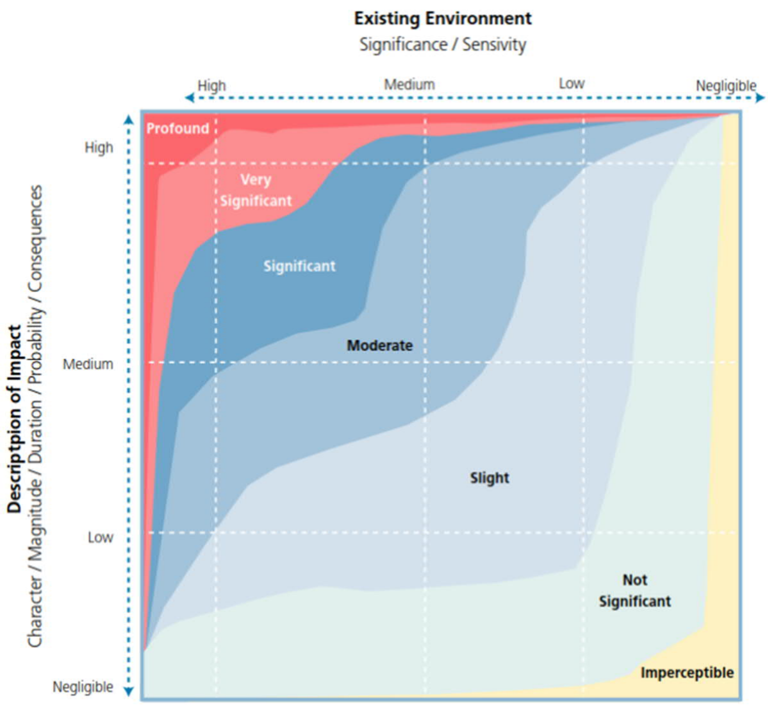

Figure 8.1: Determination of the Significance of the Impact

8.3 Existing Environment

8.3.1 Site Description

The Proposed Development is known as the 'Opera Site' in Limerick City. It is a c.2.35 hectare site that occupies the majority of a city block bounded to the west by Patrick Street and Rutland Street, to the north by Bank Place (including the open space), to the east by Michael Street and to the south by Ellen Street.

The current site comprises of areas of brown field, at-grade public car parking areas, derelict Georgian buildings, occupied offices and the Granary Complex. The site has a vehicular access off Michael Street and Rutland Street.

Existing ground levels surrounding the proposed development range between 4.50m and 5.20m OD Malin.

8.3.2 Drainage and Natural Surface Water Bodies

8.3.2.1 Local Hydrology

The site is situated within a built up urban area and there are no water courses within or around the proposed development site.

LCCC records show that there is no separate surface water drainage network within or around the proposed development site. There is an existing combined sewer network in the area surrounding the site. Surface water runoff generated within the site is currently collected by gullies and discharges to an existing 350mm diameter brickwork combined sewer that runs through the site. The existing road gullies on Michael Street, Ellen Street, Patrick Street, and Rutland Street are likely to discharge into the local combined sewer network. Existing gullies on Bank Place discharge directly to the Abbey River.

The existing combined sewer running through the site ultimately discharges to an interceptor sewer in the River Shannon. The existing combined sewers in Bank Place discharge to an interceptor sewer in the Abbey River. These interceptor sewers convey flow to the Wastewater Treatment Plant (WwTP) at Bunlicky.

8.3.2.2 Regional Hydrology

The building footprint within the proposed development is situated approximately 30m south of Abbey River and 150m east of the River Shannon.

The River Shannon is both the longest and largest river in Ireland. The River Shannon rises in the Shannon pot in County Cavan and generally flows in a south-westerly direction towards the Shannon Estuary where it enters the Atlantic Ocean. The catchment upstream of Limerick is greater than 10,000 km^2. There are three major lakes, Lough Allen, Lough Ree and Lough Derg on the Shannon. There is a very limited fall between Lough Allen and Lough Derg (circa 13 m over 200 km). The presence of the lakes and the small fall between the outlet of Lough Derg and inlet of Lough Allen has the effect of attenuating flows in the catchment. The lag time between runoff from rainfall in the middle and upper sections of the Shannon catchment and increased flows in Limerick may be of the order of days.

Downstream of Lough Derg a hydroelectric scheme was built in the 1920's. A weir at Parteen splits the flow of the River Shannon into two separate flows. One flow continues in the natural channel via Castleconnell and the second flow is diverted down a manmade head race to Ardnacrusha generating station. The flow passes through the power station and re-joins the natural channel just upstream of Limerick.

The Abbey River is a distributary of the River Shannon and flows around the north eastern, eastern, and southern shores of King's Island, Limerick before re-joining the Shannon, just downstream of the subject site.

Both the River Shannon and the Abbey River are tidal in the vicinity of the Proposed Development site.

8.3.3 Flood Risk

The predominant flood risk to the Proposed Development is associated with coastal flooding as the Abbey and Shannon Rivers are tidal adjacent to the site. While fluvial flooding has occurred in and around Limerick City in the past, it has been noted that water levels associated with storm surges are generally higher. Therefore, it is considered that tidal storm surges pose the primary risk in the vicinity of the Proposed Development.

8.3.4 Water Quality

The Shannon International River Basin District is one of the eight river basin districts established in Ireland. As detailed in the SRBD, the pressures on the River Shannon have been identified as high nutrients, oxygen demand. The main causes can be attributed to agriculture, wastewater and industrial discharges, due to misconnected foul sewers, combined sewer overflows and urban area pollution. The implementation of the programme of measures developed as part of the River Basin Management Plan is aimed at achieving improvements to the existing moderate status of the water body.

Following the construction of c.45km of large diameter interceptor sewers and the associated Waste Water Treatment Plant, untreated wastewater discharges to the Shannon and Abbey Rivers from Limerick City have been eliminated.

The EPA River Waterbody WFD Status 2010-2015 report shows that typically the ecological status of rivers in the Lower Shannon (25D) is good or moderate and that there has been no deterioration in ecological status between 2007–2009 and 2010–2015.

8.3.5 Designated Sites

A review of designated sites, considered nationally and internationally protected, showed that the lands on which the Proposed Development site is located have no formal designations.

The closest designated sites to the Proposed Development site are the River Shannon and River Fergus Estuaries Special Protection Areas (SPAs) and the River Shannon Special Area of Conservation (SAC). The River Shannon is 150m west of the Proposed Development site.

8.4 Characteristics of the Proposed Development

The proposed development includes demolition, new-build and refurbishment/ adaptive re-use of Protected Structures and other structures and other structures of heritage value within the site. The development comprises a mixed-use scheme of primarily office uses, supported by a range of retail/ non-retail services, café/restaurants, licensed premises, apart-hotel, civic/cultural uses including the City Library, residential use, open spaces, access routes and ancillary areas.

The development includes environmental improvement works to the adjacent public streets, development of a public plaza; pedestrian linkages; communal and private open space areas; bicycle parking; vehicular access and 155 car parking spaces at basement level; surface water attenuation tanks, general plant; storage areas and refuse management; signage; diversion of underground services; set-down areas; and all related site development and excavation works above and below ground.

8.4.1 Foul Sewerage

<u>Existing Foul Water Drainage</u>

The existing site is currently served by an existing 350mm diameter brick work culvert combined sewer. This discharges to a 450mm diameter combined sewer in Patrick Street which in turn discharges to an 1800mm diameter interceptor sewer in the River Shannon. This ultimately flows to the wastewater treatment facility in Bunlicky.

<u>Proposed Foul Water Drainage</u>

It is proposed to decommission the existing 350mm diameter culvert crossing the site. It is proposed to provide a new 450 mm diameter sewer in Michael Street which will intercept flow and allow the existing sewer within the site to be decommissioned. This new sewer will divert flows around the site and discharge to the existing combined sewer on Bank Place, which then discharges to an existing interceptor sewer in the Abbey River.

Within the proposed development, a separate foul water drainage network will be provided to serve all new buildings. A gravity network will discharge foul flows to the diverted sewer in Michael Street and to the existing 600mm diameter combined sewer on Bank Place. As the basement is at a lower level than the proposed gravity system, a pumped system will be required to convey wastewater from the basement to the gravity network at ground floor level. It is proposed to provide duty and stand-by pumps in order to ensure the system stays operational in the event of a pump failure. In addition, the pump sump has been designed to provide 24 hour storage to allow for emergency works in the event of a failure.

Due to the particular risk of contamination by detergents, runoff from the basement car park will also be discharged to the foul water network.

All food production areas that may generate grease, fats, oils will discharge through a grease trap to prevent maintenance issues during the operation phase of the development.

The wastewater loading estimate is based on the Environmental Protection Agency (EPA) Waste Water Manual “Treatment Systems for Small Communities, Business, Leisure Centres and Hotels” with specific guidance taken from Table 3 “Recommended Wastewater Loading Rates from Commercial Premises”. The occupancy loading factors are based on the guidelines set out in ‘Table 1.1 – Occupancy Load Factor’ in ‘Part B’ of ‘The Building Regulations’. The calculations are included in Section 2 of the Infrastructure Report.

8.4.2 Storm Water Drainage

Existing Storm Water Drainage

LCCC records show that there is no separate storm water drainage network within or around the proposed development site. Surface water runoff generated within the site is currently collected by gullies and discharges to an existing 350mm diameter brickwork combined sewer that runs through the site. The existing road gullies on Michael Street, Ellen Street, Patrick Street, and Rutland Street are likely to discharge into the local combined sewer network. Existing gullies on Bank Place discharge directly to the Abbey River.

Proposed Storm Water Drainage

Within the site, a separate storm water drainage network will be provided to serve the proposed development. This network will collect, attenuate and treat runoff generated within the development. In addition to the new foul sewer in Michael Street it is proposed to provide a new storm water sewer and hydrocarbon interceptor, which includes a silt trap. Existing gullies which currently discharge to the combined sewer in Michael Street will be diverted to the proposed surface water sewer. Surface water run-off collected by this sewer will discharge to the Abbey River through the proposed outfall.

Surface water runoff generated within proposed development will be collected by a combination of linear drains (ACO Brickslot or equivalent) and gullies. It is proposed to provide a sewer network within the development which will convey runoff to an attenuation tank. The attenuation tank will have a flow control device restricting the discharge to the equivalent greenfield run-off rate (9.4l/s). This network also includes a by-pass oil interceptor to remove hydrocarbons suspended in runoff. Due to level constraints within and surrounding the proposed development, a pump will be required to convey flow from the manhole downstream of the attenuation tank (MH S1-12) to a header manhole in Bank Place. From here surface water will be discharged to the Abbey River via the proposed outfall. Surface water run-off from the facade of the landmark building in Bank Place will discharge to an attenuation tank located in Bank Place prior to forward discharge to the Abbey River. The attenuation tank will have a flow control device restricting the discharge to the equivalent greenfield run-off rate (4 l/s).

It is proposed to provide a Rain Water Harvesting System (RWHS) within the development to facilitate re-use of roof run-off. The proposed surface water drainage network has been designed to allow for overflow from the areas served by the RWHS. The rainwater harvesting tanks capacity has been designed in accordance with BS 8515: 2009 Rainwater harvesting systems: Code of practice. It proposed that tanks will be fitted with an overflow system that pumps overflow water to the adjacent surface water system.

Surface water run-off can impact on receiving watercourses in two ways:

- Discharge Rate: if the rate of discharge from the proposed development exceeds that of the existing catchment area then it is possible that existing watercourses could be overloaded, causing localised flooding or erosion of watercourse banks within the catchment.
- Quality of Run-Off: Run-off from trafficked areas can contain pollutants associated with traffic loading.

Therefore, the design of the proposed surface water drainage system includes:

- Consideration of pollution and flood risk requirements,
- Determination of the design storm used in the design of the drainage elements,
- Calculation of flows from the design storm within each drainage catchment,
- Determination of the location of outfall(s),
- The rainfall intensities used in the design have been increased by 20% to allow for the future effects of climate change.

Hydraulic Capacity

The proposed surface water drainage network has been designed to convey run-off associated with a 1 in 5 year return period event without surcharge and a 1 in 100 year return period event without flooding.

Attenuation of Run-off

In accordance with LCCC requirements, all surface water runoff generated by the proposed development will be attenuated and discharged at a restricted rate equal to the equivalent of the Greenfield runoff for a site of this area. The forward flow rate from the site will be restricted to 9.4l/s downstream of the proposed attenuation tank. During rainfall events where the flow rate in to the attenuation tank exceeds the forward flow rate, the attenuation tank will store flows in excess of 9.4l/s. Surface water run-off from the facade of the landmark building in Bank Place will discharge to an attenuation tank in Bank Place which will have a flow control device restricting the discharge to the equivalent greenfield run-off rate (2.5 l/s).

There has been no provision for green roof as it is proposed to utilise the roof space for plant and photovoltaic solar panels.

Proposed Outfall

As there are no existing storm water only sewers in the area, it is proposed to discharge all storm water run-off generated on the development site to the Abbey River through a new outfall. A new surface water sewer will be provided between the site and the proposed outfall. The rate of discharge at this outfall is limited to the greenfield run off rate of 9.4l/s.

The maximum discharge rate associated with the façade of the landmark building is limited to 2.5 l/s.

Treatment of Run-off

It is proposed to provide a Class I By-Pass hydrocarbon separator upstream of the main development attenuation tank to remove any hydrocarbons suspended in the site run-off. The separator also includes a silt trap to allow suspended solids to settle out prior to entering the attenuation tank and being discharged from the site. A Class I Bypass Hydrocarbon Separator has also been provided to treat surface water collected in the new gullies on Michael Street.

8.4.3 Water Supply

There is an existing 9” diameter cast iron Irish Water water main running on all streets surrounding the site, from which it is intended to supply the proposed development.

It is proposed that each building will be served by an individual service connection from the existing 9” diameter water mains. 2 no. additional fire hydrants will be provided within the Public Plaza and a single sluice valve that will service the irrigation system for landscape within the plaza. Irish Water have requested the upgrades of the existing 9” diameter cast iron to a 250mm diameter HDPE on Ellen Street and Rutland Street to accommodate future demand and consolidate the resilience of the local network. The new water supply connection serving the development will incorporate a bulk water meter and sluice valves to the requirements of Limerick City & County Council and Irish Water. Individual water meters will be incorporated into the design and installed upon the water supply to the individual buildings.

8.4.4 Flood Risk

A Site-Specific Flood Risk Assessment (SSFRA) has been carried out in support of the Planning application for the development and is in full compliance with the requirements of “The Planning System & Flood Risk Management Guidelines” published by the Department of the Environment in November 2009. The SSFRA is included in Appendix 8.

As the development is close to the Shannon and Abbey Rivers, coastal flooding is considered to pose the primary risk. A review of the Shannon CFRAM Study indicates that the proposed development is located in an area at risk during a 1 in 1,000 year return period (0.1% AEP) coastal flood event. The estimated 1 in 200 year return period (0.5% AEP) event water level in the area is 4.72 m OD Malin while the 1 in 1000 year return period event water level is 5.15 m OD Malin. This places the site of the proposed development in Flood Zone B.

The Planning System and Flood Risk Management Guidelines classifies the vulnerability to flooding of different types of development. Buildings with a commercial element are classed as ‘Less Vulnerable’ and are considered a suitable land use for areas within Flood Zone B. The proposed residential and Apart Hotel elements of the overall development are classed as ‘Vulnerable’ development. As the development site is located within Flood Zone B, the Justification Test - Box 5.1 was undertaken.

The Planning System and Flood Risk Management Guidelines recommends that minimum floor levels for a new development are set above the 1 in 100 year return period event water level for rivers or the 1 in 200 year return period event coastal water level, include an allowance for climate change, while also providing an appropriate freeboard.

The OPW Assessment of Potential Future Scenarios, Flood Risk Management Draft Guidance”, 2009 gives advice on the expected impacts of climate change and the allowances to provide for future flood risk management in Ireland. Based on the mid- range future scenario (MRFS) and including an allowance of 0.5mm/year for land movement.

Based on a 1 in 200 year return period coastal flood level of +4.72 m, a climate change allowance of 500mm and an allowance of 100mm for land movement, the appropriate Finished Floor Level is 5.32mOD Malin. It is noted that all essential infrastructure serving the proposed development, such as primary transport and utility distribution including electricity generating power sub-stations etc., which are considered highly vulnerable development elements will be sited above the 0.1% AEP event coastal flood water level of 5.15 m OD Malin.

The residential townhouses are located in the existing Georgian buildings in Patrick Street, Ellen Street and Rutland Street. The proposed aparthotel is also located within Ellen Street. The existing ground and floor levels associated with the buildings on Patrick Street, Ellen Street and Rutland Street are all above the CFRAM 1 in 1000 year return period event coastal water level and are therefore in Flood Zone C.

Although the proposed development is in close proximity to Shannon and Abbey Rivers there is no risk associated with fluvial flooding. This is supported by the lack of recorded fluvial flood events in the vicinity of the proposed development.

No instances of pluvial flooding have been recorded for the site of the proposed development and it was concluded that there is no risk associated with pluvial flooding. The proposed finished floor and ground levels within the development will prevent pluvial flood waters from entering the proposed development.

The surface water drainage network is designed to cater for runoff from all roof and hardstanding areas within the proposed development and will be capable of conveying runoff during a 1 in 100 year return period rainfall event.

The development design incorporates super-elevated entrance/exists as a mitigation measure to prevent any flood waters entering the main structure or the underground structure.

In case of emergency, vehicular access to the building for Fire and Ambulance services is available from Patrick Street and Ellen Street westbound. These roads are located within Flood Zone C.

AECOM recommends that the residual flood risk is managed using emergency plans and evacuation procedures, which will be prepared upon development occupation in order to suit specific needs.

It is also noted that the proposed development will not increase the flood risk elsewhere.

8.5 Predicted Impacts

8.5.1 Potential Construction Impacts

The civil works which may potentially impinge upon the water environment will include the following activities:

- Preliminary works, including clearance, levelling, site roads / pedestrian access, establishment of lay-down and fabrication area;
- Basement Excavation;
- Laying of foundations for plant and buildings;
- Diversion of services;
- Outfall Construction;
- Landscaping and reinstatement.

The risk of potential significant impacts occurring during the construction phase (in the absence of adequate management and mitigation measures) can arise from several activities. These typically could include:

- Discharge of vehicle wash-down water to surface and ground waters;
- Discharge of construction materials, e.g. uncured concrete;
- Uncontained spillage of wastewater effluent;
- Uncontrolled sediment erosion and contaminated silty runoff;
- Refuelling facilities, chemical and waste storage or handling areas;
- Polluted drainage and discharges from site;
- Discharge of groundwater to surface water;
- Increased runoff from cleared and capped areas (relative to Greenfield values);
- Works within water; and
- Construction of outfall points.

During construction, pollution from mobilised suspended solids would generally be the prime concern, but spillage of fuels, lubricants, hydraulic fluids and cement from construction plant may lead to incidents, especially where there are inadequate pollution mitigation measures.

Sedimentation (Suspended Solids)

Pollution of surface waters by mobilised suspended solids (SS) can have significant adverse impacts on receiving waters. Various construction activities have the potential to release sediment and increase SS levels in nearby watercourses. Site stripping and excavation works during construction would leave the ground exposed to erosion by wind or rain and this could potentially lead to increases in sediment loading of the combined sewer network or nearby watercourses.

Runoff containing high concentrations of suspended solids could potentially adversely impact on surface water. The impact is considered a direct effect of negative nature and temporary duration given it only poses a risk during the construction stage. Runoff containing large amounts of suspended solids is considered unlikely to occur given the urban nature of the site.

Accidental Spillage and Leaks

Any construction activities carried out close to surface waters involve a risk of pollution due to accidental spillage and leaks. While liquids such as oils, lubricants, paints, bituminous coatings, preservatives and weed killers present the greatest risk, fuel spillages from machinery operating close to watercourses also present a risk. The refuelling of general construction plant also poses a significant risk of pollution, depending on how and where this activity is carried out. Pollution as a result of accidental spillage could potentially affect fish, aquatic flora and invertebrate communities.

Possible contamination of bedrock by leakage or spillage from machinery and associated equipment, may occur during the construction phase. Leakages or spillages associated with any temporary waste water facilities would have a negative short term moderate impact on ground water quality.

Accidental spillage may potentially result in the indirect impact to surface water at the proposed development site should contaminants enter surface waters directly or migrate thorough the subsoils and underlying groundwater to surface waters. The impact is considered an indirect effect of negative nature and temporary given it is only associated with the construction stage. Accidental spillages and leaks are considered unlikely to occur and are should they occur are likely to be rare. Any accidental spillage would have a negative short-medium term moderate impact on water quality at the site.

Use of Concrete and Lime

Lime and concrete (specifically, the cement component) is highly alkaline and any spillage could enter surface water or migrate though subsoils and groundwater impacting surface water quality. The activities most likely to result in contamination include concreting during building construction, pipeline construction and headwall works.

The impact is considered an indirect effect of a negative nature and of a temporary duration given it is only associated with the construction stage, which is temporary in nature. Impacts associated with the use of concrete and lime are considered unlikely to occur and should they occur are likely to be rare events.

Swales /sedimentation ponds have the potential to store contaminated surface water run-off from the hardstanding areas and associated drainage network. If not properly constructed and maintained there is a potential for seepage through the unlined bases and sidewalls and / or bank overflow to infiltrate into the underlying aquifer. This potential seepage into the underlying ground water would have a negative short-term impact on groundwater quality.

8.5.2 Potential Operational Impacts

The potential adverse impacts during the operational phase, in the absence of adequate management and mitigation measures are as follows:

- Excessive demand on the water mains network resulting in reduced supply or loss of pressure in the surrounding area;

- Potential contamination of flood waters in the event of flooding on the site;
- Increase in the rate of runoff from the site during rainfall events, which could result in higher water levels or flow rates downstream of the site;
- Increase in the concentration of hydrocarbons in run-off from the site;
- Infiltration of contaminated groundwater into surface water network, which discharges to the Abbey River.

Bedrock and subsoils.

There is not expected to be any impacts on the bedrock or subsoils during the operation phase.

Groundwater

Possible contamination of the groundwater by leakage or spillage from machinery and associated equipment, fuel tanks or back-up generators may occur during the operational phase. Any accidental hydrocarbon spillage would have a negative short-medium term moderate impact on groundwater quality at the spillage location and downgradient if not quickly contained and removed.

8.6 Mitigation Measures

8.6.1 Construction Methodology and Phasing Management Plan

The Construction Methodology and Phasing Management Plan (CMPP) provided with the EIAR incorporates relevant environmental avoidance or mitigation measures to reduce potential environmental impact of the construction work and covers all potentially polluting activities and include an emergency response procedure. All personnel working on the site will be trained in the implementation of the procedures. The CMPP will be modified and extended by any relevant construction related requirements imposed as conditions of any planning permission granted as a result of these applications.

The CMPP will include a Waste Management Plan, to be prepared in accordance with Department of Environment, Community & Local Government guidelines. It will also include details of proposed environmental monitoring for the duration of the construction works. Earth works will take place during periods of low rainfall to reduce run-off and potential siltation of watercourses.

Good construction practices such wheel washers and dust suppression on site roads, and regular plant maintenance will ensure minimal risk.

8.6.2 Construction Stage Controls

The Contractor will take all precautions to prevent the pollution or silting of watercourses from the construction of the proposed development.

The Contractor will apply the following mitigation:

- Prior to excavation of the basement, the proposed foul and storm water sewers in Michael Street will be laid and commissioned to allow the existing combined sewer to be diverted. During the construction of the new sewers, surface water arising from the development will continue to discharge to the combined sewer. Surface water collected will be treated by sedimentation prior to discharge to the existing combined sewer. Total Suspended Solids (TSS) and colour will be monitored daily by a hand held multi parameter sonde.
- Maintain and monitor the performance of the surface water drainage network throughout the construction of the proposed development noting that the proposed storm sewer will include a permanent hydrocarbon separator which will treat runoff from Michael Street.

- Cover all temporary stockpiles generated during construction to minimise run-off.
- Locate spoil and temporary stockpiles in locations which are at least 15 m from drainage systems.
- Neither ground water or surface water runoff from the working areas will be permitted to discharge directly to the Abbey River or Shannon River. Run off generated within the site during construction will be filtered and treated to remove hydrocarbons and sediment. Total Suspended Solids (TSS), pH/EC and colour will be monitored daily by a hand held multi parameter sonde. In addition, the outlet from the sedimentation pond will incorporate a turbidity monitor with alarm at high level. In the event of surface water failing to meet the required standards, as set out in the discharge licence, water will be recirculated to the inlet of the sediment pond to provide further time for settlement. A penstock will be provided on the outlet from the sediment pond to control discharge from the site.
- Avoid direct or indirect discharges of untreated surface or ground water generated during the proposed development, to any surface water.
- Dewater all working areas at the end of each working day, if necessary, using pumping and transport of water off site in tankers if volumes prevent effective treatment prior to discharge.
- Where the Contractor utilises pumping to drain works areas, a backup pump and generator must be provided on site for use in the event of the primary pump failing.
- Use wheel washers and dust suppression on site roads (to be captured within the proposed SUDS system) and undertake daily plant maintenance checks and corrective actions where required.
- Establish contingency measures to cater for impacts to unknown services underlying the construction site (for example, old sewers or culverts).
- Identify whether shallow groundwater monitoring wells on site will be maintained and protected during construction works; decommissioned; or removed completely as part of excavation works, to prevent them from acting as direct pathways for contamination to enter the groundwater body beneath the site.
- Ready mixed concrete will be brought to the proposed development site by truck.
- The pouring of concrete shall take place within a designated area to prevent concrete runoff into the soil/ground water media.
- Proposed surface water drainage network outfall:
  - Outfall construction will avoid the pouring of concrete.
  - The proposed pipe will be installed by coring through the quay wall.
  - The Contractor’s method statement for the works will be reviewed by a suitably qualified ecologist.
  - The works to provide the outfall will be supervised by the suitably qualified ecologist to advise and direct the Contractor on compliance with the method statement.
- Washout of concrete transporting vehicles shall take place at an appropriate facility, offsite or where onsite wash out will be captured, for disposal off-site.

All design and construction will be carried out in accordance with the Construction Industry Research and Information Association (CIRIA) C532 Control of Water Pollution from Construction Sites Guidance for Consultants and Contractors.

Daily monitoring of the excavation/earthworks, the water treatment and pumping system will be completed by a suitably qualified person during the demolition / basement excavation and construction phases. Preventative measures will be implemented to ensure no entrained sediment, or deleterious matter directly into any drains or watercourses.

If high levels of silt or other contamination is noted in the pumped water or the treatment systems, all construction works will be stopped. No works will recommence until the issue is resolved and the cause of the elevated source is remedied.

The primary flood risk to the site is associated with coastal flooding. The Contractor will provide a ramp to the development site as a mitigation measure to prevent any flood waters to enter the main structure or the underground structure during the Construction Stage.

As coastal flooding is somewhat predictable (usually 24-36 hours in advance) the Contractor shall take note of when coastal flooding warnings are issued for the Limerick City area. In the event that a flood warning is issued, all plant and construction materials must be moved and stored in parts of the site that are located within Flood Zone C or above the estimated 1 in 1000 year return period coastal flood event (CFRAM). Therefore, in the event of floodwaters inundating the site, no materials will be washed from the site into nearby watercourses.

8.6.2.1 Spill Control Measures

No oils/ fuels will be stored on the proposed development site for the purpose of refuelling on the site.

On-site plant will be refuelled by an external Contractor who will call to site as required. Road vehicles will not be refuelled at the site. Minor spills and leaks may occur from road vehicles and the onsite excavator. Any oils or fuels onsite will be removed by an experienced and authorised contractor.

Fixed plant shall be self-bunded; mobile plant shall be in good working order, kept clean, fitted with drip trays where appropriate and subject to regular inspection.

Spill kits and oil absorbent material shall be carried with mobile plant and located at vulnerable locations around the site to reduce the risk of spillages entering the sub-surface or groundwater environment; booms shall be held on site for works near drains or dewatering points.

The Contractor will train all operatives in the proper handling of materials, the sensitive nature of the wider drainage system, and the consequences or accidental spillage.

The following steps provide the procedure to be followed by the Contractor(s) in the event of any significant spill or leak:

- Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers;
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident;
- Contain the spill using the spill control materials, track mats or other material as required. Do not spread or flush away the spill;
- If possible, cover or bund off any vulnerable areas where appropriate such as drains or watercourses;
- If possible, clean up as much as possible using the spill control materials;
- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited;
- Notify the Contractor immediately giving information on the location, type and extent of the spill so that they can take appropriate action and further investigate the incident to ensure it has been contained adequately;
- Verify if necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring, where necessary proposing additional the necessary; and,
- The Contractor will notify LCCC and (if LCCC deem it appropriate) Inland Fisheries Ireland.

8.6.2.2 Monitoring

The Contractor will produce and commence a Water Quality Monitoring Programme (WQMP) at least one month in advance of the construction programme including any enabling works to establish a baseline dataset, and continue throughout construction. The regularity of, and specification for water quality monitoring in this section has been agreed following consultation with IFI during EIAR production. A consultation meeting was held with IFI on 12th Feburary 2019. The proposed surface water drainage network design, construction stage monitoring and mitigation measures were presented to IFI to obtain feedback for incorporation within the scheme.

The baseline water quality dataset will include sampling at low tide, sampling at high tide, and (where possible should such events overlap with the pre-construction monitoring period) periods of elevated rainfall.

The WQMP will sample surface water discharge upstream and downstream from the proposed outfall to the Abbey River, in similar habitat and flow conditions, to enable siltation and other contaminants from the proposed development to be detected and distinguished from ‘background’ levels (including natural and man-made activities.

The WQMP will include relevant parameters from the European Communities (Quality of Salmonid Waters) Regulations, 1988 S.I. No. 293 as amended including Suspended Solids, pH, Dissolved Oxygen, Biochemical Oxygen Demand, hydrocarbons, Nitrites, Nitrates and heavy metals.

Testing for pH, turbidity and/or Total Suspended Solids will be carried out daily in-situ sing a calibrated multi-parameter sonde (to 0.1 NTU accuracy), and fortnightly for all other parameters.

The WQMP will inform the Contractor’s adaptive management of the temporary construction-phase drainage works, having regard for any consents or planning conditions.

The Contractor will provide WQMP results to the Ecologist and LCCC at least fortnightly (but immediately after a known silt release or other pollution incident), along with a record of any corrective actions taken by the Contractor to improve or repair performance of silt fencing or other surface water protection measures.

Highest standards of site management will be maintained and utmost care and vigilance followed to prevent accidental contamination or unnecessary disturbance to the site and surrounding environment during construction. A named person will be given the task of overseeing the pollution prevention measures.

8.6.3 Construction Phase Materials Handling and Storage

Materials will be stored within the site compound and outside of areas identified as being at risk of flooding.

Means to ensure that surface water run-off is controlled such that no silt or other pollutants enter local surface water sewers or drains are as outlined above.

8.6.3.1 Disposal of materials

All material to be disposed of off-site will be disposed of to a disposal facility licensed in accordance with Irish Waste Management Legislation. Where material is to be stockpiled on site prior to disposal, the contractor will control all run-off to prevent contamination of surrounding watercourses.

Contaminated soil will be assessed to determine its constituents and disposed of offsite in accordance with Irish Waste Management Legislation.

8.6.3.2 Control of Concrete

Ready-mixed concrete will be brought to the Proposed Development site by truck. Measures for protection of watercourses from wet concrete shall be included in the CMPP. This will include measures to prevent discharge of alkaline wastewaters or contaminated storm water to the underlying subsoil / groundwater or nearby surface watercourses.

The pouring of concrete shall take place within a designated area to prevent concrete runoff into the soil / groundwater media. Washout of concrete transporting vehicles shall take place at an appropriate facility, offsite where possible, alternatively, where wash out takes place on-site, it shall be carried out in carefully managed on- site wash out areas.

8.6.3.3 Foul Sewer

Foul sewage arising from temporary toilets and sanitary facilities on the Proposed Development site will initially be discharged to an on-site receptacle which will be emptied by tanker on a regular basis for disposal. This arrangement will be in place until the construction of on-site facilities connected to the existing Irish Water wastewater network.

It is anticipated that due to the scale of the Proposed Development that a canteen will be provided on site during construction. Provisions will be made for a grease trap at the canteen drain outlet and this drain will connect to the on-site receptacle and later to the foul sewer. Drumming of waste cooking oil within the canteen will also be provided.

8.6.4 Operational Phase Controls

8.6.4.1 Water Supply

The water system will be metered to determine water consumption and facilitate leakage detection.

8.6.4.2 Flood Risk

The proposed development is located within Flood Zone B and the associated water level in the area is 4.72 m OD Malin.

The proposed finished floor level for new buildings within the development is 5.32 m OD Malin. This level includes a climate change and land movement allowance of 600mm and is above the 1 in 200 year return period coastal flood event level. In addition, all critical infrastructure within the buildings will be at a minimum level of 5.16 m OD Malin. All existing buildings to be retained are located within Flood Zone C.

The design incorporates super-elevated entrance/exits for the development as a mitigation measure to prevent any flood waters to enter the main structure or the underground structure. In case of emergency there is vehicular access for Fire and Ambulance services to the building via Rutland Street, Patrick Street and Ellen Street westbound as these roads are outside of the areas identified as being at risk of flooding by the CFRAM project.

The above measures incorporated into the proposed development design will minimise potential adverse effects due to flooding and drainage.

8.6.4.3 Storm Water Drainage

The proposed storm water drainage system has been designed to ensure that there will be no increase in water levels or flow rates downstream of the proposed outfall. The system includes two attenuation tanks which will store run-off when the inflow rate exceeds 9.4l/s the greenfield runoff rate. The system also includes a Class I Bypass Hydrocarbon Separator to remove hydrocarbons which may be suspended in runoff. To minimise sediment build up within the storm water drainage network, trapped inlets will be used at all points of entry and key manholes will have sumps to collect material.

A regular maintenance regime, including monitoring, will be put in place to remove any excess build-up of material. A Class I Bypass Hydrocarbon Separator has also been provided to treat surface water collected in the new gullies on Michael Street.

LCCC shall establish a maintenance company that will be responsible for the regular maintenance and monitoring of all infrastructure installed as part of the development. This includes the surface water drainage, gullies and petrol interceptor on Michael Street. Future third party Connection to the infrastructure in Michael Street will only be permitted if the same standard can be given with regards maintenance and monitoring. On behalf of LCCC, Limerick Twenty Thirty will be responsible for funding of the company and should units be sold (or resold) or leased (or subsequently lease), the sale shall incorporate a legal obligation on each unit owner to fund this management company on a pro rata basis.

8.6.4.4 Foul Sewer

All foul water from the Proposed Development will discharge to the existing Irish Water combined sewer network.

8.7 Residual Impacts

8.7.1 Construction Phase

Residual impacts will be non-significant following implementation of mitigation measures.

8.7.2 Operational Phase

Residual impacts will be non-significant following implementation of mitigation measures.

8.8 Cumulative Impacts

8.8.1 Construction impacts

Cumulative impacts on the water environment during construction are associated with spillage and leakage of oils and fuels and disturbance of land.

Individual impacts from the Proposed Development are generally considered to be medium impacts to a medium sensitivity environment and the significance of the impacts has been assessed as moderate. As outlined in Section 8.6 above, mitigation measures proposed to manage and control potential impacts during development will further reduce the magnitude and significance of impacts

As it does not appear that construction of the Proposed Development will proceed in tandem with other significant developments in the immediate area, a cumulative impact is unlikely to occur, and the potential impact of the Proposed Development and other consented developments is considered to be slight.

8.8.2 Operational Impacts

Irish Water has confirmed that subject to a valid connection agreement being put in place, a connection to the Irish Water network can be facilitated for both foul and potable water.

The surface water runoff from the Proposed Development will be limited to a pre-development Greenfield discharge rate and will discharge to existing drainage infrastructure.

The individual impacts from the Proposed Development to water range from slight to moderate and mitigation measures proposed to manage and control potential impacts during operation will further reduce the magnitude and significance of impacts. Potential impacts primarily relate to accidental releases which on independent sites cannot be considered to be cumulative.

Therefore, the cumulative operational impact of the Proposed Development and other consented developments are considered to be slight.

The existing water quality downstream of the proposed development site offers a useful proxy metric for the pressure of existing projects and plans on the aquatic features within the Shannon Estuary, including the Lower River Shannon SAC and River Fergus and River Shannon Estuary SPA. The water quality of estuarine waters within the Zone of Influence of the proposed development (as well as the water quality of coastal waters further downstream in the mouth of the Shannon) is unpolluted according to the EPA. The existing unpolluted status suggests a relatively high assimilative capacity to absorb pollutants, relative to watercourses of polluted status. However, the RBMP (DoHGLP, 2018) states that "significant progress remains to be made regarding meeting the requirements for protected areas". This is reflected in the fact that, based on data from 2007-2015, the EPA considers both the Upper and Lower Shannon Estuaries as "At Risk".

The following policies in the Limerick City Development Plan will help mitigate the risk to water quality in the Shannon Estuary from cumulative impacts:

- Under Policy WS.6 Surface Water Drainage, it is the policy of Limerick City Council to provide a high quality Surface Water Collection and Disposal System. Specific objectives under this policy include:
  - "Control discharges of surface water into drainage systems where the receiving drainage system is at or nearing full capacity"; and,"
  - To work in conjunction with other public bodies towards a sustainable programme of improvement for riverbanks, back drains, etc.
- Under Policy WS.5 Waste Water, "All new development proposals shall adhere to the following:
  - "Have regard to the policy, national standards and guidelines, of not allowing the discharge of contaminants and greases to the City Council sewers";
  - "Have regard for the specifications and details as defined in the DEHLG 'Recommendations for Site Development Works for Housing Areas', National and Limerick City Council requirements in respect of discharges"; and,
  - "Provide an adequate surface water system in order to minimise the risk of flooding".

Furthermore, Irish Water, who has national statutory remit for wastewater and drinking water services, has committed to a 25 year programme of improvements to wastewater impacts on surface waters in their Water Services Strategic Plan (WSSP).

There are binding obligations on all Irish local authorities including LCCC to achieve good status of surface waters, under the terms of the EU Water Framework. Having regard for the inherent legal and policy requirements for good water quality above, no significant cumulative pollution impacts are predicted.

Having regard for these legal protections, the existing unpolluted status of the Shannon Estuary, and the review of projects and plans above, <u>no significant cumulative pollution impacts are predicted during construction or operation.</u>

9 Air Quality and Climate

9.1 Introduction

This section of the EIAR considers the impact of air quality and climate on the project as detailed Chapter 3 of this document. This assessment characterises the existing ambient air quality at the EIAR study area and considers the impact of the proposed developments on air quality at sensitive receptors. An assessment was carried out to determine the potential impacts of the proposed development on human health as a result of change in air quality. The process features acknowledgement of appropriate legislate on, a definition of terms used to describe impacts, characterisation of the site baseline conditions and detailed assessment of potential air quality impacts where appropriate. This chapter also assesses the potential impacts the proposed development may have on climate change, as well as the vulnerability of the project to climate change.

As baseline conditions at a given site inform the methodology used, *i.e.* which pollutants should be assessed, it is necessary to discuss bassline conditions before detailing methodology. This chapter is laid out in a slightly different manner to the other chapters within this EIAR. With the baseline being considered in section 9.3 and the methodology in section 9.4.

9.2 Air Quality and Climate Legislative context

9.2.1 Legislation

The Clean Air for Europe (CAFE) programme revisited the management of Air Quality within the EU and replaced the EU Framework Directive 96/62/EC (Ref. 9-1), its associated Daughter Directives 1999/30/EC (Ref. 9-2)2000/69/EC (Ref. 9-3), 2002/3/EC (Ref. 9-4), and the Council Decision 97/101/EC (Ref. 9-5) with a single legal act, the Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC (Ref. 9-6). Directive 2008/50/EC is currently transposed into Irish legislation by the Air Quality Standards Regulations 2011 (Ref. 9-7). These limit values are binding on Ireland and have been set with the aim of protecting health vegetation and ecosystems. Table 9-1 shows the limit values for human health associated with this legislation, Table 9-2 shows the critical levels of pollutants for protection of vegetation. This chapter will be used to assess the potential for this proposed development to breach these limit values.

Table 9-1 Air quality limit values for protection of human health

Pollutant	Criteria	Limit Value
Sulphur dioxide	Hourly limit – not to be exceeded more than 24 times per calendar year	350 µg/m^3
	Daily limit – not to be exceeded more than 3 times per calendar year	125 µg/m^3
Nitrogen dioxide	Hourly limit – not to be exceeded more than 18 times per calendar year	200 µg/m^3

Pollutant	Criteria	Limit Value
	Annual mean	40 µg/m^3
Carbon monoxide	Maximum daily 8-hour running mean	10,000 µg/m^3
Benzene	Annual mean	5 µg/m^3
Lead	Annual mean	0.5 µg/m^3
PM_{10}	Daily limit – not to be exceeded more than 35 times per calendar year	50 µg/m^3
	Annual mean	40 µg/m^3
$PM_{2.5}$	Annual mean	25 µg/m^3

Table 9-2 Critical level for protection of vegetation

Pollutant	Criteria	Limit Value
NO_x	Calendar year	30 µg/m^3
SO_2	Calendar year and winter (October to March	20 µg/m^3

9.2.2 Climate Agreements

The impact of the proposed development is assessed in the context of the various climate and climate change agreements to which Ireland is a party. Ireland's climate change policy has been developed in the context of national and European Union (EU) commitments to the 1992 United Nations Framework Convention on Climate Change (UNFCC). Ireland ratified the UNFCCC in April 1994 and Kyoto Protocol in principle in 1997 and formally in May 2002 (Framework Convention on Climate Change, 1997 and Framework Convention on Climate Change, 1999). For the purposes of the EU burden sharing agreement under Article 4 of the Kyoto Protocol, in June 1998, Ireland agreed to limit the net growth of the six Greenhouse Gases (GHGs) under the Kyoto Protocol (first commitment period) to 13% above the 1990 level over the period 2008 to 2012. 2013 was also the first year of the second commitment period under the Kyoto Protocol, the Doha Amendment. The Doha Amendment was ratified by Ireland and the EU on 21 December 2017, but it will not take legal effect until ratified by 144 parties to the Kyoto Protocol. As of 18th January 2019, 124 parties have deposited their instrument of acceptance.

The Paris Agreement, a legally binding, global agreement on climate change was adopted by 195 parties to the UNFCCC in December 2015, setting out to limit global warming to less than 2 degrees centigrade above pre-industrial levels. The ratification of the Agreement by the EU triggered its entry into force on 4 November 2016, the same date the Agreement was ratified by Ireland. For the period 2013 - 2020, the EU's Climate and Energy Package of 2009 has mandated a 20% reduction in overall greenhouse gas emissions by 2020 compared to 1990 levels. EU policy distinguishes between emissions included in the Emissions Trading Scheme (ETS) and other non-ETS emissions. The ETS includes large energy users such as electricity generation, cement production, petrochemical and some large-scale pharmaceutical manufacture. Emissions from ETS sites are managed on a harmonised basis across the EU rather than nationally but is administered in Ireland by the EPA. The current phase of ETS targets a sector reduction of 21% by 2020 compared to 2005 across the EU. The non-ETS sector includes agriculture, transport, households and non-energy intensive industry. The target for reduction in emission from the non-ETS sector in Ireland is 20% by 2020 compared to 2005 levels. Formulated to meet the EU's commitments under the Paris Agreement, the EU 2030 Targets commit to a 40% reduction in EU-wide emissions, to be achieved by reductions (compared to 2005) of 43% and 30% in in the ETS and non-ETS sectors, respectively. Though not yet agreed, the Effort Sharing Regulation (ESR) published by the European Commission in July 2016 proposes a headline target reduction in GHG emissions for Ireland of 30% over the period 2021 to 2030.

In 2014, the Irish Government adopted the National Policy Position on Climate Action and Low Carbon Development which envisages an aggregate reduction in CO_2 emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors. In December 2015, the Climate Action and Low Carbon Development Act 2015 was enacted, providing a statutory basis for the objectives laid out in the National Policy Position. A statutory National Mitigation Plan was provided for by the Act, the first edition of which was published in July 2017

9.2.3 National Planning Framework

The Project Ireland 2040 National Planning Framework (Ref. 9-8) states that the population of Ireland is set to grow by one million persons. Accordingly, the document sets out Ireland's plan to grow the infrastructure to support this population growth while maintaining responsibility for the built and natural environment. The document places a large emphasis on the importance of low carbon development and resilience to climate change, this is outlined in strategic outcome and priority 8 of the national development plan. In the context of air quality, National Policy Objective 64 states:

> *Improve air quality and help prevent people being exposed to unacceptable levels of pollution in our urban and rural areas through integrated land use and spatial planning that supports public transport, walking and cycling as more favourable modes of transport to the private car, the promotion of energy efficient buildings and homes, heating systems with zero local emissions, green infrastructure planning and innovative design solutions.*

9.2.4 Additional Guidance

In addition, the following legislation and guidance were reviewed and considered for this chapter:

- National Roads Authority (2011), Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes
- Environmental Impacts Assessment Directive 2011/92/EU as amended by Directive 2014/52/EU;
- Air Quality Standards Regulation 2011 (S.I No.180/2011);
- Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, DRAFT August 2017); https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf
- Environmental Impact Assessment of Projects, Guidance on the preparation of the Environmental Impact Assessment Report (European Commission, 2017); http://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003); https://www.epa.ie/pubs/advice/ea/guidelines/EPA_advice_on_EIS_2003.pdf
- Environmental Protection Agency. (2010) Air Dispersion Modelling from Industrial Installations Guidance Note (AG4); http://www.epa.ie/pubs/advice/air/emissions/ag4%20guidance%20note%20for%20web.pdf
- S.I. No 595/2017 - European Union Medium Combustion Plant Regulations.
- IAQM Land-Use Planning & Development Control: Planning for Air Quality
- IAQM Guidance on the assessment of dust from demolition and construction V1.1

- S.I. No. 490/2012 - European Communities (Greenhouse Gas Emissions Trading) Regulations 2012

9.3 Baseline Conditions

The Air Quality in Ireland 2016 (Ref. 9-10) document acts as a source of information for ambient air quality in Ireland based on measurements of pollutants outlined in Table 9-1. Air Quality in Ireland 2015 (Ref. 9-10) outlines zones specified within Ireland, in accordance with Chapter 3 of EU Directive 2008/50/EC (Ref. 9-6), as follows:

- Zone A, Dublin conurbation
- Zone B, Cork conurbation
- Zone C, 23 large towns in Ireland with population >15,000
- Zone D, remaining rural areas of Ireland

The EIAR study area in Limerick falls into the category defined as Zone C. Air quality in Zone C based on the Air Quality in Ireland 2016 (Ref. 9-10), is good with pollutant concentrations falling comfortably below EU limit values. Concentrations of individual pollutants are described in greater detail in the subsequent sections of this of this chapter, however, Air Quality in Ireland 2016 (Ref. 9-10) contains no raw data compare pollutant concentrations carefully with EU limit values. Accordingly, Air Quality in Ireland 2015 (Ref. 9-11) is used instead.

On a more local level, LCCC began monitoring of particulate air pollutants in 2017 at three locations in Limerick City, Mungret and Castletroy. In 2018, monitors for gaseous pollutants were also added at these sites. Results from the monitors at these sites are freely available and provide a good insight into the baseline air quality in Limerick, these are outlined in the sections below.

9.3.1 Sulphur Dioxide

Sulphur dioxide concentrations for Zone C based on data from two different monitoring sites are reported in Air Quality in Ireland 2015 (Ref. 9-11). These sites are located in Ennis, Country Clare and Portlaoise, County Laois, located 31 km and 100 km from the EIAR study area respectively. Concentrations of sulphur dioxide in Air Quality in Ireland 2015 (Ref. 9-10) are reported as an annual mean of 3 µg/m^3 for Ennis, with an hourly maximum recorded value of 68 µg/m^3, indicating no breaches of the 350 µg/m^3 hourly limit value or the 125 µg/m^3 daily limit value. Concentrations are similarly low at the Portlaoise monitoring site, with an annual mean concentration of 1 µg/m^3, an hourly maximum recorded value of 17 µg/m^3, indicating no breaches of the 350 µg/m^3 hourly limit value or the 125 µg/m^3 daily limit value.

In to context of the EIAR site, local monitoring of sulphur dioxide has been operated by LCCC at three different sites in the vicinity of Limerick since 24th of January 2018. These sites are located at:

- O'Connell Street in the centre of Limerick, 500m from the EIAR study site;
- Mungret, in the industrial area of the town, adjacent to a cement production facility, 4.5 km from the EIAR study site; and
- Castletroy, a suburban area of Limerick, located 5.7 km from the EIAR study site.

The council has produced monthly reports since the monitoring began, reporting the concentrations of sulphur dioxide observed at these sites (Ref. 9-12). Concentrations reported are presented in Table 9-3. While EU Directive 2008/50/EC does not provide a long-term average sulphur dioxide limit value for the protection of human health, the long-term values reported by LCCC are appreciably small. Data from LCCC does not indicate concentrations of sulphur dioxide on a daily or hourly basis, though it is expected that there were no breaches of the limit values for these averaging periods. Limerick City and County Council report one 15-minute episode of high sulphur dioxide concentration (instrument sampling resolution is 15 minutes), where concentrations reached 676 µg/m^3 on O'Connell Street. This event occurred at 06:30 on Thursday 8th of February 2018, instrument data available at AirQWeb (Ref. 9-9) shows that sulphur dioxide concentrations at the site were below the limit of detection in the 30 minutes both before and after the event.

Table 9-3. Mean sulphur dioxide concentrations (µg/m^3) observed at O'Connell Street, Mungret and Castletroy as reported by Limerick City and County Council

Period	O'Connell Street	Mungret	Casteltroy
January 2018 to September 2018	6 µg/m^3	5 µg/m^3	6 µg/m^3

9.3.2 Oxides of Nitrogen

Oxides of nitrogen concentrations for Zone C are obtained from two monitoring sites, Portlaoise, County Laois and Kilkenny, County Kilkenny, 100 km and 92 km from Limerick, respectively. Annual mean concentrations of oxides of nitrogen for 2015 at these two sites were reported as 16 µg/m^3 at Portlaoise and 7 µg/m^3 at Kilkenny.

There is currently no monitoring of total oxides of nitrogen carried out by LCCC. Nitrogen dioxide is measured and discussed in the next subsection.

9.3.3 Nitrogen Dioxide

Air Quality in Ireland 2015 (Ref. 9-11) reports nitrogen dioxide concentrations for Zone C based on data from two different monitoring sites. These sites are located in Portlaoise, County Laois and Kilkenny, County Kilkenny, 100 km and 92 km from Limerick respectively. Portlaoise monitoring site reports an annual mean nitrogen dioxide concentration of 10 µg/m^3, with no breaches of the 1-hour limit of 200 µg/m^3, and an annual maximum of 88 µg/m^3. Kilkenny monitoring site reports an annual mean Nitrogen dioxide concentration of 5 µg/m^3, with no breaches of the 1-hour limit of 200 µg/m^3, and an annual maximum of 70 µg/m^3.

On a local monitoring level, LCCC operate monitoring of nitrogen dioxide at the same three sites where sulphur dioxide monitoring occurs. Monitoring commenced on 24th of January 2018, concentrations are similarly presented in monthly reports (Ref. 9-12), as described in the previous section. Nitrogen dioxide concentrations reported are presented in Table 9-4. Concentrations reported amount to low long-term concentrations, there is no data in the report to suggest that any breaches of the hourly limit value occurred.

Table 9-4. Mean nitrogen dioxide concentrations (µg/m^3) observed at O'Connell Street, Mungret and Castletroy as reported by Limerick City and County Council

Period	O'Connell Street	Mungret	Casteltroy
January 2018 to September 2018	16 µg/m^3	10 µg/m^3	11 µg/m^3

9.3.4 Carbon Monoxide

Carbon monoxide concentrations for Zone C based on data from one monitoring sites is reported in Air Quality in Ireland 2015 (Ref. 9-11). The site is located in Portlaoise, County Laois, located 100 km from the EIAR study area. Concentrations of carbon monoxide in this report, are displayed as an annual mean of 400 µg/m^3, with a maximum 8-hourly running mean value recorded as 200 µg/m^3, sufficiently less that the 10,000 µg/m^3 8-hourly limit value (Ref. 9-6).

Limerick City and County Council operate monitoring of carbon monoxide at the same three sites where sulphur dioxide monitoring occurs. Monitoring commenced on the 24th of January 2018, concentrations are similarly presented in monthly reports (Ref. 9-12). as described in earlier sections of this chapter. Carbon monoxide concentrations presented in these reports are presented in Table 9-5. Directive 2008/50/EC (Ref. 9-6) does not provide a long-term average carbon monoxide limit value for the protection of human health, the long term values reported by LCCC are considered to be small. Data from LCCC does not indicate concentrations of carbon monoxide on an 8-hourly running mean basis, though it is assumed there were no breaches of the limit values for these averaging periods.

Table 9-5. Mean carbon monoxide concentrations (µg/m^3) observed at O'Connell Street, Mungret and Castletroy as reported by Limerick City and County Council

Period	O'Connell Street	Mungret	Casteltroy
January 2018 to September 2018	300 µg/m^3	100 µg/m^3	100 µg/m^3

9.3.5 Benzene

Air Quality in Ireland 2015 (Ref. 9-11) reports nitrogen dioxide concentrations for Zone C based on data from one site, in Kilkenny, County Kilkenny, 92 km from the EIAR study area. Benzene concentrations at the site averaged 0.13 µg/m^3 in 2015 according to the report, with a maximum daily concentration recorded as 0.81 µg/m^3. These values are considerably less than the limit value for annual mean concentration of 5 µg/m^3 in EU Directive 2008/50/EC (Ref. 9-6).

There is no local monitoring available from LCC for benzene.

9.3.6 Lead

Lead concentrations for Zone C, as reported in Air Quality in Ireland 2015 (Ref. 9-11), were recorded from a single air monitoring station in Galway, County Galway. The site is located 70 km from the EIAR study area. Lead concentrations at the Galway site were recorded as an annual mean concentration of 0.0025 µg/m^3, with a maximum monthly average of 0.0057µg/m^3. These quantities are considerably lower than the air quality limit value for protection of human health of 0.5 µg/m$^{3.}$

There is no local monitoring available from LCC for Lead

9.3.7 PM_{10}

Air Quality in Ireland 2015 (Ref. 9-11) reports PM_{10} concentrations for Zone C based on data from three different monitoring sites. These sites are located in Galway, County Galway, Portlaoise, County Laois and Ennis, County Clare, 70 km, 100 km and 31 km from Limerick respectively. Galway monitoring site reports an annual mean PM_{10} concentration of 15 µg/m^3, with 2 breaches of the daily maximum limit value of 50 µg/m^3, and a daily maximum of 59 µg/m^3. Portlaoise monitoring site reports an annual mean PM_{10} concentration of 12 µg/m^3, with 1 breach of the daily maximum limit value of 50 µg/m^3, and a daily maximum of 52 µg/m^3. Ennis monitoring site reports annual mean PM_{10}

concentrations of 18 µg/m^3, with 10 breaches of the daily maximum limit value of 50 µg/m^3, and a daily maximum of 72 µg/m^3. The annual average mean concentrations for PM_{10} as monitored in Zone C amount to low pollutant concentrations, well below the limit value. Despite the fact that there were breaches of the hourly concentration of 50 µg/m^3, relatively few of these breaches occurred and at any site, the quantity was well below the 35 permissible breaches in the air quality limit value.

On a local monitoring level, LCCC operate monitoring of PM_{10} at the same three sites where sulphur dioxide monitoring occurs, using different instrumentation. Monitoring of PM_{10} commenced in October 2017, concentrations are presented in a monthly report (Ref. 9-12), as described in earlier sections of this chapter. PM_{10} concentrations reported are presented in Table 9-6. Data in Table 9-6 show that long term concentrations of PM_{10} are far below the limit value of 40 µg/m^3.

Table 9-6. Mean PM_{10} concentrations (µg/m^3) observed at O'Connell Street, Mungret and Castletroy as reported by Limerick City and County Council

Period	O'Connell Street	Mungret	Casteltroy
October 2017 to September 2018	11 µg/m^3	7 µg/m^3	8 µg/m^3

9.3.8 $PM_{2.5}$

Air Quality in Ireland 2015 (Ref. 9-11) reports $PM_{2.5}$ concentrations for Zone C based on data from three different monitoring sites. These sites are located in Bray, County Wicklow and Ennis, County Clare, 170 km and 31 km from Limerick respectively. Bray monitoring site reports an annual mean $PM_{2.5}$ concentration of 7 µg/m^3, and a daily maximum of 40 µg/m^3. Ennis monitoring site reports annual mean $PM_{2.5}$ concentrations of 12 µg/m^3, and a daily maximum of 65 µg/m^3. The annual average mean concentrations for $PM_{2.5}$ as monitored in Zone C are considered low pollutant concentrations, considerably less than the limit value of 25 µg/m^3.

Limerick City and County Council operate monitoring of monitoring of $PM_{2.5}$ at the same three sites where $PM_{2.5}$ monitoring occurs. Monitoring of $PM_{2.5}$ commenced in October 2017, concentrations are presented in a monthly report (Ref. 9-12) as described in earlier sections of this chapter. Data for $PM_{2.5}$ concentrations reported are presented in Table 9-7. Results from LCCC monitoring show $PM_{2.5}$ concentrations well below air quality limit values.

Table 9-7. Mean $PM_{2.5}$ concentrations (µg/m^3) observed at O'Connell Street, Mungret and Castletroy as reported by Limerick City and County Council

Period	O'Connell Street	Mungret	Casteltroy
October 2017 to September 2018	7 µg/m^3	6 µg/m^3	6 µg/m^3

9.3.9 Baseline Climate

Limerick is located in western Ireland, at the Shannon Estuary. The climate in Limerick can be characterised as Cfb using the Koppen-Geiger climate classification. This classification indicates a mainly warm climate, which is fully humid, experiencing warm summers. Flood risk at the site is addressed in Section 8.3.4 of Chapter 8.

9.4 Assessment Methodology

The potential impacts associated with the EIAR study site are described in this chapter on a do-nothing and do-something basis. In this manner the do-nothing scenario refers to the proposed development not occurring, and the do-something scenario refers to proposed development going ahead. Accordingly, the potential impacts of the do-something scenario on air quality and climate can be further separated into the demolition and construction phase and the operational phase. The specific extent of which are as follows:

- Impact of fugitive emissions of dust and PM_{10} from the demolition and construction activities;
- impact of vehicle and plant emissions associated with the demolition and construction phases;
- impact of existing sources of poor air quality on new receptors during operation;
- impact on existing receptors during operation; and
- Impact on change during demolition and construction phase and/or operational phase

This section covers the necessity to consider these potential impacts in detail. Where appropriate, air quality effects on receptors will be determined using the methodology described below.

9.4.1 Local Air Quality Emissions Methodology

The assessment considers local air quality and climate. It is predicted that this development will influence the volume of traffic using local roads, this can have a potentially significant impact on local receptors due to increase in pollutants associated with road traffic. Combustion of fuel in vehicle engines results in the presence of hydrocarbons (HC) such as benzene and 1,3-butadiene, and sulphur dioxide (SO2), carbon monoxide (CO), carbon dioxide (CO_2), PM_{10} and $PM_{2.5}$ in exhaust emissions. In addition, at the high temperatures and pressures found within vehicle engines, some of the nitrogen in the air and the fuel is oxidised to form NO_X, mainly in the form of nitric oxide (NO), which is then converted to NO_2 in the atmosphere. NO_2, PM_{10} and $PM_{2.5}$ are associated with adverse effects on human health, while carbon dioxide is of particular concern to climate change. Better emission control technology and fuel specifications are expected to reduce emissions per vehicle in the long term.

Although SO_2, CO, benzene and 1,3-butadiene are also present in motor vehicle exhaust emissions, detailed consideration of the associated impacts on local air quality is not considered relevant for the proposed site. Where applicable, LCCC monitoring of these substances indicate that there is very little risk of this development being capable of compromising the achievement of the relevant air quality limit values for the protection of human health. Emissions of SO_2, CO, benzene and 1,3-butadiene from road traffic are therefore not considered further within this assessment.

Local concentrations of NO_2, PM_{10} and $PM_{2.5}$ are low, as outlined in section 9.3, and the change in road traffic is not expected to cause a significant increase in concentrations of these pollutants at new and existing sensitive human receptors in the vicinity of the development. Despite this, concentrations of NO_2, PM_{10} and $PM_{2.5}$ due to operational traffic will be subject to detailed assessment for the proposed development within this chapter. Quantities of carbon dioxide derived from road traffic will be predicted in each scenario, to assess the potential effects the scheme may have on climate change. In addition, concentrations of oxides of nitrogen (NO_x) and deposited nitrogen (from nitrogen dioxide) will be assessed at sensitive ecological sites, where road links which are potentially affected by the scheme are present within 200m. The Lower River Shannon SAC, is located near the north of the proposed site, containing species of bryophytes which are potentially sensitive to NO_x and deposited nitrogen. The methodology for assessing impacts at human and ecological receptors is described in detail in the following sections.

The demolition and construction phase of the Proposed Development is likely to lead to an increase in the number of vehicles on the local highway network, for the duration of the construction works only.

This has the potential to cause significant impacts on receptors as a result of pollutants associated with vehicle use. Construction traffic data as specified in Chapter 13 Traffic and Transport, indicates the greatest number of vehicle movements during the construction phase. The construction phase is expected to occur during the 7 month period during which soil is removed from site, with a total of 918 HDV movements per month. This equates to 18 HDV movements in terms of annual average daily traffic, along the construction route along R445 and Michael Street. This number of HDV movements is considered small with respect to construction sites. Nonetheless, an assessment was carried out using the same process as described for the operational traffic assessment.

9.4.1.1 Modelling Methodology for Local Air Quality

This assessment has used the latest version of dispersion model software ‘ADMS-Roads’ (v4.1.1.0) to quantify baseline pollution levels at selected receptors due to road traffic emissions. ADMS-Roads is a modern dispersion model that has an extensive published track record of use in the UK for the assessment of local air quality impacts, including model validation and verification studies. Table 9-8 shows the parameters used for the operational phase modelling using ADMS-Roads.

Table 9-8. ADMS-Roads parameters used in modelling

Variables	Model Input
Surface roughness at source	1m
Surface roughness at meteorological site	0.3m
Minimum Monin-Obukhov length for stable conditions	10m
Terrain Types	Flat
Receptor location	X,Y co-ordinates determined by GIS, Z = various
Emissions	Oxides of nitrogen (NOx), particulate matter (PM_{10}) and fine particulate matter ($PM_{2.5}$)
Emission factors	EFT Version 8.0.1 emission factor dataset. 2015 for all scenarios
Meteorological data	1 year (2017) hourly sequential data from Shannon meteorological station
Emission profiles	No emission profiles have been used
Receptors	Selected receptors only
Model output	Long-term annual mean oxides of nitrogen concentrations
	Long-term annual mean particulate matter (PM_{10}) concentrations
	Long-term annual mean fine particulate matter ($PM_{2.5}$) concentrations

9.4.1.2 Local Air Quality Receptors

Human receptors located close to the proposed development were selected, these include current dwellings and those proposed based on the most recent building use provided at the time of modelling. Table 9-9 outlines receptors selected for modelling. Receptor heights are assigned at 1.5m above floor level to represent the breathing zone for human receptors. It is noteworthy that the proposed receptors are each part of a multi-storey residential complex, whereby each floor contains receptor locations. In each incidence the dwelling located closest to the ground is selected as a conservative representation of the dwellings above it. In each case this was the first floor, as the building plans do not contain residences on the ground floor. These receptor locations are displayed graphically in Figure 9.1.

Table 9-9. Operational phase human receptors

Receptor ID	Name	Status	Distance from site (m)	Irish Transverse Mercator Coordinates	Height above ground (m)
R1	Rutland House	Existing	<20	557751, 657479	1.5
R2	5 Rutland St	Operational	Within	557753, 657434	5.4
R3	4 Rutland St	Operational	Within	557756, 657446	5.4
R4	1 Patrick St	Operational	Within	557709, 657357	4.5
R5	2 Patrick St	Operational	Within	557705, 657353	4.5
R6	3 Patrick St	Operational	Within	557702, 657347	4.5
R7	4 Patrick St	Operational	Within	557697, 657343	4.5
R8	5 Patrick St	Operational	Within	557693, 657337	4.5
R9	7 Ellen St	Operational	Within	557714, 657289	4.5
R10	8 Ellen St	Operational	Within	557718, 657285	4.5
R11	Ellen St 1	Existing	<20	557692, 657292	4.5
R12	Ellen St 2	Existing	<20	557809, 657291	4.5
R13	Michael St	Existing	<20	557746, 657248	1.5

As outlined in Section 9.4.1, the proposed site has potential impacts on bryophytes in the Lower River Shannon SAC. These organisms exist on the walled section of the SAC. Receptor points were selected along the southern boundary of the SAC at locations nearest to junctions, which are likely to represent points of highest exposure to vehicle pollutants. Locations of these points are displayed in table 9-10 and in Figure 9.1.

Table 9-10. Operational phase ecological receptors

Receptor ID	Irish Transverse Mercator Coordinates	Height above ground (m)
E1	557753, 657490	0
E2	557768, 657489	0
E3	557836, 657470	0
E4	557878, 657462	0

9.4.1.3 Traffic Data

Air quality predictions are based on traffic data for 6 roads in the direct vicinity of the proposed development. Traffic data, as specified in Chapter 13, has been provided for the base year (as 2017, for completeness of data), the opening year of the development (2022), the opening year plus 5 years (2027) and the opening year plus 15 years (2037). A more detailed description of the data is provided in Chapter 13 of this document. The traffic data includes vehicle use of the underground car park as part of the development.

9.4.1.4 Meteorological Data

One year of hourly sequential observation data from Shannon meteorological station has been used in this assessment of the proposed development. The year 2017 was selected, so as to match the base year for traffic data. Shannon meteorological station is located 20 kilometres from the proposed development and is representative of the meteorological conditions experienced at the proposed development site. Background Data

As recommended in the National Roads Authority (2011), Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes(Ref. 9-18), background data for nitrogen dioxide, NO_x, $PM_{2.5}$ and PM_{10} was sourced from the form United Kingdom's Department for the Environment Farming and Rural Affairs (Defra) 2015-based background maps 2015 (Ref. 9-17), for each relevant traffic year. As per the guidance document, an average of background pollutant values across Northern Ireland is an appropriate estimate of the background pollutant concentrations for Ireland.

9.4.1.5 Road Traffic Model Verification

Model verification is the exercise undertaken to account for dispersion model bias. This involves aligning model output data with actual measurements gathered at locations within the study area. The factor of the difference between modelled output and measured data is then applied to all representative locations in the model domain. Measurement data from LCCC are not collected at a location sufficiently close to the site to be used for model verification, however the site at O'Connell Street is located 500m from the site and is likely to be a fair representation of the nitrogen dioxide concentrations at the proposed site. Roadside pollutant measurement data at O'Connell Street, as outlined in section 9.3.2, indicate that nitrogen dioxide concentrations are well below limit values, under the definition of "well below" specified in National Roads Authority (2011), Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (Ref. 9-18), it is therefore not necessary to obtain baseline data. A professional judgement was made to apply a verification factor of 3 to the road NOx concentrations predicted by the model. This represents a conservative factor which is likely to over predict the concentrations of pollutants at receptors. The location of this monitoring site is displayed in Figure 9.1.

9.4.1.6 Oxides of Nitrogen to Nitrogen Dioxide Conversion

The National Roads Authority (2011), Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes recommends use of the oxides of nitrogen to nitrogen dioxide converter tool supplied by Defra to calculate the road nitrogen dioxide contribution from modelled road oxides of nitrogen contributions (Version 6.1). The tool comes in the form of an MS Excel spreadsheet and uses borough specific data to calculate annual mean concentrations of nitrogen dioxide from dispersion model output values of annual mean concentrations of oxides of nitrogen. This tool was used to calculate the total nitrogen dioxide concentrations at receptors from the modelled road oxides of nitrogen contribution and associated background concentration. As recommended in the National Roads Authority (Ref. 9-18), Armagh Banbridge and Craigavon was selected as the local authority which best represents regional background concentrations of pollutants.

9.4.1.7 Predicting the Number of Days in which the particulate matter 24-hour mean Limit Value is Exceeded

The National Roads Authority's guidance document (Ref. 9-18) makes reference to Defra guidance document LAQM.TG (03) (Ref. 9-20) with regards to Predicting the number of days in which the particulate matter 24-hour mean objective limit value is exceeded. The method by which the number of days in which the particulate matter 24hr limit value is exceeded can be obtained based on a relationship with the predicted particulate matter annual mean concentration. As such, the formula used within this assessment is:

$$No.\,of\ Exceedances = 0.0014 * C^3 + \frac{206}{C} - 18.5$$

1.1

Where C is the annual mean concentration of PM_{10}.

9.4.1.8 Predicting the Number of Days in which the Nitrogen Dioxide Hourly Mean Limit Value is Exceeded

References within National Roads Authority's guidance document (Ref. 9-18) Laxan and Marner (Ref. 9-21) and AET (Ref. 9-22) have concluded that the hourly mean nitrogen dioxide limit value is unlikely to be exceeded if annual mean concentrations are predicted to be less the 60 µg/m^3. This assessment will evaluate the likelihood of exceeding the hourly mean nitrogen dioxide limit value by comparing predicted annual mean nitrogen dioxide concentrations at all receptors to an annual mean equivalent threshold of 60 µg/m^3 nitrogen dioxide. Where predicted concentrations are below this value, it can be concluded that the hourly mean nitrogen dioxide limit value (200 µg/m^3 NO_2 not to be exceeded more than 18 times per year) will be achieved.

9.4.2 Fugitive Dust Emissions Methodology

Fugitive emissions of dust occur during demolition and construction as a result of abrasive forces on materials. Consequential effects occur when this occurs to such an extent that there is a significant increase in airborne particles and/or deposition of these particles on property. These effects are usually only observed at the immediate vicinity of the source and is highly dependent on local factors. Under part 1 of the Government of Ireland air pollution act 1987 (Ref. 9-13) air pollution (including dust, as defined in section 7 of this act) can be defined as the condition of the atmosphere in which a pollutant is present in such a quantity as to be liable to:

- Be injurious to public health, or
- Have a deleterious effect on flora or fauna or damage property, or
- Impair or interfere with amenities or with the environment

Despite this, there is no statutory limit value on this concentration. Professional guidance from the Institute of Air Quality Management (IAQM) (Ref. 9-15) and (Ref. 9-16) does exist on the topic to provide support for assessments of this nature. The majority of these particles are considered to be intermediate to large, *i.e.* >10 µm, therefore not considered a health risk outside of the occupational health risk zone. Particles of this size are unable to penetrate into the deep lung region and are removed by mucociliary clearing. The extent of the impact which dust from the proposed development may have on damage to property or impairment of amenity is slightly less clear. Guidance from the IAQM (Ref. 9-16), suggests that an assessment will be required if human receptors exist within 350 m of the site boundary and/or ecological receptors exist within 50m of the site boundary or 50 m of the site route, up to 500 m from the site entrance. A review imaging from the vicinity of the site indicates that there are commercial and residential properties and the Lower River Shannon SAC around the perimeter of the site. Accordingly, the risk of dust impacts will be assessed qualitatively in 9.5.

The largest source of pollution (particularly PM_{10} and nitrogen dioxide) during the demolition and construction phase is as a result of exhaust emissions from vehicular activity. The IAQM (Ref. 9-15) indicates an increased annual average daily traffic of light duty vehicles or heavy-duty vehicles of 500 and 100, respectively. A change in traffic flow of this magnitude has the potential to cause a significant air quality impact on local receptors and merits a detailed assessment. It is believed that the scale of this potential development would not cause an increase in traffic to such a degree, therefore the potential impact of pollution from vehicle and plant emissions or from demolition and construction activities will not be considered further.

A qualitative assessment has been undertaken to assess the significance of any effects on sensitive receptors associated with the demolition and construction phase. The assessment is based on the Institute of Air Quality Management guidance and it will assess potential sources of emissions on the basis of the four main activity groupings:

- Demolition;
- Earthworks;
- Construction; and
- Track-out.

For each activity group the following steps are applied with respect to identifying the potential effects, before coming to an overall conclusion about the significance of the effects predicted.

The approach to the assessment involves the following process:

- Identify the nature, duration and the location of activities being carried out;
- Establish the risk of significant effects occurring as a result of these activities;
- Review the proposed or embedded mitigation against good site practice;
- Identify additional mitigation measures, if necessary, to reduce the risk of a significant adverse effect occurring at receptors; and
- Summarise the overall effect of the works with respect to fugitive emissions of dust and then report the significance of the effects.

The emphasis of the regulation and control of demolition and construction dust should be the adoption of good working practices. Good practice is a process that is informed by the assessment, which seeks to avoid the potential for adverse effects. This approach assumes that mitigation measures, beyond those inherent in the proposed design, will be implemented during works to ensure potential significant adverse effects do not occur. Receptors during the demolition and construction phase activities include any property where dust soiling or PM_{10} concentrations may cause adverse effects. These are considered to be local residences and sensitive commercial properties in the vicinity of the site. Identification of sensitive commercial properties is a process which requires careful consideration on a case-by-case basis and an understanding of relevant processes, but often includes:

- Cultural heritage locations (art galleries, museums etc.);
- Showrooms;
- Food manufacturing/food merchants;
- Manufacturing processes which could be sensitive to dust deposition; and
- Sensitive ecological sites

A review of the local area indicates that there are several residential and commercial properties located in close proximity to the site, along Ellen Street, Michael Street and Rutland Street, in addition to the Lower River Shannon SAC.

9.4.3 Quantification of Carbon Dioxide from Road Traffic Methodology

Carbon dioxide from road traffic is quantified using Defra’s Emissions Factor Toolkit for the same spatial area for the local assessment. Use of this tool is endorsed by the guidance from the National Roads Authority (Ref. 9-18). The tool calculates emissions of pollutants in g/km based on the user defined traffic flow and fleet composition. This is then multiplied by the length of road within the modelled domain to achieve a mass of pollutant per road link, which are summed to represent the scheme.

9.4.4 Determination of Significance

9.4.4.1 Significance of Effects on Local Air Quality or Ecological Sites

The National Roads Authority's Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (Ref. 9-18) offers guidance defining significance of a scheme in terms of change in pollutants. The document sets out impact descriptors at each human receptor, set out in Table 9-11, which then inform descriptors for change with consideration to EU limit values, this is outlined in Table 9-12. The outcome of this process is then reported in terms of the descriptors used by EPA (2017) Guidance (Guidelines on the Information to be contained in Environmental Impact Assessment Reports, Draft), as outlined in Section 1.3.2 of this document.

Table 9-11. Descriptors for magnitude by changes in ambient pollutant concentrations

Magnitude of change	Annual Mean NO_2/PM_{10}	No. of days with PM_{10} concentrations greater than 50µg/m^3	Annual mean $PM_{2.5}$
Large	Increase/decrease ≥4 µg/m^3	Increase/decrease >4 days	Increase/decrease ≥2.5µg/m^3
Medium	Increase/decrease 2-≥4µg/m^3	Increase/decrease 3 or 4 days	Increase/decrease 1.25-<2.5µg/m^3
Small	Increase/decrease 0.4-<2 µg/m^3	Increase/decrease 1 or 2 days	Increase/decrease 0.25-<1.25µg/m^3
Imperceptible	Increase/decrease <0.4 µg/m^3	Increase/decrease <1 day	Increase/decrease <0.25µg/m^3

Table 9-12. Impact descriptors for change to annual mean pollutant concentrations

Absolute concentration	Small magnitude of change	Medium magnitude of change	Large magnitude of change
40 µg/m^3 for NO_2/PM_{10} or 25 µg/m^3 for $PM_{2.5}$	Slight	Moderate	Substantial
36-40 µg/m^3 for NO_2/PM_{10} or 22.5-25 µg/m^3 for $PM_{2.5}$	Slight	Moderate	Moderate
30-36 µg/m^3 for NO_2/PM_{10} or 18.75-22.5 µg/m^3 for $PM_{2.5}$	Negligible	Slight	Slight
<30 µg/m^3 for NO_2/PM_{10} or <18.75 µg/m^3 for $PM_{2.5}$	Negligible	Negligible	Slight

When assessing significance of effects on ecological receptors, the National Roads Authority's guidance document (Ref. 9-18) states:

> "Where a scheme is expected to cause an increase in concentration of more than 2 µg/m3 and the predicted concentrations (including background) are close to (within 10% of) or exceed the standard then the sensitivity of the habitat to NOx should be assessed by the project Ecologist."

The guidance also states, with reference to deposition of nitrogen:

> *"The road contribution to dry deposition should then be calculated and compared with the published critical loads for the selected habitat. The change in deposition due to the scheme should be assessed in relation to the relevant critical load by the project Ecologist."*

Section 9.5 presents the magnitude of the change in NOx concentrations and deposited nitrogen. The significance of this change is considered in the Chapter 17 Biodiversity.

9.4.4.2 Significance of Effects on Amenity due to Fugitive Dust

Significance criteria outlined in section 1.5.3.9 indicate that it is necessary to classify the significance of the existing environment, along with magnitude of change to derive significance. For the assessment of the effect of amenity due to fugitive dust, the existing environment will be defined as of high significance. This is due to the proximity of the ecological sites and the assumed good dust climate as the site currently operates. The assessment of fugitive dust carried out in the next section will determine the magnitude of change to derive significance based on the Table 9-13.

Table 9-13. Significance due to magnitude of change for fugitive dust emissions

Magnitude of Change		Significance
High	→	Profound
Medium	→	Very Significant/Significant
Low	→	Significant/Moderate
Negligible	→	Not Significant
No change	→	Neutral

9.4.4.3 Significance of Effects on Climate

Magnitude of change of carbon dioxide as a result of the scheme will be treated in a similar manner to how magnitude of change is defined for local air quality. Table 9-14 displays the approach to defining magnitude of change in carbon dioxide to determine significance.

Table 9-14. Significance due to magnitude of change for local road derived carbon dioxide

Change in local road derived carbon dioxide	Magnitude of change	Significance
Increase/decrease ≥25%	High	Profound
Increase/decrease 25-10%	Medium	Very Significant/Significant
Increase/decrease 5-10 %	Low	Significant/Moderate
Increase/decrease 1-5 %	Negligible	Not Significant
Increase/decrease <1 %	No change	Neutral

9.5 Assessment of Emissions from Roads

9.5.1 Human Receptors

Assessing impacts at human receptors in the operational phase of the proposed development predicts annual mean concentrations of nitrogen dioxide, particulate matter, fine particulate matter, the number of exceedances of the 24-hr particulate matter limit value and the number of exceedances of the hourly nitrogen dioxide limit value at the selected existing and proposed air quality sensitive receptors.

Table 9-15 shows the predicted concentrations of pollutants at receptors under the base year scenario, which includes 2017 traffic data, 2017 met data, 2017 backgrounds and 2017 emissions factors. The table shows that concentrations of pollutants at receptors are considerably smaller than the EU limit value as outlined in Table 9-15. The modelling predicts that there are no exceedances of the 24-hr particulate matter limit value or the number of exceedances of the hourly nitrogen dioxide limit value.

Table 9-15. Predicted pollutant concentrations at receptors in the 2017 scenario

Receptor	Total NO_2 Concentration ($\mu g/m^3$)	Total PM_{10} Concentration ($\mu g/m^3$)	$PM_{2.5}$ Concentration ($\mu g/m^3$)
R1	20.9	9.8	6.0
R2	10.8	8.6	5.2
R3	10.8	8.6	5.2
R4	12.4	8.8	5.4
R5	12.1	8.8	5.4
R6	11.8	8.7	5.3
R7	11.6	8.7	5.3
R8	11.5	8.7	5.3
R9	9.1	8.3	5.1
R10	8.9	8.3	5.1
R11	8.9	8.3	5.1
R12	7.5	8.1	4.9
R13	12.3	8.8	5.3
EU Limit Value	40	40	25

Modelling for the operational effects during opening year of the development (Phase 1 -2022), opening year + 5 year forecast (2027) and opening year + 15 year forecast (2037) for do-nothing and do-something scenarios all predict smaller concentrations of pollutants at each receptor than the base year scenario. Table 9-16 shows the differences in pollutant concentrations for the do-something and do-nothing scenarios at each receptor for each scenario year.

Table 9-16. Predicted differences between do-something and do-nothing scenarios for each traffic year

Receptor	NO_2 Concentration difference between do-something and do-nothing ($\mu g/m^3$)	PM_{10} Concentration difference between do-something and do-nothing ($\mu g/m^3$)	$PM_{2.5}$ Concentration difference between do-something and do-nothing ($\mu g/m^3$)
2022			
R1	0.5	0.1	0.1
R2	0.3	0.1	<0.1
R3	0.3	0.1	<0.1
R4	0.5	0.1	0.1
R5	0.5	0.1	0.1
R6	0.5	0.1	0.1
R7	0.5	0.1	0.1
R8	0.5	0.1	0.1
R9	0.5	0.1	0.1
R10	0.5	0.1	0.1
R11	0.4	0.1	0.1
R12	0.4	0.1	<0.1
R13	0.8	0.2	0.1
2027			
R1	0.5	0.1	0.1
R2	0.2	0.1	<0.1
R3	0.2	0.1	<0.1
R4	0.3	0.1	0.1
R5	0.3	0.1	0.1
R6	0.3	0.1	0.1
R7	0.3	0.1	0.1
R8	0.3	0.1	0.1
R9	0.3	0.1	0.1
R10	0.3	0.1	0.1
R11	0.3	0.1	<0.1
R12	0.2	0.1	<0.1
R13	0.5	0.2	0.1
2037			
R1	0.3	0.1	0.1
R2	0.2	0.1	<0.1

Receptor	NO_2 Concentration difference between do-something and do-nothing (µg/m^3)	PM_{10} Concentration difference between do-something and do-nothing (µg/m^3)	$PM_{2.5}$ Concentration difference between do-something and do-nothing (µg/m^3)
R3	0.2	0.1	<0.1
R4	0.3	0.1	0.1
R5	0.3	0.1	0.1
R6	0.3	0.1	0.1
R7	0.3	0.1	0.1
R8	0.3	0.1	0.1
R9	0.2	0.1	0.1
R10	0.2	0.1	0.1
R11	0.2	0.1	<0.1
R12	0.2	0.1	<0.1
R13	0.5	0.2	0.1

Construction phase emissions of pollutants were calculated using the methods using the same parameters as the 2017 model, with the exception of increased HDV flows appropriately. The model predicts nitrogen dioxide concentrations increases by less than 0.1 µg/m^3 at any given receptor.

Based on the method for determining significance of impacts, as outlined in Table 9-11 of section 9.4.4.1 of this chapter, the changes in the concentration of nitrogen dioxide, PM_{10} and $PM_{2.5}$ at all receptors for each traffic year results in a small or imperceptible magnitude of change. This equates to an overall negligible impact, as per Table 9-12. In terms of the impact descriptors outlined in Section 1.3.2 of this document, this can be considered not significant in terms of contribution to nitrogen dioxide, PM_{10} and $PM_{2.5}$ in the construction and operational phase.

9.5.2 Ecological Receptors

Modelling predicts that NO_x emissions from roads, as currently operate (base year scenario), exceed the critical level of 30 µg/m^3. It is predicted that each scenario year with the development in place, concentrations of NO_x will improve relative to this base year. The largest predicted oxides of nitrogen concentration change between do minimum and do something scenarios on the Lower River Shannon SAC, exist on the river bank at the corner of R445 and Bridge Street (E2). The largest change is predicted to occur in operational year 2022, where a concentration of 1.2 µg/m^3 is predicted. As this concentration change is less than 2 µg/m^3, there is no need to refer this value to the project Ecologist, as recommended by National Roads Authority guidance (Ref. 9-17). Tabulated values of these concentrations and changes are available in Table 9-17. Assessment of NO_x concentrations at ecological receptors during the construction phase were calculated using the methods using the same parameters as the 2017 model, with the exception of increased HDV flows. Concentrations of NO_x at receptors during the construction phase increased by less than 0.1 µg/m^3 at all receptors.

Table 9-17. NO_x concentrations at receptors in operational scenarios

Receptor	Total NOx at receptor points (µg/m³)							Change greater than 2 µg/m³ within scenario?
	BY	2022DM	2022DS	2027DM	2027DS	2037DM	2037DS	
E1	33.7	24.3	25.2	17.7	18.4	16.2	16.6	No
E2	47.0	33.1	34.3	23.5	24.6	21.3	22.0	No
E3	34.1	25.1	26.4	18.4	19.2	16.7	17.4	No
E4	35.4	26.2	27.4	19.2	20.0	17.4	18.0	No

The largest predicted deposited nitrogen concentration from road traffic during the operational years of the scheme occurs in year 2022 with the scheme in place. Under this scenario, the absolute concentration is predicted to be 1.9 Kg(N)/ha/yr., which includes background concentrations as determined from background nitrogen dioxide. Deposited nitrogen concentrations for each assessment year are displayed in Table 9-18. This is lower than the concentrations predicted for the baseline year 2017.The table of nitrogen sensitive habitats listed within National Roads Authority guidance (Ref. 9-18) does not list a habitat which closely resembles the Lower River Shannon SAC, site specific critical load values are therefore difficult to determine. The lowest critical load value presented in the table is 5 Kg(N)/ha/yr taking this as a critical value for this site presents itself as a very conservative approach, despite this it is predicted that there will be no exceedances of this critical load for any scenario.

Table 9-18. Deposited nitrogen concentrations in each assessment year

Receptor	Deposited Nitrogen (Kg(N)/ha/yr)						
	BY	2022DM	2022DS	2027DM	2027DS	2037DM	2037DS
E1	1.9	1.4	1.5	1.1	1.1	1.0	1.0
E2	2.6	1.9	1.9	1.4	1.4	1.2	1.3
E3	1.9	1.5	1.5	1.1	1.1	1.0	1.0
E4	2.0	1.5	1.6	1.1	1.2	1.0	1.1

9.6 Assessments of Fugitive Dust Impacts

The early phases of the works will involve excavations and earthworks and temporary stockpiling of potentially dusty material. These activities are likely to be the principal sources of dust during these early phases. During the middle phases, when the buildings are erected the principal sources of dust are likely to be from the cutting and grinding of materials and the movement of construction related road vehicles. The latter phases, when the majority of the buildings and infrastructure are complete, will involve the landscaping and finishing works. During these phases, the principal sources of dust will include the storage, handling and movement of materials generated during the associated earthworks.

9.6.1 Demolition

There are several structures which will be cleared. Without standard environmental management measures, there is the potential for emissions of dust associated with demolition work to impact upon the nearest sensitive receptors. Environmental management measures will be implemented on site to control emissions of dust during the demolition works. Such measures are in common use on all well managed construction sites, if implemented correctly, have a proven track record of controlling emissions so that a significant effect does not occur. Such measures considered good practice include, but are not limited to:

- required demolition works to be undertaken in a phased and controlled manner;
- the dampening down of potential dust generating demolition activities;
- regular inspections of works for visible signs of emissions of dust and early application of measures to minimise emissions at source; and
- considerate location of temporary storage of dusty materials and material transfer operations so that it is as far from the nearest sensitive receptors as practicable.

The nearest receptors are adjacent to the proposed demolition works and are potentially highly sensitive to dust and particulate matter. This makes the construction of the Proposed Development a high-risk site that will require normal good working practices to be adopted to prevent potential impacts being realised. Given the likely methods of work, scale and materials involved in the demolition works, it is considered that with good site practices of the types identified in the CMPP, the demolition works would have a negligible effect on amenity.

9.6.2 Earthworks

Site clearance works, the removal of material for the car park excavation and temporary stockpiling of material represent the principal activities that may generate emissions of dust. The potential for stockpiles of materials to generate dust depends on the nature of the material. Earth is soft and friable compared to hardcore. However, hardcore generally has a lower moisture content than soil, and consequently they can both be a potential source of dust. Standard mitigation measures would be implemented onsite to control emissions of dust during the earthworks. Such measures are in common use on all well managed construction sites and, if implemented correctly, have a proven track record of controlling emissions so that a significant effect does not occur. Such mitigation measures considered good practice include:

- Use Hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable; and
- Only remove the cover in small areas during work and not all at once.

The risk of amenity effects and the amount of mitigation effort required is strongly influenced by weather conditions at the time of the works. There is the potential for site specific earthworks to generate dust at identified receptors. Given the likely methods of work, scale of materials involved in the earthworks, it is considered that with good site practices identified in the CMPP, they would have a negligible effect on amenity.

9.6.3 Construction

Dust emissions during construction can give rise to elevated dust deposition. These are generally short-lived changes over a few hours or days, which occur over a limited time period of several weeks or months. Placing activities which are a potential source of dust such as cutting and grinding of materials and cement mixing away from boundaries would minimise the possibility of exposure at receptors. If this measure is implemented, then impacts on dust concentrations at local receptors are capable of being reduced to at worst a minor adverse level. Good site practice measures during this phase of the project are similar to those described above. Standard mitigation measures would be implemented onsite to control emissions of dust during construction include:

- Avoid scrabbling (roughening of concrete surfaces);
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery; and
- For smaller supplies of fine powder materials ensure bags are sealed after use and stored to prevent dust.

Given the likely methods of work, scale and materials involved in the construction works, it is considered that with good site practices identified in the CMPP, the construction works would have a negligible effect on amenity and short-term emissions of fugitive dust.

9.6.4 Track Out

The impact of track-out of material can be minimised by limiting the amount of material transferred onto local roads and by removal of any transferred material from the roads. The impacts associated with the track-out of material can be controlled through the measures set out in the CMPP, such that it would have a negligible effect on amenity.

9.6.5 Summary

The conclusion of the fugitive dust assessment indicates that the proposed development would have, at worst, a small effect on amenity. In the context of significance outlined in section 9.4.4.1, the fugitive dust impacts have been defined as negligible, which is determined as not-significant as per section 1.5.3.9.

9.7 Assessment of Climate

As outlined in the introduction section of this chapter, the assessment of effects due to climate change must consider the influence this scheme may have on climate change, as well as the resilience of the scheme to future climate change.

With regards to the impact that future climate change may have on the scheme, the reader is directed to Chapter 8 for the consideration of future hydrological impacts and associated mitigation. Chapter 16 assesses impacts on biodiversity and gives regard for climate. With respect to future hydrological impacts or impacts on biodiversity, the assessment of climate concludes no significant outcomes.

With consideration to the input this scheme may have on climate change, annual quantities of carbon dioxide were predicted, as set out in the methodology section of this chapter. Table 9-19 shows that the local traffic derived carbon dioxide for the proposed development is set to increase by up to 20% relative to the baseline year and up to 8% relative to future base year. This is defined as very significant/significant and significant/moderate, respectively, as defined in section 9.4.4.1 and represents an expected outcome for a development that introduces an increased number of vehicle movements through the regeneration of land.

The mass of carbon dioxide for the transport sector as suggested in the Irish Greenhouse Gas Emissions Projections 2017-2035 indicates a total mass of 13 Mt for 2017 increasing to 14.8 Mt by 2035. The difference in mass of road derived carbon dioxide with the proposed development in place in 2037 relative to the proposed development not going ahead is 48 tonnes per year. This value represents less than 0.0004% of the national total for transport.

Table 9-19. Local road derived carbon dioxide quantities due to the proposed development

	Assessment Year		
	2022	2027	2037
Change in annual CO_2 emissions from future baseline year (tonnes)	54	50	48
Change relative to future baseline (%)	8%	7%	7%
Change in annual CO_2 emissions from current baseline year (tonnes)	105	95	125
change relative to current baseline (%)	17%	15%	20%

9.8 Mitigation Measures

9.8.1 Local Air Quality

Based on the assessments carried out in the previous sections, it is unlikely that further mitigation for the operational effects of the proposed development are required for the effects of nitrogen dioxide, PM_{10} or $PM_{2.5}$.

9.8.2 Fugitive Emissions of Dust

Demolition, earthworks and construction activities have been defined as a medium risk, while trackout activities have been defined as a small risk of dust impacts. IAQM guidance specifies that the highest category of risk should be applied to all activities when assigning mitigation measures to reduce dust emission from each of these four activities to low/negligible level. Procedures to assess deposition of dust shall be undertaken on site. Due to the proximity of human and ecological receptors, measurement data shall be obtained from at least three points on the site boundary. A sampling campaign, including baseline measurements (prior to construction), of sticky pads will consist of a suitable approach to collecting a catalogue of emitted dust particles. In addition to this the following section describes measures for the purpose of dust suppression that will be included in the CMPP which are considered standard practice.

Measures Specific to Demolition (medium risk):

- Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust);
- Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as water can be directed to where it is needed;
- Avoid explosive blasting, using appropriate manual or mechanical alternatives; and
- Bag and remove biological debris or damp down such material before demolition.

Measures Specific to Earthworks (High risk):

- Ensure excavated soil is stored in appropriate areas and removed from site as soon as practicable
- Use Hessian, mulches or tackifiers where it is not possible to cover with topsoil, as soon as practicable; and
- Only remove the cover in small areas during work and not all at once.

Measures Specific to Construction (medium risk):

- Avoid scabbling (roughening of concrete surfaces); and
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;

Measures Specific to Trackout (low risk):

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site;
- Avoid dry sweeping of large areas;
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport; and
- Implement a wheel washing system to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable.

9.8.3 Climate Change Mitigation

Mitigation measures in place to address the vulnerability of the proposed development to the potential effects of climate change are covered in chapter 8 and 9 of this document. These includes a finished floor level for the new buildings which allows for climate change and emergency plans and evacuation procedures. Mitigation measures to reduce the impact which the proposed development may have on climate change will include the measures which are consistent with good practice regarding sustainable building design, safe bicycle storage and electric car charge points.

9.9 Residual Impacts

Under appropriate mitigation, it is predicted that there will be no significant air quality or climate impacts due to this development.

9.10 Difficulties Encountered in Compiling Information

There were no difficulties compiling information.

9.11 Cumulative Impacts

There are several developments determined by Limerick City Council as a potential cause of cumulative impacts with respect to the EIAR study site. Those are:

- Permitted Part 8 development at the Former GPO incorporating the 'Hanging Gardens', Henry Street & no. 19 Henry Street;
- Permitted Part 8 development at ‘Bishop’s Quay’ including the construction of a residential building comprising 15-storeys over 2-basement levels fronting Bishop’s Quay to provide 35 no. apartments, and;
- The remodelling of O'Connell Street proposed under the LUCROC project.

It is unlikely that exiting receptors outlined in this chapter will suffer cumulative construction related impacts from the proposed development and one of the other proposed developments listed here. This will be further minimised if the council can ensure that good practice is observed during the construction phase of these developments.

Impacts due to increased traffic as a result of these developments has been accounted for with the traffic data used in the assessment in this chapter. These were deemed not to be significant, as outlined in the residual impacts section.

9.12 References

(Ref. 9-1) Council of European Communities (1996), Framework Directive on ambient air quality assessment and management, European Council, 96/62/EC

(Ref. 9-2) Council of European Communities (1999), First Daughter Directive on limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air, 1999/30/EC

(Ref. 9-3) Council of European Communities (2000), Second Daughter Directive on limit values for benzene and carbon monoxide in ambient air, 2000/69/EC

(Ref. 9-4) Council of European Communities (2002), Third Daughter Directive on ozone in ambient air, 2002/3/EC

(Ref. 9-5) Council of European Communities (1997), Council Decision 97/101/EC on exchange of information and data as amended by Commissions Decision 2001/752/EC

(Ref. 9-6) Council of European Communities (2008), Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe

(Ref. 9-7) Air Quality Standards Regulation (2011), S.I 180 of 2011

(Ref. 9-8) Government of Ireland, Department of Housing Planning and Local Government, Project Ireland 2040 National Planning Framework

(Ref. 9-9) AirQWeb (Last accessed 18/12/2018), https://www.airqweb.com/#

(Ref. 9-10) Air Quality in Ireland (2016), Environmental Protection Agency

(Ref. 9-11) Air Quality in Ireland (2015), Environmental Protection Agency

(Ref. 9-12) Limerick City and County Council, (Last accessed 18/12/2018), https://www.limerick.ie/council/services/environment/environmental-control/air-quality#assessments

(Ref. 9-13) Ireland's National Inventory Report 2018

(Ref. 9-14) Air Pollution Act (1987), S.I 6 of 1987

(Ref. 9-15) IAQM (2017) Land-Use Planning and Development Control: Planning for Air Quality

(Ref. 9-16) IAQM (2016) Guidance on the assessment of dust from demolition and construction

(Ref. 9-17) United Kingdom Department for Environment Food and Rural Affairs (Defra) (2015), https://uk-air.defra.gov.uk/data/laqm-background-home

(Ref. 9-18) National Roads Authority (2011), Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes

(Ref. 9-19) United Kingdom Department for Environment Food and Rural Affairs (Defra) (2016), Air Quality Management Technical Guidance 2009 LAQM, TG (16)

(Ref. 9-20) United Kingdom Department for Environment Food and Rural Affairs (Defra) (2003), Air Quality Management Technical Guidance 2003 LAQM, TG (03).

(Ref. 9-21) Laxen and Marner, Analysis of the Relationship Between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, 2003

(Ref. 9-22) AEAT, Analysis of the relationship between annual mean nitrogen dioxide concentration and exceedances of the 1-hour mean AQS Objective. AEA Technology plc, 2008

10 Noise and Vibration

10.1 Introduction

This Chapter presents an assessment of the likely significant effects of the construction and operation of the proposed mixed-use development with respect to noise and vibration. This Chapter describes the methods used to assess the effects; the baseline conditions currently existing at the Site and surrounding area; the likely noise and vibration impacts upon noise sensitive receptors (NSRs); the measures required to prevent, reduce or offset any significant negative effects; and the likely residual effects after these measures have been adopted.

Noise theory and terminology are given in Appendix 10.A.

10.2 Methodology

10.2.1 Legislative context

10.2.1.1 Transport Infrastructure Ireland, TII (formerly National Roads Authority, NRA)

The National Roads Authority (NRA) and now Transport Infrastructure Ireland (TII) have published guidelines which propose design goals for noise related to both the construction and operational stages of new road schemes (NRA, 2004) (TII, 2004).

There are no national roads within the Proposed Project. While the proposed project will involve modal distribution of traffic flows, it does not involve the construction of new roads.

10.2.1.2 National Planning Policy

National Planning Framework 2040, February 2018

The National Planning Framework 2040 (NPF) was introduced in February 2018 (DHPLG), 2018). The document sets out the Government’s planning policies for Ireland and how these are expected to be applied.

The planning system is required to contribute to and enhance the natural and local environment. Consequently, the aim is to prevent both new and existing development from contributing to or being put at unacceptable risk from or being adversely affected by unacceptable levels of noise pollution.

With regards to noise, the NPF states that planning policies and decisions should aim to create a clean environment for a healthy society by:

> *“Noise Management and Action Planning – Measures to avoid, mitigate and minimise or promote the pro-active management of noise, where it is likely to have significance adverse impacts on health and quality of life, through strategic noise mapping, noise action plans and suitable planning conditions.*
>
> *Noise, Amenity and Privacy – This includes but is not limited to, good acoustic design in new developments, in particular residential development, through a variety of measures such as setbacks and separation between noise sources and receptors, good acoustic design of buildings, building orientation, layout, building materials and noise barriers and buffer zones between various uses and thoroughfares.*

> *Quiet Areas – The further enjoyment of natural resources, such as our green spaces and sea frontage, through the preservation of low sound levels or reduction in undesirably high sound levels, is particularly important for providing respite from high levels of urban noise. As part of the noise action plans, an extra value placed on these areas, in terms of environmental quality and the consequential positive impact on quality of life and health, due to low sound levels and the absence of noise, can assist in achieving this."*

In addition, Government Policy Objective 65 aims to:

> *"Promote the pro-active management of noise where it is likely to have significant adverse impacts on health and quality of life and support the aims of the Environmental Noise Regulations through national planning guidance and Noise Actions Plans".*

The proposed development will be progressed in accordance with the aims of this National Planning Policy.

10.2.1.3 Local Planning Policy

Limerick Draft Noise Action Plan, May 2018

In May 2018, Limerick City and County Council published their Draft Noise Action Plan (LCCC, 2018), as required under the EU Directive 2002/49/EC, relating to the assessment and management of environmental noise.

The development of noise action plans aims to reduce environmental noise where necessary and maintains a quality acoustic environment where it is good.

In order to meet National Policy Objective 65 within the NPF, LCCC will take a strategic approach to managing environmental noise within its functional area by ensuring that appropriate noise assessments are carried out in respect of planning applications for residential and other noise sensitive developments and the principles of good acoustic design applied.

The proposed development will be progressed in accordance with the aims of this Local Planning Policy.

10.2.2 Other Guidance

Many of the Guidance documents and Standards employed within the UK are adopted in Ireland. These are detailed below.

10.2.2.1 British Standard 7445-1:2003

BS 7445 'Description and measurement of environmental noise' (BSI, 2003) defines parameters, procedures and instrumentation required for noise measurement and analysis.

10.2.2.2 British Standard 5228:2009+A1:2014

There is currently no published statutory Irish guidance relating to the maximum allowable noise level that may be generated during the construction phase of a project. BS 5228:2009+A1:2014 'Code of Practice for Noise and Vibration Control on Construction and Open Sites' (BSI, 2014a) sets construction noise and vibration criteria with reference to existing noise levels. In this instance, the limits within BS 5228 are considered to be the most appropriate noise limits to apply.

Construction Noise

BS 5228-1 (BSI, 2014b) provides a 'best practice' guide for noise control and includes Sound Power Level (Lw) data for individual plant as well as a calculation method for noise from construction activities.

The calculation method provided in BS 5228 takes account of factors including the number and types of equipment operating, their associated Sound Power Levels (SWLs), their modes of operation (% on-times within the working period), the distance to noise sensitive receptors (NSRs), and the effects of any intervening ground cover or barrier/ topographical screening. This allows prediction of the magnitude of impact.

The subsequent assessment of construction noise ‘effects’ at sensitive receptors is based on the guidance in ‘example method 1 – the ABC method’ as defined in BS 5228-1:2009+A1:2014 (BSI, 2014b).

Construction Vibration

BS 5228-2 ‘Code of practice for noise and vibration control on construction and open sites. Vibration’ (BSI, 2014c) provides comparable ‘best practice’ for vibration control, including guidance on the human response to vibration and building damage.

Vibration due to construction activities has the potential to result in adverse impacts at nearby NSRs. The transmission of ground-borne vibration is highly dependent on the nature of the intervening ground between the source and receiver and the activities being undertaken. BS 5228-2: 2009+A1: 2014 ‘Code of Practice for Noise and Vibration Control on Construction and Open Sites - Vibration’ (BSI, 2014c) provides data on measured levels of vibration for various construction works, with particular emphasis on piling. Impacts are considered for both damage to buildings and annoyance to occupiers.

10.2.2.3 British Standard 8233: 2014

BS 8233 (BSI, 2014d) provides criteria for the assessment of internal and external noise levels for various uses. These criteria apply to general ambient noise defined as “sources without a specific character, previously termed ‘anonymous noise’. For commercial/industrial type noise sources BS 8233 identifies BS 4142 (BSI, 2014e) as a suitable assessment method.

BS 8233 notes that if closed windows are required to meet the internal guide values, there needs to be appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level. BS 8233 also notes that where development is considered necessary or desirable, despite external noise levels above the external target levels, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

10.2.2.4 British Standard 4142:2014

BS 4142 ‘Methods for rating and assessing industrial and commercial sound’ (BSI, 2014e) can be used for assessing the effect of noise of an industrial nature, including mechanical services plant noise.

The basis of BS 4142 is a comparison between the background noise level in the vicinity of residential locations and the rating level of the noise source under consideration. The relevant parameters in this instance are as follows:

- Background Sound Level – $L_{A90,T}$ – defined in the Standard as the ‘A’ weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels;
- Specific Sound Level – $L_{Aeq,Tr}$ – the equivalent continuous ‘A’ weighted sound pressure level produced by the specific sound source at the assessment location over a given time interval, T;
- Residual Sound Level - $L_{Aeq,T}$ - the equivalent continuous ‘A’ weighted sound pressure level at the assessment location in the absence of the specific sound source under consideration, over a given time interval, T; and

- Rating Level – $L_{Ar,Tr}$ – the specific sound level plus any adjustment made for the characteristic features of the noise.

The standard recognizes that certain acoustic features of a sound source can increase the impact over that expected based purely on the sound level. The standard identifies the following features to be considered:

- Tonality – a penalty of 2 dB is applied for a tone which is just perceptible at the receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible;
- Impulsivity - a penalty of 3 dB is applied for impulsivity which is just perceptible at the receptor, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible. An impulse is defined as the sudden onset of a sound;
- Intermittency – a penalty of 3 dB can be applied if the intermittency of the specific sound is readily identifiable against the residual acoustic environment at the receptor i.e. it has identifiable on/off conditions; and
- Other sound characteristics – a penalty of 3 dB can be applied where the specific sound features characteristics that are neither tonal or impulsive but are readily distinctive against the residual acoustic environment.

Once any adjustments have been made, the background level and the rating levels are compared. The standard states that:

- ‘Typically, the greater the difference, the greater the magnitude of impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending upon the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending upon the context.
- The lower the rating level is to the measured background sound level, the less likely it is that the specific sound will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending upon the context.’

The standard emphasises the importance of taking context into consideration and identifies a range of pertinent factors including:

- The absolute level of the sound;
- The character and level of the residual sound compared to the character and level of the specific sound, for example, comparing the frequency spectrum and variation over time; and
- The sensitivity of the receptor, including whether affected residential properties incorporate design measures to secure a good internal acoustic environment.

The standard specifies the specific sound level as an L_{Aeq} with a one-hour assessment period during the day (07:00-23:00) and a fifteen minute assessment period at night (23:00-07:00).

10.2.2.5 Calculation of Road Traffic Noise

The ‘Calculation of Road Traffic Noise’ (DfT/ Welsh Office, 1988) describes procedures for traffic noise calculation, and is suitable for environmental assessments of schemes where road traffic noise may have an effect. The criteria for the assessment of traffic noise changes arising from construction and operational road traffic have been taken from the Design Manual for Roads and bridges (DMRB) (Highways Agency, 2011).

10.2.3 Informal Consultation

Following discussions with Limerick City and County Council (LCCC) the proposed monitoring and assessment methodology was established, including:

- The noise monitoring locations on the site boundary.
- The suitability of the site for residential use to be assessed in terms of acceptable internal and external noise levels. Internal noise levels estimated based on the predicted future noise levels from road traffic and measured operational noise levels at the existing land uses and assessed against the levels given in BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'. External noise levels are to be assessed against the upper guideline value of 55 dB $L_{Aeq,16hr,}$ also given in BS 8233:2014.
- A quantitative assessment of noise and vibration from construction activities to l be undertaken using the prediction and assessment methods given in BS 5228: 2009+A1 2014 'Control of Noise and Vibration from Construction and Open Sites' Parts 1 and 2. Construction noise impacts to be assessed using the TII 70 dB L_{Aeq} limit for construction noise and the BS 5228 ABC Method.
- Noise levels across the site due to future with development road traffic predicted to determine noise impacts upon proposed noise sensitive land uses (offices, residential, aparthotel and library/educational).
- At this stage, details of proposed fixed plant are not available; therefore, a full BS 4142 assessment cannot be undertaken. Instead, limits for fixed plant (in the form of a maximum rating level) will be recommended. The LCCC requirement is a Rating Level of equal to background at existing and proposed residential properties.
- Any changes in road traffic noise levels, at selected existing residential receptors predicted using the standard methodology given in the 'Calculation of Road Traffic Noise' (CRTN). The predictions to be based on baseline and with development traffic data. The significance of the impact of changes in road traffic noise will be assessed, based on the guidance given in the 'Design Manual for Roads and Bridges' (DMRB).

10.2.4 Assessment Methodology

10.2.4.1 Sensitive Receptors

Due to the location of the Proposed Development there are many sensitive receptors surrounding the Site. These receptors include residential properties, offices, educational and cultural uses. For the construction and operational noise assessments a number of representative receptors have been selected surrounding the site. These are detailed in Table 10.1 and Figure 10.1.

Table 10.1: Selected Existing Sensitive Receptors

Receptor Reference	Address	Receptor Type	Sensitivity
R1	Rutland House, Rutland Street	Residential	High
R2	The Hunt Museum, Rutland Street	Museum	High
R3	Sarsfield House, Francis Street	Offices	Medium
R4	16-19 Ellen Street	Retail. Assumed residential above.	Medium/High
R5	Westgate House, Michael Street	Residential	High
R6	1 – 6 Michael Street	Offices	Medium
R7	Limerick School of Art and Design, George's Quay	Educational	High
R8	7 Bank Place	Offices	Medium
R9	2-3 Rutland Street	Retail. Assumed residential above.	Medium/High
R10	1 George's Quay	Bar. Assumed residential above.	Medium/High
R11	The Granary	Offices (to be refurbished)	Medium
R12	9-11 Patrick Street	Retail/commercial. Assumed residential above	Medium/High

10.2.4.2 Noise Measurements

Baseline noise monitoring has been undertaken in line with measurement guidance in British Standard BS 7445: 2003 'Description and Measurement of Environmental Noise'.

10.2.4.3 Construction Noise and Vibration

Assessment of Construction Noise Effects

Before the appointment of a construction contractor, site specific details on the construction activities, programme and number or type of construction plant are not available.

Construction noise predictions have been undertaken using the calculation methods set out in BS 5228:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' (BSI, 2014a), using a selection of typical demolition and construction plant based on experience of similar schemes.

The calculation method provided in BS 5228 (BSI, 2014b) takes account of factors including the number and types of equipment operating, their associated Sound Power Levels (SWLs), their modes of operation (% on-times within the working period), the distance to NSRs, and the effects of any intervening ground cover or barrier/ topographical screening. This allows prediction of the magnitude of impact.

TII published the ‘Good Practice Guidance for the Treatment of Noise and Vibration in National Road Schemes’. These guidelines proposed design goals for noise related to construction and recommends a maximum noise level of 70 dB L_{Aeq} at noise sensitive receptors. Predicted noise levels have initially been assessed against this limit.

In addition to assessing the predicted noise levels against the TII limit of 70 dB L_{Aeq}, they have also been assessed based on the guidance in ‘example method 1 – the ABC method’ as defined in BS 5228-1:2009+A1:2014 (BSI, 2014a). Table 10.2 (reproduced from BS 5228) provides guidance in terms of appropriate threshold values for residential NSRs, based upon existing ambient noise levels. Whilst the threshold values are for residential noise sensitive receptors, these have also been applied to non-residential sensitivity receptors.

Table 10.2: Construction Noise Thresholds at Residential Dwellings

Assessment Category and Threshold Value Period	Threshold Value $L_{Aeq,T}$ dB(A) – free-field		
	Category A (a)	**Category B (b)**	**Category C (c)**
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends (d)	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

NOTE 1: A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise.

NOTE 3: Applies to residential receptors only.

(a) Category A: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

(b) Category B: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values.

(c) Category C: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values.

(d) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays, 07:00 – 23:00 Sundays.

For the appropriate period (day, evening, night, weekend etc.), the ambient noise level is determined and rounded to the nearest 5 dB and the appropriate Threshold Value is then derived. The predicted construction noise level is then compared with this Threshold Value. Based upon this BS 5228 ABC method (BSI, 2014b), the criterion adopted in this assessment for the determination of potentially significant effects is the exceedance of the $L_{Aeq,T}$ threshold level for the category appropriate to the ambient noise level at each NSR.

Based upon the above, the magnitude of the impact of construction noise is classified in accordance with the descriptors in Table 10.3.

Table 10.3: Magnitude of Construction Noise Impacts

Magnitude of Impact	$L_{Aeq,T}$ dB (façade)
High	Exceedance of ABC Threshold Value by ≥5dB
Medium	Exceedance of ABC Threshold Value by up to 5dB
Low	Equal to or below the ABC Threshold Value by up to 5dB
Negligible	Below the ABC Threshold Value by ≥5dB

Assessment of Construction Vibration Effects

Vibration due to construction activities has the potential to result in adverse impacts at nearby NSRs. The transmission of ground-borne vibration is highly dependent on the nature of the intervening ground between the source and receiver and the activities being undertaken. BS 5228-2: 2009+A1: 2014 ‘Code of Practice for Noise and Vibration Control on Construction and Open Sites - Vibration’ (BSI, 2014c) provides data on measured levels of vibration for various construction works, with particular emphasis on piling. Impacts are considered for both damage to buildings and annoyance to occupiers.

With regards to annoyance, the magnitude of the impact of construction vibration from piling is classified with the descriptors in Table 10.4, taken from Table B.1 in BS 5228-2.

Table 10.4: Magnitude of Construction Vibration Impacts

Vibration level ppv mms^{-1}	Effect		Magnitude of Impact
10	Vibration is likely to be intolerable for any more than a brief exposure at this level.	Intolerable	High
1	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.	Complaints likely	Medium
0.3	Vibration might just be perceptible in residential environments	Just perceptible	Low
0.14	Vibration may be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	Complaints unlikely	Negligible

With regards to building damage, the threshold values for construction vibration are classified within Table B.2 in BS 5228-2 (taken from BS7385:1993). These threshold values are given in Table 10.5.

Table 10.5: Transient Vibration Guide Values for Cosmetic Damage

Building type	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mms^{-1} at 4 Hz and above	50 mms^{-1} at 4 Hz and above
Unreinforced or light framed structure Residential or light commercial buildings	15 mms^{-1} at 4 Hz increasing to 20 mms^{-1} at 15 Hz	20 mms^{-1} at 15 Hz increasing to 50 mms^{-1} at 40 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mms^{-1} at 4 Hz and above	50 mms^{-1} at 4 Hz and above

Note 1: Values referred to are at the base of the building.

Note 2: For unreinforced or light framed structures and residential or light commercial buildings, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.

These levels were derived following an extensive review of UK data (which yielded very few cases of vibration-induced damage) and include the results of experimental investigations carried out in other countries into vibration-induced damage thresholds. Note the standard uses peak component particle velocity for guidance purposes. The levels suggested are judged to give a minimal risk of vibration induced damage.

The estimated Peak Particle Velocity (ppv) values due to construction works on Site are compared to the target limits specified above to determine the significance of the vibration effect in terms of cosmetic building damage.

These values are for vibration that is classified as intermittent. If the vibration is of sufficient duration that it can give rise to amplification within a building structure due to resonance, these limit values should be halved.

The guidance presented in BS 7385 states that for intermittent vibration the probability of cosmetic damage occurring tends to zero at a level of 12.5 mms^{-1} ppv.

It is understood that any proposed piling would use rotary bored piling techniques.

10.2.4.4 Suitability of Site for Proposed Uses

The noise modelling software SoundPLAN (v8) has been used to determine noise levels incident on the development site and upon existing noise sensitive receptors for the operating year of 15 years after opening (2037) baseline plus development scenario.

In addition, the change in noise level at existing sensitive receptors as a result of the development has been determine by comparing the 15 years after opening (2037) with the development and the 15 years after opening (2037) without development scenarios.

Road traffic noise levels across the site have been predicted using the SoundPLAN (v8) noise mapping software, which implements the Calculation of Road Traffic Noise (CRTN) methodology.

The $L_{A10,18h}$ traffic noise levels determined by CRTN are converted within SoundPLAN to the standard European Union 12-hour day (07:00-19:00), 4-hour evening (19:00-23:00) and 8-hour night (23:00-07:00) L_{Aeq} levels using the conversion factors provided by the Transport Research Laboratory (TRL, 2002, 2006). For residential, a 16-hour daytime (07:00-23:00) and 8-hour night-time (23:00-07:00) period is used in BS 8233. To determine a 16-hour daytime L_{Aeq}, the 12-hour day and 4 hour evening levels are logarithmically combined and weighted for their respective durations.

Internal Noise Levels

Suitable glazing and ventilation measures are recommended to provide acceptable internal noise levels, in accordance with the guidance in BS 8233: 2014. BS 8233 gives recommended internal noise levels for various room uses, shown in Table 10.6 (taken from BS 8233 Tables 2 and 4).

Table 10.6: Indoor Ambient Noise Levels

Criterion	Typical Situation	07:00 to 23:00	*23:00 to 07:00*
Non-Domestic Spaces			
Typical noise levels for acoustic privacy in shared spaces	Restaurant	*40-55 $L_{Aeq,T}$*	
	Open Plan Office	*45-50 $L_{Aeq,T}$*	
	Nightclub/ Public House	*40-45 $L_{Aeq,T}$*	
Residential Dwellings			
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	*Bedroom*	*35 dB $L_{Aeq,16hr}$*	*30 dB $L_{Aeq,8hr}$*

BS 8233 notes that where development is considered necessary or desirable, despite external noise levels above the external target levels, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

The magnitude of impact for internal noise levels is given in Table 10.7.

Table 10.7: Classification of Magnitude of Internal Noise Level Impacts

Level Above Recommended Limit dB	Magnitude of Impact
<0	None
0 – 1	Negligible
1 – 3	Low
3 – 5	Medium
5+	High

External Noise Levels

In addition to ensuring satisfactory internal noise levels can be achieved, noise levels within external amenity areas should also be considered. BS 8233 guidelines recommend that external noise levels in amenity areas should not exceed the upper guideline value level of 55 dB $L_{Aeq,16hr}$. The magnitude of impact for external noise levels is given in Table 10.8.

Table 10.8: Classification of Magnitude of External Noise Level Impacts

Level Above Recommended Limit dB	Magnitude of Impact
<0	None
0 – 1	Negligible
1 – 3	Low
3 – 5	Medium
5+	High

10.2.4.5 Road Traffic Noise

The proposed redevelopment of the site may impact traffic flows on existing roads in the area. The impact of the additional traffic on the local public road network has been assessed using the baseline and with development traffic flows for the scenario of 15 years after opening (2037).

The magnitude of the impact of the additional traffic generated by the operation of the proposed development has been assessed by calculating the change in the 18-hour traffic noise levels ($L_{A10,18h}$) on a selection of road links surrounding the proposed redevelopment.

The calculations have employed the methodology provided in Calculation of Road Traffic Noise (CRTN), which is the standard methodology adopted in the UK for the calculation of noise levels from road traffic.

The criteria for the assessment of traffic noise changes arising from operational road traffic have been taken from Table 3.1 of DMRB (Highways Agency, 2011). The magnitude of impact for changes in road traffic noise given in Table 10.9.

Table 10.9: Classification of Magnitude of Traffic Noise Impacts

Change in Traffic Noise Level, $L_{A10,18h}$ (Operation – Baseline) dB	Magnitude of Impact
0	No change
0.1 – 0.9	Negligible
1 – 2.9	Low
3 – 4.9	Medium
5+	High

Forecast operational traffic movements have been provided from the transport assessment in the format 18-hour AAWT data for the operational year of 15 years after opening (2037) for the scenarios 'with' and 'without' the Proposed Development in place. 18hr AAWT (Annual Average Weekday Traffic) flows are required for CRTN calculations.

10.2.4.6 Noise from Fixed Plant

The assessment of noise from fixed plant to be installed as part of the Proposed Development has been assessed using the methodology given in BS 4142.

Table 10.10 gives the adopted magnitude of impact scale used in this assessment based upon the numerical level difference between the Rating Level and the Background Level.

Table 10.10: Magnitude of Impact for Industrial Noise Including Building Services

Rating Level – Background Sound Level (dB)	BS 4142 Descriptor	Magnitude of Impact
>15	No BS 4142 descriptor for this magnitude level	High
+10 approx.	Indication of a significant adverse effect, depending upon context	Medium
+5 approx.	Indication of an adverse effect, depending upon context	Low
≤ 0	Indication of low impact, depending upon context	Negligible

10.2.4.7 Receptor Sensitivity

In accordance with the principles of environmental impact assessment, the sensitivity of existing receptors to noise (or vibration) impacts during either construction or operational phases has been defined in Table 10.11.

Table 10.11: Sensitivity of Receptors

Sensitivity	Description	Examples of Receptor
High	Receptors where people or operations are particularly susceptible to noise or vibration.	Residential Quiet outdoor areas used for recreation Schools/ educational facilities in the daytime Hospitals/ residential care homes Libraries
Medium	Receptors moderately sensitive to noise or vibration where it may cause some distraction or disturbance	Offices Restaurants/ retail Sports grounds when spectator or noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf)
Low	Receptors where distraction or disturbance of people from noise or vibration is minimal	Residences and other buildings not occupied during working hours Factories and working environments with existing high noise levels Sports grounds when spectator or noise is a normal part of the event

10.2.4.8 Significance of Effects

The effect resulting from each individual potential impact type above is classified according to the magnitude of the impact and the sensitivity or value of the affected receptor using the matrix presented in Table 10.12 below, but where necessary also considering the context of the acoustic environment.

Table 10.12: Classification of Effects

Magnitude of Impact	Sensitivity of Receptor		
	High	Medium	Low
High	Profound	Moderate	Slight
Medium	Moderate	Slight	Negligible
Low	Slight	Negligible	Negligible
Negligible	Negligible	Negligible	Negligible
None/No change	Neutral	Neutral	Neutral

Negligible and slight effects are considered to be not significant, whereas moderate and profound effects are considered to be significant.

10.3 Baseline Conditions

10.3.1 Overview

Daytime attended noise monitoring was undertaken at six locations around the site boundary on 15th December 2017. Evening time monitoring was undertaken in the car park on the corner of Ellen Street and Michael Street on 14th December 2017.

The daytime attended noise monitoring locations were:

- Rutland Street: outside Bruce House,1 m from the façade;
- Patrick Street: outside Williams Stores, 1 m from the façade;
- Ellen Street: outside gateway opening to development site, 1 m from the façade;
- Michael Street: at car park edge, opposite gateway to housing development, free-field measurement;
- Michael Street: on footpath opposite No. 3, 1 m from the façade; and
- Bank Place: adjacent to second bollard in pedestrian zone, free-field measurement.

The monitoring locations are shown on Figure 10.1.

10.3.2 Survey Details

All noise measurements were taken at between 1.2 and 1.5 metres above ground level. All free-field measurements were located at least 3.5 metres from any vertical reflecting surfaces.

10.3.3 Instrumentation

Details of the instrumentation employed during the ambient noise surveys are provided in Table 10.13 below.

Table 10.13: Instrumentation Details

Equipment	Type	Serial Number
Sound Level Meter	Rion NL52	00672930
Calibrator	Rion NC74	34425537

The instrumentation was programmed to log the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} values, logging in fifteen-minute periods. The calibration level of the equipment was checked prior to and after the monitoring periods – no significant changes were noted.

Calibration certificates for the noise instrumentation are available on request.

10.3.4 Meteorological Conditions

Weather conditions during the attended noise measurements satisfied the requirements of British Standard BS 7445: 2003 'Description and Measurement of Environmental Noise'.

10.3.5 Results

A summary of the measured daytime noise levels is provided in Table 10.14. L_{Aeq} values have been averaged logarithmically while L_{A10} and L_{A90} values have been averaged arithmetically. All façade measurements have been converted to free-field values by the subtraction of 3 dB.

Table 10.14: Summary of Daytime Measured Noise Levels (Free-field)

Location	Start Time	End Time	L_{Aeq} (dB)	L_{Amax} (dB)	L_{A10} (dB)	L_{A90} (dB)
Rutland St	10:16	10:31	68	87	71	63
	11:12	11:27	66	78	69	61
	12:05	12:20	67	77	70	61
	Average / Max		67	87	70	61
Patrick St	10:33	10:48	74	99	71	61
	11:31	11:46	66	84	68	61
	12:21	12:36	65	77	68	60
	Average / Max		70	99	69	60
Ellen St	10:55	11:10	61	85	62	57
	11:47	12:02	59	73	62	52
	12:39	12:54	62	72	64	57
	Average / Max		60	85	63	55
Michael St	13:22	13:37	61	71	65	54
(car park)	14:15	14:30	62	75	66	52
	15:06	15:21	61	71	65	53
	Average / Max		62	75	65	53
Michael St	13:41	13:56	60	72	64	51
(north end)	14:32	14:47	59	70	63	51
	15:22	15:37	60	72	63	52
	Average / Max		60	72	63	51

Location	Start Time	End Time	L_{Aeq} (dB)	L_{Amax} (dB)	L_{A10} (dB)	L_{A90} (dB)
Bank Place	13:58	14:13	69	91	64	58
	14:48	15:03	61	71	64	57
	15:43	15:58	62	69	64	57
	Average / Max		66	91	64	57

At all locations the dominant noise source was road traffic. Due to the close proximity to the city centre there were periods during the monitoring where traffic was queuing, and engine noise dominated over tyre noise.

Other contributions to the noise climate included people on the street and occasional emergency sirens and horn beeps. At Ellen Street during the third measurement period there was a significant contribution from fan noise on the roof of the nearby car park at Arthur's Quay.

A summary of the measured evening noise levels from Ellen Street are shown in Table 10.15.

Table 10.15: Summary of Evening Monitoring Data

Location	Start Time	End Time	L_{Aeq} (dB)	L_{Amax} (dB)	L_{A10} (dB)	L_{A90} (dB)
Corner of Ellen St & Michael St	22:03	22:18	65	85	68	61
	22:18	22:33	68	92	68	61
	Average / Max		67	92	68	61

During the evening monitoring there was live music at a nearby venue and there were many people in the area making their way through the car park and surrounding street. This is considered typical of the area on a Thursday evening as there were several licenced premises in operation along Ellen Street and the surrounding area.

10.4 Predicted Impacts

10.4.1 Construction

This section discusses the potential noise and vibration effects on NSRs arising during the construction phase of the Proposed Development.

Noise levels experienced by NSRs during such works depend upon a number of variables, the most significant of which are:

- the noise generated by plant or equipment used on Site, generally expressed as Sound Power Levels (Lw) or the vibration generated by the plant;
- the periods of use of the plant on Site, known as its on-time;
- the distance between the noise/ vibration source and the NSR;
- the noise attenuation due to ground absorption, air absorption and barrier effects;

- in some instances, the reflection of noise due to the presence of hard surfaces such as the sides of buildings; and
- the time of day or night the works are undertaken.

It is assumed that construction works will be undertaken between 08:00-18:00 Monday to Friday, 08:00-13:00 on Saturdays, with no working on Sundays or bank holidays. However, where emergency work is required, out of hours work will be subject to approval from LCCC.

10.4.1.1 Construction Noise Emission Criteria

The TII published the 'Good Practice Guidance for the Treatment of Noise and Vibration in National Road Schemes'. These guidelines proposed design goals for noise related to construction and recommends a maximum noise level of 70 dB L_{Aeq} at noise sensitive receptors. Predicted noise levels have initially been assessed against this limit.

In addition to the TII criteria, based upon the analysis and summary of the results of the existing free-field baseline ambient noise surveys undertaken for the Proposed Development, Table 10.16 sets out the BS 5228 'ABC' noise threshold categories (BSI, 2014b) at each NSR.

Table 10.16: Measured free-field $L_{Aeq,T}$ noise levels and associated 'ABC' assessment category

Receptor		Daytime 07:00 – 18:00		
		Ambient Noise Level $L_{Aeq,T}$ dB*	ABC Category	Construction Noise Limit $L_{Aeq,T}$ dB (free-field)
R1	Rutland House, Rutland Street	67	B	70
R2	The Hunt Museum, Rutland Street	67*	B	70
R3	Sarsfield House, Francis Street	67	B	70
R4	16-19 Ellen Street	60	A	65
R5	Westgate House, Michael Street	62	A	65
R6	1 – 6 Michael Street	60	A	65
R7	Limerick School of Art and Design, George's Quay	<60**	A	65
R8	7 Bank Place	66	B	70
R9	2-3 Rutland Street	67	B	70
R10	1 George's Quay	67*	B	70
R11	The Granary	62	A	65

Receptor		Daytime 07:00 – 18:00		
		Ambient Noise Level $L_{Aeq,T}$ dB*	ABC Category	Construction Noise Limit $L_{Aeq,T}$ dB (free-field)
R12	9-11 Patrick Street	70	C	75

* No ambient noise measurements were undertaken at these locations. Due to their similar proximity to Bridge Street as Rutland House is to Bank Place/Bridge Street ambient noise levels have been assumed to be the same.

** No ambient noise measurements were undertaken at this location. Due to not being located on a main road ambient noise levels are assumed to be lower than 60 dB L_{Aeq} for a worst-case assessment.

10.4.1.2 Predicted Construction Noise Levels

Predicted noise levels for construction of the Proposed Development have been based upon construction methods used for other similar developments. As a conservative approach, it is assumed that all plant and activities will be taking place at the closest approach to each NSR, whereas in reality this will not always be the case and, in any event, activities are unlikely to occur for any significant duration.

It has been understood that rotary bored piling will be employed on site for any buildings requiring piled foundations.

The predicted levels apply to normal weekday daytime (07:00 – 18:00) working. Full details on the noise prediction methodology, including a full list of construction plant and associated sound power levels for each construction phase, are presented in Appendix 10.B.

A summary of predicted free-field noise levels at NSR locations around the Site are presented in Table 10.17. Predicted levels above the 70 dB L_{Aeq} noise limit given in the TII are in bold.

Table 10.17: Predicted Construction Noise Levels

Activity	Predicted Free-Field Noise Level for Daytime Construction Activity dB $L_{Aeq,1h}$											
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12
Demolition and site clearance	66	59	57	73	76	59	59	85	85	59	93	78
Earthworks	64	57	55	71	74	57	57	83	83	57	79	75
Rotary Bored Piling	68	61	59	75	78	61	61	81	81	61	83	80
Foundations	68	61	59	75	78	61	61	81	81	60	83	79
Slab construction	67	60	58	74	77	60	60	80	80	60	82	79
Steelwork construction	67	60	58	74	77	68	60	80	80	59	82	78
Building construction	65	58	56	72	75	58	58	78	78	57	80	76
Fitting out	63	63	60	64	67	63	56	76	76	50	78	74

Activity	Predicted Free-Field Noise Level for Daytime Construction Activity dB $L_{Aeq,1h}$											
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12
Access road/ car park construction	67	61	58	64	78	60	60	86	86	60	86	60

10.4.1.3 Construction Noise Effects

A comparison of the predicted noise levels at NSRs with the BS 5228 ABC threshold values is given in Table 10.18. Levels above the threshold values are in bold.

Table 10.18: Predicted construction noise level above threshold value

Receptor		Demolition and site clearance	Earthworks	Rotary Bored Piling	Foundations	Slab construction	Steelwork construction	Building construction	Fitting out	Access road/ car park construction
R1	Construction Limit	70	70	70	70	70	70	70	70	70
	Level above limit	-4	-6	-2	-2	-3	-3	-5	-7	-3
	Magnitude of Impact	Low	Negligible	Low	Low	Low	Low	Negligible	Negligible	Low
R2	Construction Limit	70	70	70	70	70	70	70	70	70
	Level above limit	-11	-13	-9	-9	-10	-10	-12	-7	-9
	Magnitude of Impact	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
R3	Construction Limit	70	70	70	70	70	70	70	70	70
	Level above limit	-13	-15	-11	-11	-12	-12	-14	-10	-12
	Magnitude of Impact	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
R4	Construction Limit	65	65	65	65	65	65	65	65	65
	Level above limit	+8	+6	+10	+10	+9	+9	+7	-1	-1
	Magnitude of Impact	High	High	High	High	High	High	High	Low	Low
R5	Construction Limit	65	65	65	65	65	65	65	65	65
	Level above limit	+11	+9	+13	+13	+12	+12	+10	+2	+13

Receptor		Demolition and site clearance	Earthworks	Rotary Bored Piling	Foundations	Slab construction	Steelwork construction	Building construction	Fitting out	Access road/ car park construction
	Magnitude of Impact	High	High	High	High	High	High	High	Medium	High
R6	Construction Limit	65	65	65	65	65	65	65	65	65
	Level above limit	-6	-8	-4	-4	-5	+3	-7	-2	-5
	Magnitude of Impact	Negligible	Negligible	Negligible	Low	Negligible	Medium	Negligible	Low	Negligible
R7	Construction Limit	65	65	65	65	65	65	65	65	65
	Level above limit	-6	-8	-4	-4	-5	-5	-7	-9	-5
	Magnitude of Impact	Negligible	Negligible	Negligible	Low	Negligible	Negligible	Negligible	Negligible	Negligible
R8	Construction Limit	70	70	70	70	70	70	70	70	70
	Level above limit	+15	+13	+11	+11	+10	+10	+8	+6	+16
	Magnitude of Impact	High	High	High	High	High	High	High	High	High
R9	Construction Limit	70	70	70	70	70	70	70	70	70
	Level above limit	+15	+13	+11	+11	+10	+10	+8	+6	+16
	Magnitude of Impact	High	High	High	High	High	High	High	High	High
R10	Construction Limit	70	70	70	70	70	70	70	70	70
	Level above limit	-11	-13	-9	-10	-10	-11	-13	-20	-9

Receptor		Demolition and site clearance	Earthworks	Rotary Bored Piling	Foundations	Slab construction	Steelwork construction	Building construction	Fitting out	Access road/ car park construction
	Magnitude of Impact	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
R11	Construction Limit	65	65	65	65	65	65	65	65	65
	Level above limit	**+28**	**+14**	**+18**	**+18**	**+17**	**+17**	**+15**	**+13**	**+21**
	Magnitude of Impact	High	High	High	High	High	High	High	High	High
R12	Construction Limit	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**
	Level above limit	**+3**	0	**+5**	**+4**	**+4**	**+3**	**+1**	-1	-15
	Magnitude of Impact	Medium	Low	Medium	Medium	Medium	Medium	Medium	Negligible	Negligible

The effects of the predicted daytime construction noise levels on NSRs have been classified by considering the daytime ABC noise threshold values in Table 10.18, and using the semantic scales in Table 10.12. These effects are summarised in Table 10.19 below.

Table 10.19: Daytime Construction Noise Effects

Receptor/ Sensitivity		Construction Activity								
		Demolition and site clearance	Earthworks	Rotary Bored Piling	Foundations	Slab construction	Steelwork construction	Building construction	Fitting out	Access road/ car park construction
R1	High	Slight	Negligible	Slight	Slight	Slight	Slight	Negligible	Negligible	Slight

Receptor/ Sensitivity		Construction Activity								
		Demolition and site clearance	Earthworks	Rotary Bored Piling	Foundations	Slab construction	Steelwork construction	Building construction	Fitting out	Access road/ car park construction
R2	High	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
R3	Medium	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
R4	Medium/ High	Moderate - Profound	Moderate - Profound	Moderate - Profound	Moderate-Profound	Moderate-Profound	Moderate-Profound	Moderate-Profound	Negligible - Slight	Negligible - Slight
R5	High	Profound	Profound	Profound	Profound	Profound	Profound	Profound	Moderate	Profound
R6	Medium	Negligible	Negligible	Negligible	Negligible	Negligible	Minor	Negligible	Negligible	Negligible
R7	High	Negligible	Negligible	Negligible	Slight	Negligible	Negligible	Negligible	Negligible	Negligible
R8	Medium	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
R9	Medium/ High	Moderate - Profound	Moderate - Profound	Moderate - Profound	Moderate - Profound	Moderate - Profound	Moderate - Profound	Moderate - Profound	Moderate - Profound	Moderate - Profound
R10	Medium/ High	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
R11	Medium	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
R12	Medium/ High	Slight - Moderate	Negligible - Slight	Slight - Moderate	Slight - Moderate	Slight - Moderate	Slight - Moderate	Slight - Moderate	Negligible - Slight	Negligible - Slight

At receptor R1 (residential), predicted noise levels during all demolition and construction activities fall below the TII limit of 70 dB L_{Aeq}. Using the ABC method in BS 5228, the magnitude of impact during activities is either negligible or low, resulting in a significance of effect of negligible or slight (not significant).

At receptor R2 (museum), predicted noise levels during all demolition and construction activities fall below the TII limit of 70dB L_{Aeq}. Using the ABC method in BS 5228, the magnitude of impact during activities is negligible and a significance of effect of negligible (not significant).

At receptor R3 (offices), predicted noise levels during all demolition and construction activities fall below the TII limit of 70 dB L_{Aeq}. Using the ABC method in BS 5228, the magnitude of impact during activities is negligible and a significance of effect of negligible (not significant).

At receptor R4 (retail with assumed residential above), predicted noise levels exceed the TII limit of 70 dB L_{Aeq} during the majority of demolition and construction activities, with the highest-level during construction of foundations for the new Aparthotel (76 dB $L_{Aeq,1h}$). Only during the fitting out and the construction of access roads/car parking areas is the 70 dB $L_{Aeq,1h}$ criterion met. Using the ABC method in BS 5228, the magnitude of impact during the majority of activities is high, resulting in a significance of effect of moderate to profound (significant).

At receptor R5 (residential), predicted noise levels exceed the TII limit of 70 dB L_{Aeq} during the majority of demolition and construction activities, with the highest-level during construction of foundations (78 dB $L_{Aeq,1h}$). Only during the fitting out is the 70 dB $L_{Aeq,1h}$ criterion met. Using the ABC method in BS 5228, the magnitude of impact during the majority of activities is high, resulting in a significance of effect of profound (significant).

At receptor R6 (offices), predicted noise levels during all demolition and construction activities fall below the TII limit of 70 dB L_{Aeq}. Using the ABC method in BS 5228, the magnitude of impact during the majority of activities is negligible to low, resulting in a significance of effect of negligible. During any steelwork construction predicted levels will result in a magnitude of impact of medium and a significance of effect of slight (not significant).

At receptor R7 (art and design college), predicted noise levels during all demolition and construction activities fall below the TII limit of 70 dB L_{Aeq}. Using the ABC method in BS 5228, the magnitude of impact during activities is negligible to low, resulting in a significance of effect of negligible to slight (not significant).

At receptor R8 (offices), predicted noise levels during all demolition and construction activities exceed the TII limit of 70 dB L_{Aeq}, with the highest levels during demolition and the construction of access roads/ car parking. Using the ABC method in BS 5228, the magnitude of impact during the construction activities is high, resulting in a significance of effect of moderate (significant).

At receptor R9 (retail with assumed residential above), predicted noise levels during all demolition and construction activities exceed the TII limit of 70 dB L_{Aeq}, with the highest levels during demolition and the construction of access roads/ car parking. Using the ABC method in BS 5228, the magnitude of impact during the construction activities is high, resulting in a significance of effect of moderate to profound (significant).

At receptor R10 (public house with assumed residential above), predicted noise levels during all demolition and construction activities fall below the TII limit of 70 dB L_{Aeq}. Using the ABC method in BS 5228, the magnitude of impact during activities is negligible and a significance of effect of negligible (not significant).

At receptor R11 (offices – to be refurbished as part of the development), predicted noise levels during all demolition and construction activities exceed the TII limit of 70 dB L_{Aeq}, with the highest levels during demolition. Using the ABC method in BS 5228, the magnitude of impact during the construction activities is high, resulting in a significance of effect of moderate (significant).

At receptor R12 (retail with assumed residential above), predicted noise levels during the majority of the demolition and construction activities exceed the TII limit of 70 dB L_{Aeq}, with the highest levels during piling works. Using the ABC method in BS 5228, the magnitude of impact during the construction activities is negligible to medium, resulting in a significance of effect of negligible to moderate (significant).

It must be noted that the predicted levels given above are for a worst-case scenario, with the construction activities being undertaken at the closest approach to each selected receptor. In reality, noise levels from construction activities will be lower, with the predicted high levels only prevailing for relatively short periods of time. Construction works will also be temporary.

Internal Noise Levels within Offices at The Granary

During demolition and construction activities at the site, The Granary (Receptor R11) will remain occupied. Predicted worst-case free-field noise levels (assuming activities directly next to the building) indicate high noise levels incident upon the building.

Assuming the glazing installed at the Granary building provides an attenuation of 30 dB Rw, internal noise levels are estimated to be in the region of 51-56 dB during the main construction phases when working at the closest approach. When works are undertaken at a greater distance, internal noise levels will reduce and should meet the criteria for noise levels within open plan offices of 45-50 dB.

During demolition of the existing library, internal noise level may reach 66 dB when works are immediately next to the building. When works are undertaken at a larger distance from The Granary building these levels will reduce, although are likely to still exceed the criteria for noise levels in open plan offices. However, it must be noted that the demolition works directly next to The Granary building will be of relatively short duration.

During the construction of hardstanding, when working at the closest approach internal noise levels will be in the region of 59 dB and will exceed the criteria for noise levels within open plan offices. The construction of hardstanding directly next to The Granary building is likely to be transient and therefore will only result in a significant noise impact upon offices immediately next to where the works are being undertaken.

Construction Traffic Noise

It is understood that construction HGVs will enter and leave the site from Michael Street, with the route being along Michael Street and the R445 (east of Michael Street). Information provided by the Traffic Consultants indicates that there would be 48 HGV movements per day. Assuming a 10hr day this equates to 4.8 HGV movements per hour during the construction phase. Worst-case $L_{A10,1h}$ levels at the NSRs along Michael Street have been predicted with three HGVs entering the site and three exiting the site per hour (six HGV movements per hour) and are presented in Table 10.20.

Table 10.20: Road Traffic Noise - Construction

Receptor	Predicted Noise Levels from Construction HGVs $L_{Aeq,1h}$ dB	Measured Ambient Level $L_{Aeq,1h}$ dB	Total Ambient Noise Level Including HGV Traffic $L_{Aeq,1h}$ dB	Change in $L_{Aeq,1h}$ as a Result of Construction Traffic on Public Roads
R5 – Westgate house	53	62	63	+1
R6 – 1-6 Michael Street	47	60	60	0

The significance of effect of changes in road traffic noise levels due to construction HGVs is given in Table 10.21.

Table 10.21: Changes in Road Traffic Levels During Construction – Significance of Effect

Receptor	Change in Road Traffic Noise dB	Magnitude of Impact	Receptor Sensitivity	Classification of Effect
R5 – Westgate House	+1	Negligible/ Low	High	Negligible/Slight
R6 – 1-6 Michael Street	0	No change	Medium	Neutral

As shown in Table 10.21, the increase in the ambient noise level as a result of construction traffic during construction of the Proposed Development will result in negligible/slight effects (not significant) at the selected NSRs.

10.4.1.4 Construction Vibration

It is understood that secant piling will be installed on site using rotary bored piling methods. This type of piling produces much lower levels of ground-borne vibration compared to other piling methods.

As sensitive receptors are located in close proximity to piling works it is possible that there may be significant adverse effects in terms of annoyance.

BS 5228-2 provides measured data for rotary bored piling at a range of distances. A summary of vibration levels from rotary bored piling is given in Table 10.22, along with an assessment of the significance in terms of annoyance.

Table 10.22: Measured Vibration Levels from Rotary Bored Piling

Activity	Distance from Piling Works (m)	Measured Vibration Level ppv mms^{-1}	Magnitude of impact	Receptor Sensitivity	Significance of Effect
Auguring	3.5	0.23	Low	High	Slight
	5	0.54	Low	High	Slight
	10	0.38	Low	High	Slight
	15	0.1	Negligible	High	Negligible
	20	0.3	Low	High	Slight
	30	0.03	Negligible	High	Negligible
Misc. auguring activities	3.5	2.4	Medium	High	Moderate
	10	1.1	Medium	High	Moderate

Activity	Distance from Piling Works (m)	Measured Vibration Level ppv mms^{-1}	Magnitude of impact	Receptor Sensitivity	Significance of Effect
	20	0.55	Low	High	Slight

* Miscellaneous auguring activities include: Auger hitting base of hole and dolly casing

As shown in Table 10.22, rotary bored piling results in relatively low levels of vibration. For receptors with high sensitivity that are located in close proximity to piling works a low vibration impact is estimated during auguring, with a significance of effect of slight (not significant). Occasionally vibration levels may be higher, for example when the auger hits the base of the hole, resulting in a short-term medium vibration impact and a significance of effect of moderate (significant). Overall, in terms of annoyance, the effect is assessed as not significant.

With regards to building damage from vibration, all predicted levels fall well below the 15 mms^{-1} level at which cosmetic damage could occur in residential or light commercial buildings. The magnitude of impact is low, with a significance of effect of negligible/slight (not significant). This includes those buildings on site which are to be retained.

10.4.2 Operational Traffic

A noise model has been developed which consists of a detailed three-dimensional representation of the Proposed EIA Development and surroundings, including existing buildings, buildings to be retained on site, residential receptors, topography and ground conditions.

Details of the settings used in the noise modelling software are presented in Appendix 10.C.

10.4.2.1 Impacts upon Existing Noise Sensitive Premises

To determine the noise impact upon existing NSRs located close to the Proposed Development from changes in road traffic flows, a comparison has been made between the future year (2037) Without Development and Future Year (2037) With Development scenarios. The traffic data employed in the noise model are given in Appendix 10.D.

The change in road traffic noise incident on existing receptors is given in Table 10.23.

Table 10.23: Change in Road Traffic Flows Upon the Closest Existing NSRs

Receptor	Floor Level	Predicted Noise Levels from Road Traffic $L_{A10,18h}$ dB		Change in $L_{A10,18h}$ as a Result of the Operation of the Proposed Development
		2037 Without Development	2037 Without Development	
R1 – Rutland House	GF	72.9	73.1	0.2
R2 - The Hunt Museum, Rutland Street	1st F	63.7	67.6	0.3
R3 - Sarsfield House,	1st F	70.9	71.1	0.2

Receptor	Floor Level	Predicted Noise Levels from Road Traffic $L_{A10,18h}$ dB		Change in $L_{A10,18h}$ as a Result of the Operation of the Proposed Development
		2037 Without Development	2037 Without Development	
Francis Street	3rd F	70.4	70.7	0.3
R4 – 16-19 Ellen Street	1st F	70.2	70.8	0.6
R5 - Westgate House, Michael Street	GF	69.1	70.4	1.3
	2nd F	68.1	69.3	1.2
R6 - 1 – 6 Michael Street	GF	70.0	70.2	0.2
R7 - Limerick School of Art and Design, George's Quay	GF	62.2	62.4	0.2
R8 - 7 Bank Place	1st F	73.9	74.0	0.1
R9 – 2-3 Rutland Street	1st F	73.7	73.8	0.1
R10 - 1 George's Quay	GF	69.9	70.0	0.1
R11 – The Granary	1st F	70.8	71.4	0.6
R12 – 9-11 Patrick Street	1st F	73.2	73.6	0.4

The significance of effect as a result of changes in road traffic noise levels is given in Table 10.24.

Table 10.24: Changes in Road Traffic Levels – Significance of Effect

Receptor	Floor Level	Change in Road Traffic Noise dB	Magnitude of Effect	Receptor Sensitivity	Significance of Effect
R1 – Rutland House	GF	0.2	Negligible	High	Negligible
R2 - The Hunt Museum, Rutland Street	1st F	0.3	Negligible	High	Negligible
R3 - Sarsfield House, Francis Street	1st F	0.2	Negligible	Medium	Negligible
	3rd F	0.3	Negligible	Medium	Negligible
R4 – 16-19 Ellen Street	1st F	0.6	Negligible	Medium/ High	Negligible
R5 - Westgate House, Michael Street	GF	1.3	Low	High	Slight
	2nd F	1.2	Low	High	Slight
R6 - 1 – 6 Michael Street	GF	0.2	Negligible	Medium	Negligible
R7 - Limerick School of Art and Design, George's Quay	GF	0.2	Negligible	High	Negligible
R8 - 7 Bank Place	1st F	0.1	Negligible	Medium	Negligible
R9 – 2-3 Rutland Street	1st F	0.1	Negligible	Medium/ High	Negligible
R10 - 1 George's Quay	GF	0.1	Negligible	Medium/High	Negligible
R11 – The Granary	1st F	0.6	Negligible	Medium	Negligible
R12 – 9-11 Patrick Street	1st F	0.4	Negligible	High	Negligible

As shown in Table 10.24, the change in road traffic noise levels as a result of the operation of the Proposed Development will result in a significance of effect of negligible or slight (not significant) at all selected NSRs.

10.4.2.2 Suitability of Site for Proposed Land Uses

To determine the suitability of the site for the proposed land uses, an estimation of internal noise levels and assessment against recommended internal noise levels given in BS 8233 has been carried out.

The selected proposed receptors are illustrated in Figure 10.2.

The calculated 16-hour daytime L_{Aeq} and night-time 8-hour L_{Aeq} levels for the selected proposed receptors for 2037 are given in Table 10.25. These levels are external façade levels.

Table 10.25: Calculated 16-hour and 8-hour L_{Aeq}

Receptor/Zone	Floor Level	Predicted levels dB			Calculated Daytime $L_{Aeq,16h}$ dB
		Lday	Levening	Lnight	
Offices					
P1 – Michael Street	1st	68	65	59	67
	3rd	65	62	57	65
	5th	63	60	54	62
P5 – Bank Place	GF	63	60	55	63
	2nd	65	62	56	64
	5th	64	61	55	63
	8th	63	60	54	62
	12th	61	58	53	61
P6 – The Granary	1st	69	66	61	69
	3rd	67	64	59	67
Commercial/ Cultural					
P2B – Restaurant/café/bar	GF	68	65	60	68
P3A – Cultural	GF	70	67	61	70
P4 – Library - Rutland Street	GF	72	69	63	71
	2nd	71	68	62	70
P4 – Library – Central	GF	44	40	36	43
	2nd	44	41	37	43
	4th	45	41	37	44
	6th	46	42	38	45
P6 – Restaurant - The Granary	GF	70	67	61	69
Residential/ Aparthotel					

Receptor/Zone	Floor Level	Predicted levels dB			Calculated Daytime $L_{Aeq,16h}$ dB
		Lday	Levening	Lnight	
P2A – Residential - 1-5 Patrick Street	GF	72	69	63	71
	2nd	70	67	61	70
P2A – Residential - 7-8 Ellen Street	1st	68	65	59	67
	3rd	65	62	57	65
P3B – Residential – Rutland Street	1st	72	69	63	72
	3rd	71	68	62	70
P2A – Aparthotel/ Residential - Patrick Street	1st	72	69	63	71
	3rd	69	66	60	68
P2A – Aparthotel - Ellen Street	1st	70	67	61	69
	3rd	67	64	58	66

For the daytime and night-time periods, internal noise levels have been estimated assuming a closed window providing a representative sound reduction of 30 dB Rw. Table 10.26 gives the estimated daytime internal levels, along with a comparison with the recommended internal noise levels for each proposed land use.

Table 10.26: Calculated Internal Noise Levels - Daytime

Receptor	Floor level	Calculated External Daytime $L_{Aeq,16h}$ dB	Calculated Internal Daytime $L_{Aeq,16h}$ dB*	Recommended Daytime Internal Noise Level $L_{Aeq,T}$ dB	Level above criteria dB
Offices					
P1 – Michael Street	1st	67	37	45	-8
	3rd	65	35	45	-10
	5th	62	32	45	-13
P5 – Bank Place	GF	63	33	45	-12
	2nd	64	34	45	-11
	5th	63	33	45	-12
	8th	62	32	45	-13
	12th	61	31	45	-14
P6	1st	69	39	45	-6

Receptor	Floor level	Calculated External Daytime $L_{Aeq,16h}$ dB	Calculated Internal Daytime $L_{Aeq,16h}$ dB*	Recommended Daytime Internal Noise Level $L_{Aeq,T}$ dB	Level above criteria dB
	3rd	67	37	45	-8
Commercial/ Cultural					
P2B – Restaurant/café/bar	GF	68	38	40	-2
P3A – Cultural	GF	70	40	40	0
P4 – Library - Rutland Street	GF	71	41	40	+1
	2nd	70	40	40	0
P4 – Library – Central	GF	43	13	40	-27
	2nd	43	13	40	-27
	4th	44	14	40	-26
	6th	45	15	40	-25
P6 – Restaurant - The Granary	GF	69	39	40	-1
Residential/Aparthotel					
P2A – Residential - 1-5 Patrick Street	GF	71	41	35	+6
	2nd	70	40	35	+5
P2A – Residential - 7-8 Ellen Street	1st	67	37	35	+2
	3rd	65	35	35	0
P3B – Residential – Rutland Street	1st	72	42	35	+7
	3rd	70	40	35	+5
P2A – Aparthotel/ Residential - Patrick Street	1st	71	41	35	+6
	3rd	68	38	35	+3
P2A – Aparthotel - Ellen Street	1st	69	39	35	+4
	3rd	66	36	35	+1

The significance of effect for daytime internal noise levels for the different land uses is given in Table 10.27.

Table 10.27: Calculated Daytime Internal Noise Levels – Significance of Effect

Receptor	Floor level	Level above criteria dB	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect
Offices					
P1 – Michael Street	1st	-8	None	Medium	Negligible
	3rd	-10	None	Medium	Negligible
	5th	-13	None	Medium	Negligible
P5 – Bank Place	GF	-12	None	Medium	Negligible
	2nd	-11	None	Medium	Negligible
	5th	-12	None	Medium	Negligible
	8th	-13	None	Medium	Negligible
	12th	-14	None	Medium	Negligible
P6	1st	-6	None	Medium	Negligible
	3rd	-8	None	Medium	Negligible
Commercial/ Cultural					
P2B – Restaurant/café/bar	GF	-2	None	Medium	Negligible
P3A – Cultural	GF	0	None/ Negligible	High	Negligible
P4 – Library - Rutland Street	GF	+1	Negligible	High	Negligible
	2nd	0	None/ Negligible	High	Negligible
P4 – Library – Central	GF	-27	None	High	Negligible
	2nd	-27	None	High	Negligible
	4th	-26	None	High	Negligible
	6th	-25	None	High	Negligible
P6 – Restaurant - The Granary	GF	-1	None	Medium	Negligible
Residential/Aparthotel					
P2A – Residential - 1-5 Patrick Street	GF	+6	High	High	Profound
	2nd	+5	Medium/ high	High	Moderate/ profound

Receptor	Floor level	Level above criteria dB	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect
P2A – Residential - 7-8 Ellen Street	1st	+2	Low	High	Slight
	3rd	0	None/ negligible	Negligible	Negligible
P3B – Residential – Rutland Street	1st	+7	High	High	Profound
	3rd	+5	Medium/ high	High	Moderate/ profound
P2A – Aparthotel/ Residential - Patrick Street	1st	+6	High	High	Profound
	3rd	+3	Low/ medium	High	Slight/ moderate
P2A – Aparthotel - Ellen Street	1st	+4	Medium	High	Moderate
	3rd	+1	Low	High	Slight

As shown in Table 10.27, during the daytime, predicted internal noise levels meet the recommended levels for offices at all proposed office locations, assuming a closed window. A significance of effect of negligible (not significant) has been assessed.

Within the proposed library and cultural land uses, internal noise levels will be met through the majority of the premises. Only for room areas along the western façade of the buildings on to Rutland Street will internal noise levels exceed the recommended internal levels for libraries. However, the level is only marginally exceeded. A significance of effect of negligible (not significant) is therefore assessed.

Within proposed restaurants/bars, internal noise levels are predicted to be met. A significance of effect of negligible (not significant) is assessed.

At residential land uses, and also at the proposed Aparthotel, internal noise levels during the day are predicted to exceed the recommended internal noise level of 35 dB L_{Aeq}, with the greatest exceedance at the lower floors. Assuming a closed window, internal noise levels are exceeded by up to 7 dB. At lower floors a significance of effect of moderate to profound is assessed. At higher floors a significance of effect of slight to moderate (significant) is assessed.

Table 10.28 presents the calculated night-time internal levels for the proposed residential and aparthotel uses, along with a comparison with the recommended internal noise levels.

Table 10.28: Calculated Night-time Internal Noise Levels

Receptor	Floor level	Predicted External Night-time $L_{Aeq,8h}$ dB	Calculated Internal Night-time $L_{Aeq,8h}$ dB*	Recommended Night-time Internal Noise Level $L_{Aeq,T}$ dB	Level above criteria dB
Residential/ Aparthotel					
P2A – Residential - 1-5 Patrick Street	GF	63	33	30	+3
	2nd	61	31	30	+1

Receptor	Floor level	Predicted External Night-time $L_{Aeq,8h}$ dB	Calculated Internal Night-time $L_{Aeq,8h}$ dB*	Recommended Night-time Internal Noise Level $L_{Aeq,T}$ dB	Level above criteria dB
P2A – Residential - 7-8 Ellen Street	1st	59	29	30	-1
	3rd	57	27	30	-3
P3B – Residential – Rutland Street	1st	63	33	30	+3
	3rd	62	32	30	+2
P2A – Aparthotel/ Residential - Patrick Street	1st	63	33	30	+3
	3rd	60	30	30	0
P2A – Aparthotel - Ellen Street	1st	61	31	30	+1
	3rd	58	28	30	-2

The significance of effect for night-time internal noise levels for the different land used are given in Table 10.29.

Table 10.29: Calculated Night-time Internal Noise Levels – Significance of Effect

Receptor	Floor level	Level above criteria	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect
Residential/Aparthotel					
P2A – Residential - 1-5 Patrick Street	GF	+3	Low/ Medium	High	Slight/ Moderate
	2nd	+1	Negligible/ Low	High	Slight/ Negligible
P2A – Residential - 7-8 Ellen Street	1st	-1	None	High	Negligible
	3rd	-3	None	High	Negligible
P3B – Residential – Rutland Street	1st	+3	Low/Medium	High	Slight/ Moderate
	3rd	+2	Low	High	Slight
P2A – Aparthotel/ Residential - Patrick Street	1st	+3	Low/ Medium	High	Slight/ Moderate
	3rd	0	None	High	Negligible
P2A – Aparthotel - Ellen Street	1st	+1	Negligible/ Low	High	Slight/ Negligible
	3rd	-2	None	High	Negligible

At residential land uses, and also at the proposed Aparthotel, internal noise levels at night are predicted to exceed the recommended internal noise level of 30 dB L_{Aeq}, with the greatest exceedance at the lower floors. Assuming a closed window, internal noise levels are exceeded by up to 3 dB. At lower floors a significance of effect of slight to moderate (significant) is assessed. At higher floors a significance of effect of negligible to moderate (not significant) is assessed.

Whilst internal noise levels exceed the criteria levels given in BS 8233, it must be noted that BS 8233 states that, where development is considered necessary or desirable, despite external noise levels above the external target levels, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. If the relaxation is implemented, internal noise levels will marginally exceed the requirements in BS 8233 for daytime periods (by up to 2 dB) at some of the residential receptors.

10.4.2.3 Noise in external areas

Predicted $L_{Aeq,16hr}$ noise levels have been predicted within the proposed Central Plaza, The Granary Courtyard and the roof top garden to Zone P1. The predicted levels are given in Table 10.30 below.

Table 10.30: Predicted Noise Levels in External Areas

Location	Predicted $L_{Aeq,16h}$ dB	Criteria Level dB	Meets Criteria?	Magnitude of Impact	Sensitivity	Significance of Effect
Central Plaza	34-51	55	Yes	Negligible	High	Neutral
The Granary Courtyard	35	55	Yes	Negligible	High	Neutral
P1 Rooftop Garden	35	55	Yes	Negligible	High	Neutral

As illustrated in Table 10.30, noise levels within external areas are predicted to fall below the BS = 8233 and LCCC criteria level of 55 dB $L_{Aeq,16h}$. This results in a very low magnitude of impact and a neutral significance of effect (not significant).

10.5 Mitigation Measures

10.5.1 Construction

10.5.1.1 Noise

The contractor will follow Best Practicable Means (BPM) to reduce the noise and vibration impact on the local community, including:

- Fixed and semi-fixed ancillary plant such as generators, compressors etc. to be positioned so as to cause minimum noise disturbance. If necessary, acoustic barriers or enclosures to be provided for specific items of fixed plant;
- Use of site boundary acoustic barriers/hoarding to screen neighbouring receptors;
- All plant used on site will comply with the EC Directive on Noise Emissions for Outdoor Equipment (2000/14/EC), where applicable;
- Operation of plant in accordance with the manufacturer's instructions;
- All major compressors to be 'sound reduced' models fitted with properly lined and sealed acoustic covers which are kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools to be fitted with mufflers or silencers of the type recommended by the manufacturers;

- All plant used on site will be regularly maintained, paying particular attention to the integrity of silencers and acoustic enclosures;
- Machines in intermittent use to be shut down in the intervening periods between work or throttled down to a minimum;
- Drop heights of materials from lorries and other plant will be kept to a minimum;
- Adherence to the codes of practice for construction working and piling given in BS 5228 and the guidance given therein for minimising noise emissions from the site;
- Provision of rest periods during any prolonged noisy activities;
- prohibition of the use of stereos and radios on site;
- Compliance with normal construction working hours of 08:00-18:00 Monday to Friday, 08:00-13:00 on Saturdays, with no working on Sundays or bank holidays, however if out of hours work is deemed necessary, it is subject to approval by LCCC; and
- Keeping local residents informed and provision of a contact name and number for any queries or complaints.

In addition to BPM, the site perimeter will have site hoarding which will provide some attenuation of noise to receptors on lower floors (first floor and below). Such hoarding will provide a conservative reduction of approximately 5dB.

During particularly noise works, consideration shall be given to the implementation of mobile noise barriers. As with site hoarding, mobile noise barriers will only provide attenuation of noise at lower floor levels. With the use of such barriers, noise levels at lower floor levels of NSRs could be reduced by up to 10 dB. With the use of mobile noise barriers, noise levels during the majority of construction activities will be reduced to below the threshold values. Where the threshold values are exceeded, this shall not be by more than 6 dB (during the construction of access roads/car parking).

Construction Traffic

Noise levels from the construction HGVs entering and leaving the Proposed Development Site have been predicted to result in a low noise impact and a negligible to slight significance of effect (not significant). As such, no mitigation measures are required.

10.5.1.2 Vibration

As the type of piling to be undertaken results in low levels of vibration, there is little that can be done to mitigate vibration levels further. However, consideration should be given to the times of day and duration of piling works to reduce potential annoyance as far as possible. Prior notification of piling works, along with information on anticipated durations and the negligible likelihood of damage to property, will provide reassurance to nearby residents.

With regards to building damage from vibration, all predicted levels fall well below the 15 mms^{-1} level at which cosmetic damage could occur in residential or light commercial buildings. No specific mitigation is proposed.

10.5.2 Operation

10.5.2.1 Existing Noise Sensitive Premises

Road traffic noise

The magnitude of the impact of noise increases resulting from the ‘with development traffic’ are negligible to low resulting in a significance of effect of negligible to slight (not significant) on all roads surrounding the Proposed Development. As such, no mitigation measures are required.

10.5.2.2 Proposed Land Uses

Internal Noise Levels

Calculated daytime $L_{Aeq,16hr}$ levels at the different land uses illustrate that at the most sensitive uses (residential and aparthotel), internal noise levels during the day may exceed the recommended guideline levels given in BS 8233 by up to 7 dB with a closed window (providing a representative sound reduction of 30 dB Rw). If the relaxation provided for in BS 8233 is implemented, internal noise levels will marginally exceed the requirements in BS 8233 for daytime periods (by up to 2 dB) at some of the residential receptors.

Options for mitigation include:

- Double-glazing
- Secondary glazing
- Uprated single-glazing

10.6 Residual Impacts

10.6.1 Construction

Construction Noise

Noise levels incident on noise sensitive receptors can be effectively managed. With the use of mobile noise barriers threshold values may still be exceeded on average by 1 – 3 dB, resulting in a residual noise impact of medium, resulting in a residual significance of effect of slight to moderate (depending on the receptor sensitivity).

During the construction of access roads/car parking the threshold values may be exceeded by up to 6 dB, resulting in a noise impact of high and a residual significance of effect of moderate to profound (significant).

The predicted construction noise levels are a worst-case and assume activities are undertaken at the closest approach to each selected receptor. In practice, noise levels from construction activities will be lower, with the predicted high levels only being in evidence for short periods of time. In addition, the construction works will be temporary. Overall, a significance of effect of slight adverse (not significant) is assessed. Noise monitoring will be carried out at site boundary locations during the construction phase to clarify noise emissions during this phase of the development.

Construction Traffic

No mitigation measures are required to reduce noise impacts from construction traffic. The significance of effect remains negligible to slight significance of effect (not significant).

Construction Vibration

The overall significance of construction vibration (in terms of annoyance and building damage) is negligible.

10.6.2 Operation

10.6.2.1 Existing Noise Sensitive Premises

Changes in Road Traffic Noise

As no mitigation is required to reduce noise levels at existing receptors, residual noise impacts remain negligible to low (not significant).

10.6.2.2 Proposed Land Uses

Internal Noise Levels

With the provision of a bespoke mitigation strategy for the retained historic buildings and the new buildings, taking into account best conservation practice, acceptable internal noise levels will be achieved, and the significance of operational noise effects will be Negligible. Noise monitoring will be undertaken post introduction of the bespoke mitigation strategy.

Noise monitoring will be undertaken post introduction of the bespoke mitigation strategy to determine compliance with recommended internal noise levels.

10.7 Difficulties Encountered in Compiling Information

During the assessment of noise and vibration assessment, the following difficulties were encountered:

- Limited construction information was available. The construction noise assessment was therefore undertaken based on experience of other similar projects.

10.8 Cumulative Impacts

There are a number of developments with secured planning permission surrounding the proposed development, including the conversion of residential uses to a dental surgery on Ellen Street and the completion of a mixed used development (building structure already complete), also on Ellen Street. Review of these developments indicates that they are small in scale.

Construction of these smaller developments is likely to be localised and short-term due to the nature of the developments. Cumulative noise impacts are therefore unlikely to change from those given within the noise assessment for the proposed development.

Given the nature of the smaller developments it is unlikely that there would be any significant increase in road traffic flows as a result of their operation. Therefore, cumulative noise impacts from increases in road traffic flows upon the closest noise sensitive receptors is negligible.

10.9 References

National Roads Authority (NRA): 2004: Guidelines for the Treatment of Noise and Vibration in National Road Schemes'. (NRA, 2004)

Transport Infrastructure Ireland (TII): 2014. Good Practice Guidance for the Treatment of Noise and Vibration in National Road Schemes'. (NRA, 2014)

Department for Housing, Planning and Local Government: 2018: National Planning Framework 2040, (DHPLG, 2018)

Limerick Draft Noise Action Plan, May 2018, Limerick City and County Council (LCCC, 2018)

Council Directive 2002/49/EC of 25 June 2002 – Environmental Noise Directive

British Standard Institute BS 7445: 2003: Description and Measurement of Environmental Noise. (BSI, 2003)

British Standards Institution BS 5228: 2009+A1:2014 Code of Practice for Noise and Vibration on Construction and Open Sites, Part 1: Noise. (BSI, 2014a)

British Standards Institution BS 5228: 2009+A1:2014 Code of Practice for Noise and Vibration on Construction and Open Sites, Part 1: Noise. (BSI, 2014b)

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British Standards Institution BS 8233:2014. Guidance on sound insulation and noise reduction for buildings. (BSI, 2014d)

British Standards Institution BS 4142: 2014 Methods for rating and assessing industrial and commercial sound. (BSI 2014e)

Department of Transport (DfT)/ Welsh Office Memorandum 'Calculation of Road Traffic Noise' (CRTN)' (DfT/ Welsh Office, 1988)

Highways England 'Design Manual for Road and Bridges Volume 11 Section 3 Part 7 HD213/11 (Revision 1) Traffic Noise and Vibration' (DMRB) (Highways Agency, 2011)

Email from Simon Jennings at LCCC to Jordan Hunter of AECOM, 21st December 2017 and 10th January 2018.

BS 7385-2 'Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration' (BSI, 1993)

TRL (2002) Converting the UK traffic noise index $L_{A10,18h}$ to EU Noise Indices for Noise Mapping, TRL Report PR/SE/451/02.

TRL (2006) Method for converting the UK road traffic noise index $L_{A10,18h}$ to EU Noise Indices for road noise mapping, TRL Report st/05/91/AGG04442.

Council Directive 2000/14/EC of 8 May 2000 - Noise Emissions for Outdoor Equipment

11 Microclimate

11.1 Introduction

The proposed assessment for microclimate is split into two separate assessments:

- Pedestrian Wind Comfort and Distress; and,
- Sunlight, Daylight and Shadow Analysis

The results of each assessment are reported within the chapter.

11.2 Pedestrian Wind Comfort and Distress

11.2.1 Introduction

This chapter considers the impact on pedestrian comfort due to wind caused by the proposed development.

Simulations of the existing site and the proposed development scenario were conducted to quantitatively assess the wind microclimate and the effects on pedestrian comfort levels.

Over 10 rounds of mitigation measures were then applied, and the final chosen mitigation measures are presented in this report.

This section of the report details the results of quantitative simulations used to produce the standard Lawson Comfort and Distress plots.

11.2.2 Methodology

11.2.2.1 Outline of the Proposed Development

The proposed development consists of an office-based scheme complemented with commercial and residential mixed buildings. It included a tower at the south corner approximately 30m tall, with setbacks which will help to reduce downdraft, and a tower at the north side of the development, approximately 65m tall, bounded by two partially enclosed courtyards.

The image below shows the proposed development.

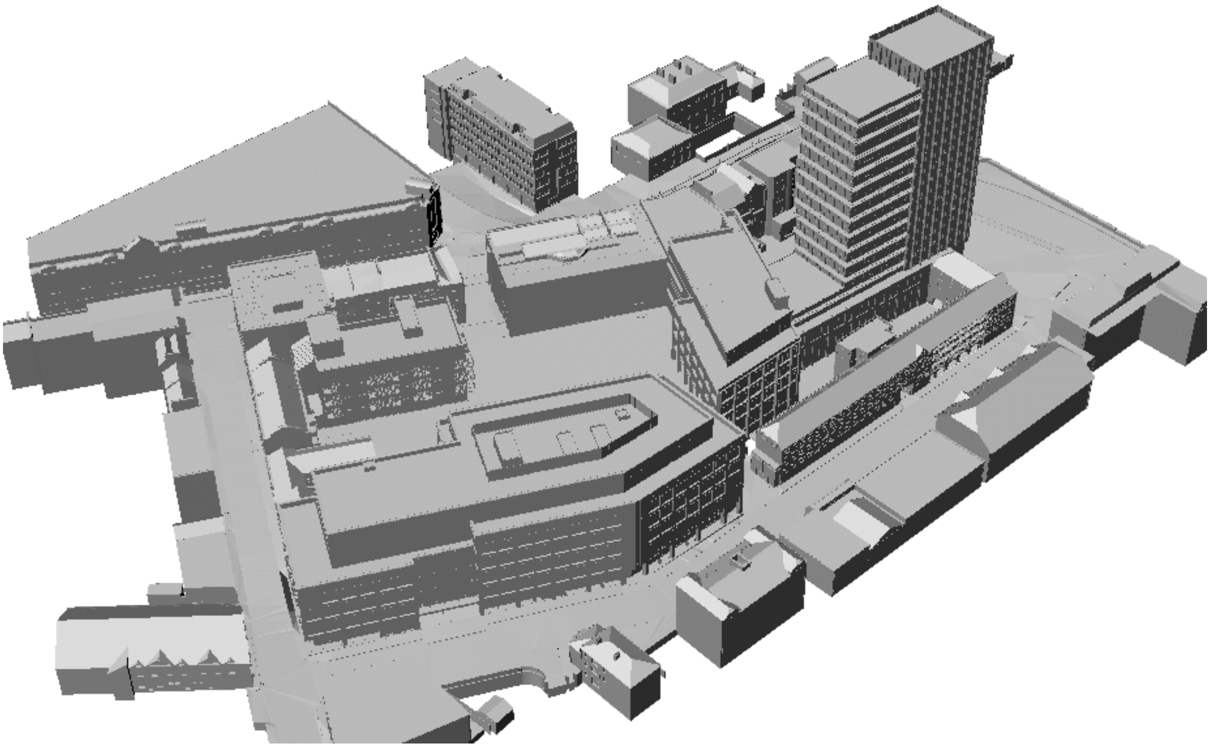


Figure 11-1: Geometry used to model the proposed development

Limerick is predominantly a low rise city, and it is expected this development will be relatively exposed to wind. This report details the assessment of the baseline, the unmitigated scheme, and the steps taken to reduce the impact of wind on the surroundings of the building at pedestrian level.

11.2.2.2 Scope of the Computational Fluid Dynamics (CFD) Study

The assessment was undertaken through computational wind engineering (CWE) which uses computational fluid dynamics (CFD) techniques to model the wind conditions at full scale and simulate conditions around the site. This report contains the methodology, inputs and results from this simulation.

The aim of the simulation was to reproduce the macro-level wind regime around the buildings. 36 wind directions (every 10° around the compass) were analysed using representative strong winds applied to a full 3D model of the development within the local built environment.

Further analysis was undertaken to assess compliance with Lawson Criteria by interpolating steady state CFD simulations of the site to predict wind frequencies across the course of a typical year using historic weather data.

Turbulence has also been accounted for in the Lawson analysis.

11.2.2.3 Limitations of Modelling

The use of CFD or wind tunnels for wind modelling is not an exact science. Although software or physical models can be used to demonstrate an improvement (or otherwise) in the wind microclimate around a development, like any modelling technique, absolute improvements cannot be guaranteed.

CFD simulation presents an efficient and comprehensive solution to predicting Lawson pedestrian Comfort and Distress. Since the domain is divided into millions of separate cells, results can be reported in high resolution throughout the full 3D domain.

This report is suitable for Lawson pedestrian Comfort and Distress and is not intended to be used for any other purpose.

11.2.2.4 Transient Effects

The industry standard method of assessing pedestrian comfort with computer simulations is to perform a series of steady-state simulations from different wind directions. These are then combined into 'Lawson Comfort plots' and 'Lawson Distress plots'.

The transient (varying in time) portion of the flow field is represented as a time-averaged turbulence at each point in the domain. Turbulence generated by interactions between the wind and buildings acts to increase the viscosity of the air, and in this way the influence of turbulence on the steady-state results is accounted for. This steady-state result is then suitable for input to the steady-state Lawson Comfort and Distress method.

The steady-state turbulence model used calculates the turbulence kinetic energy, which is a prediction of the average velocity fluctuations, at each point in the domain.

The velocity fluctuations, calculated from the recorded turbulence kinetic energy, have been included in the current Lawson comfort study.

Figure 11-2 shows an idealised diagram of airflow around a building block. It is these mechanisms, amongst others, that introduce turbulence in the real world and the simulation.

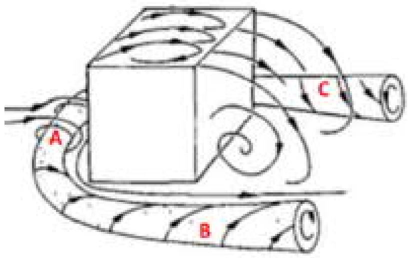


Figure 11-2: Schematic of turbulent airflow around a building block

11.2.2.5 The Lawson Criteria

The assessment of pedestrian level wind conditions requires a standard against which measured or expected wind velocities can be compared. There are a number of these standards in use throughout the world, with the most common in the UK and Ireland being the Lawson method. The Comfort and Distress criteria used will be those described in “Building Aerodynamics” by T.V. Lawson as “The LDDC (London Docklands Development Corporation) Method” (Lawson T. , 2001).

The Distress criteria specify a limit of 0.025%, using wind speeds of 20m/s for “General Public”, and 15m/s for “Frail Person or Cyclist”. A breach of these distress criteria requires a consideration of:

- Whether the location is “on a major route through the complex” and;
- Whether there are “suitable alternate routes which are not “distressful”.

Levels of pedestrian comfort strongly depend on individual activity. Therefore, the Lawson Comfort criteria are defined for each activity in terms of a threshold wind speed, which should not be exceeded for more than a given number of hours throughout the year.

Pedestrian Comfort and Distress criteria are assessed at 1.5m above ground level. With exception of unusual circumstances, wind speeds at pedestrian level increase with height from the ground. Therefore, an assessment at 1.5m will be more onerous than one at 0.5m, for example.

AECOM has developed a methodology to predict how often a given wind speed will occur each year over a specified area, interpolating the results of steady state computational fluid dynamics simulations using weather data measured at an appropriate nearby location.

Pedestrian activity varies throughout the year. However, the Lawson criteria percentages are across the whole year and assume that people will be suitably dressed for the time of year and individual activity.

The LDDC Method Comfort Criteria are set out in Table 11-1 below.

Table 11-1: Lawson Comfort Criteria

Category	Comfort Category	Threshold Wind Velocity (m/s)	Colour Scale	Percentage of Exceedance
I	Pedestrian sitting	4		5%
II	Pedestrian standing	6		5%
III	Pedestrian walking	8		5%
IV	Business walking/Cycling	10		5%
V	Unacceptable for Pedestrian Use	>10		>5%

If a category in Table 11-1 is shown in a Lawson comfort plot then that area will be acceptable for that category and all those with less onerous thresholds (i.e. those categories below it in the table). For example, if an area is coloured with the green shown for “Category III” in the Lawson comfort plot, it will be acceptable if its proposed use is “Pedestrian walking” and/or “Business walking/Cycling”, but not acceptable if the proposed use is “Pedestrian standing” and/or “Pedestrian sitting”.

It is important that entrance doors are situated in areas which provide a slow transition from the calm indoor area to the windier exterior. Entrance doors should have an area suitable for pedestrian standing directly outside.

As a guide to the experience of various wind speeds please refer to Table 11-2.

Table 11-2: The Beaufort scale

Beaufort Force	Hourly average wind speed (m/s)	Description of wind	Noticeable effect of wind
2	1.55 – 3.35	Light	Wind felt on faces: leaves rustle; wind vanes moves
3	3.35 – 5.60	Light	Leaves and twigs in motion; wind extends a flag
4	5.60 – 8.25	Moderate	Raises dust and loose paper; small branches move
5	8.25 – 10.95	Fresh	Small trees in leaf sway
6	10.95 – 14.10	Strong	Large branches begin to move; telephone wires whistle

Distress caused by extreme winds was also considered. The Lawson LDDC method for the Distress criteria was used, as set out in Building Aerodynamics, (Lawson T. , 2001). Distress is considered to be when:

> *"someone could find walking difficult, or could even stumble or fall".*

Furthermore, the Lawson Distress criteria state that for elderly or infirm pedestrians and cyclists, the hourly mean wind speed should exceed 15 m/s for no more than 0.025% of the year (approximately 2 hours). For able-bodied pedestrians, the hourly mean wind speed limit should exceed 20 m/s for no more than 0.025% of the year. Should these be exceeded for more than 0.025% of the year, the method informs the wind engineer to consider:

> *"Is the location on a major route through the complex, and are there suitable alternate routes which are not 'Distressful'?"*

The standards were developed for use around London's docklands redevelopment and do not account for local human factors. The accompanying text does introduce the idea of probability – what are the chances that the frailest members of the population will be traversing the site on the windiest days, coupled with the probability that these windy days exist.

Assessments have been carried out by AECOM, on other projects, in extremely windy locations such as the island of Orkney. There, even low buildings caused some areas of distress. In that project this was considered a reasonable outcome as it was felt by the wider project team that the local population would expect winds of that nature in their urban landscapes. The standard defines areas of distress as a probability of being blown over that was felt to be appropriate in the London Docklands.

These areas of "distress" are not *always* distressful. On a calm day these areas will also be calm. In the greatest storm of the century distress will be felt well outside these areas. They are balanced probability of what is felt to be an acceptable occurrence of distressful winds.

11.2.2.6 Computational Fluid Dynamics (CFD)

Simulations of the site's microclimate were conducted using ANSYS CFX-16 CFD software. CFD simulation of likely wind patterns uses a three-dimensional computer model of the site and surrounding buildings.

The computational process involves solving the fundamental equations of fluid motion within the CFD software. A computational 'mesh' was created to represent the geometry by dividing the domain into a large number of cell volumes. An example of the mesh used is shown in Figure 11-3**Error! Reference source not found.**. During the simulation, the values of each variable are determined at each cell of the mesh and thus a calculation of the variation of velocity and scalar variables within the domain is obtained.

The dependent variables are as follows:

- Velocities in the three co-ordinate directions (U, V, W)
- Pressure (P)
- Turbulence Kinetic Energy (k)
- Turbulence Dissipation Rate (ε)
- Turbulence Specific Dissipation (ω)

To improve the resolution of the results, the mesh was refined in the areas of most interest i.e. at pedestrian level around the proposed development and around significant small-scale flow features. This ensures greater accuracy of the variables under investigation. The Shear Stress Transport (SST) turbulence model has been used for this analysis.

11.2.2.7 Mesh

The computational mesh used for each simulation used approximately 3 million calculation nodes. Three layers of prisms were used on surfaces.

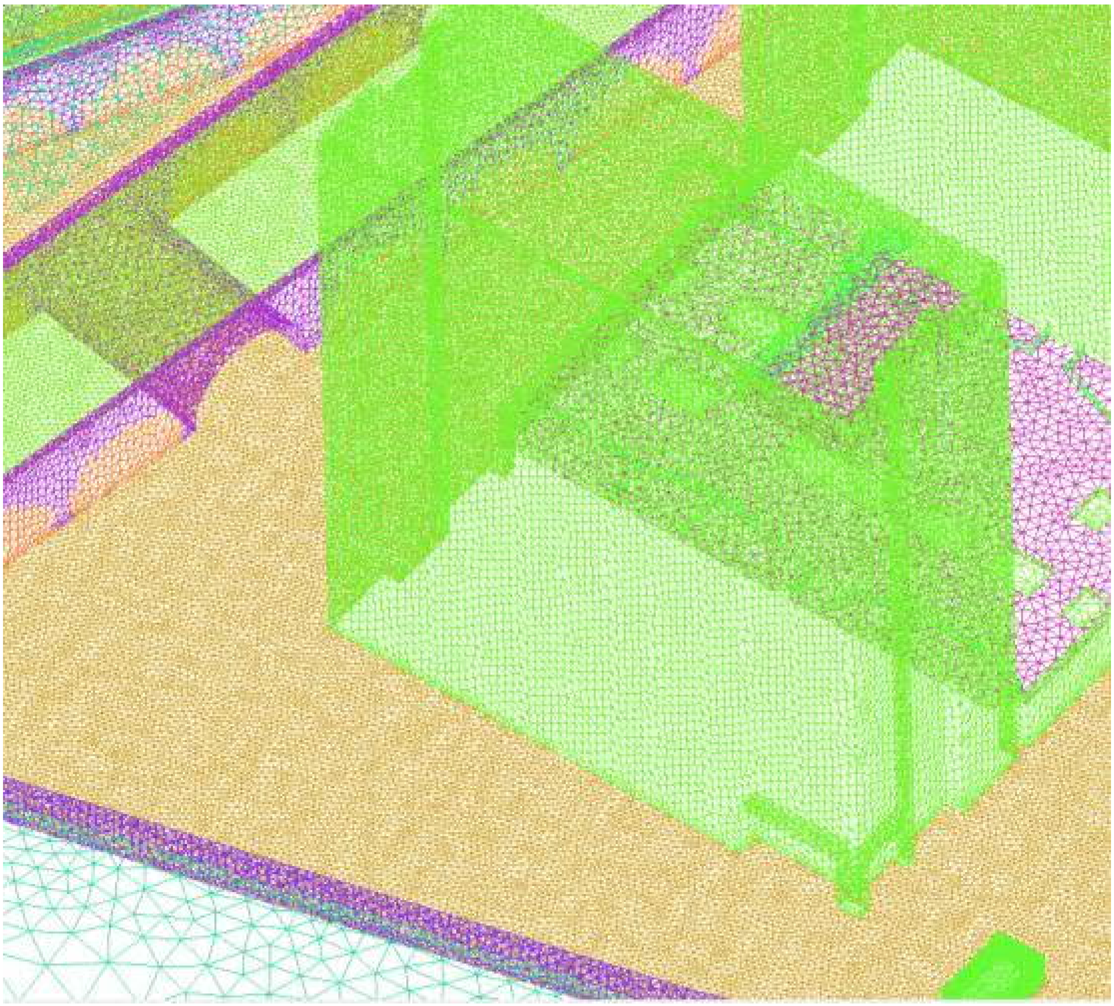


Figure 11-3 : Example of typical mesh

11.2.2.8 Boundary Conditions
Around the perimeter of the 3D domain, a profile for the velocity and turbulence parameters was specified to take into account the variation in wind speed with height from the ground. Surfaces within the model were specified as having 'no slip'. This condition ensures that flow is brought to rest at the point where it meets the surface. In addition, the type of terrain has been identified using Google Map. A roughness is specified to account for the roughness present on the surfaces.

11.2.2.9 Atmospheric Boundary Layer Profile
Accurate specification of the atmospheric boundary layer profile is crucial in correctly simulating the pedestrian level wind environment. For this reason, a logarithmic profile was assumed, which creates an atmospheric boundary layer profile based on the assumption that wind speed increases proportionally with the natural logarithm of the height from the ground. The upstream logarithmic velocity profile and turbulence profiles were applied for the simulations. This velocity profile is representative of most strong winds.

11.2.2.10 Building and Terrain Surfaces
All solid surfaces were represented as 'no slip' with an appropriate roughness height to account for small surface features. Geometry data for ground level and buildings far from the site have been taken from the Lidar data and Google Maps.

11.2.2.11 Trees

The modelling of trees is not an exact science. In addition, the very highest winds tend to occur in winter when deciduous trees are leafless. It is possible to model trees in CFD and wind tunnels, but it is extremely difficult to quantify the true effect of an individual tree on airflow within the real site. The porosity and resistance to flow is highly sensitive to many factors such as species, age, health, aspect, soil, season etc.

In this study, deciduous trees have been represented as totally transparent to wind. This is because the strongest winds tend to occur in winter when leaves are not on the trees. Evergreen trees have been modelled as having a resistance to wind of loss coefficient 1.75/m, a middling value based on available literature. The validity of this assumption should be checked once a selection of the actual trees has been selected for purchase.

Trees have been modelled as shown in the picture below, trimmed to a height decided by the mitigation strategy. The image below thus represents the maximum size of tree considered in any of the mitigation runs. For the final mitigation run the trees will be shorter.

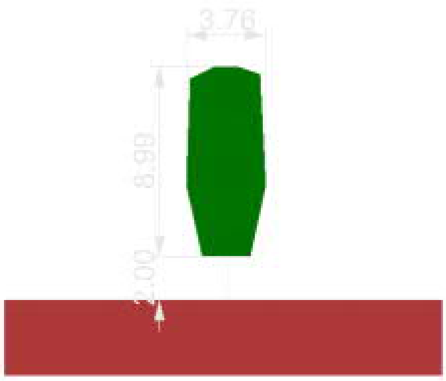


Figure 11-4: Typical computational domain for the proposed development

11.2.2.12 Domain

The domain used for the simulations is shown in Figure 11-5. As can be seen it covers a large area of the city, beyond the redline boundary.

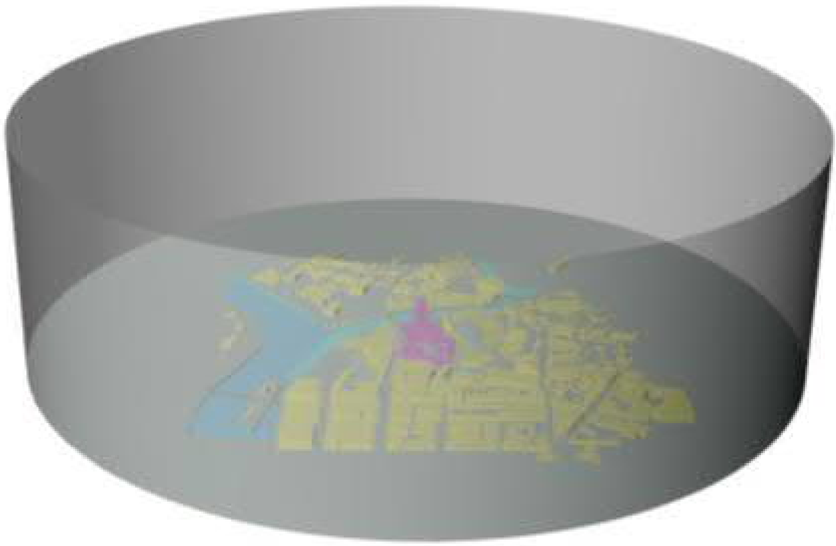


Figure 11-5: Typical computational domain for the proposed development

11.2.2.13 Inputs

A 3D model of the proposed development ("Opera.rvt") was provided by the project team. This was based on a detailed survey of the existing buildings within and in close proximity to the redline boundary, combined with the proposed development.

Data from a Lidar survey was purchased. Lidar is a method measuring the height of buildings by using a pulsed laser light from a plane. This was used to construct a model of the surrounding built environment using Rhinoceros 5 (industry standard geometric modelling software).

Figure 11-6: Google Earth aerial view of proposed development's location

It is recommended (Tominaga, AIJ Guidelines for Practical Applications of CFD to Pedestrian Wind Environment around Buildings, 2008) that the domain should extend upstream by a distance five times the height of the building being analysed. In this analysis, the maximum building height is 65m; therefore a domain extending to a minimum of 325m in all directions. In this study, the domain extended further than 325m from the proposed site in all directions, as this would provide a more accurate representation of the upstream terrain. The boundary of the domain extends such that this recommendation is implemented all around the site.

Wind is simulated in 36 directions around the compass, so that even rarely seen wind effects can be captured and appropriately represented.

11.2.2.14 Wind Data Analysis

Wind microclimate studies require that wind speed data obtained from a measurement station be transposed to the site of interest.

The wind speed history, provided by weather centres such as the nearby airports, is reformatted into the number of observations of mean hourly wind speeds within each of the wind speed ranges, for each wind direction. A Weibull distribution is fitted to the wind speed distribution for each wind direction.

From the Weibull cumulative distribution, for a given wind direction, the probability, P, that a wind speed, V, will be exceeded is given by:

$$P = e^{-(\frac{v}{c})^\wedge k}$$

where c is the scale parameter and k is the shape parameter.

The resulting weather centre wind data is transposed to a standard reference terrain category, 'open country terrain', at sea level, accounting for upwind terrain, topography and altitude for the weather centre.

The probability, P, of each wind direction occurring is then added to these parameters. Thus, the probability that a specified wind speed will be exceeded for a specified wind direction may be calculated. The resulting weather centre wind data is transposed to a standard reference terrain category, 'open country terrain', at sea level. The open country wind data is then transposed to a reference height at the site of the proposed development, accounting for upwind terrain, topography and altitude at the target site.

Values of P, c and k for the Shannon Airport weather station from 1989 to 2019, were transposed to open-country terrain at 10m height above sea-level.

There is some disagreement between the peak wind standard across Europe, and the UK and Ireland are not an exception. The raw airport weather data was a good fit to the UK standards, but predicted a lower probability of strong winds than the Irish standards. Met Éireann Climate Services are a recognised authority on Irish weather data, and they were contacted in regards to this issue. The raw Weibull data collected at the airport was modified by reducing the shape factor to 88%. Reducing the shape factor has the result of producing more relatively high winds, and resulted in a very close match to the Met Éireann data. This modified data will be used in this study.

11.2.2.15 Ground Surface Roughness

The roughness of the upwind ground surface is important in the formulation of the atmospheric boundary layer and as a result will affect the wind velocity felt at pedestrian level on the site. An approaching terrain roughness was chosen, at 10° intervals, according to the method described in (BS EN, 2010). The roughness used to define the wind profile approaching the domain is shown in Table 11-3.

Table 11-3: Terrain Categories and Related Parameters

Terrain Category		z0 (m)
0	Sea or coastal area exposed to the open sea	0.003
I	Lakes or flat and horizontal area with negligible vegetation and without obstacles	0.01
II	Area with low vegetation such as grass and isolated obstacles (trees, buildings) with separations of at least 20 obstacle heights	0.05
III	Area with regular cover of vegetation or buildings or with isolated obstacles with separations of maximum 20 obstacle heights (such as villages, suburban terrain, permanent forest)	0.3
IV	Area in which at least 15% of the surface is covered with buildings and their average height exceeds 15m	1.0

A roughness of 0.3m has been allocated to most of the external boundary, except at the north and the south west, where a river with trees on the banks seems to bring fast wind straight into the city.

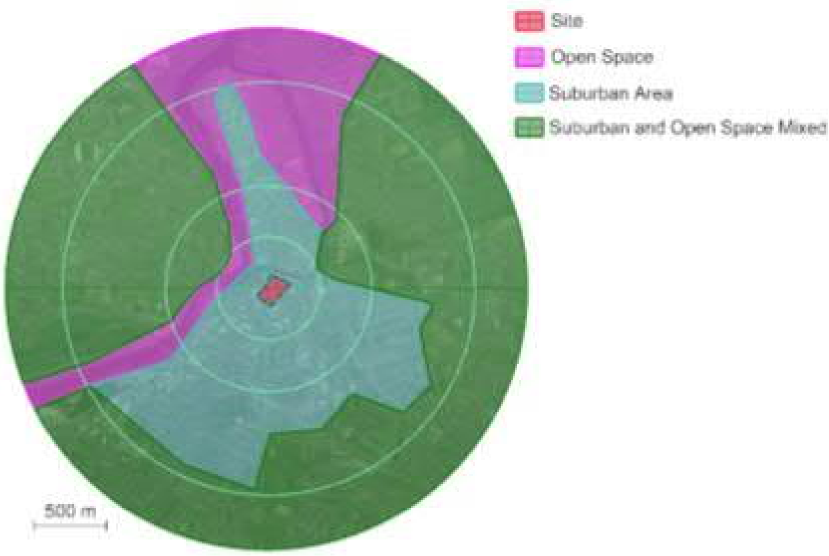


Figure 11-7: Terrain category around the site

For this analysis, a combination of category II and III was chosen for the surrounding terrain in every direction, as shown in Table 11-3.

Table 11-4: Roughness categories used for CFD simulations

Angle from North (degrees)	Roughness category	z0 value (m)
0-30	2	0.05
30-60	3	0.3
60-90	3	0.3
90-120	3	0.3
120-150	3	0.3
150-180	3	0.3
180-210	3	0.3
210-240	2	0.05
240-270	3	0.3
270-300	3	0.3
300-330	3	0.3
330-360	2	0.05

11.2.2.16 Pedestrian Activity

Levels of pedestrian comfort strongly depend on individual activity. Therefore, the Lawson Comfort criteria are defined for each activity in terms of a threshold wind speed, which should not be exceeded for more than 5% of the year.

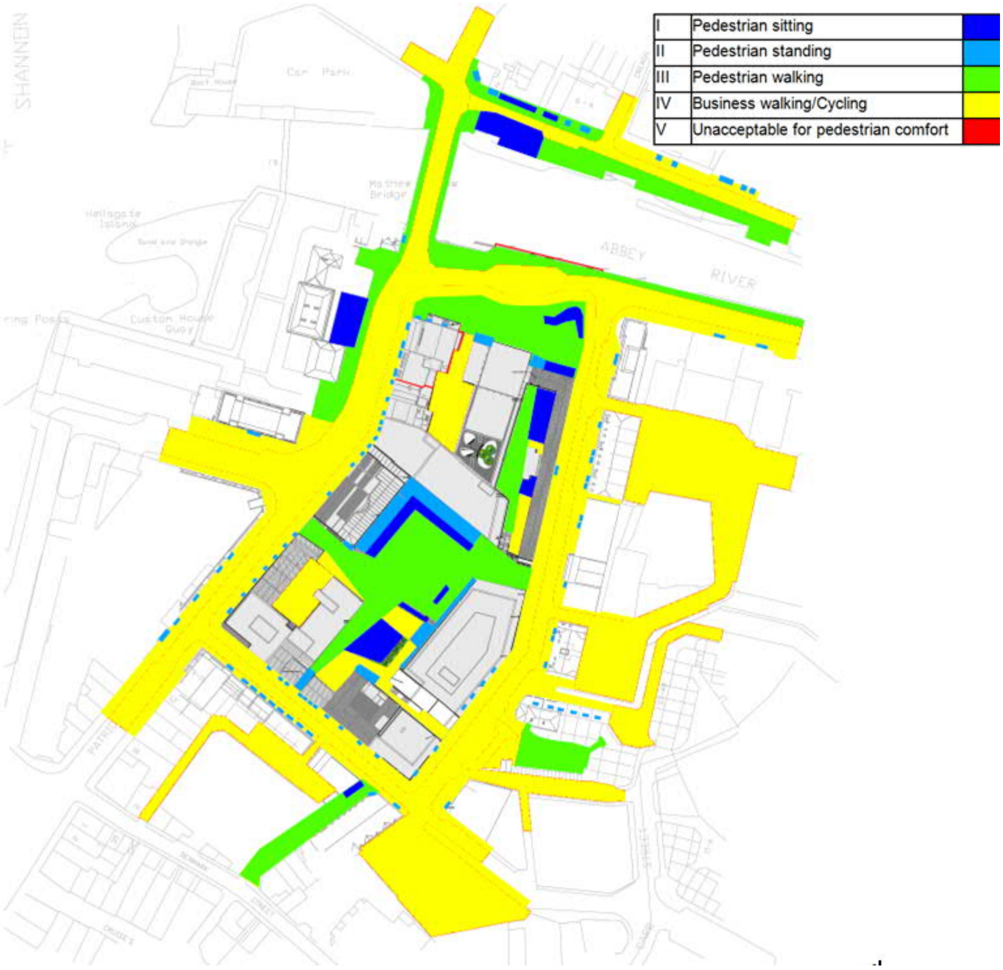


Figure 11-8: Intended use of the terrain on the site

11.2.2.17 Locations

Figure 11-9 shows the labelling used henceforth to refer to each block in the proposed development.

Figure 11-9: Naming convention used for blocks in proposed site

The image below shows the street names surrounding the site. The new development sits in the block formed by Michael street to the east, Charlotte's Quay to the north, Patrick Street/Rutland street/Bridge Street to the west, and Ellen street to the south.

The plaza to the north of the development, between it and the river to the south of Charlotte's Quay is to be known as Bank Place.

Figure 11-10: Location Map

11.2.2.18 Impact Criteria

For this report, the well-established Lawson comfort criteria must be mapped onto significance criteria categories. In this report the following rules have been used:

Major
Comfort conditions are four categories more windy than the windiest of the intended use or the baseline condition.
Distress 15m/s exceeds five hours per year where it did not before.
Distress 20m/s exceeds three hours per year where it did not before.

Major-Moderate
Comfort conditions are three categories more windy than the windiest of the intended use or the baseline condition.
Distress 15m/s exceeds four hours per year where it did not before.
Distress 20m/s created where it was not previously found.

Moderate
Comfort conditions are two categories more windy than the windiest of the intended use or the baseline condition.
Distress 15m/s exceeds three hours per year where it did not before.

Minor
Comfort conditions are one category windier than the windiest of the intended use or the baseline condition.
Distress 15m/s exceeds two hours per year where it did not before.

Negligible
Comfort condition meets intended use, is calmer than or as calm as the baseline condition.
Distress meets guidelines, or is unchanged from baseline case.

11.2.3 Baseline Conditions

11.2.3.1 Geometry

Figure 11-11 shows the underlying geometry for the existing site.

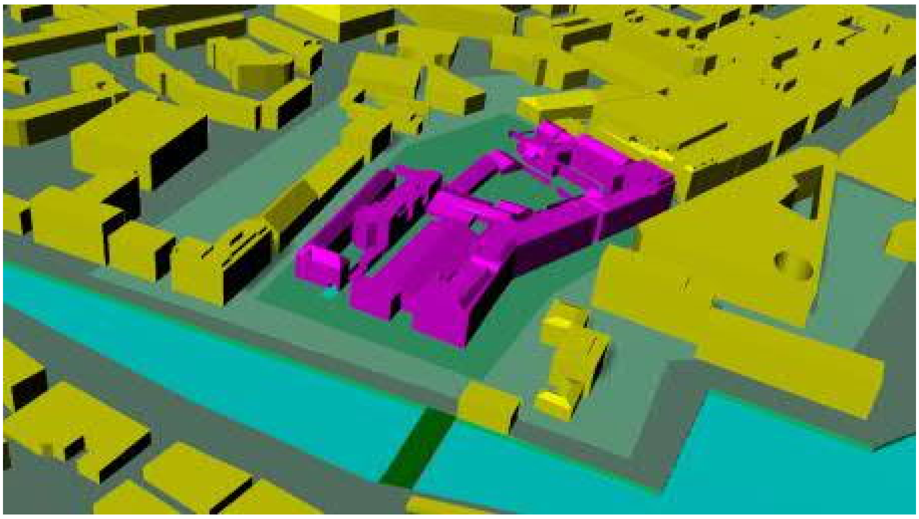


Figure 11-11 Geometry used for the simulation of the Existing site (shown in pink)

The graphics presented in this and other sections are from the CFD model. Colours and textures should not be taken from this report, but from the wider submission.

11.2.3.2 Baseline Site – Comfort

For the purposes of making comparisons to the current conditions at and around the site, the existing site was assessed.

Error! Reference source not found. below shows the wind conditions with existing surrounding buildings, and existing buildings within the redline boundary. As can be seen from the figure, areas around the site are suitable for a mix of pedestrian sitting and pedestrian standing. To the north of the site, on the bridges across the river including the Bridge Street bridge and on the northern side of the river at St George's Quay, the site is more suitable for pedestrian walking.

I	Pedestrian sitting	
II	Pedestrian standing	
III	Pedestrian walking	
IV	Business walking/Cycling	
V	Unacceptable for pedestrian comfort	

11.2.3.3 Baseline Site – Distress (15m/s)

Figure 11-12 below shows the existing distress case for less able bodied users and cyclists. It can be seen that the majority of the site and surrounding urban area meets guidance; however a small patch on the bridge of Bridge Street is slightly above guidance. The baseline condition is that the majority of the site and surrounding area meets the guidelines, with small isolated patches not meeting this.

Figure 11-12 : Lawson 15m/s Distress for frail/elderly and cyclists - Existing. Red indicates unacceptable conditions.

11.2.3.4 Baseline Site – Distress (20m/s)

Figure 11-13 below shows there are no areas of distress for the able bodied in the existing site. This will form the baseline.

Figure 11-13: Lawson 20m/s Distress for able-bodied – Existing. Red indicates unacceptable conditions.

11.2.4 Predicted Impacts

11.2.4.1 Geometry

Figure 11-14 shows the default geometry for the proposed site, pre-mitigation.

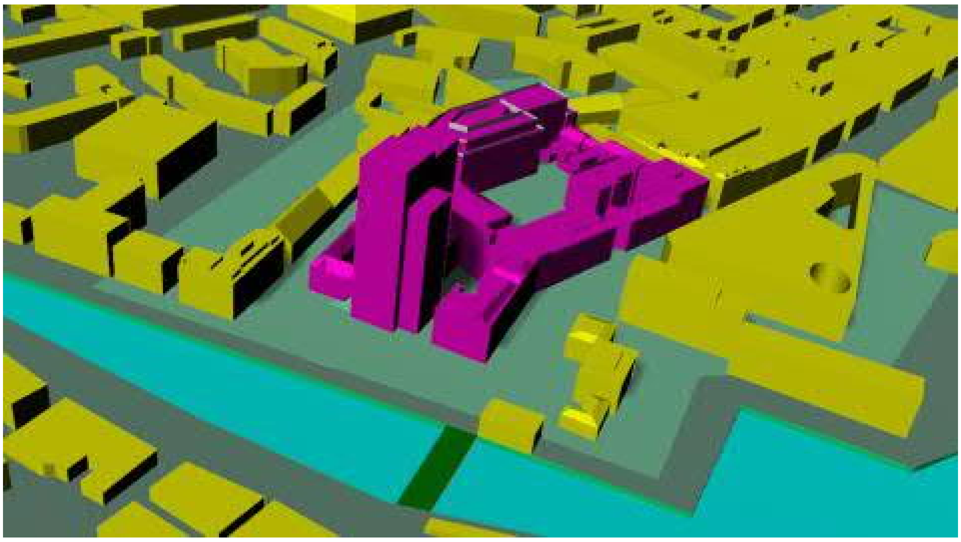


Figure 11-14: Geometry used for the simulation of the proposed development (shown in pink)

11.2.4.2 Proposed development – Comfort

Figure 11-15 shows Lawson comfort conditions for the proposed development with existing surroundings.

Most of the bridge on Bridge Street is suitable for pedestrian walking, with some areas more calm.

Around Block 3, it is observed that areas close to the building are suitable for sitting and much of the courtyard in the centre of the proposed development is suitable for standing. However, the area between the archway and the access to Michael Street on the east side of the site is mainly suitable for pedestrian walking.

West and south of the development, most of Patrick Street and Ellen Street are suitable for standing pedestrians. On the east, Michael Street is mostly suitable for pedestrian walking, with some areas suitable for walking.

Figure 11-15: Lawson comfort - Proposed development

I	Pedestrian sitting	
II	Pedestrian standing	
III	Pedestrian walking	
IV	Business walking/Cycling	
V	Unacceptable for pedestrian comfort	

11.2.4.3 Proposed development – Distress (15m/s)

Figure 11-16 shows Lawson Distress 15m/s for frail/elderly and cyclists, with red indicating unacceptable conditions, an approximately two hour or more per year incidence.

The proposed development experiences a large Distress region between Block 2 and the river. This is caused in large part by air quickly exiting the western courtyard, and spilling out across Bank Place.

The archway and beside The Granary courtyard to the east is also seeing a Distress region, mainly due to 220-230 degrees winds driven downwards hitting the new tower on the east of the Proposed development.

The bridge at the northwest of the proposed development is largely covered by a Distress region, due to a 130 degrees wind deflecting from the tall buildings of Block 2.

Northern corners of the site also experience Distress regions mostly due to a range of 240-270 degrees wind being deflected around the main tower, coming across Bank Place, and then impacting the buildings on the eastern edge of Bank Place.

Another smaller Distress region can be seen at the south east corner of the proposed development. In this case Block 3 is driving the 250 degrees wind down creating higher velocity at pedestrian level.

The next section of the report will detail mitigation measures put in place to improve these conditions.

Figure 11-16: Lawson 15m/s Distress for frail/elderly and cyclists - Proposed development. Red indicates unacceptable conditions.

11.2.4.4 Proposed development – Distress (20m/s)

Figure 11-17 below shows there are no areas of distress for the able bodied in the proposed case. This matches the baseline.

Figure 11-17: Lawson 20m/s Distress for able-bodied - Proposed development. Red indicates unacceptable conditions.

11.2.4.5 Impacts Tables

11.2.4.6 Comfort Lawson

The table below shows the intended, baseline, and proposed wind conditions at locators through the site.

Table 11-5 Wind Conditions at locators throughout the site

Receptor	Intended Wind Conditions	Baseline Wind Conditions	Proposed Wind Conditions
Building Entrances along George's Quay	Pedestrian Standing	Pedestrian Standing	Pedestrian Standing
Roadway along George's Quay	Business Walking	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing
Riverside along George's Quay	Pedestrian Walking	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing /Pedestrian Walking
Riverside seating area George's Quay, next to Bridge Street bridge	Pedestrian Sitting	Pedestrian Walking	Pedestrian Walking
Bridge Street Bridge, Roadway	Business Walking	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing /Pedestrian Walking
Bridge Street Bridge, Pavement	Pedestrian Walking	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing /Pedestrian Walking
Rutland Street roadway in front of the Hunt Museum	Business Walking	Pedestrian Sitting/Pedestrian Standing	Pedestrian Sitting /Pedestrian Standing/ Pedestrian Walking
Rutland Street pavement in front of the Hunt Museum	Pedestrian Standing	Pedestrian Sitting/Pedestrian Standing	Pedestrian Sitting/Pedestrian Standing
Sitting Area Directly in front of Hunt Museum	Pedestrian Sitting	Pedestrian Sitting/Pedestrian Standing	Pedestrian Sitting/Pedestrian Standing
Building Entrances to East of Rutland Street and Patrick Street	Pedestrian Standing	Pedestrian Sitting/Pedestrian Standing	Pedestrian Sitting/Pedestrian Standing
Northern End of Patrick Street Roadway	Business Walking	Pedestrian Sitting/Pedestrian Standing	Pedestrian Sitting/Pedestrian Standing
West end of Ellen Street	Business Walking	Pedestrian Standing	Pedestrian Standing
West end of Ellen Street Building Entrances	Pedestrian Standing	Pedestrian Standing	Pedestrian Standing
Corner of Ellen Street and Michael Street	Business Walking	Pedestrian Sitting	Pedestrian Standing with large area of Pedestrian Walking
Little Ellen Street	Pedestrian Walking	Pedestrian Sitting	Pedestrian Sitting/Pedestrian Standing
Southern Half of Michael	Business Walking	Pedestrian Sitting	Pedestrian

Receptor	Intended Wind Conditions	Baseline Wind Conditions	Proposed Wind Conditions
Street Roadway (Excluding impacts from corner of Ellen Street)			Standing
Southern Half of Michael Street Pavement (Excluding impacts from corner of Ellen Street)	Business Walking	Pedestrian Sitting	Pedestrian Standing
Southern Half of Michael Street Doorways (Excluding impacts from corner of Ellen Street)	Pedestrian Standing	Pedestrian Sitting	Pedestrian Standing
Northern Half of Michael Street Roadway	Business Walking	Pedestrian Sitting / Pedestrian Standing	Pedestrian Standing /Pedestrian Walking
Northern Half of Michael Street Pavement	Business Walking	Pedestrian Sitting / Pedestrian Standing	Pedestrian Standing /Pedestrian Walking
Northern Half of Michael Street Doorways	Pedestrian Standing	Pedestrian Sitting / Pedestrian Standing	Pedestrian Standing
Bank Place Seating Area	Pedestrian Sitting	Pedestrian Sitting	Pedestrian Standing
Bank Place Walking Area	Pedestrian Walking	Pedestrian Sitting / Standing	Pedestrian Standing / Walking / Business Walking
Bank Place Building Entrances	Pedestrian Standing	Pedestrian Sitting	Pedestrian Standing /Pedestrian Walking
Charlotte's Quay Roadway, north of Bank Place	Business Walking	Pedestrian Standing	Pedestrian Standing / Walking / Business Walking
Pavement between the Abby River and Charlotte's Quay, north of Bank Place	Pedestrian Walking	Pedestrian Standing	Pedestrian Standing / Walking / Business Walking
Western Courtyard (Service Yard)	Business Walking	N/A	Pedestrian Standing /Pedestrian Walking
Eastern Courtyard (Granary Square) - seating areas	Pedestrian Sitting	N/A	Pedestrian Standing
Eastern Courtyard (Granary Square) - other areas	Pedestrian Walking	N/A	Pedestrian Standing
Southern Courtyard Seating Areas	Pedestrian Sitting	N/A	Pedestrian Standing
Southern Courtyard Building Entrances	Pedestrian Standing	N/A	Pedestrian Standing
Southern Courtyards Other Areas	Pedestrian Walking	N/A	Pedestrian Walking
Carpark Underpass	Business Walking	N/A	Pedestrian Walking

11.2.4.7 Comfort Impact

The table below shows the proposed impacts through the site for comfort.

Table 11-6 Proposed Impacts through the site for comfort

Receptor	Proposed Impact
Building Entrances along George's Quay	Negligible
Roadway along George's Quay	Negligible
Riverside along George's Quay	Negligible
Riverside seating area George's Quay, next to Bridge Street bridge	Negligible
Bridge Street Bridge, Roadway	Negligible
Bridge Street Bridge, Pavement	Negligible
Rutland Street roadway in front of the Hunt Museum	Negligible
Rutland Street pavement in front of the Hunt Museum	Negligible
Sitting Area Directly in front of Hunt Museum	Negligible
Building Entrances to East of Rutland Street and Patrick Street	Negligible
Northern End of Patrick Street Roadway	Negligible
West end of Ellen Street	Negligible
West end of Ellen Street Building Entrances	Negligible
Corner of Ellen Street and Michael Street	Negligible
Little Ellen Street	Negligible
Southern Half of Michael Street Roadway (Excluding impacts from corner of Ellen Street)	Negligible
Southern Half of Michael Street Pavement (Excluding impacts from corner of Ellen Street)	Negligible
Southern Half of Michael Street Doorways (Excluding impacts from corner of Ellen Street)	Negligible
Northern Half of Michael Street Roadway	Negligible
Northern Half of Michael Street Pavement	Negligible
Northern Half of Michael Street Doorways	Negligible
Bank Place Seating Area	Minor
Bank Place Walking Area	Negligible
Bank Place Building Entrances	Minor
Charlotte's Quay Roadway, north of Bank Place	Negligible
Pavement between the Abby River and Charlotte's Quay, north of Bank Place	Negligible
Western Courtyard (Service Yard)	Negligible
Eastern Courtyard (Granary Square) - seating areas	Minor
Eastern Courtyard (Granary Square) - other areas	Negligible
Southern Courtyard Seating Areas	Minor
Southern Courtyard Building Entrances	Negligible
Southern Courtyards Other Areas	Negligible
Carpark Underpass	Negligible

11.2.4.8 Distress Lawson

The table below shows the intended, baseline, and proposed wind conditions at locators through the site for the 15m/s wind condition.

Table 11-7 15m/s wind conditions

Receptor	Baseline Wind Conditions	Proposed Wind Conditions
Building Entrances along George's Quay	No Distress	No Distress
Roadway along George's Quay	No Distress	No Distress
Riverside along George's Quay	No Distress	No Distress
Riverside seating area George's Quay, next to Bridge Street bridge	No Distress	No Distress
Bridge Street Bridge, Roadway	No Distress	Areas of distress for 5 hours per year
Bridge Street Bridge, Pavement	Small Area of Distress	Areas of distress for 5 hours per year
Rutland Street roadway in front of the Hunt Museum	No Distress	Small Area of Distress for 3 hours per year
Rutland Street pavement in front of the Hunt Museum	No Distress	No Distress
Sitting Area Directly in front of Hunt Museum	No Distress	Small Area of Distress for 3 hours per year
Building Entrances to East of Rutland Street and Patrick Street	No Distress	No Distress
Northern End of Patrick Street Roadway	No Distress	No Distress
West end of Ellen Street	No Distress	No Distress
West end of Ellen Street Building Entrances	No Distress	No Distress
Corner of Ellen Street and Michael Street	No Distress	Area of distress for 3 hours per year
Little Ellen Street	No Distress	No Distress
Southern Half of Michael Street Roadway (Excluding impacts from corner of Ellen Street)	No Distress	No Distress
Southern Half of Michael Street Pavement (Excluding impacts from corner of Ellen Street)	No Distress	No Distress
Southern Half of Michael Street Doorways (Excluding impacts from corner of Ellen Street)	No Distress	No Distress
Northern Half of Michael Street Roadway	No Distress	Areas of distress for 12 hours per year
Northern Half of Michael Street Pavement	No Distress	Areas of distress for 8 hours per year
Northern Half of Michael Street Doorways	No Distress	No Distress
Bank Place Seating Area	No Distress	No Distress
Bank Place Walking Area	No Distress	Areas of distress for 20 hours per year
Bank Place Building Entrances	No Distress	No Distress
Charlotte's Quay Roadway, north of Bank Place	No Distress	Areas of distress for 12 hours per year

Receptor	Baseline Wind Conditions	Proposed Wind Conditions
Pavement between the Abby River and Charlotte's Quay, north of Bank Place	No Distress	Areas of distress for 8 hours per year
Western Courtyard (Service Yard)	N/A	No Distress
Eastern Courtyard (Granary Square) - seating areas	N/A	No Distress
Eastern Courtyard (Granary Square) - other areas	N/A	No Distress
Southern Courtyard Seating Areas	N/A	No Distress
Southern Courtyard Building Entrances	N/A	No Distress
Southern Courtyards Other Areas	N/A	No Distress
Carpark Underpass	N/A	Areas of distress for 8 hours per year

11.2.4.9 Distress Impact

The table below shows the proposed impacts through the site for distress.

Table 11-8 Proposed Impacts through the site for distress

Receptor	Proposed Impact
Building Entrances along George's Quay	Negligible
Roadway along George's Quay	Negligible
Riverside along George's Quay	Negligible
Riverside seating area George's Quay, next to Bridge Street bridge	Negligible
Bridge Street Bridge, Roadway	Major-Moderate
Bridge Street Bridge, Pavement	Major-Moderate
Rutland Street roadway in front of the Hunt Museum	Minor
Rutland Street pavement in front of the Hunt Museum	Negligible
Sitting Area Directly in front of Hunt Museum	Minor
Building Entrances to East of Rutland Street and Patrick Street	Negligible
Northern End of Patrick Street Roadway	Negligible
West end of Ellen Street	Negligible
West end of Ellen Street Building Entrances	Negligible
Corner of Ellen Street and Michael Street	Minor
Little Ellen Street	Negligible
Southern Half of Michael Street Roadway (Excluding impacts from corner of Ellen Street)	Negligible
Southern Half of Michael Street Pavement (Excluding impacts from corner of Ellen Street)	Negligible
Southern Half of Michael Street Doorways (Excluding impacts from corner of Ellen Street)	Negligible
Northern Half of Michael Street Roadway	Major
Northern Half of Michael Street Pavement	Major
Northern Half of Michael Street Doorways	Negligible
Bank Place Seating Area	Negligible
Bank Place Walking Area	Major
Bank Place Building Entrances	Negligible
Charlotte's Quay Roadway, north of Bank Place	Major
Pavement between the Abby River and Charlotte's Quay, north of Bank Place	Major
Western Courtyard (Service Yard)	Negligible
Eastern Courtyard (Granary Square) - seating areas	Negligible
Eastern Courtyard (Granary Square) - other areas	Negligible
Southern Courtyard Seating Areas	Negligible
Southern Courtyard Building Entrances	Negligible
Southern Courtyards Other Areas	Negligible
Carpark Underpass	Major

11.2.5 Mitigation Measures

Figure 11-18 below shows the geometry used for the proposed site with final mitigation. This is the combination of the dozen or so mitigation runs performed, and not reported in detail here. The mitigation consists of

- vertical and horizontal fins being added to the building,
- horizontal shelter fins above some entrances,
- gates to the northern courtyards and
- the inclusion of evergreen trees.

These trees are 5m tall from the ground in the courtyard areas, and 9m tall in Bank Place.

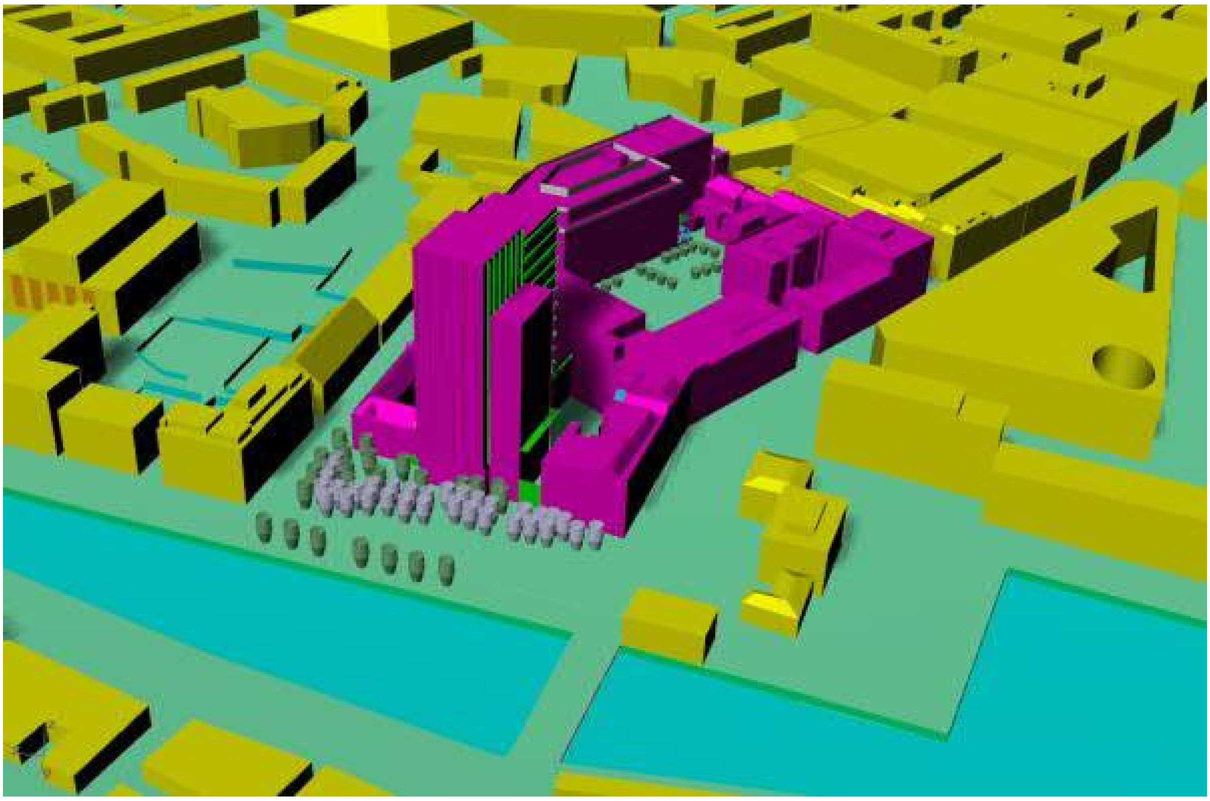


Figure 11-18: Geometry used for the simulation of the proposed development with mitigation

The section below outlines the culmination of the mitigation studies. All of the described mitigation measures were applied to the final mitigation run.

Mitigation Measure 1 – Porous Gate to Western Courtyard

To help prevent the exit of wind from the western courtyard onto Bank Place, a 7.2m high porous gate was proposed. It is anticipated this will have a pressure loss coefficient of 7/m, corresponding to an open area of approximately 30%. This was chosen so the power of the wind is partly absorbed, and a low pressure area is not created on the downstream side of the gate. Were this low pressure area be allowed to form, it could lead to gusts developing over the top of the gate. It is intended that this gate be power operated to prevent possible injury when operating in strong winds.

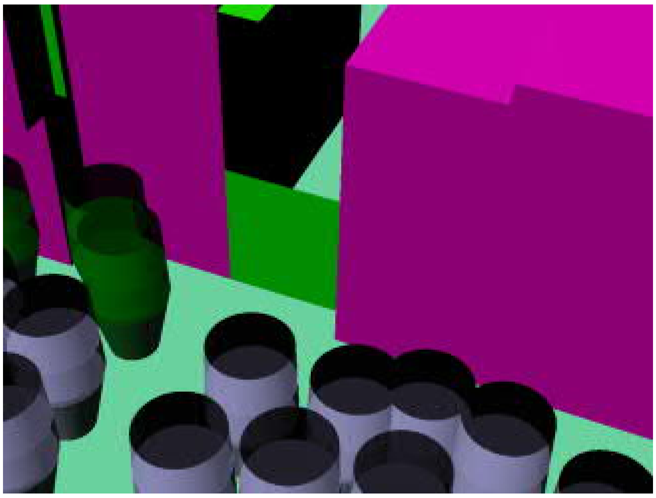


Figure 11-20: Mitigation Measure 1 – Porous Gate to Western Courtyard

Mitigation Measure 2 – Tower Skirt

To help prevent wind washing down the face of the northern tower into the eastern and western courtyards, an approximately 2m wide horizontal skirt has been placed on the eastern and western facades. This can be seen in green in the image below. It is intended this is impermeable to wind, and deflect the wind rather than absorbing it.

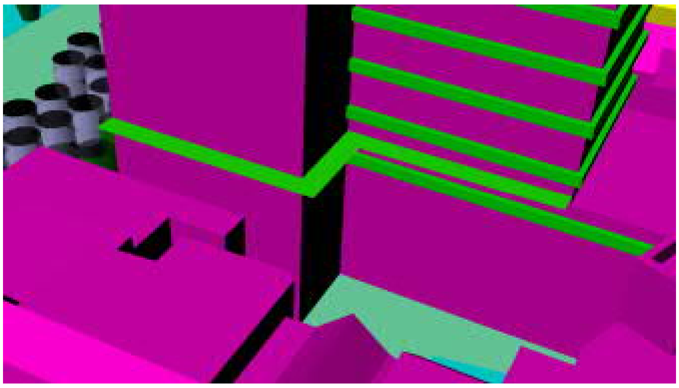


Figure 11-21: Mitigation Measure 2 – Tower Skirt

Mitigation Measure 3 – Southern Courtyard Planting

5m high evergreen planting in the southern courtyard is proposed. These were modelled as the shape previously set out, and so were modelled as having a 2m clear stem. These were intended to both calm the wind conditions around the proposed seating area, but also to aid in reducing velocities through the under croft created at the exit to the underground carpark.

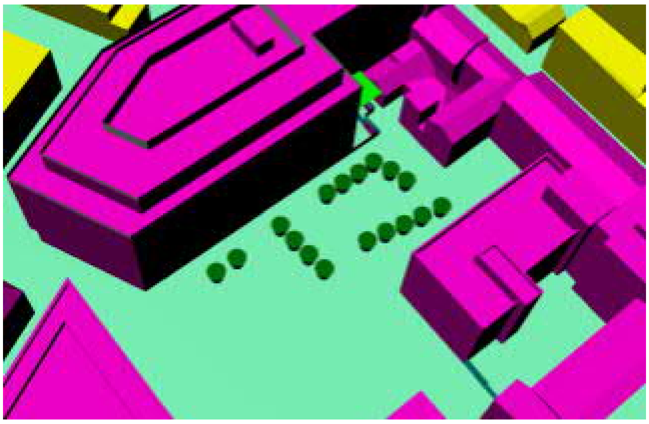


Figure 11-22: Mitigation Measure 3 – Southern Courtyard Planting

Mitigation Measure 4 – Canopy Above Carpark Entrance/Exit

In the proposed scenario there was a situation where wind entering the southern courtyard became trapped in the angle shown in the picture below, and then deflected down the southern and eastern façade creating a high pressure region close to the entrance/exit to the underground carpark. This wind then accelerated through the under croft / tunnel created by the building above. To mitigate against this the horizontal screen has been placed as shown in green in the picture below. This will deflect south westerly winds away from the tunnel and reduce distress/discomfort in this area.

Figure 11-23: Mitigation Measure 4 – Canopy Above Carpark Entrance/Exit

Mitigation measure 5 – Planting in the Eastern Courtyard

Trees of a similar type and scale to those shown in the southern courtyard are proposed for the eastern courtyard. These are to calm winds circulating in the courtyard which were brought down to low level by the tall northern tower.

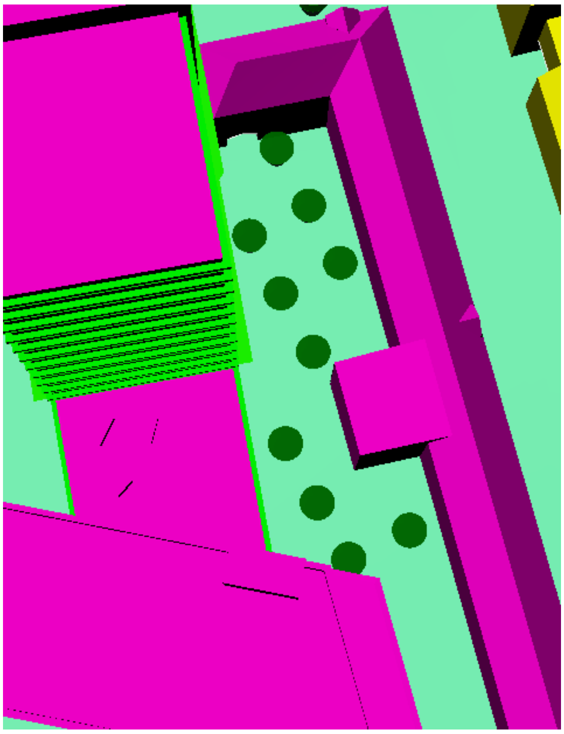


Figure 11-24: Mitigation measure 5 – Planting in the Eastern Courtyard

Mitigation measure 6 – Retention of Door to Eastern Courtyard

On the windiest days, there is the possibility of distress in the existing tunnel formed between the eastern courtyard and Bank Place. It is proposed the door to this passageway be retained, so the passageway can be closed off should this be required.

Figure 11-25: Mitigation measure 6 – Retention of Door to Eastern Courtyard

Mitigation measure 7 – Trees in Bank Place

The placement of evergreen trees in Bank Place. These will be 9m tall and have a 2m clear stem as previously set out.
These calm otherwise high winds crossing Bank Place, and prevent this relatively high wind exiting Bank Place and leading to problematic conditions in other areas.

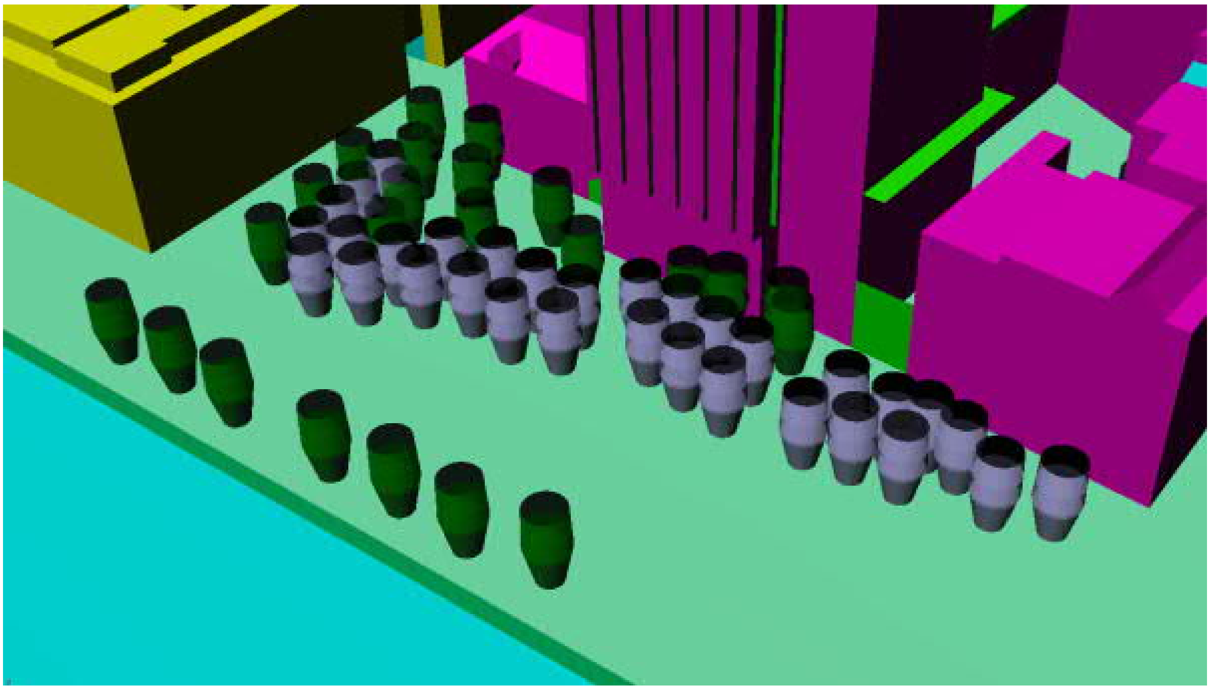


Figure 11-26: Mitigation measure 7 – Trees in Bank Place

11.2.6 Residual Impacts

In this section results will be presented with the inclusion of the mitigation measures from the previous section.

11.2.6.1 Proposed development with mitigation – Comfort

With these mitigation measures in place, the comfort conditions can be seen in Figure 11-19 below. As can be seen there has been a large calming of the wind conditions in and around the site.
The conditions in all courtyards have been improved, the conditions in Bank Place calmed.

Figure 11-19: Lawson comfort - Proposed development with mitigation

I	Pedestrian sitting	
II	Pedestrian standing	
III	Pedestrian walking	
IV	Business walking/Cycling	
V	Unacceptable for pedestrian comfort	

11.2.6.2 Proposed development with mitigation – Distress (15m/s)

The proposed with mitigation distress for the most frail users of the site and cyclists can be seen in Figure 11-20 below. It can be seen that the majority of the site and surrounding urban area meets guidance, with small isolated areas which do not meet these guidelines. These simulations show a similar pattern to the baseline, with small areas around the site over the guidance value of 0.025% of time over 15m/s. For ease of reference in this section, the regions of distress have been labelled.

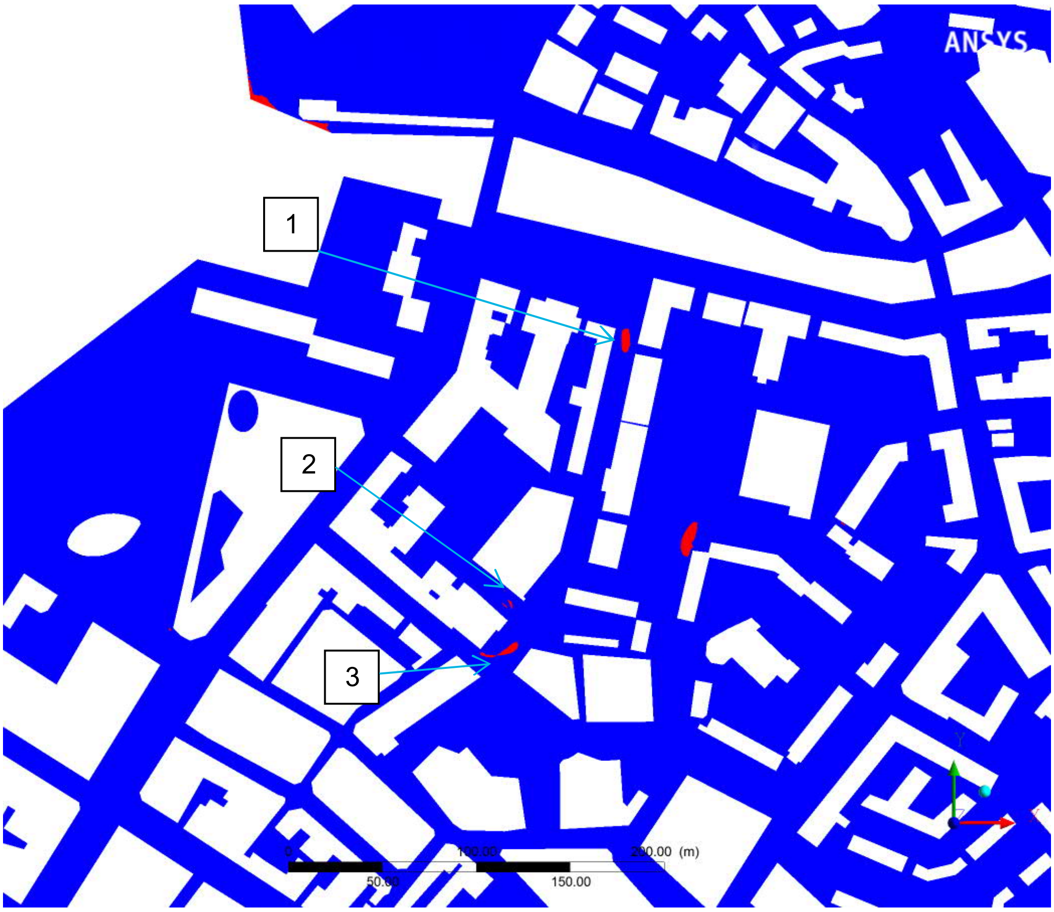


Figure 11-20: Lawson 15m/s Distress for frail/elderly and cyclists - Proposed development with mitigation. Red indicates unacceptable conditions.

As detailed in the methodology section, the acceptability of these regions of slightly over guidance areas should be considered alongside the following:

- Are conditions in the wider urban area more windy than the area for which the guidelines were developed – were similar areas of above guidance found in the baseline case?
- Would we expect the most frail users of the space and cyclists to be using these areas on the most windy hours of the year, are there alternative routes, and would a local to the town know that it is particularly windy, so be less likely to be walking around on more windy days?

In all three regions of distress, the maximum number of hours distress occurs at the worst point in the region is three hours per year, compared to a guidance value of two. This is a small increase beyond guidance, in three very small areas.

Region 1 occurs almost exclusively in the roadway, not along the pavement.

Region 2 occurs on a no-pedestrian access ramp to an underground carpark, and on the service access to the carpark. Beyond this region of distress is a set of stairs, forming the rear end to the carpark. Using the alternative route argument as set out in the original Lawson guidance, it is felt more likely that the most frail users and cyclists will use the main entrance to the car park, rather than this rear and stepped access.

The majority of region 3 is in the roadway, with only a tiny area on pavement. Looking at the site as a whole this gives a very small area of distress on the pavement, and that very small distress area is only very slightly above the distress threshold of 2 hours per year.

The 15m/s distress regions apply to the frailest members of the public as well as cyclists. The distress regions are mainly in the roadway, and this is an area that cyclists could occupy. As the distress regions are only for 3 hours per year, and as regions of distress of 3 hours per year existed (at a different location) in the baseline, it is expected that cyclists in this city would be aware of these types of wind microclimate and would moderate their behaviour with this in mind.

It is felt that these slight exceedances of guidance are appropriate when taken in the whole and balanced against the other project priorities.

11.2.6.3 Proposed development with mitigation – Distress (20m/s)

As can be seen in the figure below, there remain no areas of distress for the more able users of the site and surroundings.

Figure 11-21: Lawson 20m/s Distress for able-bodied - Proposed development with mitigation. Red indicates unacceptable conditions.

11.2.6.4 Impacts Tables

11.2.6.5 Comfort Lawson

The table below shows the intended, baseline, proposed and proposed with mitigation wind conditions at locators through the site.

Table 11-9 Wind conditions with mitigation measures

Receptor	Intended Wind Conditions	Baseline Wind Conditions	Proposed Wind Conditions	Proposed Mitigated Wind Conditions
Building Entrances along George's Quay	Pedestrian Standing	Pedestrian Standing	Pedestrian Standing	Pedestrian Standing
Roadway along George's Quay	Business walking	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing	Pedestrian Standing
Riverside along George's Quay	Pedestrian Walking	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing
Riverside seating area George's Quay, next to Bridge Street bridge	Pedestrian sitting	Pedestrian Walking	Pedestrian Walking	Pedestrian Standing
Bridge Street Bridge, Roadway	Business Walking	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing/Pedestrian Walking
Bridge Street Bridge, Pavement	Pedestrian Walking	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing/Pedestrian Walking
Rutland Street roadway in front of the Hunt Museum	Business Walking	Pedestrian Sitting/Pedestrian Standing	Pedestrian Sitting/Pedestrian Standing/ Pedestrian Walking	Pedestrian Sitting/Pedestrian Standing
Rutland Street pavement in front of the Hunt Museum	Pedestrian Standing	Pedestrian Sitting/Pedestrian Standing	Pedestrian Sitting/Pedestrian Standing	Pedestrian Sitting/Pedestrian Standing
Sitting Area Directly in front of Hunt Museum	Pedestrian Sitting	Pedestrian Sitting/Pedestrian Standing	Pedestrian Sitting/Pedestrian Standing	Pedestrian Sitting/Pedestrian Standing
Building Entrances to East of Rutland Street and Patrick Street	Pedestrian Standing	Pedestrian Sitting/Pedestrian Standing	Pedestrian Sitting/Pedestrian Standing	Pedestrian Sitting/Pedestrian Standing
Northern End of Patrick Street Roadway	Business Walking	Pedestrian Sitting/Pedestrian Standing	Pedestrian Sitting/Pedestrian Standing	Pedestrian Sitting
West end of Ellen Street	Business Walking	Pedestrian Standing	Pedestrian Standing	Pedestrian Sitting
West end of Ellen Street Building Entrances	Pedestrian Standing	Pedestrian Standing	Pedestrian Standing	Pedestrian Sitting
Corner of Ellen Street and Michael Street	Business Walking	Pedestrian Sitting	Pedestrian Standing with large area of Pedestrian Walking	Pedestrian Standing with reduced area of Pedestrian Walking
Little Ellen Street	Pedestrian Walking	Pedestrian Sitting	Pedestrian Sitting/Pedestrian Standing	Pedestrian Sitting
Southern Half of Michael Street	Pedestrian Walking	Pedestrian Sitting	Pedestrian Standing	Pedestrian Standing

Receptor	Intended Wind Conditions	Baseline Wind Conditions	Proposed Wind Conditions	Proposed Mitigated Wind Conditions
Roadway (Excluding impacts from corner of Ellen Street)				
Southern Half of Michael Street Pavement (Excluding impacts from corner of Ellen Street)	Pedestrian Walking	Pedestrian Sitting	Pedestrian Standing	Pedestrian Standing
Southern Half of Michael Street Doorways (Excluding impacts from corner of Ellen Street)	Pedestrian Standing	Pedestrian Sitting	Pedestrian Standing	Pedestrian Standing
Northern Half of Michael Street Roadway	Pedestrian Walking	Pedestrian Sitting / Pedestrian Standing	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing/Pedestrian Walking
Northern Half of Michael Street Pavement	Pedestrian Walking	Pedestrian Sitting / Pedestrian Standing	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing/Pedestrian Walking
Northern Half of Michael Street Doorways	Pedestrian Standing	Pedestrian Sitting / Pedestrian Standing	Pedestrian Standing	Pedestrian Standing
Bank Place Seating Area	Pedestrian Sitting	Pedestrian Sitting	Pedestrian Standing	Pedestrian Standing
Bank Place Walking Area	Pedestrian Walking	Pedestrian Sitting	Pedestrian Walking/Business Walking	Pedestrian Walking
Bank Place Building Entrances	Pedestrian Standing	Pedestrian Sitting	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing
Charlotte's Quay Roadway, north of Bank Place	Business Walking	Pedestrian Standing	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing/ Pedestrian Walking
Pavement between the Abby River and Charlotte's Quay, north of Bank Place	Pedestrian Walking	Pedestrian Standing	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing/ Pedestrian Walking
Western Courtyard (Service Yard)	Business Walking	N/A	Pedestrian Standing/Pedestrian Walking	Pedestrian Standing/Pedestrian Walking
Eastern Courtyard (Granary Square) - seating areas	Pedestrian Sitting	N/A	Pedestrian Standing	Pedestrian Standing
Eastern Courtyard (Granary Square) - other areas	Pedestrian Walking	N/A	Pedestrian Standing	Pedestrian Standing
Southern Courtyard Seating Areas	Pedestrian Sitting	N/A	Pedestrian Standing	Pedestrian Standing
Southern Courtyard Building Entrances	Pedestrian Standing	N/A	Pedestrian Standing	Pedestrian Standing
Southern Courtyards Other Areas	Pedestrian Walking	N/A	Pedestrian Walking	Pedestrian Walking
Carpark Underpass	Business Walking	N/A	Pedestrian Walking	Pedestrian Walking

11.2.6.6 Comfort Impact

The table below shows the proposed and proposed with mitigation impacts through the site for comfort.

Table 11-10 Mitigation impacts through the site for comfort

Receptor	Intended Wind Conditions	Proposed	Proposed Mitigation
Building Entrances along George's Quay	Pedestrian Standing	Negligible	Negligible
Roadway along George's Quay	Business walking	Negligible	Negligible
Riverside along George's Quay	Pedestrian Walking	Negligible	Negligible
Riverside seating area George's Quay, next to Bridge Street bridge	Pedestrian sitting	Negligible	Negligible
Bridge Street Bridge, Roadway	Business Walking	Negligible	Negligible
Bridge Street Bridge, Pavement	Pedestrian Walking	Negligible	Negligible
Rutland Street roadway in front of the Hunt Museum	Business Walking	Negligible	Negligible
Rutland Street pavement in front of the Hunt Museum	Pedestrian Standing	Negligible	Negligible
Sitting Area Directly in front of Hunt Museum	Pedestrian Sitting	Negligible	Negligible
Building Entrances to East of Rutland Street and Patrick Street	Pedestrian Standing	Negligible	Negligible
Northern End of Patrick Street Roadway	Business Walking	Negligible	Negligible
West end of Ellen Street	Business Walking	Negligible	Negligible
West end of Ellen Street Building Entrances	Pedestrian Standing	Negligible	Negligible
Corner of Ellen Street and Michael Street	Business Walking	Negligible	Negligible
Little Ellen Street	Pedestrian Walking	Negligible	Negligible
Southern Half of Michael Street Roadway (Excluding impacts from corner of Ellen Street)	Pedestrian Walking	Negligible	Negligible
Southern Half of Michael Street Pavement (Excluding impacts from corner of Ellen Street)	Pedestrian Walking	Negligible	Negligible
Southern Half of Michael Street Doorways (Excluding impacts from corner of Ellen Street)	Pedestrian Standing	Negligible	Negligible
Northern Half of Michael Street Roadway	Pedestrian Walking	Negligible	Negligible
Northern Half of Michael Street Pavement	Pedestrian Walking	Negligible	Negligible
Northern Half of Michael Street Doorways	Pedestrian Standing	Negligible	Negligible
Bank Place Seating Area	Pedestrian Sitting	Minor	Minor
Bank Place Walking Area	Pedestrian Walking	Negligible	Negligible
Bank Place Building Entrances	Pedestrian Standing	Minor	Negligible
Charlotte's Quay Roadway, north of Bank Place	Business Walking	Negligible	Negligible
Pavement between the Abby River and Charlotte's Quay, north of Bank Place	Pedestrian Walking	Negligible	Negligible
Western Courtyard (Service Yard)	Business Walking	Negligible	Negligible
Eastern Courtyard (Granary Square) - seating areas	Pedestrian Sitting	Minor	Minor
Eastern Courtyard (Granary Square) - other areas	Pedestrian Walking	Negligible	Negligible
Southern Courtyard Seating Areas	Pedestrian Sitting	Minor	Minor
Southern Courtyard Building Entrances	Pedestrian Standing	Negligible	Negligible
Southern Courtyards Other Areas	Pedestrian Walking	Negligible	Negligible

Receptor	Intended Wind Conditions	Proposed	Proposed Mitigation
Carpark Underpass	Business Walking	Negligible	Negligible

11.2.6.7 Distress Lawson

The table below shows the intended, baseline, proposed and proposed with mitigation wind conditions at locators through the site for the 15m/s wind condition.

Table 11-11 15m/s wind condition with mitigation measures

Receptor	Baseline Wind Conditions	Proposed Wind Conditions	Proposed Mitigated Wind Conditions
Building Entrances along George's Quay	No Distress	No Distress	No Distress
Roadway along George's Quay	No Distress	No Distress	No Distress
Riverside along George's Quay	No Distress	No Distress	No Distress
Riverside seating area George's Quay, next to Bridge Street bridge	No Distress	No Distress	No Distress
Bridge Street Bridge, Roadway	No Distress	Areas of distress for 5 hours per year	No Distress
Bridge Street Bridge, Pavement	Small Area of Distress	Areas of distress for 5 hours per year	No Distress
Rutland Street roadway in front of the Hunt Museum	No Distress	Small Area of Distress for 3 hours per year	No Distress
Rutland Street pavement in front of the Hunt Museum	No Distress	No Distress	No Distress
Sitting Area Directly in front of Hunt Museum	No Distress	Small Area of Distress for three hours per year	No Distress
Building Entrances to East of Rutland Street and Patrick Street	No Distress	No Distress	No Distress
Northern End of Patrick Street Roadway	No Distress	No Distress	No Distress
West end of Ellen Street	No Distress	No Distress	No Distress
West end of Ellen Street Building Entrances	No Distress	No Distress	No Distress
Corner of Ellen Street and Michael Street	No Distress	Area of distress for 3 hours per year	Trace area of distress, for 3 hours per year
Little Ellen Street	No Distress	No Distress	No Distress
Southern Half of Michael Street Roadway (Excluding impacts from corner of Ellen Street)	No Distress	No Distress	No Distress
Southern Half of Michael Street Pavement (Excluding impacts from corner of Ellen Street)	No Distress	No Distress	No Distress
Southern Half of Michael Street Doorways (Excluding impacts from corner of Ellen Street)	No Distress	No Distress	No Distress
Northern Half of Michael Street Roadway	No Distress	Areas of distress for 12 hours per year	Area of distress for 3 hours per year
Northern Half of Michael Street Pavement	No Distress	Areas of distress for 8 hours per year	No Distress
Northern Half of Michael Street Doorways	No Distress	No Distress	No Distress
Bank Place Seating Area	No Distress	No Distress	No Distress

Receptor	Baseline Wind Conditions	Proposed Wind Conditions	Proposed Mitigated Wind Conditions
Bank Place Walking Area	No Distress	Areas of distress for 20 hours per year	No Distress
Bank Place Building Entrances	No Distress	No Distress	No Distress
Charlotte's Quay Roadway, north of Bank Place	No Distress	Areas of distress for 12 hours per year	No Distress
Pavement between the Abby River and Charlotte's Quay, north of Bank Place	No Distress	Areas of distress for 8 hours per year	No Distress
Western Courtyard (Service Yard)	N/A	No Distress	No Distress
Eastern Courtyard (Granary Square) - seating areas	N/A	No Distress	No Distress
Eastern Courtyard (Granary Square) - other areas	N/A	No Distress	No Distress
Southern Courtyard Seating Areas	N/A	No Distress	No Distress
Southern Courtyard Building Entrances	N/A	No Distress	No Distress
Southern Courtyards Other Areas	N/A	No Distress	No Distress
Carpark Underpass	N/A	Areas of distress for 8 hours per year	Area of distress for 3 hours per year

11.2.6.8 Distress Impact

The table below shows the proposed and proposed with mitigation impacts through the site for distress.

Table 11-12 Proposed with mitigation impacts through the site for distress

Receptor	Proposed	Proposed Mitigation
Building Entrances along George’s Quay	Negligible	Negligible
Roadway along George’s Quay	Negligible	Negligible
Riverside along George’s Quay	Negligible	Negligible
Riverside seating area George’s Quay, next to Bridge Street bridge	Negligible	Negligible
Bridge Street Bridge, Roadway	Major-Moderate	Negligible
Bridge Street Bridge, Pavement	Major-Moderate	Negligible
Rutland Street roadway in front of the Hunt Museum	Minor	Negligible
Rutland Street pavement in front of the Hunt Museum	Negligible	Negligible
Sitting Area Directly in front of Hunt Museum	Minor	Negligible
Building Entrances to East of Rutland Street and Patrick Street	Negligible	Negligible
Northern End of Patrick Street Roadway	Negligible	Negligible
West end of Ellen Street	Negligible	Negligible
West end of Ellen Street Building Entrances	Negligible	Negligible
Corner of Ellen Street and Michael Street	Minor	Minor
Little Ellen Street	Negligible	Negligible
Southern Half of Michael Street Roadway (Excluding impacts from corner of Ellen Street)	Negligible	Negligible
Southern Half of Michael Street Pavement (Excluding impacts from corner of Ellen Street)	Negligible	Negligible

Receptor	Proposed	Proposed Mitigation
Southern Half of Michael Street Doorways (Excluding impacts from corner of Ellen Street)	Negligible	Negligible
Northern Half of Michael Street Roadway	Major	Minor
Northern Half of Michael Street Pavement	Major	Negligible
Northern Half of Michael Street Doorways	Negligible	Negligible
Bank Place Seating Area	Negligible	Negligible
Bank Place Walking Area	Major	Negligible
Bank Place Building Entrances	Negligible	Negligible
Charlotte's Quay Roadway, north of Bank Place	Major	Negligible
Pavement between the Abby River and Charlotte's Quay, north of Bank Place	Major	Negligible
Western Courtyard (Service Yard)	Negligible	Negligible
Eastern Courtyard (Granary Square) - seating areas	Negligible	Negligible
Eastern Courtyard (Granary Square) - other areas	Negligible	Negligible
Southern Courtyard Seating Areas	Negligible	Negligible
Southern Courtyard Building Entrances	Negligible	Negligible
Southern Courtyards Other Areas	Negligible	Negligible
Carpark Underpass	Major	Minor

11.2.7 Difficulties Encountered in Compiling Information

There are two main unknowns that impact this study:

1. The porosity and modelling of trees. As previously stated all CFD studies and wind tunnels make best attempts to model vegetation, but this is not an exact science.

2. The wind data used to drive the study. A conservative method has been used, but if the Met Office hourly average data has been artificially increased, and the raw airport data could be used many of the distress regions will vanish.

11.2.8 Cumulative Impacts

The cumulative impacts section considers buildings close enough to the site to impact the wind, and which have recently obtained planning permission.

In general if Limerick adopts future developments of the same scale, height and density as this development they will likely provide beneficial sheltering to this development.

A list of planning applications within 1km which may interact with the proposed development was created, and one development was close enough to have some (minor) impact on the local microclimate. Details of this cumulative development are set out below:

Table 11-13 Cumulative Development

Heading	Data
Application	Limerick County Council18168
Address	Ellen Street/Carr Street/Punch's Row , Limerick
Details	completion of the works comprising of a mixed development as follows: (a) language school and seven retail shop units on ground floor; (b) five duplex 4 bedroom apartments and three duplex 6 bedroom apartment on first and second floors; (c) basement with 24 private car spaces and (d) new connections to the mains public water and sewer
Decision	PERMISSION APPLICATION FINALISED 26/02/2018 00:00

Details of the application are set out in the images below.
Images from the location appear to show the building is being, or by now has been constructed. These images are shown below.

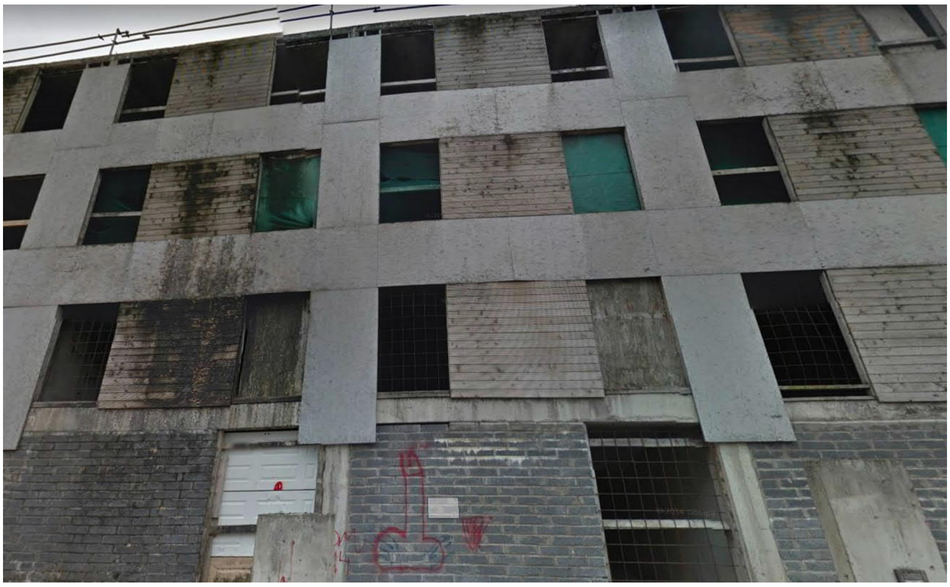


Figure 11-30: Building location

Figure 11-31: Building location

As this building was 4 floors high at the time of the study it was included with the main study, so need not be considered further in the Cumulative Impacts study.

11.3 Sunlight, Daylight and Shadow Analysis

11.3.1 Introduction

AECOM has been appointed to undertake a Sunlight, Daylight and Shadow Analysis of the proposed new Limerick Opera, Limerick.

The size and scale of new Limerick Opera development is larger than existing context on site and within the surrounding area, and so a sunlight, daylight and overshadowing assessment is needed to review the daylight and sunlight amenity that local residents are likely to have with the proposed development in place compared to the levels of daylight and sunlight they currently enjoy. The study will allow the potential change in natural lighting condition to be quantified, where present.

All analysis and comments are made with reference to the Building Research Establishment (BRE) design guide 209 'Site Layout Planning for Daylight and Sunlight', 2011.

Daylight analysis is made using the following:

- Distance review
- Angular analysis
- Vertical Sky Component (VSC)

Sunlight analysis is made using the following:

- Sunlight Hours to windows
- Overshadowing to amenity space

Findings of this analysis focus on daylight and sunlight effects to properties that are most likely to be affected by new development.

This report is accompanied by Appendices detailing individual outcomes for the processes described by the Assessment Approach.

11.3.2 Methodology

11.3.3 Standards

11.3.3.1 BS 8206:2008 – Lighting for Buildings – Part 2: Code of practice for daylighting

This updated standard describes good practice in daylighting design and presents criteria intended to enhance the well-being and satisfaction of people in buildings. It is referenced by the BRE Site layout planning for daylight and sunlight document identified above.

11.3.4 Good practice guidance

11.3.4.1 BRE 209: BRE Site layout planning for daylight and sunlight, a guide to good practice, Rev 2, 2011 (BRE, 2011)

Daylight and sunlight assessments were conducted based on the methodology and criteria set out by the Building Research Establishment (BRE) design guide 'Site Layout Planning for Daylight and Sunlight', 2011. The main criteria, outlined in Sections 2.2, 2.3, 3.2, Appendix A and Appendix C, are typically identified in local planning guidance as the ones by which the daylight and sunlight performance of a proposed development will be assessed.

BRE design guidelines are intended to be used as the basis for assessing change to daylight and sunlight conditions as a result of a proposed development. The overall outcome depends on a number of factors and it is recognised that there is no simple rule of thumb that can be applied.

With reference to guidance recommendations, buildings within three times (3x) the height of a new or changed development may experience a change in their daylight and sunlight amenity and access. If the distance between them is three or more times the height of the new development, no assessment is required, it is accepted that there will be no effects on the existing windows that exceed recommendations set out within BRE guidance.

It is understood that while some windows on the façade of an existing building may experience a change in daylight or sunlight access due to new or changed development, not all windows will be affected in every case.

It is also important to note that while the BRE report provide designers and planners with a clear and objective way of assessing the daylight and sunlight conditions associated with a new development, recommended criteria which are referenced within this report are not mandatory and are intended to be used flexibly. The following guidance is provided within BR 209:

"The advice given here is not mandatory and this document should not be seen as an instrument of planning policy. Its aim is to help rather than constrain the designer. Although it gives numerical guidelines these should be interpreted flexibly because natural lighting is only one of many factors in site layout design. In special circumstances, the developer or the planning authority may wish to use different target values."

11.3.5 Assessment Approach

Sunlight, Daylight and Overshadowing assessment is undertaken in two main parts that compare the existing, or baseline condition, with the proposed condition which introduces new built elements which could affect sunlight and daylight performance. Sunlight and daylight are assessed to inform on the following effects:

- Impact on neighbouring buildings, where sunlight and daylight are assessed for buildings within the area of influence by the Proposed Development, or what we refer to as the Study Area.
- Impact on neighbouring amenity areas, sunlight is assessed for exterior amenity, which is typically considered to include spaces such as gardens, parks or other types of recreation areas.

This analysis assesses the potential change to daylight and sunlight conditions on and around the Application Site with the Proposed Development in place. This process is outlined by the following:

- Identification of a baseline condition;
- Identification of potential receptors and assessment of their sensitivity;
- Identification of a proposed condition with the Proposed Development;
- Assess, compare and benchmark the baseline to proposed lighting condition variance and good practice guidance criteria for operational effects;
- Identify any additional mitigation; and
- Summarise and conclude results based on findings.

Sunlight and daylight conditions are assessed quantitatively through the modelling and simulation of both baseline and proposed conditions using industry standard software which incorporates Radiance. This allows predicted results for receptors which are likely to be affected by new development to be compared to the numerical targets set out within BR 209.

11.3.6 Baseline data collection

Although the ultimate receptors are people, as a proxy, receptors are typically considered to be windows serving residential or office space used by the people who live and work in local buildings that would normally expect to have reasonable access to daylight and sunlight. Other receptors include public open spaces which would normally be expected to receive sunlight.

11.3.7 Data Collection

In terms of natural light, the term 'baseline lighting condition' refers to how an area is affected by local lighting conditions with the existing land use in place. The baseline lighting condition was identified by collecting data about the proposed Site and surrounding area. Together, these are referred to as 'the Study Area', defined as the area within which receptors are most likely to experience a noticeable change in natural lighting condition.

Information was collected on aspects of the built and natural environment that may have a particular sensitivity to a change in their local lighting condition, be it an increase or decrease in daylight and sunlight availability. From this, receptors likely to experience the change were identified; typically these are people living in local residences and people using amenity areas.

Baseline conditions have been identified from site survey records, OS mapping and site photography provided by the Design Team, and aerial mapping from google earth for buildings and spaces internal and external to the redline boundary. This helps to identify locations of existing windows and open spaces of existing development which are used to construct the baseline and proposed lighting models.

11.3.8 Identification of receptors

11.3.8.1 Buildings

For the purposes of this assessment 'buildings' are considered as either single structures or groups of development such as blocks of flats comprised of multiple units. Buildings within the scope of this assessment are identified in Figure 11.33 and further summarised in Table 11.54 and Table 11.55. It should be noted that not all buildings within three times the proposed height of the Proposed Development are assessed as they may not have a particular requirement for daylight or sunlight or access to it due to lack of windows.

11.3.9 Daylight Analysis

11.3.9.1 Daylight (buildings)

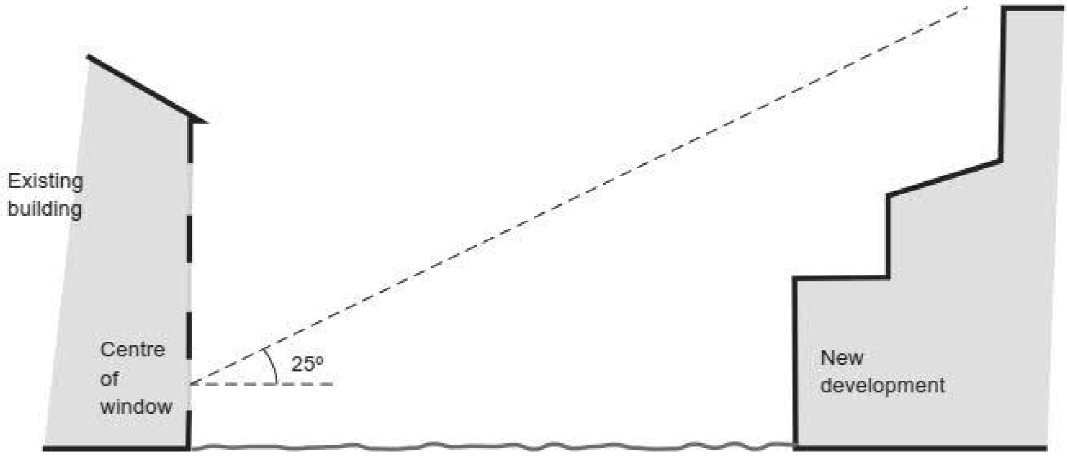
As described above, the Study Area is the area within which receptors are most likely to experience a noticeable change in natural lighting condition. In general, these are buildings that fall within a certain proximity of new development, which in turn is dependent upon the height and density of the proposed development as well as its distance from the location of existing / proposed built structures.

BRE guidance (BR 209, 2011) advises that if an existing building is within a distance of 3x the height of a proposed development, it may be close enough that it may be affected, or for building / space users, to experience a noticeable change in their local natural lighting condition. A 'distance check' has been undertaken to identify buildings within approximately 3x the height of each of the proposed buildings comprising the Proposed Development.

A geometric angular assessment is a first stage assessment made prior to undertaking daylight simulation using the lowest windows of an existing development, as these are the most likely to be affected by a new building or development than those higher up on a facade.

This is done by placing horizontal plane from the centre of an existing window and then angling that plane by 25 degrees upward. If the proposed development in its entirety falls under this angled plane, then further analysis is not considered to be necessary as the daylight and sunlight condition will be relatively unchanged. Figure 11.32 shows an extract of how angular assessment is considered.

Figure 11.32: Angular assessment diagram (BRE 209 extract)



If the proposed development does not fall under this angled plane in its entirety, further review of daylight and sunlight on the façade is made in the form of the Vertical Sky Component (VSC).

With the potential scale of the Proposed Development generating an initial Study Area that encompasses a significant number of buildings that could be affected by a reduction in sunlight or daylight, the majority of buildings within the Study Area are tested at façade level for VSC and angular assessment is not made.

11.3.9.2 Vertical Sky Component

Vertical Sky Component (VSC) looks at how much light from the sky a room could receive, but it does not relate to how light behaves inside a room. VSC measures the amount of potential light reaching a vertical surface, specifically windows, with obstructions in the way and compares the outcome with the amount of light available in that location under unobstructed conditions.

In absolute terms, guidance recommends that a VSC of 27% should provide adequate daylight access to interior spaces, although guidance does caution that benchmarks need to be applied flexibly with respect to the style of a built environment (for example, benchmarks are not often achievable in a dense urban context where tall buildings are commonly found in close proximity and having a tight grain).

Guidance also recommends that any change between the amount of daylight a window receives prior to new development and after it has been constructed be limited to 20%, or be at least 0.8 times the amount of light available under existing conditions. It cautions that a window found to have less than 27% of skylight available to it with a proposed development in place, and the change in lighting conditions between the existing and proposed is more than 20%, the level of change may be more noticeable by room users and the room is likely to appear gloomier, leading to an increased need for supplementary electric light.

It is equally as important to consider that a reduction in available daylight in excess of 20% does not mean that good light will not be available to an internal space. Depending on the size and shape of the room and the size of window serving it, adequate light may still be available to the interior, but the reduction is likely to be more noticeable. It is recommended that a change between conditions not exceed 30%, or 0.7 times the amount of light available under existing conditions, in order to limit the degree of perceptible change in available light to room occupants.

In terms of deviation from the minimum recommended value, if this is positive the effects are considered to be generally negligible, and where effects are found to be negative they are considered to be adverse as they may result in varying degrees of noticeable reduction in daylight and sunlight access.

11.3.10 Notes on Daylight Planning Guidance

Reduction in access to direct daylight is directly proportional to reduction in vertical sky component. There are a number of context factors that can have additional influence with daylight and sunlight access which may incorporate existing built forms, or nearby vegetation. The following factors are

- Balconies and overhangs above existing windows tend to block sunlight and, depending on depth, are often the main factors in the relative loss of daylight.
- Trees and other tall landscaping, such as shrubs / hedges, are generally ignored in general calculation. In cases where plantings create dense continuous belts or are located near windows, their contribution may be considered.
- In cases where foliage is established and dense or new and expected to mature in locations near windows, guidance indicates that approximate daylight access can be expected in the region of 50 - 80% of available unobstructed light when trees are bare of leaves, and 10 - 30% of the unobstructed value when they are in full leaf.

11.3.11 Sunlight Analysis

Amenity spaces are considered to be non-transient exterior areas where people may choose to linger for an unspecified period of time rather than serving as a pedestrian access routes. These may form part of existing conditions, or be proposed as part of new development. Amenity space may take the form of private gardens associated with residential housing; open space within the public realm such as parks, playgrounds or public squares; or sitting out areas formed as part of new development.

Sunlight access to windows and to gardens or amenity space is variable, dependant on the amount of sunlight available in certain climates, locations and weather conditions.

As the proposed development is located in the northern hemisphere, buildings that have windowed facades within 90 degrees of north are excluded as the majority of any overshadowing they receive, they do to themselves. Additionally, where mature trees are present, further sunlight reduction is expected depending on proximity to the tree, potentially between 10 - 30% during winter months, and 50 – 80% in summer months. Conifers are more likely to retain their density seasonally and the potential obstruction is likely to be consistent throughout the year.

The sunlight performance of existing and proposed amenity space that falls within the 3x height distance from new development was taken as the study area for this element of the assessment. This is the same Study Area established for assessment of buildings.

11.3.11.1 Sunlight to Windows

The probable hours that a window is likely to receive direct sunlight are assessed using weather data of sunlight data covering 1 January through 31 December. Sunlight hours to windows is normally assessed for windows which face within 90 degrees of due south as this orientation optimal for receiving direct sunlight. Windows with a northerly orientation are not assessed as are not oriented toward the sunpath and do not receive direct sunlight.

Annual Probable Sunlight Hours (APSH) assessment looks for at least 25% of available sunlight hours to be accessible by windows annually, and at least 5% availability for winter months, between 21 September and 21 March. In the London area, the average time where sunlight is available is suggested to be 1486 hours and 5% winter at approximately 446 hours.

Good practice is met where a change in lighting conditions is limited to 20% as this is less likely to be noticeable, and changes of less than 4% which are considered as not perceptible. Changes in excess of 20% may be more material, with reference to effects on main windows. Sunlight hours are focussed on primary living spaces such as living rooms, followed by bedrooms and kitchens which don’t have as high a sunlight recommendation.

11.3.11.2 Sunlight to Amenity

Good sunlight availability within a garden or amenity space looks for a minimum of two hours direct sunlight for over 50% of its area on 21 March. This date presents a middle case halfway between the longest and shortest day of the year, and considers that as the sun shines at a higher angle that less shadowing will occur towards the longest day of the year and more shadowing towards the shortest day of the year. Achieving two hours on 21 March indicates that sunlight will reach the space during winter months.

Sunlight access enjoyed by existing gardens or amenity space which is changed by more than 20% between conditions has the potential to be noticeable by space users, although this will depend on the arrangements of the garden and how it is used. As with local effects on daylight, established, dense, mature landscape can reduce sunlight access locally, depending on the planting and time of year.

11.3.12 Simulation Parameters

Simulations incorporate industry standard reflectance values for spaces and materials, assigned during the assessment process.

Daylight simulations use a 0% reflectance to ensure only direct light is assessed with an overcast sky that creates a consistent ambient lighting condition. Sunlight simulations use materials which allow for a clear depiction of shadowing extents under clear sky conditions, so that the performance of direct light can be assessed.

11.3.13 Significance Criteria

An assessment of receptor sensitivity, magnitude of change experienced by those receptors and how significant that change is, has been made in the context of, and informed by, local natural lighting conditions, site specific building and environmental factors, legislation, planning policy, current relevant standards and good practice guidance.

Ratings represent a range of conditions, some of which are a combination of two conditions (i.e. medium – low). These combined conditions are intended to mark change at the higher or lower end of a particular threshold.

The sensitivity of built receptors relates to the type of development they are and their normal exposure to daylight and sunlight. Table 11.84 indicates how sensitivity has been considered for both built development and open spaces.

Table 11.54: Receptors and receptor sensitivity

Receptor sensitivity	Receptor type
High	Windows that serve spaces that have a high sensitivity of requirement for daylight such as classrooms, single aspect living spaces and kitchens. Land that contains highly light sensitive species / habitat or is marked for a large increase in local biodiversity. Public / open space meant to encourage people to spend longer periods of time, or does not experience a significant amount of overshadowing.
Medium	Windows that serve spaces where there is an intermediate sensitivity of requirement for daylight such as commercial offices, retail spaces, bedrooms and dual aspect living spaces or kitchens. Land that contains common species or is marked for increased biodiversity. Open / public space that experiences some overshadowing or is desired to have a degree of solar control.
Low	Windows or doors that serve spaces where there is a low sensitivity of requirement for daylight such as storage spaces, car parks, circulation space, stairwells, utility rooms and bathrooms. Land that contains limited species, or habitat that does not have a particular sensitivity to a change in lighting condition,

	Land that will only be used by people for a short period of time or is already experiencing noticeable overshadowing effects.
Negligible	Windows or doors that serve spaces where there is no requirement for daylight such as boarded windows and buildings with few to no windows. Land that is not suitable for biodiversity or being designated as open / public space. Often this type of receptor is excluded from simulated analysis. There is no potential for significant effects on a receptor with very low sensitivity, whatever the magnitude of change.

Table 11.55 indicates more specifically how sensitivities are considered in relation to specific developments / room types as part of this assessment, in line with how receptor sensitivity is considered in line with the above.

Table 11.55: Specific Receptors and Receptor Sensitivity

Space Use	Sensitivity
Domestic - Bedroom	High
Domestic - Living Room	High
Domestic - Unknown	High
Domestic Kitchen	High
Domestic Kitchen/Living Room - covered balcony	High
Museum - Exhibition	High
Unknown	High
Unknown - Vacant	High
Commercial - Retail	Low
Commercial - Retail - boarded up	Low
Commercial - Office	Low
Commercial - Office - boarded up	Low
Commercial - Restaurant Kitchen	Low
Commercial - Restaurant Office/Store	Low
Commercial - Retail	Low
Commercial - Retail - boarded up	Low
Commercial - Retail - Vacant	Low
Domestic - External Door to balcony	Low
Domestic - Landing	Low
Domestic Bathroom	Low
Museum - Office	Low
Museum - Retail Shop	Low
Staircore	Negligible
Commercial - Office - Emergency Exit	Negligible
Commercial - Office - Stairs	Negligible
Shed - boarded up	Negligible

The variance between lighting conditions, or magnitude of change, is a measure of the degree of perceived change likely to result from a new lighting condition. Table 11.56 indicates how the magnitude of change has been rated.

Table 11.56: Effect magnitude and perception

Receptor sensitivity	Receptor type
High	Extensive, unmistakable, noticeable intrusive change to a lighting condition affecting the appearance, characteristics and effects of daylight and sunlight to identified receptors. This may be considered to be a drastic increase or decrease in available sunlight for exterior and interior spaces. These spaces are likely to have a significant amount of natural light in their existing condition, or have a strong requirement for natural light Typically this will encompass a change of 41% + from baseline conditions.
Medium	Noticeable, distinct, but not always intrusive, change to a lighting condition affecting the appearance, characteristics and effects of daylight and sunlight to identified receptors. This would be considered a noticeable increase or decrease to hours of available sunlight for building façades and open spaces, or daylight for internal spaces which are likely to have good daylight access in their existing condition. Typically this will encompass a change of 31 – 40% of baseline conditions.
Low	Small change to an existing lighting condition, new lighting condition creating only a low level of change or new effects to identified receptors. This may be a small reduction or increase in hours of available sunlight for building façades and open spaces, or daylight for internal spaces which have a reasonable expectation for daylight. Typically this will encompass a change of 21 – 30% from baseline conditions.
Negligible	No perceptible change, barely noticeable. Outcome of analysis falls within BRE guidance recommended criteria or does not significantly vary from existing conditions. There is no potential for a magnitude at this level to have a significant effect, even if the receptor is highly sensitive. Typically this effect will encompass a change of 0 – 20% from baseline conditions.

The combination of the sensitivity of a given receptor and the predicted magnitude of change in the local lighting condition helps identify how significant an effect is likely to be (see Table 11.57 below).

Effects may be either adverse or beneficial. Beneficial effects would occur where there were increases in available sunlight to exterior spaces or increases of daylight to interior spaces (for example through demolition of existing buildings), while adverse effects would be occur as a result of new buildings and structures reducing access to sunlight or daylight.

Effects to north facing windows are not assessed for sunlight, as the majority of overshadowing that they will experience is caused by the building to itself.

Table 11.57: Lighting effect rating matrix

Magnitude of effect	Receptor Sensitivity			
	High	Medium	Low	Negligible
High	**Profound**	**Very Significant / Significant**	**Moderate** / Slight	Not significant
Medium	**Very Significant / Significant**	**Moderate**	**Moderate** / Slight	Slight / Not Significant
Low	**Significant / Moderate**	**Moderate** / Slight	Minor	Slight / Not Significant
Negligible	Not Significant	Not Significant	Not Significant	Imperceptible

(NB effects of that are found to be profound or very significant / significant (in bold above) are considered to be likely significant effects in EIA terms)

11.3.14 Assumptions

The placement and geometry of the proposed development and surrounding buildings have been provided to AECOM Lighting in drawing format by the project architect / design team. The simulation model placement and geometry has been confirmed by the project architect. The location and size of the test planes correspond to existing windows.

Daylight and Sunlight analysis does not take into account the effects of landscape or other changeable obstruction unless it forms a normally continuous, dense 'wall' effect such as with hedgerows or closely planted treeline. This means that any changes to landscape, whether it is retention of trees or shrubs, removal of the same, or recommendations for additional plantings to be made, can be considered for effect but effects are not able to be quantified. It is assumed that there are no landscape features creating a dense 'wall' effect in close enough proximity to existing buildings and exterior spaces that will affect daylight and sunlight access.

It is assumed that there will be conifer trees planted as part of a wind mitigation strategy for the Proposed Development. While they are variable in size, the density of the trees is not expected to decrease, and their potential effects are incorporated into the sunlight analysis.

Where direct comparison of baseline to proposed lighting conditions is not possible, or applicable, due to unavailability or incompatibility of information, reasonable assumptions are made based on available information or agreed with the design team. Assumptions in these cases are addressed within the relevant section of analysis.

As the proposed development is located in the northern hemisphere, buildings that have windowed facades within 90 degrees of north are excluded from sunlight assessment as the majority of any overshadowing they receive, they do to themselves.

Windows and spaces which face within 90 degrees of south are expected to have good potential for sunlight access, following the sun path throughout the day / year.

Potential overshadowing to amenity spaces is a function of built height / proximity and space size. Exterior amenity spaces which are north of existing development are expected to experience consistent overshadowing throughout the year. Those spaces which have buildings closely located to more than one side are expected to be normally overshadowed if building height exceeds space depth. In other words, tall buildings could cast shadows across a small space throughout the day / year.

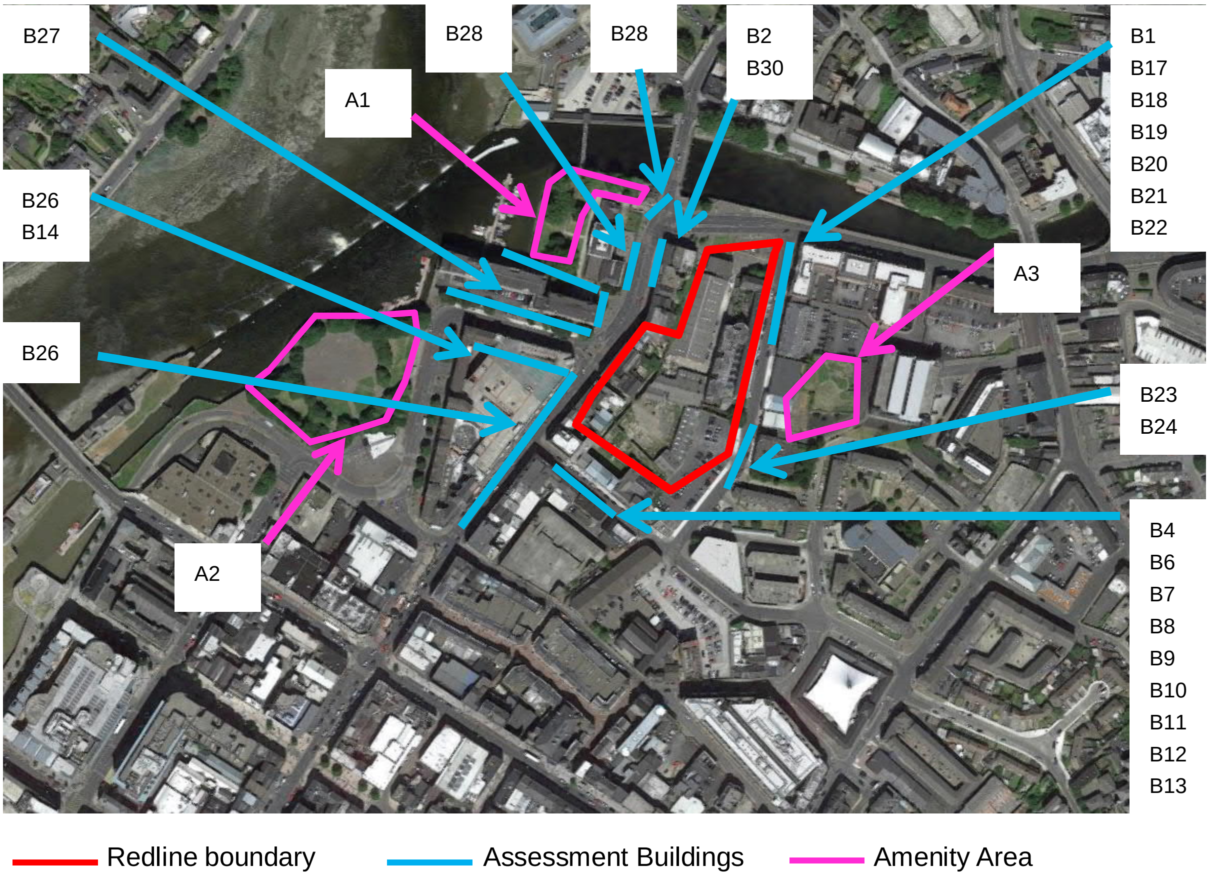
11.3.15 Baseline Conditions

30 individual developments have been assessed in detail within the Study Area, and an additional set of access points are used within the Study Area to provide an overview of natural light performance around the Proposed Development. A total of 1733 points have been assessed across the Study Area for sunlight and daylight assessment of buildings, and four key amenity spaces have been assessed for sunlight.

Figure 11.33 indicates the location of the Proposed Development, Study Area, location of assessment points and amenity spaces.

In each case the analysis point refers the centre of the selected window and is aligned with the vertical surface of the window being tested.

Figure 11.33: Locations of Buildings and Amenity Spaces assessed



Developments which are assessed in detail are provided in Table 11.58, with further information on sensitivity and detailed outputs found within Appendix 11.A.

Table 11.58 provides information on Amenity Space.

Table 11.58: Detailed Assessment Buildings

Building Reference	Address / Name	Use
B1	Gardner House, Bank Place	Commercial Office
B2	7, Bank Place	Unknown
B3	Pillar House, Ellen Street	Domestic, Commercial Office, Commercial Retail
B4	11, Ellen Street	Commercial leisure / restaurant
B5	12, Ellen Street	Commercial, Office / retail
B6	13, Ellen Street	Unknown, vacant
B7	14, Ellen Street	Unknown, vacant
B8	15, Ellen Street	Unknown, vacant
B9	16, Ellen Street	Commercial Office
B10	17, Ellen Street	Commercial Office
B11	18, Ellen Street	Domestic
B12	19, Ellen Street	Unknown, vacant
B13	Ormston House, Ellen Street	Commercial Office
B14	Arthurs Quay SC, Francis Street	Commercial Office / Retail

Building Reference	Address / Name	Use
B15	Sarsfield House, Francis Street	Commercial Office
B16	Pillar House, Little Ellen Street	Commercial Office / Retail, Domestic
B17	1, Michael Street	Commercial Office
B18	2, Michael Street	Commercial Office
B19	3, Michael Street	Commercial Office
B20	4, Michael Street	Commercial Office
B21	5, Michael Street	Commercial Office
B22	6, Michael Street	Commercial Office
B23	Westgate House, Michael Street	Domestic
B24	St Michaels Court, Michael Street	Domestic
B25	Barrow House, Michael Street	Commercial Office / Retail
B26	Arthurs Quay SC, Patrick Street	Commercial Office / Retail
B27	Sarsfield House, Rutland Street	Commercial Office
B28	Hunt Museum, Rutland Street	Museum Office / Retail / Exhibition
B29	Rutland House, Rutland Street	Domestic / Storage
B30	Rutland House Apartments, Rutland Street	Domestic, rear aspect of B29

Table 11.59: Existing Amenity Space

Space Reference	Location	Use
A1	Near the river to the north of the Proposed Development	Amentiy
A2	Near the river to the west of the Proposed Development	Amenity
A3	East of the Proposed Development and to the back of assessment buildings along Michael street	Amenity

11.3.15.1 Effects to Buildings

11.3.15.2 Sunlight

Table 11.60 summarises the sunlight accessibility by windows on identified receptors and provides an overview of how many windows are expected to meet the good practice guidance targets of 25% APSH and 5% WPSH in the baseline condition.

Table 11.60:Baseline Effects - Built Receptors – Sunlight Hours to Windows, APSH and WPSH

Building	Sunlight Hours Target	Windows achieving Sunlight Hours target	Quantity of Windows tested	Comments
B1	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B2	APSH - 25%	2	4	One window achieves BRE criteria for APSH, and all windows achieve criteria

Building	Sunlight Hours Target	Windows achieving Sunlight Hours target	Quantity of Windows tested	Comments
	WPSH – 5%	4	4	for WPSH
B3	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B4	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B5	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B6	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B7	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B8	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B9	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B10	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B11	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B12	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B13	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B14	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B15	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B16	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B17	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B18	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight

Building	Sunlight Hours Target	Windows achieving Sunlight Hours target	Quantity of Windows tested	Comments
	WPSH – 5%	N/A	N/A	
B19	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B20	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B21	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B22	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B23	APSH - 25%	23	28	3 windows are north facing. Limited direct sunlight is found at lower level, or where the building shadows itself
	WPSH – 5%	23	28	
B24	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B25	APSH - 25%	4	20	Windows achieving BRE criteria are found at upper levels of the building
	WPSH – 5%	5	20	
B26	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B27	APSH - 25%	39	173	134 windows are North facing and do not receive direct sunlight, and less than half the windows are found to achieve BRE criteria for APSH and WPSH
	WPSH – 5%	39	173	
B28	APSH - 25%	31	39	2 windows are north facing. Limited direct sunlight is found at lower level, or where the building shadows itself
	WPSH – 5%	31	39	
B29	APSH - 25%	12	12	All windows are found to achieve BRE criteria for APSH and WPSH
	WPSH – 5%	12	12	
B30	APSH - 25%	17	19	Nearly all windows are found to achieve BRE criteria for APSH and WPSH
	WPSH – 5%	16	19	

Out of the 30 detailed buildings assessed, 23 contain north facing windows that do not receive direct sunlight and are excluded from further analysis.

Of the 7 remaining buildings assessed for sunlight, 6 buildings are found to have the majority of their windows achieve good annual and winter sunlight with the Proposed Development in placed, in line with BRE recommended criteria. This includes B1, B23, B27, B28, B29 and B30. It should be noted that B27 has a significant number of windows that face north and will not receive direct sunlight.

B25 is expected to have more limitation in direct sunlight access with the proposed development in place to windows on lower floors, or those which are obstructed by the building to itself.

11.3.15.3 Daylight

Table 11.61 summarises the sunlight accessibility by windows on identified receptors and provides an overview of how many windows are expected to meet the good practice guidance targets of 25% APSH and 5% WPSH in the baseline condition.

Table 11.61: Baseline Effects - Built Receptors – Daylight (VSC)

Building	Standard VSC target (absolute)	Windows achieving VSC target	Quantity of Windows tested	Comments
B1	27%	45	46	Nearly all windows are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B2	27%	0	4	No windows are found to achieve BRE VSC criteria
B3	27%	9	9	All windows are found to achieve BRE
B4	27%	2	3	2 windows are found to be sufficiently close to 27% at 26.5% that they are considered to achieve BRE criteria.
B5	27%	6	7	Nearly all windows are found to achieve BRE VSC criteria
B6	27%	4	7	Over half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B7	27%	4	7	Over half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B8	27%	4	7	Over half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B9	27%	3	7	Less than half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B10	27%	2	7	Less than half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B11	27%	2	7	Less than half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on
B12	27%	6	10	Windows not achieving the target are

Building	Standard VSC target (absolute)	Windows achieving VSC target	Quantity of Windows tested	Comments
				found at lower ground level or are obstructed by the buildings they are located on.
B13	27%	3	8	Less than half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on
B14	27%	2	5	Less than half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on
B15	27%	132	138	Nearly all windows are found to achieve BRE VSC criteria
B16	27%	9	25	Less than half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on
B17	27%	4	10	Less than half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on
B18	27%	6	7	Nearly all windows are found to achieve BRE VSC criteria
B19	27%	3	6	Half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on
B20	27%	5	7	Over half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B21	27%	3	6	Half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B22	27%	4	7	Over half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B23	27%	28	28	All windows are found to achieve BRE VSC criteria
B24	27%	10	11	Nearly all windows are found to achieve BRE VSC criteria

Building	Standard VSC target (absolute)	Windows achieving VSC target	Quantity of Windows tested	Comments
B25	27%	18	20	Nearly all windows are found to achieve BRE VSC criteria
B26	27%	0	66	No windows are found to achieve BRE VSC criteria
B27	27%	170	173	Nearly all windows are found to achieve BRE VSC criteria
B28	27%	27	39	Over half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B29	27%	12	12	All windows are found to achieve BRE VSC criteria
B30	27%	14	19	Over half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.

Out of the 30 detailed buildings assessed, 21 are found to have the majority of their windows achieve the BRE recommended 27% VSC. Windows which do not achieve typically are found at lower level on the façade, or are obstructed by the building form to itself.

Of the 9 remaining buildings assessed for daylight, which include B2, B9, B10, B11, B13, B14, B16, B17 and B26, the majority are identified as commercial offices and a limited number of windows are found to achieve the recommended 27%, although the majority of their windows which are obstructed from receiving the recommended levels of daylight are found at lower level of buildings, and where the buildings provide shadowing to themselves, which is typical in an urban setting. VSCs overall trend toward the mid to high teens through to the mid-twenties, which can be considered to be normal, or average, daylight access within a relatively dense urban environment.

11.3.15.4 Effects to Amenity

11.3.15.5 Sunlight

Table 11.62 summarises the sunlight accessibility by windows on identified receptors and provides an overview of amenity space and indicates whether they achieve the BRE criteria for a minimum of two hours of direct sunlight to over half their area on 21 March in the baseline condition. Shadowing diagrams for shadowing conditions are provided by Figures A.14 – A.16, Appendix 11.A.

Table 11.62: Baseline Effects – Sunlight Hours to Amenity

Area	Space	Presence	Minimum 2 hours sunlight achieved	Comments
A1	Public Amenity / Green space	People	Y	The space receives some shading throughout the day from existing adjacent buildings, however over 50% of its area receives sunlight for 2 hours or more
A2	Public Amenity / Green space	People	Y	Generally unobstructed, some shadowing may be created by trees throughout the day due to their planted

				density
A3	Public Amenity / Green space	People	Y	Surrounding buildings are set back far enough and are of sufficient height that long shadows are not observed.

Shadowing to identified amenity areas A1 – A3 are found to achieve the recommended 2 hours of sunlight for over half of their area on 21 March, the recommended shadowing test date. This meets good practice recommendations under existing conditions. Additional shadow studies are provided for 21 June and 21 December for an overview of the shadowing extents throughout the year.

11.3.16 Predicted Impacts

11.3.17 Effects to Buildings

11.3.17.1 Sunlight

Table 11.93 summarises the sunlight accessibility by windows on identified receptors and provides an overview of how many windows are expected to meet the good practice guidance targets of 25% APSH and 5% WPSH in the proposed condition, and indicates the degree of change predicted between baseline and proposed conditions which allows the magnitude of effect to be determined. Full details for individual windows are provided in Section 1 Figures and Section 2 Performance Data within Appendix 11.A.

Table 11.63: Baseline Effects - Built Receptors – Sunlight Hours to Windows, APSH and WPSH

Building	Sunlight Hours Target	Windows achieving Sunlight Hours target	Deviation from min. APSH and WPSH target (<20%)	Quantity of Windows tested	Comments
B1	APSH - 25%	N/A	N/A	46	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	46	
B2	APSH - 25%	1	3	4	All windows retain WPSH in line with BRE criteria, and one window retains APSH.
	WPSH – 5%	4	4	4	
B3	APSH - 25%	N/A	N/A	9	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	9	
B4	APSH - 25%	N/A	N/A	3	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	3	
B5	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B6	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B7	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B8	APSH - 25%	N/A	N/A	7	Windows are North facing and do

Building	Sunlight Hours Target	Windows achieving Sunlight Hours target	Deviation from min. APSH and WPSH target (<20%)	Quantity of Windows tested	Comments
					not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B9	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B10	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B11	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B12	APSH - 25%	N/A	N/A	10	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	10	
B13	APSH - 25%	N/A	N/A	8	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	8	
B14	APSH - 25%	N/A	N/A	5	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	5	
B15	APSH - 25%	N/A	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	N/A	
B16	APSH - 25%	N/A	N/A	25	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	25	
B17	APSH - 25%	N/A	N/A	10	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	10	
B18	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B19	APSH - 25%	N/A	N/A	6	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	6	
B20	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B21	APSH - 25%	N/A	N/A	5	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	5	
B22	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B23	APSH - 25%	3	3	28	25 windows are North facing and do not receive direct sunlight.

Building	Sunlight Hours Target	Windows achieving Sunlight Hours target	Deviation from min. APSH and WPSH target (<20%)	Quantity of Windows tested	Comments
	WPSH – 5%	3	3	28	
B24	APSH - 25%	N/A	N/A	11	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	11	
B25	APSH - 25%	1	1	20	19 windows are North facing and do not receive direct sunlight
	WPSH – 5%	0	0	20	
B26	APSH - 25%	N/A	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	N/A	
B27	APSH - 25%	39	39	39	Windows retain APSH and WPSH in line with BRE recommendations
	WPSH – 5%	39	39	39	
B28	APSH - 25%	33	35	39	2 windows face North and do not receive direct sunlight, remaining windows retain good APSH ad WPSH
	WPSH – 5%	30	35	39	
B29	APSH - 25%	12	12	12	All windows retain APSH and WPSH in line with BRE criteria.
	WPSH – 5%	12	12	12	
B30	APSH - 25%	2	4	19	The majority of windows retain WPSH in line with BRE criteria, and one window retains APSH
	WPSH – 5%	13	13	19	

The majority of buildings assessed are found to retain similar levels of daylight to that which they currently enjoy both annually and during winter months with the Proposed Development in place, although there is likely to be some variation across facades. This includes B2, B27, B28 and B29. The space uses for B2 are unknown and a high sensitivity has been assumed. Effects for B2 could be overall significant / moderate even with a low level of potential change, although this could be reduced based on a reduced sensitivity to a change in lighting condition. Effects to B27, B28 and B29 are considered to be negligible.

Buildings B30 is expected to experience a noticeable decrease in sunlight access throughout the year, with four windows retaining the recommended 25% APSH under proposed conditions. B30 is found to retain the recommended 5% sunlight during winter months. This effect is considered to be profound.

B25 is also likely to experience a reduction in sunlight access, however it should be considered that this is identified as a commercial / retail premises and it is likely that this will be less noticeable as it is common for retailers to utilise electric lighting rather than natural light for their main light source, or desire to restrict the access of high levels of direct sunlight to interior spaces as part of climate control measures. The majority of effects are considered to be negligible, although there is potential for moderate / slight effects to be found to some windows which may serve as offices.

Daylight

Table 11.510 summarises the daylight accessibility by windows on identified receptors and provides an overview of how many windows are expected to meet the good practice guidance target of 27%

VSC in the proposed condition, and indicates the degree of change predicted between baseline and proposed conditions which allows the magnitude of effect to be determined.

Table 11.57: Baseline Effects - Built Receptors – Daylight (VSC)

Building	Daylight Target (VSC)	Windows achieving Daylight target	Deviation from min. APSH and WPSH target (<20%)	Quantity of Windows tested	Comments
B1	27%	25	22	46	The majority of windows are found to retain the BRE recommended 27% VSC, while just under half of windows assessed retain the minimum 0.8x baseline daylight
B2	27%	0	0	4	No windows are found to retain the BRE recommended VSC, or retain below the recommended 0.8x baseline daylight
B3	27%	1	1	9	Nearly all windows are not found to retain the BRE recommended 27% VSC, or to retain a minimum of 0.8x baseline daylight.
B4	27%	0	0	3	No windows are found to retain the BRE recommended VSC, or retain below the recommended 0.8x baseline daylight
B5	27%	4	7	7	Over half of windows are found to retain the BRE recommended 27% VSC, and all windows retain a minimum 0.8x baseline daylight
B6	27%	3	7	7	Just under half of windows are found to retain the BRE recommended 27% VSC, and all windows retain a minimum 0.8x baseline daylight
B7	27%	3	7	7	Just under half of windows are found to retain the BRE recommended 27% VSC, and all windows retain a minimum 0.8x baseline daylight
B8	27%	2	7	7	Just under half of windows are found to retain the BRE recommended 27% VSC, and all windows retain a minimum 0.8x baseline daylight
B9	27%	2	7	7	Just under half of windows are found to retain the BRE recommended 27% VSC, and all windows retain a minimum 0.8x baseline daylight
B10	27%	2	7	7	Just under half of windows are found to retain the BRE recommended 27% VSC, and all windows retain a minimum 0.8x baseline daylight
B11	27%	1	7	7	1 window is found to retain the BRE recommended 27% VSC and all windows are found to retain the minimum 0.8x

Building	Daylight Target (VSC)	Windows achieving Daylight target	Deviation from min. APSH and WPSH target (<20%)	Quantity of Windows tested	Comments
					baseline daylight
B12	27%	1	3	10	Nearly all windows are not found to retain the recommended 27% VSC, while a third of windows are found to retain the recommended 0.8x baseline daylight.
B13	27%	0	2	8	No windows are found to retain the BRE recommended 27% VSC, while 2 retain the recommended 0.8x baseline daylight.
B14	27%	2	5	5	2 windows are found to retain the BRE recommended 27% VSC, while all windows retain the recommended 0.8x baseline daylight
B15	27%	132	132	138	The majority of windows are found to retain the BRE recommended 27% VSC, and retain the recommended 0.8x baseline daylight.
B16	27%	5	20	25	A fifth of windows are found to retain the BRE recommended 27% VSC, while nearly all windows are found to retain the recommended 0.8x baseline daylight
B17	27%	0	0	10	No windows are found to retain the BRE recommended VSC, or retain below the recommended 0.8x baseline daylight
B18	27%	0	0	7	No windows are found to retain the BRE recommended VSC, or retain below the recommended 0.8x baseline daylight
B19	27%	0	0	6	No windows are found to retain the BRE recommended VSC, or retain below the recommended 0.8x baseline daylight
B20	27%	0	0	7	No windows are found to retain the BRE recommended VSC, or retain below the recommended 0.8x baseline daylight
B21	27%	0	0	5	No windows are found to retain the BRE recommended VSC with the proposed development in place
B22	27%	0	0	7	No windows are found to retain the BRE recommended VSC with the proposed development in place
B23	27%	6	8	28	Less than a quarter of windows are found to retain the BRE recommended 27% VSC, and just under a third are found to retain the recommended 0.8x

Building	Daylight Target (VSC)	Windows achieving Daylight target	Deviation from min. APSH and WPSH target (<20%)	Quantity of Windows tested	Comments
					baseline daylight.
B24	27%	1	3	11	Nearly all windows are not found to retain the BRE recommended 27% VSC, while 3 are found to retain the recommended 0.8x baseline daylight.
B25	27%	10	11	20	The majority of windows are found to retain the BRE recommended 27% VSC, and retain the recommended 0.8x baseline daylight.
B26	27%	0	65	66	No windows are found to retain the BRE recommended VSC, or retain below the recommended 0.8x baseline daylight
B27	27%	165	173	173	All windows are found to retain the minimum 0.8x baseline daylight
B28	27%	16	38	39	Approximately half of windows are found to retain the BRE recommended 27%, and all but 1 are found to retain the minimum 0.8x baseline daylight.
B29	27%	10	12	12	All windows are found to retain the minimum 0.8x baseline daylight
B30	27%	0	0	19	No windows are found to retain the BRE recommended VSC, or retain below the recommended 0.8x baseline daylight

Out of the 30 detailed buildings assessed, 16 are found to have the majority of their windows retain the BRE recommended 27% VSC, or to have the majority of windows retain at least 0.8x baseline daylight available to them. This includes B1, B5, B6, B7, B8, B9 B10, B11, B14, B15, B16, B20, B26, B27, B28 and B29. Windows which do not achieve typically are found at lower level on the façade, or are obstructed by the building form to itself. There is potential for some windows along their facades to experience a low level of change which may be more noticeable due to their sensitive nature, although in those cases effects are typically considered to be moderate / slight. Effects to other windows on these buildings are considered to be negligible.

Of the 14 remaining buildings assessed for daylight, which include B2, B3, B4, B12, B13, B17, B18, B19, B20, B21, B22, B23 and B30, are found to have a higher level of change in daylight access. Effects to commercial / retail are not considered to be as significant and effects are typically considered at most to be moderate / slight when not found to be minor or negligible. Focus is made for buildings which contain a residential element.

Buildings B3, B16, B13, B23, B24 and B30 contain residential windows which have the potential to have significant reductions in daylight which could be considered to be profound, very significant / significant, or significant. Buildings B3, B13, B23, B24 are expected to retain VSCs in the region of mid-teens through to low-twenties, which can be considered in keeping with recommendations for dense urban environments and the perceived effect is expected to be more moderate. B16 affected windows are found to be limited in receipt of direct daylight under existing conditions and are likely to affect bedroom / bathrooms, which are considered to have less sensitivity to a change in lighting condition, and the perceived effects is expected to be considered to be moderate. B30 is likely to be more significantly affected by decreased light available from the south and effects are considered to be profound.

11.3.17.2 Effects to Amenity

11.3.17.3 Sunlight

Table 11.65 summarises the sunlight accessibility by windows on identified receptors and provides an overview of amenity space and indicates whether they achieve the BRE criteria for a minimum of two hours of direct sunlight to over half their area on 21 March in the proposed condition, and indicates the degree of change predicted between baseline and proposed conditions which allows the magnitude of effect to be determined.

Table 11.65 Baseline Effects – Sunlight Hours to Amenity

Area	Space	Presence	Total % area receiving a minimum 2 hours sunlight	Comments
A1	Amenity	People	100	Some new shadowing during morning hours, shading consistent with existing conditions at other times during the day
A2	Amenity	People	100	Some new shadowing during afternoon hours, shading consistent with existing conditions at other times during the day
A3	Amenity	People	100	Shadowing appears to be consistent with existing conditions

Overall shading to the amenity spaces identified for assessment are largely unchanged with the proposed development in place. There is some new shading in the morning to A1, but this is limited and sunlight conditions are unchanged outside of morning hours.

All existing amenity areas that are assessed are found to receive as a minimum at least 2 hours or more of sunlight on 21 March for over 50% of their area, and overall are not expected to experience a significant amount of change. This is considered to be in line with guidance recommendations, with all existing spaces retaining good sunlight.

11.3.18 Mitigation Measures

The majority of mitigation measures are incorporated into the design of the Proposed Development, where required.

No additional mitigation measures are proposed.

11.3.19 Residual Impacts

As there are no mitigation measures that are proposed, the Residual Impacts are considered to be in line with Predicted Impacts.

11.3.20 Difficulties Encountered in Compiling Information

The overall size of the study area and number of buildings included for assessment precluded obtaining verified internal layouts for rooms served by the windows tested. Therefore, assessment is taken at façade level, with reference to the criteria and benchmarks set out within good practice guidance BR 209.

11.3.21 Cumulative Impacts

There have been no developments identified within the Study Area that have been consented planning approval or are under construction; therefore, there are no developments which could create combined, or increased, effects on daylight and sunlight access to identified receptors. On this basis, no cumulative impacts are identified or assessed.

11.3.22 References

BS 8206-2– Lighting for Buildings – Part 2: Code of practice for daylighting (BSI, 2008)

BRE BR 209 - BRE 209: BRE Site layout planning for daylight and sunlight, a guide to good practice, Rev 2, 2011 (BRE, 2011)

BS EN. (2010). EN 1991-1-1-4:2005+A1:2010 (E). (n.d.).

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Tominaga, Y. (2008). AIJ Guidelines for Practical Applications of CFD to Pedestrian Wind Environment around Buildings. *Journal of Wind Engineering and Industrial Aerodynamics*, 1750.

11.4 Sunlight, Daylight and Shadow Analysis

11.4.1 Introduction

AECOM has been appointed to undertake a Sunlight, Daylight and Shadow Analysis of the proposed new Limerick Opera, Limerick.

The size and scale of new Limerick Opera development is larger than existing context on site and within the surrounding area, and so a sunlight, daylight and overshadowing assessment is needed to review the daylight and sunlight amenity that local residents are likely to have with the proposed development in place compared to the levels of daylight and sunlight they currently enjoy. The study will allow the potential change in natural lighting condition to be quantified, where present.

All analysis and comments are made with reference to the Building Research Establishment (BRE) design guide 209 ‘Site Layout Planning for Daylight and Sunlight’, 2011.

Daylight analysis is made using the following:

- Distance review
- Angular analysis
- Vertical Sky Component (VSC)

Sunlight analysis is made using the following:

- Sunlight Hours to windows
- Overshadowing to amenity space

Findings of this analysis focus on daylight and sunlight effects to properties that are most likely to be affected by new development.

This report is accompanied by Appendices detailing individual outcomes for the processes described by the Assessment Approach.

11.4.2 Methodology

11.4.3 Standards

11.4.3.1 BS 8206:2008 – Lighting for Buildings – Part 2: Code of practice for daylighting

This updated standard describes good practice in daylighting design and presents criteria intended to enhance the well-being and satisfaction of people in buildings. It is referenced by the BRE Site layout planning for daylight and sunlight document identified above.

11.4.4 Good practice guidance

11.4.4.1 BRE 209: BRE Site layout planning for daylight and sunlight, a guide to good practice, Rev 2, 2011 (BRE, 2011)

Daylight and sunlight assessments were conducted based on the methodology and criteria set out by the Building Research Establishment (BRE) design guide ‘Site Layout Planning for Daylight and Sunlight’, 2011. The main criteria, outlined in Sections 2.2, 2.3, 3.2, Appendix A and Appendix C, are typically identified in local planning guidance as the ones by which the daylight and sunlight performance of a proposed development will be assessed.

BRE design guidelines are intended to be used as the basis for assessing change to daylight and sunlight conditions as a result of a proposed development. The overall outcome depends on a number of factors and it is recognised that there is no simple rule of thumb that can be applied.

With reference to guidance recommendations, buildings within three times (3x) the height of a new or changed development may experience a change in their daylight and sunlight amenity and access. If the distance between them is three or more times the height of the new development, no assessment is required, it is accepted that there will be no effects on the existing windows that exceed recommendations set out within BRE guidance.

It is understood that while some windows on the façade of an existing building may experience a change in daylight or sunlight access due to new or changed development, not all windows will be affected in every case.

It is also important to note that while the BRE report provide designers and planners with a clear and objective way of assessing the daylight and sunlight conditions associated with a new development, recommended criteria which are referenced within this report are not mandatory and are intended to be used flexibly. The following guidance is provided within BR 209:

"The advice given here is not mandatory and this document should not be seen as an instrument of planning policy. Its aim is to help rather than constrain the designer. Although it gives numerical guidelines these should be interpreted flexibly because natural lighting is only one of many factors in site layout design. In special circumstances, the developer or the planning authority may wish to use different target values."

11.4.5 Assessment Approach

Sunlight, Daylight and Overshadowing assessment is undertaken in two main parts that compare the existing, or baseline condition, with the proposed condition which introduces new built elements which could affect sunlight and daylight performance. Sunlight and daylight are assessed to inform on the following effects:

- Impact on neighbouring buildings, where sunlight and daylight are assessed for buildings within the area of influence by the Proposed Development, or what we refer to as the Study Area.
- Impact on neighbouring amenity areas, sunlight is assessed for exterior amenity, which is typically considered to include spaces such as gardens, parks or other types of recreation areas.

This analysis assesses the potential change to daylight and sunlight conditions on and around the Application Site with the Proposed Development in place. This process is outlined by the following:

- Identification of a baseline condition;
- Identification of potential receptors and assessment of their sensitivity;
- Identification of a proposed condition with the Proposed Development;
- Assess, compare and benchmark the baseline to proposed lighting condition variance and good practice guidance criteria for operational effects;
- Identify any additional mitigation; and
- Summarise and conclude results based on findings.

Sunlight and daylight conditions are assessed quantitatively through the modelling and simulation of both baseline and proposed conditions using industry standard software which incorporates Radiance. This allows predicted results for receptors which are likely to be affected by new development to be compared to the numerical targets set out within BR 209.

11.4.6 Baseline data collection

Although the ultimate receptors are people, as a proxy, receptors are typically considered to be windows serving residential or office space used by the people who live and work in local buildings that would normally expect to have reasonable access to daylight and sunlight. Other receptors include public open spaces which would normally be expected to receive sunlight.

11.4.7 Data Collection

In terms of natural light, the term 'baseline lighting condition' refers to how an area is affected by local lighting conditions with the existing land use in place. The baseline lighting condition was identified by collecting data about the proposed Site and surrounding area. Together, these are referred to as 'the Study Area', defined as the area within which receptors are most likely to experience a noticeable change in natural lighting condition.

Information was collected on aspects of the built and natural environment that may have a particular sensitivity to a change in their local lighting condition, be it an increase or decrease in daylight and sunlight availability. From this, receptors likely to experience the change were identified; typically these are people living in local residences and people using amenity areas.

Baseline conditions have been identified from site survey records, OS mapping and site photography provided by the Design Team, and aerial mapping from google earth for buildings and spaces internal and external to the redline boundary. This helps to identify locations of existing windows and open spaces of existing development which are used to construct the baseline and proposed lighting models.

11.4.8 Identification of receptors

11.4.8.1 Buildings

For the purposes of this assessment 'buildings' are considered as either single structures or groups of development such as blocks of flats comprised of multiple units. Buildings within the scope of this assessment are identified in Figure 11.33 and further summarised in Table 11. and

Table 11.. It should be noted that not all buildings within three times the proposed height of the Proposed Development are assessed as they may not have a particular requirement for daylight or sunlight or access to it due to lack of windows.

11.4.9 Daylight Analysis

11.4.9.1 Daylight (buildings)

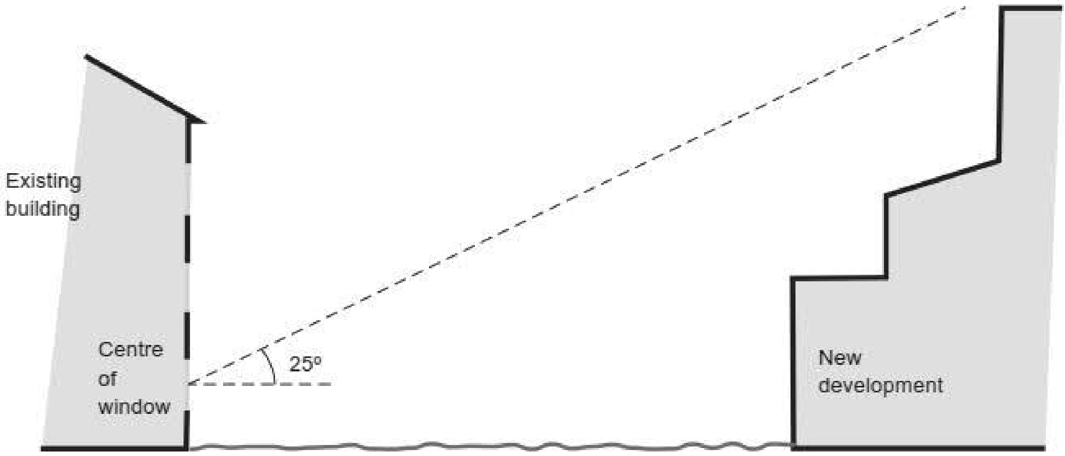
As described above, the Study Area is the area within which receptors are most likely to experience a noticeable change in natural lighting condition. In general, these are buildings that fall within a certain proximity of new development, which in turn is dependent upon the height and density of the proposed development as well as its distance from the location of existing / proposed built structures.

BRE guidance (BR 209, 2011) advises that if an existing building is within a distance of 3x the height of a proposed development, it may be close enough that it may be affected, or for building / space users, to experience a noticeable change in their local natural lighting condition. A 'distance check' has been undertaken to identify buildings within approximately 3x the height of each of the proposed buildings comprising the Proposed Development.

A geometric angular assessment is a first stage assessment made prior to undertaking daylight simulation using the lowest windows of an existing development, as these are the most likely to be affected by a new building or development than those higher up on a facade.

This is done by placing horizontal plane from the centre of an existing window and then angling that plane by 25 degrees upward. If the proposed development in its entirety falls under this angled plane, then further analysis is not considered to be necessary as the daylight and sunlight condition will be relatively unchanged. Figure 11. shows an extract of how angular assessment is considered.

Figure 11.32: Angular assessment diagram (BRE 209 extract)



If the proposed development does not fall under this angled plane in its entirety, further review of daylight and sunlight on the façade is made in the form of the Vertical Sky Component (VSC).

With the potential scale of the Proposed Development generating an initial Study Area that encompasses a significant number of buildings that could be affected by a reduction in sunlight or daylight, the majority of buildings within the Study Area are tested at façade level for VSC and angular assessment is not made.

11.4.9.2 Vertical Sky Component

Vertical Sky Component (VSC) looks at how much light from the sky a room could receive, but it does not relate to how light behaves inside a room. VSC measures the amount of potential light reaching a vertical surface, specifically windows, with obstructions in the way and compares the outcome with the amount of light available in that location under unobstructed conditions.

In absolute terms, guidance recommends that a VSC of 27% should provide adequate daylight access to interior spaces, although guidance does caution that benchmarks need to be applied flexibly with respect to the style of a built environment (for example, benchmarks are not often achievable in a dense urban context where tall buildings are commonly found in close proximity and having a tight grain).

Guidance also recommends that any change between the amount of daylight a window receives prior to new development and after it has been constructed be limited to 20%, or be at least 0.8 times the amount of light available under existing conditions. It cautions that a window found to have less than 27% of skylight available to it with a proposed development in place, and the change in lighting conditions between the existing and proposed is more than 20%, the level of change may be more noticeable by room users and the room is likely to appear gloomier, leading to an increased need for supplementary electric light.

It is equally as important to consider that a reduction in available daylight in excess of 20% does not mean that good light will not be available to an internal space. Depending on the size and shape of the room and the size of window serving it, adequate light may still be available to the interior, but the reduction is likely to be more noticeable. It is recommended that a change between conditions not exceed 30%, or 0.7 times the amount of light available under existing conditions, in order to limit the degree of perceptible change in available light to room occupants.

In terms of deviation from the minimum recommended value, if this is positive the effects are considered to be generally negligible, and where effects are found to be negative they are considered to be adverse as they may result in varying degrees of noticeable reduction in daylight and sunlight access.

11.4.10 Notes on Daylight Planning Guidance

Reduction in access to direct daylight is directly proportional to reduction in vertical sky component. There are a number of context factors that can have additional influence with daylight and sunlight access which may incorporate existing built forms, or nearby vegetation. The following factors are

- Balconies and overhangs above existing windows tend to block sunlight and, depending on depth, are often the main factors in the relative loss of daylight.
- Trees and other tall landscaping, such as shrubs / hedges, are generally ignored in general calculation. In cases where plantings create dense continuous belts or are located near windows, their contribution may be considered.
- In cases where foliage is established and dense or new and expected to mature in locations near windows, guidance indicates that approximate daylight access can be expected in the region of 50 - 80% of available unobstructed light when trees are bare of leaves, and 10 - 30% of the unobstructed value when they are in full leaf.

11.4.11 Sunlight Analysis

Amenity spaces are considered to be non-transient exterior areas where people may choose to linger for an unspecified period of time rather than serving as a pedestrian access routes. These may form part of existing conditions, or be proposed as part of new development. Amenity space may take the form of private gardens associated with residential housing; open space within the public realm such as parks, playgrounds or public squares; or sitting out areas formed as part of new development.

Sunlight access to windows and to gardens or amenity space is variable, dependant on the amount of sunlight available in certain climates, locations and weather conditions.

As the proposed development is located in the northern hemisphere, buildings that have windowed facades within 90 degrees of north are excluded as the majority of any overshadowing they receive, they do to themselves. Additionally, where mature trees are present, further sunlight reduction is expected depending on proximity to the tree, potentially between 10 - 30% during winter months, and 50 – 80% in summer months. Conifers are more likely to retain their density seasonally and the potential obstruction is likely to be consistent throughout the year.

The sunlight performance of existing and proposed amenity space that falls within the 3x height distance from new development was taken as the study area for this element of the assessment. This is the same Study Area established for assessment of buildings.

11.4.11.1 Sunlight to Windows

The probable hours that a window is likely to receive direct sunlight are assessed using weather data of sunlight data covering 1 January through 31 December. Sunlight hours to windows is normally assessed for windows which face within 90 degrees of due south as this orientation optimal for receiving direct sunlight. Windows with a northerly orientation are not assessed as are not oriented toward the sunpath and do not receive direct sunlight.

Annual Probable Sunlight Hours (APSH) assessment looks for at least 25% of available sunlight hours to be accessible by windows annually, and at least 5% availability for winter months, between 21 September and 21 March. In the London area, the average time where sunlight is available is suggested to be 1486 hours and 5% winter at approximately 446 hours.

Good practice is met where a change in lighting conditions is limited to 20% as this is less likely to be noticeable, and changes of less than 4% which are considered as not perceptible. Changes in excess of 20% may be more material, with reference to effects on main windows. Sunlight hours are focussed on primary living spaces such as living rooms, followed by bedrooms and kitchens which don’t have as high a sunlight recommendation.

11.4.11.2 Sunlight to Amenity

Good sunlight availability within a garden or amenity space looks for a minimum of two hours direct sunlight for over 50% of its area on 21 March. This date presents a middle case halfway between the longest and shortest day of the year, and considers that as the sun shines at a higher angle that less shadowing will occur towards the longest day of the year and more shadowing towards the shortest day of the year. Achieving two hours on 21 March indicates that sunlight will reach the space during winter months.

Sunlight access enjoyed by existing gardens or amenity space which is changed by more than 20% between conditions has the potential to be noticeable by space users, although this will depend on the arrangements of the garden and how it is used. As with local effects on daylight, established, dense, mature landscape can reduce sunlight access locally, depending on the planting and time of year.

11.4.12 Simulation Parameters

Simulations incorporate industry standard reflectance values for spaces and materials, assigned during the assessment process.

Daylight simulations use a 0% reflectance to ensure only direct light is assessed with an overcast sky that creates a consistent ambient lighting condition. Sunlight simulations use materials which allow for a clear depiction of shadowing extents under clear sky conditions, so that the performance of direct light can be assessed.

11.4.13 Significance Criteria

An assessment of receptor sensitivity, magnitude of change experienced by those receptors and how significant that change is, has been made in the context of, and informed by, local natural lighting conditions, site specific building and environmental factors, legislation, planning policy, current relevant standards and good practice guidance.

Ratings represent a range of conditions, some of which are a combination of two conditions (i.e. medium – low). These combined conditions are intended to mark change at the higher or lower end of a particular threshold.

The sensitivity of built receptors relates to the type of development they are and their normal exposure to daylight and sunlight. Table 11.84 indicates how sensitivity has been considered for both built development and open spaces.

Table 11.84: Receptors and receptor sensitivity

Receptor sensitivity	Receptor type
High	Windows that serve spaces that have a high sensitivity of requirement for daylight such as classrooms, single aspect living spaces and kitchens. Land that contains highly light sensitive species / habitat or is marked for a large increase in local biodiversity. Public / open space meant to encourage people to spend longer periods of time, or does not experience a significant amount of overshadowing.
Medium	Windows that serve spaces where there is an intermediate sensitivity of requirement for daylight such as commercial offices, retail spaces, bedrooms and dual aspect living spaces or kitchens. Land that contains common species or is marked for increased biodiversity. Open / public space that experiences some overshadowing or is desired to have a degree of solar control.
Low	Windows or doors that serve spaces where there is a low sensitivity of requirement for daylight such as storage spaces, car parks, circulation space, stairwells, utility rooms and bathrooms. Land that contains limited species, or habitat that does not have a particular sensitivity to a change in lighting condition,

	Land that will only be used by people for a short period of time or is already experiencing noticeable overshadowing effects.
Negligible	Windows or doors that serve spaces where there is no requirement for daylight such as boarded windows and buildings with few to no windows. Land that is not suitable for biodiversity or being designated as open / public space. Often this type of receptor is excluded from simulated analysis. There is no potential for significant effects on a receptor with very low sensitivity, whatever the magnitude of change.

Table 11.555 indicates more specifically how sensitivities are considered in relation to specific developments / room types as part of this assessment, in line with how receptor sensitivity is considered in line with the above.

Table 11.55: Specific Receptors and Receptor Sensitivity

Space Use	Sensitivity
Domestic - Bedroom	High
Domestic - Living Room	High
Domestic - Unknown	High
Domestic Kitchen	High
Domestic Kitchen/Living Room - covered balcony	High
Museum - Exhibition	High
Unknown	High
Unknown - Vacant	High
Commercial - Retail	Low
Commercial - Retail - boarded up	Low
Commercial - Office	Low
Commercial - Office - boarded up	Low
Commercial - Restaurant Kitchen	Low
Commercial - Restaurant Office/Store	Low
Commercial - Retail	Low
Commercial - Retail - boarded up	Low
Commercial - Retail - Vacant	Low
Domestic - External Door to balcony	Low
Domestic - Landing	Low
Domestic Bathroom	Low
Museum - Office	Low
Museum - Retail Shop	Low
Staircore	Negligible
Commercial - Office - Emergency Exit	Negligible
Commercial - Office - Stairs	Negligible
Shed - boarded up	Negligible

The variance between lighting conditions, or magnitude of change, is a measure of the degree of perceived change likely to result from a new lighting condition. Table 11.56 indicates how the magnitude of change has been rated.

Table 11.56: Effect magnitude and perception

Receptor sensitivity	Receptor type
High	Extensive, unmistakable, noticeable intrusive change to a lighting condition affecting the appearance, characteristics and effects of daylight and sunlight to identified receptors. This may be considered to be a drastic increase or decrease in available sunlight for exterior and interior spaces. These spaces are likely to have a significant amount of natural light in their existing condition, or have a strong requirement for natural light Typically this will encompass a change of 41% + from baseline conditions.
Medium	Noticeable, distinct, but not always intrusive, change to a lighting condition affecting the appearance, characteristics and effects of daylight and sunlight to identified receptors. This would be considered a noticeable increase or decrease to hours of available sunlight for building façades and open spaces, or daylight for internal spaces which are likely to have good daylight access in their existing condition. Typically this will encompass a change of 31 – 40% of baseline conditions.
Low	Small change to an existing lighting condition, new lighting condition creating only a low level of change or new effects to identified receptors. This may be a small reduction or increase in hours of available sunlight for building façades and open spaces, or daylight for internal spaces which have a reasonable expectation for daylight. Typically this will encompass a change of 21 – 30% from baseline conditions.
Negligible	No perceptible change, barely noticeable. Outcome of analysis falls within BRE guidance recommended criteria or does not significantly vary from existing conditions. There is no potential for a magnitude at this level to have a significant effect, even if the receptor is highly sensitive. Typically this effect will encompass a change of 0 – 20% from baseline conditions.

The combination of the sensitivity of a given receptor and the predicted magnitude of change in the local lighting condition helps identify how significant an effect is likely to be (see Table 11.57 below).

Effects may be either adverse or beneficial. Beneficial effects would occur where there were increases in available sunlight to exterior spaces or increases of daylight to interior spaces (for example through demolition of existing buildings), while adverse effects would be occur as a result of new buildings and structures reducing access to sunlight or daylight.

Effects to north facing windows are not assessed for sunlight, as the majority of overshadowing that they will experience is caused by the building to itself.

Table 11.57: Lighting effect rating matrix

Magnitude of effect	Receptor Sensitivity			
	High	Medium	Low	Negligible
High	**Profound**	**Very Significant / Significant**	**Moderate** / Slight	Not significant
Medium	**Very Significant / Significant**	**Moderate**	**Moderate** / Slight	Slight / Not Significant
Low	**Significant / Moderate**	**Moderate** / Slight	Minor	Slight / Not Significant
Negligible	Not Significant	Not Significant	Not Significant	Imperceptible

(NB effects of that are found to be profound or very significant / significant (in bold above) are considered to be likely significant effects in EIA terms)

11.4.14 Assumptions

The placement and geometry of the proposed development and surrounding buildings have been provided to AECOM Lighting in drawing format by the project architect / design team. The simulation model placement and geometry has been confirmed by the project architect. The location and size of the test planes correspond to existing windows.

Daylight and Sunlight analysis does not take into account the effects of landscape or other changeable obstruction unless it forms a normally continuous, dense 'wall' effect such as with hedgerows or closely planted treeline. This means that any changes to landscape, whether it is retention of trees or shrubs, removal of the same, or recommendations for additional plantings to be made, can be considered for effect but effects are not able to be quantified. It is assumed that there are no landscape features creating a dense 'wall' effect in close enough proximity to existing buildings and exterior spaces that will affect daylight and sunlight access.

It is assumed that there will be conifer trees planted as part of a wind mitigation strategy for the Proposed Development. While they are variable in size, the density of the trees is not expected to decrease, and their potential effects are incorporated into the sunlight analysis.

Where direct comparison of baseline to proposed lighting conditions is not possible, or applicable, due to unavailability or incompatibility of information, reasonable assumptions are made based on available information or agreed with the design team. Assumptions in these cases are addressed within the relevant section of analysis.

As the proposed development is located in the northern hemisphere, buildings that have windowed facades within 90 degrees of north are excluded from sunlight assessment as the majority of any overshadowing they receive, they do to themselves.

Windows and spaces which face within 90 degrees of south are expected to have good potential for sunlight access, following the sun path throughout the day / year.

Potential overshadowing to amenity spaces is a function of built height / proximity and space size. Exterior amenity spaces which are north of existing development are expected to experience consistent overshadowing throughout the year. Those spaces which have buildings closely located to more than one side are expected to be normally overshadowed if building height exceeds space depth. In other words, tall buildings could cast shadows across a small space throughout the day / year.

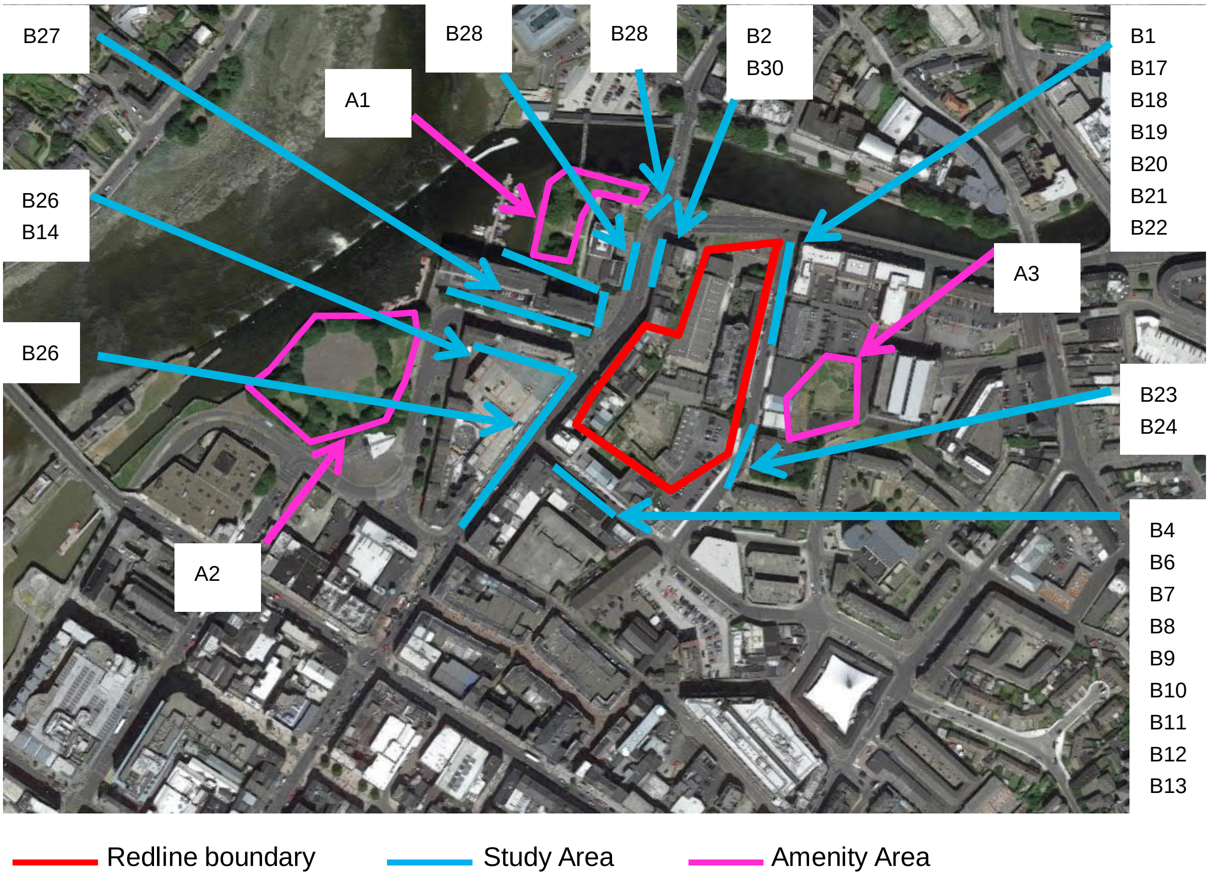
11.4.15 Baseline Conditions

30 individual developments have been assessed in detail within the Study Area, and an additional set of access points are used within the Study Area to provide an overview of natural light performance around the Proposed Development. A total of 1733 points have been assessed across the Study Area for sunlight and daylight assessment of buildings, and four key amenity spaces have been assessed for sunlight.

Figure 11.33 indicates the location of the Proposed Development, Study Area, location of assessment points and amenity spaces.

In each case the analysis point refers the centre of the selected window and is aligned with the vertical surface of the window being tested.

Figure 11.33: Locations of Buildings and Amenity Spaces assessed



Developments which are assessed in detail are provided in Table 11.58, with further information on sensitivity and detailed outputs found within Appendix 11.A.

Table 11.58 provides information on Amenity Space.

Table 11.58: Detailed Assessment Buildings

Building Reference	Address / Name	Use
B1	Gardner House, Bank Place	Commercial Office
B2	7, Bank Place	Unknown
B3	Pillar House, Ellen Street	Domestic, Commercial Office, Commercial Retail
B4	11, Ellen Street	Commercial leisure / restaurant
B5	12, Ellen Street	Commercial, Office / retail
B6	13, Ellen Street	Unknown, vacant
B7	14, Ellen Street	Unknown, vacant
B8	15, Ellen Street	Unknown, vacant
B9	16, Ellen Street	Commercial Office
B10	17, Ellen Street	Commercial Office
B11	18, Ellen Street	Domestic
B12	19, Ellen Street	Unknown, vacant
B13	Ormston House, Ellen Street	Commercial Office
B14	Arthurs Quay SC, Francis Street	Commercial Office / Retail

Building Reference	Address / Name	Use
B15	Sarsfield House, Francis Street	Commercial Office
B16	Pillar House, Little Ellen Street	Commercial Office / Retail, Domestic
B17	1, Michael Street	Commercial Office
B18	2, Michael Street	Commercial Office
B19	3, Michael Street	Commercial Office
B20	4, Michael Street	Commercial Office
B21	5, Michael Street	Commercial Office
B22	6, Michael Street	Commercial Office
B23	Westgate House, Michael Street	Domestic
B24	St Michaels Court, Michael Street	Domestic
B25	Barrow House, Michael Street	Commercial Office / Retail
B26	Arthurs Quay SC, Patrick Street	Commercial Office / Retail
B27	Sarsfield House, Rutland Street	Commercial Office
B28	Hunt Museum, Rutland Street	Museum Office / Retail / Exhibition
B29	Rutland House, Rutland Street	Domestic / Storage
B30	Rutland House Apartments, Rutland Street	Domestic, rear aspect of B29

Table 11.59: Amenity Space

Space Reference	Location	Use
A1	Near the river to the north of the Proposed Development	Amentiy
A2	Near the river to the west of the Proposed Development	Amenity
A3	East of the Proposed Development and to the back of assessment buildings along Michael street	Amenity

11.4.15.1 Effects to Buildings

11.4.15.2 Sunlight

Table 11.60 summarises the sunlight accessibility by windows on identified receptors and provides an overview of how many windows are expected to meet the good practice guidance targets of 25% APSH and 5% WPSH in the baseline condition.

Table 11.60:Baseline Effects - Built Receptors – Sunlight Hours to Windows, APSH and WPSH

Building	Sunlight Hours Target	Windows achieving Sunlight Hours target	Quantity of Windows tested	Comments
B1	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B2	APSH - 25%	2	4	One window achieves BRE criteria for APSH, and all windows achieve criteria

Building	Sunlight Hours Target	Windows achieving Sunlight Hours target	Quantity of Windows tested	Comments
	WPSH – 5%	4	4	for WPSH
B3	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B4	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B5	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B6	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B7	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B8	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B9	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B10	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B11	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B12	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B13	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B14	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B15	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B16	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B17	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B18	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight

Building	Sunlight Hours Target	Windows achieving Sunlight Hours target	Quantity of Windows tested	Comments
	WPSH – 5%	N/A	N/A	
B19	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B20	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B21	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B22	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B23	APSH - 25%	23	28	3 windows are north facing. Limited direct sunlight is found at lower level, or where the building shadows itself
	WPSH – 5%	23	28	
B24	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B25	APSH - 25%	4	20	Windows achieving BRE criteria are found at upper levels of the building
	WPSH – 5%	5	20	
B26	APSH - 25%	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	
B27	APSH - 25%	39	173	134 windows are North facing and do not receive direct sunlight, and less than half the windows are found to achieve BRE criteria for APSH and WPSH
	WPSH – 5%	39	173	
B28	APSH - 25%	31	39	2 windows are north facing. Limited direct sunlight is found at lower level, or where the building shadows itself
	WPSH – 5%	31	39	
B29	APSH - 25%	12	12	All windows are found to achieve BRE criteria for APSH and WPSH
	WPSH – 5%	12	12	
B30	APSH - 25%	17	19	Nearly all windows are found to achieve BRE criteria for APSH and WPSH
	WPSH – 5%	16	19	

Out of the 30 detailed buildings assessed, 23 contain north facing windows that do not receive direct sunlight and are excluded from further analysis.

Of the 7 remaining buildings assessed for sunlight, 6 buildings are found to have the majority of their windows achieve good annual and winter sunlight with the Proposed Development in placed, in line with BRE recommended criteria. This includes B1, B23, B27, B28, B29 and B30. It should be noted that B27 has a significant number of windows that face north and will not receive direct sunlight.

B25 is expected to have more limitation in direct sunlight access with the proposed development in place to windows on lower floors, or those which are obstructed by the building to itself.

11.4.15.3 Daylight

Table 11.61 summarises the sunlight accessibility by windows on identified receptors and provides an overview of how many windows are expected to meet the good practice guidance targets of 25% APSH and 5% WPSH in the baseline condition.

Table 11.61: Baseline Effects - Built Receptors – Daylight (VSC)

Building	Standard VSC target (absolute)	Windows achieving VSC target	Quantity of Windows tested	Comments
B1	27%	45	46	Nearly all windows are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B2	27%	0	4	No windows are found to achieve BRE VSC criteria
B3	27%	9	9	All windows are found to achieve BRE
B4	27%	2	3	2 windows are found to be sufficiently close to 27% at 26.5% that they are considered to achieve BRE criteria.
B5	27%	6	7	Nearly all windows are found to achieve BRE VSC criteria
B6	27%	4	7	Over half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B7	27%	4	7	Over half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B8	27%	4	7	Over half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B9	27%	3	7	Less than half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B10	27%	2	7	Less than half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B11	27%	2	7	Less than half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on
B12	27%	6	10	Windows not achieving the target are

Building	Standard VSC target (absolute)	Windows achieving VSC target	Quantity of Windows tested	Comments
				found at lower ground level or are obstructed by the buildings they are located on.
B13	27%	3	8	Less than half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on
B14	27%	2	5	Less than half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on
B15	27%	132	138	Nearly all windows are found to achieve BRE VSC criteria
B16	27%	9	25	Less than half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on
B17	27%	4	10	Less than half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on
B18	27%	6	7	Nearly all windows are found to achieve BRE VSC criteria
B19	27%	3	6	Half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on
B20	27%	5	7	Over half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B21	27%	3	6	Half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B22	27%	4	7	Over half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B23	27%	28	28	All windows are found to achieve BRE VSC criteria
B24	27%	10	11	Nearly all windows are found to achieve BRE VSC criteria

Building	Standard VSC target (absolute)	Windows achieving VSC target	Quantity of Windows tested	Comments
B25	27%	18	20	Nearly all windows are found to achieve BRE VSC criteria
B26	27%	0	66	No windows are found to achieve BRE VSC criteria
B27	27%	170	173	Nearly all windows are found to achieve BRE VSC criteria
B28	27%	27	39	Over half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.
B29	27%	12	12	All windows are found to achieve BRE VSC criteria
B30	27%	14	19	Over half the windows assessed are found to achieve BRE VSC criteria. Windows not achieving the target are found at lower ground level or are obstructed by the buildings they are located on.

Out of the 30 detailed buildings assessed, 21 are found to have the majority of their windows achieve the BRE recommended 27% VSC. Windows which do not achieve typically are found at lower level on the façade, or are obstructed by the building form to itself.

Of the 9 remaining buildings assessed for daylight, which include B2, B9, B10, B11, B13, B14, B16, B17 and B26, a limited number of windows are found to achieve the recommended 27%, although the majority of their windows which are obstructed from receiving the recommended levels of daylight are found at lower level of buildings, and where the buildings provide shadowing to themselves, which is typical in an urban setting.

11.4.15.4 Effects to Amenity

11.4.15.5 Sunlight

Table 11.62 summarises the sunlight accessibility by windows on identified receptors and provides an overview of amenity space and indicates whether they achieve the BRE criteria for a minimum of two hours of direct sunlight to over half their area on 21 March in the baseline condition. Shadowing diagrams for shadowing conditions are provided by Figures A.14 – A.16, Appendix 11.A.

Table 11.62: Baseline Effects – Sunlight Hours to Amenity

Area	Space	Presence	Minimum 2 hours sunlight achieved	Comments
A1	Public Amenity / Green space	People	Y	The space receives some shading throughout the day from existing adjacent buildings, however over 50% of its area receives sunlight for 2 hours or more
A2	Public Amenity / Green space	People	Y	Generally unobstructed, some shadowing may be created by trees throughout the day due to their planted density
A3	Public Amenity /	People	Y	Surrounding buildings are set back far

Green space	enough and are of sufficient height that long shadows are not observed.

Shadowing to identified amenity areas A1 – A3 are found to achieve the recommended 2 hours of sunlight for over half of their area on 21 March, the recommended shadowing test date. This meets good practice recommendations under existing conditions. Additional shadow studies are provided for 21 June and 21 December for an overview of the shadowing extents throughout the year.

11.4.16 Predicted Impacts

11.4.17 Effects to Buildings

11.4.17.1 Sunlight

Table 11.93 summarises the sunlight accessibility by windows on identified receptors and provides an overview of how many windows are expected to meet the good practice guidance targets of 25% APSH and 5% WPSH in the proposed condition, and indicates the degree of change predicted between baseline and proposed conditions which allows the magnitude of effect to be determined. Full details for individual windows are provided in Section 1 Figures and Section 2 Performance Data within Appendix 11.A.

Table 11.93: Baseline Effects - Built Receptors – Sunlight Hours to Windows, APSH and WPSH

Building	Sunlight Hours Target	Windows achieving Sunlight Hours target	Deviation from min. APSH and WPSH target (<20%)	Quantity of Windows tested	Comments
B1	APSH - 25%	N/A	N/A	46	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	46	
B2	APSH - 25%	1	3	4	All windows retain WPSH in line with BRE criteria, and one window retains APSH.
	WPSH – 5%	4	4	4	
B3	APSH - 25%	N/A	N/A	9	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	9	
B4	APSH - 25%	N/A	N/A	3	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	3	
B5	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B6	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B7	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B8	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	

Building	Sunlight Hours Target	Windows achieving Sunlight Hours target	Deviation from min. APSH and WPSH target (<20%)	Quantity of Windows tested	Comments
B9	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B10	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B11	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B12	APSH - 25%	N/A	N/A	10	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	10	
B13	APSH - 25%	N/A	N/A	8	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	8	
B14	APSH - 25%	N/A	N/A	5	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	5	
B15	APSH - 25%	N/A	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	N/A	
B16	APSH - 25%	N/A	N/A	25	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	25	
B17	APSH - 25%	N/A	N/A	10	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	10	
B18	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B19	APSH - 25%	N/A	N/A	6	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	6	
B20	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B21	APSH - 25%	N/A	N/A	5	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	5	
B22	APSH - 25%	N/A	N/A	7	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	7	
B23	APSH - 25%	3	3	28	25 windows are North facing and do not receive direct sunlight.
	WPSH – 5%	3	3	28	
B24	APSH - 25%	N/A	N/A	11	Windows are North facing and do

Building	Sunlight Hours Target	Windows achieving Sunlight Hours target	Deviation from min. APSH and WPSH target (<20%)	Quantity of Windows tested	Comments
					not receive direct sunlight
	WPSH – 5%	N/A	N/A	11	
B25	APSH - 25%	1	1	20	19 windows are North facing and do not receive direct sunlight
	WPSH – 5%	0	0	20	
B26	APSH - 25%	N/A	N/A	N/A	Windows are North facing and do not receive direct sunlight
	WPSH – 5%	N/A	N/A	N/A	
B27	APSH - 25%	39	39	39	Windows retain APSH and WPSH in line with BRE recommendations
	WPSH – 5%	39	39	39	
B28	APSH - 25%	33	35	39	2 windows face North and do not receive direct sunlight, remaining windows retain good APSH ad WPSH
	WPSH – 5%	30	35	39	
B29	APSH - 25%	12	12	12	All windows retain APSH and WPSH in line with BRE criteria.
	WPSH – 5%	12	12	12	
B30	APSH - 25%	2	4	19	The majority of windows retain WPSH in line with BRE criteria, and one window retains APSH
	WPSH – 5%	13	13	19	

The majority of buildings assessed are found to retain similar levels of daylight to that which they currently enjoy both annually and during winter months with the Proposed Development in place, although there is likely to be some variation across facades. This includes B2, B27, B28 and B29. The space uses for B2 are unknown and a high sensitivity has been assumed. Effects for B2 could be overall significant / moderate even with a low level of potential change, although this could be reduced based on a reduced sensitivity to a change in lighting condition. Effects to B27, B28 and B29 are considered to be negligible.

Buildings B30 is expected to experience a noticeable decrease in sunlight access throughout the year, with four windows retaining the recommended 25% APSH under proposed conditions. B30 is found to retain the recommended 5% sunlight during winter months. This is effect is considered to be profound.

B25 is also likely to experience a reduction in sunlight access, however it should be considered that this is identified as a commercial / retail premises and it is likely that this will be less noticeable as it is common for retailers to utilise electric lighting rather than natural light for their main light source, or desire to restrict the access of high levels of direct sunlight to interior spaces as part of climate control measures. The majority of effects are considered to be negligible, although there is potential for moderate / slight effects to be found to some windows which may serve as offices.

Daylight

Table 11.510 summarises the daylight accessibility by windows on identified receptors and provides an overview of how many windows are expected to meet the good practice guidance target of 27% VSC in the proposed condition, and indicates the degree of change predicted between baseline and proposed conditions which allows the magnitude of effect to be determined.

Table 11.510: Baseline Effects - Built Receptors – Daylight (VSC)

Building	Daylight Target (VSC)	Windows achieving Daylight target	Deviation from min. APSH and WPSH target (<20%)	Quantity of Windows tested	Comments
B1	27%	25	22	46	The majority of windows are found to retain the BRE recommended 27% VSC, while just under half of windows assessed retain the minimum 0.8x baseline daylight
B2	27%	0	0	4	No windows are found to retain the BRE recommended VSC, or retain below the recommended 0.8x baseline daylight
B3	27%	1	1	9	Nearly all windows are not found to retain the BRE recommended 27% VSC, or to retain a minimum of 0.8x baseline daylight.
B4	27%	0	0	3	No windows are found to retain the BRE recommended VSC, or retain below the recommended 0.8x baseline daylight
B5	27%	4	7	7	Over half of windows are found to retain the BRE recommended 27% VSC, and all windows retain a minimum 0.8x baseline daylight
B6	27%	3	7	7	Just under half of windows are found to retain the BRE recommended 27% VSC, and all windows retain a minimum 0.8x baseline daylight
B7	27%	3	7	7	Just under half of windows are found to retain the BRE recommended 27% VSC, and all windows retain a minimum 0.8x baseline daylight
B8	27%	2	7	7	Just under half of windows are found to retain the BRE recommended 27% VSC, and all windows retain a minimum 0.8x baseline daylight
B9	27%	2	7	7	Just under half of windows are found to retain the BRE recommended 27% VSC, and all windows retain a minimum 0.8x baseline daylight
B10	27%	2	7	7	Just under half of windows are found to retain the BRE recommended 27% VSC, and all windows retain a minimum 0.8x baseline daylight
B11	27%	1	7	7	1 window is found to retain the BRE recommended 27% VSC and all windows are found to retain the minimum 0.8x baseline daylight
B12	27%	1	3	10	Nearly all windows are not

Building	Daylight Target (VSC)	Windows achieving Daylight target	Deviation from min. APSH and WPSH target (<20%)	Quantity of Windows tested	Comments
					found to retain the recommended 27% VSC, while a third of windows are found to retain the recommended 0.8x baseline daylight.
B13	27%	0	2	8	No windows are found to retain the BRE recommended 27% VSC, while 2 retain the recommended 0.8x baseline daylight.
B14	27%	2	5	5	2 windows are found to retain the BRE recommended 27% VSC, while all windows retain the recommended 0.8x baseline daylight
B15	27%	132	132	138	The majority of windows are found to retain the BRE recommended 27% VSC, and retain the recommended 0.8x baseline daylight.
B16	27%	5	20	25	A fifth of windows are found to retain the BRE recommended 27% VSC, while nearly all windows are found to retain the recommended 0.8x baseline daylight
B17	27%	0	0	10	No windows are found to retain the BRE recommended VSC, or retain below the recommended 0.8x baseline daylight
B18	27%	0	0	7	No windows are found to retain the BRE recommended VSC, or retain below the recommended 0.8x baseline daylight
B19	27%	0	0	6	No windows are found to retain the BRE recommended VSC, or retain below the recommended 0.8x baseline daylight
B20	27%	0	0	7	No windows are found to retain the BRE recommended VSC, or retain below the recommended 0.8x baseline daylight
B21	27%	0	0	5	No windows are found to retain the BRE recommended VSC with the proposed development in place
B22	27%	0	0	7	No windows are found to retain the BRE recommended VSC with the proposed development in place
B23	27%	6	8	28	Less than a quarter of windows are found to retain the BRE recommended 27% VSC, and just under a third are found to retain the recommended 0.8x baseline daylight.

Building	Daylight Target (VSC)	Windows achieving Daylight target	Deviation from min. APSH and WPSH target (<20%)	Quantity of Windows tested	Comments
B24	27%	1	3	11	Nearly all windows are not found to retain the BRE recommended 27% VSC, while 3 are found to retain the recommended 0.8x baseline daylight.
B25	27%	10	11	20	The majority of windows are found to retain the BRE recommended 27% VSC, and retain the recommended 0.8x baseline daylight.
B26	27%	0	65	66	No windows are found to retain the BRE recommended VSC, or retain below the recommended 0.8x baseline daylight
B27	27%	165	173	173	All windows are found to retain the minimum 0.8x baseline daylight
B28	27%	16	38	39	Approximately half of windows are found to retain the BRE recommended 27%, and all but 1 are found to retain the minimum 0.8x baseline daylight.
B29	27%	10	12	12	All windows are found to retain the minimum 0.8x baseline daylight
B30	27%	0	0	19	No windows are found to retain the BRE recommended VSC, or retain below the recommended 0.8x baseline daylight

Out of the 30 detailed buildings assessed, 16 are found to have the majority of their windows retain the BRE recommended 27% VSC, or to have the majority of windows retain at least 0.8x baseline daylight available to them. This includes B1, B5, B6, B7, B8, B9 B10, B11, B14, B15, B16, B20, B26, B27, B28 and B29. Windows which do not achieve typically are found at lower level on the façade, or are obstructed by the building form to itself. There is potential for some windows along their facades to experience a low level of change which may be more noticeable due to their sensitive nature, although in those cases effects are typically considered to be moderate / slight. Effects to other windows on these buildings are considered to be negligible.

Of the 14 remaining buildings assessed for daylight, which include B2, B3, B4, B12, B13, B17, B18, B19, B20, B21, B22, B23 and B30, are found to have a higher level of change in daylight access. Effects to commercial / retail are not considered to be as significant and focus is made for buildings which contain a residential element. Buildings B3, B16, B13, B23, B24 and B30 contain residential windows which have the potential to have significant reductions in daylight which could be considered to be profound, very significant / significant, or significant.

The majority of these properties are identified as being commercial / offices in nature, although the area does contain a residential element. Non-residential buildings are not considered to have as high a requirement for daylight and effects are typically considered at most to be moderate / slight when not found to be minor or negligible.

11.4.17.2 Effects to Amenity

11.4.17.3 Sunlight

Table 11.65 summarises the sunlight accessibility by windows on identified receptors and provides an overview of amenity space and indicates whether they achieve the BRE criteria for a minimum of two hours of direct sunlight to over half their area on 21 March in the proposed condition, and indicates the degree of change predicted between baseline and proposed conditions which allows the magnitude of effect to be determined.

Table 11.65 Baseline Effects – Sunlight Hours to Amenity

Area	Space	Presence	Total % area receiving a minimum 2 hours sunlight	Comments
A1	Amenity	People	100	Some new shadowing during morning hours, shading consistent with existing conditions at other times during the day
A2	Amenity	People	100	Some new shadowing during afternoon hours, shading consistent with existing conditions at other times during the day
A3	Amenity	People	100	Shadowing appears to be consistent with existing conditions

Overall shading to the amenity spaces identified for assessment are largely unchanged with the proposed development in place. There is some new shading in the morning to A1, but this is limited and sunlight conditions are unchanged outside of morning hours.

All areas are found to receive as a minimum at least 2 hours or more of sunlight on 21 March for over 50% of their area, and overall are not expected to experience a significant amount of change. This is considered to be in line with guidance recommendations, with all spaces retain good sunlight.

11.4.18 Mitigation Measures

The majority of mitigation measures are incorporated into the design of the Proposed Development, where required.

No additional mitigation measures are proposed.

11.4.19 Residual Impacts

As there are no mitigation measures that are proposed, the Residual Impacts are considered to be in line with Predicted Impacts.

11.4.20 Difficulties Encountered in Compiling Information

The overall size of the study area and number of buildings included for assessment precluded obtaining verified internal layouts for rooms served by the windows tested. Therefore, assessment is taken at façade level, with reference to the criteria and benchmarks set out within good practice guidance BR 209.

11.4.21 Cumulative Impacts

There have been no developments identified within the Study Area that have been consented planning approval or are under construction; therefore, there are no developments which could create combined, or increased, effects on daylight and sunlight access to identified receptors. On this basis, no cumulative impacts are identified or assessed.

11.4.22 References

BS 8206-2– Lighting for Buildings – Part 2: Code of practice for daylighting (BSI, 2008)

BRE BR 209 - BRE 209: BRE Site layout planning for daylight and sunlight, a guide to good practice, Rev 2, 2011 (BRE, 2011)

BS EN. (2010). EN 1991-1-1-4:2005+A1:2010 (E). (n.d.).

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12 Landscape and Visual

12.1 Introduction

This chapter considers and assesses the potential effects of the Opera Site development on the townscape and visual resource of the study area. It identifies the mitigation measures that will be implemented to prevent, reduce or offset potential adverse townscape and visual effects or enhance potential beneficial effects, where possible.

In the context of this project 'landscape' includes urban landscape or townscape. As the majority of the study area is predominantly built-up, the term 'townscape' has been used rather than landscape. Both terms are, however, interchangeable, depending on the nature and context of the area.

This chapter considers how:

- Townscape effects associated with a development relate to changes to the fabric, character and quality of the townscape resource and how it is experienced; and
- Visual effects relate closely to townscape effects, but also concern changes in views as visual assessment is also concerned with people's perception and response to changes in visual amenity.

Townscape and visual effects are interrelated with other environmental effects but are assessed separately. Whilst elements of the built heritage such as Listed Buildings and Conservation Areas are important elements of the townscape and contribute to its character and influence its quality and value, effects on the significance of these designated features and their setting will be assessed in the Architectural Heritage Impact Assessment by JCA Architects included in the planning application.

This chapter is also supported by the following technical appendices included in Appendix 12.A:

- 60568520_OPERA_AEC_LE_FIGURE_1: Townscape Designations – Scale 1:12,500
- 60568520_OPERA_AEC_LE_FIGURE_2: Landscape Designations at County Level – Scale 1:60,000

Please note that further references to townscape and landscape designation figures in the text will be made as 'Designation Figure 1' and 'Designation Figure 2'.

Photomontages 1-23, which informed the townscape and visual impact assessment are enclosed in the booklet of 'Planning Application Photomontages' by Pedersen Focus Ltd, which is included in the submission.

12.2 Scoping

12.2.1 Study Area

The extent of the study area has been identified through a review of maps and aerial photographs of the development site and site surveys. The study area has been selected to identify potential significant townscape and visual impacts within the City of Limerick and the County as follows:

- 1.5km core study area from the boundary of the proposed development site within Limerick City (refer to Designation Figure 1); and

- 5km wider study area from the boundary of the proposed development covering areas of Limerick City; County Limerick and County Clare (refer to Designation Figure 2).

It is acknowledged that the proposed development may be visible from locations beyond the study area, mainly from elevated locations, and as such it is important to note that the 5km study area defines the area within which potential effects could be significant, rather than defining the extent of visibility.

Photomontages have been produced to describe and illustrate the view from representative viewpoints located within the study area.

12.2.2 Consultation and Scoping

Informal consultations have been undertaken with Limerick City and County Council from an early stage in the Townscape and Visual Impact Assessment (TVIA) process. This has enabled the desk study and data collection to be supplemented. An agreement was made on the list of representative viewpoints from which photomontages were to be produced. In addition to consultations with Limerick City and County Council, submissions received by the Department of Culture, Heritage and the Gaeltacht have been considered and informed the selection and inclusion of additional viewpoints for photomontages.

Table 12.1 Consultation and Scoping Summary

Consultee and Date	Consultation matter	Issue Raised	Response / Action taken
Limerick City and County Council April 2017	Discussion with representatives of Limerick 2030 and Limerick City & County Council over proposed viewpoints for photomontages. AECOM provided an initial set of 18 representative viewpoints based on initial site observations and protected viewpoints indicated in Figure 15: Key Views & Landmarks included in the Limerick 2030 report.	The views were broadly accepted by the planning authority. However, some viewpoint locations were adjusted, combined or removed. A total of 16 viewpoints were suggested following the discussions.	The list of 16 viewpoints was reviewed and adopted by AECOM. Few locations had to be adjusted following verification on site to show the proposed development as fully and comprehensively as possible.
Department of Culture, Heritage and the Gaeltacht September 2017	Location of viewpoints for photomontages	Concern was raised that a number of close distance views had not been included in the assessment for example a view from the entrance of the hunt Museum and from Mathew Bridge down Rutland Street.	Seven additional photomontages were added to the overall number of photomontages reviewed in the townscape and visual assessment.

12.2.3 Temporal Scope

The development at the Opera site will introduce a replacement of some of the existing buildings and the introduction of new buildings and open spaces creating the potential for townscape or visual effects. The type and duration of the townscape and visual effects fall within two main stages as follows:

Construction (temporary and of a short duration)

- Potential physical effects arising from construction of the development on the townscape resource within the development application boundary area;
- Potential effects to townscape character or visual amenity within the wider study area as a result of visibility of construction activities or the development during construction;
- Effects of temporary site infrastructure such as –site traffic; construction compounds; and
- Potential effects of partially built development in various stages of construction.

Operational

- Potential effects of the proposed development on townscape resources and townscape character, including the perceptual qualities of the townscape;
- Potential effects of the proposed development on views and visual amenity; and
- Potential cumulative effects of the development in combination with other planned and proposed developments of a similar type and scale upon the townscape and visual resource of the study area.

12.2.4 Effects Scoped Out

The proposed building structures and alterations to existing buildings will become permanent features in the townscape following the completion of construction works. The assessment takes account of this in the determination of residual landscape and visual effects.

12.3 Methodology

12.3.1 Legislative context

This section sets out the methodology for the Townscape and Visual Impact Assessment (TVIA) as a result of the Proposed Development.

European

The European Landscape Convention provides guidelines for managing landscapes/townscapes. The Convention is not an EU Directive. Countries that sign and ratify the Convention make a commitment to upholding the principles it contains within the context of their own domestic legal and policy frameworks. The convention was ratified by Ireland in March 2002 and came into effects in Ireland in 2004. The European Landscape Convention requires "*landscape to be integrated into regional and town planning policies and in cultural, environmental, agricultural, social and economic policies, as well as any other policies with possible direct or indirect impacts on Landscape*".

National

The National Landscape Strategy (NLS) for Ireland 2015-2025 was launched in May 2015 and is to be implemented by the Government in the future. The NLS promotes the sustainable protection, management and planning for the landscape/townscape. The NLS states that the "*National Landscape Strategy will be used to ensure compliance with the European Landscape Convention and to establish principles for protecting and enhancing the landscape* (townscape) *while positively managing its change. It will provide a high-level policy framework to achieve balance between the protection, management and planning of the landscape by way of supporting actions.*" It also states that "*The Strategy sets out Ireland's high-level objectives and actions with regard to landscape* (townscape)*. It also positions landscape in the context of existing Irish and European strategies, policies and objectives, and outlines methods of ensuring co-operation at a sectoral and at a European level by the State.*"

Urban Development and Building Heights – Guidelines for Planning Authorities, published in December 2018, sets out national planning policy guidance on building heights with regard to urban areas. Under these guidelines, it is considered that by consolidating and strengthening existing built up areas, more sustainable development patterns can be achieved by limiting the expansion of towns and cities outwards. These guidelines build upon the strategic policy framework set out in Project 2040 and the National Planning Framework. With regard to the building heights of new developments, relevant aspects of these guidelines are extracted and listed as follows:

- Increased building height is a significant component in making optimal use of the capacity of sites in urban locations where transport, employment, services or retail development can achieve a requisite level of intensity for sustainability;
- Taller buildings can assist in reinforcing and contributing to a sense of place within a city or town centre;
- In some cases, statutory development plans have tended to set out overly restrictive maximum height limits in certain locations and crucially without the proper consideration of the wider planning potential of development sites.

Regional (Limerick City & County)

Limerick City Development Plan 2010-2016 (LCDP) provides the overall strategy for the proper planning and sustainable development of the city. In September 2014, the Planning Authority proposed not to commence the review of the Limerick County Development Plan 2010 - 2016 and the Limerick City Development Plan 2010 - 2016. Therefore, the City and County Development Plans will continue to have effect until a new Development Plan for Limerick City and County is prepared.

The City of Limerick does not include a specific townscape character assessment to date; however, the Limerick City Development Plan contains a description of 'Area Profiles' which give details about the character of each area. A number of policies in relation to the protection of the city's landscape character and key landscape assets are also included in the plan. Relevant policies are listed below:

*Policy LBR.*1 - It is the policy of Limerick City Council to ensure that Limerick's landscape, biodiversity and recreational facilities are preserved and enhanced, and that the overall combined potential and value of the network of open spaces and related assets within the City is recognized, retained and enhanced.

Policy LBR.2 - It is the policy of Limerick City Council to:

- preserve and enhance Limerick's Landscape Assets and Key Landscape Sites;
- preserve and enhance Limerick's Views and Prospects of Special Amenity Value.

It acknowledges that the city landscape character "*involves the combination interplay of many elements, including: the landscape; built environment; riverscape and natural heritage. Landscape is largely a non-renewable resource and therefore it is in the City's interest to ensure that the City's* *landscape assets that remain are protected for future generations for their visual, functional, natural heritage and other values*".

Views and Prospects

The LCDP states: "*The City at large is appreciated by most people along important viewpoints such as the River Shannon or panoramic views from vantage points both inside and outside the City. The amenity views indicate the outer visual border of the City, the main character areas, and principle elements of the City skyline. These special views are of strategic significance to Limerick City and the City Council will seek to protect and enhance them, where appropriate*". (Source LCDP, pg 11.2)

The City Development Plan identifies the following 3 different view types:

Linear Views of Landmark Buildings, the City Walls & City Skyline - Linear Views occur when a single landmark building (e.g. King John's Castle) is the main point of focus within the view path. Views tend to be framed within relatively narrow viewing corridors. The city skyline is a combination of elements - the general scale of buildings, streets and spaces from area to area, major landmarks on the skyline, other individual higher buildings, higher building groups and landscape elements.

River Prospects - River Prospects are usually (though not exclusively so) experienced while crossing a bridge. While many bridge crossings allow opportunities to pause and appreciate views, many of these views can also be enjoyed in motion as a viewer moves across a bridge. River Prospects in this instance refer to the ability to see landmark building(s) from bridges.

Approach Road Views - Approach Road prospects often give the visitor the vital 'first impressions' of a city. The approach roads into Limerick City give the viewer an instant appreciation of the topography and character of Limerick. New developments in these areas will be required to take due cognisance of these qualities and clearly demonstrate how they will preserve and enhance their visual appearance and amenity.

Policy LBR.5 - It is the policy of Limerick City Council to protect the intrinsic character and scale of the City and the City skyline.

Policy LBR.6 - It is the policy of Limerick City Council to protect key views and vistas and the visual prominence of important city landscape and townscape features such as areas of woodland, important tree groupings and areas of special architectural or heritage value.

The LCDP also states that: "Limerick City Council will have a presumption against development that threatens to obstruct strategic views or compromise the quality or setting of these views. In addition to these strategic views and prospects of special amenity value which are enjoyed by large numbers of people, local views of significance are also very important to the character and legibility of areas within Limerick. Local views will be identified on a case-by-case basis through the planning process. There will also be a presumption against proposals that would cause unacceptable harm to local views of significance and their settings".

As mentioned above, the city development plan describes 'Area Profiles' for individual suburban quarters outside the City Centre. Each profile provides a brief description of a particular area and key objectives supplementing development management guidelines.

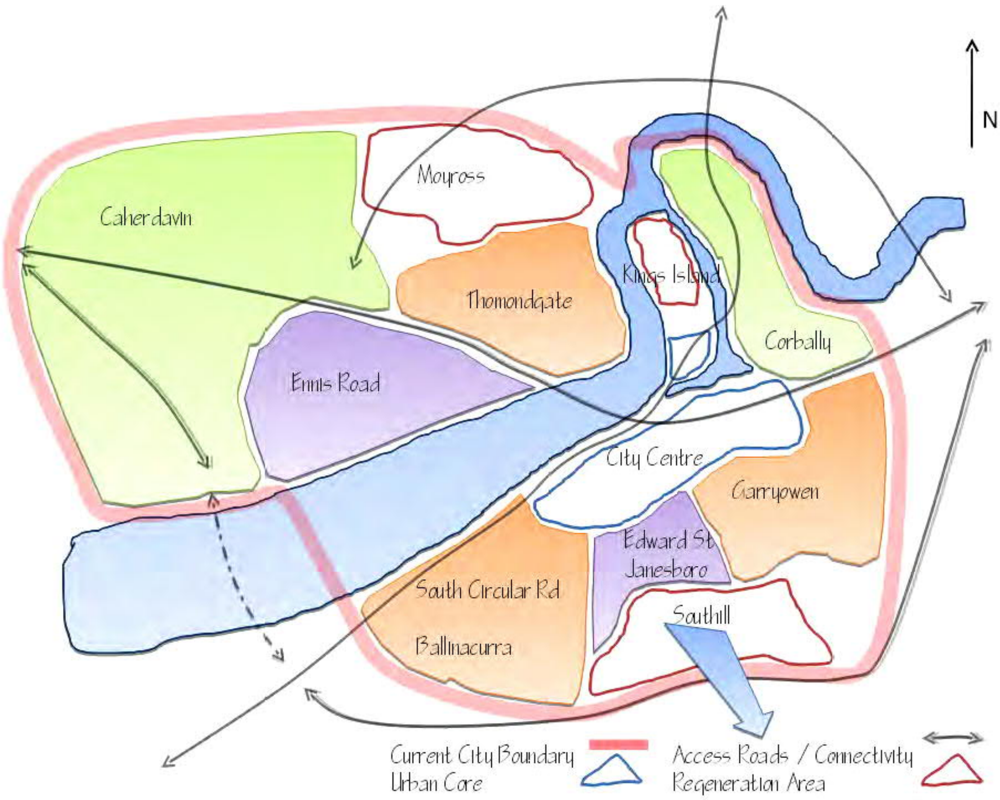


Figure 12.1: City Area Profiles (Source LCDP 2010-2016, Figure 14.1)

The following profiles as listed in the development plan:

- Ennis Road;
- Caherdavin;
- Thomondgate;
- Corbally / Rhebogue;
- Garryowen / Singland; and
- Edward Street / Jansboro
- South Circular Road / Ballinacurra

The areas of Moyross, Southill and the northern part of King's Island are designated as areas for regeneration.

The Development Management Chapter in the current Limerick City Development Plan sets out objectives for future development. It states in relation to landscape the following:

"Limerick's landscape and in particular the River Shannon is one of its key assets. It is vital that all new developments of any scale incorporate high quality landscape design and it is therefore essential that:

- *Landscaping proposals are of a high standard and are in the form of a landscape master plan for small and medium-sized developments;*
- *Planning applications shall clearly detail how such schemes will be implemented.*

Major developments will also be required to prepare a Landscape Strategy as part of their development strategy submitted in their Design Statement. This must be prepared as part of the design process and to inform the site analysis and development proposal configuration, as well as detailed design of public, private and communal space".

It also describes objectives in relation to building heights. The plan acknowledges that "*Limerick has many different character areas reflecting histories, communities and various opportunities for change. Different character areas will require different approaches to the issue of building heights. There is a recognised need to protect conservation areas and the architectural character of existing buildings, streets and spaces of artistic, civic or historic importance. In particular, any new proposal must be sensitive to the historic City Centre.*

Limerick City Council also recognises the needs of the City to grow and to reach its full potential as a significant Gateway for the Mid-Western Region and it is Limerick City Council's policy to allow for the development of high buildings in appropriate locations in order to promote investment, vitality and identity".

It also sets out the following special standard for medium & high-rise buildings in relation to open space, urban design and visual amenity:

- "The need to create a positive urban design;
- The need to suitably incorporate the building into the urban grain;
- The need to create positive urban spaces;
- In view of the inevitable prominence of a high building it should be of outstanding architectural quality, creating a building which is elegant, contemporary, stylish, and, in terms of form and profile, makes a positive contribution to the existing skyline;
- The need to respect important views, landmarks, prospects, roofscapes and vistas;
- The proposal should be very carefully related to, and not have any serious disadvantages to, its immediate surroundings, both existing and proposed, and especially to any other high buildings and prominent features in the vicinity and to existing open space;
- The site must be of appropriate size and context to allow for a well-designed setting of lower buildings and/or landscaped open space".

Limerick County Development Plan 2010-2016 contains a landscape character assessment segmenting the county into different landscape character areas excluding the City of Limerick. While the proposed development is not located within the jurisdiction of the county development plan, the plan has been reviewed to identify potential interrelations in terms of landscape character and visual amenity with Limerick City. Relevant landscape character areas partially covered by the wider study area (up to 5km radius from the development site) are illustrated in Designation Figure 2. The 5km study area covers partially the 'Shannon Integrated Coastal Management Zone' (Shannon ICMZ) character area. This landscape character area borders along the City of Limerick and the River Shannon Estuary. The character description and objectives do not identify protected views or prospects in connection with the City of Limerick and its skyline. Protected views and prospects concerning the county in general are not located within the 5km study area.

Clare County Development Plan 2017-2023 has equally been reviewed to identify potential interrelations in terms of landscape character and visual amenity with Limerick City. The still valid 2003 Landscape Character Assessment of County Clare identifies Landscape Character Types and Landscape Character Areas as well as Living Landscapes Types and Seascape Character Areas. Designation Figure 2 illustrates the location of relevant landscape character areas. However, none of the landscape character descriptions takes reference to visual interrelations to Limerick City, which will be relevant for the proposed development.

Local

Limerick 2030 is an Economic and Spatial Plan for Limerick setting out a framework for public sector action and private sector investment until 2030. Part of the future vision for Limerick is to become a "*major economic force in the Irish and European economy, a leading centre for commercial investment … The City Centre will be at the heart of this economic force … .*" The spatial plan and its key objectives aim on the transformation and renaissance of the city centre and waterfront to make Limerick into a 21st Century cultural, commercial and economic centre. The Opera site is considered to play a key business role for the City Centre in conjunction with adjoining other developments and is also one of the 'City Centre Zones'. City Centre Zones describe individual city quarter, which are considered essential as part of the development for the Limerick City. Limerick 2030 provides a description for these 'Zones', a vision and key components as well as proposed project summary and implementation tables. An extract of Limerick 2030 illustrating the location and vision for the Opera site and adjacent projects is included below.

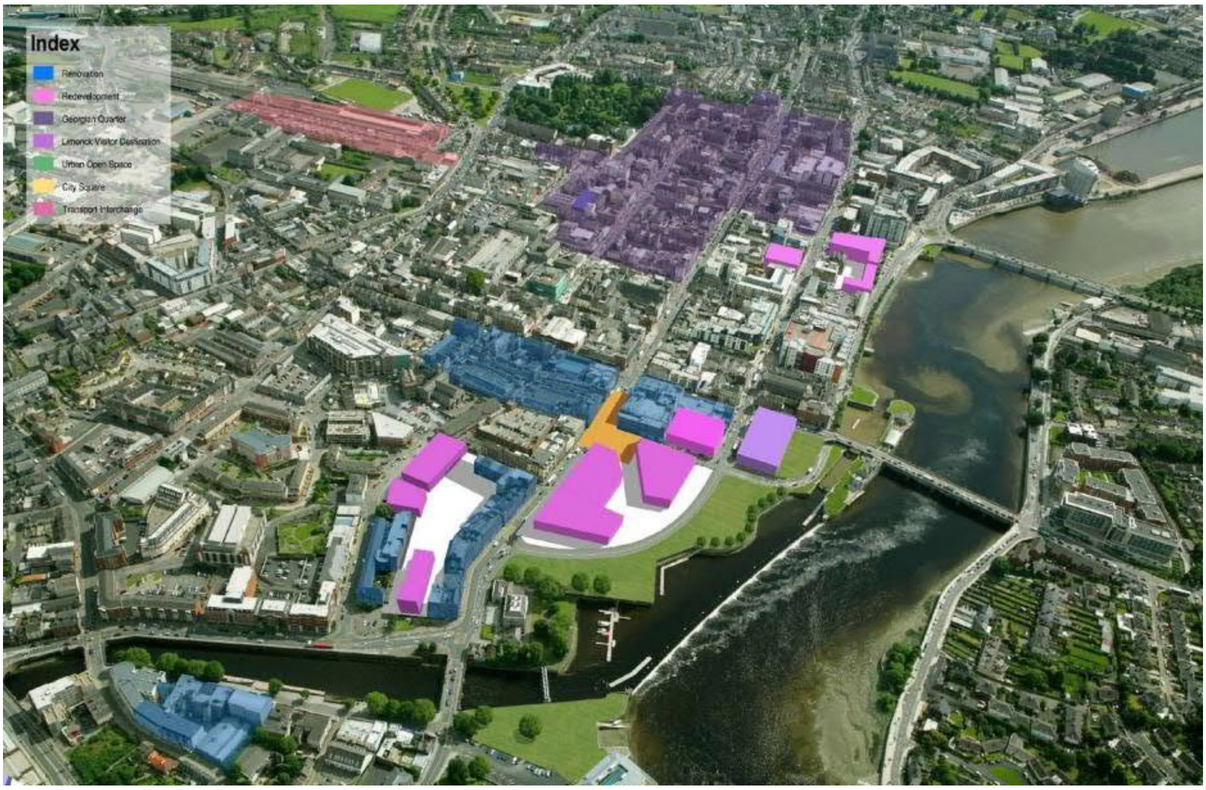


Figure 12.2: Indicative visualisation of city centre vision as per Limerick 2030 report (Fig. 36)

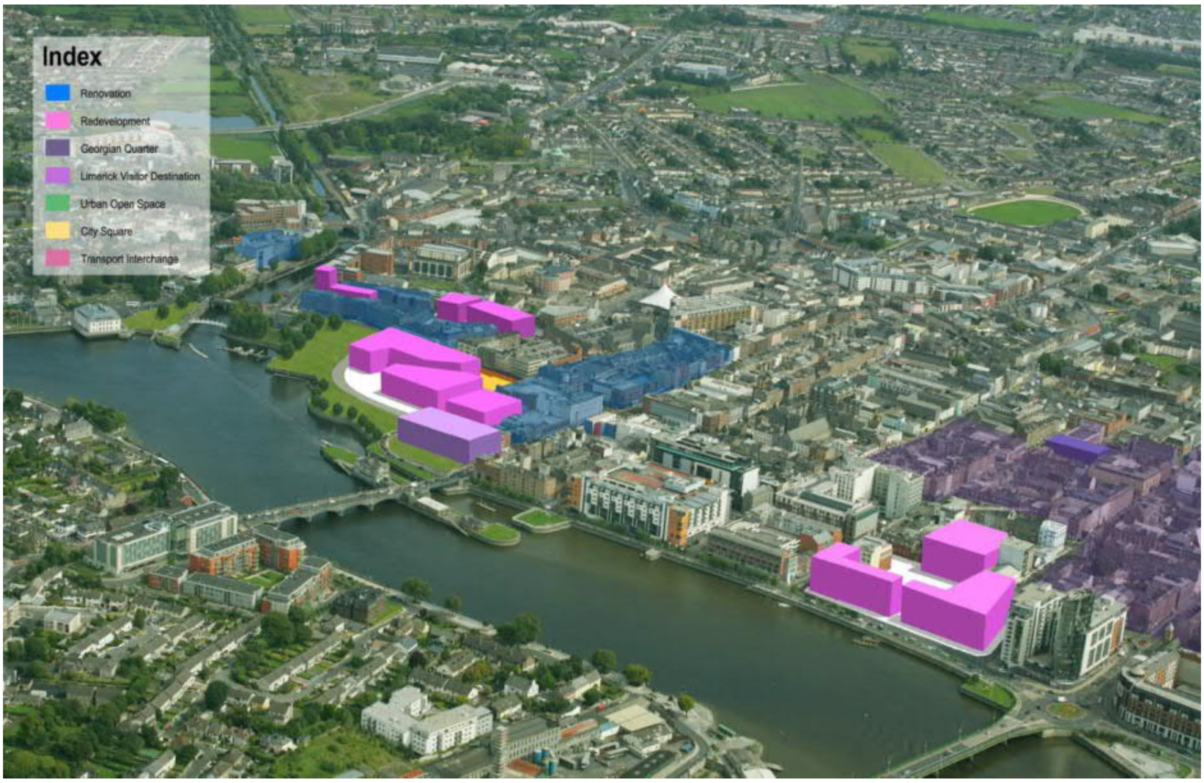


Figure 12.3: Indicative visualisation of city centre vision as per Limerick 2030 report (Fig. 38)

Figure 12.4: Indicative visualisation for Arthur's Quay vision as per Limerick 2030 report (Fig. 5)

Limerick 2030 states that the Opera site is recognised as a "*highly visible block on Patrick and Rutland Street, fronting onto Bank Place and Charlotte's Quay and primarily owned by Limerick City Council. It is a critically important site at the heart of the City Centre, easily accessed from shopping locations on O'Connell Street and Arthur's Quay ...* ".

The vision of Limerick 2030 for the Opera site is that it will "*be revived through a new, more intensive collection of activities focused on commercial, civic and public sector offices, an Innovation Hub, higher education facilities and supplementary retail/leisure uses … A new setting will include high quality pedestrian-oriented streets, strengthened connections to and through Arthur's Quay to the Waterfront and a new managed public space within the Site itself*".

Figure 12.5: Indicative vision for Opera site from Abbey River as per Limerick 2030 report (Fig. 26)

Potential challenges resulting from the proposed vision for the city centre have also been recognised by Limerick 2030. The figure below shows key views and landmarks identified in the city centre and the waterfront.

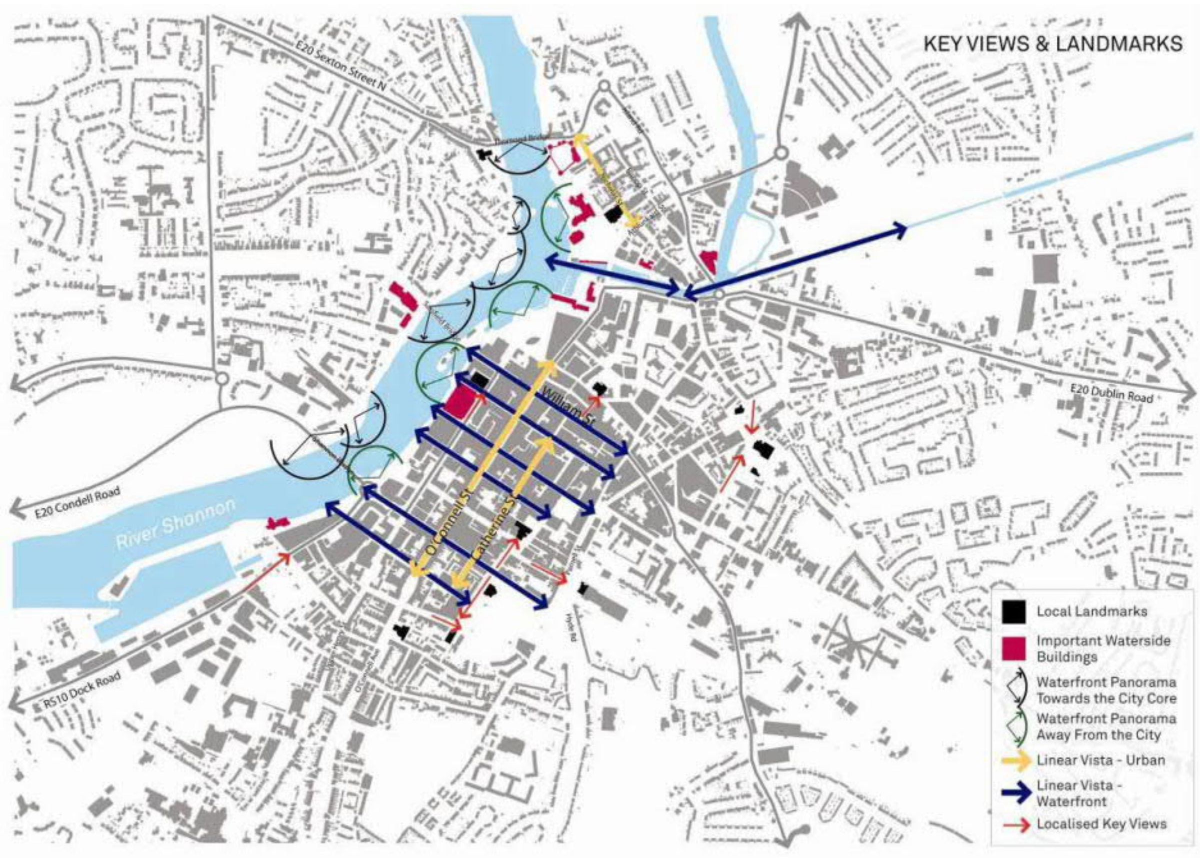


Figure 12.6: Key View & Landmarks (Source:Limerick 2030 report (Fig. 15))

Relevant views have been included in this townscape and visual impact assessment and are shown in Designation Figure 1.

12.3.2 Guidance and other information used in the Townscape and Visual Impact Assessment

The assessment had regard to the draft EIAR '*Guidelines on the information to be contained in Environmental Impact Assessment Report*s', EPA, August 2017, which provide a general methodology and effect ratings for all types of specialist assessments. Best practice guidance, such as the '*Guidelines for Landscape and Visual Impact Assessment'*, 3rd Edition, 2013, Landscape Institute (UK) & IEMA" provide specific guidelines for landscape (townscape) and visual impact assessments. These guidelines will be referred to as GLVIA3 for the purposes of this assessment.

Therefore, a combination of the draft EPA guidelines, the Landscape Institute guidelines and professional experience has informed the methodology for the assessment herein. The Landscape Institute guidelines require the assessment to identify, predict and evaluate the significance of potential effects to landscape characteristics and established views. The assessment is based on an evaluation of the sensitivity to change and the magnitude of change for each landscape or visual receptor. For clarity, and in accordance with best practice, the assessment of potential effects on landscape character and visual amenity, although closely related, are undertaken separately.

Archaeological, cultural and built heritage are important elements of the townscape and contribute to its character and influence its quality and value. While there are interrelations between these features and landscape and visual aspects, effects on the significance of these designated features and their setting are assessed separately in the Architectural Heritage Assessment by JCA Architects, refer to Chapter 18, and in the Archaeological and Cultural Heritage Assessment by IAC Archaeology, refer to Chapter 17.

12.3.3 Townscape and Visual Impact Assessment Criteria

The significance of an effect is determined by two distinct considerations:

1. The nature of the RECEPTOR likely to be affected, namely:

- The **susceptibility** of the receptor to the type of change arising from the proposed developments; and
- The **sensitivity** to change is related to the value attached to the receptor.

2. The nature or magnitude of the EFFECT likely to occur, namely:

- The **size and scale** of the landscape and visual effect (for example, whether there is a complete or minor loss of a particular landscape element);
- The **geographical extent** of the areas that will be affected;
- The **duration** of the effect and its **reversibility**; and
- The **quality** of the effect – whether it is neutral, beneficial or adverse.

The '*Guidelines for Landscape and Visual Impact Assessment*', 3rd Edition, 2013 recognise a clear distinction between the **impact**, as the action being taken, and the **effect**, being the result of that action, and recommend that the terms should be used consistently in this way. 'Impact' should not be used to mean a combination of several effects. These principles have been applied for the assessment herein.

12.3.4 Assessment Process

The assessment is undertaken based on the following key tasks and structure:

- Establishment of the Baseline;

- Appreciation of the proposed development; and
- Assessment of Effects.

12.3.5 Establishment of the Baseline

A baseline study has been undertaken through a combination of desk based research and site appraisal in order to establish the existing conditions of the townscape and visual resources of the study area. Desk based research has involved a review of mapping and aerial photography, relevant planning and policy documents, the relevant Landscape Character Assessments and other relevant documents and publications.

12.3.6 Appreciation of the Proposed Development

In order to be able to accurately assess the full extent of likely effects on townscape character and visual amenity it is essential to develop a thorough and detailed knowledge of the proposed development. This includes a comprehensive understanding of its location, nature and scale and is achieved through a review of detailed descriptions of the proposed development and drawings and an on-site appraisal.

The townscape and visual impact assessment has considered all elements of the proposed development. Please refer to Chapter 3, Description of the Proposed Development for a detailed description of individual development parts.

12.3.7 Assessment of Effects

The landscape and visual impact assessment seeks to identify, predict and evaluate the significance of potential effects to townscape characteristics and established views. The assessments are based on an evaluation of the sensitivity to change and the magnitude of change for each townscape or visual receptor.

The assessment acknowledges that townscape and visual effects change over time as the existing townscape and vegetation external to the proposed development evolves. The assessment therefore reports on potential effects during both construction and completion/operation of the proposed development. The prominence of the proposed development in the townscape or view will vary according to the existing screening effects of local topography, intervening existing building structures and vegetation.

GLVIA 3 requires that a clear distinction is drawn between landscape (which includes the urban townscape) and visual effects:

- Townscape effects relate to the degree of change to characteristics or physical components of an urban area, which together form the character of that townscape, e.g. topography, streets, buildings and open space.
- Visual effects relate to the degree of change to an individual receptor's or a receptor group's view of that townscape, e.g. local residents, users of public open space, footpaths or motorists passing through the area.

As mentioned in the scope above, construction and operational stages of the proposed development are assessed separately. Distinctions may be drawn between temporary and permanent effects, with permanent effects typically being of greater importance. Residual effects are those likely to arise from the proposed development taking into account all embedded measures.

The assessment forms part of an iterative process where potentially significant effects are identified; these inform the design of the proposed development. Mitigation of the development has been considered throughout the process, including site selection, consultation and design development.

This process and the conclusions of the considerations by all disciplines are described within Chapter 4 Examination of Alternatives.

When considering the potential effect of changes that a future development may have on the townscape and visual resource it is necessary to identify those key elements of the townscape which make it distinctive. These can be seen as layers which overlay each other and vary in dominance from place to place. These layers mainly comprise of the buildings, structures and spaces which influence the pattern of uses, activity and movement in a place and the experience of those who visit, work and live there.

'Area Profiles' for individual suburban quarters are included in the current city development plan. Each profile provides a brief description of a particular area and key objectives supplementing development management guidelines. AECOM has studied these as well as the existing townscape character and city centre skyline, the setting of the existing site and its environs on site in order to understand the baseline character, where common settlement patterns and townscape features and elements are evident.

Cumulative effects arise from changes brought about by one development in conjunction with another of similar character. Cumulative effects are considered where the presence of developments of a similar type or scale, that have planning consent but are not constructed, or that are the subject of undetermined applications may have a combined effect on the perception of townscape character and visual amenity.

12.3.8 Townscape Effects

Townscape effects have been assessed by considering the sensitivity of the townscape and the magnitude of effects in relation to the baseline at the time of construction and operation. Townscape effects may arise from changes to the physical components of the townscape, its setting, character, or how it is experienced. For example, within the study area there will be areas where development will take place resulting in direct effects, or where the proposed development will cause indirect effects on setting, or where no change will be perceptible. This may, in turn, affect the perceived value attached to the townscape.

Townscape Receptors

The townscape resources within the study area that could be affected by the development include:

- Physical resources such as buildings, open space, trees, watercourses etc.;
- Designated, valued or recognised components that contribute to townscape character; and
- Cultural heritage interests that contribute to townscape character.

Townscape receptors are defined as those townscape resources within the study area from which the development may be visible or where potential visibility of the development in one part of the townscape resource affects the experience of another part. Field assessment studies were used to check the potential visibility of the development from the townscape resources within the study area. Within this section specific consideration is also given to changes to townscape elements such as the built fabric, open space or trees.

Townscape Character

Townscape character is a complex mix of physical features and patterns and cultural elements. Buildings, structures and spaces and the resulting layout and urban grain, the density and mix, scale and appearance, human interaction and cultural and historic features combine to create a common 'sense of place' and identity that is experienced as townscape character. Definable units (character areas and character zones) can be used to categorise the townscape and the level of detail and size of unit can be varied to reflect the scale of definition required. It can be applied at national, regional and local levels.

The quality or condition of a townscape character receptor is a reflection of its attributes, such as the condition of the buildings and spaces or vegetative components and the attractiveness and townscape quality of the area as well as its sense of place. A townscape with consistent, intact and well-defined, distinctive attributes is generally considered to be of higher quality and in turn, higher sensitivity, than a townscape where the presence of inappropriate or discordant elements has detracted from its inherent attributes. The higher the quality of a receptor the greater is its sensitivity to the proposed Development.

Sensitivity of Townscape Receptors

The sensitivity of a townscape receptor is an expression of its ability to accommodate the proposed development as part of its own character. The sensitivity of a townscape varies according to the nature of the existing resource and the nature of the proposed changes as a result of the proposed development. The sensitivity of the townscape is based on interpretation of a combination of judgements relating to their susceptibility to the type of change or development proposed and the value attached to the townscape.

Townscape Value to Change

The value of a townscape receptor is a reflection of its importance in terms of any designations that may apply, or its importance in itself as a townscape or townscape resource, which may be due to its ecological, cultural or recreational value. A receptor that lies within the boundary of a recognised townscape or townscape related planning designation, such as a Conservation Area, will be of high value, depending on the proportion of the receptor that is covered and the level of importance – international, national, regional or local - of the designation. It is important to note that the absence of designations does not preclude local resource value, as an undesignated townscape character receptor may be important as a resource in the local or immediate environment due to its relative rarity.

The following factors are generally agreed to influence value (according to GLVIA3):

- Townscape quality (condition);
- Scenic quality;
- Rarity;
- Representativeness;
- Conservation interests;
- Recreation value;
- Perceptual aspects; and
- Associations.

Townscape value has been judged with reference to the table below:

Table 12.2 Townscape Value Criteria

Townscape Value	Classification Criteria
National	Townscape with elements of national importance
Regional	Townscape with elements of regional importance, regional parks or designated regional leisure routes and conservation areas.

Townscape Value	Classification Criteria
Local	Townscape with elements which are protected or valued through local planning policies, such as protected open space or groups of listed buildings or buildings of townscape merit
Community	Townscape with relatively common elements which are likely to be valued by the community which lives and works in the area
Limited	Townscape with weak or discordant elements and characteristics which detract from the quality of the area

Townscape Susceptibility to Change

The GLVIA3 defines susceptibility to change as the "*ability of the townscape to accommodate the proposed development without undue consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policies and strategies*". The more susceptible the receptor is to the type of change proposed, the greater is its sensitivity to the Proposed Development. Susceptibility of the townscape within the study area to change has been assessed in consideration of the criteria set out in the table below:

Table 12.3 Townscape Susceptibility Criteria

Townscape resource	Susceptibility to change		
	High	Medium	Low
Townscape quality / condition	High quality elements in good condition	Generally good quality elements but may have some detracting elements	Poor condition and disparate elements
Sense of place	Distinctive, leading to a strong sense of place	Generally common elements but some features which contribute to sense of place	Very common or disparate elements leading to a limited sense of place
Intactness	A high degree of unity represented by layout, design and detailing	A generally clear and intact pattern of elements but some loss of cohesiveness in some places	Demonstrates high degree of change or transition
Scarcity of the resource	Particularly scarce elements or fragile townscape	Mainly common features, but occasional interesting or locally distinctive features	Common features found in many cities or towns
Historic interest	Historic elements which contribute strongly to townscape character	Some locally distinctive historic elements which contribute to townscape character	Limited or no historic interest
Tranquillity	Includes tranquil and reflective places	Generally high levels of activity with some quieter areas	High degree of activity and disturbance

Townscape Sensitivity to Change

The sensitivity of a townscape is an expression of its ability to accommodate the proposed development as part of its own character. The nature of a receptor's sensitivity can be assessed by combining judgements about its value and susceptibility to change arising from the specific proposal (GLVIA3). It is defined with reference to the table overleaf.

Table 12.4 Townscape Sensitivity Criteria

Townscape Sensitivity	Classification Criteria
High	• Townscape characteristics or features with little or no capacity to absorb change without fundamentally altering their present character • Townscape designated for its international or national townscape value or with highly valued features • Outstanding example in the area of well cared for townscape or set of features that combine to give a particularly distinctive sense of place • Few detracting or incongruous elements
High-Medium	• Townscape characteristics or features with a low capacity to absorb change without fundamentally altering their present character • Townscape designated for regional or county-wide townscape value where the characteristics or qualities that provided the basis for their designation are apparent or a townscape with highly valued features locally • Good example in the area of a well-cared for townscape or set of features that combine to give a clearly defined sense of place
Medium	• Townscape characteristics or features with moderate capacity to absorb change without fundamentally altering their present character • Townscape designated for its local townscape value or a regional designated townscape where the characteristics and qualities that led to the designation of the area are less apparent or are partially eroded or an undesignated townscape which may be valued locally – for example an important open space • An example of a townscape or a set of features which is relatively coherent, with a good but note exceptional sense of place - occasional buildings and spaces may lack quality and cohesion
Medium-Low	• Townscape characteristics or features which are reasonably tolerant of change without determent to their present character • No designation present or of little local value • An example of an un-stimulating townscape or set of features; with some areas lacking a sense of place and identity
Low	• Townscape characteristics or features which are tolerant of change without determent to their present character • An area with a weak sense of place and/or poorly defined character /identity • No designation present or of low local value or in poor condition • An example of monotonous unattractive visually conflicting or degraded townscape or set of features

Magnitude of Townscape Change (Townscape Effects)

Magnitude of change is an expression of the size or scale of change in the townscape, the geographical extent of the area influenced and the duration and reversibility of the resultant effect. The variables involved are described below:

- The extent of existing townscape elements that will be lost, the proportion of the total extent that this represents and the contribution of that element to the character of the townscape;
- The extent to which aesthetic or perceptual aspects of the townscape are altered either by removal of existing components of the townscape or by addition of new ones;
- Whether the effect changes the key characteristics of the townscape, which are integral to its distinctive character;
- The geographic area over which the townscape effects will be felt (within the development application boundary itself; the immediate setting of the site; at the scale of one townscape character area; on a larger scale influencing several townscape character areas); and
- The duration of the effects (short term, medium term or long term) and the reversibility of the effect (whether it is permanent, temporary or partially reversible).

Changes to townscape characteristics can be both direct and indirect. **Direct change** occurs where the proposed development will result in a physical change to the townscape within or adjacent to the proposed development site. **Indirect changes** are a consequence of the direct changes resulting from the proposed development. They can often occur away from the proposed development site and may be a result of a sequence of interrelationships or a complex pathway. They may be separated by distance or in time from the source of the effects.

The magnitude of change affecting the baseline townscape resource is based on an interpretation of a combination of the criteria set out in the table below:

Table 12.5 Magnitude of Townscape Change

Magnitude	Classification Criteria
Very High	Highly noticeable change, affecting most key characteristics and dominating the experience of the townscape or the addition of new features or components that will substantially alter the character or setting of the area.
High	Noticeable change affecting many key characteristics and the experience of the townscape or the addition of new features or components will be prominent and alter the existing character of the setting of the area.
Medium	Noticeable change or alteration of some key characteristics or the addition of new features or components that will be clearly recognisable but largely in keeping with the existing character or the setting of the area
Low	Limited loss or alteration of common components or characteristics or the addition of new features or components that largely reflect the existing character or setting of the area
Negligible	Virtually imperceptible change in any component or to the setting of the character area
Neutral	No change discernible in any component or characteristic

12.3.9 Visual Effects

For there to be a visual effect there is the need for a viewer (receptor). Visual effects are specific to individual receptors and result from changes in the composition of views (replacement of open space with buildings, for example) or changes to visual amenity (replacement of poor quality buildings with new buildings of a high architectural quality, for example). Unlike the townscape assessment, the assessment of visual effects considers such changes with respect to views of individual visual receptors identified in the baseline, which will have views of the proposed development. The degree to which receptors, i.e. people, will be affected by changes as a result of the proposed development depends on a number of factors, including:

- Receptor activities, such as taking part in leisure, recreational and sporting activities, travelling or working;
- Whether receptors are likely to be stationary or moving and how long they will be exposed to the change at any one time;
- The importance of the location, as reflected by designations, inclusion in guidebooks or other travel literature, or the facilities provided for visitors;
- The extent of the route or area over which the changes will be visible;
- Whether receptors will be exposed to the change daily, frequently, occasionally or rarely;
- The orientation of receptors in relation to the proposed development and whether views are open or intermittent;
- Proportion of the developments that will be visible (full, sections or none);
- Viewing direction, distance (i.e. short-, medium- and long-distance views) and elevation;
- Nature of the viewing experience (for example, static views, views from settlements and views from sequential points along routes);
- Accessibility of viewpoint (public or private, ease of access);
- Nature of changes (for example, changes in the existing skyline profile, creation of a new visual focus in the view, introduction of new man-made objects, changes in visual simplicity or complexity, alteration of visual scale, landform and change to the degree of visual enclosure);
- Nature of visual receptors (type, potential number and sensitivity of viewers who may be affected); and
- Impact of ancillary developments.

It is not necessary to assess every conceivable viewpoint; rather, viewpoints have been selected to illustrate views from a range of distances, aspects and degrees of visibility and agreed, where necessary, with those consultees with a statutory duty in relation to views and visual amenity. Photomontages have been prepared for each of the 23 viewpoints selected.

Value of the View

The assessment of the value of views has been informed by the location of the viewing place and the quality or designation of the existing elements in the view, as shown in the table below:

Table 12.6 Value of views

Value	Classification Criteria
Regional	Strategic views and panoramas
Local	Views across high quality townscape which might include features of interest, such as landmarks
Community	Views of relatively common elements of townscape, likely to be valued by the community which experience the view
Limited	Views across poor quality townscape with a high degree of detracting or common elements

Visual Susceptibility to Change

The GLVIA guidelines identify that the susceptibility of visual receptors to changes in views and visual amenity is a function of:

- The occupation or activity of people experiencing the view at a particular location; and
- The extent to which their attention or interest may therefore be focused on the views and visual amenity they experience at particular locations.

For example, residents in their home, walkers whose interest is likely to be focused on the townscape or a particular view, or visitors at an attraction where views are an important part of the experience often indicate a higher level of susceptibility. Whereas receptors occupied in outdoor sport, where views are not important, or at their place of work, are often considered less susceptible to change. Visual susceptibility criteria are outlined in the table below.

Table 12.7 Visual Susceptibility to Change

Visual receptor	Susceptibility to change		
	High	Medium	Low
Occupation or activity	People living in the area or visiting areas because of their high townscape value	People passing through the area on designated routes	People working inside or passing through the area on public roads or railway lines
Degree of attention on the view	Views are an important part of the experience of the townscape	Views are relevant to the experience or activity but not central to it	Views are likely to be focused on the activity of the receptor, rather than the view
Degree of exposure to the view	Views are likely to be open	Views may be framed, partially screened or filtered	Views are likely to be limited to glimpses or are heavily screened
Length of exposure to the view	Views are likely to be experienced daily or for long periods of time	Views may be fleeting or experienced as a sequence of views moving through the area	Views are likely to be short

Visual Sensitivity to Change

Visual receptors have been assigned a category of sensitivity based on a combination of the value of the view and their susceptibility to the type of change proposed, as set out in the table below:

Table 12.8 Visual Sensitivity of visual receptors

Visual Sensitivity	Classification Criteria
High	• Users of outdoor recreational facilities, on recognised national cycling or walking routes or in nationally designated townscapes • Residential buildings
High-Medium	• Users of outdoor recreational facilities, in highly valued townscapes or locally designated townscapes or on local recreational routes that are well publicised in guide books • Road and rail users in nationally designated townscapes or on recognised scenic routes, likely to be travelling to enjoy the view
Medium	• Users of outdoor recreational facilities including public open space in moderately valued townscapes • Users of primary transport road network, orientated towards the Proposed Development, likely to be travelling for other purposes than just the view
Medium-Low	• People engaged in active outdoor sports or recreation and less likely to focus on the view • Primary transport road network and rail users likely to be travelling to work with oblique views of the Project or users of minor road network
Low	• People engaged in work activities indoors, with limited opportunity for views of the Proposed Development

Magnitude of Visual Change

Visual effects are direct effects as the magnitude of change within an existing view will be determined by the extent of visibility of the proposed development. The magnitude of the visual effect resulting from the development at any particular viewpoint or receptor is based on the size or scale of change in the view, the geographical extent of the area influenced and its duration and reversibility. The variables involved are described overleaf:

- The scale of the change in the view with respect to the loss or addition of features in the view and changes in its composition, including the proportion of the view occupied by the development;
- The degree of contrast or integration of any new features or changes in the townscape form, scale, mass, line, height, sky lining, back-grounding, visual clues, focal points, colour and texture;
- The nature of the view of the development, in relation to the amount of time over which it will be experienced and whether views will be full, partial or glimpses.
- The angle of view in relation to the main activity of the receptor, distance of the viewpoint from the development and the extent of the area over which the changes will be visible; and
- The duration of the effects (short term, medium term or long term) and the reversibility of the effect (whether it is permanent, temporary or partially reversible).

The magnitude of visual effects resulting from the development at any particular viewpoint or receptor is based on the interpretation of the above range of factors and is set out in the table below:

Table 12.9 Magnitude of Visual Change (Visual effects)

Magnitude	Classification Criteria
Very High	Intensive change to the composition of the existing view (e.g. widespread loss of characteristic features or the addition of new dominating features within the view, which alter substantially the existing view) and/or high degree of exposure to view (e.g. long-term, close, direct or open views)
High	Considerable change to the composition of the existing view (e.g. noticeable loss of characteristic features or the addition of new dominant features within the view) and/or medium-high degree of exposure to view (e.g. Long-Term, close, direct or open views, or partially screened views)
Medium	Noticeable change to the composition of the existing view (e.g. noticeable loss of some characteristic features or the addition of new features within the view) and/or medium degree of exposure to view (e.g. medium-term, middle-distance or partially screened views)
Low	Minor change to existing view (e.g. limited loss of characteristic features or the addition of new features within the view) and/or low degree of exposure to view (e.g. medium term, long-distance, substantially screened or glimpsed views)
Negligible	Barely perceptible change to the existing view and/or very brief exposure to view
Neutral	No change discernible in existing view

The table below provides the definition of the duration of townscape and visual effects:

Table 12.10 Definition of Duration of Effects

Magnitude	Classification Criteria
Temporary	Effects lasting one year or less
Short Term	Effects lasting one to seven years
Medium Term	Effects lasting seven to fifteen years
Long Term	Effects lasting fifteen to sixty years
Permanent	Effects lasting over sixty years

The following terms have been used to define the quality of residual townscape and visual effects:

Table 12.11 Definition of Quality of Effects

Magnitude	Classification Criteria
Neutral	The proposed development will neither enhance or detract from the townscape character of view
Beneficial (Positive)	The proposed development will enhance the existing townscape character or view
Adverse (Negative)	The proposed development will reduce the quality of the existing townscape character or view

12.3.10 Significance Criteria

The objective of the townscape and visual impact assessment (TVIA) is to identify and evaluate the likely significant effects on townscape and visual receptors arising from the proposed development. Whilst there is a degree of professional judgement involved in determining the level of significance of townscape and visual effects, they can broadly be determined by the interaction of the sensitivity of the receptor and magnitude of effects. This interaction results in categorisation of effects as shown in the table overleaf.

Table 12.12 Matrix of significance of townscape and visual effects

SIGNIFICANCE OF EFFECTS (effects rated Moderate & above are considered significant)		SENSITIVITY OF CHANGE				
		High	**High-Medium**	**Medium**	**Medium-Low**	**Low**
MAGNITUDE OF CHANGE	**Very High**	Major	Major	Major-Moderate	Moderate	Moderate
	High	Major	Major-Moderate	Major-Moderate	Moderate	Moderate-Minor
	Medium	Major-Moderate	Moderate	Moderate	Moderate-Minor	Minor
	Low	Moderate	Moderate	Moderate-Minor	Minor	Minor-Negligible
	Negligible	Minor	Minor-Negligible	Minor-Negligible	Negligible	Negligible

Please note that the above matrix is a guide – the determination of significance of effects also requires an element of professional judgement.

Townscape and visual effects are categorised as being beneficial, adverse, negligible or neutral. Those classified as minor or negligible are not likely to be significant. In addition, where it is determined that there will be no change in the baseline; these effects are classified as neutral. A textual description of townscape and visual effects, developed from guidance in GLVIA3, is given in the table below. This has been used to inform judgements when determining the level of significance.

Table 12.13 Description of Significant Townscape and Visual Effects

	Townscape effects	**Visual effects**
Major	Substantial alteration to elements/features of the baseline (pre-development) conditions. Wide scale change across all or most of the	Major/substantial alteration to elements/features of the baseline (pre-development) conditions. Where the proposed development will

	Townscape effects	Visual effects
	TCA resulting in substantial loss, alteration or replacement of existing components, scale or pattern of the townscape which transforms the character of the area. This is most likely to relate to a townscape of national or regional value with a high susceptibility to change.	cause a very noticeable alteration in the existing view. This will typically occur where the development closes an existing view of a townscape of regional or national importance and the proposed development will dominate the future view.
Major-Moderate	This category is a combination of descriptions of Major listed above and Moderate below. These combinations are discussed within the assessment of each townscape or visual receptor when they occur.	
Moderate	Alteration to elements/features of the baseline conditions. Noticeable loss, alteration or replacement of existing components, scale or pattern of the townscape within part of the TCA. This is most likely to relate to a townscape of regional or local value with a medium susceptibility to change.	Alteration to one or more elements/features of the baseline conditions such that post development character/attributes of the baseline will be clearly changed. Whilst some existing characteristic components of the existing view remain, there is a noticeable change in the overall composition. This will typically occur where the development closes an existing view of a local townscape and the proposed development will be prominent in the future view.
Moderate-Minor	This category is a combination of descriptions of Moderate listed above and Minor below. These combinations are discussed within the assessment of each townscape or visual receptor when they occur.	
Minor	A minor shift away from baseline conditions. The development partially changes the character of the site without compromising the overall existing townscape character area. This is most likely to relate to a townscape of local or limited value with a low susceptibility to change.	A minor shift away from baseline conditions. This will typically occur where change arising from the alteration will be discernible, but the underlying character / composition / attributes of the baseline condition will be similar to the predevelopment. It will also occur where the development newly appears in the view but not as a point of principal focus or where the proposed development is closely located to the viewpoint but seen at an acute angle and at the extremity of the overall view. The view may be of local or limited value and the susceptibility to change of the receptor is most likely to be low.
Negligible	No or very little change from baseline conditions. Change not material, barely distinguishable or indistinguishable.	Where there is no discernible improvement or deterioration in the existing view.

	Townscape effects	Visual effects
Neutral	The Proposed Development will not affect the townscape receptor	The Proposed Development will not affect the view

Townscape or Visual Effects of above (i.e. Moderate or Major-Moderate) are considered to be significant; all other effects are considered Not Significant.

Effects will be assessed for all phases of the proposed development. Construction effects are considered to be temporary, short term effects which occur during the construction phase only. Operational/residual effects are those long term effects which will occur as a result of the presence of the development.

The quality of each effect is based on the ability of the townscape character or visual receptor to accommodate the proposed development, and the impact of the development within the receiving context. Once this is done, the quality of the effect is then assessed as being neutral, beneficial or adverse. A change to the townscape or visual resource is not considered to be adverse simply because it constitutes an alteration to the existing situation.

12.3.11 Cumulative Effects

The approach used to determine cumulative effects has drawn on guidance on cumulative effects assessment published by the GLVIA3. Cumulative townscape and visual effects may result from additional changes to the baseline townscape or views as a result of the proposed development in conjunction with other developments of a similar type and scale.

The cumulative assessment includes developments that are consented but not constructed, that are the subject of undetermined applications, or are currently at scoping which are similar in type and scale to the Proposed Development.

The list of cumulative developments has been compiled from known planning applications available on Planning Search of Limerick City & County Council's website.

Magnitude of Cumulative Effects

The principle of magnitude of cumulative effects makes it possible for the proposed scheme to have a major effect on a particular receptor, while having only a minor cumulative effect in conjunction with other existing developments.

The magnitude of cumulative effects arising from the proposed scheme is assessed as **very high, high, medium, low or negligible, with intermediate categories**, based on interpretation of the following parameters:

- The additional extent, direction and distribution of existing and other developments in combination with the proposed development;
- The distance between the viewpoint, the proposed development and the cumulative developments; and
- The townscape setting, context and degree of visual coalescence of existing and proposed development and cumulative developments.

Significance of Cumulative Effects

As for the assessment of townscape and visual effects, the significance of any cumulative effects follows a similar classification and will be assessed as **major, moderate, minor or negligible, with intermediate categories**. This considers both receptor sensitivity and the predicted magnitude of change.

Limitations of Cumulative Assessment

The cumulative assessment focuses on potential cumulative effects relating to the main permanent structure of each cumulative development. This is due to the uncertainty of the timing of construction activities for each of the identified developments. As a result, temporary structures and activity relating to construction have not been considered within the cumulative assessment.

Sensitivity Test Methodology

In addition to other developments that are considered cumulatively, there are certain elements of development in the vicinity of the site for which there is a reasonable certainty of them coming forward but not enough detail available for a full cumulative assessment to be carried out. These other developments may interact with the Proposed Development and consequently a high level, qualitative assessment of the potential effects of these additional developments when considered in combination with the Proposed Development on the townscape and visual resource has been carried out. These are referred to as Sensitivity Tests.

12.3.12 Field Work

Site surveys of the study area and beyond were carried out on 27th April 2017 and 2nd and 3rd of May 2017 as well as on 25th May 2018 identifying the potential visibility of the proposed development and key viewpoints within the core study area and the wider townscape/landscape. Photomontages showing the existing view and the superimposed development on photomontages have been produced from key representative viewpoints, taking into account topography, existing buildings, screening vegetation and other localised factors. The Booklet of Planning Application Photomontages by Pedersen Focus Ltd., included with the planning application, contains details on viewpoint locations and Photomontages 1 – 23. The photomontage locations are also indicated in Designation Figures 1 & 2.

12.3.13 Selection of Viewpoints

Viewpoint selection has been carried out according to the current best practice standards and the following industry guidelines:

- Photography and Photomontage in Landscape and Visual Impact Assessment, Landscape Institute Advice Note 01/2011.

It is not feasible to produce photomontages from every possible viewpoint in the study area. The majority of photomontages have been produced from key viewpoints located within the 1.5km radius core study area, which are representative of the nature of visibility at various distances, from townscape designations and in various contexts, illustrating the worst case scenario. A representative long distance view from within the wider study area of 5km has also been included.

Photomontages are one source of information and used as a tool to help to understand the nature of potential effects and to assist the determination of the magnitude and significance of residual townscape and visual effects.

12.3.14 Photomontages

Photomontages are photorealistic visualisations produced using specialist software. They illustrate the likely future appearance of the proposed development from a specific viewing point. They are useful tools for examining the impact of the development from a number of critical viewpoint positions along the public road network within the study area.

However, photomontages in themselves can never provide the full picture in terms of potential impacts, they can only inform the assessment process by which judgements are made. A visualisation can never show exactly what the proposed development will look like in reality due to factors such as;

different lighting, weather and seasonal conditions which vary through time and the resolution of the image. As the photomontages are representative of viewing conditions encountered, some of them may show existing buildings or vegetation screening some or all parts of the developments. Such conditions are normal and representative.

The images provided give a reasonable impression of the scale of the development and the distance to the development, but can never be 100% accurate. It is recommended that decision-makers and any interested parties or members of the public should ideally visit the viewpoints on site, where visualisations can be compared to the ‘real life’ view, and the full impact of the proposed development can be understood.

The visual impact assessment on site identified a range of viewpoints located within the study area at varying distances from the proposed developments to show the effect of the development in key close, middle and distant views.

Viewpoints / Photomontages 1 - 23 show the proposed development including the following information:

- Existing View, showing the baseline image; and
- Photomontage, showing the proposed development including all visible components at full height.

Photomontage images have been produced with reference to best practice and the following industry guidelines:

- Photography and Photomontage in Landscape and Visual Impact Assessment, Landscape Institute Advice Note 01/2011, 2011;
- Guidelines for Landscape and Visual Impact Assessment (GLVIA), Third Edition, Landscape Institute and Institute of Environmental Management and Assessment, IEMA, 2013; and
- Visual Representation of Wind Farms, Version 2.2, Scottish Natural Heritage, February 2017 (in relation to viewpoint selection, technical equipment, function and limitations of visualisations).

12.3.15 Zone of Theoretical Visibility (ZTV)

Mapping the extent of the area from which a development is likely to be visible was originally known as a Visual Envelope Map (VEM), then as a Zone of Visual Influence (ZVI) and more recently as a Zone of Theoretical Visibility (ZTV). These changes in terminology reflect attempts to address frequent challenges occasioned by the mapping. Thus, as a theoretical methodology, ZTV prediction does not take into account the effects of seasons, lighting, weather conditions or visibility over distance. Moreover, a ZTV does not take into account the screening effects of vegetation or built structures and can omit topographical variations up to several metres. Therefore, in reality, ZTV mapping ‘s principal use is to identify viewing points for further analysis.

Considering the mostly flat or gently undulating nature of Limerick City Centre and the absence of 3D data of existing building structures throughout the city centre of Limerick including vegetation, the production of a ZTV would not have been useful in the identification of viewpoints within the study area. The assessment relied therefore on comprehensive site surveys to establish the nature of visibility within the study area and to identify key viewpoint locations.

12.4 Baseline Conditions

This section provides a summary of the current (2019) baseline conditions within the study area, as defined in Section 12.2.1 Study Area and Section 12.3.5 Establishment of the Baseline.

12.4.1 Site Context

The city block containing the Opera site and the proposed development is bound to the west by Rutland Street (R526), to the north by Bank Place (R526), to the east by Michael Street and to the south by Ellen Street. It is situated to the northernmost section of the Georgian expansion of Limerick City. The site along Bank Place is facing the Abbey River, which merges into the River Shannon east of Rutland Street and Bridge Street. The site comprises a block of urban structures, yards, sheds, warehouses, car parking facilities and the former Granary (along parts of Michael Street), which is currently in use for offices including the Limerick city library.

12.4.2 Historical Context

The Opera site is located south of the medieval centre of Limerick and outside the former city walls, which were demolished from 1760. The area adjacent to the Opera site and the site itself including the granary building formed part of the large city expansion beginning in the last quarter of the 18th century, generally referred to as the Georgian Quarter or Georgian extension. The former Custom House, which is the Hunt Museum of today, is one of the earliest buildings of this expansion and architecturally the most significant building remaining in the immediate area to the development site.

A detailed description on the building and site history is contained in the Archaeological Assessment by IAC Archaeology and in the Architectural Heritage Impact Assessment by JCA Architects included with the planning application.

12.4.3 Existing Urban Context

Limerick City Development Plan 2010-2016 categorises the city into Area Profiles, which provide general information about the townscape character. These profiles exclude the City Centre / Urban Core and regeneration areas such as Moyross, Southill and King's Island (northern section). The predominant element of the City of Limerick and the core study area is the River Shannon. The eastern and western part of the city is connected by 3 bridges, Thomond Bridge in the north, Sarsfield Bridge in the centre and Shannon Bridge in the south. An overview of the existing urban setting and townscape character profiles on either side of the River Shannon based on the profile zoning, desktop studies and site surveys are provided herein.

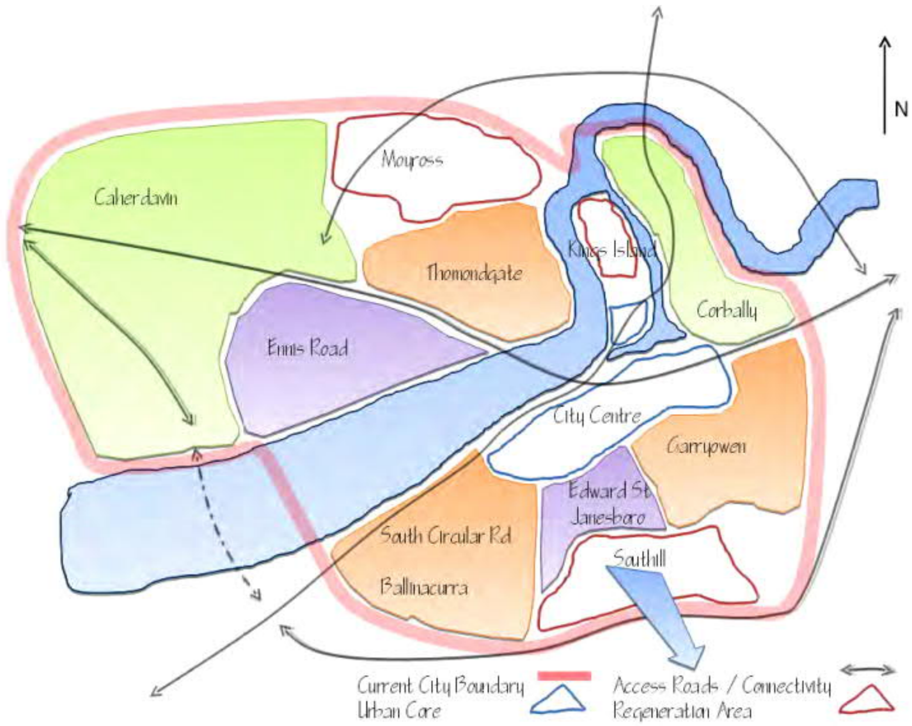


Figure 12.7 City Area Profiles (Source: LCDP 2010-2016, Figure 14.1)

City Centre / Urban Core

The Urban Core area consists of the southern part of King's Island, the medieval heart and the Georgian Quarter, which is the commercial and cultural heart of Limerick. Both are separated by the Abbey River. The Docklands connect immediately to the southern end of the Georgian Quarter. The overall building height of the City Centre, including King's Island and the majority of the Georgian Quarter stretching to the south is low-rise. Tall landmarks are church spires, a lattice structure telecommunication tower and the modern developments along the riverfront close to the Docklands, where 2 tall buildings, the 59m high Riverpoint building and the Clayton Hotel with 57m have become new landmarks of the southern city skyline in recent years.

The Opera site is the located at a key position between King's Island situated north of the Abbey River and the entrance to the Georgian Quarter south of the Abbey River. It forms a gateway between the medieval heart and the commercial heart of Limerick. Adjacent areas to the development site west of Rutland Street contain the Hunt Museum, Sarsfield House and Arthur's Quay Shopping Centre. South of Ellen Street, a mixed city quarter with some remaining Georgian architecture rising to 2 or 3 floors above ground floor level.

Sarsfield House with a total of 6 floors above ground floor level, multi-storey car parking facilities and low-rise retail units (1 to 2 floors) define the streetscape. Mixed developments (up to 4 floors), such as residential buildings, a large garage and office buildings flank the streetscape of Michael Street to the east. Bank Place, to the north, is a public open space facing the road and quays along the Abbey River. The majority of buildings within the Opera site are 2 or 3 storeys above the ground floor level except for one level outhouses, sheds and warehouses located in the yards in the centre of the Opera site.

The immediate city quarters to the east and southeast of the Opera site are a conglomerate of historic buildings, markets (such as the Milk Market), residential and office developments of modern times, car parks and brown field sites where development activity has been stalled or building structures have been removed but not replaced. The street pattern is irregular, and the existing building mixture lacks a concerted appearance. Areas further to the east become more interspersed with green spaces and contain further low-rise housing estates as well as the Limerick School of Art & Design and St. John's Cathedral with its tall spire, which is one of Limerick's landmarks in the city skyline.

The wider city centre area to the south, southeast of the Opera site is characterised by late 18th and 19th century Georgian architecture, which is interrupted by buildings of the 20th century, which often replaced original buildings from the time of the city expansion. This area is the commercial and cultural centre of Limerick. The mixed urban grain along the streets is characterised by a regular grid pattern, which is becoming fully evident from Sarsfield Street continuing south, southwest. Terraced houses and often enclosed block structures with similar building heights (generally 3 floors above ground floor level for Georgian houses and 3 to 5 floors for more recent buildings) define the Georgian Quarter. Heights of buildings from the 20th century and more recent times are generally orientated on the heights of the concerted Georgian architecture. However, newer developments of the late 20th century and early 21st century have altered the city skyline towards the docklands, where developments along the banks of the River Shannon created a new river side front. Most notable are 2 high-rise developments of the Riverpoint Building and the Clayton Hotel, which have become new landmarks.

Colbert Station is located at the south-eastern fringe of the Gregorian city extension. The city character further south of the Georgian Quarter is defined by low-rise residential developments, mixed with light industrial developments particularly towards the docklands in the southwest.

The docklands area is characterised by low-rise warehouses and storage buildings, some of which are several storeys high (Ranks Silo) but considerably lower than the Clayton Hotel at Steamboat Quay.

To the north, across the Abbey River begins King's Island and the medieval heart of Limerick. Bound by the Abbey River, it contains King John's Castle, St. Mary's Cathedral as some of the oldest buildings in Limerick. Little of the original medieval structures remain. A network of narrow streets with generally low buildings from all eras concentrates along the western side of the island across from the Opera site between the Abbey River and King John's Castle. Limerick City Council and Circuit Court are also located along the banks of the River Shannon south of King John's Castle. 19th century cottages and St. Mary's Roman Catholic Church with its spire are the most striking features on the south-eastern part of the Island.

King's Island (Northern Section)

The remaining areas north and east of the island are partially suburbanised with low-rise houses (mainly 1 floor above ground floor) dating to the 20th century. This area is part of a regeneration scheme, which seeks to re-develop this area sensitively and in a sustainable manner.

Suburban East and South of the River Shannon

Corbally / Rhebogue

This area is defined by the Abbey and Shannon rivers to the north, east and west and by the Dublin Road to the south. The area is bisected by the recently restored Park Canal. It comprises generally low-rise buildings in the Corbally, Mill Road, Park, and Rhebogue residential areas as well as the Grove Island Neighbourhood complex. This area is a mixture of predominantly residential and environmentally sensitive wetland areas. The area is well served by recreational sports clubs. The Shannon Fields, Red Path and Canal Bank provide more passive recreational space.

Garryowen / Singland

This area comprises the area between the Dublin Road and the main railway line out of the City. It includes the old historical area of Garryowen and the newer residential areas of Lynwood Park and Singland. This area has historically developed as an overall low-rise residential suburb of Limerick City, with the social housing in Garryowen but in more recent times the Dublin Rd and Childers Rd interchange at the Parkway Roundabout has become a major retail development node for developments to the east of the City. Crossagalla and Eastway Business Parks provides a mix of retail and industrial uses. The area also contains a number of state bodies including Limerick Prison, St Joseph's Hospital, Limerick VEC Adult Education Campus, the School of Music and the graveyard at Mount St. Oliver's.

Edward Street / Jansboro

This area consists of a primarily low-rise residential area stretching from the City Centre at Edward Street/the Railway Station to the north, to the Childers Road to the south, the regeneration area to the east and the Ballinacurra Road to the west. This area is substantially residential in character with a high proportion being former public housing. Some new development has been constructed in the vicinity of the park consisting largely of residential apartment with commercial uses. The existing recreational facilities in the area consist of the Peoples Park and Caledonian Park and adjacent lands.

South Circular Road / Ballinacurra

This area stretches from the Docklands to the city boundary and includes Wolfe Tone Street, Ballinacurra Gardens and Greenfields as well as the entire South Circular Road area. This area includes the two strategic arterial routes to the city centre namely the Dock Road and O'Connell Avenue. The area contains a high concentration of educational institutions. Low-rise residential development is the predominant land use in the area from the high density inner urban areas of Wolfe Tone Street through the period dwellings along O'Connell Avenue and the South Circular Road and the more modern housing of Ballinacurra, Greenfields and the lower portions of the South Circular Road. The former Limerick Race Course represents one of the largest remaining undeveloped land banks in the City. Allendale developments represent the latest housing area in the City. Developed open space and recreational facilities are limited.

Southill

The area is largely characterised by 1950 and 1960 type low-rise suburban housing development designated for regeneration.

Wider study area to the east and south

The wider study area to the east and south of the River Shannon contains further suburban housing estates including Castletroy in the east, large industrial developments such as Irish Cement as the most visually prominent development in the south. Generally low-rise cityscape is prevailing. The outskirts of Limerick become quickly rural.

Suburban profile areas west of the River Shannon

The west of the River Shannon shores has a generally low-rise residential character. Beginning in the early 19th century and expanding rapidly in the 20th century to current times as this part of Limerick was suburbanised.

Thomondgate

This Northern Suburban area covers the St Munchin's Parish comprising the neighbourhoods of Ballynanty, Kileely and a portion of Thomondgate. The area largely comprises the Limerick Institute of Technology and a variety of low-rise social housing estates developed largely by the City Council between 1930-1990. In respect of recreational facilities, the area is dominated by the River Shannon, however the full potential of its use has not been realised. Internally the area is reasonably serviced by open space however these spaces are poorly developed. Thomond Park Stadium has become a major landmark in the skyline of the area and the City of Limerick following its recent redevelopment.

Ennis Road

The Ennis Road profile area is defined by the River Shannon, High Road/Sextons Street North and the Northern Ring Road, the Condell Road to Clonmacken. The area is characterised by a number of low-rise distinct residential areas from Thomondgate, one of the oldest parts of the City to the 1950’s, 60’s and 70’s housing estates of Landsdowne, Mayorstone and Clareview to the North Circular Road with its mix of period and modern housing. Recent 21st century prominent building structures includes the Strand Hotel and surrounding buildings located on the banks of the River Shannon on the western side of Sarsfield Bridge, which created a new river side front.

Caherdavin

The Caherdavin area is defined by the River Shannon, Clonmacken, Coonagh Caherdavin housing estates to the boundary with Moyross to Thomond Park along the northern relief road. This area largely equates to the area of extended City in 2008. The area contains the last substantial undeveloped residential land bank in the City at Caherdavin, the only agriculturally zoned land at Coonagh. Commercial development is centred on the Coonagh Cross Shopping centre and adjoining lands at Clondrinagh and Coonagh. The area is largely characterised by1960 type low-rise suburban housing development with similar type of housing over the last decade. There are tracts of open space in the housing areas which largely consist of grassed areas with limited active recreation facilities.

Moyross

The area is largely characterised by 1950 and 1960 type low-rise suburban housing development with cluster of more modern housing types developed over the last few years as part of the beginning regeneration process.

Wider study area to the west, north and northeast

The outskirts of Limerick become quickly rural in character. The jurisdiction of County Clare begins shortly after the boundary of Limerick City in the west, and in the River Shannon to the north and northeast. Some of the housing estates and sections of the University of Limerick extend across the River Shannon into County Clare. Apart from church spires, the general built development is low-rise.

12.4.4 Open Space, Vegetation and Green Infrastructure

The Limerick City Development Plan identifies and designates a number of public open spaces and sports grounds. The location of these within the core study area and adjacent lands have been illustrated in Designation Figure 1.

The City Development Plan sets out the following relevant policy for public open spaces:

Policy LBR.12 - It is the policy of Limerick City Council;

- To protect existing green areas and public open spaces, which provide for the passive and active recreational needs of the population;
- To protect and enhance recreational areas including sports grounds and facilities;
- To improve the quality and range of uses provided within parks and public open spaces including sports facilities and encourage their greater use and enjoyment in accordance with the objectives of this plan;
- To manage and maintain parks to the highest standards;
- To provide new parks and green spaces with proper facilities, which are designed to a high standard;
- To develop and improve linkages between parks and public open spaces such as public walkways / cycleways.

The Opera site does not currently provide public open spaces of any quality. The majority of the site is closed off. Existing buildings are often derelict and any former access to the yards at the back of buildings is prevented by fencing or hoardings. The car park along sections of Michael Street and Ellen Street does provide access to this part of the site but has no quality in terms of public open space or green infrastructure.

The city centre surrounding the Opera site has little permeability. Open Spaces are mainly confined to the streets. Bank Place at the north end of the Opera site provides a humble amenity with the provision of some trees, which are otherwise often absent in the vicinity of the Opera site and within the grid pattern of the Georgian Quarter. One exception are the grounds of the Hunt Museum, located west of the Opera site, which contain mature trees and open up to the River Shannon. The Sylvester O'Halloran Bridge provides access to the north across the Abbey River to the former Potato Market. Separated from the Opera site by Arthur's Quay Shopping Centre, lies Arthur's Quay Park to the west along the River Shannon shore. Semi mature rows of trees line Francis Street connecting to Rutland Street along Sarsfield House. The nearest open green space north of the Opera site lies across the Abbey River and within the grounds of St. Mary's Cathedral and graveyard. Lines of trees are also located along George's Quay on the opposite side of Bank Place and Charlotte's Quay along the Abbey River. There are no trees of significance within the grounds of the Opera site.

12.4.5 International Designations

The site does not lie within any internationally or regionally designated landscape or townscape and there are no international designations within the study area.

12.4.6 National and Regional Townscape Designations

For the purposes of this assessment, a distinction has been made between townscape designations, architectural conservation designations and cultural heritage designations. These are all assessed by the relevant expertise within the respective chapter or appendices. Townscape designations relevant for this chapter are illustrated in Designation Figure 1.

The site does not lie within any national or regionally designated townscapes. Local policies for the protection of views and prospects, landscape/townscape assets, landscape/townscape sites and the intrinsic character and scale of the City and City skyline are set out in the Limerick City Development Plan 2010-2016. Relevant policies are listed in Section 12.3 above.

Designations such as Key Views & Prospects as shown Designation Figure 1 have been identified in the Limerick 2030 Economic and Spatial Plan and are also shown in Designation Figure 1. Key linear views identified include urban and waterfront vistas, panoramic views along both sides of the banks of the River Shannon as well as localised views often to local landmarks. Local landmarks identified include following:

- St. Mary's Cathedral / King's Island
- St. Michael's Church
- St. John's Cathedral
- Dance Hall Limerick
- St. Michael's Church – Ellen Street
- Franciscan Friary
- St. Michael's (Limerick City Parish) – People's Park
- St. Joseph's
- Limerick City Gallery of Art
- Colbert Station – Railway Station
- Dominican Church
- St. Munchin's Church

Limerick 2030 identifies also important waterside buildings such as:

- King John's Castle
- Limerick City Council Buildings
- Limerick Circuit Court Building
- Potato Market Hall
- LSAD George's Quay
- Absolute Hotel Building at Abbey Bridge
- Hunt Museum
- Sarsfield House
- The Strand Hotel and adjoining buildings along O'Callaghan Strand
- Dunnes Stores Building at Harvey's Quay
- Clayton Hotel at Steamboat Quay

Further, Limerick City Development Plan 2010-2016 identifies proposed and envisages green routes, which are illustrated in Designation Figure 1.

Protected scenic views and prospects as shown in Limerick County Development Plan 2010-2016 and scenic routes as shown in Clare County Development Plan 2017-2023 are not located within the study area. However, potential long-distance views along designated scenic routes located in the area of Woodcock Hill in County Clare northwest of Limerick City are shown in Designation Figure 2 and have been assessed.

12.4.7 Walking and Cycling Routes

There is a number of walking and cycling routes located within the study area as indicated in Designation Figures 1 & 2. The majority is located within the core study area and comprise the following:

Walking Routes

King's Island Bridge Slí na Sláinte

This is a looped 3.3km walking route starting at King John's Castle and follows mainly the banks of the River Shannon and Abbey River around King's Island. The trail turns onto Athlunkard Street and passes St. Mary's Roman Catholic Church, turns right and follows alongside the old Walls of Limerick on the Island Road and returns to the starting point at King John's Castle.

The Three Bridges Slí na Sláinte

This 3.6km walking routes starts at the Tourist Information Office at Arthurs Quay and follows the banks of the River Shannon, crossing Matthew Bridge, passing St. Mary's Cathedral and the historic King John's Castle, before crossing Thomond Bridge. The route continues for approximately 1km along the waterfront, passing Sarsfield Bridge and onto O'Callaghan's Strand. Following the loop along the North Circular Road, the route takes a left turn and then crosses the Shannon Bridge. The route then returns to the starting point at Arthurs Quay via Bishop's Quay, Bedford Row and Henry Street.

The City Centre Slí na Sláinte

This is a 3.8km walking route which takes in the heart of Limerick City starting on the corner of Bedford Row and O'Connell Street. The route continues through the city centre, taking in O'Connell Street, Glentworth Street, Pery Square and Barrington Street before joining O'Connell Avenue and onto New Street.

The Medieval Quarter

This looped walking route is starting at O'Connell Street / Mallow Street. It crosses Sarsfield Bridge and continues north along the banks of the River Shannon. After crossing Thomond Bridge, it passes King John's Castle and follows the route of Nicholas Street and Bridge Street crossing the Abbey Rive, where it passes along the Opera site at Rutland Street and Patrick Street to O'Connell Street.

The Georgian Quarter

This looped walking route starts at O'Connell Street / Mallow Street and meanders through the grid pattern of the Georgian city extension in the heart of Limerick including Thomas Street, Catherine Street, Glenworth Street and Percy Street. It also passes the People's Park along Percy Square as well as The Crescent coming from Hartstonge Street. It continues along O'Connell Street and Mallow Street Lower to the banks of the River Shannon at Bishop's Quay, where it returns into the grid pattern again along Cecíl Street Lower, Henry Street and Bedford Row concluding at the starting point at O'Connell Street.

Lough Derg Way

The Lough Derg Way is an approximately 64km long distance walking route. The trail starts at the banks of the River Shannon near the Hunt Museum in Limerick City and follows within the study area the quays along the Abbey River and then the Park Canal banks to the River Shannon in the east. Following the course of the River Shannon it turns north near the University of Limerick and follows the River Blackwater further to the north leaving the 5km study area.

Castletroy Slí na Sláinte

This is a 6.8km looped walking route within Castletroy starting at the junction of Milford Road and the Dublin Road. The route follows the Dublin road for over 2km passing through the Kilmurray roundabout before turning left at the Annacotty roundabout and then onto Plassey Park Road. It turns left again at the next roundabout and continues along Plassey Park Road for over 2km. It passes the University of Limerick on the right. It then turns left at the Groody Roundabout and continues back to the starting point.

Cycling Routes

The Limerick City Development Plan indicates a number of existing, long term and proposed cycle ways. None passes the proposed development site.

12.4.8 Likely Evolution of the Baseline Environment without the proposed development

All components of the environment are constantly changing due to a combination of natural and human processes. When predicting likely direct and indirect effects it is important to remember that there are two available for comparison: the existing environment and the environment as it will be in the future if no development of any kind were to take place – the ‘do nothing‘ impact.

In townscape terms, if the development did not go ahead, the proposed development site will remain as an area with decaying historic building structures, car parking facilities, no public permeability through the city quarter from east to west and north to south. The existing Limerick City Library in the Granary building and other residential buildings at the corner of Patrick Street / Ellen Street will remain unaltered. However, its proximity to the commercial and cultural heart of Limerick and other potential development / re-development sites in close proximity to the west, south and southeast will retain the Opera site as being subject to development consideration. In visual terms, the content in available views of the development site will remain the same, although potential measures to secure decaying buildings on site may require external support structures, which would adversely affect the visual amenity of the vicinity in the future.

12.5 Characteristics of the Proposed Development

The project proposes the regeneration of the ‘Opera site’ (2.35 ha) in the City of Limerick for mixed use development. Please refer to Chapter 3 for a detailed development description.

A summary of the proposed development, separated into 6 Parcels, is shown and described overleaf.

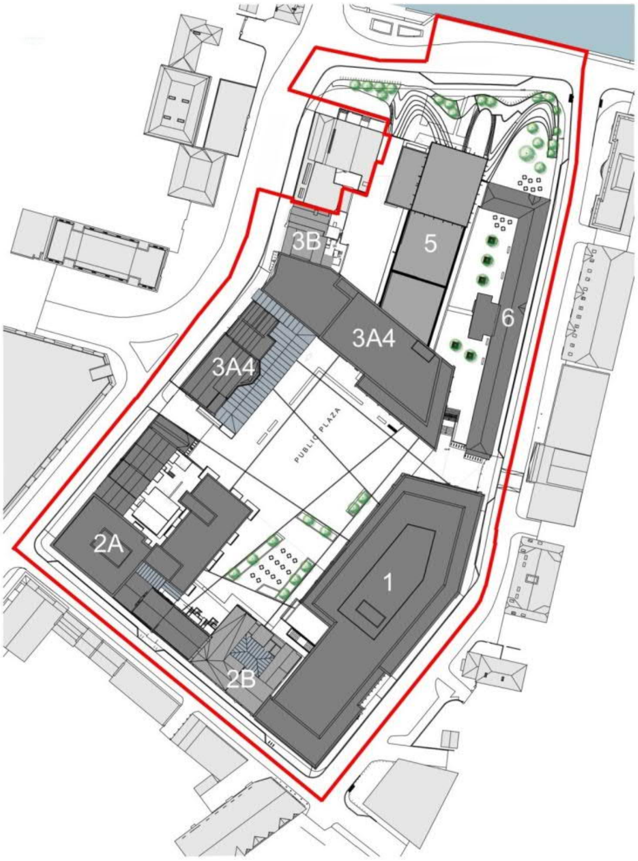


Figure 12.8 Project Opera: Proposed Architectural Layout

An overview of the proposed maximum building heights per parcel is listed below:

Parcel 1: Height from ground floor 29.675m (34.995 OSi datum)

Parcel 2A: Height from ground floor 21.45m (26.850m OSi datum)

Parcel 2B: As existing

Parcel 3A4: As existing (town Hall element)

Parcel 3A4: Height from ground floor 23.75m (29.250m OSi datum) for new commercial element

Parcel 3B: As existing

Parcel 5: Height from ground floor 66.10m (71.60m OSi datum)

Parcel 6: As existing

12.6 Predicted and Residual Impacts

The following potential direct visual effects, direct and indirect townscape effects, as well the duration and nature of effects arising from the proposed development, have been identified. Photomontages 1-23 illustrate the proposed development from representative viewpoint locations within the study area. A description of each photomontage is included in Section 12.6.4 herein.

12.6.1 Effects at Construction

Areas experiencing townscape and visual effects during the construction stage will vary considerably, depending on the active construction phase. All groundworks, refurbishment or the construction of the lower floors will be mainly experienced locally from the adjacent street network and from buildings facing the construction site. However, areas experiencing construction effects will become wider with increasing height of the buildings and will be most prominent along the riverbanks of the Abbey River and the western shores of the River Shannon in the city centre area. Long distance views of construction works from the built up city centre and surrounding mainly suburban quarters will be restricted due to intervening building structures, topography and vegetation.

Construction effects will result in:

- Potential effects to townscape character or visual amenity within the locality or the wider study area as a result of the visibility of construction activities such as demolitions works, the construction / restoration of buildings, associated scaffolding and tall equipment such as cranes and containers
- Effects of temporary site infrastructure such as site traffic and construction compounds especially those located in areas adjacent to sensitive townscape and visual receptors.
- Potential physical effects arising from construction of the development and in particular on the townscape resource within the site area.

Construction phasing will follow the sequence identified in section 3.5 of Chapter 3**.**

Photomontages 1-23 supplementing this assessment illustrate the townscape and visual effects at operational stage only. The proposed phasing of the construction works over several years does not allow for a meaningful illustration in photomontages as these can only show one particular snapshot in time, which will not capture the dynamic and complex nature of construction works comprehensively.

Townscape and visual effects will be highest within the immediate vicinity of the site and within the principal visual zones with a radius of approximately 500m from the boundary of the Opera site. The visibility of construction works within the wider study will be limited to glimpsed views from within the urban or suburban quarters of the high-rise construction works if there is screening provided by intervening buildings, topography and/or vegetation. More open views of the construction works but less significant due to the effects of distance, intervening built structures and vegetation will also be available from locations beyond 500m along the banks of the River Shannon.

Townscape and visual effects and their significance at construction stage will be temporary, adverse and range from Minor-Negligible (in the wider study area) to Major (within 500m radius from the boundary of the proposed development site depending on the type of construction activities).

A full description of the proposed construction plan is contained in the Construction Methodology and Phasing Management Plan.

12.6.2 Effects at Operation

The Opera site is in need of regeneration to restore this overall city quarter to a lively and high-quality townscape. This will extend the core commercial city, the Georgian Quarter, to the north and re-connect it to the medieval heart across the Abbey River. The Opera site can become the cardinal point between both city parts and function as a gateway. The proposed development will provide a major starting point for the overall envisaged regeneration in this quarter. It already contains some high-quality settings such as the Hunt Museum and its grounds.

Changes to the physical townscape of the Opera site are likely to be extensive and its material quality is forecasted to be greatly different to the baseline situation. The articulation of the scale and mass of the proposed development will be partially in contrast to its existing context and setting. Except for the restored historic buildings, its appearance will be of a different quality when compared to the surrounding baseline. Access and linkages via the proposed public spaces at Bank Place and in the centre of the Opera site will enhance the pedestrian experience, whilst providing a high-quality appearance and open space to the public.

Operational effects will result in:

- Potential effects of the development on townscape resources and townscape character, including the perceptual qualities of the townscape, and upon designated townscapes where the primary focus of designations or sensitive townscapes is altered;
- Potential effects of the development on views and visual amenity such as the potential for the development to alter (beneficial or adverse) the composition of the view from a viewpoint; and
- Potential cumulative effects of the development in combination with other planned and proposed developments of similar type and scale upon the townscape and visual resource of the study area.

Some of the key townscape and visual operational effects may relate to:

- The significant opportunity to improve views from within the local and wider townscape character areas;
- The potential to improve the relationships between the commercial and medieval heart of Limerick and the surrounding townscape;
- Consideration of how a new landmark structure has the potential to effect surrounding townscape areas and their perceptual qualities;
- Potential effects between visible facades throughout the city centre;
- How terminating views within surrounding townscapes may change as a result of the scale and nature of the development;
- Longer/ glimpsed views in which the composition of the view is altered;
- The extent to which the development has the potential to improve the townscape character by reinforcing and/or enhancing its overall integrity and character, for example restoration and integration of existing historic buildings into the overall development or the removal of derelict or unused structures;
- The extent to which the development may intrude into existing views or improve views experienced by residents and day to day users of the area; and
- The extent to which users of the townscape such as tourists and visitors may be subject to effects (beneficial or adverse).

12.6.3 Residual Townscape Effects

Direct or indirect townscape effects on the fabric of the townscape and its receptors are closely related to the nature and extent of visibility.

The proposed development will continue a recent trend within the city centre of Limerick – a city centre with a townscape changing in character from a low-rise cityscape, previously accentuated by church spires to a city scape accentuated by high-rise commercial buildings.

The proposed Opera development site is located at the northern end of the commercial district of the city centre at a cardinal point between the medial heart and the Georgian extension of the late 18th and 19th century. Existing high-rise developments, namely the Clayton Hotel and the Riverpoint building are both located at the southern end of the Georgian city extension and form the transition into the docklands.

The proposed development will therefore appear as a standalone development as the distance between the existing high-rise developments and the Opera site is too great (approximately 650m at its closest) in order to read these developments together as one unit.

As there is no specific townscape character assessment carried out for Limerick, the classification of the city into 'Area Profiles' (as described in Section 12.4.3) will be used to assess potential townscape effects.

City Centre / Urban Core including medieval part of King's Island

The majority of townscape character effects resulting from the proposed development will be experienced in this area profile as it contains the Opera site. The visual receptor groups affected will be pedestrians, office staff, vehicle drivers, tourists and residents. The sensitivity of this area is considered to range from High in the Georgian and medieval core to Medium-Low in areas of the northern city centre south of the Abbey River where the urban character becomes less uniform and areas of neglect undermine the overall quality of the urban character.

Direct and permanent change will occur locally where the proposed development will be physically located. The sensitivity is considered Medium-Low. The magnitude of townscape change within the proposed development site is considered Very High as the current character of the site will substantially change. The proposed development will alter the existing townscape character intensively when experienced from surrounding city quarters where the development can be seen in its majority. The existing site will transform from a place with mainly vacant and derelict structures to a new city quarter with a range of buildings at various heights, new permeability through the quarter and public open spaces within the site. The retention and refurbishment of a number of historic buildings along the edge of the site will anchor the proposed development within its urban context. The highest direct townscape effects will arise from the density and height of the proposed development elements resulting in a Very High magnitude of townscape change. The significance of change is considered Major-Moderate Beneficial.

Outside the development site, recognisable indirect changes will be experienced along the surrounding streetscapes adjacent to the site. The character of existing built structures will change significantly, particularly in sections where new street fronts and public realm will be created (Sections of Ellen Street, Michael Street and Bank Place). However, existing historic building structures will be largely retained and refurbished, such as in Rutland Street, Patrick Street (former City Hall and adjacent buildings), Ellen Street and Michael Street / Bank Place (Granary Building). Sections of the new development will rise above the existing historic roof lines and, while stepped back, indicate a recognisable change to the existing vertical streetscape character. The magnitude of change is considered Very High to High, the significance of change in character along the surrounding streets is considered to range from Major to Moderate. The majority of the proposed changes will be beneficial to the townscape character as it will become a high-quality urban city block and replace the current degraded and neglected character of the area. However, adverse impacts can arise due to the height of sections of the proposed development (Parcel 1, 4, 5 and sections of 3A) when compared to other quarters in the vicinity, which will stand in contrast to the proposed development character. However, the development should be considered as the first part of a general transformation envisaged for the northern end of the Georgian city extension (refer to the vision of Limerick 2030 Economic and Spatial Plan and development policies of Limerick City Council as outlined in Chapter 2, and cumulatively assessed in conjunction with the Opera development in Section 12.8 below).

The effect on the character from longer distance views within the Georgian Quarter and general commercial core further south is restricted due to intervening existing building structures obstructing either fully or the majority of the proposed development, so that changes in character are considered to range from Low to Neutral. The sensitivity is considered High. The significance is therefore considered Moderate-Minor or Negligible. The quality of change to the character of the inner-city Georgian Quarter is considered adverse as the development can partially intrude above the historic rooflines (refer to Photomontage 6 for reference).

It is important to note that two existing high-rise developments have transformed the river front in the southern part of this area profile. The proposed development will become a counterpart on the northern side, which will be read as a separate development due to the long distance between the proposed Opera site high-rise buildings and the existing Riverside Building (approx. 850m) and the Clayton Hotel (approx. 1.1km).

Thomondgate / Ennis Road

The proposed development will alter the townscape character in its immediate vicinity but will also impact significantly on the wider area profile (up to 1km), particularly when experienced in open views from the western river bank of the River Shannon where the overall character of the city centre skyline can be experienced. The visual receptor groups affected in these areas will be pedestrians, residents, office staff, vehicle drivers and tourists. The sensitivity of this area is considered High. The proposed development will result in permanent noticeable changes to some of the key characteristics of the city centre skyline. The development will introduce a prominent high-rise element in the currently low-rise character of the centre and northern part of the Georgian Quarter (refer to Photomontage 14 for reference). It will form a prominent new vertical landmark in open views of the development. While the bell towers of St. Mary's and St. John's Cathedrals also provide vertical landmarks, the new development will be much more noticeable due to its mass. The prominence of building parts rising above the general roof lines of the city is counterbalanced by the unity of the structures, the architectural articulation and use of materials which carefully respond to the townscape setting. The development will not conflict with the visual integrity of the Cathedral spires from the majority of viewpoints. As such, the magnitude of change is considered to be High-Medium in the majority of open views, particularly east, south or north across the River Shannon. While there will be noticeable change to the wider character due to the building height. The significance is considered to be Major-Moderate. The quality of effects is generally considered beneficial as the development will be well composed and contribute to the quality of the townscape character. However, the alteration of the overall low-rise skyline in this part of the city can also be seen as adverse.

Changes in character will mainly be limited to areas located along the river front as intervening building structures and vegetation will otherwise screen all or the majority of the development for the remaining parts of these area profiles due to the flat nature of the topography. The sensitivity in these areas is considered Medium. The magnitude of character change in potential glimpsed views of the development from within the suburbs is considered Low to Negligible. The significance is considered Minor to Negligible Neutral and therefore not significant. While the development may be discernible in the distance, it will not change the overall character of the area occupied by visual receptor groups, which are mainly considered residential, vehicle drivers and pedestrians.

Corbally / King's Island

These townscape profile areas are located north and northeast of the proposed development. The main visual receptors groups will be residents, pedestrians and vehicle drivers. The sensitivity to change is considered Medium-Low. The introduction of the proposed development may be visible in open view where it will be seen rising above the existing skyline of the city centre. However, intervening buildings structures and vegetation in this low-lying part of the city will screen most views of the proposed development. If visible, the magnitudes of townscape effects are considered Medium to Low. The significance is considered Minor Neutral. The introduction of the development in the distance will not alter the existing locally prevailing townscape character.

Garryowen / Singland, Edward Street / Jansboro, South Circular Road / Ballinacurra, Southill

These townscape profiles are located east, southeast, south and southwest of the city centre profile and are predominantly residential apart from clusters of commercial & light industrial development and business parks along the fringe of these profiles. The main visual receptors groups will be residents, pedestrians and vehicle drivers. The sensitivity to change is considered to range from Medium to Low. The introduction of the proposed development may be visible in open views where it will be seen rising above the existing skyline of the city centre in the distance. However, intervening building structures and vegetation in this low-lying part of the city will screen most views of the proposed development. If visible, the magnitude of townscape effects is considered Medium to Low. The significance is considered Minor to Negligible Neutral. The introduction of the development in the distance will not alter the existing locally prevailing townscape character.

Caherdavin / Moyross

These townscape profiles are located to the west and northwest of Limerick at a distance to the city centre. The overall topography begins to rise gently to the north and northwest. The character of these profiles is mainly residential with few light industrial and commercial developments located near the western fringe. The main visual receptor groups will be residents, pedestrians and vehicle drivers. The sensitivity to change is considered Medium to Low. The introduction of the proposed development may be visible in open views where it will be seen rising above the existing skyline of the city centre in the distance. Generally, intervening buildings structures and vegetation will screen views of the city skyline in the majority of views. However, isolated views of the city skyline may be possible from more elevated areas. If visible, the magnitude of townscape effects is considered Medium as a noticeable change in the city skyline can be recognised due to the introduction of a new vertical built element. The significance is considered Moderate to Minor.

The quality of effects is generally considered beneficial as the development will be well composed and contribute to the quality of the townscape character in the distance, but it will have no effect on the townscape character where the receptor is located. A summary of townscape effects is enclosed in the table below:

Table 12.14 Summary of Residual Townscape Effects

Receptor	Main Receptor Group	Sensitivity	Magnitude (at operation)	Quality of Effects	Significance of Effects
Townscape Area Profiles					
City Centre / Urban Core - Opera site	Pedestrians, Office staff, Vehicle Drivers, Tourists, Residents	Medium-Low	Very High	Beneficial	Major-Moderate
City Centre / Urban Core - Immediate surroundings of Opera site including medieval core of Kings Island	Pedestrians, Office staff, Vehicle Drivers, Tourists, Residents	Medium-Low	Very High to High	Both, Beneficial and Adverse	Major-Moderate

Receptor	Main Receptor Group	Sensitivity	Magnitude (at operation)	Quality of Effects	Significance of Effects
City Centre / Urban Core - Wider Setting (Georgian Quarter)	Pedestrians, Office staff, Vehicle Drivers, Tourists, Residents	High	Low to Neutral	Adverse	Moderate-Minor to Negligible
Thomondgate / Ennis Road - River front	Residents, Pedestrians, Visitors (Thomond Gate Park Stadium), Vehicle Drivers	High	High-Medium	Both, Beneficial and Adverse	Major-Moderate
Thomondgate / Ennis Road - Away from river front	Residents, Pedestrians, Vehicle Drivers	Medium	Low to Negligible	Neutral	Minor to Negligible
Corbally	Residents, Pedestrians, Vehicle Drivers	Medium	Medium to Low	Neutral	Minor to Negligible
King's Island - Outside Medieval Core	Residents, Pedestrians, Vehicle Drivers	Low	Medium to Low	Neutral	Minor to Negligible
Garryowen / Singland	Residents, Pedestrians, Vehicle Drivers	Medium	Medium to Low	Neutral	Minor
Edward Street / Jansboro	Residents, Pedestrians, Vehicle Drivers	Medium	Medium to Low	Neutral	Minor
South Circular Road / Ballinacurra	Residents, Pedestrians, Vehicle Drivers	Medium	Medium to Low	Neutral	Minor
Southill	Residents, Pedestrians, Vehicle Drivers	Low	Medium to Low	Neutral	Minor
Caherdavin	Residents, Pedestrians, Vehicle Drivers	Medium	Medium	Beneficial	Moderate to Minor
Moyross	Residents, Pedestrians, Vehicle Drivers	Low	Medium	Beneficial	Moderate to Minor

12.6.4 Residual Visual Effects

The proposed development is located in a mainly flat or gently undulating urban landscape. Therefore, existing buildings or street side vegetation can quickly provide partial or full screening to receptors when moving away from the site. The highest visual effects tend to occur where there are no intervening building structures between the viewer and the proposed development, such as in views across the River Shannon or in views where the viewer is at a close distance to the development. 23 No. photomontages from representative viewpoint locations have been prepared illustrating the nature of visibility of the proposal at various distances and contexts. Considering the nature of the proposed development, the magnitude of visual change is considered permanent.

The proposed development is located at the edge of the urban centre of Limerick. The site is enclosed on 3 sides. The northern side faces the Abbey River and comprises the development of a new waterside plaza at Bank Place. The majority of significant views will be experienced within the core study area of 1.5km where open or partial views of the development are possible, particularly in views from close proximity around the Opera site and from Thomond, Sarsfield and Abbey Bridge crossing the River Shannon as well as from the river fronts along the River Shannon.

Principal open and partial close distance views of the development will be available from adjoining streets and city quarters (refer to Photomontages 1, 4, 7 – 11 and 17-22 as described in this section). Medium distance open and therefore principal views will be possible along the Shannon river front, particularly from the western side of the river along Clancy's Strand and O'Callaghan's Strand and adjoining quarters (refer to Photomontages 12 -15). Visibility of the development will become quickly partially or fully obstructed by intervening building structures and vegetation within the city centre and when moving away from the river fronts as indicated in Photomontages 2, 3, 5 & 6.

The majority of visual receptors will be pedestrians, staff of nearby offices and visitors, who pass through the area, and in particularly along streets including Bank Place, Michael Street, Ellen Street, Patrick Street, Francis Street, Rutland Street and Georges' Quay, Bridge Street, Merchant's Quay and Charlotte's Quay. The overall proposed development will result in significant beneficial changes to the Opera site and its appearance from all sides. The proposed restoration of a number of currently vacant and often derelict historic houses along Ellen Street, Patrick Street and Rutland Street will retain an interesting mix of historic and contemporary architecture in available views, which is generally beneficial for visual receptors as a currently unused, run down city quarter will become visually attractive and part of the active city life again. The proposed upgraded public realm immediately surrounding the site, which includes the upgrade of Bank Place to the north with a new public plaza, will contribute to the overall visual amenity and vibrancy of this part of the city.

The area in the vicinity of the Opera site hosts a number of residential units but mainly commercial premises (shopping centre or individual local shops etc.). Residences concentrate along Michael Street and St. Michael Court, Mungret Court and Tara Court who are located east to the Opera site in close proximity. Views across car parking facilities and the back of low-rise, vacant and often derelict structures within the Opera site from Ellen Street and Michael Street (were possible) are of low quality. The introduction of the proposed scheme will substantially alter the existing character of these views. The introduction of new buildings and upgraded public realm with a high-quality appearance and public access across the Opera site will change and enhance the current quality of views significantly and positively. Considering the close proximity of some residential units to the development site, and in particular along Michael Street or adjacent perpendicular streets, the new development will likely result in High to Very High magnitudes of visual change resulting in Moderate to Major or Major Significance. Some of these effects can be perceived as adverse due to the close proximity of tall building frontages currently not in existence, particularly when experienced from Michael Street and St. Michael's Court looking west. Residents in this area will experience these views as their daily principle views. However, considering the city centre location of the site, views of building facades as part of the townscape from surrounding quarters are not considered unusual. The new facades will become part of the generally built up urban character of the area over time. Staff working in offices along Michael Street or Ellen Street and going or coming from work will also be sensitive receptors but less likely to the same extend as residents. There is otherwise no known other residential occupation of houses evident in the streets surrounding the Opera site. Residences along Carr Street, Mungret Court and at Tara Court are already set back from the overall development. While views from upper floors will experience a considerable change in the character of the view, the visual effects will reduce to Medium with a Moderate significance due to intervening existing buildings along Michael Street. This effect will increase further on Mungret Street, northeast of the Milk Market, where the proposed development will likely not be visible from the majority of locations due to intervening built structures.

The majority of medium distance views will include the high-rise sections of the development only, which will be experienced from the western bank of the River Shannon along Clancy's Strand and O'Callaghan's Strand, Arthur's Quay, Lock Quay and from the visitor platform within St. John's Castle in north. The proposed development, and in particular the proposed 14 storey tower, will significantly alter the existing skyline in these panoramic views. It will introduce a new vertical urban landmark in the skyline of Limerick City additional to the bell towers of the cathedrals (where visible). It will set the scene for a new phase of city development. It becomes evident that the development will act as an important gateway between the medieval heart and the commercial heart of the city in these views. It will provide the northern counter development to the new river fronts along Harvey's Quay, Howley's Quay, Bishops' Quay and Steamboat Quay located further south. However, the Opera development is not located at the river front; it will integrate in the general surrounding cityscape. The stepped down tower structures to the east, west and south of the main tower and the different choice of materials and façade patterns softens the overall verticality. The underlying existing characteristic components of the river front will remain intact. The change in visual amenity from these areas is considered to be beneficial due to the bold but high quality appearance of the proposed development.

Potential views from within the city centre and in particular from the Georgian Quarter are either fully screened or restricted by intervening building structures. However, sections of the upper floors of Parcel 5 will appear above the roofscape in some locations (refer to Photomontage 6 as an example) The small visible part of the development will introduce a new type of building structure and materials in these views along the roofscape of the otherwise often uniform and straight lined brick parapets of the historical Georgian buildings. In that sense the potential visibility of the straight lined roof of the proposed development is not totally out of character. The proposed development will generally not become a character changing element in these views. However, it will intrude above the otherwise mainly unbroken historic roof lines. It will also gain more prominence with less distance when walking on the western side along O'Connell Street to the north.

Long distance views from within the remainder of the 5km study are generally restricted by the overall flat or gently undulating nature of the land and by intervening existing building structures and vegetation. However, long distance views of the skyline of Limerick and the upper sections of the high-rise element of the development can be experienced from isolated locations where there is no or little intervening topography, vegetation or building structures (refer to Photomontage 16 for reference).

Photomontages 1-23 illustrate a range of views throughout the core study area. A description of effects on visual receptors in described herein. All photomontages are included in the booklet of 'Planning Application Photomontages' provided as a separate document in this submission.

Viewpoint / Photomontage 1: Lough Derg Way at Park Canal near junction with Lock Quay / Abbey Bridge

This viewpoint is representative of views west when walking along Park Canal and Lough Derg Way towards the city centre and the River Shannon. The distance to the closest building part from this viewpoint is approximately 345m.

The value of this view is considered at Community level as it overlooks ordinary townscape elements, which are likely to be valued by the local community and walkers along the canal and Lough Derg Way. Visual receptors, such as local residents, walkers or visitors are considered to have a Medium to

High susceptibility to change. The majority of people will be passing through this area while walking. Views are an important part of the experience along the nationally designated walking route, the Lough Derg Way, particularly when entering the city centre of Limerick. Views are open and will be experienced regularly. The overall sensitivity is considered High-Medium.

Views of the development will be partially screened by intervening existing building structures. The mid to upper sections of the Parcel 5 tower will be openly visible to the walking receptor in this view. The development will redefine the skyline of the overall view introducing tall building structures above existing roof levels to an otherwise relatively homogenous height of existing buildings in this view.

The development will become clearly noticeable. The choice of glazing and façade details help to reduce the massing of the building structures visible against the sky. However, the proposal will become a prominent new landmark above the surrounding buildings. The magnitude of visual effects is considered to be High resulting in a Major-Moderate Beneficial Significance. While there will be a noticeable change in the overall composition of the view, the development will integrate into the skyline from this position when approaching the city centre of Limerick.

Viewpoint / Photomontage 2: O'Dwyer Bridge on Athlunkard Street

This viewpoint is representative of views southwest when crossing the Abbey River via the O'Dwyer Bridge, which is a local highpoint connecting to King's Island. St. Mary's Roman Catholic Church is a landmark in the middle distance on the right. St. Mary's Cathedral within the medieval core of King's Island can be seen in the background. Recent modern hotel and apartment style developments have transformed sections of the river front to the left adjacent to Abbey Bridge. The distance to the closest proposed building part from this viewpoint is approximately 503m.

The value of this view is considered at Local level as a number of landmark buildings are visible in this view. Visual receptors will most likely be pedestrians and vehicular traffic and are considered to have a Medium to Low susceptibility to change. The majority of receptors will be passing the bridge while walking or driving. Views will likely be relevant to the experience of the receptor but not central to it. Views of the development will mainly be possible when on the bridge or in close proximity to it due to its elevated location. Intervening existing vegetation and building structures will otherwise quickly obstruct potential views of the development. The sensitivity is considered Medium.

Views of the proposed development will be partially screened by intervening river bank vegetation and existing buildings. However, this effect changes and views become more open again when continuing walking across the bridge towards King's Island. The upper section of Parcel 5 will be visible from this location introducing another vertical structure in the skyline when seen together with the bell towers. The magnitude of visual effects is considered to be Medium resulting in Moderate Beneficial Significant effects. The overall character of the view will remain. The addition of the proposed development provides a counterbalance on the left side when seen in combination with the bell towers on the right. The proposed building height appears to be at similar height with the church towers from this viewpoint.

Viewpoint / Photomontage 3: Limerick School of Art and Design

This viewpoint is representative of views west, northwest from the Limerick School of Art and Design. The viewpoint is located near the entrance steps in front of the main building. This viewpoint has been chosen as this area is a highly frequented public open space. The distance to the closest proposed building part is approximately 632m.

The value of this view is considered Limited as there are a number of detracting and common townscape elements in this view, such as concrete ramps and walls as well as plain functional building structures. Visual receptors are students, staff and visitors of the school. Their susceptibility to change is considered High as views of the proposed development are likely to be experienced daily. The majority of receptors will experience the view when entering or leaving the building and when socialising at the main school entrance. The sensitivity is considered Medium-Low.

The majority of the proposed development will be screened by intervening existing building structures in the middle distance. However, sections of the upper floors and the screening of the roof top plant area of Parcel 5 will become partially visible. The magnitude of visual effects is considered Low. While the proposed development will be noticeable from this or similar locations near the school entrance, the overall character of the view will not significantly change. The significance of the visual effects is therefore considered Minor Neutral.

Viewpoint / Photomontage 4: Milk Market at junction Carr Street / Mungret Court

This viewpoint is representative of views north, northwest from the corner of the Milk Market. This viewpoint has been selected as this area is a highly frequented streetscape at a relative short distance to the proposed development, and comprises various layers of urban grain. The distance to the closest building part is approximately 126m.

The value of this view is considered Limited due to the prominent investment ruin in the foreground. However, the view offers a sightline to St. Mary's Cathedral on King's Island in the background. Visual receptors are residents, pedestrians and passing vehicular traffic. The receptors susceptibility to change is considered High-Medium as this side of the overall city quarter is a mix of commercial and residential units, i.e. the duration of the view is daily and prolonged for residents but short for pedestrians and vehicular traffic. The overall sensitivity is considered to be High-Medium.

The proposed development will result in a clearly noticeable change in the view. The majority of the tower of Parcel 5 will be visible above the existing buildings in the fore- and middle ground. The tower of St. Mary's Cathedral will remain visible in the distance. The visible parts of the proposed development will introduce a new urban quality and point of focus into this view. The magnitude of visual effects is considered to be Medium. While the visible parts of the proposed development will be prominent, they will not dominate this view. The significance of visual effects is therefore considered to be Moderate Beneficial.

Viewpoint / Photomontage 5: Front Plaza at Limerick Colbert Station

This viewpoint is representative of views north from the new plaza in front of Colbert Station. This is a highly frequented square located at the eastern fringe of the Georgian Quarter of the city centre. The square is the first impression of Limerick for any visitor arriving by train. The distance to the closest building part is approximately 639m.

The value of this view is considered at Local level as the newly refurbished front plaza at the train station provides a high-quality streetscape enhancing the overall townscape in this area. Detracting elements are the lattice structure of the telecommunication mast rising up above the roofs of the houses on the left. Visual receptors of this view will mainly be pedestrians on the way to or from the train station. The receptors susceptibility is therefore considered Medium as the people passing through this area are not primarily focused on views but on reaching their destination. Views of the surrounding area are likely to be short. The sensitivity is therefore considered Medium-Low.

The upper sections of Parcel 5 including the screening panels of the roof top plant area will appear above the roofs of houses located in the middle distance. The visible part of the proposed development will introduce a new type of building feature to the square but it will not be prominent or alter the existing focus in the view. The flat linear form of the development corresponds with a number of flat roofs of existing buildings facing the square. The development will result in a minor change of the existing view but not alter the character and composition of the overall view. The magnitude of visual effects is therefore considered Low resulting in a Minor Neutral level of significance.

Viewpoint / Photomontage 6: The Crescent at junction Lower Hartstonge Street

This viewpoint is of one of the key linear urban vistas north available in the grid pattern of the Georgian Quarter of the city centre as identified in the Limerick 2030 Economic and Spatial Plan (refer to Designation Figure 1). This view, looking north, is enclosed to either side by Georgian terraced townhouses. This view captures a homogeneous scale of high-quality townscape with a regular tall and narrow pattern of house fronts reflecting the consistent architectural vernacular. Local landmarks are the tower of St. Augustine's Church and the clock tower of Penny's department store in the middle distance. Arthur's Quay Shopping Centre is a low-rise focal point at the end of the vista in the background. The distance to the closest building part from this viewpoint is approximately 791m.

The value of this view is considered Regional. The overall Georgian townscape appears largely intact from this viewpoint, which is located at the southern end of the main commercial district of the city centre. Visual receptors are therefore pedestrians, vehicular traffic, people going or coming from work, working inside and some residents. Views are experienced on a daily basis and mainly as a sequence of views moving through the area. The susceptibility of receptors to change is therefore considered Medium. The sensitivity is considered High.

Sections of the upper most floors and the roof top plant screening panels of Parcel 5 will appear above the roofscape on the right in the middle distance. This includes a section of the lower stepped element along the western side of Parcel 5. The visible part of the development will introduce a new type of building structure and materials along the roofscape of the otherwise mainly uniform and straight -lined brick parapets screening hipped roofs. In that sense the potential visibility of the straight-lined roof of the proposed development is not totally out of character. The proposed development will not become a character changing element in this view. However, it will intrude above the otherwise mainly unbroken historic roof lines. It will also gain more prominence with less distance when walking on the western side along O'Connell Street to the north. The magnitude of visual effects is considered Low resulting in Moderate-Minor Adverse significance.

Viewpoint / Photomontage 7: O'Connell Street near T-Junction with Cruise's Street

This viewpoint is located near the northern end of one of the key linear urban vistas north available in the grid pattern of the Georgian Quarter of city centre as identified in the Limerick 2030 Economic and Spatial Plan (refer to Designation Figure 1). The distance to the closest building part from this viewpoint is approximately 168m.

This view is enclosed to either side by a mix of historic Georgian and modern commercial buildings. The value of the existing view is considered at a Community to Limited level. While, the building height is generally uniform and orientated on the Georgian terraced townhouses, variable architectural styles, floor heights, large shop advertising attached to facades and movable kiosks in variable styles are distracting elements in this view. The view in its current condition does not have the same high townscape quality as in Viewpoint 6. Characteristic is the bend of Rutland Street in the background, where the long straight view along the Georgian grid pattern comes to an end. Visual receptors are pedestrians, vehicular traffic, people working inside shops or outside in market stands. Views are experienced on a daily basis and mainly as a sequence of views moving through the area. The susceptibility of receptors to change is therefore considered Medium-Low. The sensitivity is considered Medium.

The proposed development will be partially screened, however, Parcel 5 will appear clearly above the existing roofscape along with a new corner building (Parcel 2A) at the junction of Patrick Street / Ellen Street. A section of Parcel 3A is visible along the existing terrace at Rutland Street. The development will introduce prominent but not dominating new building structures in this view. It will lead to a noticeable change in the overall focus and composition of this view and to a new background element on the right. The magnitude of visual effects is considered Medium and the Significance is Moderate Beneficial. While the development introduces a prominent new feature in this view, it will also become a new focus and endpoint of the Georgian Quarter on this side of the city centre.

Viewpoint / Photomontage 8: Francis Street at Arthur's Quay side

This viewpoint is representative for views east from Arthur's Quay of the former Town Hall at end of Francis Street, which forms the western side of the Opera redevelopment site. Sarsfield House to the left has been identified as one of the important water side buildings in the Limerick 2030 Economic and Spatial Plan (refer to Designation Figure 1). The distance to the closest building part from this viewpoint is approximately 117m.

The view is enclosed by Sarsfield House on the left and Arthur's Quay Shopping Centre to the right. Irregular bands of street trees flank Francis Street on the left. The value of this view is considered at Community level. The former Town Hall at the end of this view provides a local focal point with its well-proportioned vernacular façade. Visual receptors are pedestrians, vehicular traffic and people going or coming from work. Views are experienced on a daily basis and mainly as a sequence of views moving through the area. The susceptibility of receptors to change is therefore considered Low as views are likely to be focused on the activity of the receptor rather than the view. The sensitivity is considered Medium-Low.

The upper floors of Parcel 5 of the proposed development will be partially visible above the roof of Sarsfield House in this view. Refurbished Georgian properties associated with Parcel 3A are visible along Rutland Street up ahead. The urban character of this view will be intensified slightly due to the partial view of the proposed tower. The development will be clearly recognisable but it will not dominate or alter the focus in the view. The magnitude of visual effects is therefore Medium-Low. The significance is considered Moderate-Minor. The change in visual amenity from this viewpoint is Beneficial due to the restored appearance of the Georgian terrace along Rutland Street, the retention of the historical rooflines, and the addition of contemporary and high-quality architecture in the background.

Viewpoint / Photomontage 9: Hunt Museum – Vehicular entrance from Rutland Street / Bank Place

This view is looking east towards Bank Place from the corner of the vehicular entrance of the Hunt Museum, which is located behind this viewpoint location. The distance to the closest building part is approximately 34m.

The view contains one of the earliest Georgian houses in Limerick at the corner of Rutland Street and Bank Place. While outside of the development area they belong overall to the Opera site. The open view is guided along Bank Place, which is largely architecturally empty and framed by a modern office and residential building block located in the background. The corner of the grounds of the Hunt Museum is located to the far right in this view. The value of this view is considered at Community level. Visual receptors are pedestrians and vehicular traffic. Views are experienced on a daily basis and mainly as a sequence of views moving through the area. The susceptibility of receptors to change is therefore considered Low as views are likely to be focused on the activity of the receptor rather than the view. The sensitivity is considered Medium.

Parcel 5 of the proposed development will be prominently visible with its front façade facing Bank Place and the new public plaza. A small upper most section of Parcel 3A can be seen to the far right in this view above the Georgian terrace along Rutland Street. The proposed new tower structures will considerably alter the existing view due to the introduction of a tall building structure exceeding the height of adjacent buildings several times. Whilst the underlying existing characteristic components of the view remain, there is a substantial change in the overall composition of the view. The development will become a dominating element of focus but also a new anchor in the overall townscape. The stepped down tower to the west and south of the main tower softens the overall verticality and helps to connect better to the adjacent existing buildings. The proposed landscape design of Bank Place will result in a considerable increase in tree planting. The magnitude of visual effects is considered High. The resulting significance is Major-Moderate Beneficial.

Viewpoint / Photomontage 10: Georges' Quay near entrance of Limerick School of Art and Design (LSAD)

This view is looking southwest of the Opera site from the entrance of the LSAD. The view across the quay walls and the Abbey River contains the Hunt Museum to the right, sections of Sarsfield House in the background, Georgian townhouses at the junction of Bank Place and Rutland Street, the old Granary building on the eastern site of the Opera site, a 2 storey office building in the centre of Bank Place and an mixed use residential and office block to the left along Charlotte Quay. The distance to the closest building part from this viewpoint is approximately 100m.

The value of this view is considered at Local level as the Hunt Museum is one of the main landmark buildings of Limerick and is also recognised as an important water side building in the Limerick 2030 Economic and Spatial Plan (refer to Designation Figure 1). Visual receptors will most likely be pedestrians, vehicular traffic, residents, students and staff of the LSAD. The receptors are considered to have a High-Medium susceptibility to change. The majority of receptors will experience this view on a daily basis. While the Hunt Museum is an important part of the townscape in this location it is not central to it. The sensitivity is considered High-Medium.

The upper parts of Parcel 1 & 3A will be partially visible in background of the Opera site behind Parcel 5 at Bank Place, which will replace the existing 2 storey office building and be openly visible from this location. Proposed alterations to the Granary building are mainly internal and not obvious in this view however, the new public plaza to the north of the Granary building and Parcel 5 tower at Bank Place will be noticeable mainly due to the removal of existing trees and the addition of new tree planting as part of this redeveloped public amenity space. The proposed 14 storey tower of Parcel 5 will be 66.10m above street level at its highest point. The lower façade of the proposed tower is closely aligned on the eaves height of the Granary building. The tower of Parcel 5 will alter the existing view significantly and form a new landmark in this view. The proposed Opera development becomes visually a gateway at this sensitive point between the Georgian Quarter, the commercial and cultural centre of Limerick, and the medieval heart of Limerick. While the underlying characteristic components of the existing view remain, there is a substantial change in the overall composition of the view due to the introduction of the tower, which exceeds the height of adjacent buildings several times. The stepped down tower parts to the side and the back of the main tower softens the overall verticality and helps to relate better to the adjacent existing buildings. However, the Granary building and the Georgian buildings to either side will look slight when compared to the adjacent tower development in this view. The magnitude of visual effects is considered Very High. The resulting significance is Major Beneficial.

Viewpoint / Photomontage 11: Car Park at Limerick Circuit Court and Limerick City Council

This view is looking southeast of the Opera site from the edge of the open plaza in front of Limerick Circuit Court across the former site of the Potato Market. Upper sections of the Hunt Museum and Georgian townhouses at the corner of Bank Place and Rutland Street are located in the middle ground. Sarsfield House and its upper floors form the backdrop to the right. The distance to the closest building part is approximately 165m.

The value of this view is considered at Local level. While mostly screened, the Hunt Museum is one of the main landmark buildings of Limerick. The area and buildings of the former potato market in the middle ground adjacent to the car park are important architecturally but do not contribute to a high-quality townscape in its current condition. Visual receptors will most likely be staff of the circuit court, Limerick City Council and visitors of the Limerick Museum and 1916 Commemorative Garden. The receptors are considered to have a High-Medium susceptibility to change. The majority of receptors will experience this view on a daily basis. The sensitivity is considered High-Medium.

Parcel 5 of the proposed development will be prominently visible with its front façade facing Bank Place largely unscreened. Less noticeable structures include the upper sections of Parcel 1 and 3A which are orientated on the height of the existing roof levels and blend into the existing city skyline and will therefore not be immediately apparent in the view. The proposed new tower structures will considerably alter the existing view due to the introduction of a tall building exceeding the height of adjacent buildings several times. The lack of architectural focus in this view will change significantly with the introduction of the proposed development. It will become a dominant point of focus and a new anchor in the overall townscape in this view. The stepped down tower to the right softens the overall verticality and helps to integrate the building better to adjacent existing buildings. The underlying existing characteristic components of the view remain. Similar to Viewpoint 10, the proposed Opera development will become visually a gateway to the commercial and cultural centre of Limerick as well as a visible and recognisable link to the medieval heart. The magnitude of visual effects is considered High. The resulting significance is Major-Moderate Beneficial.

Viewpoint / Photomontage 12: Thomond Bridge

This view is of one of the key waterfront panoramas towards the core city as identified in the Limerick 2030 Economic and Spatial Plan (refer to Designation Figure 1). The River Shannon is framed by the medieval quarter of Limerick and the Georgian Extension on the left and the promenade along Clancy's Strand on the right. The open view south across the River Shannon captures a number of important waterside buildings as identified in the Limerick 2030 Economic and Spatial Plan (refer to Designation Figure 1) namely, sections of King John's Castle to the left followed by the buildings of Limerick City Council, Limerick Circuit Court, the Hunt Museum and Sarsfield House. Local landmarks are the bell towers of St. Mary's Cathedral adjacent to the right of King John's Castle and St. John's Cathedral adjacent to the right of the City Council buildings. A further landmark, although not designated, is the lattice structure telecommunication tower above the Georgian Quarter in the background. The distance to the closest proposed building part is approximately 481m.

The value of this view is considered at Regional level. Visual receptors will mainly be pedestrians, tourists and vehicle drivers. The susceptibility to change is considered High as the majority of receptors will view this open panorama as an important and integral part of a high townscape quality experienced daily or at least regularly. The sensitivity is considered High.

The proposed development and in particular Parcel 5 will be prominently visible above the Limerick Circuit Court building. Parcel 1 and 3A will stay lower rise and form a new backdrop to sections of Sarsfield House and the Hunt Museum. The proposed 14 storey tower will considerably alter the existing skyline in this panoramic view. It will provide a new vertical urban landmark in the skyline of Limerick City additional to the bell towers of the cathedrals. It will set the scene for a new phase of city development. It becomes evident that the development will act as an important gateway between the medieval heart and the commercial heart of the city in this view. It will provide the northern counter development to the new river fronts along Harvey's Quay, Howley's Quay, Bishops' Quay and Steamboat Quay located further south and outside of this view. The stepped down tower structure to the right of the main tower softens the overall verticality. The underlying existing characteristic components of the river front remain intact. The magnitude of visual effects is considered High. The resulting significance is Major-Moderate. The change in visual amenity from this viewpoint is considered to be beneficial due to the bold but high-quality appearance of the proposed development.

Viewpoint / Photomontage 13: Riverfront at Curragour Park in front of Strand Barracks

This view east across the River Shannon is also one of the key waterfront panoramas towards the core city as identified in the Limerick 2030 Economic and Spatial Plan (refer to Designation Figure 1). The open view captures a number of important waterside buildings as identified in the Limerick 2030 Economic and Spatial Plan (refer to Designation Figure 1) namely the Hunt Museum and Sarsfield House, which sit prominently on the river bank. A local landmark is the upper part of the bell tower of St. John's Cathedral, which appears from behind Arthur's Quay Shopping Centre. The distance to the closest proposed building part approximately 311m. Limerick 2030 identifies also linear waterfront vistas along the Abbey River, which is joining the River Shannon to the left of the Hunt Museum. The white Sylvester O'Halloran pedestrian bridge connects the grounds of the Hunt Museum with the former Potato Market on the left side.

The value of this view is considered at Regional level. Visual receptors will mainly be pedestrians, local residents and tourists. The susceptibility to change is considered High as the majority of receptors will view this open panorama as an important and integral part of a high townscape quality experienced daily or at least regularly. The sensitivity is considered High-Medium.

The proposed western building front of the Opera development will form a new backdrop to the view while retaining the overall character of the river front. Parcel 5 will constitute hereby the most prominent change to the components altering the skyline. The upper parts of Parcel 1 appear similar in height to Arthurs Quay Shopping Centre and is not out of character in terms of appearance, although this building will screen a small section of the upper bell tower of St. John's Cathedral in this view. A limited view is available of the Parcel 3A façade and roof structures to the left of Sarsfield

House, partially screened by existing tree vegetation along the river front. It should be noted that in winter views, visibility of the development will increase slightly due to the absence of foliage on the existing trees. The tower structure will provide a new vertical urban landmark and a starting point for a new phase of city development. The magnitude of visual effects is considered High. The resulting significance is Major-Moderate Beneficial.

Viewpoint / Photomontage 14: Sarsfield Bridge - Western Bridgehead

This view is part of a range of key waterfront panoramas towards the core city as identified in the Limerick 2030 Economic and Spatial Plan (refer to Designation Figure 1). The view is framed by the medieval quarter to the left and the Georgian extension of the modern commercial heart of the city centre. This open view captures a number of important waterside buildings as identified in the Limerick 2030 Economic and Spatial Plan (refer to Designation Figure 1) namely Limerick Circuit Court, the Hunt Museum and Sarsfield House. Local landmarks are the bell towers of St. Mary's Cathedral to the left and St. John's Cathedral to the right. The view captures the beginning of the medieval heart to the left and the Georgian part of the city to the right very well, they are visually separated by the white Sylvester O'Halloran pedestrian bridge. The distance to the closest proposed building part is approximately 414m.

The value of this view is considered at Regional level. Visual receptors will mainly be pedestrians, residents, tourists and vehicle drivers. The susceptibility to change is considered High as the majority of receptors will view this open panorama as an important and integral part of a high townscape quality experienced regularly or daily. The sensitivity is considered High-Medium.

The proposed tower of Parcel 5 will form a new urban landmark behind Sarsfield House. The upper floors of the building structure of Parcel 1 and 3A will appear above Arthur's Quay Shopping Centre and to the side of Sarsfield House. The view of the existing river front will remain unchanged. However, the background of this view will be altered considerably with the introduction of the tall buildings of Parcel 5. As stated before, the proposed development will become a gateway between the medieval heart and the commercial heart of the city. It will provide a new urban anchor in the skyline. The magnitude of visual effects is considered High. The resulting significance is Major-Moderate Beneficial.

Viewpoint / Photomontage 15: Riverfront at O'Callaghan Strand

This view is also part of a range of key waterfront panoramas towards the core city as identified in the Limerick 2030 Economic and Spatial Plan (refer to Designation Figure 1). This open upstream view contains the bell tower of St. Mary's Cathedral in the background to the left, a local landmark as stated by Limerick 2030 and indicated in Designation Figure 1. Sarsfield House, an important waterside building as identified by Limerick 2030, is located to the right of the historic building of the Shannon Rowing Club Clubhouse and Sarsfield Bridge. Modern apartment blocks frame the water front along the River Shannon to the right. The roof top of the Franciscan Friary and sections of its bell tower are visible in the middle background. The distance to the closest proposed building part is approximately 588m.

The value of this view is considered at Regional level. Visual receptors will mainly be pedestrians, residents, and tourists. The susceptibility to change is considered High as the majority of receptors will view this open panorama as an important and integral part of a high townscape quality experienced regularly or daily. The sensitivity is considered High-Medium.

The proposed tower of Parcel 5 will form a new urban vertical landmark in the background. The view of the existing river front will remain unchanged. The tower structure will integrate well into the existing urban grain presented in this view due to the selection of façade material. While it will form a prominent element, it will not alter the overall composition of the view as it can be seen as a further extension of the recently built structures along the riverfront. The magnitude of visual effects is considered Medium. The resulting significance is Moderate Beneficial. The change in visual amenity from this viewpoint is considered to be beneficial due to the high-quality appearance of the proposed development.

Viewpoint / Photomontage 16: Brendan's Cross Roads in the vicinity of the townland of Knockalisheen, Co. Clare

This is a long-distance view from an elevated location in County Clare overlooking sections of the Limerick City skyline. The distance to the closest building part from this viewpoint is approximately 4.42km. Limerick City is located in the far middle distance and is seen in the rural context of County Clare. The city has a general low-rise appearance. The bell tower of St. John's Cathedral is one of the most pronounced vertical features of the skyline in this view. Other bell towers such as the ones of St. Mary's Cathedral and St. Mary's RC Church are recognisable but not as prominent as St. John's. Thomond Park Stadium is also clearly visible as a less vertical but prominent landmark in this view.

Elevated views of the City of Limerick along public roads from the west are rare. The value of this view is considered at Community level as there are generally common features of the rural landscape visible, which are valued locally. Visual receptors will be vehicle drivers and some nearby residents potentially walking along the road. The majority of receptors will not experience this view on a daily basis as views from within a car are barely possible due to intervening road side vegetation, particular during the summer months. Local residents may be able to capture this view on a more regular basis when walking. The receptors are considered to have a Medium-Low susceptibility to change. The sensitivity is considered Medium.

The proposed development will be visible from this location, with Parcel 5 being the most recognisable part followed by Parcel 1. A small section of the upper recessed portion of Parcel 3A is also visible. The visibility of the development at this distance will partially alter the character of the existing view. A new vertical urban landmark will be introduced to the skyline of Limerick City, setting the scene for a new phase of city development from this point of view. While St. John's bell tower will remain the tallest feature in this view, there will be a noticeable change in the overall composition. The Opera development will gain prominence in this view but it will not dominate. The magnitude of visual effects is considered Medium. The resulting significance is Moderate Beneficial.

Viewpoint / Photomontage 17: Bank Place / Charlotte's Quay

This close distance view is representative of views south west from Bank Place and from along a short section of Charlotte's Quay. The Granary building, flanked by mature tree planting, defines much of the western edge of Michael Street further to the south and strongly influences the nature of townscape character experienced in this view. In sharp contrast, the eastern building edge of Bank Place and Michael Street to the south, are defined by more recent developments which comprise office buildings, commercial premises and private residences of varying styles, materiality and scales. The view is terminated by mixed use developments in the far distance. The distance to the closest proposed building part is approximately 31m.

The value of this view is considered at Local level as this location offers a complete and unobstructed view of the western elevation of the Granary building in combination with a partial view of the river facing northern section of the building along Bank Place. Visual receptors will mainly be pedestrians, residents, vehicle drivers and tourists. This open view of the Granary building is experienced by receptors on a daily basis and therefore is an important part of the experience of townscape in this part of the city. The susceptibility to change is considered High and the resulting sensitivity is considered Medium.

The proposed development will introduce two clearly noticeable contemporary building structures into the view. The eastern façade of Parcel 5 is partially visible and is the most recognisable structure of the development in regard to its overall height and massing, generating a new scale of vertical development into this part of the city. The structure rises above the Granary building as a new city landmark that will mark the gateway between the medieval and commercial/Georgian areas of Limerick City. In visual terms, the horizontal bands of cladding to the building façade echo the horizontal and linear form of the Granary building along Michael Street. Parcel 1 further south will be partially visible above the Granary building and along Michael Street. The overall building mass at this location helps to define the Granary building by providing a strong urban edge that bookends the historic building, with its height and scale not dissimilar to the office buildings along Bank Place and

Charlotte's Quay. The development will introduce a new contemporary urban character within this view while also maintaining the integrity and setting of the Granary building which will retain its prominence and influence along Michael Street. The removal of existing trees against the Granary façade as part of the new public plaza at Bank Place will further increase the prominence of this historic building, with newly proposed trees set away from the immediate building façade. The magnitude of visual effects is considered High. The resulting significance is Major-Moderate Beneficial.

Viewpoint / Photomontage 18: Michael Street

This view north is located in close proximity to residential properties and is representative of views along Michael Street towards the proposed development. The extent of visibility is largely defined by the road carriageway and adjacent built form along the eastern and western edges of the street. The Granary building façade defines the eastern edge of the street, however, this strong building edge terminates at the existing stone wall boundary to the left of the view where a surface car park is currently located further south in an undeveloped area of land. The eastern edge of the street is comprised of various building types, scales and materiality. In the far distance, the view is terminated by buildings located on the north side of the Abbey River which include the Limerick School of Art & Design and residential buildings. The distance to the closest proposed building part is approximately 18m.

Despite the fact that there is an open view of the Granary buildings historic eastern façade, this viewing location is somewhat removed from the riverfront area in a more derelict and run down part of the street and therefore it is considered that the value of this view is at Community level. Likely visual receptors will be pedestrians, residents, and vehicle drivers. The susceptibility to change is considered High due to the close proximity of residential receptors along this area of Michael Street. The sensitivity is considered High

The proposed development will significantly transform the urban character experienced along Michael Street from this viewing location. The eastern façade of Parcel 1 will be visible in its entirety, continuing the built edge of the Granary building southwards along Michael Street, offering a strong urban edge and definition to the existing streetscape which is currently lacking. The mid to upper floors of the eastern façade of Parcel 5 will be visible over the Granary building. The development will replace a derelict and underdeveloped void to the south eastern portion of the overall urban block, providing a counterbalance between development along the east and west sides of Michael Street. While the newly introduced development will contrast with the existing urban character and scale of the established urban form, it will not detract or diminish the existing urban character in this area but rather enhance and improve it by redefining the eastern edge of Michael Street with high quality architecture and urban form. The Granary building will become further defined as a result of the proposed massing in combination with the removal of existing tree vegetation, with the resulting effect that this historic building will become an integrated, prominent and considered structure within the overall development. The magnitude of visual effects is considered High. The visual improvements to the streetscape and cohesive urban form of Michael Street are material and beneficial. However, there will be direct visual effects on residential properties along Michael Street located opposite the proposed development. The visual change is considered significant due to the enclosure of the block structure and the resulting effect on currently open view across the Opera site. The significance of visual effects is therefore considered Major-Moderate Adverse.

Viewpoint / Photomontage 19: Ellen Street

This view is representative of views northwest from Ellen Street near the junction with Michael Street. The existing derelict, degraded and underdeveloped character of the south eastern portion of the proposed development site is visible in the middle distance to the right of this view. Beyond the junction with Michael Street, Ellen Street becomes defined by a mix of buildings on each side comprised of various building types and materiality, some of which are derelict and in need of repair. Arthurs Quay Shopping Centre, located on Patrick Street, can be seen in the distance. The distance to the closest proposed building part is approximately 37m.

The value of this view is considered limited due to the relatively poor quality of townscape and large number of detracting elements which include derelict buildings, poor quality public realm, palisade fencing, and the weak urban grain associated with the proposed development site. Receptors include residents, pedestrians and vehicle drivers. The susceptibility to change is considered High and the sensitivity is High considering the proximity of residential receptors to the proposed development.

The proposed development will transform the south eastern portion of the Opera site at the junction of Ellen Street and Michael Street, generating a contemporary urban character. Parcel 1 stands at 5 storeys high and will be in open view from this location. The overall height before the setback above the fourth floor is respectful to the existing scale and height of existing buildings along the street, and does not appear out of scale in the existing setting. It’s important to note that the existing red brick building at the junction of Michael Street and Ellen Street (to the far right of this view), is 4 storeys in height and will offer a complimentary balance to the proposed scale and height of Parcel 1 at this location. Furthermore, the infill of the currently underdeveloped and degraded south eastern area of the Opera site is beneficial in terms of creating a defined urban block and street edge. Further west near the junction with Patrick Street, the refurbishment and development of Parcel 2A will lead to an increase in building height at this location however, the straight uninterrupted line of the proposed parapet is in keeping with the Georgian architecture of the area and will define the edge of the Opera site coming from the south along Patrick Street. Further improvements to existing buildings associated with the Parcel 2B refurbishments will increase the overall quality of townscape character experienced along Ellen Street. The magnitude of visual effects is Very High and the resulting significance is Major Beneficial.

Viewpoint / Photomontage 20: Patrick Street

This viewpoint looks northeast and is located towards the northern end of Patrick Street in close proximity to the south western portion of the proposed development site. The distance to the closest proposed building part is approximately 34m.

The view is largely contained to either side of the street by a mix of Georgian architecture and modern commercial buildings including Arthurs Quay Shopping Centre along the western side. A small section of Ormston House, a 19th century building located along Patrick Street with its distinctive Italianate style, can be seen to the right of the view near the junction with Ellen Street. To the east of the street, the Georgian terraced buildings define much of the townscape character experienced in this view however, the degraded and derelict condition of several of these buildings along with the presence of many distracting townscape elements along the street detract from the overall quality of the townscape experienced from this and similar locations along Patrick Street. The value of the view is therefore considered at a Community to Limited level. Visual receptors will mainly be pedestrians, tourist’s vehicle drivers and staff. The susceptibility to change is considered Medium as the view is likely to be experienced as part of a sequence of views as receptors move through the area, with the view not central to the main activity. The sensitivity is considered Medium.

The proposed development will be highly noticeable at this location along Patrick Street, with Parcel 2A, 3A, 3B and 5 visible in this view. The combined effect of the Opera development from here will alter the existing Georgian scale and urban character of this part of the city and signal the arrival at a new city district which aligns with the visions set out in the Limerick 2030 Economic and Spatial Plan. The refurbishment of existing Georgian buildings along Patrick Street combined with the addition of ground floor retail units will contribute to the overall upgrade of this part of Limerick City into a vibrant and modern city quarter. The magnitude of visual effects is High. The resulting significance is Major-Moderate Beneficial.

Viewpoint / Photomontage 21: Hunt Museum

This viewpoint is located to the front of the Hunt Museum within the grounds along Rutland Street and is oriented directly towards the existing Georgian terraced townhouses to the east. The foreground of the view is comprised of paving setts and planting within the museum grounds and is delineated from Rutland Street by a set of railings. While the overall form and presence of the Georgian architecture along the street remains intact, the addition of modern PVC windows and guard rails along several windows and a section of roofline detract from these historic building facades. The distance to the closest proposed building part is approximately 31m.

While detracting townscape elements exist within this view, the value of the view is considered at Local level given the location of this viewpoint to the front of the Hunt Museum, one of the main landmark buildings in Limerick, and within a relatively intact part of the Georgian quarter of Limerick. Visual receptors will mainly be pedestrians, tourists and museum staff. The susceptibility to change is considered High as the majority of receptors will experience this part of the townscape on a daily basis and the view is likely to be an important part of the experience for visitors at the museum. The sensitivity is considered High-Medium.

The proposed development will introduce a bold and prominent vertical structure in this view that will protrude over the existing buildings, altering the inherent Georgian scale currently experienced along Rutland Street. The mid to upper floors of the western elevations of Parcel 5 will be visible from this location, and the introduction of a tall building will slightly alter the focus in this view, however, given the setback of the development from the Georgian buildings along Rutland Street the proposed Opera development will become a contemporary new addition to the cityscape that is clearly defined as a separate entity behind the Georgian terraced buildings, reflecting the visions and aspirations for Limerick City as set out in the Limerick 2030 Economic and Spatial Plan. The magnitude of visual effects is considered High. The resulting significance is Major. Considering the immediate effect on the historical Georgian façades in this restricted view the quality of effects is deemed Adverse.

Viewpoint / Photomontage 22: Matthew Bridge

This viewpoint location is representative of views looking south from Matthew Bridge at Bank Place and along Rutland Street. This point in the city marks the transition between the medieval quarter to the north and the Georgian quarter to the south. Beyond the Abbey River and quay wall and to the centre of the view, Bank Place sits against a backdrop of the existing urban block where the proposed Opera site is located, and is flanked by Georgian terraced townhouses to the right and the Granary building to the left with a two storey office building in between. To the very left of the view, a mixed use residential and office block is located along Charlotte's Quay. Continuing south from Matthew Bridge along Rutland Street, the road corridor becomes distinctly Georgian in character enclosed by terraced buildings to the left of the street. A section of the Hunt Museum front façade is visible to the far right just beyond Matthew Bridge along with a small area of the upper parts of Sarsfield House which is located along Francis Street. The distance to the closest proposed building part is approximately 84m.

The value of this view is considered at Local level given the open nature of the view and visibility of the Abbey River, quayside environs and the relatively intact Georgian architecture along Rutland Street. The value of the view is also attributed to the extent of visibility of the Hunt Museum, one of the main landmark buildings of Limerick which is recognised as an important water side building in the Limerick 2030 Economic and Spatial Plan (refer to Designation Figure 1). Visual receptors will mainly be pedestrians, tourists and vehicle drivers. The susceptibility to change is considered High as the majority of receptors will experience this part of the townscape on a daily basis and the view is likely to be an important part of the experience as receptors transition over the Abbey River channel into the commercial core of the City Centre. The sensitivity is considered High-Medium.

The proposed development will become a bold, noticeable and prominent vertical landmark building at Bank Place due to the visibility of Parcel 5. Standing at 14 storeys and 66.10m above street level at its highest point, Parcel 5 is openly visible from this location. The building will introduce a new architectural style, form and scale to this part of the city and along the river front that will mark the gateway between the Georgian quarter, the commercial and cultural centre of Limerick, and the medieval heart of Limerick. The overall massing of Parcel 5 in this view is experienced as two vertical elements side by side, with glazing used as the predominant façade material. The introduction of the tall building at this location will alter the current townscape character of this area, introducing a new urban quality to this part of the city. The new public plaza at Bank Place will result in the removal of several existing trees in this view, along with the addition of new tree planting as part of the overall upgraded public amenity space to the north of the Granary building and Parcel 5. Further south along Rutland Street and Patrick Street, Parcel 3A and 2A, which involve the refurbishment and development of existing Georgian buildings, will be less noticeable from this viewpoint and will integrate into the existing building line along the street, with the main changes in visual terms relating to amendments in façade treatments. The overall massing and form of Parcel 2A in this view integrates successfully into the existing Georgian parapet line along Rutland Street and Patrick Street, offering a more simplified and linear outline which is more homogenous with the prevailing Georgian architecture along the streetscape when compared to the existing building form and roofscape. The magnitude of visual effects is considered High and the resulting significance is Major Beneficial.

Viewpoint / Photomontage 23: St. John's Castle

This viewpoint is oriented south east from the visitor platform within St. John's Castle and overlooks the castle courtyard and a section of the River Shannon. Notable landmarks in the existing city skyline are St. Mary's Cathedral and St. John's Cathedral to the south east. From this open panoramic vantage point, the city centre skyline to the south is visible which is comprised of various building developments which reflect the expansion of the city centre over time. Sarsfield House is a prominent building along the riverside with Arthur's Quay Park a significant green open space further to the south west. The distance to the closest proposed building part is approximately 445m.

The value of this panoramic view is considered at Local level as it contains prominent landmark buildings and several important waterside buildings as identified within the Limerick 2030 Economic and Spatial Plan (refer to Designation Figure 1), which include sections of St. John's Castle, Sarsfield House and the Limerick Court building. Visual receptors will mainly be tourists and castle staff. The susceptibility to change is considered High and the sensitivity is considered High.

The proposed development introduces a prominent landmark building into the city centre skyline along with additional lower level building structures in its immediate adjacency. Parcel 5 will appear as a stepped tower that is somewhat matched in height with the bell tower and spire of St. Mary's Cathedral and St. John's Cathedral. This tall building element will become a new point of focus within the existing skyline of Limerick City Centre and will mark the intended gateway into the commercial core of Limerick between the medieval heart and the Georgian quarter. Parcel 1 and 3A located in different parts of the development are visible to the right of Parcel 5 in this view, and will appear as a contemporary addition to the skyline that are not dissimilar in scale to Sarsfield House to the west and various taller mixed use developments further south in the city centre and to the far right of this view. The magnitude of visual effects is considered High and the resulting significance is Major Beneficial.

A summary table of visual effects from representative viewpoint locations is presented in table 12.15.

Table 12.15 Summary of Residual Visual Effects from representative viewpoint locations

Receptor/ Location	*Receptor Group*	*Approximate distance to development*	*Sensitivity*	*Magnitude (at operation)*	*Quality of Effects*	*Significance of Effects*
Photomontage 1: Lough Derg Way at Park Canal near junction with Lock Quay / Abbey Bridge	Residents, Walkers	345m	High-Medium	High	Beneficial	Major-Moderate
Photomontage 2: O'Dwyer Bridge on Athlunkard Street	Pedestrians, Vehicular traffic	503m	Medium	Medium	Beneficial	Moderate

Receptor/ Location	*Receptor Group*	*Approximate distance to development*	*Sensitivity*	*Magnitude (at operation)*	*Quality of Effects*	*Significance of Effects*
Photomontage 3: O'Dwyer Bridge on Athlunkard Street	Students, Staff, Visitors	632m	Medium-Low	Low	Neutral	Low
Photomontage 4: Milk Market at junction Carr Street / Mungret Court	Residents, Pedestrians, Vehicular traffic	126m	High-Medium	Medium	Beneficial	Moderate
Photomontage 5: Front Plaza at Limerick Colbert Train Station	Pedestrians	639m	Medium-Low	Low	Neutral	Low
Photomontage 6: The Crescent at junction Lower Hartstonge Street	Pedestrians, Vehicular traffic, Residents	791m	High	Low	Adverse	Moderate-Minor
Photomontage 7: O'Connell Street near T-Junction with Cruise's Street	Pedestrians, Vehicular traffic, Staff	168m	Medium	Medium	Beneficial	Moderate
Photomontage 8: Francis Street at Arthur's Quay side	Pedestrians, Vehicular traffic, Staff	117m	Medium-Low	Medium-Low	Beneficial	Moderate-Minor
Photomontage 9: Hunt Museum – Vehicular entrance from Rutland Street / Bank Place	Pedestrians, Vehicular traffic	34m	Medium	High	Beneficial	Major-Moderate
Photomontage 10: Georges' Quay near entrance of Limerick School of Art and Design (LSAD)	Students, Staff, Visitors, Vehicular traffic, Residents	100m	High-Medium	Very High	Beneficial	Major
Photomontage 11: Car Park at Limerick Circuit Court and Limerick City Council	Staff, Visitors	165m	High-Medium	High	Beneficial	Major-Moderate
Photomontage 12: Thomond Bridge	Pedestrians, Tourists, Vehicular traffic	481m	High	High	Beneficial	Major-Moderate
Photomontage 13: Riverfront at Curragour Park in	Pedestrians, Tourists, Residents	311m	High-Medium	High	Beneficial	Major-Moderate

Receptor/ Location	Receptor Group	Approximate distance to development	Sensitivity	Magnitude (at operation)	Quality of Effects	Significance of Effects
front of Strand Barracks						
Photomontage 14: Sarsfield Bridge - Western Bridgehead	Pedestrians, Tourists, Residents, Vehicular traffic	414m	High-Medium	High	Beneficial	Major-Moderate
Photomontage 15: Riverfront at O'Callaghan Strand	Pedestrians, Tourists, Residents	588m	High-Medium	Medium	Beneficial	Moderate
Photomontage 16: Brendan's Cross Roads in the vicinity of the townland of Knockalisheen, Co. Clare	Residents, Vehicular traffic	4.42km	Medium	Medium	Beneficial	Moderate
Photomontage 17: Bank Place / Charlotte's Quay	Pedestrians, Residents Vehicular traffic, Tourists	31m	Medium	High	Beneficial	Major-Moderate
Photomontage 18: Michael Street	Pedestrians, Residents Vehicular traffic	18m	High	High	Adverse	Major-Moderate
Photomontage 19: Ellen Street	Pedestrians, Residents Vehicular traffic	37m	High	Very High	Beneficial	Major
Photomontage 20: Patrick Street	Pedestrians, Tourists, Vehicular traffic, Staff	34m	Medium	High	Beneficial	Major-Moderate
Photomontage 21: Hunt Museum	Pedestrians, Tourists, Staff	31m	High-Medium	High	Adverse	Major
Photomontage 22: Matthew Bridge	Pedestrians, Tourists, Vehicular traffic	84m	High-Medium	High	Beneficial	Major
Photomontage 23: St. John's Castle	Tourists, Staff	445m	High	High	Beneficial	Major

Effects on Walking Routes

King's Island Bridge Slí na Sláinte

The tall components of the proposed development will be partially visible when walking along the open land along the banks of the River Shannon and Abbey River looking south as part of the overall Limerick skyline. The significance of visual effects is considered to range from Minor to Moderate depending on visibility and distance to the proposed development.

The Three Bridges Slí na Sláinte

The highest visual effects will be experienced when in close proximity to the development at Matthew Bridge crossing the Abbey River (refer to Photomontage 9 and 22 and associated descriptions in this section). The majority of open views of the proposed development, however, will be experienced when crossing the bridges and walking the banks of the River Shannon along Clancy's Strand and O'Callaghan's Strand. The significance of visual effects are illustrated in Photomontages 8 & 10 – 15 and described above. The significance of visual effects will range from Negligible to Major.

The City Centre Slí na Sláinte

The proposed development will either be fully screened or appear above the rooftops of existing intervening buildings. The significance of visual effects will range from Negligible to Moderate.

The Medieval Quarter

Views of the proposed development will be available for the majority of this walk. The significance of visual effects will depend on the openness of the view and the proximity of the walker to the Opera site. The walking route passes also directly along the western side of the Opera development. Views will become available on O'Connell Street, Patrick Street and Rutland Street. Further views will be experienced when crossing the Abbey River and later from Thomond Bridge, Clancy's Strand and Sarsfield Bridge. Photomontages 7, 9,10-14 and 20-22 as described above illustrate representative views of the development. The significance of visual effects will range between Negligible and Major depending on the distance and openness of the view.

The Georgian Quarter

Similar to the City Centre Slí, the proposed development will either be fully screened or appear above the rooftops of existing intervening buildings as shown in Photomontage 6 and as described above. The majority of this walk is located within the core of the Georgian quarter. The significance of visual effects will range from Negligible to Moderate.

Lough Derg Way

The vast majority of this walk will not be affected by the proposed development. Photomontage 1 illustrates a view when approaching the city centre. The development will come into view for the last 600m of the walking route when approaching Limerick city centre. The majority of significant views will be experienced when walking along the banks of the Abbey River. The significance of visual effects will range from Negligible to Major depending on the level of vegetative screening provided along the Park Canal and the overall distance to the development. Long distance views of the skyline of Limerick may be possible but are not considered significant as the walking route follows the lower grounds along or near rivers for some distance beyond the 5km study area.

Castletroy Slí na Sláinte

Views of the Limerick skyline including the proposed development are unlikely due to intervening road side vegetation and existing building structures

Effects on key linear vistas

The Limerick 2030 Economic and Spatial Plan identifies a number of key linear vistas, localised views and waterfront panoramas as indicated in Designation Figure 1.

Localised Key Views will not be affected by the proposed development. There will be visual effects on Linear Urban Vistas, namely north along O'Connell Street. Photomontages 6 and 7 illustrate the potential effects arising from the proposed development as described above. The significance of visual effects is considered to range between Moderate-Minor to Moderate. The Linear Urban Vista along Catherine Place / Catherine Street will be similarly affected as shown in Photomontage 6. However, small sections of the proposed building structures may appear above the roof tops on the left in the background. The third vista is located along Nicholas Street in the medieval heart of Limerick. There will be glimpsed views of the development appearing above the roofscape in the background in some locations. Views will be generally restricted by intervening building structures located to either side of this street. The significance of visual effects is considered Minor.

The majority of *Linear Waterfront Vistas* are located across the Georgian Quarter from east to west and will therefore not be affected by the proposed development. However, the proposed development will introduce a new urban built structure in the viewshed along the Abbey River and the Canal Park as illustrated in Photomontage 1 and 10 as described above. The significance of visual effects ranges between Negligible to Major.

The Limerick 2030 Economic and Spatial Plan identifies also *Riverside Panoramas* and distinguishes them into views away from the city or towards the city core. The development will be seen in panoramic views towards the city core only. Photomontages 12-15 illustrate the development in these vistas as described above. The significance of visual effects is considered to range from Moderate in the southern part to Major-Moderate in the northern part of the views designated.

12.7 Mitigation Measures

Mitigation is a term used to describe the measures or actions that may be taken to minimise environmental effects. The purpose of mitigation is to avoid, reduce and where possible remedy or offset, any significant adverse direct and indirect effects on the environment arising from the proposed development.

The principal mitigation for the proposed development is inherent in the design of its architecture, public realm and open space, which has evolved through an iterative process of assessment and consultation. There are no operational management measures required in respect of townscape and visual issues.

During the demolition and construction works of each, measures such as site hoardings and cleaning roads to remove any track out will be undertaken to reduce temporary effects on visual amenity. No additional mitigation is proposed further to that incorporated into the design.

Landscape Masterplan

The masterplan has been developed through an iterative process which has helped to ensure that, wherever possible, adverse effects on the townscape and visual amenity are designed out, and the opportunity for beneficial effects is maximised. The master plan has been developed around the parameters of Permeability, Movement, Spatial Hierarchy, Gateway, Peripheral Streetscape and Desire Lines.

The landscape proposals are comprised of the following main elements:

The Central Plaza: A contemporary main plaza space located in the centre of the development providing a structural element to the site layout. It will be a focus for daily activity and seasonal events.

Bank Place: New tree planting is proposed across this new public space within the planters and the lower terrace in front of the Granary Building. These trees will be cleared stemmed to 3m and ultimately conjoined to form a constant canopy to the space. It is envisaged that the trees will be lopped at 9m height. This provides enclouse and wind shelter to the public space.

The Granary: Provides a hidden space to be discovered. Its character is inherently influenced by the adjoining Granary building.

Surrounding Streetscape improvements: Public realm and street scape improvements to the surrounding streets anchor the site into its setting.

Roof Gardens: There are two private roof gardens included in the development providing amenity space to the adjoining buildings.

The complete landscape master planning set is contained in the planning submission package.

12.8 Cumulative Effects

In order to ensure a reasonable and proportionate cumulative assessment, only developments that are considered to be similar in scale, type and nature to the Proposed Development have been included within the assessment of cumulative effects within this TVIA. A list of cumulative schemes that have planning consent or are in the planning process and may be completed by 2023, the anticipated completion of the Opera Development, is enclosed below. Furthermore, developments that are currently under construction are considered to be part of the townscape and visual baseline.

Table 12.16 Cumulative developments considered within this assessment

Scheme	Distance from development site centres	Status	Anticipated Status at 2024	Description
The Bishop's Quay	650m	Consented	100% complete and operational	Planning Ref 16800: Commercial and residential mixed along Bishops Quay including the construction of a building comprising 15-storeys over 2 basement levels fronting Lower Cecil Street and Bishop's Quay
The International Rugby Experience	530m	Consented	100% complete and operational	Planning Ref 171180: The demolition of No. 40 and No. 41 O'Connell Street and construction of a new building consisting of a 7-storey block with 2-storey portico fronting O'Connell Street. Development will provide multi-media visitor experience, exhibition and education space for the "International Rugby Experience”

Cumulative townscape and visual effects with The Bishop's Quay development

Combined views of The Bishop's Quay and Opera developments will be possible for the majority of views from Shannon Bridge and O'Callaghan's Strand towards Sarsfield Bridge or from the eastern end of Thomond Bridge looking south. The tallest and most prominent building structures of the proposed developments will be approximately 650m apart. The Opera development will introduce a new high-rise development at the northern end of the city centre of Limerick, which is currently low-rise but pronounced by the bell tower of St. Mary's Cathedral. The Bishop's Quay development adds another high-rise development in close proximity to the existing 59m high Riverpoint building, also located at The Bishop's Quay, and the existing Clayton Hotel with 57m slightly further south at Steamboat Quay. If the second high-rise building would be constructed at The Bishops' Quay, there would be 3 high-rise buildings located within approximately 480m to each other at the southern end of the Limerick city centre forming a band of similar buildings in style and height along the quays. The proposed Opera development will be seen as detached from these developments due to the long distance between them. The Opera site is also not located along the river front, which integrates this proposed development into the existing townscape. Views of both developments at the same time from within the city centre and the Georgian Quarter are unlikely. The viewer has to turn the head to see either one or the other development if any at all due the distance between each other, intervening existing built structures and their location at the north end and south end of the city centre. Views of both developments along the river banks will also become gradually sequential when moving towards Sarsfield Bridge and further north as both developments cannot be seen at the same time without turning the head. Only further north, along the eastern part of Thomond Bridge and sections of the eastern river embankments, both developments can be seen in combination again when looking south. The sensitivity of the townscape character in views along the river front is considered High-Medium. Additional changes to the townscape character are considered High as the character of the Limerick skyline will change further. A new prominent tall landmark will be introduced to the currently low-rise character of the northern city centre. The significance of cumulative effects is considered Major-Moderate. The cumulative change is considered to be Neutral as both developments stand apart and do not directly relate to each other.

Cumulative townscape and visual effects with the International Rugby Experience development (Rugby Museum)

The majority of combined views of the Rugby Museum and the Opera site development will be possible in views north along O'Connell Street beginning approximately at The Crescent (refer to Photomontage 6). Views along O'Connell Street belong to one of the key linear urban vistas available in the grid pattern of the Georgian Quarter of the city centre as identified in the Limerick 2030 Economic and Spatial Plan (refer to Designation Figure 1). The consented 7 floor tower of the Rugby Museum will partially screen the upper floors of Parcel 5 of the Opera site in views to the north. In fact, the Rugby Museum will become visually more prominent than the proposed Opera site in views further north along O'Connell Street until passing the Rugby Museum. The architectural language of both developments is similar. Both will introduce contemporary architecture with taller building elements into a historical city centre context. The Rugby Museum is hereby prominently located within the centre of the Georgian core of Limerick City. The proposed Opera site is located at approximately 530m distance at the edge of the city centre. Views further north along O'Connell Street will become sequential, i.e. the viewer has to turn the head to see either one or the other development. Combined visibility of both developments away from O'Connell Street will be limited to sections along O'Callaghan Strand along the western shore of the River Shannon and in views south from the visitor platform at St. John's Castle (refer to Photomontage 23), from sections of Thomond Bridge (refer to Photomontage 12) and sections of Clancy's Strand.

The magnitude of cumulative townscape and visual effects is therefore considered to be Moderate-Low. The significance of cumulative change is considered Neutral as both developments stand apart and do not directly relate to each other. However, the historic low-rise central townscape of similar roof heights will become more diverse when both developments are visible together.

Cumulative Sensitivity Tests

The following provides a high level, qualitative assessment of potential cumulative effects on the townscape character and visual amenity of the Opera development together with the envisaged Arthur's Quay developments as outlined in the Limerick 2030 Economic and Spatial Plan.

Limerick 2030 envisages the redevelopment of Arthur's Quay including Arthurs' Quay Shopping Centre and Sarsfield House. The vision is to replace the existing building structures with a quayside park forming a new public waterfront. New commercial buildings and a new city square across O'Connell Street are to redefine this quarter entirely and integrate the River Shannon to this part of the city again. Indicative visualisations illustrating the Limerick 2030 vision are included in Section 2 Relevant Legislation, Planning Policies and Guidance.

These proposals would be located west and adjacent to the Opera site. The transformation of this site would lead to a significant positive cumulative change in the townscape character. While there are no details on the development scale, materials and final location available, it would appear that the visual amenity can be enhanced as the result of a much-improved architectural response and landmark development. This would result in significant positive cumulative visual effects as the overall city quarter would become in its entirety a new focal point of the northern city centre and indeed a gateway or cardinal point between the medieval heart and the commercial heart of the city, much more than the Opera site alone. It would seem that the Opera site would be the first development in this area and its effects and changes to the skyline and on surrounding blocks should be considered together in the light of the vision set out by Limerick 2030 rather than in isolation.

12.9 Difficulties Encountered in Compiling Information

Sections 12.2 - Scoping and 12.3 - Methodology above outlines in detail the approach of the preparation of this townscape and visual impact assessment. References used are included in Section 12.11 below.

The information available combined with on-site surveys have allowed for the preparation of a comprehensive and robust landscape (townscape) and visual impact assessment.

12.10 Summary

The principal mitigation for the proposed development is inherent in the design of its architecture, public realm and open space, which has evolved through an iterative process of assessment and consultation. There are no operational management measures required in respect of townscape and visual issues. A full set of the landscape architectural master planning as well as a design rationale is included in the planning application.

12.10.1 Effects at Construction

During construction townscape and visual effects will be highest within the immediate vicinity of the site and within the principal visual zones with a radius of approximately 500m from the boundary of the Opera site. The visibility of construction works within the wider study will be limited to glimpsed views from within the urban or suburban quarters. In these quarters, glimpsed views will become available of the high-rise construction works only as screening provided by intervening buildings, topography and/or vegetation. More open views of the construction work but less significant due to the effects of distance will also be available from locations beyond 500m along the banks of the River Shannon. Construction effects will be temporary.

12.10.2 Townscape Effects

The majority of the proposed changes will be beneficial to the townscape character as it will become a high-quality urban quarter and replace the current degraded and neglected character of the area. However, adverse effects can arise due to the height of some of the proposed buildings when compared to other quarters in the vicinity, which will stand in contrast to the proposed development character. However, the development should be considered in the light of the most recently published guidelines for ‘Urban Development and Building Heights’ published by the Department of Housing, Planning and Local Government, December 2018., which recognises that taller buildings can assist in reinforcing and contributing to a sense of place within a city or town centre. The proposal is also to be seen as the first part of a general transformation envisaged for the northern end of the Georgian city extension (refer to the vision of Limerick 2030 Economic and Spatial Plan and development policies of Limerick City Council).

The effect on the character from longer distance views within the Georgian Quarter and general commercial core further south is restricted due to intervening existing building structures obstructing either fully or the majority of the proposed development. The quality of change to the character of the inner-city Georgian Quarter is considered adverse in locations where the development will partially intrude above the historic rooflines. While it will not change the overall character of the townscape in these areas, it will add a new feature to the baseline conditions.

The proposed development will also impact significantly on the wider area profile (up to 1km), particularly when experienced in open views from the western river bank of the River Shannon (Area Profiles of Thomondgate / Ennis Road) where the overall character of the city centre skyline can be experienced. The proposed development will result in permanent noticeable changes to some of the key characteristics of the city centre skyline. The development will introduce a prominent high-rise element in the currently low-rise character of the centre and northern part of the Georgian Quarter. The development will not conflict with the visual integrity of the Cathedral spires from the majority of viewpoints.

Townscape effects from the remaining Area Profiles including Thomondgate / Ennis Road (away from the river front), Corbally / King's Island (outside the medieval centre to the north), Garryowen / Singland, Edward Street / Jansboro, South Circular Road / Ballinacurra and Southill, will likely not result in significant effects due to the flat topography and wealth of intervening buildings and vegetation. The main visual receptor groups will be residents, pedestrians and vehicle drivers in these areas. The introduction of the proposed development may be visible in glimpsed or open views where it will be seen rising above the existing skyline of the city centre in the distance. However, introduction of the development in the distance will not alter the existing locally prevailing townscape character.

Isolated views of the city skyline may be possible from the Area Profiles of Caherdavin & Moyross. These townscape profiles are located to the west and northwest of Limerick at a distance to the city centre. The overall topography begins to rise gently to the north and northwest. The introduction of the proposed development may be visible in open views where it will be seen rising above the existing skyline of the city centre in the distance. While the change in the city skyline will be noticeable, the introduction of the development in the distance will not alter the existing locally prevailing townscape character.

12.10.3 Visual Effects

A detailed description and analysis of visual effects for all 23 representative photomontages as well as a summary table is provided in Section 12.6.4 above.

The highest significant visual effects tend to occur when in close proximity to the site, such as from Bank Place, Michael Street, Ellen Street, Patrick Street, Francis Street, Rutland Street and Georges' Quay, Bridge Street, Merchant's Quay and Charlotte's Quay. The overall proposed development will result in significant changes to the Opera site and its appearance from surrounding areas. The proposed restoration of a number of currently vacant and often derelict historic houses along Ellen Street, Patrick Street and Rutland Street will retain an interesting mix of historic and contemporary architecture in available views, which is generally positive as a currently unused, run down city quarter will become visually attractive and part of active city life again. The proposed development will considerably alter the existing views, particularly due to the introduction of the 14 storey tower, which will exceed the height of adjacent buildings several times. The development will become a prominent focus in these close distance views but also a new anchor in the overall townscape. The stepped down tower to the west and south of the main tower softens the overall verticality and helps to connect better to the adjacent existing buildings.

The main visual receptor susceptible to potential adverse visual effects is the local community in close proximity of the Opera site, which will experience potential views of the development on a daily basis. The introduction of the proposed scheme will substantially alter the existing character of these views. The introduction of new buildings with a high-quality appearance and public access across the Opera site will change and enhance the current quality of views significantly. However, considering the close proximity of some residential units located along Michael Street or adjacent perpendicular streets some of these effects can be perceived as adverse. This is due to the close proximity of tall building frontages currently not in existence, particular when experienced from Michael Street and St. Michael's Court looking west.

The majority of medium distance views will include the high-rise sections of the development only, which will be experienced from the western bank of the River Shannon along Clancy's Strand and O'Callaghan's Strand, Arthur's Quay, Lock Quay and visitor platform of St. John's Castle. The proposed development and in particular the proposed 14 storey tower will significantly alter the existing skyline in these panoramic views. It will introduce a new vertical urban landmark in the skyline of Limerick City additional to the bell towers of the cathedrals (where visible). It will set the scene for a new phase of city development. It becomes evident that the development will act as an important gateway between the medieval heart and the commercial heart of the city in these views. It will provide the northern counter development to the new river fronts along Harvey's Quay, Howley's Quay, Bishops' Quay and Steamboat Quay located further south. However, the Opera development is not located at the river front; it will integrate into the general surrounding townscape. The stepped down tower structures to the west and south of the main tower and the choice of façade materials softens the overall verticality. The underlying existing characteristic components of the river front will remain intact. The change in visual amenity from these areas is considered to be beneficial due to the bold but high-quality appearance of the proposed development.

Potential views from within the city centre and in particular from the Georgian Quarter are either fully screened or restricted by intervening building structures. However, sections of the upper floors of Parcel 5 will appear above the roofscape in some locations (refer to Photomontage 6 as an example). Visible parts of the development will introduce a new type of building structure and materials in these cases along the roofscape of the otherwise often uniform and straight-lined brick parapets of the historic Georgian buildings. In that sense the potential visibility of the straight-lined roof of the proposed development is not totally out of character. The proposed development will not become a character changing element in these views. However, it will intrude above the otherwise mainly unbroken historic roof lines. It will also gain more prominence with less distance when walking on the western side along O'Connell Street to the north.

Long distance views, outside the core study area of 1.5km, from within the remainder of the 5km study area are generally restricted by the overall flat or gently undulating nature of the land and by intervening existing building structures and vegetation. However, long distance views of the skyline of Limerick and the upper sections of the high-rise element of the development can be experienced from isolated locations where there is no or little intervening topography, vegetation or building structures (refer to Photomontage 16 for reference).

12.10.4 Cumulative Effects

There are two consented projects, which may result in cumulative townscape and visual effects when seen together with the Opera development, namely 'The Bishop's Quay' at the southern end of the Georgian Quarter and 'The International Rugby Experience' (Rugby Museum) located along O'Connell Street in the historic centre of Limerick.

Additional changes to the townscape character and visual amenity will arise mainly from 'The Bishop's Quay' development due to the height of the proposed river front building, which would add a 3rd high-rise building to the river front in this area. Combined views of the Opera development and The Bishop's Quay development will be possible from Shannon Bridge and O'Callaghan's Strand towards Sarsfield Bridge or from the eastern end of Thomond Bridge as well as sections of the eastern river embankments looking south, resulting in moderately significant additional townscape and visual effects. The tallest and most prominent building structures of the proposed developments will be approximately 650m apart. The Opera development will introduce a new high-rise development at the northern end of the city centre of Limerick, which is currently low-rise but pronounced by the bell tower of St. Mary's Cathedral. The Bishop's Quay development adds another high-rise development in close proximity to the existing 59m high Riverpoint building, also located at The Bishop's Quay, and the existing Clayton Hotel with 57m slightly further south at Steamboat Quay. The proposed Opera development will be seen as detached from these developments due to the long distance between them. The Opera site is also not located along the river front, which integrates this proposed development into the built townscape. Views of both developments at the same time from within the city centre and the Georgian Quarter are unlikely. The viewer has to turn the head to see either one or the other development due to their location at the north end and south end of the city centre and the resulting distance between them. The majority of views of one or other development will be obstructed due to intervening existing buildings.

Cumulative changes resulting from the consented Rugby Museum and the Opera site development will concentrate in views north along O'Connell Street beginning approximately at The Crescent. The 7 floor tower of the Rugby Museum will partially screen the upper floors of Parcel 5 of the Opera site in views to the north. The Rugby Museum will become visually more prominent than the proposed Opera site in views further north along O'Connell Street until passing the Rugby Museum. The architectural language of both developments is similar. Both will introduce contemporary architecture with taller building elements into a historic city centre context. The Rugby Museum is hereby prominently located within the centre of the Georgian core of Limerick City. The proposed Opera site is located at approximately 530m distance at the edge of the city centre.

Combined visibility of both developments away from O'Connell Street will be limited to sections along O'Callaghan Strand along the western shore of the River Shannon and in views south from the visitor platform at St. John's Castle (refer to Photomontage 23), from sections of Thomond Bridge (refer to Photomontage 12) and sections of Clancy's Strand.

The significance of cumulative change is considered Neutral as both developments stand apart and do not directly relate to each other. However, the historic low-rise central townscape of similar roof heights will become more diverse when both developments are visible together.

12.11 References

The following sources, national and international best practice guidelines were used in the assessment:

- EPA guidance 'Guidelines on the Information to be contained in Environmental Impact Statements', 2002;
- EPA EIS Manual 'Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)', 2003;
- EPA 'Revised Guidelines on the Information to be contained in Environmental Impact Statements', Draft, September 2015;
- EPA 'Guidelines on the information to be contained in Environmental Impact Assessment Reports', Draft, August 2017;
- GVLIA3, 'Guidelines for Landscape and Visual Impact Assessment', 3rd Edition, 2013, Landscape Institute (UK) & IEMA;
- 'Urban Development and Building Heights', December 2018, Department of Housing, Planning and Local Government
- 'Limerick 2030 Economic and Spatial Plan for Limerick', November 2014, Limerick City & County Council
- Limerick City Development Plan 2010-2016
- Limerick County Development Plan 2010-2016
- Clare County Development Plan 2017-2023
- 'European Landscape Convention', Council of Europe, Florence, 2000
- 'National Landscape Strategy for Ireland 2015-2015', Department of Arts, heritage and the Gaeltacht, 2015
- 'Photography and Photomontage in Landscape and Visual Impact Assessment', Landscape Institute Advice Note 01/2011;
- 'Visual Representation of Wind Farms', Version 2.2, Scottish Natural Heritage, February 2017 (in relation to viewpoint selection, technical equipment, function and limitations of visualisations).
- Irishtrails; http://www.irishtrails.ie/; and
- Ordnance Survey Ireland, 1:50,000 Discovery Mapping.

13 Traffic and Transport

13.1 Introduction

This chapter assesses the impact of the proposed development on the surrounding transport network and where required mitigation measures are identified.

The site location is outlined in Chapter 2. The following are relevant to note in relation to the development proposal:

- The site currently generates traffic movements as a surface car park of approximately 100 car parking spaces is provided;
- This existing surface car park is accessed from Michael Street;
- The development proposal involves a basement car park which will provide 155 car parking spaces;
- The proposed basement car park will be accessed from Michael Street;
- The proposed development involves the regeneration of an underutilised site within Limerick City Centre. From a traffic and transport perspective development in this type of City Centre location supports the provision of sustainable transport.

13.2 Methodology

The methodology for this chapter was developed using recognised national assessment guidelines[24] and is outlined in the following sections.

13.2.1 Baseline Conditions

The baseline conditions have been established by means of site visits, traffic surveys, policy review, GIS mapping, and aerial photography. These were used to develop an understanding of the existing baseline conditions within the surrounding transport network.

13.2.2 Defining the Study Area

The study area has been established based on the likely areas of influences of the development on various travel modes, such as walking, cycling, public transport and vehicular traffic:

- Walking – the focus is on the impact of the development on the urban realm and walking conditions near the site;
- Cycling – the focus is on the impact that the development could have on cycle facilities surrounding the site;
- Public transport – the focus is on access to public transport facilities such as local bus stops and the impact that traffic congestion could have on public transport service reliability; and
- Vehicular traffic – the focus is on traffic flows at several key junctions and road links surrounding the site and the impact that traffic congestion could have on network performance.

Based on the above the study area has been defined to include the areas within the following links and junctions:

[24] See references in Section 13.9

Junctions

- Patrick Street / Ellen Street Priority Junction;
- Patrick Street / Francis Street Signalised Junction;
- Bridge Street / Rutland Street / R445 Signalised Junction;
- R445 / Michael Street Priority Junction;
- Michael Street / Ellen Street Priority Junction; and
- Michael Street / Car Park Access Priority Junction.

Links

- Patrick Street;
- Rutland Street;
- Francis Street;
- Michael Street;
- Ellen Street; and
- Bank Place / R445;

13.2.3 Defining Significance

Significance of Effects

The EPA (2017) Guidance (Guidelines on the Information to be contained in Environmental Impact Assessment Reports, Draft) identified that significance of effects

"Is usually understood to mean the importance of the outcome of effects (consequences of the change). Significance is determined by a combination of (objective) scientific and subjective (social) concerns".

In general, impact significance is defined using a combination of sensitivity (e.g. high, medium and low) of the environmental feature and the magnitude of impact (e.g. major, moderate, slight and negligible).

The criteria for assessing sensitivity and magnitude level has been defined in Tables 13.1 and 13.2. The overall significance of an impact, taking the relationship between sensitivity and the magnitude level into consideration in Table 13.3.

The significance level attributed to each effect has been assessed based on the magnitude of change due to the proposed development and the sensitivity of the affected receiving environment to change as set out in Section 1.3 EIA Methodology.

Receptor Sensitivity (or significance)

Sensitivity is generally defined according to the relative value or importance of the feature, i.e. whether it is of international, national, regional and local importance; by the sensitivity of the receptor in the case of traffic and transport as its susceptibility or vulnerability to change.

Table 13.1 Sensitivity and Description of Impact

Sensitivity Description of Impact	Criteria
High	Receptors of greatest sensitivity to change such as highly congested junctions, which have a low capacity to accommodate change without significant effect arising.
Medium	Receptors which have a moderate capacity to accommodate change without significant effects arising.
Low	Receptors which have a high capacity to accommodate change without significant effects arising.
Negligible	Receptors with low sensitivity to traffic flows and those sufficiently distant from affected links and junctions. Receptors that are very lightly used (relative to other modes within the study area) which have a very high capacity to accommodate change without significant effects arising.

Magnitude of Impact

The above criteria have been used to assess the magnitude of change as set out in Table 13.2. This table has then been used to identify the magnitude of change for quantitative assessment, supported by professional judgement to take full account of the specific context in the study area.

Table 13.2 – Magnitude of Impacts Assessment Criteria

Magnitude of Impacts	Criteria	Measure of Impact
High / Major	Change which are perceptible and would result in significantly change to conditions	Change in: Degree of Saturation > 15% or HGV flow > 6%
Medium	Change which are perceptible and would change conditions which otherwise prevail.	Change in: Degree of Saturation > 10% but <15% or HGV flow > 4% but < 6%
Low / Small	Change which are perceptible but would not change conditions which otherwise prevail	Change in: Degree of Saturation > 5% but <10% or HGV flow > 2% but < 4%
Negligible	Change that is unlikely to be perceptible.	Change in: Degree of Saturation <5% or HGV flows over < 2%

Significance of Impact and Typical Description

The EPA (2017) Guidance has been used to categorise the significance of impact as shown in Table 13.3 below**.**

Table 13.3 Significance of Impact Description

Significance of Effect	Description
Imperceptible	An effect capable of measurement but without significant consequences.
Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant Effects	An effect which, by its character, magnitude, duration and intensity significantly alters most of a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of sensitive aspects of the environment.
Profound Effects	An effect which obliterates sensitive characteristics.
Neutral	No effect or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.

Traffic and Transport Impact Matrix

Based on the receptor sensitivity, the magnitude of impact and the significance of impact the following matrix (Table 13.4) have been developed for the traffic and transport assessment of the development.

Table 13.4 Traffic and Transport Impact Matrix

Description of Impacts	Existing Environment (Significance / Sensitivity)			
	High	Medium	Low	Negligible
High	Profound	Very Significant	Moderate / Slight	Not Significant
Medium	Very Significant	Moderate	Moderate / Slight	Slight / Not Significant
Low	Significant / Moderate	Moderate / Slight	Slight / Not Significant	Not Significant
Negligible	Not Significant	Not Significant	Not Significant	Imperceptible

Impacts are generally considered significant (and in need of mitigation) if they are profound, very significant, significant or moderate. Slight and imperceptible effects are not considered to be significant.

Impacts have been described as:

- Beneficial, neutral or adverse;
- Permanent or temporary; and
- Short (< 5years), medium (5-10 years) or long term (10+ years)

Temporary impacts are those associated with the demolition and construction activity, while permanent effects those associated with the operation of the development.

13.2.4 Traffic Modelling Scenarios

In accordance with TII Traffic and Transport Assessment Guidelines (2014) the following modelling scenarios have been tested:

- Base Year representing existing vehicular traffic flows and existing transport provision;
- Opening Year with / Without Development;
- Opening Year + 5 Year Forecast With / Without Development; and
- Opening Year + 15 Year Forecast With / Without Development.

From a traffic and transport perspective the opening year for the development is 2022 when Phase 1 will be complete, and the basement car park will be available for use. The future year plus five- and fifteen-year assessments are therefore 2027 and 2037 respectively.

13.2.5 Traffic Flow and Junction Data

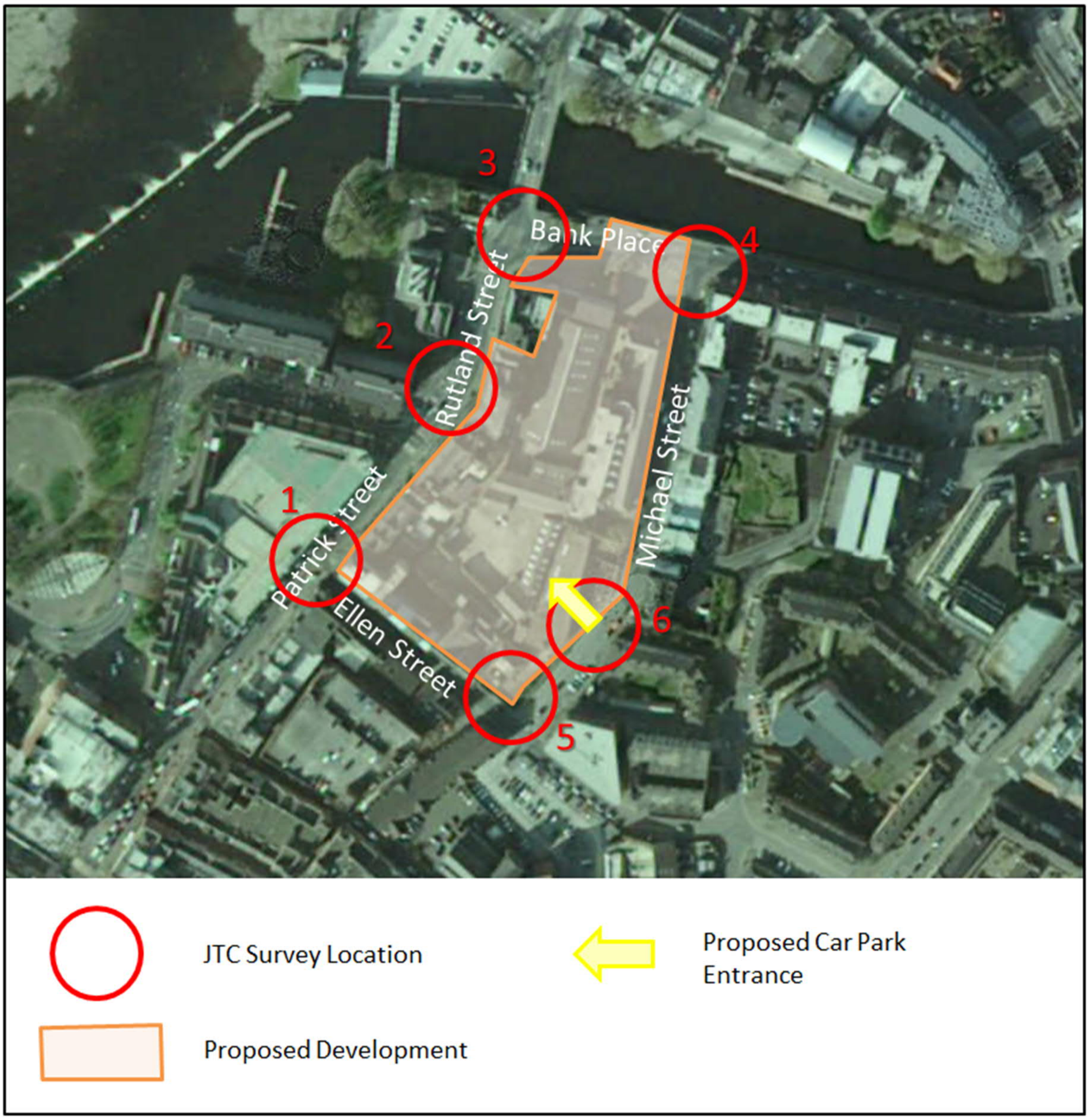
Baseline junction turning counts (JTC) were undertaken at six junctions near the proposed development site to establish the existing traffic conditions.

The junctions surveyed are as follows:

1. Patrick Street / Ellen Street (Priority Junction);
2. Patrick Street / Francis Street (Signalised Junction);
3. Bridge Street / Rutland Street / R445 (Signalised Junction);
4. R445 / Michael Street (Priority Junction);
5. Michael Street / Ellen Street (Priority Junction);
6. Michael Street / Car Park Access (Priority Junction);

These are illustrated in the map in Figure 13.1 below.

Figure 13.1: JTC Survey Locations (Source: Google Maps)



The traffic surveys were carried out over a three-day period from Tuesday 25th April to Thursday 27th April 2017. Data was collected in 15-minute intervals and classified according to vehicle type as follows:

- Car;
- Light Goods Vehicle (LGV);
- Other Goods Vehicle 1 (OGV) refers to 2 or 3 axle rigid vehicles;
- Other Goods Vehicle 2 (OGV2) refers to 3-axle articulated or 4 to 6 axle vehicles;
- Public Service Vehicle (PSV) refers to bus or coach;
- Motor Cycle (MC); and
- Pedal Cycle (PC).

Junction 1 to Junction 5 inclusive was surveyed for a three-hour morning period (07:00 – 10:00) and a three-hour evening period (16:00 – 19:00) to capture the AM and PM peak traffic hours. Junction 6, the car park access, was surveyed for a twelve - hour period (07:00 – 19:00) to determine the occupancy levels of the car park over the day.

Following analysis of the collected traffic survey data, the AM and PM peak periods for the assessment were determined as (08:00-09:00) and (17:00-18:00) respectively. The traffic impacts of the development have been assessed during the AM and PM peak periods, for the six junctions highlighted above.
Transport Infrastructure Ireland (TII) Project Appraisal Guidelines (PAG) – Unit 5.5 Link Based Traffic Growth Forecasting has been used to forecast future year flows for this assessment.

Annual Average Daily Traffic (AADT) has been calculated based on the following methodology.

- Traffic flows were obtained from a Transport Infrastructure Ireland fixed counter site on the R445 Dublin Road approximately 400m west of the Annacotty Roundabout.
- The R445 directly passes the northern and western parts of the site and is considered a good comparison link.
- Average monthly and daily volume AM and PM peak traffic flows were extracted from the TII survey site and divided by the AADT value for the year to obtain a suitable expansion factor.
- This expansion factor was multiplied to the PM flows of the April 2017 traffic data to project a Daily AADT figure for traffic on each link.

Annual Average Weekly Traffic (AAWT) was calculated in a similar methodology to AADT.

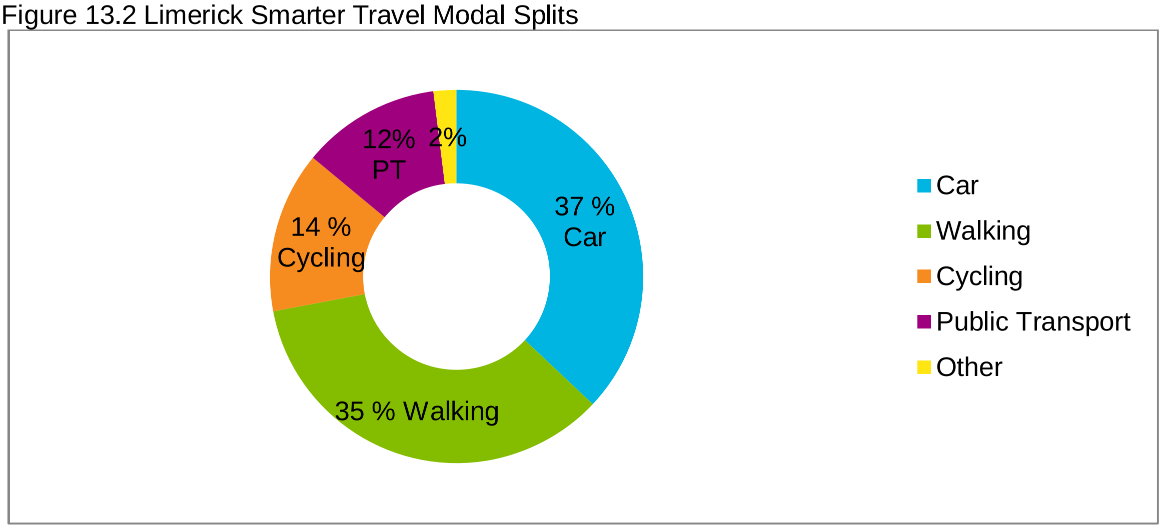
The distribution of development traffic has principally been based on existing link gravity flows and turning counts from baseline traffic data and proximity of public car parks.

13.2.6 Trip Rates

Development multi-modal trip rates were derived from the Employment Densities Guide 2nd Edition by Drivers Jonas Deloitte (2010).

Limerick Smarter Travel modal split targets were used to inform the mode share projections for the proposed development. These targets are shown in the Figure 13.2 below.

Figure 13.2 Limerick Smarter Travel Modal Splits



Peak AM and PM development traffic, arrivals and departure, percentages were derived from comparable sites on TRICS 7.5.3 database. The TRICS database is an industry recognised data source for deriving trip generation for developments (Table 13.5).

Table 13.5 – TRICS data source for arrival and departures percentages during peak periods.

TRICS Mode Splits

	AM (08:00 - 09:00)	PM (17:00 - 18:00)
Arrival	50.7%	32.1%
Departure	36.2%	48.6%

13.2.7 Assessment Context

This assessment has been prepared from both a review of existing information on the site and a site-specific investigation. The following is a list of sources of information consulted for use in this chapter;

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, August 2017);
- Guidelines on the Information to be Contained in Environmental Impact Statements, (EPA, 2002);
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003);
- Transport Infrastructure Ireland (TII) Transport Assessment Guidelines (TII, 2014);
- Area Based Transport Assessment (ABTA) Guidance Notes (TII 2017);
- The Traffic Signs Manual (DTTAS, 2010);
- The National Cycle Manual (NTA, 2011);
- The Design Manual for Roads and Bridges (DMRB); and
- The Design Manual for Urban Roads and Streets (DMURS) (DTTAS, 2013);
- Transport Infrastructure Ireland (TII) Project Appraisal Guidelines (PAG) Unit 16.1 – Expansion Factors for Short Period Traffic Counts;
- Transport Infrastructure Ireland (TII) Project Appraisal Guidelines (PAG) – Unit 5.5 Link Based Traffic Growth Forecasting;
- Limerick City Development Plan (2010-2016 extended);
- Limerick Smarter Travel; and
- Limerick Urban Centre Revitalisation O'Connell Street (LUCROC) – Stage 4 Traffic Modelling Report (SYSTRA 2017)

13.3 Baseline Conditions

13.3.1 Overview

This section sets out an assessment of the existing baseline conditions for the defined study area surrounding the proposed development. This includes a review of current walking, cycling, public transport and operation of the surrounding road network.

13.3.2 Pedestrian Accessibility

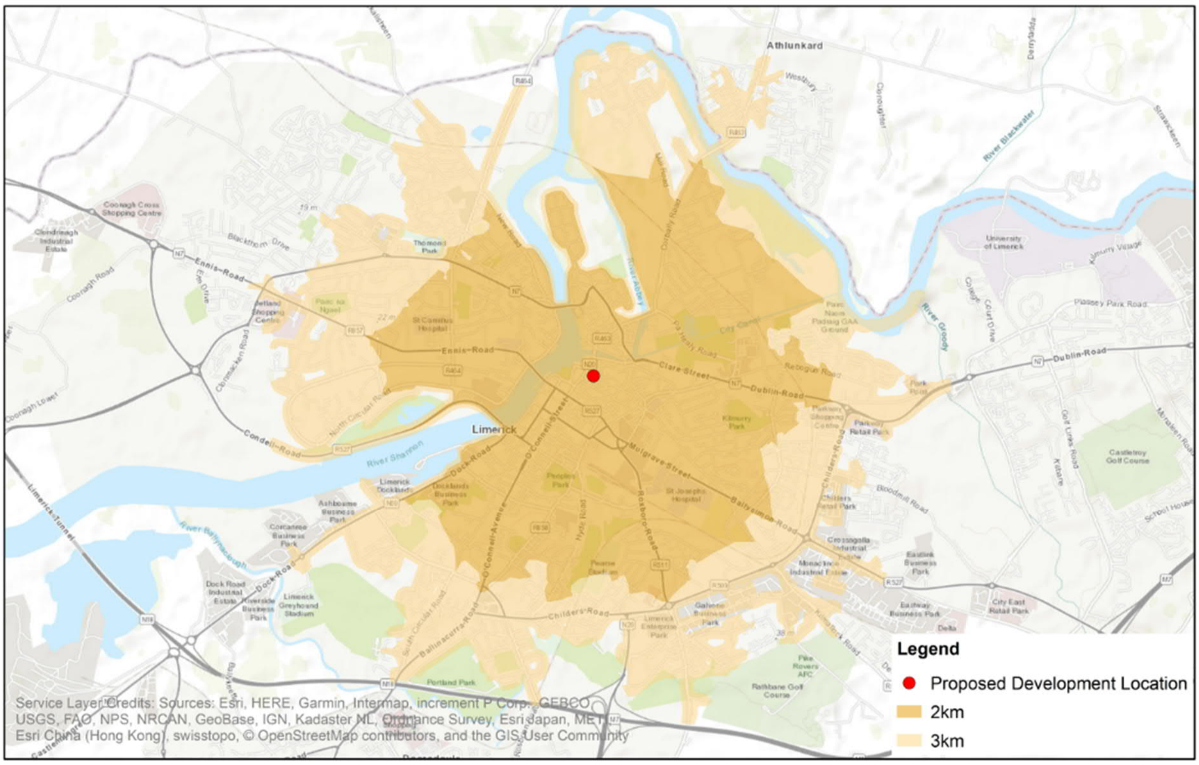
The 2016 Census data showed that 20% of people living in Limerick City chose to walk to work.

The footpaths surrounding the site are of a reasonable width and in good condition. They provide reasonable levels of service for pedestrian movement to and from the site.

The walking isochrones displayed in Figure 13.3 show a 2 to 3km walking catchment to and from the centre of the site. This demonstrates that there are large number of local facilities, amenities and extensive public transport network within an acceptable walking distance of the site.

Within the identified walking catchment area there are retail, employment, residential, educational, health, café’s, bars, restaurant and leisure facilities. There are also a public transport options within walking distance of the site including numerous bus routes and rail. This shows that the site benefits from high levels of pedestrian accessibility.

Figure 13.3: 2-3 km Walking Distance from the Development Site



13.3.3 Cycling Accessibility

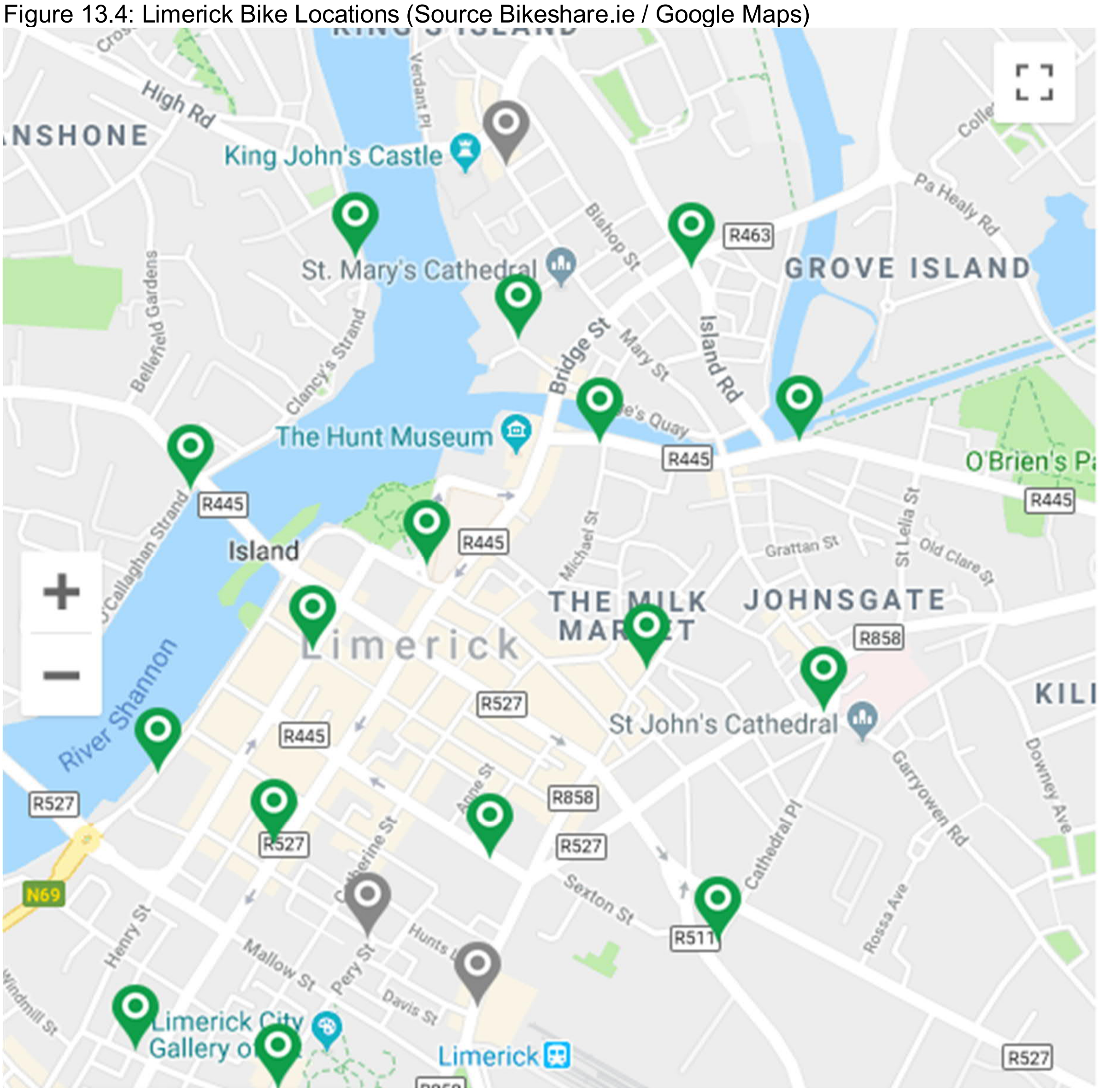
There is a growing network of cycling routes in Limerick City, from traffic free greenways to shared use paths and on road cycle lanes. However, the existing network is inconsistent and the quality service of some of the routes is below standards as recommend in the National Cycle Manual.

LCCC has produced the Limerick Metropolitan Cycle Network Study, the aim of which is develop a strategy to identify and prioritise investment in cycle infrastructure and improve cycling provision across the Limerick Metropolitan area.

The 2016 Census data showed that the mode share for cycling to work in Limerick City was 3%.

There is a total of 23 Limerick Bike Stations within Limerick City. Their locations are shown in Figure 13.4. The closest of these stations to the site are the Granary Station at the top of Michael Street, at the north east side of the site.

Figure 13.4: Limerick Bike Locations (Source Bikeshare.ie / Google Maps)

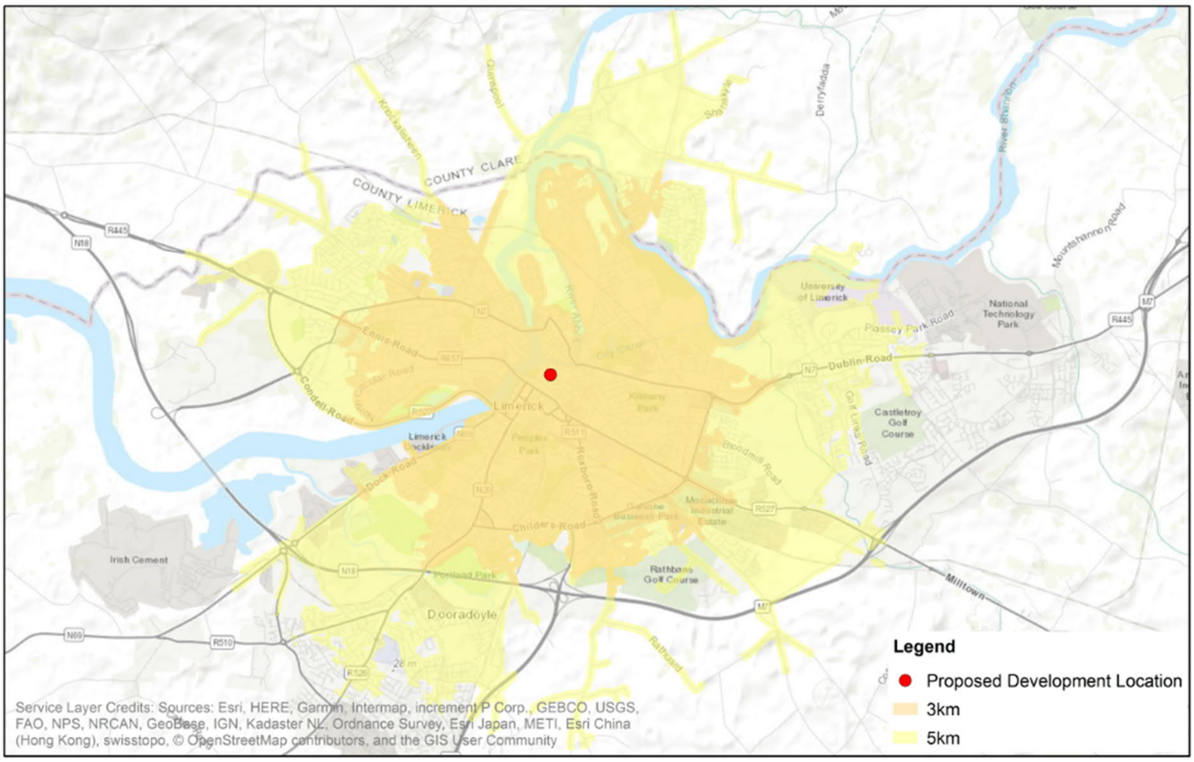


It is generally accepted that cycling has the potential to substitute for shorter car trips, particularly those under 5kms. The National Cycle Policy Framework[25] recognises that the quickest mode for

[25] National Cycle Policy Framework (2009-2020) – based on European Commission data 1999

transport in urban areas for trips up to 5-6kms and for longer trips during peak hours. This is shown in Figure 13.5 below.

Figure 13.5: A (3km and 5km) cycling isochrones from the centre of the development.



This demonstrates that there are large number of local facilities, amenities and extensive public transport network within reasonable cycling distance of the site.

13.3.4 Bus Network

Bus Éireann operates a city and suburban service within Limerick City. There are two main types of services operating within Limerick: City and Metropolitan Area Service and Regional / Inter-City Service.

These are several bus routes within walking distance of the site as set out in Table 13.6.

Table 13.6 Bus Operator, Route, Frequency and Distance from Site

Operator	Service No.	Route	Mon – Fri Frequency	Saturday Frequency	Sunday Frequency	Nearest Stop	Distance	Approx. Walking Time
Bus Éireann	301	Raheen University Hospital Limerick - Westbury	30 mins	30 mins	30 mins	Arthur's Quay (NB)	170m	2 mins
						Athlunkard St (SB)	270m	4 mins
	302	City Centre to Caherdavin	20 mins	20 mins	30 mins	Henry St	500m	6 mins
	303	Pineview to O'Malley Park	30 mins	30 mins	30 mins	Henry St (NB)	500m	6 mins
						William St (SB)	350m	4 mins
	304	University of Limerick to Ballycummin Road	15 mins	15 mins	30 mins	Sarsfield St (EB)	270m	3 mins
						Roches St (SB)	500m	6 mins
	304 A	University Limerick to Raheen University Hospital Limerick	30 mins	30 mins	30 mins	Upper William Street	500m	6 mins
	305	St. Mary's Park to Lynwood Park	60 mins	60 mins	60 mins	Liddy St (NB)	350m	4 mins
						Athlunkard St (EB)	270m	4 mins
	306	Edward Street to Ballynanty	60 mins	60 mins	60 mins	Sarsfield St (SB)	270m	3 mins
						Henry St (NB)	500m	6 mins

There are also a large number of inter urban bus services that operate to and from Limerick to a number of regional cities and towns as well as an intercity service. These services are set out in Table 13.7 below.

Table 13.7 Regional & Intercity bus service to & from Limerick City (source: www.buseireann.ie)

Route Number	Route
72	Tralee – Limerick – Birr – Athlone
313	Limerick – Ardnacrusha
314	Limerick – Askeaton - Foynes
320	Limerick – Charleville
321	Limerick – Rathkeale – Newcastlewest
323	Limerick – Killaloe –Newport – Nenagh- Borriskane- Birr

Route Number	Route
328	Limerick – Hospital – Galbally/Mitchelstown
329	Limerick – Bruff – Kilmallock -Kilfinane
332	Limerick – Newport – Rearcross – Cappamore- Dundrum
336	Limerick – Ennis – Kilrush – Kilkee
341	Shannon – Limerick- Newport – Cappmore
343	Limerick – Shannon – Ennis
343x	Limerick – Ennis
345	Scariff – Killaloe – Limerick
346	Limerick – Tulla – Scariff - Whitegate
347	Limerick – Tipperary
350	Galway – Kinvara – Doolin – Cliffs of Moher – Ennis
X12 / 12	Dublin Airport – Dublin – Portlaoise – Roscrea – Nenagh – Limerick
13	Limerick – Adare – Listowel Tralee
14	Limerick – Kerry Airport – Killarney
X51	Limerick – Galway
51	Cork – Limerick – Shannon Airport – Ennis – Galway
55	Limerick – Clonmel – Waterford

13.3.5 Rail Network

Limerick (Colbert) Railway Station is located on Parnell Street, approximately 800 metres or a 5-minute walk from the site. Services operate directly to/from Dublin, Ennis, Nenagh, Kildare, Galway and Cork.

Castleconnell Train Station is located approximately 10km north east of the city centre and operates to/from Nenagh. For other routes and services, it is necessary to change trains at Limerick Junction, located approximately 34km south east of Limerick City. Table 13.8 below sets out rail service available in proximity to the study area.

Table 13.8: Rail Services to/from Limerick City (Source: www.irishrail.ie)

Route	Mon – Fri Frequency	Saturday Frequency	Sunday Frequency
Limerick to Dublin	19 services per day	19 services per day	16 services per day
Limerick to Ennis	5 services per day	5 services per day	5 services per day
Limerick to Galway (via Ennis)	4 services per day	4 services per day	4 services per day
Limerick to Nenagh	2 services per day	2 services per day	1 service per day
Limerick to Limerick Junction	16 services per day	16 services per day	10 services per day

As set out in the Bus & Rail sections above the site benefits from good levels of accessibility by public transport. This offers a high level of choice to access the site by these sustainable modes.

13.3.6 Road Network

The existing site is located within Limerick city centre. The site is bounded by three local and one regional road. They are Michael Street, Ellen Street, Patrick Street, Rutland Street and the R445. The speed limit across the study area is 50km/h.

Michael Street

Michael Street is a two-way single- carriageway local road. It is located on the eastern side of the site. The road is wide, approximately 7-8m and has dedicated on street parking in places. There are no centre line markings along this street. There is a taxi rank in place towards the northern end of the street which is in operation 24 hours a day. There are footways on both sides of the road as well as street lighting. There are no formal pedestrian crossing points on Michael Street.

Ellen Street

Ellen Street is a two-way single carriageway local road located to the south of the site. There is dedicated parking along the length of the street on the northern side of the street. There are no centre line markings along this street. There are footways on both sides of the road as well as street lighting. There are no formal pedestrian crossing points on Ellen Street.

Patrick Street

Patrick Street operates in a one way southbound direction. The road is a busy regional road with centreline markings along it. It is located on the south west side of the site and forms part of the busy city centre streets. There is on street parking along its length on the western side of the road. There are footways on both sides of the road as well as street lighting.

Rutland Street / R445

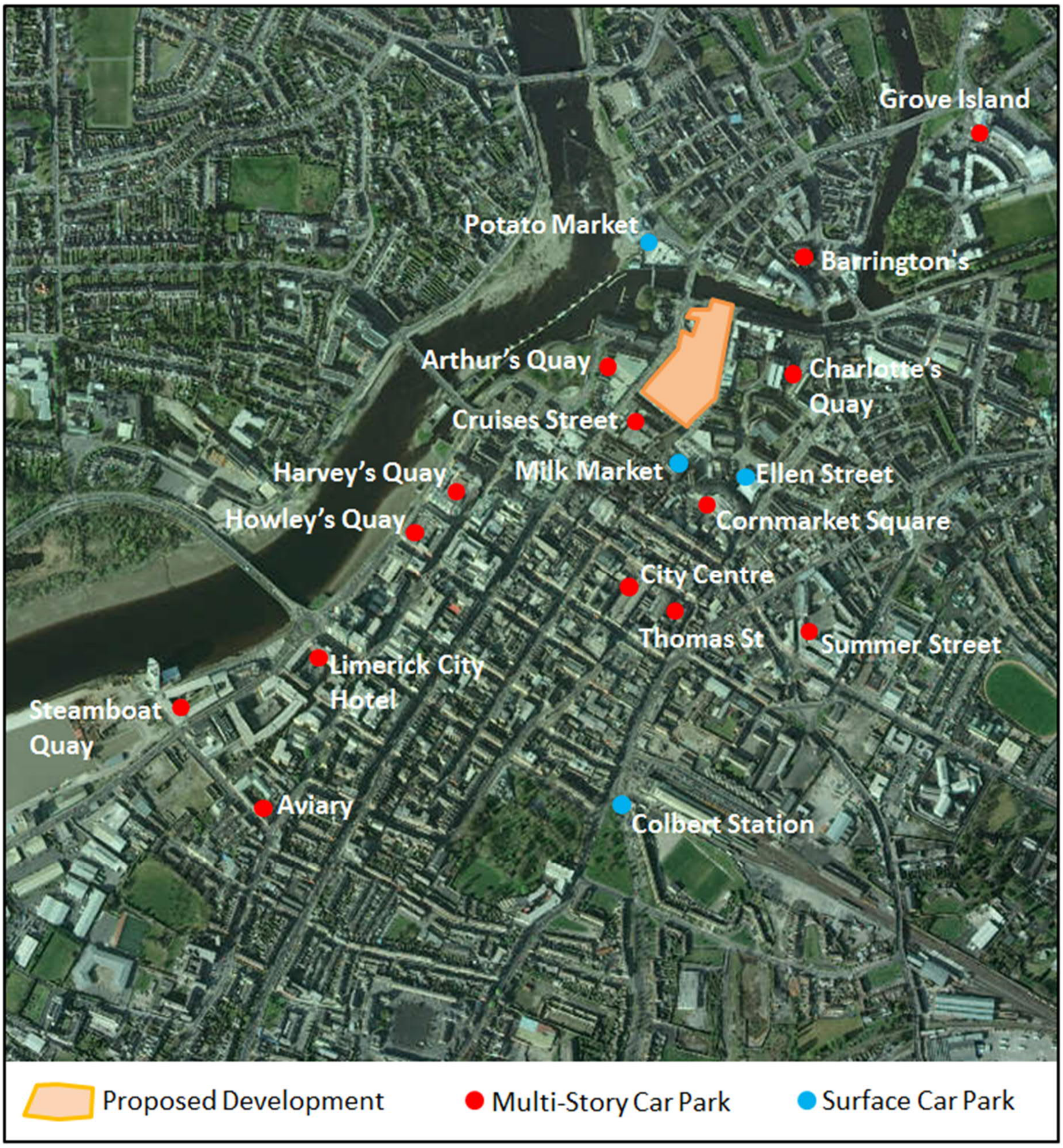
Rutland Street forms part of the regional road network and is located on the north-western side of the site. It operates as a busy two-way four lane carriageway. There is no parking along this section of road. There are footways on both sides of the road as well as street lighting. There are formal pedestrian crossing facilities at the junction of R445 / Bridge Street and R445 / Francis Street.

13.3.7 Existing Car Parking Facilities

There is an existing car park located on the development site with a 100-space capacity. Vehicular access to this car park is from Michael Street.

There are 18 other car parks within Limerick City offering a total of 5,521 car parking spaces.

Figure 13.6: Location of Limerick City Public Car Parks



The breakdown of the 5,521 car parking spaces across the car park location is outlined in Table 13.9.

There are also dedicated pay and display on street parking facilities on most of the streets within the town centre including on three roads surrounding the development.

Table 13.9 Car Parks Spaces in Limerick City centre

Car Park Name / Location	Car Parking Spaces
Arthurs Quay	570
Aviary Car Park (Richmond Court)	280
Barrington’s	230
Cruises St	350
City Centre Car Park, Anne Street	485
Charlotte Quay	428
Corn Market	425
Colbert Street Station Car Park	180
Ellen Street	100
Grove Island	300
Harvey’s Quay	675
Henry Street/Jurys Inn	290
Howleys Quay	350
Milk Market	52
Potato Market	86
Steamboat Quay	261
Summer Street	429
Thomas Street	30
Total Spaces	5,521

Limerick City and County Council (LCCC) provided car parking data for car parks close to the site. This data includes average occupancy levels in October 2018. The information obtained from LCCC indicates that the average weekday occupancy in October was 70%. Only those public car parks located within a reasonable distance of the development site have been selected for this assessment. The relevant public car parks to the development site and their capacities are set out in Table 13.10 below.

Table 13.10 Car Parks near the Development Site

Car Park Name / Location	No of Car Parking Spaces	Number of spaces typically available on a weekday
Arthurs Quay	570	171
Barrington’s	230	69
Cruises St	350	105
Charlotte Quay	428	128
Corn Market	425	127
Milk Market	52	16
Potato Market	86	26
Total Spaces	2,141	642

13.3.8 Junction and Link Traffic Volumes

The traffic surveys were used to understand the existing operation of the road network. Table 13.11 & Table 13.12 sets out the junction and link traffic volumes in the study area.

Table 13.11 Junction Traffic Volumes (PCUs)

Junction No.	Junction Name	Weekday AM Peak (0800 -0900)	Weekday PM Peak (1700 -1800)
1	Patrick Street / Ellen Street Priority Junction	997	1,083
2	Patrick Street / Francis Street Signalised Junction	1,497	1,599
3	Bridge Street / Rutland Street / R445 Signalised Junction	1,453	1,451
4	R445 / Michael Street Priority Junction	779	894
5	Michael Street / Ellen Street Priority Junction	346	583
6	Michael Street / Car Park Access Priority Junction	158	441

Table 13.12 Link Traffic Volumes (PCUs)

Road Name	Direction	AM peak flow	PM Peak flow	AADT	AAWT	% HGV
Ellen	Eastbound	34	96	3,747	3,652	1.87
	Westbound	155	201			
Rutland Street	Northbound	650	722	17,184	16,747	1.49
	Southbound	732	640			
Patrick Street	Southbound	842	883	11,141	10,857	1.49
Francis Street	Westbound	765	959	12,100	11,792	1.22
Bridge Street	Southbound	510	406	9,677	9,431	1.3
	Northbound	311	361			
R445	Eastbound	403	433	10,018	9,763	1.59
	Westbound	294	324			
Michael Street	Northbound	25	131	3,823	3,726	1.78
	Southbound	101	278			

13.3.9 Future Baseline

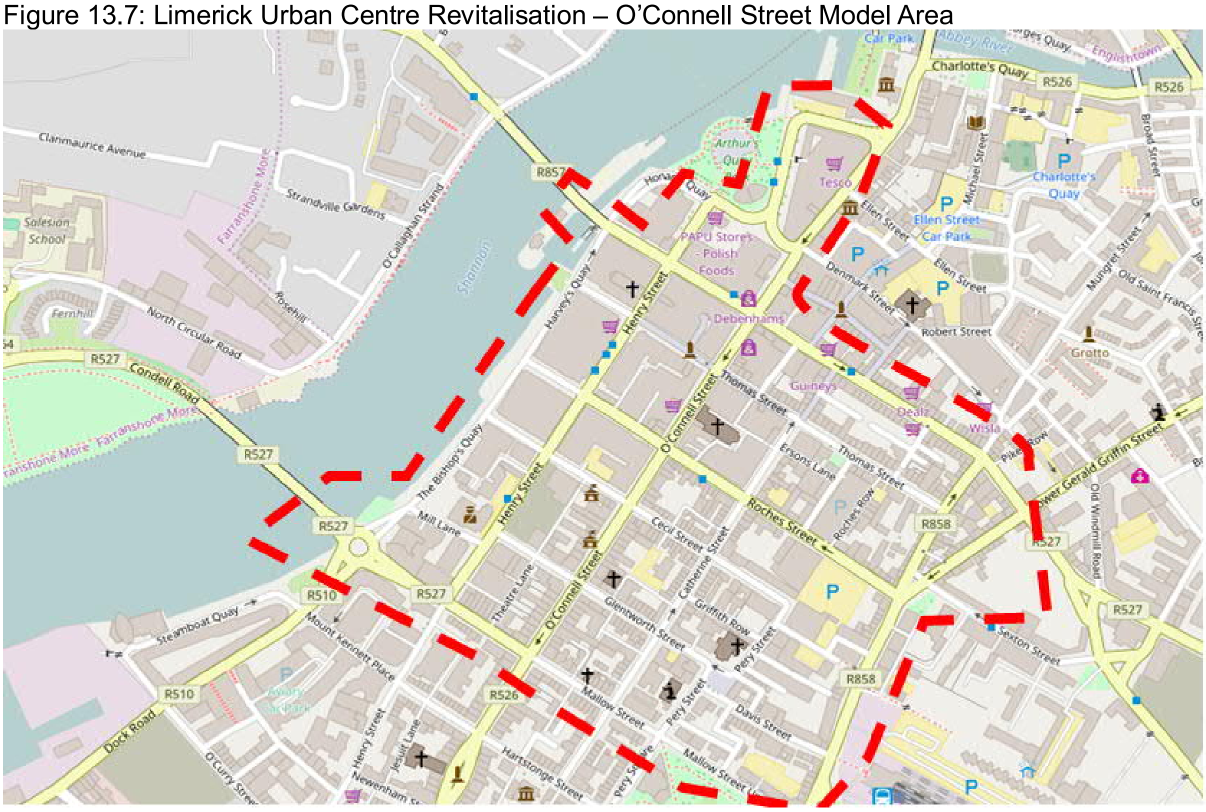
A scoping note was sent to Limerick City and County Council (Appendix 13.A) to identify committed developments that may have traffic and transport impacts on the study area. Upon assessing the information provided two major committed developments have been included in this assessment. They are:

- O'Connell Street, Urban Centre Revitalisation– Option 1b has been identified as the preferred scheme and involves the reduction of a part of O'Connell Street, between the junctions of Denmark Street and Barrington Street, to one lane south bound with associated public realm enhancements.
- Demolition of nos. 40 and 41 O'Connell Street, construction of building fronting O'Connell Street., providing multi-media visitor experience, exhibition, education space for the "International Rugby Experience".

13.3.9.1 O'Connell Street Revitalisation Scheme

In terms of the O'Connell Street Revitalisation Scheme a Stage 4 Traffic Modelling Report was prepared by SYSTRA for Limerick City and County Council in 2017. The model is known as the LUCROC (Limerick Urban Centre Revitalisation - O'Connell Street) 2019 Traffic Model. The model is a micro simulation model and the indicate area is shown in Figure 13.7 below.

Figure 13.7: Limerick Urban Centre Revitalisation – O'Connell Street Model Area



Rutland Street is located on the most northern extremity of that model and therefore the area surrounding the Project Opera site will not be calibrated as strongly as the O'Connell street area of the model. Nevertheless, it was considered important to ensure the traffic flows were relatively consistent. Consultation with Systra indicates the traffic volumes used for the Project Opera assessment are higher than those in used for comparable scenarios in the Limerick Urban Centre Revitalisation - O'Connell Street traffic model. This indicates the Project Opera assessment is robust.

Option 1B – O'Connell Street (1 Lane Southbound)

This option involves reducing vehicular capacity on O'Connell Street to one lane (southbound) rationalising kerbside activities such as parking and loading bays and including improved pedestrian and cyclist facilities.

Analysis of the Systra Stage 4 Traffic Modelling Report suggests that traffic volumes along O'Connell Street will reduce by 1% due to rerouting effects. The model outputs show that average traffic speeds across the city centre will reduce and that some junctions near O'Connell Street will experience additional queueing and delay.

Given these findings it is not anticipated the implementation of O'Connell Street Revitalisation Scheme will result in significant impact on traffic volumes in the Study Area.

13.3.9.2 Rugby Museum Development

The Rugby Museum planning application is located at 40, 41, 42 O'Connell Street / 1 Cecil Street. A description of the development is as follows:

"Demolition of nos. 40 and 41 O'Connell Street, construction of building fronting O'Connell Street., providing multi-media visitor experience, exhibition, education space for the "International Rugby Experience"

The decision to grant permission was recently upheld by An Bord Pleanála (24/10/2018). A review of both the Inspectors report and the original planning application made to LCCC (planning reference – 171180) has been undertaken to understand the likely traffic and transport impacts.

It is noted that a Traffic and Transport Assessment (TTA) was not required to support the planning application. As highlighted in an extract from the Planners report:

"No parking is proposed, and its intended use is primarily tourism related".

Most trips to and from the facility are therefore likely to occur by sustainable modes. As such the development is not anticipated to increase traffic flows within the EIAR study area.

13.3.9.3 Summary of Future Baseline

Given the above findings no significant committed developments that would result in additional traffic impacts have been identified to impact on the EIAR study area.

13.3.10 Development Car Parking Provision

The development incorporates a basement car park with a capacity of 155 spaces. The level of car parking on site has been established having regards to:

- The scale of and impact of the development;
- The site is situated in a sustainable location with good access to public transport, shops, services and amenities;
- The commitment to Limerick Smarter Travel Mode Share; and
- The availability of other car parks in the area.

13.3.11 Development Cycle Parking Provision

In accordance with "Smarter Travel" work place facilities requirements, shower and changing facilities will be provided as part of the development to encourage sustainable commuter travel.

The cycle parking standards from the development plan indicate that 1,280 cycle parking spaces could be provided for this development.

Table 13.13: Cycle Parking Standards

Land Use	LCC Parking Standards		Proposed Cycle Parking
	Cycle Parking Standard	Cycle Parking Requirement	
Restaurant/Café/Hotel / Public Houses	1 Stand: 30m^2	236	496 Cycle Spaces
Office	1 Stand: 30m^2	985	
Residential	1 space per unit	19	
Leisure / Assembly *	1 space per 100 seats	40	

*nearest use to cultural

The number of cycle spaces provided for this development was based on the modal split target set out by the Limerick Smarter Travel initiative. The split proposes a 14% cycling target. When applied to the employment numbers generated by the development, this equates to 287 employees who will cycle to/from the development.

Therefore, it is proposed to provide a total of 496 cycle parking stands (Table 13.13). The majority of these, 311, will be in the basement areas and will be used by employees. The rest of the stands are to be located at surface level that will be available for use by visitors and the public as well as by employees.

In addition to the existing Limerick Bike Hire Station (24 bikes) will be accommodated at Bank Place.

13.4 Predicted Impacts

The proposed development will have an impact during both the construction and operational phases, both of which are considered in the following sections.

13.4.1 Construction Stage

An outline construction programme and activity schedule was developed to predict the traffic that would be generated during the construction of the development.

The transport effects of the proposed development during the demolition and construction phases are considered through the following key transportation issues;

- Vehicle Routing;
- Demolition and Construction Traffic Impact;
- Pedestrian and cycle impact; and
- Public Transport impact.

Demolition and construction vehicles will remain on the strategic road network for as long as possible and that the “last mile” will be undertaken on local roads. Construction phasing is identified in section 3.6. During the demolition and construction of the proposed development there is the potential for temporary local disruption to pedestrian, cycle and vehicular traffic users because of demolition and construction traffic.

Most of the demolition and construction activity will take place during the enabling and basement construction periods. Given this programme the impacts from the demolition and construction phase are likely to be experienced in the **short to medium term period**.

Construction Access

Vehicular access during construction is proposed to be from Michael Street. Access from Michael Street ensures good connectivity with the strategic road network via R445 thus avoiding the need to route along Little Ellen street which is narrow and Patrick Street which has higher footfall close to Arthurs Quay Shopping Centre.

Constructing Routing

Demolition and construction vehicles will remain on the strategic road network for as long as possible and the "last mile" will be undertaken on local roads. This results in the following construction routing plan.

Construction vehicles arriving from the south will access the site via the following route:

- M7 exit at junction 29 before continuing northwest on the R527 Ballysimon Road;
- From the R527 onto the R509 Childers Road;
- R509 onto the R445 Dublin Road;
- R445 onto Michael Street; and
- Michael Street into the development site.

Construction vehicles arriving from the north will access the site via the following route:

- M18 exit at junction 4 before continuing southeast onto the R445 Ennis Road;
- R445 Ennis Road to R445 Northern Ring Road;
- Across Thomond Bridge
- R445 Castle Street to Island Road onto Sráid Seamus O Cinnéide;
- Across Abbey Bridge onto the R445 Charlotte's Quay
- Charlotte's Quay onto Michael Street; and
- Michael Street into the development site.

It has been assumed that 50% of construction vehicles will arrive from the south (i.e. from M7) and 50% from the north (i.e. from the M18) using the routes set out above. Within the study area, all construction traffic will therefore travel along the following roads:

- Michael Street; and
- R445.

The receptor sensitivity of the above roads is **low** for the following reasons:

- Both roads are in a city centre location that experience high volumes of traffic; and
- The composition of traffic on the road network consists of LGV's, HGV's and buses.

The above routing plans can be seen in Appendix 13.B**.**

Construction Hours

The site working hours will be 0800-1800 Monday to Friday and 0800-1300 on Saturdays. No working on Sundays or Bank Holidays is anticipated.

Construction Parking

It is proposed that part of the temporary works area of the construction site will be set aside for access, parking and deliveries. The number of spaces will depend on the level of construction activity.

Construction Traffic Generation

Construction traffic would be generated from several sources during the construction of the project Opera development, primarily attributable to:

- Removal of spoil;
- Materials delivery; and
- Equipment delivery.

In terms of construction staff, it is envisaged that during the peak construction period (Enabling and Basement Construction) a maximum of 200 construction personnel will be employed on site. Given the construction operating hours of 0800 -1800 Monday to Friday most of the workers will arrive on site prior to the AM network peak period of 0800-0900.

The removal of spoil from the site will occur during the early stage of the construction. Spoil removal would be undertaken by rigid HGVs, similar in size to the concrete delivery vehicles. For the purposes of the below calculations it has been assumed that 4 axle rigid trucks (30 tonne) will be used to remove spoil. Table 13.14 identified truck movements and assumptions for calculations.

Table 13.14: Anticipated Construction Traffic for Spoil Removal

Parameter	Unit	Assumptions
Volume of spoil from Basement	40,000m^3 (96,400 metric tonnes)	
Number of months	7 from start in Q3 2019	
Metric tonnes per month	13,771	7-month programme
Number of trucks per month	459	30 tonne 4 axle rigid trucks
Number of trucks per day one way	23	20 working days per month
Number of trucks per hour one way	2.3	10 hour working days
Number of truck movements per hour	4.6	Arrives empty leaves full

As shown above 46 no. truck movements are anticipated over the construction working day on the surrounding road network. The spoil removal stage is anticipated to be the most impactful of the construction phases.

The traffic impact of construction activity is illustrated in Table 13.15 below.

Table 13.15 Construction Impacts

Link	Base traffic volumes	Existing No. of HGV	Development Construction HGV	% Increase in HGV
Michael St	4,075	73	46	1.14%
R445	7,541	120	46	0.62%

The percentage change in traffic flow on the affected links is between 0.6% to 1.17% on the R445 and Michael Street respectively. With HGV movements the increase in general traffic volumes is in the range of 1.14 % to 0.6% on the two affected routes. Table 13.16 identifies the sensitivity impact and duration of construction impact.

Table 13.16 Sensitivity Impact and Duration of Construction Impact

Link	Receptor Sensitivity	Impact	Duration
Michael Street	Low	Negligible	Temporary / Short term
R445	Low	Negligible	Temporary / Short term

The above demonstrates that the demolition and construction stage of the development would have a temporary short term **negligible** effect on:

- Local traffic
- Pedestrian and cyclists
- Public transport

As outlined in Section 13.5 – Mitigation Measures, a Construction Traffic Management Plan will be secured by means of an appropriately worded planning condition and or Legal Agreements to manage routing and arrival profile of construction vehicles to minimise the impact to the surrounding area.

Any traffic management, temporarily road or footway closures will be controlled by way of licences from the appropriate authority in consultation with relevant bodies and affected persons as deemed appropriate based on impacts.

13.4.2 Operational Stage

Upon completion and occupation, the proposed development will generate a demand for travel on the surrounding transport network. This section evaluates the effects associated with the transport elements of the operational phase of the development.

Trip Generation

As set out in the methodology average trip rates for the development trips have been derived from the Employment Densities Guide 2nd Edition by Drivers Jonas Deloitte (2010) based on employment densities per Net Internal Floor area for the development. Table 13.17 below shows the proposed development trips. Table 13.17 does not include the basement area as this area does not generate any trips, being merely a receiving environment for vehicle trips to and from the development.

Table 13.17 – Development Trip Generation

Proposed Development	Floor Area m^2	%	Rate per Sqm	Method	Employees
Retail	2,418.02	5	19	NIA	108
Residential	1,878.70	5	0	NIA	0
Office	29,407.30	65	12	NIA	1,771
Cultural	4,147.80	9	200	GIA	21
Restaurant / Café / Bar	2,259.20	5	18	GIA	126
Apart-hotel	4,710.60	10	102	5	20
Other	54.00	0			
Totals	45,169.83	100%			2,045

Mode Splits

Limerick Smarter Travel modal split targets were used to inform the mode share projections for the proposed development. The aim of modal split targets is to reduce car usage to 37% while increasing the sustainable travel mode share for public transport, walking and cycling usage. These targets are shown in the Table 13.18 below.

Table 13.18 – Limerick Smarter Travel Modal Splits

Limerick Mode Split Targets		No of Employees by Mode
Car	37%	758
Walking	35%	717
Cycling	14%	287
Public Transport	12%	246
Other	2%	41
Totals	100%	2,049

As outlined in Table 13.18 above, it is estimated that approximately 758 employees will travel to work at Project Opera in a private vehicle. Assuming a vehicle occupancy rate of 1.22 (as outlined in TII's Project Appraisal Guidelines[26]), it is therefore estimated that the development will generate approximately 621 inbound private vehicle trips during the AM Peak period, with the same number of outbound trips during the PM peak period.

As stated previously, 155 car spaces are to be provided in the basement of the proposed development. This then requires approximately 466 vehicles to find alternative parking arrangements. As outlined previously, there is ample off-street parking availability within proximity to the site.

Although the development trips were sourced by the Employee Densities as per Table 13.18 above, this estimation only gives the total number of employees to and from the site. It also only quantifies the number of arrivals and departures in the PM.

[26] See Reference Section 13.9

There will be a percentage of vehicles departing in the AM peak hour and arriving in the PM peak hour. Therefore, the Trip Rate Information Computer System (TRICS) data was used as part of this assessment to calculate the number of total departures in the AM peak and the number of total arrivals in the PM peak. This percentage split is shown in Table 13.19.

Table 13.19: TRICS percentage split between arrivals and departures for AM and PM peak

	AM (08:00 – 09:00)	PM (17:00 – 18:00)
Arrival	85.2%	21.4%
Departure	14.8%	78.6%

Therefore, in the AM peak, 14.8% of the 621 trips were calculated as the total number of departures and 21.4% of the 621 trips were calculated as the total number of arrivals in the PM peak.

The TRICS data (Appendix 13.C) was used to quantify the percentage of car trips that will arrive and depart during the 08:00 – 09:00 AM peak and arrive and depart during the 17:00 – 18:00 PM peak. These percentages are shown in Table 13.20.

Table 13.20: TRICS percentage Split for AM and PM Arrivals and Departures

	AM (08:00 – 09:00)	PM (17:00 – 18:00)
Arrival	50.7%	32.1%
Departure	36.2%	48.6%

These percentages were then applied to the development car trips. Table 13.21 outlines the calculated car trips both to/from the basement car park and other car parks within the surrounding area.

Table 13.21: Arrivals and Departures of Car Trips generated by the Development

	AM		PM	
Car Trips	Arrivals	Departures	Arrivals	Departures
Total Trips	621	92	133	621
Total Trips to Basement	155	23	36	155
Trips to Basement in AM and PM peak hour	77	8	12	75
Total trips to other car parks	466	69	96	466
Trips to other car parks in AM and PM peak hour	233	25	31	226

Development Trip Distribution

The development trips to and from the basement car park were distributed onto the network using the turning count percentages at the six junctions based on the proximity of car parks to the origin and route of development traffic.

In terms of the other car trips to and from the development the following reasonable assumptions were made:

1. A total of 7 other car parks near the development site will be used by employees as these are the closest to the development site. These are Arthur's Quay, Barrington's, Cruises Street, Charlotte Quay, Cornmarket Square, Milk Market and Potato Market;
2. The number of employees using each car park is based on the total number of spaces provided in that car park, therefore the more spaces there are in the car park, and the more employees from the subject development proposal will use it.
3. The distribution of trips to and from each car park is based on, where possible, the turning count percentages at the six junctions that were surveyed as part of this assessment as well as some professional judgement based on the proximity of car parks to the origin and route of development traffic.

The trip distributions of all trips to and from the Opera Site and the relevant car parks are illustrated in Network Flow Diagrams in Appendix 13.D of this report.

Traffic Forecasting

The scenarios for assessment are in accordance with Transport Infrastructure Ireland's Traffic and Transport Assessment Guidelines. The required modelling scenarios are as follows:

- Base Year;
- Opening Year (With / Without Development) in 2022;
- Opening Year +5 Year Forecast (With / Without Development) in 2027; and
- Opening Year + 15 Year Forecast (With / Without Development) in 2037.

Future Year Assessment

The TII Project Appraisal Guidelines have been reviewed to determine the growth rates necessary for undertaking a +5 and +15 year forecast assessment of the base traffic on the network. A medium growth rate has been assumed for the period up to 2029 and a lower growth rate for periods after that based on the impact of delivery of the Limerick Smarter Travel mode share targets. Table 13.22 below outlines the medium growth factors.

Table 13.22 TII Medium Growth Factor

LV 2006-2025	LV 2026-2040
1.013	1.01

Table 13.23 outlines the calculated growth rates for opening year, +5 years and +15-year assessments.

Table 13.23: TII PAG - Growth Rates

Growth Years	Growth Rate
2017 – 2022	1.07
2017 – 2027	1.13
2017 – 2037	1.24

Traffic Impacts

The following sections sets out the impact of the development across the various modelling scenarios on the links and junctions within the study area.

Junction Impacts

The TII Guidelines for Transport Assessments state that the thresholds for junction analysis in Transport Assessments are as follows:

- “Traffic to and from the development exceeds 10% of the existing two-way traffic flow on the adjoining highway.”
- “Traffic to and from the development exceeds 5% of the existing two-way traffic flow on the adjoining highway, where traffic congestion exists or will exist within the assessment period or in other sensitive locations”.

To identify the potential impacts at each junction surrounding the development, the development trips have been appraised as a percentage impact. Tables 13.24 and Table 13.25 below show the impacts of the development at opening year 2022 in the AM and PM peak periods

Table 13.24– AM Impact of development on junctions surrounding the site

Scenario	Junctions					
	1	2	3	4	5	6
AM 2022 Base	1065	1597	1551	831	370	169
AM 2022 Base + Dev	1149	1748	1689	945	427	207
Difference	85	151	138	114	57	38
% impact	7.97%	9.45%	8.90%	13.75%	15.45%	22.54%

Table 13.25 PM Impact of development on junctions surrounding the site

Scenario	**Junctions**					
	1	**2**	**3**	**4**	**5**	**6**
PM 2022 Base	1156	1706	1549	954	622	470
PM 2022 Base + Dev	1309	1825	1631	1005	688	474
Difference	153	119	82	51	66	4
% impact	13.21%	6.98%	5.28%	5.40%	10.61%	0.75%

Results for the AM assessment indicate that junction 4, 5 and 6 exceed the 10% threshold and therefore will require junction analysis. While results for the PM assessment indicate that Junctions 1 and 5 exceed the 10% threshold.

It was decided, for the purposes of a robust assessment to undertake analysis of all six junctions for the AM and PM peak hour periods.

The AM and PM peak base year, opening year and future year flows are shown in the network flow diagrams in Appendix 13.D of this report.

This section details the results of the junction analysis undertaken as part of this traffic assessment. The following are the junctions that were assessed as well as the method of analysis.

1. Patrick Street / Ellen Street Priority Junction – Assessed in PICADY
2. Patrick Street / Francis Street Signalised Junction – Assessed in LinSig
3. Bridge Street / Rutland Street / R445 Signalised Junction – Assessed in LinSig
4. R445 / Michael Street Priority Junction – Assessed in PICADY
5. Michael Street / Ellen Street Priority Junction – Assessed in PICADY
6. Michael Street / Car Park Access Priority Junction – Assessed in PICADY

These junctions have been assessed for both the AM (08:00 – 09:00) and PM (17:00 – 18:00) peak hours.

LINSIG Analysis

The LinSig results below display the Degree of Saturation (%), Average Delay per PCU (s/pcu), Mean Max Queue (MMQ) and the Practical Reserve Capacity (PRC) for the junction. These are defined in more detail as follows.

Degree of Saturation (DOS) – this is based on the ratio of traffic flow to capacity for each lane. A degree of saturation of less than 80% indicates that the arm is performing within capacity. Arms that have a DOS of between 85 – 90% indicate that traffic congestion is beginning to show on the arm with the arm beginning to reach its capacity; with a DOS of 90% and above indicating that the arm is over capacity and queuing is evident.

Average Delay – the Delay is a measurement of the average delay per PCU (Passenger Car Units) on an arm because of the queueing on that arm. It is measured in seconds/pcu.

Queueing – the queuing is measured as Mean Max Queue (MMQ). It is defined as the average over several cycles within the time period of the maximum queue length in each cycle. MMQ is measured in PCU.

Practical Reserve Capacity (PRC) – the PRC is based on the worst performing arm within a junction; it is calculated from the maximum degree of saturation on a lane and is a measure of how much additional traffic could pass through a junction whilst maintaining a maximum degree of saturation of 90% on all lanes.

Rutland Street / Bridge Street / R445 Junction

Shown in Figure 13.1 is a location map for the Rutland St/Bridge St/R445 junction (Junction No.3). Shown below from Table 13.26 to Table 13.32 inclusive are the AM peak results for the Base Year, Opening Year, + 5 Year and + 15 Year assessment without development flows.

Table 13.26: 2017 AM Base Year at the Rutland St/Bridge St/R445 Junction

2017 AM Base Year

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland Street Ahead	28.90%	7.8	2.4
Rutland Street Right	61.60%	36.6	8.4
Bridge Street Left	20.70%	41.4	1.5
Bridge Street Ahead	63.50%	20.4	7.2
R445 Left	52.50%	33.9	6.9
PRC (%)		41.7%	

Table 13.27: 2022 AM Base Year at the Rutland St/Bridge St/R445 Junction

2022 AM Opening Year Without Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland Street Ahead	30.9%	8.0	2.5
Rutland Street Right	66%	38.1	9.3
Bridge Street Left	22%	41.7	1.6
Bridge Street Ahead	67.9%	21.6	8.0
R445 Left	56.2%	34.8	7.6
PRC (%)		32.5%	

Table 13.28: 2027 AM Base Year at the Rutland St/Bridge St/R445 Junction

2027 AM Opening Year Without Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland Street Ahead	32.6%	8.1	2.7
Rutland Street Right	69.6%	39.6	10.1
Bridge Street Left	23.4%	41.9	1.7
Bridge Street Ahead	71.7%	22.9	8.7
R445 Left	59.3%	35.7	8.1
PRC (%)		25.5%	

Table 13.29: 2037 AM Base Year at the Rutland St/Bridge St/R445 Junction

2037 AM Opening Year Without Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland Street Ahead	35.8%	8.4	3.1
Rutland Street Right	76.4%	43.3	11.6
Bridge Street Left	25.8%	42.3	1.9
Bridge Street Ahead	78.8%	26.2	10.3
R445 Left	65.1%	376	9.2
PRC (%)		14.2%	

Table 13.30: 2022 AM Base Year + Development at the Rutland St/Bridge St/R445 Junction

2022 AM Opening Year With Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland Street Ahead	31.%	8.0	2.5
Rutland Street Right	73.3%	41.5	10.9
Bridge Street Left	24.4%	42.1	1.8
Bridge Street Ahead	75.1%	24.3	9.4
R445 Left	62.1%	36.6	8.6
PRC (%)		19.8%	

Table 13.31: 2027 AM Base Year + Development at the Rutland St/Bridge St/R445 Junction

2027 AM Opening Year With Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland Street Ahead	32.9%	8.1	2.7
Rutland Street Right	77.3%	43.9	11.9
Bridge Street Left	25.8%	42.3	1.9
Bridge Street Ahead	79.2%	26.5	10.4
R445 Left	65.5%	37.7	9.3
PRC (%)		13.6	

Table 13.32: 2037 AM Base Year + Development at the Rutland St/Bridge St/R445 Junction

2037 AM Opening Year With Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland Street Ahead	35.9%	8.4	3.1
Rutland Street Right	83.8%	49.9	13.9
Bridge Street Left	28.1%	42.7	2.1
Bridge Street Ahead	85.9%	32.1	12.5
R445 Left	71%	40.1	10.5
PRC (%)		4.8%	

Results for the AM peak show that the junction is operating within capacity for the base AM peak hour with a PRC of 41.7%. Applying the future year forecast flows to the junction without the development in place reduces the PRC to 14.2% by 2037. With the development in place, the junction still operates within capacity by 2037, however, some arms within the junction are beginning to experience congestion and the PRC is reduced to 4.8%. Given the city centre location of the junction this level of performance is considered acceptable in the peak hours.

Shown below from Table 13.33 to Table 13.39 inclusive are the PM peak results for the Base Year, Opening Year, + 5 Year and + 15 Year assessment **without** development flows.

Table 13.33: 2017 PM Base Year at the Rutland St/Bridge St/R445 Junction

2017 PM Base Year

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland Street Ahead	33.50%	8.2	2.8
Rutland Street Right	61.50%	34.8	8.8
Bridge Street Left	26.40%	42.4	2
Bridge Street Ahead	49.10%	18.7	4.9
R445 Left	54.20%	32.6	7.6
PRC (%)		46.3%	

Table 13.34: 2022 PM Base Year at the Rutland St/Bridge St/R445 Junction

2022 PM Opening Year Without Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland Street Ahead	35.8%	8.4	3.1
Rutland Street Right	65.8%	63.2	9.6
Bridge Street Left	28.1%	42.7	2.1
Bridge Street Ahead	52.6%	19.3	5.4
R445 Left	58.1%	33.6	8.3
PRC (%)		36.8%	

Table 13.35: 2027 PM Base Year at the Rutland St/Bridge St/R445 Junction

2027 PM Opening Year Without Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland Street Ahead	37.9%	8.5	3.3
Rutland Street Right	69.5%	37.7	10.5
Bridge Street Left	29.8%	43.0	2.2
Bridge Street Ahead	55.6%	19.8	5.9
R445 Left	61.2%	34.5	8.9
PRC (%)		29.4%	

Table 13.36: 2037 PM Base Year at the Rutland St/Bridge St/R445 Junction

2037 PM Opening Year Without Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland Street Ahead	41.6%	8.9	3.7
Rutland Street Right	76.4%	41.3	12.2
Bridge Street Left	32.9%	43.6	2.5
Bridge Street Ahead	61%	21.0	6.7
R445 Left	67.3%	36.3	10.2
PRC (%)		17.9%	

Table 13.37: 2022 PM Base Year + Development at the Rutland St/Bridge St/R445 Junction

2022 PM Opening Year With Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland Street Ahead	37.5%	8.5	3.2
Rutland Street Right	67%	36.7	10.0
Bridge Street Left	29.8%	43.0	2.2
Bridge Street Ahead	54.5%	19.6	5.7
R445 Left	63.7%	35.3	9.4
PRC (%)		34.4%	

Table 13.38: 2027 PM Base Year + Development at the Rutland St/Bridge St/R445 Junction

2027 PM Opening Year With Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland Street Ahead	39.7%	8.7	3.5
Rutland Street Right	70.9%	38.3	10.8
Bridge Street Left	31.5%	43.3	2.4
Bridge Street Ahead	57.8%	20.3	6.2
R445 Left	67.3%	36.3	10.2
PRC (%)		26.9%	

Table 13.39: 2037 PM Base Year + Development at the Rutland St/Bridge St/R445 Junction

2037 PM Opening Year With Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland Street Ahead	43..2%	9.0	3.9
Rutland Street Right	77.4%	42.0	12.5
Bridge Street Left	34.2%	43.9	2.6
Bridge Street Ahead	62.9%	21.4	6.9
R445 Left	73%	39.1	11.5
PRC (%)		16.3%	

Results for the PM peak show that the junction is operating within capacity for the base PM peak hour with a PRC of 46.3%. Applying the future year forecast flows to the junction without the development in place reduces the PRC to 17.9% by 2037. With the development in place, the junction still operates within capacity by 2037. There is a slight reduction in the PRC to 16.3% against the 2037 base. Given the city centre location of the junction this level of performance is considered acceptable in the peak hours.

Rutland St / Francis St / Patrick St Junction

Shown in Figure 13.1 is a location map for the Rutland St/Francis St/Patrick St junction (Junction No.2). Shown below from Table 13.40 to Table 13.43 inclusive are the AM peak results for the Base Year, Opening Year, + 5 Year and + 15 Year assessment without development flows.

Table 13.40: 2017 AM Base Year at the Rutland St/Francis St/Patrick St Junction

2017 AM Base Year

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland St Ahead	35.50%	9.9	3.1
Rutland St Ahead	36.60%	9.9	3.3
Francis St Left	29.40%	6.3	2.2
Francis St Left	29.90%	6.3	2.2
Francis St Right	24.90%	20.2	1.3
PRC (%)		145.8%	

Table 13.41: 2022 AM Opening Year without Development at the Rutland St/Francis St/Patrick St Junction

2022 AM Opening Year Without Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland St Ahead	38%	10.1	3.4
Rutland St Ahead	39%	10.1	3.7
Francis St Left	31.4%	6.5	2.3
Francis St Left	32%	6.5	2.4
Francis St Right	26.5%	20.3	1.4
PRC (%)		130.5%	

Table 13.42: 2027 AM Future Year without Development at the Rutland St/Francis St/Patrick St Junction

2027 AM Future Year Without Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland St Ahead	40.3%	10.3	3.7
Rutland St Ahead	41.4%	10.3	3.9
Francis St Left	33.3%	6.6	2.5
Francis St Left	33.8%	6.6	2.6
Francis St Right	28.1%	20.5	1.5
PRC (%)		117.6%	

Table 13.43: 2037 AM Future Year without Development at the Rutland St/Francis St/Patrick St Junction

2037 AM Future Year Without Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland St Ahead	44.1%	10.7	4.2
Rutland St Ahead	45.1%	10.7	4.4
Francis St Left	36.4%	6.8	2.8
Francis St Left	37%	6.8	2.9
Francis St Right	30.95	20.9	1.7
PRC (%)		99.4%	

Shown below from Table 13.44 to Table 13.46 inclusive are the AM peak results for the Opening Year, + 5 Year and + 15 Year assessment with development flows.

Table 13.44: 2022 AM Opening Year with Development at the Rutland St/Francis St/Patrick St Junction

2022 AM Opening Year With Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland St Ahead	42.2%	10.5	3.9
Rutland St Ahead	43.3%	10.5	4.1
Francis St Left	33.4%	6.6	2.5
Francis St Left	33.9%	6.6	2.6
Francis St Right	31.1%	20.9	1.7
PRC (%)		107.85	

Table 13.45: 2027 AM Future Year with Development at the Rutland St/Francis St/Patrick St Junction

2027 AM Future Year With Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland St Ahead	44.65	10.8	4.2
Rutland St Ahead	45.5%	10.8	4.2
Francis St Left	35.3%	6.7	2.7
Francis St Left	35.8%	6.7	2.8
Francis St Right	32.7%	21.1	1.8
PRC (%)		97.7%	

Table 13.46: 2037 AM Future Year with Development at the Rutland St/Francis St/Patrick St Junction

2037 AM Future Year With Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland St Ahead	48.4%	11.2	4.8
Rutland St Ahead	49.3%	11.2	5.0
Francis St Left	38.4%	7.0	3.0
Francis St Left	39%	7.0	3.1
Francis St Right	35.5%	21.5	2.0
PRC (%)		82.5%	

Results for the AM peak show that the junction is operating within capacity for the base AM peak hour with a PRC value of over 100%. Applying the future year forecast flows to the junction without the development in place reduces the PRC slightly but is still over 100% available capacity. With the development in place, the junction still operates within capacity by 2037 with a PRC of 82.5%.

Shown below from Table 13.47 to Table 13.50 inclusive are the PM peak results for the Base Year, Opening Year, + 5 Year and + 15 Year assessment **without** development flows.

Table 13.47: 2017 PM Base Year at the Rutland St/Francis St/Patrick St Junction

2017 PM Base Year

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland St Ahead	35.1%	11.8	3
Rutland St Ahead	36.3%	11.9	3.2
Francis St Left	32%	6.5	2.4
Francis St Left	32.6%	6.5	2.5
Francis St Right	45.5%	19.7	3.1
PRC (%)		97.6%	

Table 13.48: 2022 PM Opening Year without Development at the Rutland St/Francis St/Patrick St Junction

2022 PM Opening Year Without Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland St Ahead	37.5%	12.1	3.2
Rutland St Ahead	38.7%	12.1	3.5
Francis St Left	34.2%	6.6	2.7
Francis St Left	34.7%	6.6	2.7
Francis St Right	48.5%	20.2	3.4
PRC (%)		85.5%	

Table 13.49: 2027 PM Future Year without Development at the Rutland St/Francis St/Patrick St Junction

2027 PM Future Year Without Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland St Ahead	39.8%	12.3	3.5
Rutland St Ahead	40.8%	12.3	3.8
Francis St Left	36.3%	6.8	2.8
Francis St Left	36.8%	6.8	2.9
Francis St Right	51.5%	20.7	3.6
PRC (%)		74.8%	

Table 13.50: 2037 PM Future Year without Development at the Rutland St/Francis St/Patrick St Junction

2037 PM Future Year Without Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland St Ahead	43.5%	12.7	3.9
Rutland St Ahead	44.7%	12.7	4.1
Francis St Left	39.7%	7.1	3.2
Francis St Left	40.1%	7.1	3.3
Francis St Right	56.3%	21.7	4.1
PRC (%)		59.8%	

Shown below from Table 13.51 to Table 13.53 inclusive are the PM peak results for the Opening Year, + 5 Year and + 15 Year assessment **with** development flows.

Table 13.51: 2022 PM Opening Year with Development at the Rutland St/Francis St/Patrick St Junction

2022 PM Opening Year With Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland St Ahead	40.5%	12.4	3.6
Rutland St Ahead	41.6%	12.4	3.8
Francis St Left	35.5%	6.7	2.8
Francis St Left	35.9%	6.7	2.8
Francis St Right	55.4%	21.5	4.0
PRC (%)		62.5%	

Table 13.52: 2027 PM Future Year with Development at the Rutland St/Francis St/Patrick St Junction

2027 PM Future Year With Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland St Ahead	42.8%	12.7	3.8
Rutland St Ahead	43.9%	12.7	3.8
Francis St Left	37.5%	6.9	2.9
Francis St Left	38.1%	6.9	3.0
Francis St Right	58.4%	22.2	4.3
PRC (%)		54.2%	

Table 13.53: 2037 PM Future Year with Development at the Rutland St/Francis St/Patrick St Junction

2037 PM Future Year With Development

Lane Description	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Rutland St Ahead	46.5%	13.1	4.3
Rutland St Ahead	47.65	13.1	4.6
Francis St Left	40.9%	7.2	3.3
Francis St Left	41.4%	7.2	3.3
Francis St Right	63.0%	23.5	4.8
PRC (%)		42.8%	

Results for the PM peak show that the junction is operating within capacity for the base PM peak hour with a very high PRC value of just below 100%. Applying the future year forecast flows to the junction without the development in place reduces the PRC slightly to 59.8% by 2037. With the development in place, the junction still operates within capacity by 2037 with a PRC of 42.8%.

PICADY ANALYSIS RESULTS

The PICADY results display the Ratio of Flow to Capacity (RFC) and the Mean Max Queue (MMQ) for all junctions assessed. It is noted that the PICADY analysis for each junction only assess the individual junction and results do not take account of any existing queueing at other junctions on the network.

PATRICK ST / ELLEN ST JUNCTION

Shown in Table 13.54 are the PICADY results for the AM and PM Base Year, 2022 Opening Year with and without development, 2027 Future Year with and without development and the 2037 Future Year with and without development scenarios for the Patrick St/Ellen St junction.

Table 13.54: PICADY Results at the Patrick St/Ellen St Junction

Assessment Year	Peak Period	Junction Arm and Link	Base		Base + Development Traffic	
			RFC	MMQ	RFC	MMQ
2017 (Base Year)	AM Peak (08:00 – 09:00)	Ellen Street -> Patrick Street	0.34	0.5	0.34	0.5
		Patrick Street -> Ellen Street	0.00	0.0	0.00	0.0
	PM Peak (16:00 – 17:00)	Ellen Street -> Patrick Street	0.44	0.8	0.44	0.8
		Patrick Street -> Ellen Street	0.00	0.0	0.00	0.0
2022 (Opening Year)	AM Peak (08:00 – 09:00)	Ellen Street -> Patrick Street	0.36	0.6	0.40	0.7
		Patrick Street -> Ellen Street	0.00	0.00	0.00	0.00
	PM Peak (16:00 – 17:00)	Ellen Street -> Patrick Street	0.48	0.9	0.63	1.7
		Patrick Street -> Ellen Street	0.00	0.00	0.00	0.00

Assessment Year	Peak Period	Junction Arm and Link	Base		Base + Development Traffic	
			RFC	MMQ	RFC	MMQ
2027 (Opening Year+5	AM Peak (08:00 – 09:00)	Ellen Street -> Patrick Street	0.39.	0.7	0.43	0.8
		Patrick Street -> Ellen Street	0.00	0.00	0.00	0.00
	PM Peak (16:00 – 17:00)	Ellen Street -> Patrick Street	0.51	1.1	0.67	2.1
		Patrick Street -> Ellen Street	0.00	0.00	0.00	0.00
2037 (Opening Year+15)	AM Peak (08:00 – 09:00)	Ellen Street -> Patrick Street	0.44	0.8	0.48	0.9
		Patrick Street -> Ellen Street	0.00	0.00	0.00	0.00
	PM Peak (16:00 – 17:00)	Ellen Street -> Patrick Street	0.58	1.4	0.74	2.9
		Patrick Street -> Ellen Street	0.00	0.00	0.00	0.00

Results show that in all scenarios during both AM and PM peaks, the junction is operating well with minimal queuing on each arm. The RFC increases from Base to Base + Development per arm, however, all arms stay within capacity. The highest RFC value in the 2037 PM Future year assessment of **0.74** on Ellen Street.

It was noted on site that Ellen Street does queue back at times; however, this is a result of queuing back from Patrick Street and is not due to the junction itself.

MICHAEL ST / R445 JUNCTION

Shown in Table 13.55 are the PICADY results for the AM and PM Base Year, 2022 Opening Year with and without development, 2027 Future Year with and without development and the 2037 Future Year with and without development scenarios for the Michael St/R445 St junction.

Table 13.55: PICADY Results at the Michael St/R445 Junction

Assessment Year	Peak Period	Junction Arm and Link	Base		Base + Development Traffic	
			RFC	**MMQ**	**RFC**	**MMQ**
2017 (Base Year)	AM Peak (08:00 – 09:00)	Michael St -> R445	0.06	0.1	0.06	0.1
		R445 -> Michael Street	0.14	0.2	0.14	0.2
	PM Peak (16:00 – 17:00)	Michael St -> R445	0.30	0.5	0.30	0.5
		R445 -> Michael Street	0.27	0.4	0.27	0.4
2022 (Opening Year)	AM Peak (08:00 – 09:00)	Michael St -> R445	0.07	0.1	0.10.	0.1
		R445 -> Michael Street	0.15	0.2	0.35	0.8
	PM Peak	Michael St -> R445	0.35	0.5	0.46	0.8

Assessment Year	Peak Period	Junction Arm and Link	Base		Base + Development Traffic	
			RFC	MMQ	RFC	MMQ
	(16:00 – 17:00)	R445 -> Michael Street	0.29	0.4	0.40	1.0
2027 (Opening Year+5	AM Peak (08:00 – 09:00)	Michael St -> R445	0.08	0.1	0.11	0.1
		R445 -> Michael Street	0.16	0.2	0.38	1.0
	PM Peak (16:00 – 17:00)	Michael St -> R445	0.38	0.6	0.49	1.0
		R445 -> Michael Street	0.31	0.5	0.44	1.1
2037 (Opening Year+15)	AM Peak (08:00 – 09:00)	Michael St -> R445	0.09	0.1	0.13	0.1
		R445 -> Michael Street	0.18	0.2	0.42	1.2
	PM Peak (16:00 – 17:00)	Michael St -> R445	0.43	0.7	0.56	1.2
		R445 -> Michael Street	0.35	0.5	0.50	1.5

Results show that in all scenarios during both AM and PM peaks, the junction is operating well with minimal queuing on each arm. The RFC increases slightly from Base to Base + Development per arm, however, all arms stay within capacity. The highest RFC value in the 2037 PM Future year assessment of **0.56** on Michael Street.

ELLEN ST / MICHAEL ST JUNCTION

Shown in Table 13.56 are the PICADY results for the AM and PM Base Year, 2022 Opening Year with and without development, 2027 Future Year with and without development and the 2037 Future Year with and without development scenarios for the Ellen St/Michael St junction.

Table 13.56: PICADY Results at the Ellen St/Michael St Junction

Assessment Year	Peak Period	Junction Arm and Link	Base		Base + Development Traffic	
			RFC	MMQ	RFC	MMQ
2017 (Base Year)	AM Peak (08:00 – 09:00)	Michael St -> Ellen St	0.17	0.2	0.17	0.2
		Ellen St -> Michael Street	0.08	0.1	0.08	0.1
	PM Peak (16:00 – 17:00)	Michael St -> Ellen St	0.46	0.9	0.46	0.9
		Ellen St -> Michael Street	0.11	0.1	0.11	0.1
2022 (Opening Year)	AM Peak (08:00 – 09:00)	Michael St -> Ellen St	0.18	0.2	0.20	0.2
		Ellen St -> Michael Street	0.09	0.1	0.15	0.2
	PM Peak (16:00 – 17:00)	Michael St -> Ellen St	0.50	1.0	0.55	1.2
		Ellen St -> Michael Street	0.12	0.1	0.10	0.1
2027 (Opening Year+5	AM Peak (08:00 – 09:00)	Michael St -> Ellen St	0.19	0.2	0.21	0.3
		Ellen St -> Michael Street	0.09	0.1	0.15	0.2
	PM Peak (16:00 – 17:00)	Michael St -> Ellen St	0.53	1.2	0.59	1.4
		Ellen St -> Michael Street	0.13	0.2	0.10	0.1
2037 (Opening Year+15)	AM Peak (08:00 – 09:00)	Michael St -> Ellen St	0.21	0.3	0.23	0.3
		Ellen St -> Michael Street	0.10	0.1	0.16	0.2
	PM Peak (16:00 – 17:00)	Michael St -> Ellen St	0.58	1.4	0.64	1.7
		Ellen St -> Michael Street	0.14	0.2	0.11	0.1

Results show that in all scenarios during both AM and PM peaks, the junction is operating well with minimal queuing on each arm. The RFC increases slightly from Base to Base + Development per arm, however, all arms stay within capacity. The highest RFC value in the 2037 PM Future year assessment of **0.64** on Michael Street.

MICHAEL ST/CAR PARK ENTRANCE JUNCTION

Shown in Table 13.57 are the PICADY results for the AM and PM Base Year, 2022 Opening Year with and without development, 2027 Future Year with and without development and the 2037 Future Year with and without development scenarios for the Michael St Car Park entrance junction.

Table 13.57 PICADY Results at the Michael St/Car Park Entrance Junction

Assessment Year	Peak Period	Junction Arm and Link	Base		Base + Development Traffic	
			RFC	MMQ	RFC	MMQ
2017 (Base Year)	AM Peak (08:00 – 09:00)	Site Access -> Michael Street	0.00	0.0	0.00	0.0
		Michael Street -> Site Access	0.01	0.0	0.01	0.0
	PM Peak (16:00 – 17:00)	Site Access -> Michael Street	0.10	0.1	0.10	0.1.
		Michael Street -> Site Access	0.06	0.1	0.06	0.1
2022 (Opening Year)	AM Peak (08:00 – 09:00)	Site Access -> Michael Street	0.00	0.00	0.01	0.00
		Michael Street -> Site Access	0.00	0.01	0.11	0.1
	PM Peak (16:00 – 17:00)	Site Access -> Michael Street	0.11	0.1	0.16	0.2
		Michael Street -> Site Access	0.06	0.1	0.01	0.00
2027 (Open7ng Year +5)	AM Peak (08:00 – 09:00)	Site Access -> Michael Street	0.00	0.00	0.02	0.0
		Michael Street -> Site Access	0.01	0.00	0.11	0.1
	PM Peak (16:00 – 17:00)	Site Access -> Michael Street	0.11	0.1	0.17	0.2
		Michael Street -> Site Access	0.06	0.1	0.02	0.0
2037 (Opening Year+15)	AM Peak (08:00 – 09:00)	Site Access -> Michael Street	0.00	0.00	0.02	0.0
		Michael Street -> Site Access	0.02	0.00	0.11	0.1
	PM Peak (16:00 – 17:00)	Site Access -> Michael Street	0.13	0.1	0.18	0.2
		Michael Street -> Site Access	0.07	0.1	0.02	0.0

Results show that in all scenarios during both AM and PM peaks, the junction is operating well with minimal queuing on each arm. The RFC increases slightly from Base to Base + Development per arm, however, all arms stay within capacity. The highest RFC value in the 2037 PM Future year assessment of **0.18** at the site entrance.

Summary of Junction Assessment

The six junctions affected by the development have been modelled using LinSig and PICADY software and it has been demonstrated for each of the junctions that spare capacity can be achieved for the proposed development flows in all future year scenarios tested (2022, 2027 and 2037). It should be noted that no junction optimisation for the two signalised junctions (2 & 3) has been undertaken. If optimisation of these junctions was undertaken, then it is likely that further improvements to traffic flows above those achieved in the above modelling scenarios will be achieved. The full modelling outputs for the six junctions under all scenarios are shown in Appendix 13.E. While Table 13.58 below summaries the findings.

Table 13.58 – Model Output Findings for all Six Junctions under all Future Scenarios

Junction	2022		2027		2037		2022 + Dev		2027 + Dev		2037 + Dev	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
	Within capacity achieved – Yes / No											
1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Defining the Traffic Impact

The following section presents the traffic impacts of the development on the junctions within the EIAR study area. Table 13.59 reflects the impact based on the Traffic and Transport matrix as defined in Section 13.2.3 Defining Significance.

Table 13.59 Operation Traffic Impact

Receptor	Sensitivity	Magnitude of impact	Effect of Significance
Junction 1 Patrick Street / Ellen Street	Low	Negligible	Not Significant
Junction 2 Patrick Street / Francis Street R445 (signalised junction)	Medium	Low	Moderate / Slight
Junction 3 Bridge Street / Rutland Street / R445 (signalised junction)	Medium	Low	Moderate / Slight
Junction 4 R445 / Michael Street	Low	Negligible	Not Significant
Junction 5 Michael Street / Ellen Street	Low	Negligible	Slight / Not Significant
Junction 6 Development site access to basement	Low	Negligible	Not Significant

As can be seen in Table 13.59 above the overall effect of the proposed development are therefore in the range of Moderate to slight / not Significant.

Pedestrian and Cycle Impacts

The development site is in a city centre, where there are good pedestrian and cycle facilities. The proposal will result in the regeneration of a partially derelict impermeable city block. The development is served by several bus routes and some rail options that provide the site with good public transport connections. Given its sustainable location the development has been designed to prioritise walking, cycling and public transport users.

The layout and design of the development looks to encourage active travel by being permeable and having active frontages on all sides. Where previously the site was impermeable with a long circuitous route required to get from one side to another, the development now provides several new routes through the site in both a north south and east west direction that opens up the site to through movement by pedestrians and cyclists. These new routes have been designed to maximise pedestrian desire lines and link into established pedestrian routes.

The mixed-use nature of the development and active uses at ground will radically improve footfall around the development throughout the day, thereby providing active and passive surveillance that will increase the perception of safety.

The urban realm within and surrounding the development has been designed to maximise space for people with features such as a centrally located square, a new public plaza on Bank Place and general improvements to footways and lighting surrounding the development. Other potential pedestrian improvements include a number of new raised tables and crossing points at the following locations:

- Michael Street / R445 junction – raised junction and new pedestrian crossing provided;
- Michael Street / Ellen Street - raised junction and new pedestrian crossing provided;
- Michael Street - raised table located to allow pedestrian access;
- Ellen Street – two pedestrian crossing facilities that links the development to Little Ellen Street (pedestrian zone) and to Market Alley;
- Ellen Street / Patrick Street junction - raised junction and new pedestrian crossing provided; and
- Patrick Street – new pedestrian crossing close to Ellen Street junction.

The development will provide opportunities to connect to existing strategic walking and cycling routes such as the Riverside route along the Shannon, from the former docks, Arthurs Quay, crossing the Abbey Rove, merchants Quay and St Johns Castle.

The development incorporates a mix of cycling facilities to encourage and promote that use. Long stay secure sheltered and accessible cycle parking will be provided within the development site for employees and residents. Short stay cycle parking will be provided at various locations within and around the development to facilitate customer cycle parking. Cycle hire facilities will be integrated into the improved plaza on Bank Place.

Defining the Walking and Cycling Impact

The following section presents the impact of the development on the walking and cycling within the EIAR study area. Table 13.60 reflects the impact based on the Traffic and Transport matrix as defined in Section 13.2.3 Defining Significance.

Table 13.60 – Walking and Cycling Impacts

Receptor	Receptor Sensitivity	Impact	Period & Significance
Walking and Cycling	High	Negligible	Permanent & Beneficial

As set out in Table 13.60 the proposed development will deliver significant benefits to pedestrian and cyclists.

Public Transport Impacts

As outlined earlier in this chapter the site already has a good public transport linkage to several bus services operating from the roads surrounding the site. This network of bus routes provides connections to and from the development to wide range of catchments within the wider Limerick urban area. Accessing the site by means of public transport will therefore be a realistic option for employees and visitors to the site.

It is recognised in transport policy that provision of and demand for public transport services is linked to creating more compact neighbourhoods and encouraging higher building densities and mixed land use to make public transport service viable. The redevelopment of this partially derelict city block at this size scale will encourage the further usage of public transport for employees, residents and visitors to the site.

In addition to existing bus stop infrastructure adjacent to the site the development will provide a new bus stop facility on Bank Place that will provide a convenient and direct link into the development.

Defining the Public Transport Impact

The following section presents the impact of the development on the public transport within the EIAR study area. Table 13.61 reflects the impact based on the Traffic and Transport matrix as defined in Section 13.2.3 Defining Significance.

Table 13.61– Public Transport Impacts

Receptor	Receptor Sensitivity	Impact	Period & Significance
Public Transport	High	Negligible	Permanent & Beneficial

As set out in Table 13.61 the proposed development will deliver benefits to public transport users.

Car Parking Impacts

The EIAR Guidance for Project Type 28, *Urban Development*, suggested that for one of the impacts from this type of development can be on parking. As set out in section 13.3.7 car parking data has been received from LCCC. This shows that during a typical week day in October 2018 that average car occupancy levels for a wide range of car parks across Limerick City were at 70% occupancy. To be robust this assessment only considered publicly accessible car parks within a reasonable distance of the site. Table 13.62 shows the number of spaces available.

Table 13.62 Availability of Car Parking Spaces on a Typical Weekday

Car Park Name / Location	Car Parking Spaces	Available spaces based on a typical weekday
Arthurs Quay	570	171
Barrington's	230	69
Cruises St	350	105
Charlotte Quay	428	128
Corn Market	425	127
Milk Market	52	16
Potato Market	86	26

Car Park Name / Location	Car Parking Spaces	Available spaces based on a typical weekday
Total Spaces	2141	642

The trip generation analysis as set out earlier in this section anticipates that the development will create an additional 451 car trips above that which can be accommodated within the basement of the development. Assuming those additional trips will travel to the above car parks will result in 191 car parking spaces still being available for parking. Table 13.63 sets out number of spaces required and percentage of car parking spaces that remain available to park.

Table 13.63 – Car parking impact of the development on adjoining car parks

Development Impact on adjoining car parks and remaining availability	
Number of car parking available within study area	642
Number of development trips by car required to park in adjoining car parks	451
Number of available space remaining	191
Percentage of car parking spaces remaining	30%
Other Car Parking spaces available in Limerick City outside of the study area	894
Percentage remaining spaces (dev + other car parks) versus totals paces (5,121)	21%

As can be seen in Table 13.63 there remain 191 car parking spaces available within the study area and an additional 894 spaces across other publicly accessible car parks not considering this assessment.

Defining the Car Parking Impact

The following section presents the impact of the development on the public transport within the EIAR study area. Table 13.64 reflects the impact based on the Traffic and Transport matrix as defined in Section 13.2.3 Defining Significance.

Table 13.64 – Car Park Impacts

Receptor	Receptor Sensitivity	Impact	Period & Significance Of Effect
Car Parks	Low	High	Permanent and Moderate

As set out in Table 13.64 the proposed development will have a moderate impact on the availability of publicly accessible car parking near the site.

13.5 Mitigation Measures

13.5.1 Construction Stage

A Construction Traffic Management Plan has been developed and is attached in Appendix 13F. The plan provides:

- Location of site and materials compound;
- Location of areas for construction site offices and staff facilities;
- Details of site hoarding and security;
- Construction traffic will be limited to certain routes and times of the day, with the aim of keeping disruption to pedestrians, cyclist, general traffic and public transport to a minimum;
- During peak network hours (0800 – 0900 and 1700-1800) construction traffic movements will be discouraged;
- The daily construction programme will be planned to minimise the number of disruptions to the local highway network by staggering HGV movements to avoid site queueing;
- Measures to prevent spillage of spoil or materials on the public highway including the use of on-site wheel washing facilities and street cleaning measures;
- Any traffic management plans that may be required for a road closure or pedestrian footpath closure, including appropriate signage advance public notice procedures;
- Monitoring and mitigation measures to minimise noise, dust and vibration impacts on any identified sensitive receptors.

13.5.2 Operational Stage

Although the operation impact of the proposed development shows that there will be no significant impacts from the development the following mitigation measures are proposed that would further mitigate the impact of the proposal. These include:

1. Mobility Management Plan (MMP)

   An MMP is a long-term management strategy for supporting sustainable and active travel for the development. The benefits of an MMP include

   – Reduction in car usage and less congestion experienced on the roads surrounding the development. This is turn improves the road safety characteristics;

   – Environmental improvements through reduced congestion, emissions, pollution and noise;

   – Increase opportunities for active healthy travel such as walking and cycling;

   – Reduced demand for parking through the promotion of active travel and car sharing;

2. Delivery Service Plan (DSP)

   A DSP is a strategy for managing and reducing the number of deliveries and service trips to a development, particularly during peak and sensitive network periods. The benefits include:

   – Reduced costs associated with the consolidation and reduction in deliveries;

   – Improvements to road safety and ricks of accidents associated with reduction in delivery goods movements;

   – Environmental improvements due to reduced congestion, emissions, pollution and noise;

3. Pedestrian Crossing Facilities

The proposed development incorporates several improved and new crossing opportunities on roads surrounding the development that will improve pedestrian facilities and enhance road safety for those vulnerable road users.

4. Cycling Facilities

   The development provides secure, sheltered and accessible cycle parking facilities for both staff and visitors that will encourage cycling as a mode of choice when accessing the development. In addition to this a new Limerick Bike docking facility will be incorporated into the public realm scheme on Bank Place that will further enhance the sustainable choices for all users.

5. Public Transport

   A new bus stop facility will be provided at Bank Place that will provide improved public transport connections to the development and this area of the city.

6. Review of signal timing at the two signalised junctions in the study area to improve conditions for all users.

13.6 Residual Impacts

Demolition & Construction Phase

During demolition and construction phase the proposed project will result in a temporary increase in traffic volumes along the construction route. However, as set out in Section 13.4.1 these increases will be negligible and temporary in nature.

As no significant adverse effects have been identified in the assessment of the demolition and construction phase of the development, no additional mitigation is necessary over and above the Construction Traffic Management Plan (CTMP) which forms part of the mitigation measures outlined in this chapter.

Operational Phase

Once operational the proposed development will result in changes to traffic flows on several road links within the study area. However, as set out in Section 13.4.2 of this chapter these increases are in the range of moderate to slight and not significant.

The impact of the proposed development on pedestrians, cyclists and public transport users (buses) is predicted to be beneficial.

The impacts to car parking are defined as moderate and permanent. The operation of the proposed development is therefore not anticipated to result in any adverse significant adverse residual impact.

The residual impacts in terms of traffic are considered further in **Chapters 9 Air Quality and Climate** and **Chapter 10 Noise and Vibration** which are the direct environmental impacts because of increased traffic.

13.7 Difficulties Encountered in Compiling Information

Limerick City and County Council in partnership with the National Transport Authority are in the process of developing a Limerick Transport Study (LTS). As the LTS is under preparation it was not possible to take account of any findings or policy direction that could impact on the transport network of the city and in particular adjacent to the site.

Although the LCCC has identified that Option 1b is the preferred scheme for the revitalisation of O'Connell Street, the final scheme has yet to be confirmed. There is a possibility that changes to final design option would result in changes to traffic flows in the area that could impact on the development site.

13.8 Cumulative Impacts

As set out in section 13.3.9, several schemes where examined to determine if they could result in cumulative impacts. For the reasons set out in that section the developments identified are not anticipated to result in cumulative traffic and transport impacts.

13.9 References

Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, August 2017)

Guidelines on the Information to be Contained in Environmental Impact Statements, (EPA, 2002)

Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003)

Transport Infrastructure Ireland (TII) Transport Assessment Guidelines (TII, 2014)

Area Based Transport Assessment (ABTA) Guidance Notes (TII, 2017)

The Traffic Signs Manual (DTTAS, 2010)

The National Cycle Manual (NTA, 2011)

The Design Manual for Roads and Bridges (DMRB)

The Design Manual for Urban Roads and Streets (DMURS) (DTTAS, 2013)

Transport Infrastructure Ireland (TII) Project Appraisal Guidelines (PAG) Unit 16.1 – Expansion Factors for Short Period Traffic Counts (TII, 2016)

Transport Infrastructure Ireland (TII) Project Appraisal Guidelines (PAG) – Unit 5.5 Link Based Traffic Growth Forecasting (TII, 2011)

Limerick City Development Plan 2010-2016 (LCC, 2010)

Limerick Urban Centre Revitalisation O'Connell Street (LUCROC) – Stage 4 Traffic Modelling Report (SYSTRA, 2017)

Limerick Metropolitan Cycle network Study (LCCC, 2017)

14 Waste Management

14.1 Introduction

This chapter of the EIAR assesses and evaluates the potential impacts of the proposed development, details of which are outlined in Chapter 3 – Description of the Proposed Project, with regard to waste and its management. In assessing likely potential and predicted impacts associated with construction and operational phases of the development, AECOM has considered both the importance of the attributes and the predicted scale and duration of likely impacts.

14.2 Methodology

14.2.1 Context

This assessment has been prepared having regard to the following guidance documents:

- Guidelines on the Information to be contained in Environmental Impact Assessment Reports, Draft August 2017, Environmental Protection Agency (EPA);
- The Southern Region Waste Management Plan (SRWMP) 2015 – 2021
- Limerick City Development Plan, 2010-2016
- Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects, Department of Environment, Community and Local Government.

The primary legislative instruments that govern waste management in Ireland and are applicable to the project are:

- Waste Management Act 1996 (No. 10 of 1996) as amended by the Waste Management (Amendment) Act 2001. Sub-ordinate legislation to this Act includes:
  - European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011) as amended 2011 (S.I. No. 323 of 2011)
  - Waste Management (Collection Permit) Regulations S.I. No. 820 of 2007 as amended 2008 (S.I. No 87 of 2008)
  - Waste Management (Facility Permit and Registration) Regulations, S.I. No. 821 of 2007 as amended 2008 (S.I. No. 86 of 2008)
  - Waste Management (Licensing) Regulations 2000 (S.I. No. 185 of 2000) as amended 2004 (S.I. No. 395 of 2004), and 2010 (S.I. No. 350 of 2010)
  - Waste Management (Packaging) Regulations 2003 (S.I. No. 61 of 2003) as amended 2004 (S.I. No. 871 of 2004), 2006 (S.I. No. 308 of 2006) and 2007 (S.I. No. 798 of 2007)
  - Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997)
  - Waste Management (Landfill Levy) (Amendment) Regulations 2012 (S.I. No. 221 of 2012), as amended 2015 (S.I. No. 189 of 2015)
  - European Communities (Waste Electrical and Electronic Equipment) Regulations 2011
  - Waste Management (Registration of Brokers and Dealers) Regulations 2008 (S.I. No. 113 of 2008)
  - Waste Management (Food Waste) Regulations 2009 (S.I. No. 508 of 2009), as amended 2015 (S.I. 190 of 2015)
  - European Communities (Asbestos Waste) Regulations 1994 (S.I. No. 90 of 1994)
- Protection of the Environment Act 2003 (No. 27 of 2003)

- Litter Pollution Act 1997 (No. 12 of 1997)

These Acts and subordinate Regulations enable the transposition of relevant European Union Policy and Directives into Irish law.

In addition, the Limerick City Development Plan 2010 - 2016 outlines strategic environmental assessment objectives with regard to waste which are relevant. Specifically:

- Soil 5, encourage reuse and recycling of soil/bedrock associated with developments; and
- Mat 18, minimise waste production and operate sustainable waste management practices.

14.2.2 Waste soils

With regard to waste generation during the construction phase, this EIAR draws on an environmental site assessment and preliminary soil waste classification completed in 2017 (see Appendix 7.A, Project Opera Environmental Site Assessment and Preliminary Soil Waste Classification).

Preliminary soil waste classification was undertaken to assess the general nature of made ground material and subsoil present beneath the site. This allowed identification of potential disposal routes for these materials that will require removal following excavation for the construction of basements, foundations, service trenches etc., at the site during the proposed development. The preliminary soil waste classification considered analytical results from 23 soil samples analysed as part of the 2017 site investigation.

Assessment of the analytical data was carried out by screening the composite soil sample results against the waste classification criteria as outlined in Table 14.1 below.

Table 14.1 Waste Classification Criteria

Waste Category	Classification Criteria
Category A** Inert	Reported concentrations less than inert waste guidelines, which are based on waste acceptance criteria set out by the adopted EU Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 and Annex II of Directive 1999/31/EC (2002). Results also found to be non-hazardous using the HazWasteOnline^{tm} application.*
Category B Inert – IMS	***Reported concentrations greater than Category A criteria but less than Integrated Materials Solutions inert waste licensed landfill acceptance criteria, as set out in their Waste Licence W0129-02.*** Results also found to be non-hazardous using the HazWasteOnline^{tm} application.*
Category C1 – Non Hazardous	Analytical results greater than Category A and B criteria but not classified as hazardous using the HazWasteOnline^{tm} application.*
Category C2 - Non Hazardous	As Category C1 but containing <0.001% w/w asbestos fibres.
Category C3 - Non Hazardous	As Category C1 but containing >0.001% and <0.01% w/w asbestos fibres.

Waste Category	Classification Criteria
Category C4 - Non Hazardous	As Category C1 but containing >0.01% and <0.1% w/w asbestos fibres.
Category D1 – Hazardous for Export	Analytical results found to be hazardous using the HazWasteOnline^{tm} application* with PAH concentration <500 mg/kg and mineral oil concentration <8000 mg/kg.
Category D2 – Hazardous for Export	Analytical results found to be hazardous using the HazWasteOnline^{tm} application* but containing >0.01% w/w asbestos fibres.
Category D3 – Hazardous for Export	Soil which has been classified as hazardous solely due to presence of asbestos.

* http://www.hazwasteonline.com. Application developed by One Touch Data Limited based on Regulation (EC) No. 1272/2008: the classification, labelling and packaging of substances and mixtures (CLP) and the latest UK Environment Agency guidance, WM3. AECOM's experience has shown that this approach is considered acceptable to the EPA and Local Authorities.

**Please note: While waste soil is classified as Inert based on the EU Council Decision 2003/33/EC, waste acceptance criteria may vary at each potential waste receiving facility and further assessment and consultation may be required with the proposed waste receiving facility to confirm suitability for disposal in terms of Waste Permitted sites. Further assessment in terms of potential impact to the environment may be required or inert waste comprising made ground may not be considered acceptable.

14.3 Baseline Conditions

The EIAR study area (i.e. within the redline site boundary) is located in Limerick city centre.

Limerick City Development Plan 2010 – 2016 notes that, in 2007, 77% of the city's municipal waste was landfilled, with a regional target to reduce this to 14%.

Limerick is one of ten local authority areas that comprise the Southern Region covered by the SRWMP 2015 – 2021. The overarching aim of that plan is to prioritise waste prevention and, for that waste which is produced, to ensure that the majority is reused, recycled and recovered in order to minimise waste disposal. The SRWMP provides a framework for the prevention and management of waste in a safe and sustainable manner.

For the region as a whole, it was estimated in the SRWMP that, for 2012, 59% of municipal waste (household and commercial) was recovered.

Targets for 2020 include:

- 50% of household and similar waste to be reused and recycled; and,
- 70% of construction and demolition waste to be reused, recycled and recovered.

In 2012, 76% of household waste collections in the Southern Region were through kerbside collections, with the majority of households having two bins – one for dry, mixed recyclables and a second for residuals. Approximately 40% of households in Limerick City had a third bin for kerbside collection of organic waste, with the plan for this proportion to increase (SRWMP).

The bulk of commercial waste is segregated at source and collected by private collectors.

It is considered that the baseline condition for the proposed redevelopment site with regard to waste management is in line with that of the Southern Region as a whole for municipal waste.

14.4 Predicted Impacts

14.4.1 Construction phase

The construction phase as a whole will likely last a number of years (estimated completion date of Q1 2024) and will be undertaken in two phases following enabling works:

- Enabling works, including demolition and site clearance;
- Phase 1 encompasses development of the northern site, Parcels 3A, 3B, 4, 5 and 6; and
- Phase 2 encompasses development of the southern site, Parcels 1, 2A and 2B.

The construction phase of the proposed redevelopment will generate a range of non-hazardous and hazardous waste materials. Correct segregation, storage, handling and transport of waste will be required so that litter is not generated and does not become a nuisance to the public.

Waste management forms part of the Construction Methodology and Phasing Management Plan (CMPP) that has been developed for the proposed redevelopment. During the construction phase, a construction and demolition waste management plan (C&D WMP) will be implemented by the contractor for the duration of construction activities. The C&D WMP will include specific detail relating to waste segregation and disposal; more detail on this is provided in Section 14.5.

14.4.1.1 Demolition and asbestos

An asbestos demolition survey was conducted in six areas across the proposed redevelopment site for the purpose of identifying asbestos containing materials in premises planned for demolition, as well as assessing and identifying the risks these may pose to workers.

As frequently identified in buildings of a similar age to those on the site, the survey identified asbestos containing materials (ACM), items such as: insulation, roof sheeting, floor tiles and toilet cisterns etc.

During demolition the removal from site of ACMs is a direct, permanent impact of the proposed redevelopment. Removal of asbestos under strictly controlled conditions is considered to be a positive impact on an environment of low sensitivity and the overall significance of the impact is slight.

14.4.1.2 Other construction and demolition waste

Other wastes which are likely to be generated during the demolition phase are summarised in Table 14.2 below. It should be noted that within each category there are subcategories, some of which are hazardous.

Table 14.2 Construction and Demolition Waste

European Waste Catalogue	Description
17 01	Concrete, bricks, tiles and ceramics
17 02	Wood, glass and plastic
17 03	Bituminous mixtures, coal tar and tarred products
17 04	Metals and their alloys
17 05	Soil, including excavated soil from contaminated sites, stones and dredged

European Waste Catalogue	Description
	spoil
17 06	Insulation materials and asbestos containing construction materials
17 08	Gypsum-based construction material
17 09	Other construction and demolition waste

Removal of these wastes from site during the construction phase is considered to be a direct, short-term, low impact on a low sensitivity environment, the overall significance is considered slight.

14.4.1.3 Soil Excavation

An environmental site assessment was completed in 2017, results of which are discussed in Chapter 7 – Land, Soils, Geology and Groundwater, and the full report is attached in Appendix 7.A.

In addition to analysis for a broad suite of potential contaminants at the site, soil samples from the 2017 environmental site assessment were also analysed for waste acceptance criteria. These laboratory results were input to the HazWasteOnline™ classification tool in 2017. Based on the available analytical results, the following waste categories were identified and classified in accordance with European Waste Catalogue and Hazardous Waste List (EPA, 2002). The findings of the hazardous waste classification are summarised in Table 14.3 below.

Table 14.3 Summary of Soil Waste Classification

Waste Classification		EWC Code	Number of Made Ground Samples	Number of Clay Samples	Total Number of Samples
Category A	Inert	17 05 04	7	6	13
Category B	Inert	17 05 04	3	-	3
Category C1	Non Hazardous	17 05 04	3	2	5
Category D1	Hazardous	17 05 03	2	-	2

Made ground samples from the site have been classified as a mixture of inert, non-hazardous and hazardous. Ten made ground samples were classified as inert (Category A and Category B); three made ground samples classified as non-hazardous (Category C) principally due to the presence of metals (antimony and molybdenum in leachate); and two made ground samples classified as hazardous (Category D1) due to the presence of metals in bulk soil (lead and zinc).

The majority of natural clay samples from the site have been classified as inert (Category A) with two soil samples classified as non-hazardous (Category C) due to the presence of molybdenum and mercury in leachate.

The volume of made ground and subsoil requiring removal from site is dependent on the dimensions of the basement to be constructed. The estimated area of the proposed basement across the site as a whole is ~9,000 m^2. From available drawings and cross-sections, the maximum depth of the basement appears to be no more than 5 m below ground level (bgl) with ground floor level at 5.5 m above Ordnance Datum (OD); that gives a maximum volume of material to be removed of 44,896 m^3.

However, there is some basement development currently on site. In addition, the ground elevation across Bogue's Yard through the middle of the site is in the region of 3.5 m OD. The bulk of excavation for new basement construction will be across the southern and eastern portion of the site, where current ground elevation is in the region of 5.0 m OD. Assuming an average of ~4.45 m to be excavated across the basement area as a whole (it may be less than 4.45 m or less in some areas, and 5 m in others) gives a volume of ~40,000 m^3. Removal of excavated material from site will generate construction traffic during the early stages of construction works and this is considered in detail in Chapter 13.

Drilling and trial pit logs indicate that made ground is present to between 0.7 m and 2.5 m bgl, and so would account for a significant proportion of material to be excavated. Based on the limited soil sampling completed, 13% of made ground beneath the site could be classified as hazardous for waste disposal purposes. Additional sampling and analysis during excavation would be required to classify excavated material for waste disposal purposes and identify suitable disposal routes.

It should be noted that the waste classification of made ground and subsoil from the site only becomes relevant when that material is excavated and requires disposal off-site. The waste classification has no bearing on the suitability of the soil remaining on site for development purposes, this is discussed in Chapter 7 and Appendix 7.A.

Removal of excavated made ground and subsoil from site during the construction phase is considered to be a direct, short-term, low impact on a low sensitivity environment, the overall significance is considered slight.

14.4.2 Operational phase

The operational phase of the proposed redevelopment will generate a range of, mostly, non-hazardous waste. Segregation at source will be practised for waste generated, in line with the SRWMP. The main non-hazardous and hazardous waste expected to be generated from the operational phase is summarised below.

Non-hazardous waste, which is expected to be produced during the operational phase will likely include:

- Packaging waste;
- Canteen waste;
- Office waste;
- Empty containers;
- General non-hazardous waste;
- Kitchen waste;
- Non-hazardous waste electrical and electronic equipment (WEEE); and
- Landscaping waste.

The main hazardous waste which is expected to be produced during the operational phase is:

- Fluorescent tubes;
- WEEE; and
- Waste batteries.

These will be stored and managed as hazardous wastes and will be sent for recovery and recycling by licensed waste contractors in accordance with the relevant national and EU legislation.

Table 14.4 below summarises the anticipated management strategy to be used for typical wastes generated at the proposed redevelopment during the operational phase.

Table 14.4 Operational Phase Waste

Waste	Hazardous	On-site Storage / Treatment	Method of Treatment / Disposal
Packaging	No	Segregated bins / skips / receptacles	Recycle
Office Waste (Mixed dry recyclables)	No	Segregated bins / skips / receptacles	Recycle
General non-hazardous waste	No	Segregated bins / skips / receptacles	Recovery / land disposal
Empty containers	Dependent on original contents	Segregated bins / skips / receptacles	Recovery / land disposal
Canteen / kitchen waste	No	Segregated bins / receptacles for metal cans, waste, plastics, cardboard, general waste	Compost food waste Recycle dry paper, plastic and aluminium waste Disposal of other general waste to landfill.
Kitchen waste	No	Vegetable oil	Recycle
Non-hazardous WEEE	No	Segregated bins / skips / receptacles for WEEE	Off-site recovery by licensed waste facility operator
Hazardous WEEE	Yes	Segregated bins / skips / receptacles for hazardous WEEE	Off-site recovery by licensed waste facility operator
Landscaping Waste	No	Composting Bins	Composting for re-use
Batteries	Yes	Specialised receptacle	Return to supplier by licensed waste contractor

It is assumed the development will generate no more than any similar mixed-use development site which is well served by local waste management contractors. All waste will be managed by licensed waste contractors in accordance with all relevant Irish and EU Waste Management legislation.

Removal of waste from site generated during the operational phase is considered to be a direct, permanent, low impact on a low sensitivity environment, the overall significance is considered slight.

14.5 Mitigation Measures

14.5.1 Construction phase

14.5.1.1 C&D WMP

In developing the C&D WMP, the contractor shall also take into account the requirements of Limerick 2030 Strategic Developments and Environmental Policy requirements, which includes minimising the quantity of waste and, in particular, eliminating waste disposed to landfill.

Construction will comply with the objectives of the SRWMP, including incorporating a system for the management of wastes in accordance with the waste management hierarchy that prioritises waste prevention and minimisation, followed by waste reuse and recycling. Disposal of waste shall only be considered as a last resort. The contractor will incorporate the reuse and recycling target of 70% for construction and demolition waste (excluding soil and stones) contained within the SRWMP.

Prior to the transfer of a waste off-site under a particular EWC Code for the first time, the contractor shall advise LCCC or its representatives of the proposed classification and shall only transfer the waste following agreement from LCCC or its representatives.

The contractor shall ensure that waste materials generated during the works are clearly identified as either hazardous or non-hazardous wastes, with reference to guidance from the Environmental Protection Agency where required and shall establish waste storage areas for the different types of waste that may arise. For each waste stream identified by the contractor, and for each additional waste stream that may arise during the course of the works, the contractor shall identify the following:

- The appropriate EWC Code;
- A suitable waste collection contractor in possession of a valid waste collection permit for the collection of the particular waste within Limerick city;
- The waste recovery or disposal site, including the transfer station where the waste may be transferred to upon leaving the site in possession of a valid Waste Facility Permit or Waste Licence, as appropriate; and
- The recovery or disposal method for the waste.

Only waste contractors in possession of a valid Waste Collection Permit shall collect wastes from the site. The contractor responsible for the waste shall ensure that the waste collection contractor:

- Is permitted to collect the particular waste;
- Is permitted to collect waste within Limerick City;
- Uses a waste collection vehicle identified on the waste collection permit; and
- Transfers the waste to a waste facility identified on the waste collection permit.

Prior to the commencement of the project, the contractor shall determine the quantity of waste expected to arise from its works, and LCCC or its representatives shall be advised accordingly.

14.5.1.2 Asbestos removal

Following risk assessment, a number of demolition options for the safe cleaning and removal of ACMs prior to demolition of the buildings were identified.

A specialist asbestos removal contractor, whose staff are trained in asbestos removal as required under the Safety Health and Welfare at Work (Exposure to Asbestos) regulations 2006 (S.I. No. 386 of 2006), will remove ACMs prior to demolition or refurbishment works commencing.

14.5.1.3 Management of excavated materials

The contractor shall develop a Soil Management Plan (SMP) set out within the C&D WMP. The SMP shall outline proposals for the management and reuse of excavated materials from the site, where permitted in accordance with the relevant legislation; and, provided that the reuse meets engineering requirements, for material used within the works.

Where the contractor proposes to maximise the reuse of excavated soil in order to minimise the generation of waste, it shall set out how it proposes to manage and document this reuse to the satisfaction of LCCC or its representatives. This shall include the following:

- Identification and recording of the location from where the material was excavated;
- Delineation of areas where excavated soil is intended for disposal as waste, and where it is intended for reuse (where permitted);
- Delineation of areas of contaminated and uncontaminated soil (if present);
- Sampling of excavated soil (the number and location of soil samples);
- Details of the proposed laboratory to carry out the testing;
- The suite of parameters for which the soil is to be tested; and
- The criteria for assessing whether the soil is contaminated or uncontaminated.

The contractor shall establish the controls necessary to manage the generation, handling and storage of waste at the site.

These controls may rely on other plans within the CMPP, for example: the protection of stockpiles of contaminated soil against rainwater ingress and leachate runoff; the bunding of hazardous waste storage areas containing liquids (e.g. oils, paints); and the management of waste collection vehicles both within the site and when leaving the site (dust and noise).

The SMP shall indicate waste soil classifications to enable LCCC or appointed contractor to identify appropriate disposal/transfer routes for proposed excavated material, based on the nature of the material i.e. made ground or natural soil.

Service clearance, foundation excavation and pile arisings will/may be generated during the works. These shall be segregated, stockpiled on site and sampled. Soil waste classification shall be completed on these materials in order to identify an appropriate waste receiving facility.

Prior to the transfer of material from the site for export or to a specific waste permitted/licensed site, the appropriate waste classification data shall be submitted to the permit/licence holder to confirm the suitability of the material in writing for transfer to their facility.

In order to control off-site soil movements and undertake appropriate waste disposal/recovery, a comprehensive docketing system shall be detailed in the site construction waste management plan and implemented on site. A daily record (including preparing and reconciling waste transfer notes) of soil excavation at the site shall be maintained by the appointed contractor.

Documentation to be maintained in relation to soil wastes includes the following:

- The names of the agent(s) and the transporter(s) of the wastes;
- The name(s) of the person(s) responsible for the ultimate recovery or disposal of the wastes;
- The ultimate destination(s) of the wastes;
- Written confirmation of the acceptance and recovery or disposal of any hazardous waste consignments;
- The tonnages and EWC (European Waste Catalogue) Code for the waste soil materials;

- Details of each individual consignment dispatched from site:
  – Description of waste (grid cell number, stockpile number or type and origin of soil)
  – Date and time of dispatch from site
  – Name of haulage company
  – Details of Contractor and Haulier docket numbers
  – Vehicle registration number and driver name
  – Volume/weight of waste removed
  – Name of waste receiving facility
  – Date and time of arrival at waste receiving facility
  – Details of any rejected consignments
- The Waste Transfer Forms for hazardous soil wastes transferred from the site (stamped at receiving facility);
- The Trans-frontier Shipment of Waste forms for hazardous soil wastes transferred abroad; and
- The results of any analysis conducted on excavated soil.

Waste transfer notes will be issued in triplicate. On dispatch, the note shall be signed by the issuing operative and one copy retained at the site office. The remaining two copies shall accompany the load and signed or stamped by the receiving facility. One of these signed copies shall be returned to the site office for reconciliation. It is noted that a suitably licensed hauler shall be appointed to transfer waste soil from site.

14.5.2 Operational phase

Waste generated during the operational phase of the proposed redevelopment will be primarily limited to activities in office and commercial buildings, apartments and hotels.

Mitigation measures proposed to manage impacts arising from waste generated during operation of the proposed redevelopment are set out below:

- On-site segregation of all waste materials into appropriate categories including:
  – organic waste;
  – cardboard and paper;
  – plastic;
  – glass;
  – metals; and
  – mixed non-recyclables.

- All waste materials will be stored in bins or other suitable receptacles in a designated, easily accessible areas of the proposed redevelopment;
- Where possible, a high percentage of waste leaving the proposed redevelopment will be recycled, with the exception of those waste streams where appropriate recycling facilities are currently not available;
- Any waste classed as hazardous will be stored in a designated area and will be removed off site by a licensed hazardous waste contractor;
- All waste leaving the proposed redevelopment will be transported by suitable permitted contractors and taken to suitably licensed or permitted facilities; and
- Waste records and copies of relevant documentation will be maintained.

14.6 Residual Impacts

14.6.1 Construction phase

The construction phase will generate a range of non-hazardous and hazardous waste materials. The C&D WMP and other management plans will also result in appropriate management of waste and avoidance of environmental impacts, as part of the implementation of the mitigation measures.

Compliance with national legislation and the allocation of adequate time and resources dedicated to efficient waste management practices will mean that impacts are short-term and not significant.

14.6.2 Operational phase

Effective and compliant waste management during the operational phase will follow provisions of the waste hierarchy, prevailing legislation and best practice to achieve optimum levels of waste reduction, re-use and recycling. The predicted impact of the operational phase will be long-term and imperceptible.

Continued use of permitted / licensed waste hauliers and facilities will check waste removed from the facility will be managed appropriately and will avoid environmental impacts or pollution. In addition, the correct management and storage of waste will avoid litter or pollution issues at the proposed redevelopment site.

14.7 Difficulties Encountered in Compiling Information

No significant difficulty was encountered in compiling information for this chapter. The main uncertainty lies in the estimation of the volume of made ground and subsoil requiring excavation and removal from site and identifying appropriate disposal routes based on the limited soil analysis that has been completed. Additional sampling and analysis during excavation would be required to classify excavated material for waste disposal purposes and identify suitable disposal routes.

14.8 Cumulative Impacts

Other approved developments scheduled for construction during a similar timeframe to the proposed development will also lead to the generation of a range of non-hazardous and hazardous waste materials.

Similar implementation of a C&D WMP at other developments will also result in appropriate management of waste and avoidance of environmental impacts. Compliance with national legislation and the allocation of adequate time and resources dedicated to efficient waste management practices will mean that impacts are short-term and not significant.

Similarly, during the operational phase of other developments in the city centre it is expected that they will follow provisions of the waste hierarchy, prevailing legislation and best practice to achieve optimum levels of waste reduction, re-use and recycling. The predicted cumulative impact of the operational phase will be long-term and imperceptible.

This chapter should be read in conjunction with Chapter 7 Land, Soils, Geology and Groundwater as well as Chapter 13 Traffic and Transport.

14.9 References

The following is a list of sources of information consulted for use in this chapter:

- Limerick 2030 – An Economic and Spatial Plan for Limerick
- Limerick City Development Plan 2010 - 2016
- Project Opera Environmental Site Assessment and Preliminary Soil Waste Classification, June 2017, AECOM
- Project Opera Outline Construction Environmental Management Plans, June 2017, AECOM
- The Southern Region Waste Management Plan (SRWMP) 2015 – 2021
- Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects, Department of Environment, Community and Local Government

15 Material Assets

15.1 Introduction

For this assessment, material assets are identified as the built services and infrastructure present in the environment which may be impacted as a result of the proposed development.

15.2 Methodology

The study area is the city block which makes up the Opera site and the built services considered as part of the assessment are:

- Electricity;
- Telecommunications;
- Gas;
- Water Supply Infrastructure; and,
- Sewage Infrastructure.

Information presented is gathered from desktop review of services maps of the Opera site and adjoining areas used during design process of the proposed development. The impact of the proposed development on electricity, telecommunications and gas services are assessed.

Impacts on water supply infrastructure and sewage infrastructure are assessed in Chapter 8 (Water).

15.3 Baseline Conditions

15.3.1 Site Context

Specifically relating to of built services; there is a network of utilities in the ownership of a variety of companies that provide services to domestic and commercial customers routed around and across the Opera site.

The majority of built services are buried beneath public roads and footpaths which surround the Opera site. There are numerous local connections branching from these main trunk services. There are also utilities routed along the perimeter of Bank Place. The existing service maps are provided below for electricity, data infrastructure and gas (Figure 15.1 to 15.3).

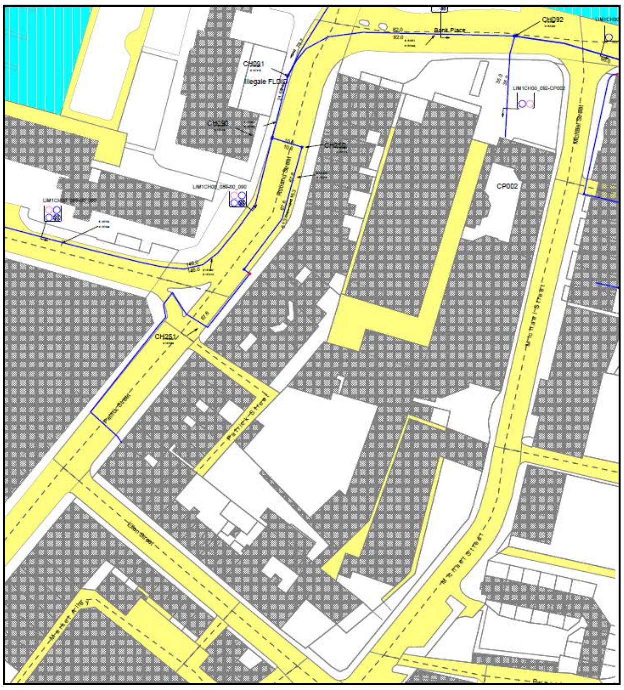


Figure 15.1: Existing Data Infrastructure

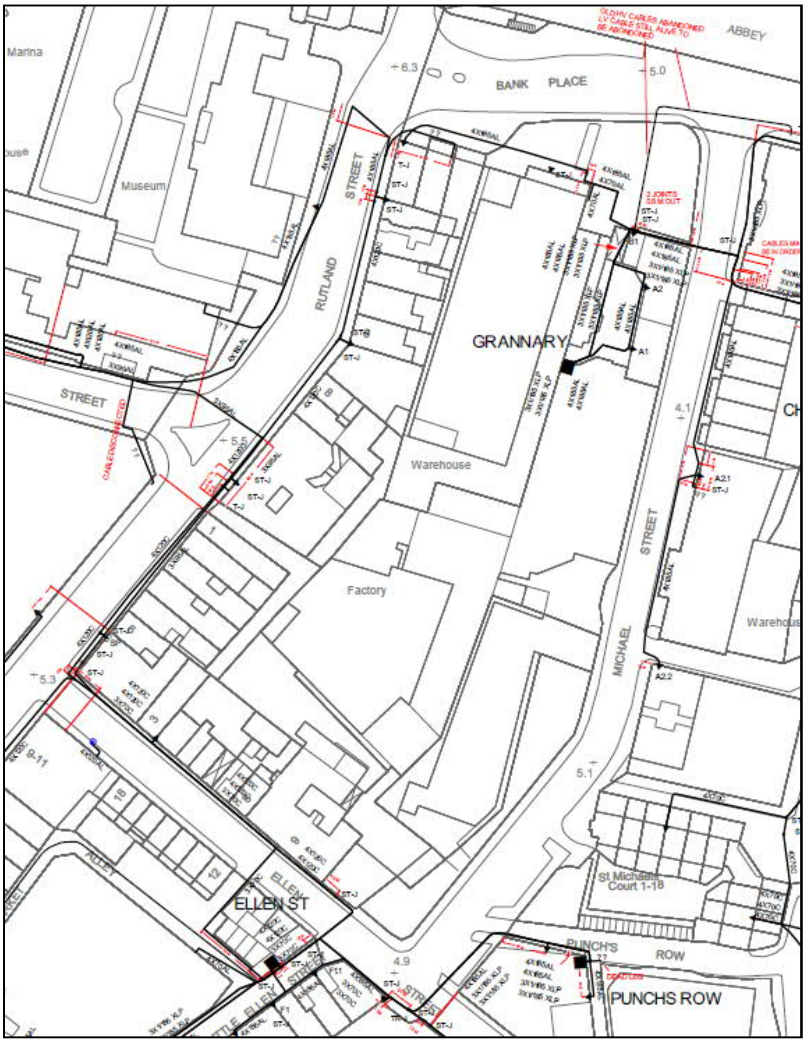


Figure 15.2: Existing ESB Infrastructure

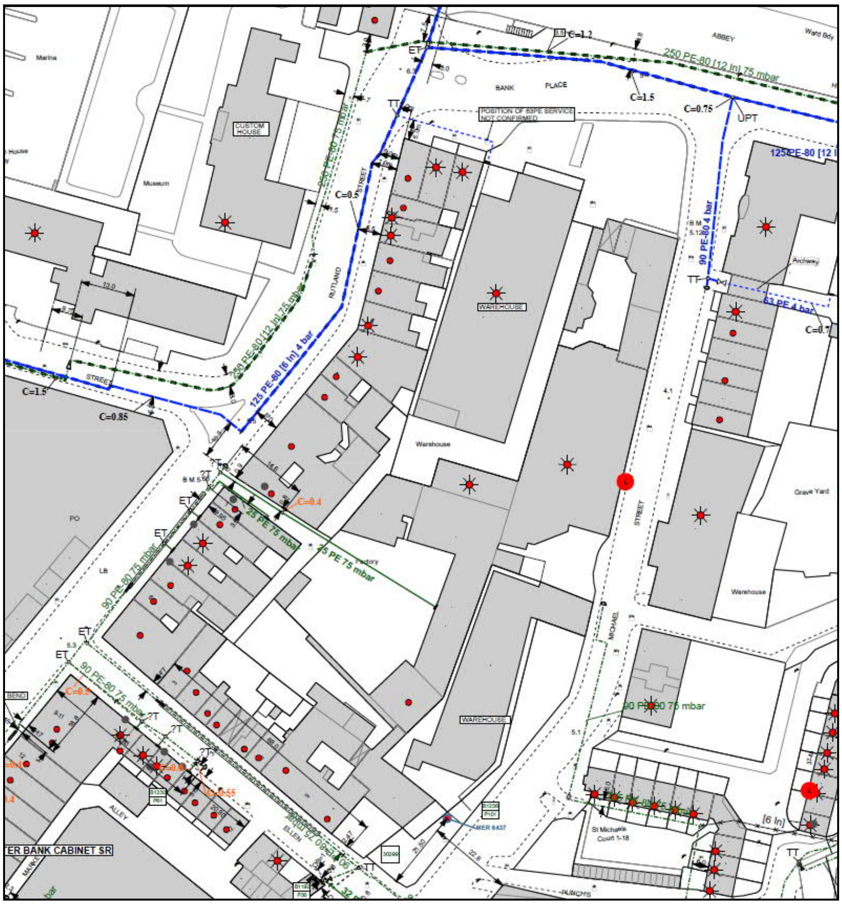


Figure 15.3: Existing Gas Infrastructure

A services survey identified the presence of overhead power lines and underground services which cross the site. These include underground electricity cables, telecommunications cables and a pressurised gas pipe which is routed from a warehouse off the carpark on Michel Street to Patrick Street.

15.4 Predicted Impacts

15.4.1 Construction Phase Impacts

15.4.1.1 Electricity

Some local diversions will be required to power supplies to accommodate the construction works.

Electricity infrastructure will be required to accommodate the development of the Opera site. Consultation will be required with ESB at detailed design stage to establish the exact point of connection with the existing ESB network. This will be within the extents of development's boundaries. The proposed installation will require ducts to be installed in the basement structure to link the various plant rooms to the existing network.

There will be some local diversions required to power supplies to accommodate the construction works. This is anticipated to be a slight, negative and short term impact.

Power will be required for construction activity, for temporary lighting and temporary signals required during construction works.

The power demands during the construction phase on the existing electricity network are considered to be slight, negative and short term.

15.4.1.2 Gas

The existing gas as built services which cross the Opera site as identified in the services layouts above, will be temporarily removed because the building it is serving is due to be demolished as part of the proposed development. Consultation will be required with Gas Networks Ireland at detailed design stage to confirm the gas pipe can be removed during construction. Further consultation will be required at detailed design to identify how the gas infrastructure proposed as part of the proposed development, for residential and commercial elements can be connected into the existing gas network.

The existing gas infrastructure can be removed during construction, as the building the gas main is coming from will be demolished.

It is anticipated there will be no effect to the gas network as a result of this removal of connection and it is not anticipated that mains gas will be used during the construction process.

It is anticipated there will be a neutral impact gas infrastructure during construction.

15.4.1.3 Telecommunications

There are local telecommunications cables within the development's boundaries and these will require diversion and improvement to facilitate the proposed development. Consultation will be required at detailed design stage with telecom service providers regarding the rerouting and reconnection of services. The proposed development will require ducting to facilitate telecommunications installation into the proposed development through the basement; however this work would take place within the development's boundaries.

There will be some local diversions required to the telecommunications network to accommodate construction work. While the contractor may require access to the telecommunications network, it would not be from the network already present on site.

Impacts are anticipated to be a slight, negative and short term.

15.4.2 Operational Phase Impacts

During operation, there will be new built services developed to both replace those which are removed as a result of the proposed development and to service the greater need for certain services relating to the use of the uses within each of the parcels.

15.4.2.1 Electricity

Electricity provision will be required for the proposed development, in addition to the commercial, residential and cultural uses, and power will also be required for the lighting in the public spaces. This will be an increase in existing electricity requirements on the Opera site, however, there will be capacity within the existing electricity network to meet these requirements. The power demands during the operational phase on the existing electricity network are considered imperceptible.

Four new ESB MV supplies will be provided to serve the site sub stations. MV to the site will be at 11 kV (± 6%).

15.4.2.2 Gas

Provision of gas infrastructure will be required during the operation of the site for both domestic, restaurant, office and residential uses, however increased demand on the existing gas network is considered imperceptible.

15.4.2.3 Telecommunications

Provision of telecommunications infrastructure will be required during the operation of the site, however the demand on the existing telecommunications network is considered imperceptible as identified in the existing services infrastructure and via liaisons with utility providers.

15.4.2.4 Sewerage Impacts

Provision of sewerage infrastructure will be required during the operation of the site. This will be dealt with further in Chapter 8 Water.

15.5 Mitigation Measures

All services are maintained unless this is agreed in advance with the relevant service provider and LCCC.

There may be some power outages required when making new connections. These will be facilitated in out of hour times to minimise impact on existing buildings and infrastructure.

All works in the vicinity of services apparatus will be carried out in ongoing consultation with the relevant utility company and/or LCCC and will be in compliance with any requirements or guidelines they may have.

Where new services are required, the contractor will apply to the relevant utility company for a connection permit where appropriate and will adhere to their requirements.

15.6 Residual Impacts

The residual impact on utility services is considered to be imperceptible.

15.7 Difficulties Encountered in Compiling Information

This assessment is based on the known built services around and on the proposed development site. The survey identified anomaly signals which could not be confirmed as built services.

The chapter should be read in conjunction with Chapter 8 to provide an overview of the impacts of the proposed development on water infrastructure.

15.8 Cumulative Impacts

In terms of other planning applications, there will be no significant effects in combination with other developments.

15.9 References

- EPA (2017) Guidelines on the Information to be contained in Environmental Impact Assessment Reports, Draft August 2017, Environmental Protection Agency (EPA);

16 Biodiversity

16.1 Introduction

This Chapter provides an assessment of the potential impacts of the proposed development on the ecological environment, i.e. flora and fauna, collectively known as biodiversity. Details of the proposed development are outlined in Chapter 3. The aims of this Chapter are to:

- Identify the relevant baseline conditions to biodiversity;
- Identify and describe all potentially significant ecological impacts associated with the proposed development;
- Ensure compliance of proposed development proposals with nature conservation legislation;
- Describe other existing and/or approved plans and projects, with which the proposed development may have significant 'cumulative impacts';
- Detail the minimum mitigation measures required to avoid or reduce significant impacts to acceptable levels;
- Identify appropriate compensation and/or enhancement measures to supplement mitigation as required;
- Provide an assessment of the significance of any residual impacts; and,
- Detail monitoring measures required to verify predictions regarding performance of mitigation measures, and to inform amended or additional mitigation as required.

16.2 Methodology

16.2.1 Naming and Formatting Conventions

Vascular plant nomenclature used in this Chapter follows that of the Botanical Society of Britain and Ireland's *Checklist of the Flora of Britain & Ireland*[27] and as such, any name changes since 2007 (including Stace, 2010) are not included. Bryophyte nomenclature follows the 2009 Checklist of British and Irish bryophytes 2009 available online from the British Bryological Society[28]. Acronyms and abbreviations are spelled in full first time. Mammal names follow those adopted in the Irish Red List (Marnell et al., 2009).

Throughout this Chapter, references to web resources not associated with a published report (e.g. online databases) are referenced in footnotes. All published reports and policy documents, including the 'grey' literature (i.e. government and consultancy documents), and peer-reviewed literature are cited within the text following the Harvard format and listed in the References in Section 16.10.

16.2.2 Context

Legislation, policy and guidelines relevant to the assessment of biodiversity are outlined in this Section.

16.2.2.1 EIA Guidance

Relevant EIA guidance to which this Chapter has had regard includes:

[27] Available online at https://bsbi.org/resources Accessed 10 October 2018.
[28] Available online at http://www.britishbryologicalsociety.org.uk/ Accessed 10 October 2018.

- Guidance on the preparation of the Environmental Impact Assessment Report (EC, 2017); and,
- Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, 2017).

16.2.2.2 European Union Habitats Directive

The "Habitats Directive" (Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna) is the main legislative instrument for the protection and conservation of biodiversity within the EU. The Habitats Directive lists habitats and species that must be protected within Special Areas of Conservation (SAC) on Annexes I and II, respectively. Additionally, the Habitats Directive identifies plant and animal species on Annex IV which are subject to strict protection anywhere they occur. The Habitats Directive sets out the protocol for the protection and management of SAC.

16.2.2.3 European Union Birds Directive

The "Birds Directive" (Council Directive 2009/147/EC on the Conservation of Wild Birds) provides a network of sites in all member states to protect birds at their breeding, feeding, or roosting areas. The Birds Directive identifies in Annex I species that are rare, in danger of extinction or vulnerable to changes in habitat and which require special protection (so-called 'Annex I' species). Special Protection Areas (SPAs) are designated under the Birds Directive to protect a range of bird populations including those of Annex I species.

Together, SACs and SPAs form a pan-European network of so-called 'European sites' for nature conservation (also known as Natura 2000 sites).

16.2.2.4 European Union Water Framework Directive

The Water Framework Directive (WFD) 2000/60/EC provides a framework for the protection and improvement of rivers, lakes, marine and ground waters in addition to water-dependent habitats. The aim of the WFD is to prevent any deterioration in the existing status of water quality, including the protection of good and high water quality status where it exists.

The WFD requires member states to manage their water resources on an integrated basis in order to achieve at least 'good' ecological status. In Ireland this is achieved through the *River Basin Management Plan for Ireland 2018-20121* (DoHGLP, 2018; 'the RBMP). The RBMP outlines all the actions required to improve the water quality, with county councils and Irish Water playing an important role in the implementation of the Plan. The proposed development site in Limerick City lies within the 'Shannon Estuary South' catchment in the Southwest region. However, the proposed development has hydrological links to the Shannon Estuary, and is upstream of the 'Upper Shannon', 'Lower Shannon' and 'Mouth of Shannon' Hydrometric Areas.

16.2.2.5 National Legislation

The primary domestic statutes in the Republic of Ireland providing for wildlife protection are the Wildlife Acts of 1976 and 2000, as amended (hereafter 'The Wildlife Acts'). A Revised and Updated version to 1 January 2017 has been published by the by the Law Reform Commission, which provided a useful reference source for this Chapter.

All bird species are protected under the Wildlife Acts from offences including intentional killing or injury, and disturbance during the breeding season. The protection extends to the eggs, young, and nests of birds. The Wildlife Acts provide protection to species not protected by the Habitats Directive (e.g. including badger *Meles meles*, hedgehog *Erinaceus europaeus,* two amphibian species, one butterfly species (small blue *Cupido minimus*), and common lizard *Zootoca vivipara*). These species are all similarly protected from intentional killing or injury. The breeding or resting sites of all these species are also protected (from wilful disturbance).

Fisheries and fish habitats are protected under the Fisheries Consolidation Act 1959 (No. 14 of 1959), as amended, the Inland Fisheries Act 2010 (No 10 of 2010) as amended, and the Local Government (Water Pollution Acts) 1977-1990, as amended.

Where used in this Chapter, the term “invasive species” refers to those species scheduled to the European Communities (Bird and Natural Habitat) Regulations 2011 (S.I. No. 477) and 2015 (S.I. No. 355) (hereafter ‘the Regulations’). The Regulations make it an offence to “plant, disperse, allow or cause to disperse, spread or otherwise cause to grow” any of the scheduled species.

A number of vascular (i.e. flowering plants) and non-vascular plant species (i.e. non-flowering or ‘lower plants’) are afforded legal protection under the Flora (Protection) Order, 2015 S.I. No. 356/2015 (hereafter ‘The Flora Protection Order’). It is an offence to cut, pick, collect, uproot or otherwise take, injure, damage, or destroy any specimens of the species listed under the Flora Protection Order.

16.2.3 Policy Context

In addition to the policy framework set out in Chapter 3, this Chapter has had regard for relevant policy at national and local levels of particular relevance to biodiversity, including:

- The National Biodiversity Plan 2017-2021 (Department of Culture Heritage and the Gaeltacht, 2017) which includes overarching policies for nature conservation across the island of Ireland without specific reference to Limerick;
- Draft Guidelines for Irish Planning Authorities on ‘Urban Development and Building Heights’ (Department of Housing, Planning and Local Government, 2018a), which state (p.9): “*In development locations in proximity to sensitive bird and / or bat areas, proposed developments need to consider the potential interaction of the building location, building materials and artificial lighting to impact flight lines and / or collision*”;
- Chapter 11 (Landscape, Biodiversity, and Recreation of the Limerick City Development Plan 2010-2016 as extended (LCC, 2010), including the protection inherent in policies LBR.8 (use of precautionary principle), LBR.7 (implementation of Limerick City Biodiversity Plan) LBR.9 (protection of River Shannon and other waterways) LBR.10 (protection of trees and wetlands);
- The Limerick City Council Biodiversity Plan (LCC, 2012) including the appendices therein which identify endangered species which have been identified in Limerick City, and “trees of note for their historical significance”;
- Policy context on invasive species in Limerick City in a report commissioned by Limerick County and City Councils (National Biodiversity Data Centre, 2010); and,
- The full suite of ‘Red Lists’, and Red Data Books which identify the conservation status of a wide range of species in Ireland, published by the National Parks and Wildlife Service (NPWS) in collaboration with relevant Northern Irish agencies (e.g. Marnell et al., 2009; Regan et al., 2010, King et al., 2011, Lockhart et al., 2012, Nelson et al., 2011; Colhoun and Cummins, 2013; Wyse-Jackson et al., 2016). The significance of the species of conservation concern identified in these lists to biodiversity is acknowledged in the National Biodiversity Plan 2017-2021, and the Limerick City Development Plan 2010-2016 as extended (LCC, 2010).

16.2.4 Defining the Study Area

The ‘Zone of Influence’ (ZoI) for a project (or “spatial extent of the impact” as described in Annex III(3) of the new EIA Directive) is the area over which ecological features may be subject to significant impacts as a result of a proposed project and associated activities. The relevant ZoI defined the Study Area for different features and impact types for the EIAR. As recommended by CIEEM (2018), professionally accredited or published studies are used to determine ZoIs. Having considered the proposed development, ZoIs have been estimated for habitats and flora and fauna species and their habitats (Appendix 16.A).

The ZoI is likely to extend beyond the boundary of a proposed development, for example where there are hydrological links downstream. The ZoI will vary for different ecological features depending on their sensitivity to an environmental change. It is therefore appropriate to identify different ZoIs for different features. The features affected could include habitats, species, and the processes on which they depend. ZoIs also differ for different types of potential impact.

It is also important to acknowledge, as per Draft EPA guidance (EPA, 2017) “that the [apparent] absence of a designation or documented feature does not mean that no such feature exists within the site”. As such, ZoIs were identified for all features potentially occurring within the proposed development site, in addition to any known to occur.

In the context of determining the ZoI for potential pollution effects from the proposed development, a conservative approach has been adopted assuming that the ZoI includes all areas downstream of the proposed development, which are:

- Within the same (freshwater) water catchment (i.e. the ‘Shannon South’ catchment’); and/or,
- All downstream estuarine areas.

16.2.5 Consultation

The Heritage Officer of Limerick City and County Council (LCCC) was contacted on 6 April 2017 to invite commentary on the scope of the ecological assessment. The Heritage Officer requested that bat and nesting bird surveys should be completed on the proposed development site, and that an AA Screening Report (and if necessary a Natura Impact Statement (NIS)) should be completed to inform the screening determination of LCCC as the competent authority. The Heritage Officer was consulted again by email on the 24 January 2019, and by phone on the 28 and 30 January 2019 to request data on any records of bird collisions with buildings in Limerick City. No records had been received at the time of writing.

The Senior Fisheries Environmental Officer of Inland Fisheries Ireland (IFI) was consulted in writing on various dates in January and February 2019. A meeting was subsequently held with the Senior Fisheries Environmental Officer on 12 February 2019, at which improvements to design of construction and operation-phase drainage were discussed and agreed between the design team and the Senior Fisheries Environmental Officer. The Senior Fisheries Environmental Officer also highlighted:

- IFI should be consulted in respect of the final mitigation measures and Construction Methodology and Phasing Management Plan proposed for the works. In particular IFI would be concerned about direct and indirect discharges to surface waters and the Abbey River in particular;
- The obligations laid down under the WFD concerning enhancement and prevention of deterioration (which apply to individual projects);
- The presence in intertidal areas of the River Shannon of native fish including dab *Limanda limanda* and plaice *Pleuronectes platessa*;
- The specific limits of surface water discharges should be provided;
- Proposed surface water treatment systems should address silt, hydrocarbons, waterborne debris, capacities (taking into account high precipitation conditions), retention times (to affect good settlement), and maintenance;
- The Abbey River is tidal, so any polluting discharge may be dispersed upstream and downstream of the point of discharge; and,
- The development of Rain Water Harvesting System (RWHS) is welcomed.

Birdwatch Ireland was consulted by email on the 29 January 2019 to request records of any bird collisions with buildings in Limerick City (or elsewhere on other tall buildings beside major rivers for context). AECOM was advised that the query had been passed to Birdwatch Ireland's scientific team on 30 January 2019. On 27 February 2019, Birdwatch responded that:

- *"Collision risk might be more related to building location rather than height";*
- *"There is historically a lack of hard data on this, while accounts and anecdotal information stems from light-related strikes from situations such as light houses whose inhabitants often had an interest in recording and rarities;*
- *"New technology in glass production is part of the solution"; as per a web (e.g. available from https://news.nationalgeographic.com/news/2014/11/141113-bird-safe-glass-window-collision-animals-science/)*

Bat Conservation Ireland (BCI) was contacted on 5 May 2017 to request bat roost records for a 5 km radius around a point centred on the proposed development site. A Data Sharing Agreement was returned to BCI on 18 May 2017; and results from the request were received on 22 May 2017.

The relevant Senior Fisheries Environmental Officer of Inland Fisheries Ireland was contacted by email on the 21 January 2019, and a response was awaited at the time of writing.

Relevant desktop resources consulted, including those maintained by the NPWS and EPA are detailed in Section 16.2.7

16.2.6 Desktop Survey Method

The desk study collated records on flora and fauna occurring within the ZoI of the proposed development. Key resources included:

- Data on designated sites and rare or protected species held online by the NPWS[29] and the National Biodiversity Data Centre (NBDC)[30];
- Data including surface and ground water quality status, available from the online database of the Environmental Protection Agency (EPA)[31]; and,
- Data on the extent and vulnerability of local groundwater bodies[32], and site-specific soil and groundwater data provided by the design team including the author of Chapter 7 of the EIAR for the proposed development ('Land Soils, Geology and Groundwater').

The following ecological records were excluded from the baseline of the EIAR:

- Records greater than 5 km from the proposed development site;
- Records greater than 50 years old;
- Records of species identified as Regionally Extinct in national Red Lists;
- Any species listed as Least Concern on Red Lists;
- Any species restricted to open coast habitats (i.e. which could not occur within the ZoI of the proposed development); and,
- Any species of upland habitats which could not occur within the ZoI (and lowland setting) of the proposed development site.

[29] Available online at www.npws.ie [Accessed January 2018].
[30] Available online at maps.biodiversityireland.ie [Accessed January 2018.
[31] Available online at http://www.epa.ie/monitoringassessment/assessment/spatial/webmapping/: Accessed June 2018.
[32] Available online at: https://gis.epa.ie/EPAMaps/ [Accessed January 2018].

16.2.7 Field Survey Methods

All surveys had regard for relevant guidance including, but not limited to, the NRA's (2009) *Ecological surveying techniques for protected flora and fauna during the planning of national road schemes*, which provides useful information on appropriate survey seasons and methods for many of Ireland's protected species, albeit in the context of road developments.

16.2.7.1 Habitats and Flora Survey Methods

Surveys were carried out on 10 and 31 May 2017 and updated on 6 June 2018 and 3 January 2019 to classify habitats using the Heritage Council's classification system (Fossitt, 2000), and map habitats following the associated mapping methodology (Smith et al., 2011). The surveys included the identification of any protected species, species of conservation concern, or species/habitats associated with designated sites.

The information gained from the survey was used to ascribe a value to habitat features, and to direct further habitat and species-specific survey work to inform this Chapter. 'Target Notes' were recorded as necessary on maps in the field to identify the location of features of note.

Habitat surveys were carried out to record dominant species, indicator species for different habitat types or conditions, rare or declining species identified on relevant Red Lists (Wyse *et al*., 2016), or invasive species.

The surveys also verified the results of desktop surveys, regarding the distribution of QI habitats of the Lower River Shannon SAC in the vicinity of the proposed development site (including the proposed outfall to the Abbey River).

16.2.7.2 Invasive species

AECOM ecologists completed a daytime walkover of the proposed development site on 10 May 2017, and again on 6 June 2018 to identify the potential presence of invasive species (i.e. those scheduled to the Regulations).

16.2.7.3 Bat surveys

Daytime Visual Inspections

A daytime visual inspection of buildings and trees (comprising existing street trees) with potential suitability for roosting bats was conducted in daylight hours on 10 and 31 May 2017 to identify and photograph potential roost features and any potential bat entry/exit points.

The visual inspection included an internal and external building inspection of safely accessible buildings including 5 & 9 Ellen Street, 8 Rutland Street and 3 Patrick Street as well as various sheds in the courtyard in the centre of the site.

The results were used to grade trees and structures as having Negligible, Low, Moderate, or High suitability for roosting bats having regard for the Bat Conservation Trust's (BCT) *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (Collins, 2016).

Bat Emergence and Re-Entry Surveys

Two surveyors carried out all surveys. Following the daytime visual inspections, emergence (pre-dusk) and re-entry (pre-dawn) surveys were carried out having regard for BCT guidance (Collins, 2016). Building features identified during the daytime inspections, characterised later in Section 16.3.6.1 were prioritised during the emergence and re-entry surveys. Dusk emergence surveys started 30 minutes before sunset and ended two hours after sunset, while dawn re-entry surveys began two hours before sunrise and ended 30 minutes after sunrise. Initial surveys were carried out in May and June 2017, with update surveys in May and June 2018. All bat survey dates are tabulated later in this Section.

Buildings identified during the daytime visual inspections as being suitable for bat roosts were watched and if any bats emerged or entered, the surveyors attempted to pinpoint the roost entrance location, and identify and count the number of bats emerging/entering where light conditions allowed.

Bat detectors were used as a means of recording bat echolocation calls and identifying species present. Bat activity was also noted during emergence surveys, to provide an indication of the site's use by bats. Surveyors listened for bats using detectors and, on hearing a bat, they made an attempt to identify species, flight direction, height, and bat behaviour (e.g. feeding indicated by a feeding 'buzz', or social calls).

In 2017, surveyors used a combination of one Batbox Duet and one EM3 Echo Meter. In 2018, full spectrum Batlogger M detectors (Elekon AG) were used by both surveyors to record bat calls for ex-situ analysis. Weather details likely to influence bat activity including temperature, wind, and rain were also recorded during each survey.

All survey data were initially recorded onto survey maps in the field before being digitised and transferred into a Geographic Information System (GIS). Bat calls collected during surveys were stored digitally and subsequently identified to species level, where possible, using Kaleidoscope Pro (version 4.5.4) specialist software. These automated species identifications were additionally verified manually.

As will be detailed in Section 16.3.6.1, once informed by the results of daytime visual inspection of buildings (and following recommendations in standard guidance (Collins, 2016) for survey effort of buildings with Moderate suitability for roosting bats), two emergence/re-entry surveys of 9 Rutland Street, 5 Ellen Street and 3 Patrick Street were carried out in May and June 2017 and a further two surveys were completed in May and June 2018 during suitable weather for bat survey (i.e. relatively calm and mild, with little or no rain). Surveyors were positioned with a view of the potential roost features on 9 Rutland Street, 5 Ellen Street and 3 Patrick Street, all of which faced into the central courtyard of the proposed development site.

Hibernation Surveys

Bat hibernation surveys were carried out by suitably experienced AECOM ecologists under licence (Licence No: DER/BAT 2017-101) on 15 December 2017 and 09 January 2018. Safely accessible basements of buildings were entered on Rutland, Ellen and Patrick Street and inspected for suitability and direct signs of hibernating bats using a combination of a torch and digital 'endoscopic' camera to inspect deeper crevices. On 15 December 2017 five buildings were inspected: 4 Rutland Street, 6 Rutland Street, 8 Rutland Street, 5 Ellen Street, and 2 Patrick Street. Following this initial inspection, two buildings were considered to be suitable for hibernating bats: 5 Ellen Street and 8 Rutland Street. These were inspected for a second time on 09 January 2018.

Bat Activity Surveys

Two surveyors carried out all surveys. Following each emergence survey, bat activity surveys were conducted within the proposed development site. A pre-determined transect route around the proposed development site was walked a total of four times over two nights on 11 May and 10 June 2017 and a total of 3 times over two nights on 10 May and 31 May 2018.

As during the emergence/re-entry surveys, surveyors listened for bats using detectors with headphones and upon hearing a bat made an attempt to identify the direction and height of bat flight, and any notable bat behaviour (e.g. foraging or commuting). The equipment used for these surveys was as described for Bat Emergence and Re-entry surveys.

A 'static' (i.e. stationary automated) bat detector (Song Meter 2+ (SM2)) was additionally placed for a period of 8 consecutive nights from 8 May to 16 May 2018 to record bat activity within the proposed development site.

As for bat emergence and return surveys, bat recordings were analysed using Kaleidoscope Pro (version 4.5.4) and confirmed with manual assessment.

Summary of Bat Surveys

A summary table identifying all bat survey dates is presented in Table 16.1.

Table 16.1. Dates and timings of bat surveys of proposed development site

Date	Survey Type	Sunset Time	Start time of survey	End time of survey
10 May 2017	Preliminary ground level assessment of trees and structures followed by dusk emergence (followed by bat activity survey)	Sunset – 21:17 Dusk– 21:59	20:48	23:20
11 May 2017	Dawn re-entry	Sunrise – 05:45 Dawn– 05:03	03:51	06:00
31 May 2017	Dusk emergence survey (followed by bat activity survey)	Sunset – 21:46 Dusk–22:35	21:16	23.17
1 June 2017	Dawn re-entry	Sunrise – 05:16 Dawn – 04:28	03:00	05:31
15 December 2017	Hibernation surveys (daytime inspections)	N/A	N/A	N/A
9 January 2018	Hibernation surveys (daytime inspections)	N/A	N/A	N/A
8 May 2018	Dusk emergence survey (followed by bat activity survey)	Sunset – 21:14 Dusk – 21:55	20:45	22:48
8 May to 16 May 2018	Static' (i.e. stationary automated) bat detector	Placed before dusk on 8 May. Removed before dusk on 16 May	N/A	N/A
6 June 2018	Dawn re-entry	Sunrise – 05:13 Dawn – 04:24	03:15	05:25

16.2.7.4 Nesting birds

A nesting bird survey was carried out on the evenings of 10 and 31 May 2017, and mornings of 11 May and 1 June 2017 following the methodology of the Common Bird Census (Merchant, 1983). This survey was repeated on the evening of 8 May 2018. The proposed development site was walked so that a surveyor came within 50 m of all potential nesting features. Birds were identified by sight and song and observations were plotted on a map. The focus of the survey was to identify the locations of individual nests in structures, to inform the potential requirement for seasonal building demolition/refurbishment. Breeding evidence was recorded in line with the British Trust of Ornithology (BTO) breeding status codes.

16.2.7.5 Wintering (Wetland Birds)

The sources of wintering bird desktop data reviewed have been described in Section 16.2.6. A walkover survey to identify the potential distribution of wintering wetland bird habitats in the Abbey

River and River Shannon within the potential ZoI of noise and vibration disturbance the proposed development was carried out in calm dry weather conditions on the morning of 12 February 2019. Wintering wetland bird surveys were not carried out (i.e. in the Abbey or Shannon Rivers upstream of the River Shannon and River Fergus Estuaries SPA), because:

- The proposed development site is dominated by existing buildings and hardstanding, and the nearest parts of the River Shannon and Abbey River (i.e. quays along the southern and eastern riverbanks) lack significant habitat features on or in which wetland birds would roost or feed (with the exception of disturbance-tolerant gull species);
- Whilst the proposed development site is (with the exception of the proposed outfall to the Abbey River) c. 75 m from the River Shannon at its nearest point, the proposed development site is visually screened from the River Shannon by existing buildings including the Hunt Museum to the northwest (two to three stories high), and Arthur's Quay Shopping Centre to the west (which is 8 stories high);
- Whilst the proposed development is (with the exception of the proposed outfall to the Abbey River) c. 14 m from the Abbey River at its nearest point, it is physically separated from the Abbey River by the existing R445 road along Charlotte's Quay (to the north), and by existing buildings three to four stories high further east along Charlotte's Quay (to the northeast); and,
- The Abbey River and River Shannon are not sufficiently tidal within the potential ZoI of disturbance from the proposed development (i.e. within c. 500 m) for there to be exposed muds on which significant populations of wetland birds would feed.

16.2.7.6 Other Protected and Notable Species

During walkover surveys of the proposed development site and wider ZoI, the potential was also noted for habitats of other protected fauna species to occur, including otter *Lutra lutra*, badger *Meles meles*, hedgehog, stoat *Mustela erminea hibernica*, pygmy shrew *Sorex minutus,* red squirrel *Sciurus vulgaris,* Irish hare *Lepus timidus hibernicus,* common lizard *Zootoca vivipara*, common frog *Rana temporaria*, smooth newt *Lissotriton vulgaris*, marsh fritillary *Euphydryas aurinia* and small blue. In the case of the latter two butterfly species, searches were made for suitable habitats for the larval food plants of marsh fritillary (devil's-bit scabious *Succisa pratensis*), and small blue (kidney vetch *Anthyllis vulneraria*).

16.2.8 Impact Assessment

16.2.8.1 Guidance

The methodology used to assess the potential impact of the proposed development on ecological features and develop relevant mitigation measures had regard for Draft EPA Guidelines on the *Information to be Contained in Environmental Impact Assessment Reports* (EPA, 2017), in addition to CIEEM's *Guidelines for Ecological Impact Assessment in the UK and Ireland* (CIEEM, 2018).

Whilst drafted in the context of transport infrastructure, the National Roads Authority's (NRA) *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (NRA, 2009) also provide useful guidance in the context of impact assessment, particularly in relation to the valuation of significant ecological features. Other guidance is referenced throughout this Chapter as relevant.

16.2.8.2 Valuing Ecological Features

Having defined the relevant baseline conditions within the ZoI of the proposed development, it is important to value significant ecological features therein, in advance of commencing the assessment of potential impacts.

The methodology used to value ecological features is compliant with relevant principles underpinning impact assessment under the revised EIA Directive 2014/52/EU. However, the methodology also has regard for the geographic frames of reference in the NRA's *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (NRA, 2009).

In conjunction with relevant terminology from Draft EPA guidance (2017), the geographic frames of reference employed by the NRA (2009) (Appendix 16.C) are employed in this Chapter when defining ecological value of features, because they provide useful examples of features at each geographic scale, and because a quantitative element (i.e. use of '1% thresholds') provides useful scientific 'rules of thumb' in an attempt standardise valuations.

Significant ecological features are those valued at Local Importance (Higher Value) or above as per the examples in Appendix 16.C. Features below this value are not carried forward to impact assessment.

16.2.8.3 Characterisation of Potential Impacts

Potential impacts of the proposed development (both positive and negative) are predicted for all significant ecological features. As already stated, in the context of the NRA's (2009) valuation criteria, significant ecological features are those valued at Local Importance (Higher Value) or above as per the examples in Appendix 16.A.

Where types of potential impact are not predicted to result in likely significant effects, these are not included. Having regard for the EPA (2017) and CIEEM (2018) guidelines, potential impacts are characterised by considering parameters shown in Table 16.2 below.

Table 16.2: Descriptions of potential impact parameters (adapted from CIEEM, NRA and EPA guidelines)

Potential Impact Parameter	Description
'Quality' of effects (i.e. positive vs negative)	Positive potential impact – a change that improves the quality of the environment or slows an existing decline in the quality of the environment. Negative potential impact – a change which reduces the quality of the environment e.g. destruction of habitat, removal of species foraging habitat.
Magnitude or extent	The size of the area, or number of sites. Proportion of a population, or other measurable unit significantly impacted by an effect.
Duration	Duration should be defined in relation to ecological characteristics (such as a species' lifecycle) as well as human timeframes. The EPA provides definitions for a wide range of effects for the following units of time in order of increasing duration: momentary, brief, temporary, short-term, medium-term, long-term, permanent.
Frequency and timing	Frequency refers to how often the effect will occur. (E.g. once, rarely, occasionally, frequently, hourly, daily or constantly). Timing differs from frequency and is of particular relevance to biodiversity effects; the timing of an activity may result in a significant potential impact if it coincides with critical life-stages or seasons (e.g. the bird nesting season). Outside this period, similar actions may not cause significant impacts.
Probability	Draft EPA Guidance (2017) categorises potential effects as either likely or not likely. Only likely (and significant) impacts are assessed in this Chapter.
Significance	Significance of effects is usually understood to mean the importance of the outcome of the effects (the consequences of the change). Refer to Section 16.2.8.4 for further details.

Potential impacts may occur during the construction phase (which is taken to also include enabling works such as demolition, vegetation clearance and earthworks) and / or the operational phase of a development. Direct potential impacts are directly attributable to an action associated with a development. Indirect potential impacts are often produced away from a development, or as a result of other initial potential impacts.

Pollution Impacts

As per the ZoIs in Appendix 16.A, pollution effects from the construction and/or operation of the proposed development are considered on a highly precautionary basis, to potentially impact hydrologically connecting wetlands downstream of, and within the same river catchment or downstream estuarine Hydrometric Areas as the proposed development.

Cumulative Impacts

Having regard for the revised wording in the New Directive (Annex IV (4)), the EIAR must consider

"*the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources*".

More than one potential impact acting on a feature simultaneously may have a cumulative potential impact that is greater than when the same potential impacts act in isolation. The study area for cumulative effects includes at least the extent of the ZoI from the proposed development boundary.

Cumulative effects can result from individually insignificant, but collectively significant, actions taking place over a period of time or concentrated in a location. Cumulative effects may be particularly important for ecological features which are already exposed to background levels of threat or pressure and could be close to critical thresholds where further impact could cause irreversible decline. This further underlines the importance of considering "*existing environmental problems relating to areas of particular environmental importance*" when assessing cumulative effects.

16.2.8.4 Determining Impact Significance

According to the EPA (2017), significance of effects is usually determined by a combination of objective (scientific) and subjective (social) concerns.

The EPA further notes that: "*While guidelines and standards help ensure consistency, the professional judgement of competent experts plays a role in the determination of significance. These experts may place different emphases on the factors involved. As this can lead to differences of opinion, the EIAR sets out the basis of these judgements so that the varying degrees of significance attributed to different factors can be understood*". With this in mind, the geographic 'frame of reference' applied to determining impact significance by the NRA (2009) in Ireland and CIEEM (2018) in Ireland and the UK, has been adopted in this report in tandem with the EPA's qualitative significance criteria. Table 16.3 compares the qualitative versus geographic approaches to determining the significance of effects.

Table 16.3: Equating the definitions of significance of effects using a geographic vs. qualitative scale of reference

Geographic Scale of Significance (NRA, 2009; but similar to CIEEM, 2018[33])	Equivalent Qualitative Scale of Significance of Effects (EPA, 2017)
Negligible or Local Importance (Lower Value). Significance of this scale of impact: No significant effects predicted to significant ecological features.	**Imperceptible**. An effect capable of measurement but without significant consequences. **Not significant**. An effect which causes noticeable changes in the character of the

[33] The categories for different scales of geographic impact significance follow those applied in the NRA (2009) in preference to CIEEM, which includes the weakly defined administrative unit "regional".

Geographic Scale of Significance (NRA, 2009; but similar to CIEEM, 2018[33])	Equivalent Qualitative Scale of Significance of Effects (EPA, 2017)
	environment but without significant consequences.
Local Importance (Higher Value), County, National, or International. Significance of this scale of impact: All impacts at these scales are significant	**Slight / Moderate / Significant / Very Significant / Profound** i

The geographic frame of reference can be a ‘good fit’ to assessments of biodiversity impacts because it allows clear judgements to be made about the scale of significance, with reference to published estimates for the population size of a given species at county, national and/or international scales or areas of habitats at such scales.

The proportion of a known feature impacted ‘at county scale’ (i.e. 1% of the known or estimated population in a given county) is measurably different from that impacted ‘at national scale’ (i.e. 1 % of the known or estimated national population).

A non-geographic ‘qualitative’ approach can be a poor fit to assessments of biodiversity, since the definitions provided for the different qualitative terms do not relate to measurable spatial units such as a county or national boundary.

In summary, given the margin of appreciation afforded for professional judgement by EPA guidance:

- A geographic rather than qualitative frame of significance is adopted in this Chapter; and,
- Potential impacts are considered either significant or not significant to reflect the wording of the revised EIA Directive, and as such the “Slight / Moderate / Significant / Very Significant / Profound” categories of the EPA are not adopted.

16.3 Baseline Conditions

16.3.1Site Overview

The proposed development site (c. 2.35 ha) is located within the urban centre of Limerick City, and is adjoined by the Abbey River to the north (which adjoins a proposed outfall in Charlotte’s Quay), the River Shannon to the west (at a separation distance of c. 75 m, beyond existing buildings and roadways), and existing urban fabric to the east.

The proposed development site contains a variety of built structures which offer nesting and roosting opportunities to bats and birds. The proposed development site is devoid of any semi-natural vegetation, with vegetation limited to scrub and weedy vegetation colonizing neglected hardstanding (and some spoil heaps), and derelict buildings.

16.3.2Sites Designated for Nature Conservation

This Section should be read with Figure 16.1: Designated sites for nature conservation. Having concluded within an Appropriate Assessment (AA) Screening Report (AECOM, 2019a) that likely significant effects on European sites could not be excluded from the construction and operation of the proposed development, the NIS (AECOM, 2019a), produced separately to this Chapter, assessed whether the proposed development could alone, or in combination with other plans and projects, have adverse effects on the integrity of any European sites.

The NIS concluded that, following implementation of mitigation, there would be no adverse effects on the integrity of European sites arising from the construction or operation of the proposed development, either alone or cumulatively with other plans or projects.

In addition to, and distinct from the NIS, this Chapter reviewed both European and nationally designated sites within the potential ZoI of the proposed development site (Figure 16.1).

The lands in which the proposed development site are located have no formal designation. A proposed surface water sewer and new outfall to the Abbey River (Charlotte's Quay) means the proposed development site is 0 m from the Lower River Shannon SAC (i.e. the proposed outfall meets the boundary of, but does not overlap the Lower River Shannon SAC). Excluding the proposed surface water sewer and associated outfall into the Abbey River, the Lower River Shannon Special Area of Conservation (SAC; site code: 002165) is located c. 75 m from the rest of the proposed development site at its nearest point.

The Lower River Shannon SAC is a very large site which stretches along the Shannon Valley from Killaloe in Co. Clare to Loop Head/ Kerry Head, a distance of some 120 km (NPWS, 2013c). This extensive freshwater and estuarine site is designated for a total of 21 terrestrial and aquatic species and habitats. As shown in Figure 16.1, the Lower River Shannon SAC is largely co-incident with two nationally designated sites:

- The Inner Shannon Estuary - South Shore proposed Natural Heritage Area (pNHA; site code 000435); and,
- The Fergus Estuary and Inner Shannon, North Shore pNHA (site code 002048).

The River Shannon and River Fergus Estuaries SPA (site code 4077), whose boundary coincides with the upper (fully) tidal limit of the Shannon Estuary is located c. 725 m downstream of the proposed development site at its nearest point. River Shannon and River Fergus Estuaries SPA is one of the most important wetland bird SPAs in Ireland, and is designated for 21 non-breeding estuarine species, a single breeding species (cormorant), and a feature comprising the totality of wetland bird habitats within the site. There are no other designated sites downstream of the proposed development site.

Excluding the two European sites within the River Shannon downstream, there are no European sites within 10 km of the proposed development site, and no other European sites are hydrologically connected to the proposed development site.

Excluding the two pNHAs within the River Shannon downstream, the nearest nationally designated site to the proposed development site is the Knockalisheen Marsh pNHA (site code 2001). This pNHA is located c. 1.75 km to the north of and upstream of the proposed development site and is not hydrologically connected to it.

The designated sites discussed in this Section are shown in Figure 16.1, and the reasons for designation of these sites are presented in Table 16.4.

Table 16.4: Reasons for designation of relevant designated sites for nature conservation

Designated Site Name (and Code)	Distance to Proposed Development (at Closest Point)	Reasons for Designation
Lower River Shannon SAC (002165)	0 m from new outfall required as part of proposed development **Designated site is hydrologically linked to proposed development**	As per latest Conservation Objectives (NPWS, 2012a): (*= Priority habitat) • *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* • Atlantic salt meadows • *Coastal lagoons

Designated Site Name (and Code)	Distance to Proposed Development (at Closest Point)	Reasons for Designation
		• Estuaries • Large shallow inlets and bays • Mediterranean salt meadows • *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils • Mudflats and sandflats not covered by seawater at low tide • Perennial vegetation of stony banks • Reefs • *Salicornia* and other annuals colonising mud and sand • Sandbanks which are slightly covered by sea water all the time • Vegetated sea cliffs of the Atlantic and Baltic coasts • Watercourses of plain to montane levels Species: • Brook lamprey *Lampetra planeri* • Common bottlenose dolphin *Tursiops truncatus* • Freshwater pearl mussel *Margaritifera margaritifera* • Otter *Lutra lutra* • River lamprey *Lampetra fluviatilis* • Atlantic salmon *Salmo salar* • Sea lamprey *Petromyzon marinus*
Fergus Estuary and Inner Shannon, North Shore pNHA (002048)	c. 140 m west and downstream **Designated site is hydrologically linked to proposed development**	No site synopsis available. This pNHA shares reasons for designation with the both the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA with which the pNHA is largely co-incident.
Inner Shannon Estuary - South Shore pNHA (000435)	c. 1.4 km south west and downstream **Designated site is hydrologically linked to proposed development**	No site synopsis available. This pNHA shares reasons for designation with the both the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA with which the pNHA is largely co-incident.
River Shannon and River Fergus Estuaries SPA (004077)	c.730 m south west and downstream **Designated site is hydrologically linked to proposed development**	As per latest Conservation Objectives (NPWS, 2012b): Species (**all non-breeding populations except for Cormorant) • Bar-tailed godwit *Limosa lapponica* • Black-headed gull *Chroicocephalus ridibundus* • Black-tailed godwit *Limosa limosa* • **Cormorant *Phalacrocorax carbo* (both breeding and non-breeding populations • Curlew *Numenius arquata* • Dunlin *Calidris alpina alpina* • Golden plover *Pluvialis apricaria* • Greenshank *Tringa nebularia* • Grey plover *Pluvialis squatarola* • Knot *Calidris canutus* • Lapwing *Vanellus vanellus* • Light-bellied Brent goose *Branta bernicla hrota* • Pintail *Anas acuta* • Redshank *Tringa totanus* • Ringed plover *Charadrius hiaticula* • Scaup *Aythya marila*

Designated Site Name (and Code)	Distance to Proposed Development (at Closest Point)	Reasons for Designation
		• Shelduck *Tadorna* • Shoveler *Anas clypeata* • Teal *Anas crecca* • Whooper swan *Cygnus cygnus* • Wigeon *Anas penelope* Habitats: • Wetland and waterbirds
Knockalisheen Marsh pNHA site Code (2001).	1.75 km north and upstream (no hydrological link	No site synopsis available. This pNHA shares reasons for designation with the Lower River Shannon SAC with which the pNHA is largely co-incident.

Applying the precautionary ZoI for pollution effects in Appendix 16.A (i.e. the downstream surface water catchment and estuarine Hydrometric Areas), all of the designated sites in Table 16.4 are within the ZoI of potential pollution effects, with the exception of the Knockalisheen Marsh pNHA.

16.3.3 Protected and Rare Species

Protected and rare fauna species returned from the desk study within a 5 km radius of the proposed development site are presented in Table 16.5.

Table 16.5: Protected and rare fauna species returned from NBDC, NPWS, and BCI data search within 5 km of proposed development site (sorted by group, then by common name)

Group	Common Name	Scientific Name	Legally Protected (see Table Footnotes for Key)	Red-Listed (Excluding Least Concern; see Table Footnotes for Key)	Habitat Preferences (see Table Footnotes for Key)
Amphibian	Common frog	*Rana temporaria*	✓ b	-	Freshwater, ponds, wet grassland, marsh, wet heat and other peatlands, woodland and scrub, dune slacks, and machair.
Amphibian	Smooth newt	*Lissotriton vulgaris*	✓ b	-	Freshwater ponds and ditches during aquatic phase of lifecycle; in addition to various scrub wooded and grassed vegetation when hibernating and otherwise in terrestrial phase.
Bird	Barn owl	*Tyto alba*	-	✓ d	Typically nests in relatively undisturbed buildings (and occasionally occupied rural dwellings). Feeds over arable and cropland, along edges of watercourses, and grass strips alongside woods and roadways.
Bird	Black-headed gull	*Larus ridibundus*	-	✓ d	Primarily nests on islands in inland lakes (and offshore islands). Rarely nests on urban rooftops. Feeds and roosts in a wide variety of habitats including urbanized contexts (parks, landfills, coastal amenity areas).

Group	Common Name	Scientific Name	Legally Protected (see Table Footnotes for Key)	Red-Listed (Excluding Least Concern; see Table Footnotes for Key)	Habitat Preferences (see Table Footnotes for Key)
	Corncrake	*Crex crex*	✓ c	✓ d	Nests on inland flood plans and offshore islands. Occasionally found in more disturbed habitats on passage migration.
	Dunlin	*Calidris alpina alpina*	✓ b	✓ d	Feeds and roosts in intertidal areas in the non-breeding season. The breeding population (*Calidris alpina schinzii*) is restricted to upland areas and relatively undisturbed machair.
	Eurasian curlew	*Numenius arquata*	✓ b	✓ d	Feeds and roosts in intertidal areas in the non-breeding season. A small proportion of the population occurring in Ireland (< 200 pairs) breeds in remote upland areas.
	Eurasian woodcock	*Scolopax rusticola*	✓ b	✓ d	Winters in relatively undisturbed grassland, wooded and farmland habitats. Breeds in relatively remote wooded areas.
	Eurasian wigeon	*Anas penelope*	✓ b	✓ d	Feeds and roosts in intertidal areas in the non-breeding season.
	European golden plover	*Pluvialis apricaria*	✓ b,c	✓ d	Feeds and roosts in intertidal areas in the non-breeding season. A small proportion of the population occurring in Ireland (<100 pairs) breeds in remote upland areas.
	Herring gull	*Larus argentatus*	✓ b	✓ d	Primarily nests on urban rooftops, and offshore islands. Feeds and roosts in a wide variety of habitats including urbanized contexts (parks, landfills, coastal amenity areas).
	Northern lapwing	*Vanellus vanellus*	✓ b,	✓ d	Feeds and roosts in intertidal areas in the non-breeding season. A smaller population of birds primarily nests in lowland floodplain habitats.
	Northern pintail	*Anas acuta*	✓ b	✓ d	Feeds and roosts in intertidal areas in the non-breeding season.
	Tufted duck	*Aythya fuligula*	✓ b	✓ d	Feeds and roosts in intertidal areas in the non-breeding season.
	Yellowhammer	*Emberiza citrinella*	✓ b	✓ d	A farmland species associated with arable land where it feeds on grain and seeds. Nests in the base of hedgerows.
Invertebrates	Desmoulin's whorl snail	*Vertigo moulinsiana*	✓ a	✓ e	Calcareous lowland wetlands, particularly swamps and marshes with tall vegetation.
	Globular pea mussel	*Pisidium hibernicum*	-	✓ e	A range of habitats including lakeshores lowland rivers and canals.
	Heath snail	*Helicella itala*	-	✓ f	Sandy calcareous pastures and heathy ground inland on the central limestone plain of Ireland.
	Large red tailed bumble bee	*Bombus lapidarius*	-	✓ b	Found in a wide range of habitats, including parks and gardens.

Group	Common Name	Scientific Name	Legally Protected (see Table Footnotes for Key)	Red-Listed (Excluding Least Concern; see Table Footnotes for Key)	Habitat Preferences (see Table Footnotes for Key)
	Marsh fritillary	*Euphydryas aurinia*	✓ a,b	✓ c	Habitats containing the larval foodplant devil's bit scabious *Succisa pratensis* including wet grasslands, coastal grey dunes, machair and cutover bog.
	Silky snail	*Ashfordia granulata*	-	✓ e	Light hazel scrub, along hedgerows and in scrubby pasture.
Mammal	Common pipistrelle	*Pipistrellus pipistrellus sensu lato*	✓ a,b	-	Along hedgerows and treelines, woodlands, parklands.
	Lesser horseshoe bat	*Rhinolophus hipposideros*	✓ a,b	-	Originally a cave-dwelling species all year round, in Ireland the lesser horseshoe bat chooses buildings for its summer or nursery roosts, prefers old stone buildings, usually with natural slate roofs, for summer roosts, because these offer a warm area, usually at the roof apex, in which to rear the young. However, this species is also found in sites that appear less suitable
	Otter	*Lutra lutra*	✓ a,b	✓ a	Lakes and ponds, watercourses, riparian woodland, estuaries, sea inlets and bays, saltmarshes, swamps, riparian

Table Footnotes

-Key to Red Lists: a Marnell et al., 2010 b Fitzpatrick et al., 2006, c Regan et al., 2010, d Colhoun, and Cummins, 2013, e Byrne et al 2009, f King et al., 2011).

-Key to Legally Protected Species: a Habitats Directive, b Wildlife Acts, c Annex 1 of Birds Directive.

-Habitat preferences:

Bird habitats from https://www.birdwatchireland.ie (Accessed December 2018) and professional experience.

Mammal (except lesser horseshoe bat), amphibian, and invertebrate habitats (except non-marine molluscs) from relevant Red Lists and professional judgement.

Lesser horseshoe bat habitats from https://www.mammals-in-ireland.ie/species/lesser-horseshoe-bat (Accessed December 2018).

Non-marine mollusc habitats from http://www.habitas.org.uk/molluscireland/species.asp?ID=91 (Accessed December 2018).

Given the city centre location of the proposed development site (which is dominated by hardstanding and which lacks any semi-natural habitats), potentially suitable habitat is present within the ZoI of the proposed development site for the following bird species from Table 16.5:

- Breeding and roosting herring gull (on rooftops of existing buildings and adjacent urban areas) which also feed in the River Shannon and adjacent urban areas;
- Black-headed gulls who could roost but typically do not breed on rooftops of existing buildings and adjacent urban areas) which also feed in the River Shannon and adjacent urban areas; and,
- Eight non-breeding ducks and other waterfowl in Table 16.5 (excluding corncrake which is found only in remote areas) which could feed in estuarine areas downstream, but would not feed, roost, or breed within or adjacent the proposed development site.

Of the other fauna species in Table 16.5, only the following could occur:

- Otter could occasionally commute or feed in the River Shannon, or along quay walls within the ZoI of the proposed development site, although the lack of semi-natural habitat means the locale is sub-optimal for otter, and would be unlikely to offer breeding or resting sites to otter; and,
- Common pipistrelle bat could (and as will be shown later in this Chapter does) feed and roost within existing buildings in the proposed development site;

There is no suitable habitat within the ZoI of the proposed development site for any of the invertebrate, or amphibian species in Table 16.5.

Protected and rare flora species returned from the desk study within a 5 km radius of the proposed development site are detailed in Table 16.6.

Table 16.6: Protected and rare flora species returned from NBDC and NPWS data search within 5 km of proposed development site

Common Name	Scientific Name	Red-listed Excluding Least Concern (See Footnotes)	Flora Protection Order	Habitat Preferences (see Table Footnotes)
Fine-leaved marsh feather-moss	*Campyliadelphus elodes*	✓ a	✓	Found in moist and wet habitats, especially those that are periodically submerged, growing in turf, on wood especially in base rich marches and seepages, on damp sand, ditches and sand dunes.
Opposite-leaved pondweed	*Groenlandia densa*	✓ b	✓	Calcareous waters in rivers, streams, canals, ditches and ponds. Associated with rivers and other periodically disturbed watercourses, where it benefits from the reduction of competition through disturbance.
River bristle-moss	*Orthotrichum rivulare*	✓ a	✓	Grows on trees by silty rivers (lowland). Also found on riverside rocks or masonry.
Triangular club-rush	*Schoenoplectus triqueter*	✓ b	✓	Restricted to tidal stretches of rivers. All known populations of the species are located within or adjacent to the Lower River Shannon SAC.

Table Footnotes

-Red List Sources: a Lockhart et al., 2012, b Wyse Jackson et al., 2016).

-Habitat Preferences: Atherton et al. (2012) for bryophytes as (available online from http://rbg-web2.rbge.org.uk; (Accessed December 2018); Wyse-Jackson et al (2016) and the Online atlas of the British and Irish Flora for vascular plants (https://www.brc.ac.uk/plantatlas/; Accessed December 2018).

There is no potentially suitable habitat for any of the rare and/or protected plant species in Table 16.6 within the footprint of the proposed development site.

Triangular club-rush is an estuarine sub-community of the Annex 1 ‘watercourses of plain to montane levels habitat’ which is a reason for designation (or Qualifying Interest; QI) of the Lower River Shannon SAC. The nearest known location for triangular club-rush is c. 845 m south east and downstream of the proposed development site, in the River Shannon (NPWS, 2012a).

The nearest known location for opposite-leaved pondweed is c. 330 m north east and upstream of the proposed development site in the Abbey River/Park Canal.

16.3.4 Habitats

Habitats recorded within the proposed development site are shown in Figure 16.2; which includes the relevant habitat codes from Fossit (2000).

A description of each habitat present within the proposed development site is provided below. Full species lists for each habitat are presented in Appendix 16.B. Whilst the habitat descriptions are written in the present tense, they are reflective of site conditions as of June 2018, and may have changed since then due to natural or man-made influences.

BL Built land

The proposed development site is dominated by built land. Buildings and artificial surfaces (BL3) are typically devoid of vegetation. However some buildings, and Stone walls (BL1) include scattered plants of Atlantic ivy *Hedera hibernica*, ivy leaved toadflax *Cymbalaria muralis*, red valerian and butterfly-bush.

ED2 Spoil and bare ground/ ED3 Recolonising bare ground mosaic

This habitat primarily occurs on hardstanding, gravel, spoil heaps, and gullies within the inner courtyard, and to the rear of the derelict Georgian buildings to the west and south of the proposed development site, and around the site entrance and security buildings.

A variety of common pioneer and weedy species such as rose-bay willow herb *Chamerion angustifolium*, common nettle *Urtica dioica*, ragwort *Senecio jacobaea*, dandelion *Taraxacum officinale* agg., ribwort plantain *Plantago lanceolata*, greater plantain *Plantago major*, daisy *Bellis perennis*, cleavers *Galium aparine*, white clover *Trifolium repens*, creeping buttercup *Ranunculus repens*, spear thistle *Cirsium vulgare*, common figwort *Scrophularia nodosa*, woody nightshade *Solanum dulcamara*, Yorkshire-fog *Holcus lanatus*, red valerian *Centranthus ruber*, as well as frequent patches of butterfly-bush *Buddleja davidii* are present across the site.

WL2 Treelines

A total of 16 planted young to semi-mature trees are located around the boundary of the proposed development site. These were dominated by non-native specimens of Norway maple *Acer platanoides,* small-leaved lime *Tilia cordata* and sycamore *Acer pseudoplatanoides.* Some (native~) planted wych elm *Ulmus glabra* trees also occurred.

16.3.4.1 Protected Flora and Plant Species of Conservation Concern

No plants protected under the Flora Protection Order were identified within the urban habitats present. All vascular plants recorded within and adjacent the proposed development site are of “Least Concern” on the Irish Red List (Wyse Jackson et al., 2016).

Neither of the two “trees of note for their historical significance” identified in the Limerick City Biodiversity Plan 2012 occur within the ZoI of the proposed development site.

Bryophyte communities (i.e. mosses and lichens) associated with QI ‘watercourses of plain to montane levels’ habitat of the Lower River Shannon SAC were identified on the existing limestone wall of Charlotte Quay by the Abbey River, in the vicinity of the proposed surface water outfall (Figure 16.2). Having regard for the Site-specific Conservation Objectives for the Lower River Shannon SAC (NPWS, 2012a), these bryophytes correspond to the “*high-conservation value sub-type*” named “*Bryophyte-rich streams and rivers*”.

The bryophyte growth noted in the wall of Charlotte Quay (Photograph 16.1), conspicuously followed the horizontal line of frequent flooding of the Abbey River, approximately 1 m below the location of the existing outfall and in the vicinity of the location of the proposed outfall. It was not safe to collect a sample of the bryophytes to determine the species present given their location below the existing road level. Furthermore, having regard for European Commission guidance (EC, 2013), it is arguable that [any] "*aquatic mosses*" (p. 46) qualify as QI 'watercourses of plain to montane levels' habitat, regardless of which species are present. As such, applying the Precautionary Principle, these aquatic bryophytes were assumed to constitute QI habitat of the Lower River Shannon SAC of international importance.

Photograph 16.1. View south of Charlotte's Quay. New outfall to be installed in the vicinity of existing outfall (blue dot), significantly above the typical flood level containing bryophytes, and indicated by a blue line.

The interpretation that the mosses present constitute the bryophyte-rich sub-type of QI 'watercourses of plain to montane levels' habitat is further supported by the relevant Conservation Objectives supporting documentation (NPWS, 2012c) in which it is stated:

- *"There are many bryophytes that grow on rocks in and by streams and rivers, where they keep moist from the constant humidity or water splashes (p. 4)"; and,*
- *"The full distributions of this habitat and its sub-types are currently unknown. Further investigation of all sub-types is required (p.3)".*

16.3.5 Invasive Flora and Fauna

No 'scheduled' invasive species were recorded within the proposed development site. All the" 'dirty dozen"[34] of invasive species identified as priorities for action in Limerick City are also scheduled species, and therefore none of these species occur within the proposed development site.

16.3.6 Bats

This Section should be read with Figure 16.2 Significant Ecological Features.

16.3.6.1 Roosting Bats

The preliminary ground level assessment in May 2017 determined that all trees around the proposed development site had negligible suitability for roosting bats. Three Georgian buildings, while dilapidated, had potentially suitable features for roosting bats (9 Rutland Street, 5 Ellen Street and 3 Patrick Street). Given the urban location (with limited habitat connectivity to semi-natural habitats), all these structures were initially assigned 'Moderate' suitability for roosting bats (following definitions in Collins, 2016). Photographs of some features in these structures are shown in Photograph 16.2.

No evidence of bats was noted during preliminary ground level assessments (e.g. droppings, staining, dead carcasses or insect feeding remains).

[34] So-called within the report commissioned by Limerick County and City Councils on invasive species (National Biodiversity Data Centre, 2010).

Photograph 16.2 Features of structures to rear of 9 Rutland Street (left hand side) and buildings on Patrick Street (centre and right) exhibiting potential entry/exit points for bats.

The cellars of 5 Ellen Street displayed some suitability for use by bats during hibernation, since these areas are designed to maintain a relatively constant temperature throughout the year. However, whilst there were some cracks and crevices in brickwork which could potentially be suitable for roosting bats, no evidence of bats was identified during hibernation surveys in December 2017 and January 2018. All other structures within the proposed development site have been determined as of negligible suitability to roosting bats

During the surveys of 9 Rutland Street, 5 Ellen Street and 3 Patrick Street During in both 2017 and 2018 (total of four surveys), common pipistrelle were active to the rear of 9 Rutland Street. Up to six common pipistrelle bats were observed exiting and re-entering an open window at 9 Rutland Street during three of the surveys conducted in 2017 and 2018 (See Photograph 16.3). The size of common pipistrelles summer roosts vary widely. The maximum of six bats counted emerging or entering this roost, suggests it is more likely a transitory male roost or non-breeding female roost (i.e. non-maternity roost).

Given the mean common pipistrelle roost size in Ireland of 23.5 individuals, and the roost size of c. 300 common pipistrelle individuals recorded in one roost (Roche et al., 2014), the common pipistrelle roosting populations present within the proposed development site are considered to be of Local Importance (Higher) value.

The specific location, and type of roosting features in 9 Rutland Street (e.g. whether in brickwork, under tiles, or in other crevices) could not be identified from ground level (the building could not be safely entered), and a precautionary approach to mitigation was adopted to address this uncertainty (See Section 16.7).

Photograph 16.3. Entrance point to confirmed common pipistrelle roost to the rear of 9 Rutland Street

No other bats were observed to emerge or re-enter from any other building during surveys carried out in 2017 and 2018, and these buildings do not contain roosting bats.

16.3.6.2 Bat Activity

Bat activity surveys on the 10 and 31 May 2017 and 8 May 2018 were carried out followed dusk emergence.

Three species of bat (common pipistrelle, soprano pipistrelle and Leisler's bat) were observed and recorded using the proposed development site on Batlogger M detectors during the (manned) bat activity surveys.

Common pipistrelle bats (which roost in No. 9 Rutland Street) were regularly observed foraging and commuting throughout the night on all surveys, while one or two passes of soprano pipistrelle and Leisler's bat were additionally recorded commuting (and potentially feeding) through the site on various surveys.

The hotspot for bat activity within the proposed development site, across all surveys, was the courtyard to the rear of Ellen Street (Figure 16.2).

Photograph 16.9 Vegetated courtyard in site interior where bat foraging activity 'hotspot' was recorded

At least five common pipistrelle bats were recorded over the vegetated courtyard, and behind the houses on Ellen Street. Several passes of foraging or commuting soprano pipistrelle and commuting Leisler's bat were noted on all survey nights, in addition to common pipistrelle.

Relative to much of the rest of the proposed development site, this courtyard is dark and vegetated. The weedy vegetation established on structures, ground and walls in this area appeared to provide invertebrate prey to the three species of bats feeding there.

Data from the (unmanned) SM2 static detector located in the courtyard behind Ellen Street over an eight-night period from 8 May to 16 May 2018 concurred with the results of the manned activity surveys that this proposed development site was most significant as a foraging and commuting resource for common pipistrelle (98% of a total of 3,955 calls recorded). Across all survey nights there were relatively few records of soprano pipistrelle (1% of calls) and Leisler's bat (1% of calls).

16.3.7 Birds

16.3.7.1 Nesting Birds

This Section should be read with Figure 16.2 Significant Ecological Features. Combining the results of 2017 and 2018, a minimum of 13 nests, from seven species were confirmed within the boundary of the proposed development site (Table 16.7).

Table 16.7 Results of breeding bird survey outlining breeding status and number of nests

Common Name	Scientific Name	Breeding status (Based on BTO Breeding Status)	Minimum No. of Probable/ Confirmed Nests (Peaks from 2017 and 2018 seasons)	Location of Nest site	Conservation Status	
					Birds of Conservation Concern in Ireland	**EU Birds Directive (Annex I)**
Feral pigeon	*Columba livia*	Nest with young heard	4	Ceiling off Ellen Street	Green-listed	-
Herring gull	*Larus argentatus*	Agitated behaviour and pair present	1	Rooftop: Rutland Street	Red-listed	-
House sparrow	*Passer domesticus*	Occupied nest	3	Colony in wall of Ellen St. Garden Centre; another: under roof slates of building off Patrick Street	Amber-listed	-
Jackdaw	*Corvus monedula*	Occupied nest	1	Lintel cavity: back of house on Ellen Street	Green-listed	-
Lesser black-backed gull	*Larus fuscus*	Occupied nest	1	Chimney pot on Rutland Street roof top	Amber-listed	
Starling	*Sturnus vulgaris*	Occupied nest	2	Under roof cavities and other locations to rear of houses on Ellen Street	Amber-listed	-
Swift	*Apus apus*	Visiting probable nest site	1	Free-standing wall in the courtyard	Amber-listed	-

The locations of all bird nest sites are shown in Figure 16.2, and some nest sites are shown in Photograph 16.4.

Photograph 16.4. a) Wall in courtyard containing swift nest. b) Starling and jackdaw nest location. c) Location of feral pigeon colony off Ellen Street.

No specially protected bird species listed under Annex I of the Birds Directive were recorded breeding, foraging, or commuting in the proposed development site.

Herring gull was the only Red-listed bird species of High Conservation Concern nesting within the proposed development site, Probable breeding evidence for a single pair of herring gull was recorded at buildings on Rutland Street in the summer of both 2017 and 2018.

Four Amber-listed bird species of Medium Conservation Concern were recorded nesting within the proposed development site (house sparrow, lesser black-backed gull, starling, and swift), in addition to two Green-listed species of Low Conservation Concern (jackdaw *Corvus monedula* and feral pigeon *Columba livia*).

Swift was observed foraging over the proposed development site in both 2017 and 2018 (peak number of 6 'screaming' birds observed in flight). Screaming flocks are often an indication that swifts are breeding in an area (Ferguson et al., 2011). One nest was confirmed in a wall (2018 only); however, given the availability of suitable nest sites for the species in buildings within the proposed development site, it is possible that additional swift nest sites are present.

There were no nesting birds identified in the existing street trees on the proposed development site.

The city centre location of the buildings made them unsuitable as nest sites for barn owl *Tyto alba*. The potential presence of peregrine falcon will be assessed prior to the commencement of demolition and construction by a suitably qualified ecologist, as they can nest on urban structures, and are the SCI of several SPAs in Ireland. There is no evidence, from desktop data or field surveys, of peregrine falcon roosting or nesting within the proposed development site.

There is no potential breeding habitat (i.e. riparian wooded areas) for cormorant of the River Shannon and River Fergus Estuaries SPA within the nearby Abbey or Shannon Rivers or wider ZoI of noise and vibrational disturbance from the proposed development site.

16.3.7.2 Wintering Birds

Feeding and Roosting Birds

The urban habitats within the proposed development site do not offer feeding or roosting habitat to significant wintering birds of conservation concern. Some nesting gull and passerines within the proposed development site may feed and/or roost there in the non-breeding season; however, such populations would be relatively mobile during the non-breeding season and are likely to also forage and roost beyond the boundary of the proposed development site during that period.

Observations on known and potential wintering wetland bird habitats were assessed in the course of the walkover survey of the Abbey River and River Shannon on the 12 February 2019, in conjunction with the digital version of the Site-Specific Conservation Objectives (SSCO) for the River Shannon and River Fergus Estuaries SPA (NPWS, 2012g). Together, field observations and desktop data indicate that the nearest significant bird populations of the River Shannon and River Fergus Estuaries SPA to the proposed development site are SCI wintering and feeding flocks of several hundred black-headed gull[35]. The SCI black-headed gull populations roost (and in some locations feed on discarded food) on existing quay walls, pontoons, and railings on the eastern bank of the River Shannon, c. 120 m southwest of the proposed development site at their nearest point (pontoons by the Hunt Museum). These SCI black-headed gull feeding/roosting locations are physically screened from the proposed development site by existing buildings.

There are likely to be SCI feeding populations of several other species for which the River Shannon and River Fergus Estuaries SPA is designated (e.g. several duck species[36], whooper swan *Cygnus cygnus*, and light-bellied Brent goose *Branta bernicla hrota*), in the River Shannon downstream of the proposed development site.

Birds In Flight

Black-headed gull individuals were observed overflying the proposed development site in winter 2018 and 2019. This would be expected due to the urban context for the proposed development site (as urban sites are favoured by many gull species) and due to the proximity of nearby black-headed gull roosts. There is also potential for other SCI bird species to overfly the proposed development site such as cormorant *Phalacrocorax carbo*, or light-bellied Brent goose *Branta bernicla hrota*, if commuting between downstream estuarine areas within the River Shannon and River Fergus Estuaries SPA, and upstream, undesignated (inland) feeding/roosting areas including playing pitches, or other wetlands/green spaces. Numbers and/or frequency of flights of these other SCI species are predicted to be significantly reduced relative to black-headed gull.

As such, whilst the wetland birds named in the preceding paragraph do not stop to feed or roost within the proposed development site, they may occasionally fly through or over it (and this is of relevance to the assessment of potential bird collision risk from proposed structures).

[35] Smaller flocks of herring gull, common gull *Larus canus,* and lesser-black-backed gull *Larus fuscus* also occur, but these are not SCI features of the River Shannon and River Fergus Estuaries SPA.
[36] Shelduck *Tadorna tadorna*, Wigeon *Anas penelope*, Teal *Anas crecca*, and Shoveler *Anas clypeata* may all occur.

16.3.8 Otter

This species is a QI of the Lower River Shannon SAC. There are no potential locations for breeding or resting sites of otter within the ZoI of the proposed development site, and there is no sheltered riparian feeding habitat often favoured by otter (O'Sullivan, 1993). A search of NBDC records[30] returned a 2017 observation of an individual otter in the River Shannon, c. 400 m south west of the proposed development. Otter may occur occasionally in the nearby Shannon and/or Abbey Rivers within the ZoI of pollution effects, and/or vibration impacts from piling.

16.3.9 Invertebrates

The presence of three species of foraging bats (including regularly common pipistrelle bats) over areas of recolonising bare ground indicates that significant flying invertebrates are present over the unlit interior of the proposed development site. However, no butterflies, bees, or other conspicuous invertebrates were recorded within the proposed development site, despite the abundance of butterfly bush and some other potential insect food plants in areas of recolonising bare ground.

No suitable habitat (devil's bit scabious*)* was identified for Ireland's only European protected butterfly species, the marsh fritillary. There was also no habitat for Ireland's only nationally protected butterfly; small blue. Kidney vetch, the larval food plant of small blue, is a plant of calcareous grassland and is not present within the proposed development site.

There are no suitable (freshwater) habitats for QI freshwater pearl mussel *Margaritifera margaritifera* within the ZoI of the proposed development. The habitat of freshwater pearl mussel in Ireland is restricted to near natural, clean flowing fresh waters, often downstream of ultra-oligotrophic lakes (NS2, 2010). The nearest known population of freshwater pearl mussel to the proposed development is within the Cloon (Shannon Estuary) catchment (NS 2, 2010), which is not hydrologically connected to the proposed development site.

There is no suitable habitat for QI marsh fritillary butterfly *Euphydryas aurinia* of the Lower River Shannon SAC within the ZoI of the proposed development (i.e. semi-natural habitats containing the larval food plant devil's bit scabious *Succisa pratensis*). The nearest European site with QI marsh fritillary butterfly is Barrigone SAC (site code 1065), located c. 28 km south west of the proposed development, which is outside the potential dispersal range of the species (i.e. c. 10 km, according to Zimmerman *et al*., 2011).

There is no potential habitat for other QI invertebrate species (e.g. whorl snails *Vertigo* spp., or Kerry slug *Geomaculus maculosus*) within the ZoI of the proposed development site

There was no known habitat for any other invertebrates of conservation interest within the ZoI of the proposed development site (see Section 16.3.3).

16.3.10 Fish and Aquatic Features

There are no suitable habitats for freshwater pearl mussel *Margaritifera margaritifera* within the estuarine waters downstream of the proposed development, as this species requires (as its name suggests) freshwater.

QI Atlantic salmon *Salmo salar* spawn upstream and outside the ZoI of the proposed development. However, the species would occur in the estuarine waters of the River Shannon on passage between upstream spawning and downstream estuarine/coastal waters.

There are three QI lamprey species of the Lower River Shannon SAC (brook lamprey *Lampetra planeri*, river lamprey *Lampetra fluviatilis*, and sea lamprey *Petromyzon marinus*). The brook lamprey is restricted to freshwater habitats and could not occur in the estuarine waters downstream of the proposed development site.

Sea lamprey is likely to spawn and feed in the estuarine habitats downstream of the proposed development site; while river lamprey (which spawns in freshwater upstream before migrating downstream) occurs in the downstream estuarine waters during its growth phase.

Bottlenose dolphin *Tursiops truncatus* is a QI of the Lower River Shannon SAC (NPWS, 2012c). Whilst bottle-nosed dolphin may occasionally occur within the middle reaches of the River Shannon Estuary in urban Limerick, the NPWS (2012c) identify the nearest 'suitable' bottlenose dolphin habitat as occurring c. 5.5 km downstream of the proposed development site. 'Critical habitat' (i.e. core habitat used preferentially within which the majority of dolphin occur) is located a minimum of c. 48 km downstream of the proposed development site. Pollution effects to fish in the Abbey River or River Shannon could reduce dolphin prey resources downstream. Despite their distance downstream, QI bottlenose dolphin is assumed to occur within the ZoI of adverse pollution effects.

Distinct from fish populations which are the Qis of European sites, the River Shannon and Abbey River downstream of the proposed development provides a migratory corridor to native sea trout and eel populations. These are valued at County scale.

16.3.11 Summary Valuation of Significant Ecological Features

As per the impact assessment methodology outlined in Section 16.2.8 significant ecological features are considered to be those valued at 'Local Importance (Higher Value)' or higher as per NRA (2009) definitions. Ecological features valued at Local Importance (Lower Value) or of negligible value are not considered significant features and are not carried forward for impact assessment. Table 16.8 summarises all significant ecological features identified within the ZoI of potentially significant impacts.

Table 16.8: Valuation of features and Identification of 'significant ecological features' in grey

Features		Highest Ecological Valuation within ZoI of Proposed development	At Risk of Significant Impact	Scoped into Impact Assessment
Designated sites	European sites: downstream species and habitat features of the: -River Fergus and Shannon Estuary SPA and; -Lower River Shannon SAC (including Atlantic salmon, sea lamprey and otter present downstream of the proposed development site)	International	Yes (pollution only for both sites; additionally, potential habitat loss of QI bryophytes from Lower River Shannon SAC)	Yes
	National sites: downstream species and habitats of the: -Fergus Estuary and Inner Shannon, North Shore pNHA and; -Inner Shannon Estuary - South Shore pNHA	National	Yes (pollution only; applying the precautionary principle)	Yes
Habitats and flora	WL2 Treelines (street trees)	Local (Higher value)	Yes	Yes
Fauna	Otter *Assessed above under the Lower River Shannon SAC*	N/A	N/A	N/A
	Fish (Sea trout and eel in adjacent River Shannon) *Note: Atlantic salmon and lamprey species are assessed above under the Lower River Shannon SAC*	County	Yes (pollution only; applying the precautionary principle)	Yes
	Birds: Nesting bird assemblage of five	Local-County	Yes	Yes

Features		Highest Ecological Valuation within ZoI of Proposed development	At Risk of Significant Impact	Scoped into Impact Assessment
	medium conservation concern species (house sparrow, herring gull, lesser black-backed gull, starling, swift) and one high conservation concern species (herring gull).			
	Bats (Non-breeding roost of common pipistrelle)	Local (Higher value)	Yes	Yes
	Bats (Foraging Leisler's bat, common pipistrelle bat, soprano pipistrelle bat)	Local (Higher value)	Yes	Yes
	Birds: Nesting bird assemblage of two species of low conservation concern (feral pigeon and jackdaw)	Local (Higher value)	Yes	Yes
Habitats and flora	ED2 Spoil and bare ground/ ED3 Recolonising bare ground	Local (Lower value)	Yes	No (insufficient value)
	BL3 Built land and artificial surfaces	Local (Lower value)	Yes	No (insufficient value)
Fauna	Birds: Wintering birds (excluding wetland birds for which the River Shannon and River Fergus SPA is designated)	Local (Lower value)	Yes	No (insufficient value)
	Other unprotected species (brown rats, and fox))	Local (Lower value)	Yes	No (insufficient value)
	Invertebrates presumed to be associated with vegetated areas of unlit interior	Local (Lower value)	Yes	No (insufficient value)

16.4 Predicted Impacts

This Section should be read with the impact assessment methodology in 16.2.8, and the Description of the Proposed Development in Chapter 3 which describes all relevant aspects of the proposed development including drainage design.

16.4.1 Do Nothing Scenario

In the absence of the proposed development, no significant changes in habitats or habitat condition are likely to occur under the current land-use.

In the absence of the proposed development, the existing street trees, scattered vegetation, and nesting/roosting opportunities in existing structures are unlikely to change significantly over time; albeit storm damage could for instance remove or create new nesting/roosting sites.

In the absence of the proposed development, the urbanized nature of the proposed development site would continue to prevent the establishment of species favouring semi-natural and/or remote environments.

16.4.2 Mitigation Inherent in Proposed development

Potential impacts are assessed after inclusion of the following 'inherent mitigation', which is part of the design of the proposed development:

- The Sustainable Urban Drainage Systems (SUDS) inherent in the proposed surface water treatment system, as detailed in Chapter 8 Water, which includes Class 1 petrol interceptors and a silt trap.
- The 'super-elevated' entrance/exits for the development designed to prevent flood waters from entering above-ground or underground structures, as detailed in Chapter 8 Water;
- Species lists for proposed landscaping (included in Drawing 60568520-SHT-20-0000-L-1000-1000) which were reviewed by the author of this Chapter, and which include no 'scheduled' (or otherwise) invasive species;
- The current lighting design submitted with the planning application for the proposed development which has been amended having regard for the latest guidance on lighting mitigation for bats (BCT and ILP, 2018). (Albeit that as a precautionary measure to reflect the potential for these designs to change, these agreed amendments are repeated as mitigation (Section 16.5.2.3).

16.4.3 Introduction to Types of Impacts

The proposed development could have a range of potential impacts upon significant ecological features during the construction and / or operation phases.

16.4.3.1 Construction Phase

In the absence of mitigation measures (i.e., measures not already inherent in the design), construction phase impacts could disturb a range of habitats and protected species throughout the construction programme (including advance or enabling works), which is estimated may take c.5 years.

Significant potential impacts to biodiversity include habitat loss, noise and visual disturbance to hibernating, breeding, or feeding populations of fauna species, and the potential for suspended solids, oils, fuels, paints, or other contaminants to be carried via the local drainage network into the Abbey River and River Shannon.

A number of factors influence the potential significance (of impacts) including the particular features affected, the time of year when potential impacts occur, and the potential for unforeseen events such as extreme weather to amplify predicted impacts. A summary of the types of potential construction phase impacts from the proposed development are provided in Table 16.9.

Table 16.9: Types of potential construction-phase impacts relevant to the proposed development site

Potential Impact	Duration	Direct (D) or Indirect (I)
Damage to or loss of habitats or plants	Medium term to permanent depending on establishment time and provision of landscape planting.	D
Damage to breeding or resting sites of protected species	Varies depending on the lifecycle of species impacted, and life stage potentially impacted.	D (but I from vibration)
Noise and visual disturbance to protected species	Temporary to short-term.	I
Noise and vibration caused by pilling foundations	Temporary to short-term.	D
Water quality impacts to aquatic features (including those arising via groundwater contamination pathways)	Temporary to short-term.	I
Air quality and dust deposition impacts to	Temporary to short-term.	I

Potential Impact	Duration	Direct (D) or Indirect (I)
habitats		
Artificial lighting impacts to protected species (particularly bats)	Temporary to short-term	I
Introduction of invasive species by construction activity (no invasive species currently present there)	Medium to long-term subject to control success.	D / I

16.4.3.2 Operational Phase

Operational phase impacts consider the future impacts of the proposed development throughout its lifetime. A summary of the types of potential operational phase impacts from the proposed development are outlined in Table 16.10.

Table 16.10: Types of potential operation phase impacts relevant to the proposed development site

Type of Potential Impact	Duration	Direct (D) or Indirect (I)
Noise and visual disturbance to protected species from traffic and pedestrians	Long-term to permanent.	I
Water quality impacts	Long-term to permanent.	I
Air quality and dust deposition impacts	N/A.	I
Artificial lighting (including rate of bird collisions associated with presence or absence of lights, and light specification)	Long-term to permanent.	I

16.4.4Potential Construction-Phase Impacts

This Section presents potential construction phase impacts for the proposed development.

Summary tables of potential impacts (at construction-phase before mitigation, at operation-phase before mitigation, residually after mitigation, and cumulatively after mitigation) are presented in Table 16.9) in Section 16.8.6.1.

16.4.4.1 Designated Sites

Potential Pollution Impacts

Surface water

The proposed development requires the installation of a new outfall to the Abbey River (in Charlotte's Quay, adjacent the Lower River Shannon SAC) to service a new surface water sewer. During construction, there is potential for dust, silt, oils, fluids, paints, and/or concrete washings, etc. to enter the Abbey River and/or the River Shannon, either:

- If contaminants within the proposed development site are washed into the proposed surface water sewer once installed, in the event where the SUDS system is not installed and operational at the same time as the sewer is installed;
- If precautions are not taken to prevent coastal flood waters from entering the proposed development site during construction (i.e. in advance of construction of the operational phase super-elevated' entrance/exits), and/or
- Should concrete washings, grout, or silt be washed overland into the adjacent Abbey River (within the Lower River Shannon SAC) during installation of the new outfall in Charlotte's Quay.

Contaminants could enter, and affect the distribution of features of the Lower River Shannon SAC, and/or River Fergus and River Shannon and Estuaries SPA downstream, including Atlantic salmon, river lamprey, sea lamprey, and 21 species of wetland birds. The Abbey River is tidal, and as such so potential pollutants could also be carried upstream of the point of discharge.

Groundwater

Excavation and removal of made ground from across the site will reduce the potential risk posed by contaminants resent in near surface soil and made ground. Groundwater at the proposed development site did not contain contaminants of concern at concentrations in excess of relevant standards. The presence of stiff clay beneath the site and cover of large areas of the site with buildings or hard standing during future development will restrict the potential vertical pathway for water moving beneath the site and limit rainfall percolation, consequently reducing further leachate generation. Excavation of made ground from across the site during the early stages of construction work will further reduce the risk posed by contaminants present in near surface soil and made ground.

Nevertheless, in addition to the above (surface water) pollution pathway, and although there is no significant tidal interaction with groundwaters the author of the 'Land, Soils, Geology and Groundwater' Chapter of the EIAR for the proposed development has identified potential pollution effects to groundwater and soils before mitigation measures. Specifically, a potential risk was identified through leaching of contaminants (principally metals) from soils at the site. Applying the Precautionary Principle, such pollution could occur during enabling works and early stages of construction in each phase, has identified the potential for soil and/or groundwater contamination encountered during construction to migrate into nearby estuarine waters within the Lower River Shannon SAC, and/or River Fergus and River Shannon and Estuaries SPA.

As such, whether by surface and/or groundwater pathways, contaminants could enter, and affect the distribution of features of the Lower River Shannon SAC, and/or River Fergus and River Shannon and Estuaries SPA downstream, including Atlantic salmon, river lamprey, sea lamprey, and 21 species of wetland birds. The Abbey River is tidal, and as such so potential pollutants could also be carried upstream of the point of discharge.

Summary Impact Assessment for Pollution

Given the international value of European sites, any significant pollution impact would be significant at the international geographic scale of significance. The Inner Shannon Estuary - South Shore pNHA and/or Fergus Estuary and Inner Shannon, North Shore pNHA could be additionally impacted, with potential impacts significant at the national geographic scale of significance. Depending on the volumes and types of contaminants concerned, the duration of potential impacts could be short-term to long-term.

Potential Habitat Loss Impacts to Designated Sites

There is no potential for installation of the new surface water sewer and outfall (in Charlotte's Quay, to the Abbey River) to result in habitat loss effects to QI Estuary habitats of the Lower River Shannon SAC, as no works will be instream.

However, as shown in Photograph 16.1, the proposed outfall is located c. 1m above the regular river tidal flood level, marked by a line of mosses potentially containing QI bryophyte communities of the Lower River Shannon SAC. Although the invert level of the proposed outfall is above the line of QI bryophyte communities, in the absence of mitigation, and applying the precautionary principle, there is potential for installation of the new outfall in Charlotte's Quay to remove QI bryophyte communities (e.g. if care is not taken to core only the localized part of the quay wall into which the outfall must be inserted).

Potential Impacts to Designated Sites Excluded as Unlikely.

Following review of the proposed development, and the distribution of relevant features the following potential impact pathways were excluded as unlikely and were not carried forward to impact assessment.

- Construction: Noise and vibration generated during construction of the proposed development (including human presence, rotary core piling, demolition, access and egress of Heavy Goods Vehicles to/from proposed development site) has been excluded as unlikely to be significant, as no sensitive QI or SCI populations are predicted to occur within the proposed development site, or within the nearby Shannon River or Abbey River. The secant piling installation using rotary bored piling methods produces significantly lower levels of groundborne vibration relative to other piling methods. Furthermore, these areas lack vegetation or other sheltered features and do not offer resting, breeding or feeding sites to significant populations of QI or SCI species on a regular basis.
  - Roosting black-headed gulls (known to be present c. 120 m from the proposed development site at their nearest point) are a 'generalist' feeder attracted to areas of human habitation (including busy city centres) where they scavenge human waste; the roosts of this species would not be significantly displaced by the additive noise from construction of the proposed development, given their tolerance for traffic and other forms of urban noise, and their likely habituation to the existing disturbance regime in nearby Limerick City.
  - If foraging or commuting otter are present in the River Shannon or Abbey Rivers, noise and human presence during piling or works to install the new surface water outfall to the Abbey River and/or within the proposed development site could temporarily displace foraging or commuting otter. However, given that otter are likely to only occur occasionally within the ZoI of disturbance, because no otter breeding or resting sites are present within the ZoI, and because otter are likely to be habituated to the existing urban lighting and noise disturbance regime, potential displacement impacts are considered non-significant.
- Construction: Noise and/ vibration from piling activities are not predicted to adversely affect QI Atlantic salmon, river lamprey, or sea lamprey populations (all of which are presumed to feed and/or migrate locally within the River Shannon and Abbey Rivers). There are no spawning populations of these species in the transitional waters within the nearby designated watercourses, who would be less able to displace in response to temporary disturbance. Importantly, there will be no instream piling, and as noted above, the proposed piling method also has relatively lower ground-borne vibration relative to other piling techniques.
- Construction and Operation: Whilst the potential for coastal flooding could result in pollution during construction, the design team has concluded there is no risk associated with pluvial or fluvial flooding due to the lack of historical flooding events of this type, and due to the finished floor levels and ground levels in the vicinity.
- Construction and Operation There is no risk of tidal ingress to the proposed development site during the construction or operation of the proposed development (which would introduce a new potential source of or pathway for pollution to enter the River Shannon).
- Construction and Operation: Lighting will be proposed as mitigation for bird collision on the proposed tower. Aside from the use of lighting as mitigation, lighting during construction and operation have been excluded as unlikely to result in significant effects because.
  - Façade lighting has been avoided on the proposed locations for artificial swift nesting provision;
  - No wintering bird feeding or roosting sites are located within the likely ZoI of construction or operation-phase lighting;
  - No lesser horseshoe bats were recorded foraging or roosting within the proposed development site or wider ZoI during two years of bat surveys completed having regard for relevant guidance.
  - No otter breeding or resting sites are present within the proposed development site or wider ZoI, and any lighting of the construction site is unlikely to significantly increase existing light spill onto otter commuting or feeding habitats in the Abbey River and Shannon River.

- Operation: Design of 'super-elevated' entrance/exits for the proposed development will prevent flood waters from entering above-ground or underground structures during operation, as detailed in Chapter 8 Water[37].
- Operation: Diversion of 'surface' waters generated in basement car parking areas during operation (potentially contaminated with detergents) which will enter an existing combined sewer for treatment at the existing licensed Bunlicky WwTP for treatment, which Irish Water has determined can cater for the proposed development.
- Operation: Licensed treatment of foul water generated at the proposed development site at the existing licensed Bunlicky WwTP for treatment, which Irish Water has determined can cater for the proposed development.
- Operation: treatment and attenuation measures incorporated into the proposed surface water sewer which will outfall to the Abbey River within the Lower River Shannon SAC. Furthermore, the use of the Abbey River during operation, which will be subject to licensing by LCCC, will be subject to monitoring as a licence condition, which will ensure that, if required, appropriate maintenance of the surface water drain and outfall will be carried out by the licensee, to protect water quality in the receiving waters of the Lower River Shannon SAC, and the River Shannon and River Fergus SPA downstream.

16.4.4.2 Habitats and Flora

The proposed development will lead to the permanent loss of 16 predominately non-native, young to – semi-mature street trees (in addition to some native wych elm). The loss of these trees will be permanent and significant at Local geographic scale.

Potential habitat loss impacts to the mosaic of Spoil and bare ground (ED2) and Recolonising bare ground (ED3) is considered non-significant (Note: potential impacts to foraging bats from removal of this habitat are considered separately).

16.4.4.3 Fauna

Bats (Roosting)
The transitory (non-breeding) common pipistrelle roost identified to the rear of 9 Rutland Street (maximum of 6 bats) will be lost as a result of the proposed development. As such it is considered that the potential impact of this loss would be limited to significance at the Local geographic scale. In the absence of mitigation, the duration of these potential impacts could be significant in the short to long-term.

Bats (Foraging)
There is potential for habitat loss, noise, and lighting during construction to significantly impact three species of bat (of a total of nine in Ireland) which were recorded commuting through and/or foraging within the proposed development site. All three bat species are widespread in Ireland, albeit one of the three species (Leisler's bat) is "near-threatened" (Marnell et al., 2009) due to the relative importance of the Irish populations in Europe.

In the absence of mitigation, the geographic scale of impact significance from temporary disturbance to bat foraging habitats (from noise and lighting during construction), and permanent removal of the bat foraging habitat in the unlit courtyard within the proposed development site during construction would be limited to the Local level.

Nesting Birds: Swift
In the absence of mitigation, structural works to the wall in the inner courtyard known to contain nesting swifts, (and works to any other buildings containing nesting swifts) could disturb and/or injure

[37] The design team for the proposed development has also determined, as stated in Chapter 8 (Water) of the EIAR for the proposed development, that these proposed super-elevated entrance/exits will also not significantly increase flood risk elsewhere

eggs, young, or adults and/or permanently remove nesting sites. Although county population estimates are not available, based on professional judgement, the numbers of confirmed swift nests present within the proposed development site (single territory confirmed) is unlikely to constitute 1% of the County Population of the species. Therefore, despite their conservation status, potential impacts are predicted to be significant at Local geographic scale only. Subject to population-level impacts which are difficult to predict, duration of potential impacts could last from the short into the medium-term if mitigation is not implemented.

Nesting Birds (Other than Swift)
In the absence of mitigation including seasonal works to relevant nesting features in structures, construction could result in disturbance and/or injury to young, eggs, and/or adults of one Red-listed bird of High Conservation Concern (herring gull), three species of Medium Conservation Concern in addition to swift (house sparrow, lesser black-backed gull, starling) and two species of Low Conservation Concern (jackdaw and feral pigeon). All these species are widespread, and no populations are likely to constitute 1% of the County Population of the species. Potential impacts are predicted to be significant at Local geographic scale only.

Subject to population-level impacts which are difficult to predict, duration of potential impacts could last from the short into the medium-term if mitigation is not implemented.

Invertebrates
Given the absence of known populations of protected invertebrate species, and likely absence of invertebrate species of conservation concern within the proposed development site, potential impacts are considered non-significant.

Fish and Aquatic Features (Excluding Features of the Lower River Shannon SAC)
Eel, sea trout, and demersal species of intertidal areas including plaice and dab occur in the Shannon Estuary downstream of the proposed development site within the ZoI of potential pollution effects. The conservation status of Dab and plaice has not been assessed nationally but both are Least Concern on the international conservation rating provided by the International Union for the Conservation of Nature (IUCN)[38]. Whist sea trout are of Least Concern on the Irish Red List, eel is critically endangered (King et al., 2011).

Any release of potential contaminants into fisheries habitats could constitute an offence under the Fisheries Consolidation Act 1959 (No. 14 of 1959), as amended, the Inland Fisheries Act 2010 (No 10 of 2010) as amended, and/or the Local Government (Water Pollution Acts) 1977-1990, as amended. In the absence of mitigation, potential impacts from pollution during the estimated 5-year construction period could be significant at the Local-County geographic scale in the short-term (i.e. during and for a period following construction).

16.4.5Potential Operation-Phase Impacts

This Section presents potential operation phase impacts for the proposed development. Summary tables of potential impacts (at construction-phase before mitigation, at operation-phase before mitigation, residually after mitigation, and cumulatively after mitigation) are presented in Table 16.13 in Section 16.8.6.

16.4.5.1 Designated Sites

Potential Bird Collision Impacts to Designated Sites

There is potential for the proposed 71.6 m high tower at Bank Place, to pose a collision risk to birds in flight. A major study of the characteristics of migratory bird populations across Western European flyways across multiple seasons and multiple years using high-precision weather radar indicates typical flight heights for birds on migration exceed 600 m above ground level (Dokter et al., 2010).

[38] Available online at https://www.iucn.org/ Accessed February 2019.

As such, significant bird populations on migration are unlikely to collide with the proposed tower. The bird populations potentially affected are most likely to be local populations using the Shannon and/or Abbey Rivers as visual cues along which to move between feeding and roosting sites. Given the River Shannon and River Fergus Estuaries SPA is designated for bird populations of estuarine habitats, and is located 0.7 km downstream of the proposed development, it is unlikely that significant populations would be at risk of collision, However, SCI black-headed gull is known to occur in the River Shannon within the vicinity of the proposed development site, and is a species which may move inland to feed on playing pitches, or urban parks. Whilst unlikely, the potential for other SCI species of the River Shannon and River Fergus Estuaries SPA (such as cormorant, or light-bellied Brent goose *Branta bernicla hrota*,) to move upstream to inland/freshwater feeding areas and collide with the proposed tower (particularly at night or in poor visibility) cannot be excluded in the absence of evidence to the contrary.

Collisions are most likely to happen at night and/or in poor light conditions. The potential collision risk is considered to be significantly reduced by the location of the tower c.38.5 m from the Abbey River, and c.116.5 m from the River Shannon. The location of the proposed tower within an urban centre, which is well-lit at night further reduces the potential for frequent collisions with SCI species. However, in the absence of mitigation, and applying the precautionary principle, the potential for SCI birds of the River Shannon and River Fergus Estuaries SPA (including black-headed gull and cormorant) to collide with the proposed tower cannot be excluded. Despite the reduced collision risk relative to the risk posed by similar structures in rural areas, potential impacts are predicted to be significant at International geographic scale due to the value of the River Shannon and River Fergus Estuaries SPA.

Other Potential Impacts to Designated sites

No other significant impacts are predicted, having regard for:

- The SUDS system included in the design of the new surface water sewer which will remove silt from roof and pedestrianised hardstanding run-off, prior to run-off entering the Abbey River within the Lower River Shannon SAC; and
- The proposed diversion of surface water from basement carparking areas (which will be contaminated with elevated levels of detergents in contrast to roof and pedestrianised hardstanding run-off) into an existing combined sewer, which will carry this contaminated surface water to the existing licensed Bunlicky Waste Water Treatment Plant (WwTP) for treatment prior to discharge to the Lower River Shannon SAC.

  In January 2019, the relevant Connections and Developer Services Manager of Irish Water responded to AECOM in writing that “*the water services authority has provided confirmation that the load generated by the proposed development can be catered for*”. Potential pollution impacts from the discharge of treated effluent in the River Shannon, following treatment at Bunlicky WwTP are therefore considered non-significant.

16.4.5.2 Habitats and Flora

No significant impacts are predicted.

16.4.5.3 Fauna

Bats
In the absence of mitigation, lighting during operation could disturb and/or displace bats. In particular, if uplighting is proposed on the façade of No. 4 and 5 Rutland Street (where compensatory roosting provision is proposed as will be detailed in Section 16.5.1.4), lighting could reduce numbers of bats or frequency of bats making use of roosts, and/or permanently displace them from compensatory roosting sites.

In the absence of mitigation, potential impacts to bats are predicted to be limited to the Local geographic scale for the duration of operation (i.e. in the long-term).

Nesting Birds
If nesting birds remain within the proposed development site during operation, operational lighting of previously unlit areas, noise and increased human presence could disturb or displace several species of conservation interest from favoured nesting sites. In the absence of mitigation, potential impacts could be significant at a Local scale for the duration of operation (i.e. in the long-term).

Bird Collision
As described in relation to bird populations of designated sites, there is potential for birds not associated with designated sites to collide with the proposed tower during operation. Populations potentially at greatest risk include those frequently migrating at night in significant numbers over urban areas in Ireland (e.g. including redwing *Turdus iliacus*). The location of the proposed tower set back from nearby watercourses, within an urban centre, which is well-lit at night significantly reduces the potential for frequent collisions. Before mitigation, potential impacts could be significant at a Local scale for the duration of operation (i.e. in the long-term).

Other Protected and Notable Species
No other potentially significant impacts to protected species are predicted during operation.

16.5 Mitigation Measures

This Section should be read with Figure 16.3 Mitigation for Significant Ecological Features.

16.5.1Construction-Phase Mitigation

16.5.1.1 Designated Sites (Pollution Mitigation)

Construction Methodology and Phasing Management Plan

The CMPP, which is included with this application, sets out the procedures, standards, work practices and management responsibilities of the appointed contractor to address potential negative environmental effects that may arise during construction of the proposed development. The primary aim of the CMPP is to reduce any potential negative effect from construction on the environment. The CMPP describes the approach that will be adopted to environmental management throughout project works at the site.

Method Statements

The Contractor shall produce site-specific Method Statements for review and agreement with the Ecologist and Inland Fisheries Ireland, to demonstrate adherence to specific, tried-and-tested pollution control measures.

All Other Pollution Control Measures

The Contractor shall take all necessary precautions to prevent the pollution or silting of watercourses from the construction of the proposed development. The Contractor will take the following mitigation:

- Prior to excavation of the basement, the proposed foul and storm water sewers in Michael Street will be laid and commissioned to allow the existing combined sewer to be diverted. During the construction of the new sewers, surface water arising from the development will continue to discharge to the combined sewer. Surface water collected will be treated by sedimentation prior to discharge to the existing combined sewer. Total Suspended Solids (TSS) and colour will be monitored daily by a hand held multi parameter sonde.
- Neither ground water or surface water runoff from the working areas will be permitted to discharge directly to the Abbey River or Shannon River. Run off generated within the site during

construction will be filtered and treated to remove hydrocarbons and sediment. Total Suspended Solids (TSS), pH/EC and colour will be monitored daily by a hand held multi parameter sonde. In addition, the outlet from the sedimentation pond will incorporate a turbidity monitor with alarm at high level. In the event of surface water failing to meet the required standards, as set out in the discharge licence, water will be recirculated to the inlet of the sediment pond to provide further time for settlement. A penstock will be provided on the outlet from the sediment pond to control discharge from the site.

- No pouring of concrete will occur during the construction of the outfall, albeit localized grouting would be required (see Section 16.5.1.2).
- Maintain and monitor the performance of the surface water drainage network throughout the construction of the proposed development (as per monitoring is set out under Section 16.9.1), noting that the proposed storm sewer will include a permanent hydrocarbon separator which will treat runoff from Michael Street.
- In the event of surface water failing to meet the required standards, as set out in the discharge licence, water will be recirculated to the inlet of the sediment pond to provide further time for settlement. A penstock will be provided on the outlet from the sediment pond to control discharge from the site.
- Where the Contractor utilises pumping to drain works areas, a back-up pump and generator must be provided on site for use in the event of the primary pump failing.
- Cover all temporary stockpiles generated during construction to minimise run-off;
- Locate spoil and temporary stockpiles in locations which are at least 15 m from drainage systems, the Abbey River and the River Shannon'
- Avoid direct or indirect discharges of untreated surface or ground water generated during the proposed development, to any surface water;
- Dewater all working areas at the end of each working day, if necessary using pumping and transport of water off-site in tankers if volumes prevent effective attenuation and treatment prior to discharge; and,
- Use wheel washers and dust suppression on site roads (to be captured within the proposed SUDS system) and undertake daily plant maintenance checks and corrective actions where required.
- Establish contingency measures to cater for potential impacts to unknown services underlying the construction site (for example, old sewers, culverts)
- Identify whether shallow groundwater monitoring wells on site will be maintained and protected during construction works; decommissioned; or removed completely as part of excavation works, to prevent them from acting as direct pathways for contamination to enter the groundwater body beneath the site
- Excavation:
  - All excavated materials will be inspected for signs of possible contamination, such as staining or strong odours;
  - Should any unusual staining or odour be noticed, this made ground / subsoil will be segregated and samples analysed for the presence of possible contaminants in order to determine an appropriate disposal outlet; and,
  - Excavated made ground and subsoil will be disposed to licensed / permitted waste management facilities, as appropriate for the waste classification of the material.
- Importation of fill:
  - The Contractor will vet the source of aggregate, fill material and topsoil imported to site in order to ensure that it is of a reputable origin and that it is "clean" (i.e. it will not contaminate the environment).
  - The Contractor and/or LCCC will implement procurement procedures to ensure that aggregate, fill material and topsoil are acquired from reputable sources with suitable environmental management systems as well as regulatory and legal compliance.

- Disposal of materials
  - All material to be disposed of off-site to a facility licensed having regard for Irish Waste management legislation. Where material is to be stockpiled on site prior to disposal, the Contractor will control all run-off to prevent contamination of surrounding watercourses.
  - Contaminated soil will be assessed to determine its constituents and disposed of offsite having regard for Irish waste management legislation; and,
  - The Contractor will dispose of all alkaline wastewaters and contaminated storm water off-site having regard for Irish waste management legislation.
- Control of concrete:
  - Ready-mixed concrete will be brought to the proposed development site by truck.
  - The pouring of concrete shall take place within a designated area to prevent concrete runoff into the drainage network, watercourses, or soil / groundwater media.
  - During construction no pouring of concrete will occur during the construction of the outfall. Works to locally grout and otherwise repair Charlotte Quay, following installation of the proposed outfall will be supervised by the Ecologist or other suitably experienced ecologist who will advise and direct the Contractor such that contaminated surface water does not enter the Abbey River.
  - Washout of concrete transporting vehicles shall take place at an appropriate facility, offsite or where onsite wash out will be captured, for disposal off-site.

Pollution Risk from Flooding

The Contractor will provide a ramp to the development site as a mitigation measure to prevent any flood waters to enter the main structure or the underground structure during the Construction Stage.

As coastal flooding is somewhat predictable the Contractor shall take note of when coastal flooding warnings are issued for the Limerick City area (usually c. 24-36 hours in advance). In the event that a flood warning is issued, all plant and construction materials must be moved and stored within areas only at risk from the 1 in 0.1% AEP coastal flood event (i.e. areas within ‘Flood Zone C’ as defined by OPW and DoEHLG (2009), which includes parts of Patrick Street, Ellen Street and Rutland Street). In this way, in the event of floodwaters inundating the site, no materials will be washed from the site into nearby watercourses.

Spill Control Measures

No oils/fuels will be stored on the proposed development site for the purpose of refuelling on the site.

On-site plant will be refuelled by an external Contractor who will call to site as required. Road vehicles will not be refuelled at the site. Minor spills and leaks may occur from road vehicles. Any oils or fuels onsite will be removed by an experienced and authorised contractor.

Fixed plant shall be self-bunded; mobile plant shall be in good working order, kept clean, fitted with drip trays where appropriate and subject to regular inspection. Drip trays will be covered, and the Contractor will empty their contents regularly as required, and dispose of off-site having regard for relevant waste legislation.

Spill kits and oil absorbent material shall be carried with mobile plant and located at vulnerable locations around the site to reduce risk of spillages entering the sub-surface or groundwater environment; booms shall be held on-site for works near drains or dewatering points

The Contractor will train all operatives in the proper handling of materials, the sensitive nature of the River Shannon, Abbey River (and the drainage system which is hydrologically connected to these Rivers), and the consequences of accidental spillages.

The following steps provide the procedure to be followed by the Contractor(s) in the event of any significant spill or leak.

- Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers;
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident;
- Contain the bulk of the spill immediately using a spill kit before placing the contaminated absorbent material and the contaminated soil in a stockpile outside the 1% Annual Exceedance Probability (AEP) floodplain (and at least 10 m from, and downslope of any drainage system or The Abbey River or River Shannon),
- Place all contaminated material on and cover with plastic to prevent leachate generation, until such time as it can be removed off-site by an appropriately licensed waste management company;
- If possible, cover or bund off any vulnerable areas where appropriate such as drains;
- Notify a fully licensed waste Contractor immediately giving information on the location, type and extent of the spill so that they can take appropriate action to further investigate the incident to ensure it has been contained adequately, and so that the fully licensed waste Contractor can, subject to the appropriate permits, dispose of the contamination off-site having regard for relevant legislation; and,
- Notify LCCC and (if LCCC deem it appropriate) Inland Fisheries Ireland (IFI).

Emergency Response and Environmental Training
The Contractor will produce an Emergency Response Plan (ERP) based on the Contractor's own Risk Assessment, which will be reviewed by the Employer's Representative Team, Including the Ecologist. The ERP will include:

- The Contractor's proposed training of relevant staff, including cover staff, in the implementation of the ERP and the use of spill kits;
- Details of procedures to be undertaken by the Contractor in the event of the release of any sediment into a watercourse, or any spillage of chemicals, fuel or other hazardous wastes, non-compliance incidents with any permit or licence, or other such risks that could lead to a pollution incident, including flood risks;
- Confirmation of the number and specification of spill kits which shall be carried by the Contractor;
- Information on clean-up procedures as specified above under 'Spill Control Measures'.

16.5.1.2 Designated Sites (Habitat Loss)

A Mobile Elevated Working Platform (MEWP), parked on Charlotte's Quay, will allow Contractors to access the limestone wall from the Abbey River side of the existing quay wall, whilst avoiding instream works. The Contractors will use a coring method (i.e. drilling from north to south), which will avoid any material from entering the Abbey River. This will avoid any disturbance to QI bryophyte communities located c.1 m below the proposed outfall location. There will be no pouring of concrete for the installation of the proposed outfall, albeit Contractors will be permitted to locally grout the finished outfall.

The Ecologist will review and input to the method statement produced by the Contractor to ensure the method statement contains the specific measures above.

The Ecologist or other similarly experienced ecologist will then supervise the works to Charlotte Quay and direct or advise the Contractor as appropriate, to ensure the method statement and mitigation are implemented, and bryophyte communities and water quality of the Lower River Shannon SAC are protected.

16.5.1.3 Other Habitats and Flora

No mitigation is required for other habitats and flora, having regard for the inherent mitigation in the landscape planting plan accompanying Chapter 12.

16.5.1.4 Fauna

Bats (Roosting)
The mitigation will be compiled into a derogation licence application and submitted to the Wildlife Licencing Unit (WLU) of the NPWS. The licence application will take account of any comments by relevant parties including the NPWS received in the course of An Bord Pleanála's determination, and any relevant planning conditions. The mitigation in the derogation licence application will have regard for relevant guidance including the NPWS Bat Mitigation Guidelines for Ireland (Kelleher & Marnell, 2006). All measures in the derogation licence application will be subject to change having regard for the requirements of the NPWS including any licence conditions.

Prior to construction, the Ecologist will notify the Contractor, who in turn shall make all site personnel aware of, the structure to the rear of 9 Rutland Street known to contain roosting bats. The Ecologist will also notify the Contractor of the strict legal protection applicable to bats and their roosts, and input to the construction programme including phasing of structural works, having regard for relevant licence conditions.

A notice will be erected at 9 Rutland Street to identify it as a legally protected bat roost to ensure no works take place unless clear instruction is given from the Ecologist that it is safe and legally compliant to do so.

Contractors will receive training by the Ecologist to advise them what to do in the event that bats (whether live or dead) are discovered in structures during works (i.e. stop works when it is safe to do so and contact the Ecologist).

Subject to any licence conditions, any works to 9 Rutland Street will be carried out outside the summer months (i.e. from 1st September to 1st May only). This has been determined to be appropriate for a summer roost, which is not a proven maternity site, having regard for NPWS guidance (Kelleher & Marnell, 2006). This timeline may change subject to the requirements of the NPWS and conditions of any derogation licence issued by them. The Contractor(s) will be informed of any such changes to timelines.

Even when carried out during the recommended season, works to 9 Rutland Street will be completed with the expectation that bats may be found, and having regard for any licence conditions. Caution will be exercised during the removal of any roofing material from 9 Rutland Street as bats may be underneath even in winter. Where required, the Contractor will remove tiles of 9 Rutland Street by hand. If bats are found, all works will cease, until the Ecologist has been contacted, and the Ecologist has in turn contacted the NPWS WLU.

As shown in Figure 16.3 (and Drawing OPRA-ACM-Z3B-ZZ-DR-AR-13001), a total of 1 no. 'bat brick' to the specification of "Habibat Bat Box - Custom Brick Facing[39]" or equivalent and 1 no. 'bat tile' to the specification of Habibat Bat Access slate[40] or equivalent have been included in the design of 4 and 5 Rutland Street respectively, which is located close to the existing roost site in 9 Rutland Street.

The bat brick and tile have been incorporated into 4 and 5 Rutland Street in a location where there is no obstruction to bat flight. Uplighting will be excluded from the façade of these structures.

Prior to commencement of construction, the Ecologist will be consulted regarding the phasing of demolition of the roost at 9 Rutland Street. Where the Ecologist deems it necessary, or as per any licence requirements, provision may be made for a temporary roosting structure in the vicinity of 9 Rutland Street (e.g. bat box to appropriate specification), to ensure continuity of roosting provision until the (permanent) bat brick and tile are installed.

As annotated on Figure 16.3 (and Drawing OPRA-ACM-Z3B-ZZ-DR-AR-13001), Breathable Roofing Membranes (BRMs) will not be installed into the roof of 4 or 5 Rutland Street. Only bituminous roofing

[39] Available from: http://www.nhbs.com/title/183578/habibat-bat-box-custom-brick-facing . Accessed December 2018.
[40] Available from http://www.nhbs.com/title/192461/habibat-bat-access-slate. Accessed December 2018.

felt that does not contain polypropylene filaments, or similar to be agreed with a bat ecologist, will be used. For example, bitumen felt type 1F, which is reinforced hessian.

Water tanks sited within roof spaces will be permanently covered to prevent future accidental drowning of bats.

Bats (Foraging)
No planting is proposed in addition to that in the landscape planting plan which includes, in Bank Place, native Alder trees and some flowering plants (e.g. *Salvia nemorosa*) would provide nectar for bees and insects. These in turn, would provide food for birds and bats.

Mitigation to minimise the potential impacts of lighting on foraging and roosting bats is proposed in Section 16.5.2.3.

Nesting Birds (including Swifts)
Structural works to building exteriors will not be carried out between March and August inclusive, unless otherwise agreed with the Ecologist. Where the construction programme does not allow this seasonal restriction to be observed, buildings will be surveyed by a suitably experienced ecologist for the presence of nesting birds prior to commencement of demolition works.

In the case of roof-nesting gulls, a Mobile Elevated Working Platform may be required to visually inspect roofs, if adequate views are not available from ground level or adjacent buildings. Nesting bird surveys will follow the species-specific guidance in the British Trust for Ornithology's Field Guide to Monitoring Nests (Ferguson et al, 2011).

Where nests are found within structures to which works are proposed, or within the potential ZoI of indirect disturbance as determined by a suitably experienced ecologist, the suitably experienced ecologist will advise the Contractor(s) if a licence is required from the NPWS to permit disturbance and/or removal of any nests, or if works must be delayed until nesting has been shown to have finished, following survey by a suitably experienced ecologist.

Structural works to buildings found not to contain nests, shall be completed within three days of bird surveys, or repeat nesting surveys will be required.

Nesting Swifts (Additional Measures)
As shown in Figure 16.3 (and Drawing OPRA-ACM-Z3B-ZZ-DR-AR-13001), one swift brick with starling barrier to the specification of 16S Schwegler Swift Box (with Starling Barrier)[41]" or equivalent has been incorporated into the design of the façade of No. 5 Rutland Street.

Grids will be installed on any ventilation holes on the building exterior, and this must be implemented from September to April inclusive during the non-breeding season to avoid unwanted occupation by birds of other sites in buildings during the breeding season.

Invertebrates Including Butterflies

No mitigation is proposed, given no protected invertebrates, or invertebrates of conservation concern are known to be present within the ZoI of the proposed development site.

Fish (excluding Designated Sites)

No mitigation measures are required in addition to those for Designated sites.

16.5.1.5 Role of the Ecologist

The Employer's Representative (ER) Team shall engage a suitably experienced ecologist (the Ecologist). The Ecologist will be a full member of a relevant professional institute such as the Chartered Institute of Ecology and Environmental Management (CIEEM), have relevant experience in

[41] Available from http://www.nhbs.com/title/177997/16s-schwegler-swift-box-with-starling-barrier Accessed 31st May 2017.

the management of ecological constraints during construction, and hold or have held a protected species licence (s) in the Republic of Ireland.

The Ecologist shall be appointed sufficiently in advance of construction to arrange for any mitigation requirements (including licensing) to be incorporated into the Contractor's site-specific Method Statements and programme.

The Contractor will accommodate the Ecologist, whose role will be to:

- Communicate relevant findings to LCCC, and other stakeholders as relevant;
- Advise the Contractor on phasing of relevant works (including structural works in relation to nesting birds and roosting bats);
- Review Contractor Method Statements for compliance with the mitigation in this EIAR, and any licenses to avoid damage or disturbance to designate sites or protected species; and,
- Attend site meetings and input to Contractor toolbox talks prior to commencement of construction.

16.5.2 Operation-Phase Mitigation Measures

16.5.2.1 Pollution Mitigation

The proposed storm water drainage system has been designed to ensure that there will be no increase in water levels or flow rates downstream of the proposed outfall. The system includes two attenuation tanks which will store run-off when the inflow rate exceeds 9.4l/s, the greenfield runoff rate. The system also includes a Class I Bypass Hydrocarbon Separator to remove hydrocarbons which may be suspended in runoff. To minimise sediment, build up within the storm water drainage network, trapped inlets will be used at all points of entry and key manholes will have sumps to collect material.

Monitoring of this system is additionally proposed under Section 16.9.2.1.

16.5.2.2 Designated Sites (Bird Collision)

Literature Review of Potential Mitigation Options

Following a meta-review of historical studies of recorded bird collisions with lit communication towers, Longcore et al., (2012) recommended that solid red lights be replaced with flashing (not slow pulsing) red, red strobe, or white strobe lights to significantly reduce bird strike in the context of communication towers, in North America and Canada, across all bird species. The nature of the review by Longcore et al. meant that only existing tower-mounted light types were assessed (i.e. red and white, both strobe and solid), and the study therefore did not assess green light.

Poot et al (2008, not cited in Longcore et al., 2012) designed a field study to test if and how changing light colour influenced migrating birds under field conditions. This study was conducted at a single location in the North Sea, off the Dutch Coast, over the course of 41 nights during autumn migration in 2003 (September–November) under various weather conditions. Poot et al found that nocturnally migrating birds were disoriented and attracted by red and white light (containing visible long-wavelength radiation), whereas they were clearly less disoriented by blue and green light (containing less or no visible long-wavelength radiation). This finding was particularly evident on overcast nights.

Flashing lights (red and white lights) have been shown to repel birds and produce significantly fewer collisions than do solid or slow-pulsing red lights to which birds may be attracted (Gehring et al., 2009; Longcore et al., 2012), particularly on foggy, misty nights. The NIS author is not aware of any available evidence on the relative merits of solid vs flashing green lights in reducing bird collisions.

Proposed Mitigation

In the absence of evidence to the contrary, in the light of best available scientific knowledge, *flashing green lights [emphasis added]* shall be installed on the proposed tower at Bank Place, and be maintained in good working order throughout building operation.

Prior to procurement of the proposed (flashing, green) lighting system, an ecologist with relevant credentials in the technical field of bird collision mitigation will review this measure, in the light of peer-reviewed scientific evidence published since the production of this NIS. In the event where new scientific evidence on lighting mitigation for bird collision conflicts with this measure, the ecologist will advise the relevant planning authority as appropriate and advise on any changes in light colour or other parameters required to minimise the potential for strike risk.

16.5.2.3 Bats

The indicative lighting design submitted with the planning application for the proposed development has been amended having regard for the latest guidance on lighting mitigation for bats (BCT and ILP, 2018).

Specifically:

- Uplighting has not been included on the façade of 4 and 5 Rutland Street; and,
- The lighting specification proposed at Bank Place on the northern boundary of the proposed development site where it borders the Abbey River has been amended to have a maximum Kelvin value of 3000, low-pressure sodium lights in preference to high pressure sodium lights or mercury lamps, and luminaires mounted on the horizontal with an upward light ratio of 0%.

However as a precautionary measure to reflect the indicative nature of the lighting designs accompanying the planning application, a suitably experienced bat ecologist (i.e. with demonstrable experience in discharging planning conditions in relation to bats and lighting) will be appointed by LCCC, to review and input to the detailed lighting designs, to ensure such designs comply with the measures from relevant guidance (including BCT and ILP, 2018), and avoid significant light spill from the proposed development impacting the proposed roosting provision in No. 4 and 5 Rutland Street.

16.5.2.4 Birds

No mitigation to reduce bird collision is required in addition to the proposed tower-mounted lighting proposed for designated sites.

16.6 Residual Impacts

The successful implementation of mitigation measures will be assured through the supervision and direction of the Ecologist during construction (16.5.1.5), through water quality monitoring during construction, (Section16.9), and through the involvement of a bat ecologist in the detailed design of operational lighting (Section 16.5.2.3).

Following successful implementation of mitigation measures, the geographic scale of significance of residual impacts will be at local level for:

- Bats, specifically relating to the potential for:
  - Abandonment of the proposed development site by feeding bats, despite the lighting and landscaping design features at Bank Place; and/or,
  - Reduction in numbers of common pipistrelle bats roosting in the proposed compensatory roosting provision in 4 and 5 Rutland Street, relative to the pre-development roosting population in 9 Rutland Street.
- Birds, specifically relating to the potential for:

- – Abandonment of the proposed development site by nesting swift, despite the provision of a compensatory swift brick in No. 5 Rutland Street;
- – Abandonment of the proposed development site by other nesting bird species, including one species of High Conservation Concern (herring gull), and three species of Medium Conservation Concern in addition to swift (house sparrow, lesser black-backed gull, starling).
- – Bird collision with the proposed tower despite the proposed lighting mitigation (e.g. in conditions of particularly poor visibility, during peak migratory periods).

All other residual impacts will be non-significant.

16.7 Difficulties Encountered in Compiling Information

No significant difficulties were encountered in obtaining desktop and field data for significant ecological features within the ZoI of the proposed development. Whilst Bat Conservation Ireland no longer provide locations of known bat roosts (i.e. only lists of bat species recorded within a given area are provided), the intensive bat survey effort (two complete seasons of bat emergence/return surveys, and hibernation surveys (to the effort recommended by Collins (2016) provided a high degree of confidence that bat roosts within the ZoI of the proposed development had been recorded.

Sources of information are not exhaustive, and every effort was made to obtain ecological data in the public domain to inform the baseline and impact assessment. It is possible that other information not in the public domain and known only to private individuals exists.

16.8 Cumulative Impacts

As street trees were the only significant habitat impacted by the proposed development, this was the only habitat of relevance in the context of cumulative impacts. Protected species of particular relevance to the cumulative impacts assessment were roosting and foraging bats, and nesting birds.

16.8.1 Known Threats to Designated Sites

This assessment has had particular regard for developments potentially affecting the Lower River Shannon SAC and the River Shannon and River Fergus Estuary SPA, given their close proximity to the proposed development, and because – in the absence of mitigation – significant effects from the proposed development site were predicted to affect these sites.

The Natura Standard Data Form for the Lower River Shannon SAC (NPWS, 2017a) ranks the following activities as posing a threat of medium importance to the SAC and identifies no threats as of high importance. The threats of medium importance are:

- Fertilisation;
- Urbanised areas;
- Air pollution;
- Discharges (unspecified)
- Waste discharge;
- Eutrophication;
- Grazing; and,
- Polderisation (i.e. reclamation of land from the sea).

The Natura Standard Data Form for the River Shannon and River Fergus Estuary SPA (NPWS, 2017b) ranks four activities as posing a threat of high importance to the SPA. These are:

- Industry and commercial areas;
- Discharge of waste;
- Fertilisation; and,
- Urbanisation.

The Natura Standard Data Form for the River Shannon and River Fergus Estuary SPA also identifies three activities posing a threat of medium importance to the SPA:

- Nautical sports;
- Shipping lanes; and,
- Marine and freshwater aquaculture.

16.8.2 Planning Application Search

A search was conducted of planning applications within the vicinity of the proposed development, using the National Planning Application Map Viewer hosted by the Department of Housing, Planning, Community and Local Government[42], and the Planning Enquiry system hosted by LCCC[43]

Retention applications (i.e. typically local-scale residential or commercial developments where an impact has already occurred) and withdrawn and refused applications were excluded (see Table 16.11).

Table 16.11. Summary Results of Planning Application Search in Limerick City

Planning Application Reference Number	Location Name	Brief Development Description	Application Status/ Outcome	Approximate distance and direction from Proposed Development	Date Planning Application Granted
N/A	O'Connell Street - Limerick Urban Centre Revitalisation	Targeted infrastructure and citizen investment programme specifically designed for O'Connell Street (the area between the junctions of Denmark Street and Barrington Street, approximately 786 metres in length). The aims of the project are to -Improve the public realm; -Regenerate the urban fabric; -Reduce air pollution; and, -Promote noise reduction. This project includes the remodelling of O'Connell Street for which an option appraisal has concluded that a single southbound lane is preferred.	Feasibility Concept Phase	c. 50 m south	N/A

[42] Available from: http://www.myplan.ie/webapp/. Accessed January 2019.
[43] Available from http://planningenquiry.limerick.ie/pes/LAResources/info.aspxs Accessed January 2019.

Planning Application Reference Number	Location Name	Brief Development Description	Application Status/ Outcome	Approximate distance and direction from Proposed Development	Date Planning Application Granted
14801	Sarsfield Lock	Construction of a pontoon and access gantry.	Conditional	c. 425 m south west	16/1/2015
16642	Dock Road , Bunlicky	The construction of a waste transfer station intended to handle 90,000 tonnes of waste material. This project has a ten year planning permission and will occur in two phases. (This development will be subject to a separate application for a Waste Licence to the Environmental Protection Agency. This application is accompanied by an Environmental Impact Statement (EIS).	Conditional	c. 2.7 km south west	23/03/2017
13300	Ballykeeffe, Dock Road	An increase in capacity of an existing waste transfer site to 130,000 tonnes. The development will require a revision of the Waste Licence granted by the EPA. This application is accompanied by an EIS.	Conditional	c. 2.7 km south west	16/4/2014
16345/ PL91 .248285	Castlemungret	An application to introduce the burning of alternative fuels, such as tires, solvents, shredded plastic and timber at a cement manufacturing plant.	Conditional, (appealed to An Bord Pleanála)	c. 4.8 km south west	11/04/2018
18168	Ellen Street/Carr Street/Punch's Row	Completion of the works comprising of a mixed development including new connections to the mains public water and sewer.	Conditional	c. 135 m south east	19/07/2018
171180/ PL91 .301154	O Connell St	The demolition of No. 40 and No. 41O'Connell Street and construction of a new building consisting of a 7-storey block with 2-storey portico fronting O'Connell Street. Development will provide multi-media visitor experience, exhibition and education space for the "International Rugby Experience".	Conditional (appealed to An Bord Pleanála)	c. 0.5 km south	14/02/2018
13770172	The Curragower , Clancy Strand	Change of use of existing Mona & Ivy Lodges from existing residential to new use as part of the Curragower Bar and restaurant complex including the construction of single storey extension to rear of building to incorporate new commercial kitchen.	Conditional	c. 425 m north west	15/10/2014
1613	Presentation National School, Sexton Street	The removal of existing pre-fab building and the construction of 3 no. pre-school class rooms with entrance, toilets, kitchen, office, link to existing sports hall and associated site works.	Conditional	c. 560 m south	01/06/2016
16800	Bishop's Quay, Lower Cecil Street, & Henry Street,	Demolition of the former Electricity Supply Board premises, demolition of rear annex, and change of use of No. 104 Henry Street from commercial use to residential use and construction of a commercial building.	Conditional	c. 620 m south west	19/06/2017
161010	Corner of Anne Street, and 42 Thomas Street	Construction of a two storey mixed commercial unit including retail/restaurant with signage and all ancillary site works.	Conditional	c. 390 m south	21/04/2017
Part 8 application	Kilmurry Court,	Provision of 7 no. residential units, 2no. two storey and 5no. single storey units.	Pending	c. 900 m east	N/A

Planning Application Reference Number	Location Name	Brief Development Description	Application Status/ Outcome	Approximate distance and direction from Proposed Development	Date Planning Application Granted
178001	Garryowen				
Part 8 application 178012	Clare Street & Leila Place	Provision of 7 no. residential units (2 no. three-storey, 3 bedroom houses and 5 no. 2 bedroom apartments in two blocks and upgrading and re-routing of foul sewers and surface water drainage.	Pending	c. 470 m east	N/A
17949	58 Clare Street	Construction of 4 No. three-storey terraced houses, car parking and ancillary site works to the rear.	Conditional	c. 830 m east	02/07/2018
18189	Strand Hotel Limerick, Ennis Road	The construction of a single storey extension of 687 sq. m (gross floor area) to the north wing of the existing hotel. The extension will include the provision of 20 additional hotel rooms; maintenance desk area; and repositioning of plant from existing roof to the roof of the new extension.	Conditional	c. 600 m west	31/05/2018
Part 8 application 188010	Lower Carey's Road, Limerick	Provision of 11 no. residential units, upgrading and re-routing of foul sewers and surface water drainage and (iv) all associated site works.	Pending	c. 1 km south	N/A

The planning portal of An Bord Pleanála[44] and lists of Strategic Housing Developments (SHD)[45] were also consulted to identify any relevant applications in close proximity to the proposed development (see Table 16.12). There were at the time of writing no SHD applications in County Limerick.

Table 16.12. Results of An Bord Pleanála Planning Search

ABP Planning Reference Number	Brief Development Description	Application Status/ Outcome
PL91 .302168	Ellen Street, Limerick (VS-028-17) / Vacant Site Appeal.	The Board considered that it is appropriate that a notice be issued to the planning authority to confirm the entry on the Vacant Sites Register.
PL13. HC0006	Proposed Foynes to Limerick Road Improvement Scheme.	Pre-application consultations completed; application yet to be lodged.
PL91 .302168	Demolition of nos. 40 and 41 O'Connell Street, construction of building fronting O'Connell Street., providing multi-media visitor experience, exhibition, education space for the "International Rugby Experience".	Granted.

[44] Available online at http://www.pleanala.ie Accessed January 2019.
[45] Available online at http://www.pleanala.ie/shd/applications/CurrentApplications/ Accessed January 2019.

16.8.2.1 Discussion of Planning Applications

Numerous permissions were granted to extend or refurbish existing properties or build new developments in the wider area surrounding the proposed development, due to the proposed developments location within Limerick City.

Some of these developments may have or may in future result in cumulative losses of street trees or related hedgerow or treeline habitats. However there are several policy protections for trees and related wooded habitats in the Limerick City Development Plan 2010 – 2016 as varied (LCC, 2010; hereafter ‘the Limerick City Development Plan’) which will mitigate this loss, including LBR.10 which includes the objective to “protect and maintain existing important individual and groups of trees from development risk, provide additional tree planting of native deciduous trees and other appropriate through planning permissions in order to benefit local biodiversity”. Furthermore, there are several habitat creation and management projects being pursued within Limerick City as identified within the Development Plan, such as the Coonagh West Sedimentation Ponds. The Development Plan is discussed in greater detail in Section 16.8.3.

With the exception of the consented (and existing) development (Reference 14801) of a pontoon and access gantry to the River Shannon at Sarsfield Lock (Harvey’s Quay), within the Lower River Shannon SAC and River Shannon and River Fergus Estuary SPA, none of the permissions reviewed comprised infrastructure within European sites or other significant areas of semi-natural habitat. Mitigation measures were proposed by the applicant to mitigate potential impacts from the construction of the pontoon and access gantry, and conditions were additionally attached by LCCC to protect the River Shannon as part of the decision to grant planning reference 14801 including:

- Construction of all structures off-site;
- Production of a Construction and Environmental Management Plan in consultation with LCCC to include restriction of all fuel storage and any refuelling on-site; and,
- The presence of an ecologist to oversee implementation of mitigation measures.

Environmental Impact Assessments (EIA), accompanied by relevant mitigation were carried out by the applicants as part of the planning applications for several developments including references 13300, 16642 and 16345.

In the context of bird strike, a review was undertaken of other tall buildings in the vicinity of the proposed development site in Limerick City. There was no relevant information obtained on known or potential bird collisions with the existing 59 m high Riverpoint building at Bishop’s Quay, either through consultation (Section 16.2.5), or through review of relevant planning files for Reference 04770206.There was similarly no information obtained on known or potential bird collisions with the existing 57 m high Clayton Hotel in Limerick City (Planning Reference P.97/409). There was no relevant information obtained on known or potential bird collisions with the proposed 15 storey structure, also at Bishops Quay (Planning Reference16800). These buildings will collectively act in combination with the proposed development to increase the number of tall structures into which birds could collide. However these and all other buildings in Limerick City are situated in a brightly lit urban centre, below the height along which significant migratory bird movements occur. No significant in-combination bird collision effects are predicted.

There are not determined to be significant in-combination collision effects on designated bird populations from the proposed development in –combination with other existing or proposed buildings in nearby urban Limerick, given that the scientific literature suggests significant migratory populations fly above urban building heights (Dokter et al., 2010).

Further detailed assessment of the potential for cumulative pollution impacts and impacts to bats and nesting birds are discussed in Section 16.8.4.

With the exception of nesting swifts (discussed in Section 16.8.4), no significant cumulative impacts were identified with the proposed developments in the planning application search results.

16.8.3 Plans

The Project Ireland 2040 National Planning Framework (Department of Housing Planning and Local Government, 2018b) is the overarching policy and planning framework for the social, economic and cultural development of Ireland. It includes a detailed capital investment plan for the period 2018 to 2027, the National Development Plan 2018-2027, and the 20-year National Planning Framework 2040. Project Ireland 2040 does not specifically identify any projects or policies in Limerick or elsewhere likely to result in significant cumulative impacts. The draft Regional Spatial & Economic Strategy for the Southern Region (Southern Regional Assembly, 2019) sets out a 12-year strategic development framework for the Southern Region. There are no potential cumulative effects from any policies in these plans, both of which have been subjected to AA's which concluded there would no adverse effects to European sites.

There are specific mitigation policies in the Limerick City Development Plan which will mitigate any potential for adverse effects from plan implementation. Chapter 11 of the Limerick City Development Plan (Landscape, Biodiversity, and Recreation) includes environmental protection inherent in several policies, as already named in Section 16.5.2.3.

One of the key objectives of the Limerick 2030 Economic and Spatial Plan (LCCC, 2015; hereafter 'the Limerick 2030 Plan') is to "*establish a unique tourism offer that takes full advantage of the City Centre's special heritage and environmental characteristics*". Further protections within the plan include the commitment to complete "*improvements to the physical environment*" (p.11). An AA Screening Statement produced by LCCC (LCCC, 2014) concluded that the Limerick 2030 Plan would not adversely affect the integrity of any European sites.

The Shannon Catchment Flood Risk Assessment and Management studies (CFRAMs) which are overseen by the Office of Public Works (OPW) provide a strategy for the reduction and management of flood risk in Ireland. Each CFRAM Study is focused on areas known to have experienced fluvial (river) and/or coastal flooding in the past or which are considered to be at potentially significant risk. Limerick City, and therefore the proposed development site fall within a catchment unit named 'Unit of Management (UoM) 25'. The OPW have proposed an extensive series of flood risk management options for UoM 25, including culvert upgrades, demountable defences, localised dredging and widening of the River Shannon, raising of road levels, and installation of various flood gates, and flapped outfalls. Following completion of an AA Screening Assessment, the OPW commissioned an NIS for UoM 25 (OPW, 2018), to assess the potential for the flood risk management options for UoM 25 to have adverse effects on European sites either alone or cumulatively with other plans or projects. The NIS concluded there would be no adverse effects on European sites, following implementation of detailed mitigation falling under five headings (Requirement for project-level assessments; survey specifications informing project-level assessments; detailed design specifications at project-level; ecological assessment specifications at project-level (e.g. flood modelling); and pollution mitigation specifications at project-level).

No significant cumulative impacts were identified with the proposed developments from the plans identified.

16.8.4 Detailed Assessment of Bats and Pollution

16.8.4.1 Bats

Any development affecting a built structure has the potential to disturb roosting bats, should they be present. However, significant protections are in place to prevent the disturbance to or removal of bat roosts via the strict legal protection afforded to bat roosts under European legislation. There are also several relevant policies of the Limerick City Development Plan which will protect bats and their habitats, including LBR.8 (use of Precautionary Principle), LBR.7 (implementation of Limerick City

Biodiversity Plan), LBR.9 (protection of River Shannon and other waterways), and LBR.10 (protection of trees and wetlands).

Finally, none of the three bat species potentially impacted by the proposed development (and therefore at risk from cumulative effects) are known to be declining. Irish bat populations are monitored annually by the Car-based Bat Monitoring Scheme, results of which demonstrate that populations of common pipistrelle and soprano pipistrelle have undergone a significant increase since monitoring began in 2003. Populations of Leisler's bat are considered stable or increasing (Roche et al. 2014). No significant cumulative impacts were identified for bats.

16.8.4.2 Nesting Birds

As for bats, any development affecting a built structure has the potential to disturb nesting birds, should they be present. Albeit less strict than the European protections applicable to bat roosts, legal protections are in place under the Wildlife Acts to prevent the disturbance to nesting birds or removal of nest sites. There is an abundance of suitable alternative nesting habitat for herring gull, lesser-black backed gull, house sparrow, and starling at other sites in urban Limerick (including both derelict and inhabited buildings). These species which have colonized urban areas have, relative to species of more remote areas, an elevated tolerance to human disturbance at nesting sites (Robert Fennelly, unpublished data; based on review of Flight Initiation Data[46]).

In conjunction with the existing legal protections, some mitigation of potential cumulative impacts to swift will be provided by the ongoing work of Birdwatch Ireland's nation-wide Swift Conservation Projects[47] and the acknowledgement of swift in the Limerick City Biodiversity Plan (LCC, 2012).

16.8.4.3 Pollution

The existing water quality downstream of the proposed development site offers a useful proxy metric for the pressure of existing projects and plans on the aquatic features within the Shannon Estuary, including the Lower River Shannon SAC and River Fergus and River Shannon Estuary SPA. The water quality of estuarine waters within the ZoI of the proposed development (as well as the water quality of coastal waters further downstream in the mouth of the Shannon) is unpolluted according to the EPA[48]. The existing unpolluted status suggests a relatively high assimilative capacity to absorb pollutants, relative to watercourses of polluted status. However, the RBMP (DoHGLP, 2018) states that *"significant progress remains to be made regarding meeting the requirements for protected areas*". This is reflected in the fact that, based on data from 2007-2015, the EPA considers both the Upper and Lower Shannon Estuaries as "At Risk" of not meeting the WFD objective of 'Good Status'[49].

The following policies in the Limerick City Development Plan will help mitigate the risk to water quality in the Shannon Estuary from cumulative impacts:

- Under Policy WS.6 Surface Water Drainage, it is the policy of Limerick City Council to provide a high quality Surface Water Collection and Disposal System. Specific objectives under this policy include:
  - "*Control discharges of surface water into drainage systems where the receiving drainage system is at or nearing full capacity*"; and,"
  - *To work in conjunction with other public bodies towards a sustainable programme of improvement for riverbanks, back drains, etc.*
- Under Policy WS.5 Waste Water, "All new development proposals shall adhere to the following:

[46] Flight Initiation Data reviewed included studies by Jiang and Moller (2017), Burger and Gochfeld, (1983), and Diaz et al., (2013).

[47] Information available from https://www.birdwatchireland.ie/OurWork/ResearchSurveys/SwiftConservationProject/tabid/1389/Default.aspx Accessed January 2019.

[48] Available from: https://gis.epa.ie/EPAMaps /. Accessed January 2019 Most recent results from 2010-2012.

[49] Available online from https://gis.epa.ie/EPAMaps/ . Accessed January 2019

- *"Have regard to the policy, national standards and guidelines, of not allowing the discharge of contaminants and greases to the City Council sewers";*
- *"Have regard for the specifications and details as defined in the DEHLG 'Recommendations for Site Development Works for Housing Areas', National and Limerick City Council requirements in respect of discharges"; and,*
- "*Provide an adequate surface water system in order to minimise the risk of flooding*".

Furthermore, Irish Water, who has national statutory remit for wastewater and drinking water services, has committed to a 25 year programme of improvements to wastewater impacts on surface waters in their Water Services Strategic Plan (WSSP).

There are binding obligations on all Irish local authorities including LCCC to achieve good status of surface waters, under the terms of the EU Water Framework. Having regard for the inherent legal and policy requirements for good water quality above, no significant cumulative pollution impacts are predicted.

16.8.5Concluding Statement: Cumulative Impacts

Having regard for existing legal protections, the existing unpolluted status of the Shannon Estuary, and the review of projects and plans above, no increase in the geographic scale of impact significance from cumulative impacts are predicted, relative to the geographic scale of impact significance from the proposed development alone.

For the reasons detailed in Section 16.8.4.2, in the absence of evidence to the contrary, potential impacts to swift from cumulative impacts are raised from Local scale for the proposed development alone, to Local-County scale taking account of in-combination effects.

16.8.6Summary of Potential Impacts Including Cumulative Impacts

16.8.6.1 Summary Tables of Potential Impacts

Table 16.13 summarises the geographic scale of potential impact significance at construction and operational phase for the proposed development:

- Before mitigation;
- After mitigation (i.e. residual impacts), and;
- Taking account of cumulative impacts.

Table 16.13: Summary tables of potential impacts; ordered by value

Ecological Feature	Valuation	Potential Construction Phase Impacts	Significance of Potential Construction-Phase Impact (Before Mitigation)	Potential Operation Phase Impacts (Before Mitigation)	Significance of Potential Operational Phase Impact (Before Mitigation)	Mitigation Proposed Additional to that Inherent in Design?	Residual Impact Significance (After Mitigation)	Cumulative Residual Impact Significance
European sites (River Fergus and Shannon Estuary SPA and Lower River Shannon SAC)	International	Pollution	International	None predicted	Not significant	Yes	Not significant	Not significant
		Habitat Loss (Lower River Shannon SAC only)	International	None predicted	Not significant	Yes	Not significant	Not significant
		Bird collision (River Fergus and Shannon Estuary SPA)	N/A	International	Not significant	Yes	Not significant	Not significant
National sites: Fergus Estuary and Inner Shannon, North Shore pNHA and Inner Shannon Estuary - South Shore pNHA	National	Pollution	Local	None predicted	Not significant	No	Not significant	Not significant
Fish excluding those for which Lower River Shannon SAC is designated (i.e. sea trout and eel in adjacent River Shannon)	County	Pollution	Local-County	None predicted	Not significant	No	Not significant	Not significant
Nesting bird assemblage of four medium conservation concern species (house sparrow, lesser black-backed gull, starling, swift) and one high conservation concern species (herring gull).	Local-County	Disturbance to and loss of nest sites	Local-County	Disturbance to any birds attempting to nest during operation (lighting, noise, human presence)	Local	Yes	Local	Local
Birds in flight	County	None predicted	None predicted	Bird collision	Local	Yes	Local	Local

Ecological Feature	Valuation	Potential Construction Phase Impacts	Significance of Potential Construction-Phase Impact (Before Mitigation)	Potential Operation Phase Impacts (Before Mitigation)	Significance of Potential Operational Phase Impact (Before Mitigation)	Mitigation Proposed Additional to that Inherent in Design?	Residual Impact Significance (After Mitigation)	Cumulative Residual Impact Significance
(excluding those of designated sites)								
Habitats: WL2 Treelines (i.e. street trees)	Local (Higher value)	Habitat loss	Local	None predicted	Not significant	Yes	Not significant	Not significant
Bats (Non-breeding roost of common pipistrelle)	Local (Higher value)	Disturbance to and loss of roost site	Local	Disturbance to artificial roost from lighting and noise	Local	Yes	Local	Local
Bats (Foraging Leisler’s bat, common pipistrelle bat, soprano pipistrelle bat)	Local (Lower value)	Permanent loss of foraging habitat in unlit site interior	Local	Disturbance to foraging bats from lighting and noise	Local	Yes	Local	Local
Nesting bird assemblage of two species of low conservation concern (feral pigeon and jackdaw)	Local (Higher value)	Disturbance to and loss of nest sites	Local	Disturbance to any birds attempting to nest during operation (lighting, noise, human presence)	Local	Yes	Local	Local
Habitats: ED2 Spoil and bare ground/ ED3 Recolonising bare ground mosaic	Local (Lower value)	Habitat loss	Not significant	None	Not significant	No	Not significant	Not significant
BL3 Built land and artificial surfaces	Local (Lower value)	Habitat loss	Not significant	None	Not significant	No	Not significant	Not significant
Other unprotected species (brown rats, and fox))	Local (Lower value)	Disturbance and habitat loss	Not significant	None	Not significant	No	Not significant	Not significant
Invertebrates presumed to be associated with vegetated areas of unlit	Local (Lower value)	Disturbance and habitat loss	Not significant	None	Not significant	No	Not significant	Not significant

Ecological Feature	Valuation	Potential Construction Phase Impacts	Significance of Potential Construction-Phase Impact (Before Mitigation)	Potential Operation Phase Impacts (Before Mitigation)	Significance of Potential Operational Phase Impact (Before Mitigation)	Mitigation Proposed Additional to that Inherent in Design?	Residual Impact Significance (After Mitigation)	Cumulative Residual Impact Significance
interior								

16.9 Monitoring

In relation to monitoring, the Draft Guidance from the EPA states (p. 61):

- *“It may be appropriate, where relevant, to propose monitoring to take place after consent is granted in order to demonstrate that the project in practice conforms to the predictions made.”*
- *“It is important to avoid excessive reliance on monitoring because this has the potential to lead to operational changes that fall outside the scope of project that was subject to scrutiny during the consent process.”*
- *“Monitoring post-consent should similarly not be used to allow the deferral of the gathering of information that is necessary for the assessment/consent.”*
- *“Monitoring descriptions should refer to remedial actions to be taken; as well as responsible parties.”*

With this in mind, appropriate monitoring measures have been proposed in relation to the proposed development.

16.9.1Construction-Phase Monitoring

The Contractor will produce and commence a Water Quality Monitoring Programme (WQMP) at least one moth in advance of the construction programme including any enabling works to establish a baseline dataset and continue throughout construction. The regularity of, and specification for water quality monitoring in this section has been agreed following consultation with IFI during EIAR production.

The baseline water quality dataset will include sampling at low tide, sampling at high tide, and (where possible should such events overlap with the pre-construction monitoring period) periods of elevated rainfall.

The WQMP will sample surface water discharge upstream and downstream from the proposed outfall to the Abbey River, in similar habitat and flow conditions, to enable siltation and other contaminants from the proposed development to be detected and distinguished from ‘background’ levels (including natural and man-made activities.

The WQMP will include relevant parameters from the European Communities (Quality of Salmonid Waters) Regulations, 1988 S.I. No. 293 as amended including Suspended Solids, pH, Dissolved Oxygen, Biochemical Oxygen Demand, hydrocarbons, Nitrites, Nitrates and heavy metals.

Testing for pH, turbidity and/or Total Suspended Solids will be carried out daily in-situ sing a calibrated multi-parameter sonde (to 0.1 NTU accuracy), and fortnightly for all other parameters.

The WQMP will inform the Contractor’s adaptive management of the temporary construction-phase drainage works, having regard for any consents or planning conditions.

The Contractor will provide WQMP results to the Ecologist and LCCC at least fortnightly (but immediately after a known silt release or other pollution incident), along with a record of any corrective actions taken by the Contractor to improve or repair performance of silt fencing or other surface water protection measures.

16.9.2 Operation-Phase Monitoring

16.9.2.1 Pollution

A regular maintenance regime, including monitoring, will be put in place to remove any excess build-up of material. A Class I Bypass Hydrocarbon Separator has also been provided to treat surface water collected in the new gullies on Michael Street.

Limerick Twenty Thirty has given an undertaking to establish a maintenance company that will be responsible for the regular maintenance and monitoring of all infrastructure installed as part of the development. This includes the surface water drainage, gullies and petrol interceptor on Michael Street. Future third party Connection to the infrastructure in Michael Street will only be permitted if the same undertaking can be given with regards maintenance and monitoring. Limerick Twenty Thirty will be responsible for funding of the company and should units be sold (or resold) or leased (or subsequently lease), the sale shall incorporate a legal obligation on each unit owner to fund this management company on a pro rata basis.

16.9.2.2 Other Monitoring

No other monitoring is proposed.

Subject to grant of planning permission, and following submission of the bat derogation licence application (as set out in Section 16.5.1.4), and assuming grant by the NPWS of a derogation licence application permitting removal of the bat roost, the NPWS may attach conditions to the bat derogation licence.

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%2520Appendices%2520Part%25201/A.4.2%2520Ecological%2520Constraints%2520Report%2520-%2520Appendix%2520E.pdf+&cd=1&hl=en&ct=clnk&gl=ie

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17 Archaeological and Cultural Heritage

17.1 Introduction

17.1.1 General

This chapter of the Environmental Impact Assessment Report (EIAR) assesses the impact, if any, on the archaeological and cultural heritage resource of the proposed Project Opera development in Limerick City (Figure 17.1).

This study determines, as far as reasonably possible from existing records, the nature of the archaeological and cultural heritage resource in and within the vicinity of the development area using appropriate methods of study. Desk-based assessment is defined as a programme of study of the historic environment within a specified area or site that addresses agreed research and/or conservation objectives. It consists of an analysis of existing written, graphic, photographic and electronic information in order to identify the likely heritage assets, their interests and significance and the character of the study area, including appropriate consideration of the settings of heritage assets, Chartered Institute of Archaeologists (CIfA 2014). This leads to the following:

- Determining the presence of known archaeological and cultural heritage sites that may be affected by the proposed development;
- Assessment of the likelihood of finding previously unrecorded archaeological remains during the construction programme;
- Assessment of the significance of the effect of the development on identified and potential archaeological and cultural heritage assets;
- Suggested mitigation measures based upon the results of the above research to mitigate the effect of the scheme on the identified archaeological and cultural heritage assets.

17.1.2 Definitions

In order to assess, distil and present the findings of this study, the following definitions apply:

- ‘the term ‘archaeological heritage’ is applied to objects, monuments, buildings or landscapes of an (assumed) age typically older than AD 1700 (and recorded as archaeological sites within the Record of Monuments and Places).
- the term ‘cultural heritage’, where used specifically, is applied to other (often less tangible) aspects of the landscape such as historical events, folklore memories and cultural associations.
- Built heritage features are addressed in Chapter 18.

17.1.3 Impact Definitions

Imperceptible Impact

An impact capable of measurement but without significant consequences

Not Significant

Impact which causes noticeable changes in the character of the environment but without significant consequences

Slight Impact

An impact which causes noticeable changes to the character of the environment without affecting its sensitivities and do not directly impact or affect an archaeological feature or monument.

Moderate Impact

An impact that alters the character of the environment in a manner consistent with existing and emerging baseline trends. A moderate impact arises where a change to the site is proposed, which although noticeable, is not such that the archaeological integrity of the site is compromised, and which is reversible. This arises where an archaeological feature can be incorporated into modern day development without damage and that all procedures used to facilitate this are reversible.

Significant Impact

An impact which, by its character, magnitude, duration or intensity, alters a sensitive aspect of the environment. An impact like this would be where part of a site would be permanently impacted upon, leading to a loss of character, integrity and data about the archaeological feature/site.

Very Significant

Impact which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment.

Profound Impact

Applies where mitigation would be unlikely to remove adverse impacts. Reserved for adverse, negative impacts only. These impacts arise when an archaeological site is completely and irreversibly destroyed by a proposed development.

Impacts as defined by the EPA 2017 Guidelines (pg. 50).

17.2 Methodology

Research for this report was undertaken in two phases. The first phase comprised a paper survey of all available archaeological, historical and cartographic sources. The second phase involved a field inspection of the site.

17.2.1 Paper Survey

- Record of Monuments and Places for County Limerick;
- Sites and Monuments Record for County Limerick;
- National Monuments in State Care Database;
- Preservation Orders List;
- Topographical files of the National Museum of Ireland;
- Cartographic and written sources relating to the study area;
- Limerick City Development Plan 2010–2016 (as extended);
- Place name analysis;
- Aerial photographs;
- Excavations Bulletin (1970–2018).

Record of Monuments and Places (RMP) is a list of archaeological sites known to the National Monuments Section, which are afforded legal protection under Section 12 of the 1994 National Monuments Act and are published as a record.

Sites and Monuments Record (SMR) holds documentary evidence and field inspections of all known archaeological sites and monuments. Some information is also held about archaeological sites and monuments whose precise location is not known e.g. only a site type and townland are recorded. These are known to the National Monuments Section as 'un-located sites' and cannot be afforded legal protection due to lack of locational information. As a result, these are omitted from the Record of Monuments and Places. SMR sites are also listed on a website maintained by the Department of Culture, Heritage and the Gaeltacht (DoCHG) – www.archaeology.ie.

National Monuments in State Care Database is a list of all the National Monuments in State guardianship or ownership. Each is assigned a National Monument number whether in guardianship or ownership and has a brief description of the remains of each Monument.

Preservation Orders List contains information on Preservation Orders and/or Temporary Preservation Orders, which have been assigned to a site or sites. Sites deemed to be in danger of injury or destruction can be allocated Preservation Orders under the 1930 Act. Preservation Orders make any interference with the site illegal. Temporary Preservation Orders can be attached under the 1954 Act. These perform the same function as a Preservation Order but have a time limit of six months, after which the situation must be reviewed. Work may only be undertaken on or in the vicinity of sites under Preservation Orders with the written consent, and at the discretion, of the Minister.

The topographical files of the National Museum of Ireland are the national archive of all known finds recorded by the National Museum. This archive relates primarily to artefacts but also includes references to monuments and unique records of previous excavations. The find spots of artefacts are important sources of information on the discovery of sites of archaeological significance.

Cartographic sources are important in tracing land use development within the development area as well as providing important topographical information on areas of archaeological potential and the development of buildings. Cartographic analysis of all relevant maps has been made to identify any topographical anomalies or structures that no longer remain within the landscape.

- Hardiman's map of *The Citie of Limerick*, 1590
- Speed's map of *Lymericke*, 1610
- *Pacata Hibernia* 2 map of *The Citie of Limerick*, 1633
- Down Survey Map of the Limerick South Liberties, 1656-1658
- William Eyres' Map: *A Plan of Limerick*, 1752
- Christopher Colles' Map of the *City and Suburbs County of Limerick*, 1769
- Ordnance Survey Maps, 1840 and 1900
- Corbett's map of Limerick for Maurice Leninhan's Forster & Co., 1865

Documentary sources were consulted to gain background information on the archaeological, architectural and cultural heritage landscape of the proposed development area.

Development Plans contain a catalogue of all the Protected Structures and archaeological sites within the county. The extended Limerick City Development Plan (2010–2016) was consulted to obtain information on cultural heritage sites in and within the immediate vicinity of the proposed development area.

Aerial photographic coverage is an important source of information regarding the precise location of sites and their extent. It also provides initial information on the terrain and its likely potential for archaeology. A number of sources were consulted including aerial photographs held by the Ordnance Survey and Google Earth.

Excavations Bulletin is a summary publication that has been produced every year since 1970. This summarises every archaeological excavation that has taken place in Ireland during that year up until 2010 and since 1987 has been edited by Isabel Bennett. This information is vital when examining the archaeological content of any area, which may not have been recorded under the SMR and RMP files. This information is also available online (www.excavations.ie) from 1970–2018.

17.2.2 Field Inspection

The archaeological field inspection was carried out on 26 May 2017 and entailed –

- Walking the proposed development and its immediate environs.
- Noting and recording the terrain type and land usage.
- Noting and recording the presence of features of archaeological or cultural heritage significance.
- Verifying the extent and condition of any recorded sites.
- Visually investigating any suspect landscape anomalies to determine the possibility of their being anthropogenic in origin.

17.2.3 Legislative Context

The following legislation, planning policy, standards and guidelines were also consulted as part of the assessment. A full description of the legislative context is given in Appendix 17.C.

- National Monuments Act 1930 to 2014;
- The Planning and Development Acts 2000 to 2017;
- Heritage Act, 1995, as amended;
- Limerick City Development Plan 2010-2016 (as amended);
- Guidelines on the information to be contained in Environmental Impact Statements, 2003, EPA;
- Advice Notes on Current Practice (in preparation of Environmental Impact Statements), 2003, EPA;
- Draft Advice Notes on Current Practice (in preparation of Environmental Impact Statements), 2015, EPA;
- Guidelines on the information to be contained in environmental impact assessment reports (Draft August 2017), EPA;
- Frameworks and Principles for the Protection of the Archaeological Heritage, 1999, (formerly) Department of Arts, Heritage, Gaeltacht and Islands;

17.3 Baseline Conditions

17.3.1 Archaeological and Historical Background

The proposed development area is bound to the west by Rutland Street (R526), to the north by Bank Place (R526), to the east by Michael Street and to the south by Ellen Street. It is situated to the southeast of the confluence of the Abbey River and the Shannon. The site comprises a block of urban structures (many of which are closed retail units), yards and a large former granary which is now in use as the city library.

The proposed development area is largely located within the Zone of Archaeological Notification for the historic town of Limerick; however there are no archaeological monuments recorded within the site boundary. The nearest monuments comprise the current location of a sheela-na-gig (LI005-017180) and a church and graveyard (LI005-078001-2) c. 30m east and 40m west of the site respectively. The site is located to the west of the medieval walled enclosure of ‘Irishtown’ and to the south of ‘Englishtown’.

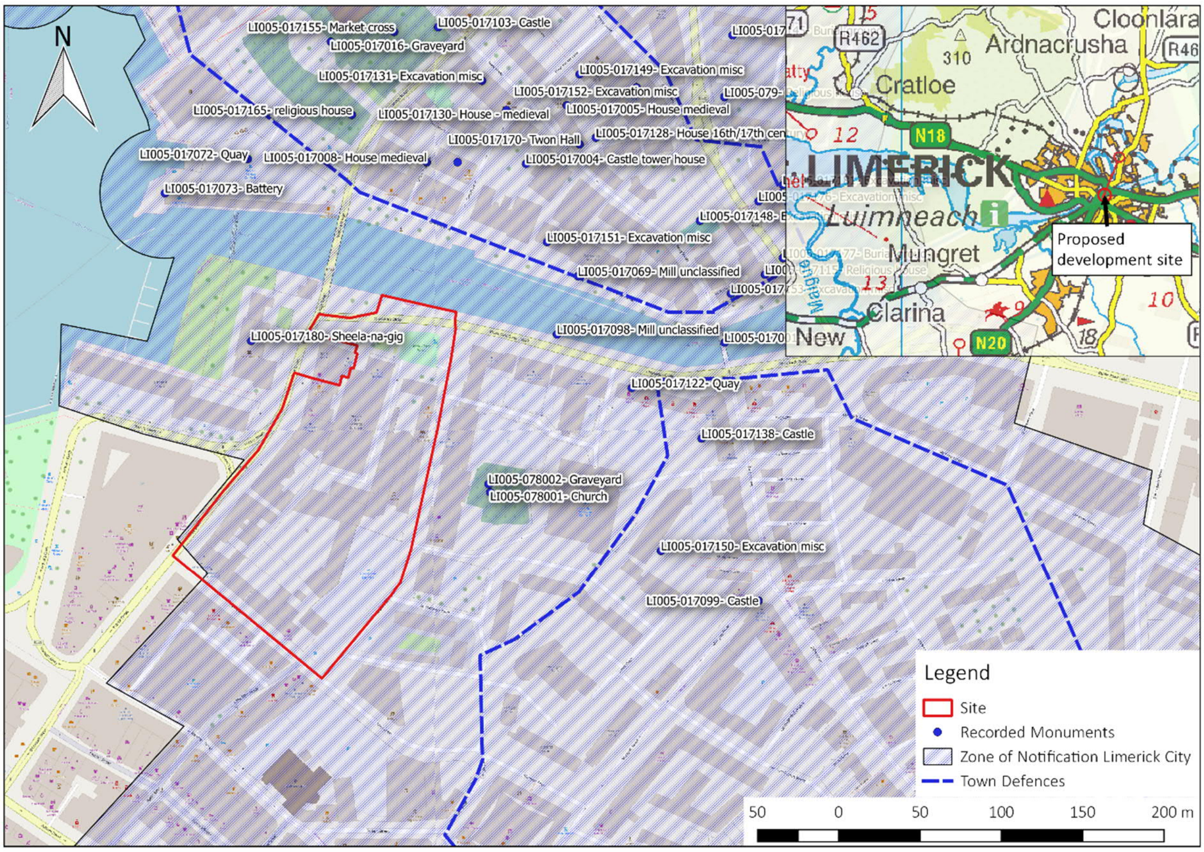

Figure 17.1: Site location showing surrounding recorded monuments

17.3.1.1 Prehistoric Period

Mesolithic Period (6000–4000 BC)

Although recent discoveries may push back the date of human activity in Ireland by a number of millennia (Dowd and Carden 2016), the Mesolithic period is the earliest recorded time for which there is clear evidence of prehistoric activity. During this period people hunted, foraged and gathered food and appear to have had a mobile lifestyle. The most common evidence indicative of Mesolithic activity at a site comprises of scatters of worked flint material; a by-product from the production of flint implements or rubbish middens consisting largely of shells (Stout & Stout 1997). The River Shannon formed one of the main access routes into mainland Ireland and was a focus for settlement from the Mesolithic period onwards.

There are no recorded sites of this date located within the environs of the proposed development area. However, the most significant discovery of this period, the oldest known formal burials in Ireland are located c. 8km northeast of the proposed development at Hermitage on the banks on the Shannon (Collins and Coyne 2006).

The results of the archaeological intertidal survey of the Shannon estuary, carried out for the North Munster Project of the Discovery Programme, revealed evidence for some sea-level rise and marine transgressions since the prehistoric period (Grogan 2005). Local conditions appear to have resulted in the submergence of Mesolithic, Neolithic and Bronze Age forest landscapes, which now lie sealed beneath estuarine clays. Evidence for this sequence has been found at Coonagh West, c. 4.6km west of the proposed development area (*ibid.*). Due to these changes, the Shannon Estuary's landscape has always been a dynamic one, varying from raised bogs to freshwater fens, salt marshes and mud flats.

Within the wider context of County Limerick, a late Mesolithic/ early Neolithic axe head and lithics were found within alluvial deposits on the northern bank of the River Shannon as part of the Limerick Southern Ring Road investigations (Bermingham *et al*. 2013).

Neolithic Period (4000–2500 BC)

During the Neolithic period communities became less mobile and their economy became based on the rearing of stock and cereal cultivation. This transition was accompanied by major social change. Agriculture demanded an altering of the physical landscape, forests were rapidly cleared, and field boundaries constructed. There was a greater concern for territory, which saw the construction of large communal ritual monuments called megalithic tombs, which are characteristic of the period. While there are no recorded megalithic tombs or sites located within the landscape surrounding the proposed development area.

Bronze Age (2500–500 BC)

The Bronze Age is characterised by the introduction of metalworking technology to Ireland and coincides with many changes in the archaeological record, both in terms of material culture as well as the nature of the sites and monuments themselves. In addition to changes in material culture, there were changes in burial rites. Megalithic tombs were no longer constructed, and the burial of the individual became more typical. Cremated or inhumed bodies were often placed in a cist, a small stone box set into the ground, a stone-lined grave or even a simple pit. Burials were often made within cemeteries and marked within the landscape with the construction of an earthen barrow or cairn of stones (Buckley and Sweetman 1991). There are no recorded sites of this type within the area of proposed development or its immediate vicinity.

Intertidal and dry land surveys also indicate that significant Bronze Age populations were active along the river shoreline and its hinterland, with settlements extending far inland (Margaret Gowen & Co Ltd. 2003). A number of artefacts dating to this period from the area surrounding the site are in possession of the National Museum such as bronze pins, rings, needle and fish hooks. These are listed in Appendix 17.B.

Iron Age (500 BC–AD 400)

There is increasing evidence for Iron Age settlement and activity in recent years as a result of development-led excavations. There are two phases of the Iron Age in Ireland, the Hallstatt and the La Tène, which are associated with distinct artwork and metalwork. There is very little in the way of recorded Iron Age archaeological activity within the landscape surrounding the development. There are a number of historical and folkloric sources which suggest a settlement at this time. The earliest map of Ireland was drawn by Ptolemy and shows a place referred to as Regia in the approximate location of Limerick city alongside the River Shannon (Spellissy 1998; O'Sullivan 2001). Sites, including burial evidence, have been identified within the wider area, including Ballysimon 1, Rathbane South and Coonagh West 4 that were excavated as part of the Limerick Southern Ring Road (Bermingham *et al*., 2013). A bronze sestertius of Domitian coin, dating to AD 81–94, was found within the River Shannon to the immediate south of Thomond Bridge (NMI Ref.: 1978:327).

17.3.1.2 Early Medieval Period (AD 400–1169)

When the Irish annals refer to a place called *Luimneach*, they specify an area by the Shannon estuary, but make no reference to any town or fort existing there. The name *Luimneach*, which can be dated to around 561 AD (when it was used in an ancient poem), is generally taken to mean 'the bare marsh'; however, as Ó Maolfabhail points out, the word is also an adjective meaning 'cloaked' or 'shielded' and may well indicate a sheltered area or harbour (1990, 213).

The range and variety of monuments of early medieval date in the vicinity of Limerick City attest to the intensive settlement of the area during this period. Field monuments of this period, notably ringforts and ecclesiastical enclosures, occur in large numbers around the city and there are suggestions from the historical record that the city area itself formed the focus of settlement before the Viking period (c. early 9th century; Spellissy 1998).

The ringfort or rath is considered to be the most common indicator of settlement during this often-violent period. The most recent study of the ringfort (Stout 1997) has suggested that there is a total of 47,000 potential ringforts or enclosure sites throughout Ireland. No ringforts are recorded within the vicinity of the proposed development area. The closest example is LI005-016001, located 600m to the northwest. This may be explained by the levelling of such features from the medieval period onwards, particularly in the hinterlands of large settlements. In the wider context of the county, West Limerick has one of the highest ringfort densities in the country, at c. 1.52 per square kilometre (Stout 1997).

In AD 812 the Vikings plundered a small settlement in Limerick and later in the tenth century Tamar, a Norse King, went on to establish a maritime settlement and centre of trade on the southern portion of the island at the lowest fording point of the River Shannon, bounded by the west by the Shannon and all other sides by the Abbey River (O'Rahilly 1988; Spellissy 1998). While there is no archaeological evidence for an enclosure around Viking Limerick, thought to be located on Kings Island 70m north of the proposed development area; it is likely that the Viking town north of the Abbey River, was enclosed by an earthen bank and ditch with a palisade in a manner similar to other Viking settlements in Ireland. An iron axehead of Viking type was recovered from Limerick Harbour, to the north of the proposed development area, and is now in the possession of the National Museum (NMI Ref.: 1965:80).

Viking raids continued in this area with the Annals of Clonmacnoise recording that in AD 843 Foranan, Primate of Armagh, was taken hostage by the Vikings and held on their ships in Limerick (Lenihan 1866). This settlement was one of the five major Viking coastal towns; the other urban centres were at Dublin, Cork, Waterford and Wexford (Edwards 1990). As with Dublin (*Dubhlinn* to *Dyflin*), the Vikings adopted the Irish name *Luimneach*, but corrupted it slightly, using one of their terms *Laemrich*, *Hlimrek*, or *Allymrick*, which means rich land, rich soil, and rich loam respectively. Later known as "Kings Island" after an English monarch but also possibly once named as *Odensay* – Odin's Island (Spellissy 1998), this naturally defended location had the double advantage that it was navigable from the sea and was presumably a crossing point over the Shannon. This provided the Vikings with a secure base from which raids could be conducted along the river upstream of Limerick and trade from Atlantic Europe could be managed.

A raid by the King of the Dublin Vikings on Clonmacnoise in AD 936, which caused a battle between the Limerick and Dublin Vikings at Lough Ree the following year, resulted in the defeat of the Vikings of Limerick and the destruction of their fleet. By this time the Vikings of Limerick had settlements throughout the mid-west region and had integrated with the native Irish (Spellissy, 1998). This allowed for an easier defeat and recapturing of Limerick city at the battle of Singland in AD 943 by the native Irish King of the Dalcassians and the King of Munster and marked the beginning of a period of *Ua Briain* tribal domination that was to last until the coming of the Anglo-Normans. Within this period, during the reign of *Toirrdelbach Ua Briain* (King of Munster from 1063-86), the *Ua Briain's* essentially abandoned their royal seat at Cashel in favour of making the Viking town their new capital (Margaret Gowen & Co Ltd., 2003).

17.3.1.3 Medieval Period (AD 1169–1600)

The beginning of the medieval period was characterised by political unrest that originated from the death of *Brian Borumha* in 1014. *Diarmait MacMurchadha*, deposed King of Leinster, sought the support of mercenaries from England, Wales and Flanders to assist him in his challenge for kingship. Norman involvement in Ireland began in 1169, when Richard de Clare and his followers landed in

Wexford to support *MacMurchadha*. Two years later de Clare (Strongbow) inherited the Kingdom of Leinster and by the end of the 12th century the Normans had succeeded in conquering much of the country (Stout & Stout 1997).

The Anglo-Normans arrived at Limerick in 1175; however, they were forced to withdraw in 1176 and did not succeed in occupying Limerick until 1190. It was one of the last towns of Ireland to fall to the invaders (Lee 1997). Prince John granted Limerick a charter seven years later, declaring that the citizens would have all the liberties and free customs through all Ireland that were enjoyed by the citizens of Dublin (*ibid*.).

The walled Anglo-Norman town was reserved to the Crown and formed part of the vast demesne lands of the King, receiving various charters and privileges. In addition, various religious orders were established within and around the town such as the Franciscan friars (LI005-079, 220m east of the site); the Fratres Cruciferi (LI005-017115, 190m northeast of the site), and the Knights Hospitallers (LI005-017165, 125m north of the site). The latter were granted the right to have a Frankhouse by the 1292 charter of Edward I (www.archaeology.ie).

The initial settlement was restricted to the walled town that occupied King's Island. Several early sources state that during the early 13th century King John instructed that a castle should be erected, along with a bridge (Thomond Bridge), within the English town of the settlement (Wiggins, 2000). King John's Castle (LI005-017014) is located c. 355m northwest of the proposed development area. However, there are references to a castle within Limerick in 1202 and it is possible that this refers to the earlier ringwork, which was constructed by the Norman garrison in 1175 (Wiggins 2016). The 12th century ringwork ditch was identified during excavations at the castle in 1990-91 (LI005-017124), beneath the 13th century masonry (Wiggins, 2000).

Other Anglo-Norman castles in this area include LI005-017103, located c. 190m to the north; LI005-017099 located c. 225m to the east and LI005-017101 located c. 280m to the northwest of the proposed development area. By the middle of the 13th century a stone curtain wall enclosed the town, which was later expanded to the east. By the early 14th century the suburb south of the Abbey River, (Irishtown), located to the immediate east of the proposed development area, had developed as the Anglo-Normans forced the original inhabitants' south from the island. St. Michael's Church (LI005-078001), which is located c. 40m to the east of the proposed development area, is likely to be an Anglo-Norman foundation. Ruined by the mid-17th century, today only the graveyard is extant (Spellissy 1998).

The construction of St. Mary's Cathedral (LI005-017015, c. 180m north of the proposed development area) began in the late 12th century by Donal Mór O'Brien, the last King of Munster and was completed around 1194. Its full title is the 'Cathedral and Parochial Church of the Blessed Virgin Mary'. The Cathedral played a dominant role in this medieval area within Limerick City showing the amalgamation of the architectural styles of Romanesque and Gothic (www.archaeology.ie). The cathedral grounds contain many graveslabs and memorial stones dating to the medieval period and later (Appendix 17.A).

Irishtown was walled, or partially walled, as early as 1310 (Collins *et. al*. 2008) and was completed with the erection of John's Gate in 1495 (Spellissy 1998), c. 450m southeast of the proposed development area. The defenses of the suburb at this time were inadequate as Irishtown was burned by Edward Bruce in 1316 and again in 1331 by the first Earl of Desmond. An extensive programme of building resulted in the completion of a walled circuit enclosing Irishtown by the end of the 15th century (O'Flaherty 2010). The gates of the walled city of the Irishtown gates were West Water Gate (c. 140m to the east), Mungret Gate (c. 190m to the southeast), Baal's Bridge South Gate (c. 175m to the east), East Water Gate (c. 240m to the east), and St. John's Gate (c. 450m to the southeast) (Spellissy 1998; irishwalledtownsnetwork.ie).

The Englishtown and the Irishtown were connected by Baal's Bridge (LI005-017001, located c. 170m to the east of the proposed development area), which was constructed around 1340 and replaced with the current bridge in 1831. The 14th century bridge of four arches and a gate at either end, was constructed on the location of an earlier bridge named after Baal who was purportedly converted to Christianity in the 4th century by St. Patrick (Spellissy 1998). The proximity of Baal's Bridge indicates that the proposed development area was located within what was a main thoroughfare between the Englishtown and the Irishtown during this time.

The city prospered in the 15th century. Gerald, earl of Kildare held a parliament in the city in 1484 with the brotherhood of the Guild of Merchants formed in 1495 (*ibid.*). Trade flourished, particularly of Spanish wine and Irish corn due to the natural properties of the River Shannon, which allowed for a ship of 200 tons burden to sail 60 miles from the sea to the quays in Limerick. During the 16th century the city militia was larger than that of any other city in Ireland bar Dublin, making Limerick Ireland's second city (*ibid*). A number of medieval house sites are recorded on King's Island to the north of the proposed development (LI005-017003, 5 and 8).

17.3.1.4 Post-Medieval Period (AD 1600–1900)

The 17th century in Ireland was a turbulent period of warfare, religious strife and political upheaval. In Limerick, as with other parts of the country, it was characterised by two particular conflicts - the Irish Confederate Wars (1641–53) and the Williamite War (or War of the Two Kings; 1688–91). In 1651 a protracted siege by Cromwell's forces left Limerick City besieged with famine, pestilence and death. The city finally surrendered with a death toll of 5000 inhabitants. The Williamite Wars of the late 17th century saw the reactivation of the city mint to finance James II's campaign. Gun money was minted in Dublin and Limerick, allegedly from the brass of old cannons, hence its name. The city withstood attacks by Williamite forces throughout 1690 and 1691, becoming the last Jacobean stronghold to repel William's army. After the slaughter of 600 inhabitants who had become trapped outside the city walls and the failure of French reinforcements to arrive, Patrick Sarsfield signed the Treaty of Limerick in October 1691 (Spellissy 1998).

Over the course of the century, the Old Gaelic order was dismantled and replaced by English governance and a Protestant Ascendancy class were installed as landowners across the vast majority of the county. The town walls at Limerick were in a poor state of repair towards the beginning of the 17th century as records survive that the Mungret Gate was rebuilt in 1622. The gate was further strengthened in 1643 when internal ramparts and an outwork were built. In 1651 Limerick was besieged by Cromwellian army and a series of ditches and outworks were constructed around the Irishtown walls. The besieging force constructed enclosing ditches and star shaped forts which barred the southern and western approaches to the city (O'Flaherty 2010).

By the 18th and 19th centuries, a slightly more stable political climate enabled the landed gentry to establish large houses within the landscape. Often these occupied areas on the outskirts of towns. This period also marked the beginning of the decline of the city walls. Charlotte Quay and Michael Street, to the north and east of the proposed development area respectively, were redeveloped by Limerick Corporation in 1715. The area was named the Mardyke, "a derivative of the Anglo-Saxon term *mere*, a pool or a lake, and dyke, an embankment, from the Old Norse/ Middle English word *dik*" (Spellissy 1998, 194).

This period also witnessed the Georgian building boom which resulted in the suburban expansion of Ireland's principal cities and the development of neo-classical principals of architecture preoccupied with fixed proportions and ordered harmonious symmetry. Irishtown was to be reimagined in this light and the building of the first Georgia Square by Sexton Pery coincided with the demolition of the town walls (Limerick City Development Plan). A formal gridded streetscape, known as Newtown Pery, was laid out stretching from Mungret Street in the east to the banks of the Shannon to the west. This area comprises Limerick's Georgian quarter and is designated an Architectural Conservations Area, protected under the Limerick City Development Plan.

The block containing the proposed development area is bound to the west by Rutland Street (R526), to the north by Bank Place (R526), to the east by Michael Street and to the south by Ellen Street. Bank Place is named for Maunsell's Bank, officially the Bank of Limerick, the first known bank in Limerick established in 1789. Rutland Street was named after the fourth Earl of Rutland, Charles

Manners. Ellen Street and Patrick Street were named after members of the prominent Arthur family after whom Arthur's Quay to the immediate west of the site is named (*ibid*.). Bank Place was laid out in the late 18th century by Philip Roche as the grandiose entrance to the new Georgian town from the mostly medieval Englishtown. The Custom House, now the Hunt Museum, is a Palladian-style building located to the immediate west of the site. Designed by Davis Ducart, construction began in 1765 and finished under Christopher Colles in 1769 (Spellissy, 1998).

The Granary, which is located within the northeast corner of the proposed development area was built after Philip Roche purchased the site in 1787. The Granary was later used as bonding stores and is marked as such on 19th century mapping. The building is largely used as offices today.

The Rivers Shannon and Abbey enabled large scale milling around Limerick city, with examples including LI005-017098 and LI005-017069 located c. 60m and c. 90m to the northeast of the proposed development area respectively. A water mill (LI005-019), is recorded c. 300m to the northwest at Thomondgate. By the 1830s the linen and cotton industry in the region declined despite efforts made by the Limerick Chamber of Commerce, including the erection of a new linen hall and the holding of a weekly market (*ibid.*). By the 1850s the previously lucrative linen market in North Munster had collapsed following the Famine, as many of the linen mills had been adapted to grind Indian corn brought in for Famine Relief (www.milkmarketlimerick.iet).

The Limerick Market Trustees was set up in the early 1850s by Act of Parliament and comprised members from Limerick Corporation, Limerick County Grand Jury and Limerick Chamber of Commerce. The trustees purchased an area of land in Garryowen where many of the markets, which were previously been scattered across the city, relocated to. These included the Butter Market, Pig Market and Hay Market. The Milk Market is situated c. 135m to the southeast and a Potato Market is indicated on the quays c. 80m north-northwest. The Corn Market or Milk Market continued to thrive throughout the 20th century and remains in robust health today (*ibid.*).

17.3.2 Summary of Previous Archaeological Fieldwork

A review of the Excavations Bulletin (1970–2018) has revealed that no archaeological investigations have previously been carried out within the proposed development area. A number of programmes of testing and monitoring have been undertaken in the wider vicinity of the development, which are summarised below.

Archaeological testing was carried out c. 80m northeast at George's Quay, which identified Georgian cellar walls, layers of urban occupation and the remains of the medieval Mill Lane, which would have provided access from the medieval main street (Mary Street) to the banks of the Abbey River (Licence Ref.: 02E0024; Bennett 2002:1216; LI005-01715).

Excavations in advance of the Limerick Main Drainage Scheme were carried out in 1998. Over 10,000 artefacts were retrieved from the Abbey and Shannon Rivers ranging from finds dating to before the Viking foundation of Limerick to the present-day occupation. Two sections of the medieval town wall were uncovered along George's Quay to the north of the proposed development area. Riverbed excavations below Matthew Bridge uncovered the remains of the 18th century bridge piers that pre-dated the current structure. A number of important Civil War artefacts, such as revolvers, hand grenades, an unexploded Civil War shell and bullet rounds, were found around the base of the bridge piers during the excavation. Additionally, the foundations of an early weir were recorded, which predated the development of Charlotte Quay and Bank Place in the early 18th century. The structure was thought to form a head-race for two mills on either side of the river, one under Bank Place and the other at the junction of Creagh Lane and George's Quay. It may have been associated with Nicholas Arthur's Mill, which is depicted on Hardiman's map of 1590 (Licence Ref. 98E0581 ext.; Bennett 2000:0589).

Monitoring for the Limerick City Water Conservation Water Mains Rehabilitation Works (Package 1), included excavations in Patrick St to the southeast of the proposed development area (Licence Ref.:

12E0365). The stratigraphy consisted of modern fills overlying natural clay and no features or finds of archaeological significance were exposed during these works (Bennett 2013:394).

17.3.3 Cartographic Analysis

17.3.3.1 Hardiman's map of *The Citie of Limerick*, 1590

This map shows the walled enclosures of Englishtown and Irishtown. The proposed development area is located west of Irishtown in an area of marginal estuarine terrain. The closest structure is St. Michael's church (LI005-078001), which is annotated as such on this map. The land located outside of the city walls is shown as rural in nature.

17.3.3.2 Speed's map of *Lymericke*, 1610

This map shows the proposed development area within the estuarine flats on the banks of the Rivers Shannon and Abbey. No buildings or features of archaeological potential are indicated within the site.

17.3.3.3 Pacata Hibernia 2 map of The Citie of Limerick, 1633

This map shows the proposed development area in an estuarine environment and contains less detail than that of Speed's map. No buildings or features of archaeological potential are indicated within the site.

17.3.3.4 Down Survey Map of the Limerick South Liberties, 1656-1658

This map does not contain a large amount of detail and the site is shown to the west of Irishtown in the estuarine flats. No buildings or features of archaeological potential are indicated within the proposed development area.

17.3.3.5 William Eyres' Map *A Plan of Limerick*, 1752 (Figure 17.2)

By this time the proposed development area is illustrated as having been partially reclaimed, although it is still marked as marginal terrain. A trackway leads from the south along the path of Patrick's Street and three large rectangular buildings are indicated within the vicinity of the northern half of the proposed development area. Although this map predates the programme of formal quay building and reclamation, the shoreline to the north and west of the site does appear to have been formalised through the construction of quay walls. It is likely that the structures at the northern half of the site relate to warehouses or stores for the nearby quays. The land to the immediate east of the proposed development area, bordering the walled Irishtown, has been cultivated and enclosed in small irregular fields. The church and graveyard (LI005-078001-2) is not annotated to the east of the site.

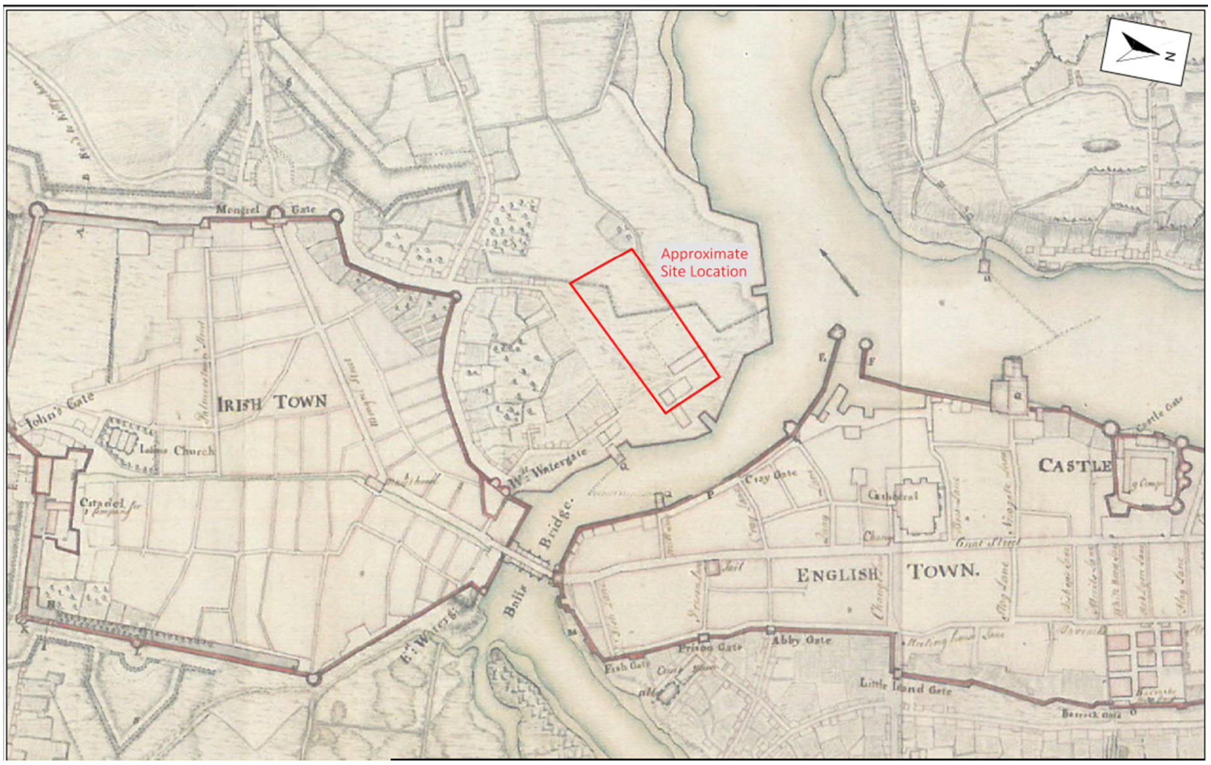

Figure 17.2: Extract from William Eyres' Map A Plan of Limerick, 1752

17.3.3.6 Christopher Colles' Map of the City and Suburbs County of Limerick, 1769

By the time of this map the proposed development area has been subject to further reclamation and development. The areas facing onto Bank Place and Rutland St. have been developed and a bridge 'new bridge' (now Matthew Bridge) has been constructed. A number of structures can be seen at the north and northeast of the site, while gardens are illustrated at the east and west. The Custom House (now the Hunt Museum), has been constructed west of the proposed development area. Irishtown is still annotated as such and New Town Pery has been laid out. Further development has occurred outside of the town walls. A mill and brewery are marked c. 280m northwest of the proposed development area, as well as another, Carrigour Mill across the River Shannon, south of the Thomond Gate.

17.3.3.7 First Edition Ordnance Survey Map, 1840-1, scale 1:10560 (Figure 17.3)

The first edition OS map shows the proposed development area to be a well-established urban streetscape. The site is occupied by a range of buildings fronting on to Patrick's Street, Ellen Street, Michael St and Bank Place, with outbuildings and other larger structures to the rear of these buildings, open yard areas and laneways are also located across the site extent. The western extent of the medieval walls for Irishtown are marked c. 85m and 130m to the east of proposed development area. These sections are extant today. A number of industrial buildings are shown in the surrounding townscape such as breweries and mills located c. 280m to the northwest (LI005-017074, 75). Mills are also shown c. 400m to the east, close to the Canal Brewery. A cotton factory is located adjacent to the Magdalene Laundry and industrial school shown c. 610m to the east. Evidence of Limerick as a centre of trade is well represented close to the proposed development area, with a potato market shown c. 75m to the northwest and the corn market, linen hall, hay market and butter market shown c. 60m to the southeast. The Milk Market, which remains a stalwart of Limerick trading, is shown in its current location c. 145m to the southeast of the proposed development area. A section of the original town wall of Englishtown (LI005-017010) is marked c. 570m to the north.

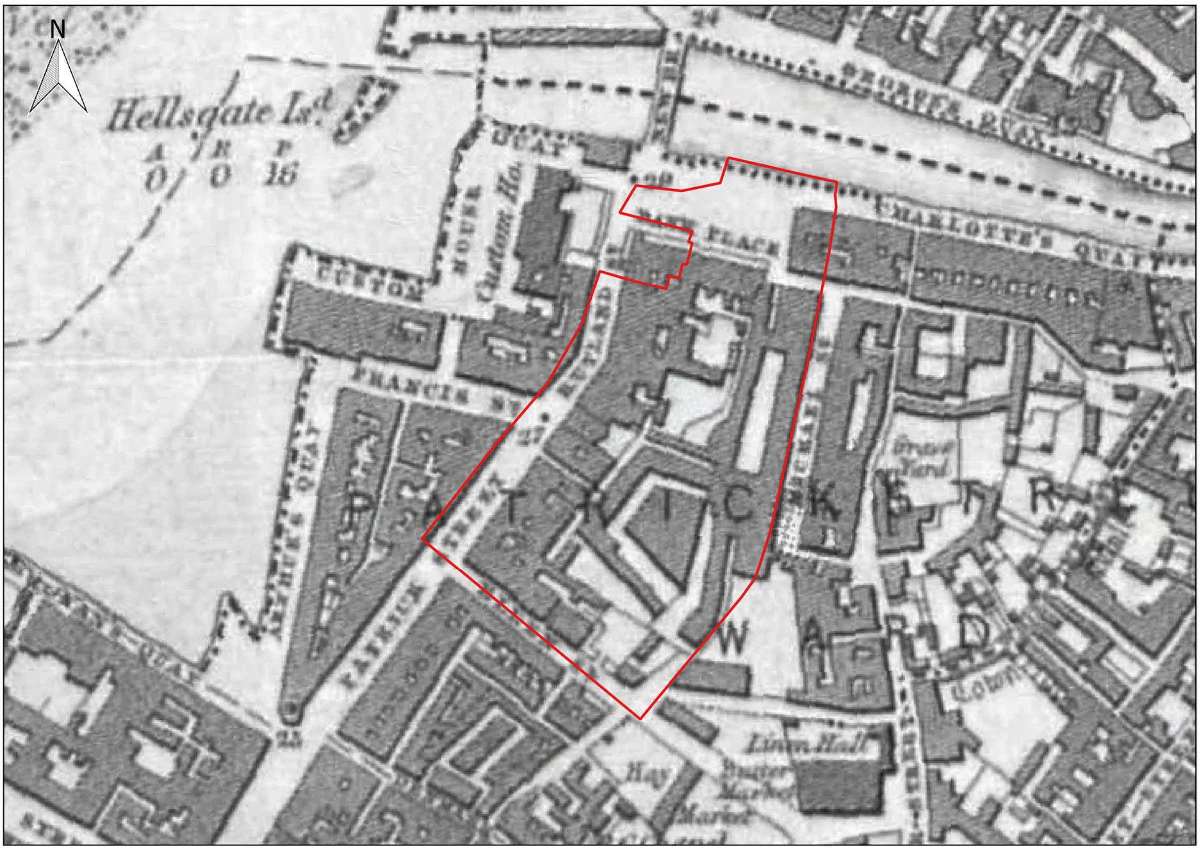

Figure 17.3: Extract from First Edition OS Map (1840-1), showing the proposed development area

17.3.3.8 William E. Corbett’s map of Limerick for Maurice Leninhan's Forster & Co. 1865

The proposed development area is depicted in less detail than the previous map, with structures shown as large blocks with little distinction between the individual buildings. The early street layout to the immediate southeast of the proposed development area is evident on this map also. West Water Gate is marked as present.

17.3.3.9 Ordnance Survey Map, 1900, scale 1:2500 (Figure 17.4)

The proposed development area contains the Town Hall fronting onto Patrick St. and Bonding Stores and Corn Stores to the east of the site. There are no significant changes to the development site from the earlier Ordnance Survey Map and Corbett’s map. The internal space in the block is filled by small sheds, warehouses, courtyards, a ball court and houses.

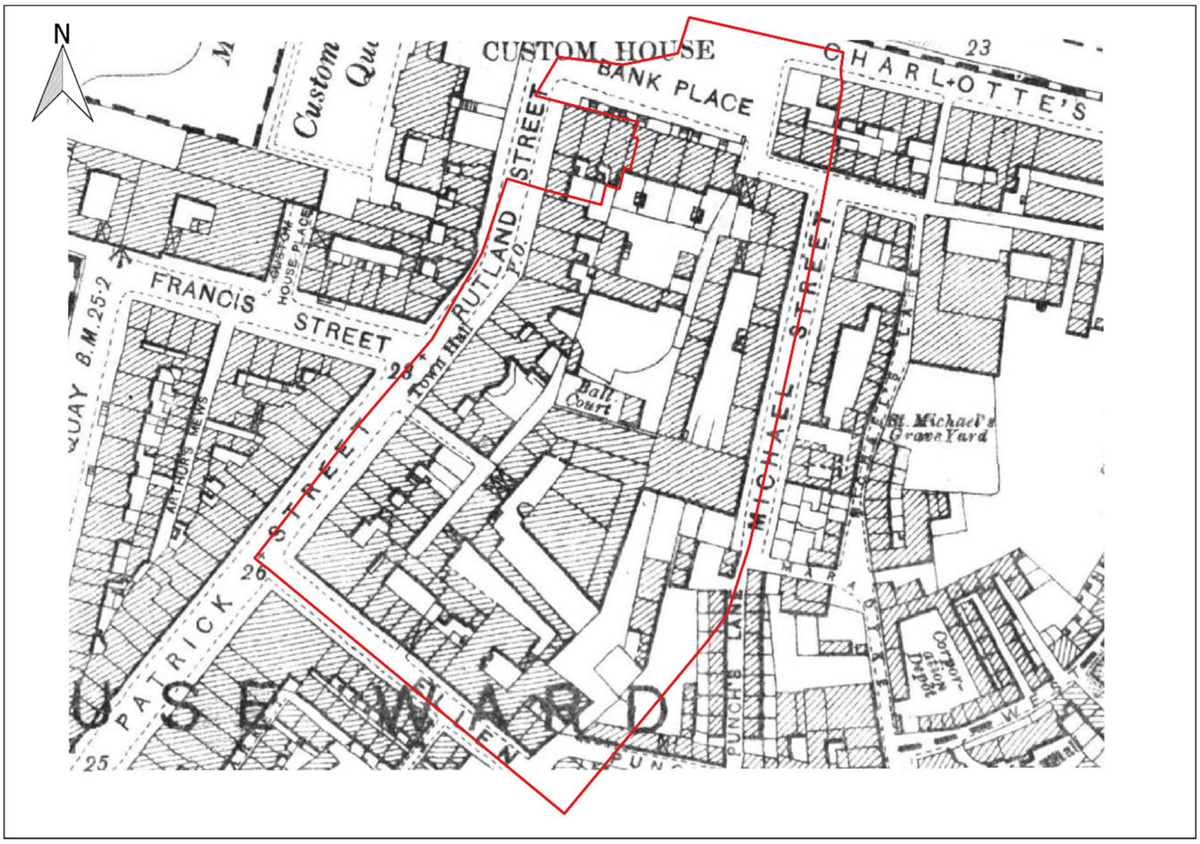

Figure 17.4: Extract from 25-inch OS Map (1900), showing the proposed development area

17.3.4 Aerial Photographic Analysis

Inspection of the aerial photographic coverage of the proposed development area held by the Ordnance Survey (1995, 2000 and 2005), Google Earth (2004–2018) and Bing Maps (2013) failed to reveal any features or areas of previously unknown archaeological significance due to the built-up nature of the area.

17.3.5 City Development Plan

The extended Limerick City Development Plan (2010–2016) recognises that the Zone of Archaeological Notification that surrounds the historic town (LI005-017) is subject to statutory protection under the National Monuments Act (1930–2014). The proposed development area is located within the Zone of Archaeological Potential for the historic town, however there are no sub-constraints recorded within the site boundary (Figure 17.1). The nearest monuments comprise the current location of a sheela-na-gig (LI005-017180) and a church and graveyard (LI005-078001-2) c. 30m east and 40m west respectively. In the wider vicinity there are four further sites located within 100m and c. 60 sites recorded within 250m radius.

There are three National Monuments listed within the wider vicinity of the proposed development area, including the town defences (LI005-017010) c. 85m to the east; Fanning's Castle (Nat. Mon. 383) c. 105m to the north and King John's Castle (Nat. Mon. 288) c. 355m to the northwest.

Table 17.1: Recorded Archaeological Sites (RMPs) within 100m of the proposed development area

RMP NO.	LOCATION	CLASSIFICATION	DISTANCE FROM DEVELOPMENT
LI005-017	Limerick	Zone of Notification for the Historic Town	0m
LI005-017180	Prior's-Land	Sheela-na-gig	30m west (present location)
LI005-078001–2	Prior's-Land	Church and Graveyard	40m east
LI005-017122	Prior's-Land	Quay	60m northeast
LI005-017098	Englishtown	Mill - unclassified	60m northeast
LI005-017151	Englishtown	Excavation - miscellaneous	80m northeast
LI005-017010	Limerick City	Town Defences	85m east
LI005-017069	Englishtown	Mill - unclassified	90m northeast

17.3.6 Place Name Analysis

Townland and topographic names are an invaluable source of information on topography, land ownership and land use within the landscape. They also provide information on history; archaeological monuments and folklore of an area. A place name may refer to a long-forgotten site and may indicate the possibility that the remains of certain sites may still survive below the ground surface. The Ordnance Survey surveyors wrote down townland names in the 1830's and 1840's, when the entire country was mapped for the first time. Some of the townland names in the study area are of Irish origin and through time have been anglicised. The main reference used for the place name analysis is *Irish Local Names Explained* by P.W Joyce (1870) and the Placenames Database of Ireland (www.logainm.ie). A description and possible explanation of each townland, parish, and barony name in the environs of the proposed development are provided in the below table.

Table17.2: List Of Townlands, Parishes, And Baronies In The Vicinity Of The Proposed Development Area

Name	Derivation	Possible Meaning
Limerick City	Cathair Luimnigh	Meaning unclear. P.W Joyce translated *Luimneach* as a bare or barren spot of land. *Luimnech* can be translated as cloaked, mantled, or shielded. Others have claimed the name relates to the mouth of the Shannon.
Clanwilliam	Clann Liam	The family of Liam, they were Burkes
St Michael's	-	Parish of St Michael's
St John's	-	Parish of St John's
St Nicholas	-	Parish of St Nicholas
St Lawrence's	-	Parish of St Lawrence's
Priorsland	Fearann an Phrióra	The land of the prior
Ballinacurra (Bowman)	Béal Átha na Cora (Bowman)	The fordmouth of the weir
Ballinacurra (Weston)	Béal Átha na Cora (Weston)	The fordmouth of the weir
Irishtown	An Baile Gaelach	The Irish town

Name	Derivation	Possible Meaning
Mountkennet	-	Kennet may be a surname i.e. Kennet’s Mount
Rathbane North	An Ráth Bhán Thuaidh	The white rath
Spital Land	-	Spital is derived from hospital i.e. hospital lands

17.3.7 Cultural Heritage Sites

The term ‘cultural heritage’ can be used as an over-arching term that can be applied to both archaeology and architectural features. However, it also refers to more ephemeral aspects of the environment, which are often recorded in folk law or tradition or possibly date to a more recent period. No additional cultural heritage features were identified during the course of this assessment.

17.3.8 Field Inspection

The field inspection sought to assess the site, its previous and current land use, the topography and any additional information relevant to the report. During the course of the field investigation, undertaken on Friday 26th May 2017, the proposed development area and its surrounding environs were inspected.

The block containing the proposed development area is bound to the west by Rutland Street (R526), to the north by Bank Place (R526), to the east by Michael Street and to the south by Ellen Street. It is situated to the southeast of the confluence of the Abbey River and the Shannon. The site comprises a block of urban structures (many of which are closed retail units), courtyards and a large former granary which is now in use as the city library.

A large open internal courtyard, completely bordered by modern warehouses and older structures, is accessed from Patrick St. to the west by a laneway (Plate 17.1). This laneway connects to a parallel internal lane forming the longitudinal portion of a T-junction layout. This parallel lane allows for access to the rear of the buildings facing onto Patrick St. and Rutland St. and is of a dilapidated limestone and redbrick construction containing large rounded entrances for carts which are also noted in the rear of the building (Plates 17.2–3). Much of the fabric of the Georgian structures remains to the rear but in poor condition. Later repairs in stone, redbrick and concrete and additional outhouse buildings are evident (Plate 17.4).

Plate 17.1 Laneway from internal courtyard, facing west to Patrick St.

Plate 17.2 Internal lane to rear of building, facing south to Patrick St.

Plate 17.3 Internal lane to rear of building, facing northeast to Rutland St.

Plate 17.4 Rear of buildings fronting onto Patrick St., facing west

The courtyard contains a rough uneven cement surface and is bounded to the south and west by internal stone wall divisions, to the southeast, east and north by modern warehouses and dilapidated structures (Plates 17.5–7). The southern portion of the site contains an internal lane like structure which is walled off from the internal courtyard to the north with a parallel laneway leading further south (Plate 17.5). A number of dilapidated structures with similar fabric to that of the surrounding Georgian buildings, ruined outhouses and an area of paving stones are located south of the southern wall of the courtyard (Plates 17.7–10). A number of these comprise of a dilapidated limestone and redbrick construction containing large rounded entrances for carriages and carts, indicative of the Georgian date and former industrial nature of the neighbourhood.

Plate 17.5 View south across internal courtyard, facing south

Plate 17.6 Internal courtyard, facing northwest

Plate 17.7 Structural remains in courtyard, facing southwest

Plate 17.8 Internal structures to south of courtyard, facing south

Plate 17.9 Internal structures south of courtyard rear of Ellen St.

Plate 17.10 Structural remains south of the courtyard to rear of Ellen St.

The south eastern portion of the site contains a car park off Michael St. (Plate 17.11). The Granary occupies much of the north eastern portion of the site (Plates 17.12–13). A number of structures of architectural merit are located along Patrick St (Plates 17.14).

Plate 17.11 Car park in southeast quadrant of site, facing west

Plate 17.12 The Granary on Michael St. (library), facing southwest

Plate 17.13 Northern limit of proposed development area, facing south

Plate 17.14 Mid-West Business Institute on Patrick St., facing southeast

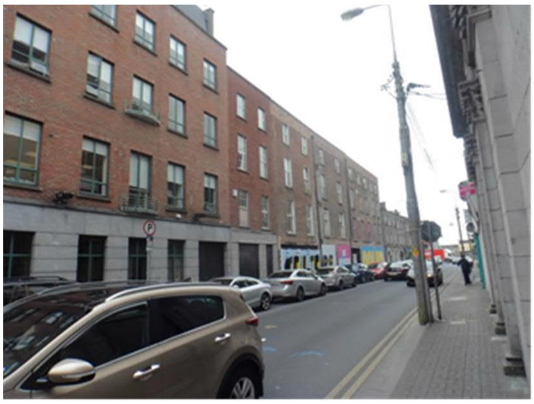

Plate 17.15 Southern boundary of development area on Ellen St., facing southeast

The partially extant line of the medieval town walls for Irishtown are situated c. 85–140m east of the proposed development area (National Monument, LI005-017010) in the Charlotte Quay car park.

17.3.9 Conclusions

The proposed development area is located within the Zone of Archaeological Notification for the historic town of Limerick, which is a recorded monument (LI005-017). There are no recorded archaeological sub-constraints located within the site. The closest consists of the current location of a sheela-na-gig (LI005-017180), c. 30m to the east and a church and graveyard (LI005-078001-2) c. 40m to the west. The line of the medieval town defences (LI005-017010) for Irishtown is located c. 85–140m to the east of the proposed development area.

Analysis of the historic cartographic resources has shown that the site was formerly located within an un-reclaimed estuarine environment to the south and west of the medieval settlement at Limerick. The river banks were gradually reclaimed and developed in the mid-late 18th century and significantly designed and reconstructed during the Georgian Period. By the 19th century the proposed development area was fully developed. Despite the development within the site, it still retains archaeological potential when considering its former estuarine nature and the proximity of the historic settlement of Limerick.

A review of the Excavations Bulletin (1970-2018) has shown that no previous archaeological investigations have been carried out within the proposed development area. A field inspection has been carried out as part of this assessment. This clearly illustrated the developed nature of the site, but no previously unrecorded features of archaeological potential were noted.

No specific cultural heritage assets were identified during the course of this assessment.

17.4 Predicted Impacts

Impacts can be identified from detailed information about a project, the nature of the area affected, and the range of archaeological resources potentially affected. Archaeological sites can be affected adversely in a number of ways: disturbance by excavation; disturbance by vehicles working in unsuitable conditions; and burial of sites, limiting access for future archaeological investigation.

17.4.1 Archaeology

- Design proposals include for the construction of a basement level across the site save for those areas where existing buildings are being retained. The formation level of the basements will be at 1.3m aOD, resulting in the removal of up to 2.4m of material across the site.
- The proposed development area was located within estuarine environment until the area was reclaimed and developed in the mid-late 18th century. It is currently largely built-up with several internal courtyards. Given the redevelopment of the site during the Georgian period it is possible that any potential archaeological remains may have been removed or disturbed at this time.
- It remains possible that groundworks associated with the proposed development may have a direct and negative impact on any surviving archaeological remains. This may include features associated with riverine activities such as fish traps, which have the potential to survive beneath the reclamation deposits. This may also include structures shown on the mid-18th century mapping, which predate the Georgian redevelopment. The significance of the impacts may range from moderate to profound negative, dependant on the value and sensitivity of any potential archaeological material that may survive beneath the current ground level.

17.4.2 Cultural Heritage

- With exception to the above, no specific potential impacts relating to Cultural Heritage have been identified.

17.5 Mitigation Measures

17.5.1 Archaeology

- A targeted programme of archaeological test trenching will be carried out following the demolition of structures proposed for removal and prior to any intrusive enabling works, including the insertion of the secant piled walled around the perimeter of the site. The programme of testing will allow for an assessment of the presence, location, extent, value and sensitivity of potential archaeological remains at the site. This work will be carried out by a qualified archaeologist, under licence from the National Monuments Service of the DoCHG.
- Archaeological mitigation, such as monitoring or excavation, may be required dependant on the results of this investigation. Full provision will be made available for the resolution of any archaeological remains, both on site and during the post excavation process, should this be deemed the appropriate manner in which to proceed.

17.6 Residual Impacts

Once the recommended mitigation measures have been applied, there will be no residual impact on the archaeological or cultural heritage resource as a result of the construction of the proposed development.

17.7 Difficulties Encountered in Compiling Information

No difficulties were encountered during the assessment.

17.8 Cumulative Impacts

A review of all relevant planning applications in the surrounding areas, has been carried out in relation to archaeology and cultural heritage impacts. The proposed development will have no impact on any known archaeological sites or deposits; however, it will be located within the Zone of Notification for the medieval city of Limerick. Of the planning applications reviewed, only two were subject to archaeological conditions.

Archaeological testing was required as a condition of planning consent for the construction of staff car park to the rear of St. John's Hospital, which is located within the Zone of Notification for the medieval city of Limerick. A review of satellite imagery indicates that this development has not been implemented and the grant of planning has since expired, therefore there will be no cumulative impact on the Zone of Notification for the medieval city of Limerick.

The development of a new public plaza, taxi rank and car set down area to the front of the Colbert Station building was subject to archaeological monitoring. This site is located outside of the Zone of Notification for the medieval city of Limerick, therefore there would be no cumulative impact on deposits within the medieval city.

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Christopher Colles' Map of the *City and Suburbs County of Limerick*, 1769

Ordnance Survey Maps, 1840 and 1900

Corbett's map of Limerick for Maurice Leninhan's Forster & Co., 1865

ELECTRONIC SOURCES

www.archaeology.ie – DoAHRRGA website listing all SMR sites

www.buildingsofireland.ie – National Inventory of Architectural Heritage website

www.excavations.ie – Summary of archaeological excavation from 1970–2016

www.googleearth.com – Satellite imagery of the proposed development area

www.bingmaps.com – Satellite imagery of the proposed development area

www.osiemaps.ie – Ordnance Survey aerial photographs dating to 1995, 2000 & 2005 and 6-inch/25-inch OS maps.

www.milkmarketlimerick.ie – The history of the Milk Market, Limerick

www.logainm.ie/en - Placenames Database of Ireland

www.irishwalledtownsnetwork.ie – Heritage Council Organisation comprising 28-member towns

18 Architectural Heritage

18.1 Introduction

This chapter of the EIAR provides information on the existing buildings of architectural, historical, social or other interest within the proposed development location at the site known as Opera Site in Limerick. JCA Architects have prepared this chapter which provides an evaluation of the quality and importance of the existing structures currently located on this site. In addition, the following information also contains a comprehensive assessment of the implications of the development for the special character of significant historic structures within the vicinity of the development. This assessment highlights how the elements of this character (those which contribute to the special architectural, historical, archaeological, artistic, cultural, scientific, social and/or technical interest) may be materially altered by the development.

JCA Architects were appointed at the initial stage of this project to redevelop the Opera Site and have carried out a full conservation assessment of all the structures on the site, which has been used to inform the approach to the reuse of the site and the multiple historic structures which are located there.

18.2 Methodology

The existing buildings on the site were originally inspected and recorded in detail by JCA Architects in 2007. The site has subsequently been visited on several occasions in 2016, 2017 and 2018, when the condition of the buildings was reviewed, the site and structures re-photographed, and any changes or loss of fabric to the structures included in addendums to the original reports. The site, surrounding area, adjacent streets and protected structures and the internal area of the site were also visited on several occasions during 2016 - 2018.

Once information resulting from the historical analysis and physical inspection of the buildings and site were compiled, the character of the historic buildings and potential risks to their character were determined. This information was summarised and compiled in to the Conservation Report, included in this document as Appendix 18.A. This understanding of the site informed an appreciation of the significance of the existing buildings on the Opera Site and allowed for the formulation of mitigation measures which would help to protect the special character of these buildings and their setting following the redevelopment.

A historical context for the development of the site, an analysis of the significance of each of the existing buildings on the site, and methodologies for conservation works to the structures to be retained as part of the redevelopment are all included in the Conservation Report, included in this document as Appendix 18.A. A desktop study of the available sources relating to the history of the area was undertaken, and in particular the history of the development of the buildings which line the streets which form the boundary of the site. In addition to the more widely available published sources on the site, Ordnance Survey and other historic maps were examined.

The significance of the individual buildings on the site was assessed according to the Architectural Heritage Protection Guidelines for Planning Authorities (DOE 2004) which provides guidance on Part IV of the Planning and Development Act 2000. Following inspections of all buildings it was evident that the significance of the surviving buildings is increased where substantial interior fabric is retained, such as an original staircase, early timber joinery, plasterwork to ceilings, historic shop fittings, etc. Therefore, while two terraced houses may have been constructed as a pair, the overall significance of each house may differ where one building has retained more of its original interior fittings and fixtures than the other. The individual levels of significance are not necessarily reflected by the building's inclusion on the National Inventory of Architectural Heritage's survey (which only aims to include a representative selection of buildings and is not based on access to the interiors).

For this reason, JCA designated four categories (A, B, C and D) for the existing buildings on the Opera Site to illustrate their individual level of architectural, historical and cultural significance, based on inspections of each structure. The categories are as follows:

Category A	a) Full conservation scope of works merited. These buildings have retained plan forms intact and substantial internal fabric. Of architectural and/or social and historical significance. b) A Protected Structure (regardless of the extent of historic fabric retained).
Category B	Full conservation scope of works merited for building envelope, including the roof (where the historic roof is retained), in order to conserve their streetscape value and original external character. The plan form to these buildings is intact and some internal features survive. Greater flexibility to internal works is acceptable to these buildings (in comparison to Category A), while respecting the plan form. This would extend to the use of modern materials, contemporary joinery and finishes as appropriate.
Category C	Full conservation scope of works merited for street elevations only in order to protect the Georgian streetscapes in which they are located. The original plan form and spatial qualities of the buildings in this category have been lost. They have substantial or total loss of internal fabric. Greater flexibility to treatment of internal spaces, including alteration to plan form, acceptable for these buildings.
Category D	Not of architectural, social or historical significance. Demolition acceptable from an architectural conservation perspective.

The impact assessment (18.4.1) will highlight how the elements of the historic structures' special character (those which contribute to their special architectural, historical, archaeological, artistic, cultural, scientific, social and/or technical significance) would be materially altered by the development. These impacts will be assessed in terms of the physical impact of the proposed works on the building (for example demolition, partial demolition or removal of interior elements, replacement of historic fabric, alteration to original floor plans etc.) and in terms of the visual impact on the existing building, both in terms of the visual impacts of proposed alterations and of new structures to be constructed on the site. Visual impacts to be assessed will include short and long range views and will be based on the information provided by the photomontages prepared for the application.

18.2.1 Legislative context

Two of the buildings on the site are included on Limerick City's Development Plan 2010-2016 Record of Protected Structures (RPS) (in addition to one doorway which is also on the RPS), while eight structures (which include the three Protected Structures) are included on the National Inventory of Architectural Heritage (NIAH). The Protected Structures on the proposed development site are the following:

- The Granary (RPS No. 272);
- The former Town Hall (RPS No. 014); and,
- Georgian doorway reused in No. 6 Rutland Street (RPS No. 317).

Under current legislation (Part IV of the Planning and Development Act 2000) all extant structures (and parts of the structure), the interior of the structures, any structures lying within the curtilage of the structures and their interiors, and all fixtures and features which form part of the interior or exterior of the structures included within the site boundaries of the Protected Structures on the Opera Site are afforded protection.

The buildings included on the NIAH are the following:

- 5 Rutland Street (NIAH Reg. No. 21513009);
- 6 Rutland Street Doorway (NIAH Reg. No. 21513008);
- 9 Rutland Street (NIAH Reg. No. 21513007);
- Town Hall (NIAH Reg. No. 21513006);
- 4 Patrick Street (NIAH Reg. No. 21513005);
- 5 Patrick Street (NIAH Reg. No. 21513069);
- 9 and 9a Ellen Street Reg. (NIAH No. 21513018); and,
- Granary (NIAH Reg. No. 21513017).

The current Development Plan recognises that the structures recorded on the NIAH come with a ministerial recommendation for inclusion on the RPS. They are identified as Candidate Protected Structures.

Prior to 2010 the site was located within an Architectural Conservation Area (ACA) but does not at present fall within an ACA.

18.3 Baseline Conditions

The proposed development site comprises a large block of land situated with its northern boundary on Bank Place, opposite the Abbey River, and with its southern side to Ellen Street. Michael Street, Rutland Street and Patrick Street form boundaries on both sides (east and west).

The proposed Opera Site development site is located in Limerick city centre, just south of the point at which the Abbey River enters the Shannon River. To the west of the site Rutland Street and Patrick Street form the main thoroughfare to the city centre and the central shopping area of the city. The Hunt Museum (former Custom House) is located across Rutland Street to the west. To the northwest is located the Court House and St. Mary's Cathedral, with St. Michael's RC Church situated to the southeast of site.

While a relatively large number of historic buildings have been retained to the Opera Site, surrounding areas have undergone a significant level of redevelopment, particularly to the west where extensive demolition of Georgian building stock was carried out in the latter half of the 20th century to make way for the construction of first the offices of the Revenue Commissioners and then the Arthurs Quay shopping centre. To the east of Michael Street are several large apartment and social housing developments. The existing buildings on the site have maintained their historic relationship with their immediate surroundings to a higher degree on Ellen Street and Bank Place (although Bank Place was significantly altered by 20th century demolition of terraced housing).

The retention of significant numbers of Georgian terraced red brick houses on Rutland Street, Patrick Street and Ellen Street has preserved much of the historic streetscape of this area, helping to maintain in particular the immediate setting of the Hunt Museum (former Custom House).

The site is located on and between several streets which were first developed in the latter half of the 18th century. As a result, terraced Georgian buildings are currently found to Ellen Street, Patrick Street and Rutland Street. In addition to the terraced houses there is a late-18th century stone granary building on Michael Street and the early-19th century former Town Hall on Rutland Street.

The majority of the existing buildings have basement areas, including coal cellars, which extend beyond the line of the front elevation of the main building. The buildings to Rutland Street and Patrick Street have additions and alterations to the rear which vary in terms of their forms and dates of construction. A rear lane services all these buildings. The rears of most of the terraced houses on Ellen Street are accessed by way of a carriage arch within the façade of No. 7 Ellen Street.

There are several modern buildings within the boundaries of the proposed development site, constructed in the 1980s and early 1990s to replace demolished terraced houses, and a large office and storage building (Cahill May Roberts, mid-20th century) to Bank Place. To the centre of the site, remains of several large stone warehouses and high stone walls have been incorporated into modern storage buildings. None of the 20th century buildings are considered to be of architectural significance. The condition of the existing buildings on the site varies, as does the extent of surviving historic fabric to the interiors of these structures.

A more thorough architectural and historical context is provided in the Conservation Report, included in this document as Appendix 18.A. Individual records prepared by JCA for each existing structure on the proposed development site are also included as part of the planning application.

18.3.1 Existing Structures on the Site

The following table provides a summary of each existing building currently found within the boundaries of the proposed development site. Baseline conditions for each structure are noted. For detailed information on the receiving environment and its historical context, please see JCA's Conservation Report, included in this document as Appendix 18.A.

Table 18.1: Existing Building Summary Description

Address	Building Description	RPS	NIAH Candidate Protected Structure	Condition Issues/LCC Remedial Works/ Survey Notes/Updates
4 Rutland St	The buildings on Rutland Street are some of the earliest surviving Georgian terraces in Limerick city, having been built following the construction of the Mathew Bridge in 1761-62. 4 Rutland Street is a three-bay four-storey over basement red brick building built as a townhouse. Moulded stone limestone sills retained to the brick front elevation. Largely rebuilt, including roof and rear elevation. New wall mid-plan. Front rooms (to Rutland St) retained, rear area including staircase rebuilt. Ground floor all new finishes.	N/A	N/A	LCC remedial works not carried out to this building. Some staining to plasterboard indicating water ingress, particularly to top floor and stairwell.
5 Rutland St	The buildings on Rutland Street are some of the earliest surviving Georgian terraces in Limerick city, having been built following the construction of the Mathew Bridge in 1761-62. 5 Rutland Street is a three-bay four-storey over basement red brick building	N/A	Reg. No. 21513009 Candidate Protected Structure	LCC remedial works not carried out to this building. Recent and progressive water ingress visible to the party wall with No. 4. The basement and shop have been cleared out. Opening up of some of the plasterboard linings has revealed some additional

Address	Building Description	RPS	NIAH Candidate Protected Structure	Condition Issues/LCC Remedial Works/ Survey Notes/Updates
	built as a townhouse, which retains its original limestone doorcase incorporated within a partially surviving nineteenth-century shopfront. Significant internal joinery surviving, including the original mid-18th century staircase.			features, such as dado rails in place to upper floor rooms. Elements of early roof structure are also *in situ*. The top flight of the staircase has been badly damaged by the insertion of a crude fire lobby. The balustrade to this area was removed causing damage to the balusters. The balustrade is retained to the building and all elements not in situ should be placed in to safe keeping for later restoration.
6 & 7 Rutland St	The building comprises a five- storey over basement building on the site of two earlier residential plots. It is situated at a point along Rutland Street where the street kinks which results in a non-co-linear façade line. It comprises in-situ reinforced concrete (RC) structure with external RC columns and 4no. internal columns supporting flat RC slabs. C.1980 construction. Historic door case set in front elevation, in the Palladian style with a double fluted limestone Doric pilaster and window either side of the main doorway.	Doorway RPS 317	Reg. No. 21513008 (Doorway)	LCC remedial works not carried out to this building.
8 Rutland St	Late-18th/e. 19th C, No. 8 Rutland Street retains many interior features, particularly the staircase and joinery items. Terraced two-bay four-storey over basement building having exposed Flemish bond brick front and rear elevations. A pair with No. 9. 20th century two-storey concrete block flat roofed outbuilding to rear, having concrete floors and a corrugated roof. This building forms part of No. 9 Rutland Street	N/A	N/A	LCC remedial works carried out. Work has heavily damaged lath and plaster and cornices to ceilings which were intact when building was first surveyed in 2007 but has stabilised the building and allows access. The roof is leaking, and some areas of floors are water damaged at the upper level. Joinery items such as staircase, window and door architraves are still in situ. Some water ingress has caused the deterioration of the condition in recent years, but not to the extent of No. 9 Rutland St, which is one of a pair with this building. Basement intact and in original form. Props to brick arch to

Address	Building Description	RPS	NIAH Candidate Protected Structure	Condition Issues/LCC Remedial Works/ Survey Notes/Updates
				underside of pavement above.
9 Rutland St	Late-18th/e. 19th C, No. 9 Rutland Street has been very heavily altered to the basement and ground floors. Terraced two-bay four-storey over basement building having exposed Flemish bond brick front and rear elevations. A pair with No. 8.	N/A	Reg. No. 21513007 Candidate Protected Structure	LCC remedial works carried out. Work has damaged lath and plaster and cornices to ceilings but has stabilised the building and allows access. Wide brick arch to rear return, first floor, has been propped. The building has deteriorated since initially recorded in 2007. There has been a high level of water ingress to the party wall with No. 8 which has severely affected floor timbers. Dry rot fruiting bodies in this area, including to LCC remedial works support. Fireplace to the front room, first floor, has been removed. Elements of the balustrade have been lost to upper floors. Wall and ceiling linings (modern and historic) have been removed to most areas. Internal walls are brick nogged.
Town Hall	Built in 1805, this building was financed by a powerful and prominent group of merchants. The Town Hall, or Commercial Buildings, were built to provide themselves with more commodious premises that were also beyond the reach of the Corporation. Incorporated as a Chamber of Commerce in 1815, until 1833. The adjacent building to the south, a two-bay four-storey building located on the corner of Rutland Street and Glover's Lane, has been heavily altered.	RPS 014	Reg. No. 21513006	LCC structural remedial works not carried out to this building. Some works to roof undertaken. The condition of the building has deteriorated since it was surveyed in 2007 (when it was still in use) due to water ingress, but no internal fabric of significance has been removed. Dry rot is visible to the top floor. Main roof timbers appear sound. Brickwork to the rear elevation is in poor condition and has been further damaged over the past 10 years by the cementitious pointing. Will require extensive repairs. Interior of bomb shelter has been cleared out following a flood to the interior since originally recorded by JCA.
1 Patrick St	Likely 18th century. No. 1 Patrick Street is a terraced two-bay four-storey over	N/A	N/A	LCC remedial works have been carried out, including insertion of steel frames to support walls

Address	Building Description	RPS	NIAH Candidate Protected Structure	Condition Issues/LCC Remedial Works/ Survey Notes/Updates
	basement house having a shopfront and retail unit inserted to the ground floor, probably in the late-19th century. The main entrance is located off Glovers Lane, and comprises a round headed cut stone lugged architrave incorporating a fanlight.			and to prop floors and the removal of cementitious render to the parapet and its repair. Floors are in very poor condition. Internal linings have been removed to the ground floor, including the lath and plaster ceiling, exposing the wall fabric and floor joists. Part of the external wall to the laneway is constructed of stone. Sections of run plaster cornice and later moulded timber cornice have been exposed.
2 Patrick St	Likely e. 19th C. No. 2 Patrick Street is a terraced two-bay four-storey over basement house having a shopfront and retail unit inserted to the ground floor, probably in the later 19th century. There is a pitched M-profile roof having imitation slate and shared with No.3 Patrick Street. Two-storey flat roofed extension to rear. This building, along with No. 3 Patrick Street, has been stripped out and all finishes internally are modern, including the staircase and partition walls.	N/A	N/A	LCC remedial works have been carried out, including propping of floors. Condition has deteriorated in recent years. All modern internal finishes. Ground and first floors are of concrete with new timber floors over.
3 Patrick St	No. 3 Patrick Street is a terraced two-bay four-storey over basement house having a shopfront and retail unit inserted to the ground floor, probably in the later 19th century. There is a pitched M-profile roof having imitation slate and shared with No.2 Patrick Street. Limestone cills to windows of front elevation. Two-storey brick structure having lean-to corrugated roof adjoining to rear. This building, along with No. 2 Patrick Street, has been stripped out and all finishes internally are modern, including the staircase and partition walls.	N/A	N/A	LCC remedial works have been carried out, including propping of floors. Condition has deteriorated since in recent years. Remedial works have exposed structural fabric. Some original lath and plaster ceilings and timber floors retained to this building (ground and first and hall), with new floors laid over (which has altered floor levels).
4 Patrick St	Late 18th/e.19th C. No. 4 Patrick	N/A	Reg. No.	No structural LCC remedial

Address	Building Description	RPS	NIAH Candidate Protected Structure	Condition Issues/LCC Remedial Works/ Survey Notes/Updates
	Street is a terraced two-bay four-storey over basement house having a shopfront and retail unit inserted to the ground floor, probably in the 19th century. The front elevation is of exposed Flemish bond brick with the rear elevation of rubble stone construction having brick to the window openings. Stone cornice running across Nos. 4 and 5 Patrick Street. Exterior mews building retained. Built as a pair with No. 5. Shop front, shop fittings and interior fabric of significance.		21513005 Candidate Protected Structure	works carried out to the building. Metal roof constructed to the mews building (this was previously a slate roof). All fabric has been retained to the main building, but the condition has deteriorated progressively over recent years. Evidence of water ingress to corner of front room, against party wall with No. 3. Damage to this corner on all floors. Severe subsidence of floors. Shop fittings and shop display window are also retained. Floor has been lost to the mews building.
4 Patrick St	Late 18th/e.19th C. No. 4 Patrick Street is a terraced two-bay four-storey over basement house having a shopfront and retail unit inserted to the ground floor, probably in the 19th century. The front elevation is of exposed Flemish bond brick with the rear elevation of rubble stone construction having brick to the window openings. Stone cornice running across Nos. 4 and 5 Patrick Street. Exterior mews building retained. Built as a pair with No. 5. Shop front, shop fittings and interior fabric of significance.	N/A	Reg. No. 21513005 Candidate Protected Structure	No structural LCC remedial works carried out to the building. Metal roof constructed to the mews building (this was previously a slate roof). All fabric has been retained to the main building, but the condition has deteriorated progressively over recent years. Evidence of water ingress to corner of front room, against party wall with No. 3. Damage to this corner on all floors. Severe subsidence of floors. Shop fittings and shop display window are also retained. Floor has been lost to the mews building.
5 Patrick St	Late 18th/e.19th C. No. 5 Patrick Street is a terraced two-bay four-storey over basement building having an exposed Flemish bond brick front elevation and a mixed rubble limestone and brick (to surrounds) rear elevation. Stone cornice running across Nos. 4 and 5 Patrick Street. Pitched roof having imitation slate and brick (rebuilt) chimneystack. Limestone sills to windows of front and rear elevation. 20th century two-storey concrete block flat roofed extension to rear, having concrete stairs and floors. Major alterations have been	N/A	Reg. No. 21513069 Candidate Protected Structure	LCC remedial works have been carried out, including propping of floors, but not to all areas. Condition has deteriorated considerably in recent years. Sheeted timber ceiling to the shop floor visible above suspended ceiling. Double leaf panelled doors between main rooms of first floor area retained with architrave with some loss of features. Remainder of building has a high level of modern finishes. Staircase is modern.

Address	Building Description	RPS	NIAH Candidate Protected Structure	Condition Issues/LCC Remedial Works/ Survey Notes/Updates
	carried out to the interior of No. 5, including the removal of the staircase and the subdivision of the rooms to the upper floor. However, some original elements remain intact.			
6 Patrick St	Late 18th/e. 19th C. No. 6 Patrick Street is a terraced two-bay four-storey over basement house having a shopfront and retail unit inserted to the ground floor. The front elevation is of exposed Flemish bond brick with the rear elevation of rubble stone construction. There is a modern single storey flat roofed extension to the rear. The interior of No. 6 lost many of its original fixtures and fittings when it was converted to flats.	N/A	N/A	LCC remedial works carried out. Work has extensively damaged the lath and plaster and cornices to ceilings but has stabilised the building and allows access. Modern internal partitions cut down in height. Staircase is retained but is in poor condition. Condition deteriorates further on upper floors. High level of deterioration of fabric in recent years.
7/8 Patrick St	This building was constructed c.1990, and formally opened in June of 1991 as an AIB bank. It was built following the demolition of a large stucco fronted building on this corner site. This former building appears to have been a 19th century remodelling of existing Georgian terraced houses.	N/A	N/A	LCC remedial works not carried out to this building. Refurbished and currently in use by Limerick 2030.
3 Ellen St	3 Ellen Street is a two-bay four story terraced building which has copied the Georgian proportions of the neighbouring buildings to the front facade. The building is narrow and deep, and projects to the rear much further than the adjoining Georgian buildings. Late 20th century construction.	N/A	N/A	LCC remedial works not carried out to this building. Not inspected by JCA Feb. 2017
4 Ellen St	E. 19th C, No. 4 Ellen Street is a terraced two-bay four-storey over basement house having a modern shopfront inserted to the ground floor. The front elevation is of exposed Flemish bond brick with the rear elevation of rubble stone construction having brick to the window openings.	N/A	N/A	LCC remedial works carried out. Floors reinforced. Parapet rebuilt.

Address	Building Description	RPS	NIAH Candidate Protected Structure	Condition Issues/LCC Remedial Works/ Survey Notes/Updates
5 Ellen St	E. 19th C, No. 5 Ellen Street is a terraced single bay four-storey over basement house having a small modern shopfront inserted to the ground floor. The front elevation is of exposed Flemish bond brick with the rear elevation of rubble stone construction having brick to the window openings.	N/A	N/A	LCC remedial works carried out. Floors reinforced allowing access throughout. Parapet rebuilt. Original roof lost – metal profile roof.
6 Ellen St	E. 19th C., No. 6 Ellen Street is a terraced single bay four-storey over basement house having a small modern shopfront inserted to the ground floor. The front elevation is of exposed Flemish bond brick with the rear elevation of rubble stone construction having brick to the window openings.	N/A	N/A	LCC remedial works carried out. Floors reinforced allowing access throughout. Parapet rebuilt. Original roof lost – metal profile roof.
7 Ellen St	No. 7 Ellen Street is a terraced three-bay four-storey over basement house having a modern No. 7 Ellen Street is a terraced three-bay four-storey over basement house having a modern shopfront to the ground floor. The front elevation is of exposed Flemish bond brick with the rear elevation of rubble stone construction having brick to the window openings and carriage arch. Shopfront to the ground floor.	N/A	N/A	LCC remedial works carried out. Floors reinforced allowing access throughout. Parapet rebuilt. Original roof lost (with the exception of two principal trusses)– metal profile roof. Deterioration halted by these works. Remedial works removed the arch to the carriage arch off the street, steel beam inserted.
8 Ellen St	No. 8 Ellen Street is a terraced two-bay four-storey over basement house having a shopfront inserted to the ground floor, probably in the later 19th century. The front elevation is of exposed Flemish bond brick with the rear elevation of rubble stone construction having brick to the window openings. Rear as to Ellen St. 5-7	N/A	N/A	LCC remedial works carried out. Floors reinforced allowing access throughout. Parapet rebuilt. Original roof lost - metal profile roof. Deterioration halted by these works.
9 and 9a Ellen St	The building found at 9 and 9a Ellen Street originally comprised the complex of buildings which formed John Quinn and Co.'s Wholesale Grocers and Wine Stores which was established in the	N/A	Reg. No. 21513018 Candidate Protected Structure	No LCC remedial works carried out. Structural condition of the building generally good. Small area of water ingress visible at upper level, party wall with No. 8. Upper floors retain post and truss structure and original

Address	Building Description	RPS	NIAH Candidate Protected Structure	Condition Issues/LCC Remedial Works/ Survey Notes/Updates
	late 19th century. Upper floors of thick timber boards supported on cast iron columns. Stone flags and brick wine vaults to basement.			floor boards. Cellar also intact.
Granary	The granary building is one of the earliest known multiple storey warehouses to be built in Limerick. The ground on which the building was constructed was bought by Philip Roche in 1787. The interior of the granary was almost completely gutted during the 1980s conversion, with all floors, supporting piers or columns, stairs etc. removed. The only internal element to be retained was the brick vaulting to the basement/lower ground floor.	RPS 272 Gate piers and iron gates within curtilage.	Reg. No. 21513017 Limestone gate piers and decorative gates to south of the granary buildings included on NIAH listing.	LCC remedial works not carried out to this building.
Interior of Site	Variety of buildings not considered of architectural significance, including Workspace which was constructed in the 2nd half of the 20th century built against an earlier stone wall to the Eastern side, and Bogue's Yard which comprise a collection of single and a two storey lean-to and double pitched roof structures.	N/A	N/A	LCC remedial works not carried out to buildings in this area.
Stone remnants of large buildings and laneway to interior of site.	Lane way and access to mew buildings, via Glover's Lane. Runs along the rear (east) of the Georgian buildings along Rutland St and Patrick St. Remnants of extensive, high limestone walls, some of which were accessed by way of carriage arches off the laneway. These buildings comprised bonded warehouses. One elevation of these buildings formed the back wall of the shared yard to the rear of Ellen St, accessed by way of the carriage arch off this street.	N/A	N/A	LCC remedial works not carried out to this area. A small amount of additional fabric has been lost to this area in recent years.
Cahill May Roberts, Bank Place	This building comprises a three-storey office block to the front of a large single storey open plan warehouse building. The office building is	N/A	N/A	LCC remedial works not carried out to this building.

Address	Building Description	RPS	NIAH Candidate Protected Structure	Condition Issues/LCC Remedial Works/ Survey Notes/Updates
	a concrete frame structure having a glazing system that incorporates spandrel panels between the floors. The warehouse structure is of reinforced concrete piers with concrete block infill, supporting a steel truss roof and corrugated fibre cement roof cladding. Mid-20th century construction.			

18.3.2 Significance of the Opera Site

Three of the structures on the proposed development site are included on Limerick City's Development Plan 2010-2016 Record of Protected Structures, while eight structures are included on the National Inventory of Architectural Heritage which the current Development Plan recognises come with a ministerial recommendation for inclusion on the RPS. It should be noted that one of the structures on the RPS comprises an 18th century doorway reconstructed in a late-20th century building.

Prior to 2010 the site was located within an Architectural Conservation Area but does not at present fall within an ACA. It is located within the Zone of Archaeological Potential forming the medieval core of the city, but there are no recorded monuments within the site area.

The significance of the surviving buildings is increased where substantial interior fabric is retained, such as the original staircase, early timber joinery, plasterwork to ceilings, historic shop fittings, etc. Therefore, while two terraced houses may have been constructed as a pair, the overall significance of each house may differ where one building has retained more of its original interior fittings and fixtures than the other. The individual levels of significance are not necessarily reflected by the building's inclusion on the National Inventory of Architectural Heritage's survey which only aims to include a representative selection of buildings and is not based on access to the interiors.

Details on the significance of each building retained to the site, and the extent to which historic fabric survives to that building, is included in the Conservation Report, included in this document as Appendix 18.A.

18.4 Predicted Impacts

The proposed development allows for the retention of the majority of the existing buildings on the Opera Site. The buildings proposed for demolition largely comprise 20th century structures and/or additions made to the rear of the existing Georgian buildings which front on to the streets. The predicted impacts, both physical and visual, are detailed below and are based on assessments of each individual building and outline the likely physical and visual impacts on each structure.

The buildings are grouped to reflect the proposed development 'parcels', and mitigation measures based on a long period of consultation between the design architects (both AECOM Architects and Coady Architects) and the conservation consultants (JCA Architects).

18.4.1 Impact of the Proposed Development on the Existing Buildings on the Site

Proposed Works to 4 and 5 Rutland Street – Parcel 3B

It is proposed to retain both of these structures, and to combine them in order to allow shared use of the existing original staircase located in No. 5 to access 1 no. apartment to each of the upper floor levels. No. 4 has undergone significant modern interventions, particularly to the rear of the building, resulting in the replacement of the original staircase and rear elevation. It is proposed to provide new staircases externally to the rear elevations in order to allow access between the ground floor and basements.

Physical Impacts:	The existing return to the rear of No. 4 will be demolished. This is a modern structure and not of architectural significance. A new opening will be formed in the party walls between Nos. 4 and 5 on each floor in the area of the stair landing, resulting in a localised area of fabric loss including wall masonry and joinery to No. 5. Partition walls to be removed from No. 4. some alteration to plan form to allow access through to No. 5. The internal fabric to this area of No. 4 comprises 20th century replacement fabric. The central bay of windows to the rear elevation, those which light the rear room, will be altered to provide doorways to the proposed balconies resulting in some loss of wall fabric. These windows do not retain original or historic joinery in terms of architraves or surrounds.
Visual Impacts:	The proposed works will not alter the front facades of either building with the exception of the provision of a new shopfront to No. 4. The existing rear elevation of No. 5 will be retained, including the brick return. The provision of new staircases to each building and balconies to No. 5 will have a visual impact on the rear elevations. These elevations will not be visible from the majority of locations and the glass balconies will mitigate the visual impacts.

Proposed Works to 8 and 9 Rutland Street, Town Hall (Protected Structure) – Parcel 3A/4

It is proposed to retain and refurbish these three existing buildings (two terraced houses and the former town hall) to provide part of the accommodation required for a new library facility. No. 8 Rutland Street retains significant historic internal fabric while No. 9 is in very poor structural condition. These buildings will be linked to the Town Hall at ground and third floor levels where existing floor levels correspond. Original room sizes will be restored to the town hall, and the central open well staircase retained.

The building adjoining the town hall to the south is a two-bay terraced structure which has undergone several phases of reconstruction, including the replacement of the front elevation. This building, and the rear additions and outbuildings adjoining the back of the town hall, are proposed for demolition.

Physical Impacts:

The two-bay building adjoining the town hall to the south will be demolished, as will additions and former cellars/mews buildings to the rear of the town hall.

A large new opening is proposed to the south gable end of the Town Hall which will become exposed following the demolition of the adjoining building as outlined above. This intervention will involve localised removal of masonry.

Modern interventions including partition walls, mezzanine floors, later additions to the rear of the town hall and No. 4 Rutland St. will be demolished.

While the staircases will be held to Nos. 8 and 9 Rutland Street, there will be high level of impact internally where it is proposed to remove the internal partition walls and to interconnect the two buildings. On some levels a new connection will also be made between the town hall and these two terraced buildings, where existing floor levels allow.

Visual Impacts:

Later additions and the remnants of the single storey former vaulted mews buildings will be removed from the rear of the town hall and the rear elevation of the main building restored. The atrium proposed to the rear will be highly glazed and will allow for views of the rear elevation of the town hall, and the adjoining terraced buildings of Rutland St. 8 & 9, from the proposed new public plaza to the interior of the site. Access from the plaza will be by way of linking bridges over a void to the rear of the town hall building, which will allow for largely uninterrupted views of the full height of the rear elevation of the historic building.

Front elevations of all three buildings will be retained and restored, resulting in a positive visual impact on the streetscape.

Proposed Works to 9 Ellen Street – Parcel 2B

The proposed commercial building to Michael Street/eastern end of Ellen Street, will result in the demolition of several small outbuildings associated with 9 Ellen Street. It is proposed to retain and restore the main L-shaped building and to provide bar and restaurant facilities within the building and a winter garden to the existing courtyard.

Physical Impacts:

Two small limestone buildings and one single storey brick building having slate roofs associated with this building are proposed for demolition. The existing fabric including timber floors, post and truss structure, joinery items and slate roof will be retained to the main structure.

It is proposed to re-open a large arched opening to the centre of the front (Ellen Street) elevation and to glaze the opening to allow views to the interior. This will involve the loss of some existing masonry to the front elevation which appears to be later infill and not original to the façade.

Visual Impacts:

The restoration of the building facades will have a positive visual impact on the streetscape of Ellen Street. Removal of the current covering of the courtyard and replacement with a more sympathetic solution (if required) will have a positive visual impact on the main facades which are orientated to the courtyard.

A new secondary stair is proposed to the northern side of the courtyard. While this new structure will alter the existing character of the courtyard to some degree it will allow for minimal intervention within the existing building and maximum retention of historic fabric.

Proposed Works to the Granary Building (Protected Structure) – Parcel 6

Minimal work is proposed to the historic granary building, which is currently in use as office space, the city library (mainly housed in a 20th century extension) and bar/nightclub facilities to the vaulted ground floor. It is proposed to demolish the 20th century library building and circulation core extensions to the granary and to retain the historic building. A new circulation block is proposed to the west elevation in the area of the courtyard to service all floors. Landscaping is proposed to the courtyard area to the west of the granary building, which will provide access through this area of the site to the main public plaza to the centre of the development site.

Physical Impacts:

The 20th century extensions to the building are to be demolished, which are not considered of architectural significance.

A new circulation block is proposed to the western elevation of the existing building at upper ground floor level to provide access to all floors. This allows for such a stair externally and therefore avoids damage to the vaults of the ground floor if the granary and minimises impact on the historic fabric. This new core will be located in the same location as the existing stair extension and will not result in any additional significant physical impact on the historic fabric. It will adjoin the western elevation of the granary between window openings I the location of the existing stairwell (to be demolished). Elsewhere existing stair locations will be maintained.

The circulation core proposed to the western elevation of the granary will also accommodate a number of toilets and two lifts. These facilities were previously located within the late-20th century library extension to the granary which is proposed for demolition. Accommodating these services (which are required to support the office use in the granary) within a new structure will minimise the physical impact on the protected structure which would result if these services were accommodated internally within the historic building.

A second glazed extension will be provided to the southern gable end of the granary building in order to accommodate an escape stair from the upper ground floor. This will avoid damage to the vault over the lower ground floor which would result from the provision of a stair internally. A new doorway will be provided in the south gable end.

New toilets are proposed to the granary to the centre of the building on the upper ground floor in order to keep the size of the proposed new circulation, lift and toilet block to the west elevation to a minimum. These will be located to adjacent to the staircase and the proposed partition walls will not affect the external elevations of the building.

With the exception of the ground floor vaults, which will not be impacted by the proposed works, all internal fabric and finishes (partition walls, staircases etc.) in the granary are of modern construction.

The construction of the proposed new building to Michael Street (Parcel 1) will result in the loss of the stone gate piers, railings and double leaf gates currently located at the southern end of the granary. These gates were introduced following the demolition of the southern block adjoining the granary in the late-20th century. The gateway appears to have been reused from another off-site location and was not originally associated with the granary or the Opera Site.

Visual Impacts: Removal of the adjoining mid-20th century library block to the granary will have a positive visual impact on the building. The retention of the courtyard space to the west of the building, and the carriage arch off Bank Place, will help maintain the setting of the building following construction of the proposed new block to the west (Parcel 4).

The proposed new stair, lifts and toilets will be housed in a highly glazed structure to the west elevation of the granary and will be located on the site of the existing late-20th century library extension. It will be maintained between window openings in the west wall of the granary and the high levels of glazing will allow for the original granary building to be partly visible through the new structure. The proposed new block is designed to allow maximum circulation of pedestrian users through the courtyard space and to maintain the connection of the granary building and the carriage arch which leads to Bank Place.

18.4.2 Impact of the Proposed New Buildings on the Site

In addition to the refurbishment and extension of the existing buildings on the development site, it is also proposed to construct a number of new buildings. These buildings are in most cases to be constructed following demolition of the existing buildings at that location. The new buildings therefore will stand amongst the historic buildings to be retained on the respective streets.

Parcel 1 - Michael Street/Ellen Street:

The proposed new building to Michael Street (Parcel 1) is to be located on the southeast corner of the site, having its main entrance located on to the new public plaza, but with a second entrance off Ellen Street. The building has a four storey elevation on to Ellen Street (adjacent to 9 Ellen Street) and rises to six storeys on Michael Street, with the top floor set back.

Physical Impacts: Much of this site is currently vacant, a large building having been recently demolished to the southern end of Michael Street, where a car park is currently located. However, a number of small outbuildings historically associated with 9 Ellen Street will be demolished in this area to facilitate this proposed building. In addition, structures known as Bogue's Yard, located to the interior of the site, will also be demolished.

Visual Impacts: The proposed new building will block currently available views through the site to the rear elevations of the buildings along Patrick Street and Rutland Street. This is not a historic view, however, as large industrial buildings previously stood on this site which would not have allowed views from street level on Michael Street across the site. In addition, this southern section of Michael Street dates to the second half of the 20th century; there was no thoroughfare connecting to Ellen Street in this location prior to that.

To the north of Michael Street, the granary building, a protected structure, retains a multiple bay (over 30 bays in length) façade which will be retained in full. A large break between the southern gable end of this building and the proposed new structure to Michael Street (Parcel 1) will be maintained, allowing the southern gable end of the protected structure to remain clearly visible from the street, and also providing access through to the proposed plaza in the centre of the site. Although the proposed building will have a visual impact on the setting of the granary, it will not obstruct existing views of the principal elevations of the granary from Michael Street. The choice of grey or buff brick to the exterior of the proposed Parcel 1 and high levels of glazing will complement the limestone Granary walls but will contrast sufficiently to allow the Granary building to retain the character of its historic finishes.

The southern end of the proposed new building to Michael Street (Parcel 1) will have a second entrance and shopfront at the eastern end of Ellen Street, which will be situated immediately east of No. 9 Ellen Street, an existing limestone fronted building. The choice of brick as the external finish to this new structure will help to provide a visual separation between it and the historic stone faced building. Fenestration and the ground floor entrance are held at a distance from the eastern edge of the front elevation of the historic building, which protects the character of this façade by allowing space to read the historic elevation.

<u>Parcel 2A - Patrick Street/Ellen Street:</u>

Physical Impacts:

With the exception of No. 6 Patrick Street (a nineteenth century terraced building), all existing historic structures to both Patrick Street and Ellen Street are to be retained. A new structure is proposed for the site to replace late-20th century structures (corner of Patrick Street and Ellen Street), which will involve the demolition of 6 Patrick Street. 6 Patrick Street is a 19th century terraced house now in derelict condition and will be the only historic structure not retained to this block.

Visual Impacts:

The proposed new building on the corner of Ellen Street and Patrick Street is a 5 storey building having retail units to the ground floor and apartment hotel use to the upper floors. This apart hotel will also incorporate the upper floors of 5 and 6 Ellen St. which will be connected to the new building by way of a glazed atrium. The scale of the ground floor to the new building has been minimised to correspond to the ground floor shopfronts to the adjoining terraced buildings on Patrick St.

The regular fenestration to the upper floors of the proposed new building respects the simple arrangements of the Georgian terraced house facades, while larger areas of glazing to the corner of the proposed building identify the proposed structure as a new intervention with a contemporary design. The proposed pale limestone cladding to the new building will contrast to the brick facades but visually complement the historic buildings and link this building to the other new structures proposed for the site which are visible in views on approach from the southern end of Patrick Street.

The height and scale of the proposed building exceeds the modest terraced houses of Ellen Street and the northern end of Patrick Street, and also the Victorian building found to the opposite corner (to the corner of the south side of Ellen Street and Patrick Street). Block 2A has been designed as an obvious intervention which identifies this corner of the new Opera site as viewed from Patrick and O Connell Streets on approach from the south.

While respecting the context in which it is to be constructed, this building will be clearly read as a modern intervention and will improve the streetscapes of Patrick Street and Ellen Street by replacing a late-20th century building on the site which does not currently enhance the historic terraced buildings of these streets.

Parcel 3A - Rutland Street/Town Hall

A three-storey library building fronting Rutland Street (increasing in height to the interior of the site) is proposed for the site currently occupied by 6 and 7 Rutland Street. Together with 8 and 9 Rutland Street and the Town Hall, this new building will form a new library facility.

Physical Impacts:

A new building is proposed to replace the late 20th century structure currently occupying Nos. 6 and 7 Rutland Street, having a three-storey over ground floor façade to the street. The existing building, which replaced two terraced Georgian buildings and was constructed in the 1980s, will be demolished.

The Georgian stone doorcase, currently located in 7 Rutland Street and included on the Record of Protected Structures, will be salvaged for reuse in the new building.

Visual Impacts:

The height of the proposed new building is reduced as it fronts Rutland Street in order to respect the existing rooflines of the Georgian buildings located on either side. Likewise, the height of the ground floor is kept to that of Nos. 4 and 5 Rutland Street (adjoining to the north). To the south a full height glazed lobby provides a visual break between the proposed new building and the Georgian buildings of 8 and 9 Rutland Street.

The façade of the new building is designed in a contemporary manner and responds to the angle in the street. The chosen material finish is of blue limestone to the Rutland Street façade which will contrast with the historic brick buildings on either side and identify this structure as a new intervention in the historic streetscape. The large areas of glazing to the ground and upper floors will allow views through to the activity of the library use inside. The proposed building façade will have a positive visual impact on the streetscape by providing a more considered design than the

20th century structure currently located on this site. The large areas of glazing and public entrance to this proposed building will enliven the street and provide passers-by with glimpses of the uses proposed for the interiors.

The elevation of the library to the internal plaza will also be finished in limestone, in order to identify the use of this section of the new building.

It is proposed to reuse the surviving e.19th century door case currently located to the façade of No. 7 Rutland Street to the interior of the library on the ground floor, where it will be set in to the northern wall of No. 8 Rutland Street where a doorway will be made to allow access through from the main entrance lobby to this building.

Parcel 4 – Interior of Site

A new building is proposed to adjoin the eastern end of the proposed new library block (Parcel 3A). The building will comprise 5 storeys of office use over 1 basement level and will front the plaza.

Physical Impacts: The proposed building is to be constructed on the site of the rear portion of the 20th century former Cahill May Roberts factory/warehouse currently located in this position, which will be demolished.

Visual Impacts: The proposed building is of five storeys and so exceeds the height of the surrounding historic buildings to be retained. It will be therefore be visible above the rooflines of the peripheral buildings to the site.

The height of this building increases to the interior of the site (in comparison to the library section, Parcel 3A) where it has an elevation on to the proposed public plaza. This higher section of the building is located back from the street frontage in order to respect existing building heights on Rutland Street and to reduce visual impact as viewed from approaches from Rutland Street and Patrick Street.

The upper floors of this new building will be visible above the terraced houses of Rutland Street when viewed from the north, west and northwest such as from Thomond Bridge and Clancy Strand. From Thomond Bridge in particular, this visual impact will result in altering the existing context of the Hunt Museum, behind which it will be visible in this view.

As the structure is located to the interior of the site it will respond to the plaza and other new structures proposed to the site such as the library building and Parcel 1. This new building will be finished with a mixture of brick and curtain walling having heavily glazed upper floors which will mitigate the visual impact of these upper storeys as viewed from outside of the site.

Parcel 5 - Bank Place/Granary Building

An office building comprising 14 storeys over 1 basement level is proposed fronting Bank Place and adjoining the existing Granary building, a protected structure.

Physical Impacts:	The former Cahill May Roberts building, which dates from the mid-20th century, is to be demolished. The three terraced 18th century houses to the west of this building (outside of the development site) and the granary building (a protected structure) are to be retained. The proposed office building will adjoin the west gable end of the northern wing of the Granary building, which is to be fully retained, but will not result in a loss of historic fabric to the Granary.
Visual Impacts:	The proposed building to Bank Place (Parcel 5) will have a high visual impact on Bank Place and the immediate surrounding area. The proposed building is 14 storeys in height, and therefore considerably exceeds the ridgelines of the historic buildings in this area. It should be noted that the historic setting of the surviving buildings to Bank Place has been changed considerably since their construction, with a number of Georgian terraced houses now demolished and replaced by 20th century buildings to both the central portion of Bank Place and to the eastern side of Michael Street. To mitigate against the visual impact of the height of the proposed building, Block 5 is designed with a base which corresponds to the height of the front (north) elevation of the granary. The base is fully glazed which allows for a light touch where it meets the west elevation of the stone granary building. The base of the building is differentiated from the upper portion of the tower by the omission of the glazed vertical fins provided at the higher levels, which allows for a clean, simple structure enclosed with frameless glazing to meet the stone walls of the Granary to the east with minimal physical and visual impact. The main core of this proposed building is expressed as three individual forms, (two when viewed from the north), with the taller elements fully glazed, and the narrower, three-bay element to the west clad with Portland Stone, which helps to emphasise the slenderness of the individual elements. While the tower exceeds the historic buildings to Bank Place by many storeys, at the lower level the scale corresponds to the existing structures located to either side. To the Granary courtyard the ground floor elevation of Block 5 is to be clad in a local blue limestone with metallic (bronze colour) infills between the fenestration. The stone cladding of this lower level of the elevation references the stonework of the Granary which it will face across the courtyard area. Views of the Granary from the eastern side of Bank Place, and from the northern end of Michael Street will also be affected by the proposed Block 1 which exceeds the Granary in height and will therefore be visible above the roofline of the protected structure.

<u>Landscaping Proposals</u>

It is proposed to hard landscape the area to the interior of the site which will be laid out as a public plaza. Access to the plaza will be provided by way of the existing laneway off Patrick Street to the side of the town hall (to be widened), through the existing carriage arch to No. 7 Ellen Street, from Bank Place through the courtyard to the west of the Granary building, and finally by way of a new access to be provided off Michael Street (to the southern end of the Granary building). Landscaping proposals are also submitted for Bank Place, located to the northern end of the site.

Physical Impacts:

The existing laneway from Patrick Street, known as Glover's Lane or Watch House Lane, will be widened by the removal of a building to the north (which currently adjoins the Town Hall). This laneway currently retains limestone setts which will be retained as part of the proposed works.

The proposed new access from Michael Street and the landscaping proposed for the southern end of the Granary building will result in the removal of the existing limestone gateway and piers, and the cast iron railings currently located on this site. This gateway was not originally part of the granary complex and has been salvaged and moved from another off-site location. The granary building is part of a larger complex which included an adjoining building to the southern gable end of the existing building which was only demolished in the later 20^{th} century. This southern block was still partially in existence in the 1970s when there was no gateway at this location. Therefore, the removal of this gateway will not have a negative impact on the architectural character of the Granary building.

Proposed landscaping to Bank Place will not affect the basements or the stone entrance steps to the terraced buildings on the northwest corner (1-3 Bank Place).

Visual Impacts:

The courtyard currently associated with the Granary building, and access through a carriage arch off Bank Place, will be retained. Access will be provided by way of this Granary outdoor space to the main urban plaza to the south. This courtyard will have a different surface material to the main plaza (here it will be of natural granite with a smaller sett size) which will identify this area as a separate outdoor space associated with the Granary building. Café/restaurant seating and planting are also proposed, and this outdoor area will be of a more private nature than the large public plaza to the central area of the site, respecting the scale and character of the Granary building.

The Granary outdoor space will have a pedestrian link to Bank Place through the existing carriage arch in the north elevation of the protected structure, which is to be retained. The granite stone steps proposed for the Granary courtyard will also be used to resurface Bank Place, which will be terraced to meet the lower level associated with the north elevation of the Granary building. A large number of trees are also proposed to this area for the purposes of wind mitigation. This planting will obscure some views of the historic buildings on Bank Place and of the Hunt Museum when seen from across the river to the north. However, the long term, positive impacts of this proposal include the creation of an inviting environment for people to inhabit around the historic buildings while the trees will also provide a buffer to the traffic along the quay.

The proposed public plaza is located to the centre of the site with limited views from the surrounding streets. It will be seen from the laneway (Glover's Lane) which runs from Patrick Street, from parts of Michael Street and from the rear windows of most of the existing buildings. The design of the proposed plaza responds to the scale of the space at the centre of the block to be developed, and incorporates a reflective water pool, trees, bicycle parking and space for café/restaurant seating. Granite paving is proposed for the surface of the plaza, of a silver grey or buff colour, with larger paving sizing (than to the Granary outdoor space) responding to the scale of the plaza and the proposed new buildings which will overlook the internal open space.

18.4.3 Impact of the Proposed Works on Adjacent Historic Buildings

Physical Impacts:

There will be no physical impact on any of the historic buildings located adjacent to the site. The three Georgian houses located to the northwest corner of the development site, Nos. 7-9 Bank Place, will be in close proximity to proposed works and measures should be agreed to mitigate against any potential construction related damage to these buildings.

Other historic buildings in the immediate area include the terraced buildings to the south side of Ellen Street and the Hunt Museum, located to the northern end of Rutland Street, across the street from the Opera Site. The proposed works will not result in any physical impact on these buildings.

Visual Impacts:

A number of views of the Hunt Museum will be altered by the proposed development at the Opera Site. The development will alter its setting, depending on the vantage point from which it is being viewed. However, the development will not obstruct current views of this building which will remain from both across the river and from Bank Place. As with Bank Place, it should be noted that the curtilage of the Hunt Museum has been significantly altered since the building was constructed in the 18th century, most notably by the large, multiple storey Revenue Offices which are located immediately south of the Hunt Museum.

The views of the Hunt Museum which will be most affected will be those of the building as seen from Clancy Strand, where the proposed new building on Bank Place (Parcel 5) will be highly visible above the roofline of the Hunt Museum. Parcels 4 and 1 will also be visible in these views, but to a far lesser extent. The 20th century buildings of the Revenue Offices and the Arthurs Quay shopping centre are already prominent in these longer range views of the Hunt Museum.

As noted above, the setting of the 18th century buildings which survive to Bank Place will also be significantly altered by the proposed development. Again, the proposed new buildings will be highly visible from all vantage points from which the existing buildings can currently be viewed, including from Bank Place and George's Quay, and from the forecourt of the Hunt Museum. However, while the proposed buildings will alter the context of the historic buildings they will not obstruct current views of the buildings.

Additionally, there will be a high visual impact on views from significant historic buildings towards Bank Place and Rutland Street, such as from the Court House and from immediately north of the Hunt Museum (west of Bridge Street).

In longer range views from the north, for example from Thomond Bridge, the proposed new buildings of Parcels 1, 4 and 5 will be visible behind the courthouse, and in the context of St Mary's Cathedral and the spire of St. John's Cathedral. From some more distant vantage points, for example from St. John's Castle, historic landmark buildings will share the skyline with the proposed new buildings, but will not be obscured from view.

Note: The visual impacts on the townscape have been comprehensively analysed in Chapter 12: Landscape and Visual, of this Assessment. Please refer for additional information.

18.5 Mitigation Measures

18.5.1 Building Specific Mitigation Measures

4 and 5 Rutland Street – Parcel 3B

The shopfront and limestone door case to No. 5 to be retained and restored to best conservation practice. The modern shopfront to No. 4 will be replaced. Removal of the existing shopfront to be monitored to ascertain whether earlier joinery is retained behind.

Limestone window sills to the front elevation of No. 4 to be retained. Rear return to No. 5 to be retained. Balconies to be glazed to rear elevation of No. 5 to minimise visual impacts.

Aluminium and uPVC windows to be replaced with multiple pane timber sash windows.

All surviving historic internal fittings to No. 5 Rutland Street to be retained, including in particular the staircase (to be repaired), architraves, dado rails and ceiling plasterwork.

The proposed new doorways off the landings of the staircase in to No. 4 are proposed in order to allow for the retention of the original floor plan of No. 5 to each floor level.

8 and 9 Rutland Street, Town Hall (Protected Structure) – Parcel 3A/4

The buildings will be interconnected at ground and third floor levels only where existing levels allow, in order to retain the original floor levels of all three buildings.

The main rooms of the town hall will be restored with later partitions removed and the floor plan retained. The existing open well staircase and vaulted cellars to the basement of the town hall will be also be retained.

The staircases to Nos. 8 and 9 will be retained as will existing floor levels which will maintain the relationship to the windows of the front elevation.

9 Ellen Street – Parcel 2B

Best conservation practice will be followed for the repair of stonework, roofs and other external fabric.

Timber sash windows to the Ellen Street elevation will help to restore the historic character of the building and will have a positive impact on the streetscape.

The large internal spaces will be retained with little subdivision or partition which will retain the character of the building internally. Surviving features such as columns, colonnade, existing panelled doors and flagged basement area etc. will be retained.

The Granary (Protected Structure) – Parcel 6

Proposed works will avoid any physical impact on the vaulted ceiling over the ground floor, carriage arch to Bank Place, or main street elevations.

The proposed new external staircase to the courtyard shall be designed to minimise loss of existing fabric to the west elevation and to require minimal intervention to the walls of the granary for construction.

Best conservation practice shall be followed for any works carried out to the historic building, including to its structure, roof and external stonework.

Landscaping materials for the proposed works to the courtyard of the granary shall be sensitive to the character of the historic building.

18.5.2 General Mitigation Measures

An accredited Conservation Architect will be appointed to oversee all works on the site and should be present from the commencement of the project. No works, including opening up, stripping out or demolition works shall be carried out to the existing buildings on the site without the appointment of a Conservation Architect.

All existing records and documentation of the existing buildings shall be updated by the findings of opening up and stripping out works. There may be some instances where the scope of recording work will be widened to include detailed record drawings and some material and finishes analysis. Only once these inspections and records have been completed shall the contractor continue with any demolition work as allowed in the planning permission.

Prior to commencement of works, a method statement will be provided by the Conservation Architect for the recording and dismantling of the doorcase at 6 Rutland Street to include details for safe storage and reinstatement in location indicated on the planning drawings.

Other items and features of architectural heritage value to be removed from site will be recorded in detail prior to dismantling. This to include the area to the rear of the Town Hall and the gateway adjacent to the Granary Building.

Prior to the commencement of works, a detailed methodology will be prepared by the Conservation Architect and Structural Engineer appointed to the project for the existing buildings on the site, during and after demolition works, from damage caused by vibration, construction traffic, water ingress and other factors which may accelerate their deterioration in condition.

With the exception of No. 6 Patrick Street, all existing Georgian buildings will be retained to the Opera Site. Areas of physical impact on the existing buildings in the form of demolition are concentrated in a small number of areas, principally to the rear elevations where additions and alterations to the original buildings have accumulated over the years.

The principal elevations of the historic buildings will be repaired using best conservation practice. The external stone work and brick work of the historic buildings will be repaired and repointed as necessary, using a suitable mortar mix as per Conservation Architect’s instruction.

The historic roofscapes of all existing buildings are to be retained, including brick parapets, pitched roofs and brick/stone chimney stacks. All proposed new building elements are designed to the rear of these buildings and will not necessitate alterations to the historic roofs.

There are a small number of surviving historic timber sashes to the buildings. These sashes will be repaired where possible and the surviving glazing bars used to provide suitable profiles for replacement sash windows for the front elevations of the Georgian terraced buildings.

The existing historic buildings to the site (with the exception of the granary building) are in poor, or extremely poor, repair with regard to their structure and/or historic fabric. All buildings have been carefully inspected, and those found to retain significant historic internal fabric have been recorded and will be repaired in a sensitive manner, with internal fittings and fabric reused where condition allows.

Existing floor levels to all historic buildings are to be retained, allowing for a meaningful relationship internally between the floor plans, individual rooms and the historic fenestration pattern.

All historic buildings will retain small retail uses to the ground floor, having active shopfronts, and will retain independent access from the street to the upper floors, regardless of whether the buildings have been integrated with new buildings to the rear. Where historic shopfronts, or elements of shopfronts, survive, these will be retained and repaired.

Existing laneways and carriage arches from the streets to the interior of the site will be maintained and remain open to provide access to the buildings and public plaza within the site. Historic fabric found to these laneways, such as cobblestones or setts, wheel guards, decorative grills or other street furniture should be preserved and reused *in situ.*

All new buildings are designed in a contemporary manner and will allow the existing historic buildings to be easily read within the new streetscapes. Proposed alterations to the rears of historic buildings will have a light touch, minimising damage to the historic fabric of the rear elevations, and with maximum glazing to allow views of the original rear elevations.

The proposed materials for the new buildings reference the existing historic building fabric on the site without attempting to reproduce any architectural details of the historic buildings, allowing the Georgian buildings to retain their own character and significance. The variety of materials used in the construction of the historic buildings which includes ashlar limestone, rubble stone and brick is reflected in the contemporary materials proposed as finished to the new structures.

Detailed fabric analysis and recording of the historic fabric of the individual buildings should be carried out prior to the commencement of work in order to establish the nature and location of significant surviving fabric and architectural features. These records shall include drawings (elevations, plans and sections) at appropriate scales and in addition to recording historic fabric should detail condition issues such as deflections in brickwork, cracking to masonry (internal and external), fissures in ceilings and faults to flooring. These records shall be supplemented by photographs illustrating the issues. This detailed analysis of the condition of the buildings will supplement the existing structural condition reports and assist in determining the extent of historic fabric which can be retained and in pricing remedial works.

18.6 Residual Impacts

While the majority of existing buildings on the site are proposed for retention, a number of structures will be demolished and replaced with new buildings. This will result in an irreversible loss of historic fabric which will have a long-term impact on the streetscapes of Rutland Street, Patrick Street and Ellen Street. In some cases, rear sections, mews buildings or out-buildings attached or associated with historic buildings will be demolished, resulting in a permanent impact on the main buildings to be retained. However, the historic structures proposed for demolition are limited, in poor condition and of less architectural significance than those proposed for retention. In most cases the removal of these later additions will have a long-term positive visual impact on the historic structures.

The restoration of the principal facades, building envelopes, windows, and in some cases interiors, of all of the buildings to be retained will result in a long term positive physical and visual impact on the protected structures, historic buildings (to the site and to the immediate vicinity) and to the streetscapes.

Removal and replacement of internal fabric to the historic buildings will also comprise a permanent loss of historic fabric which will result in a long-term impact on the historic structures affected. This can be mitigated by the retention of significant elements where condition allows.

Buildings identified as being of Category A level of architectural and historical significance, and some of Category B, will undergo conservation works to the salvageable elements of their interiors including joinery and plasterwork. This work will result in a long-term positive impact for the buildings and will help to preserve evidence of original decorative elements which are currently at high risk of irreversible deterioration. In all cases building facades will receive conservation works to best practice standards to roofs, rainwater goods, windows and brickwork, resulting in long term positive impacts on both the building fabric and on the wider streetscapes.

The construction of the new buildings to the site will all have long term visual impacts on the historic buildings on the development site, and in some cases also on adjacent buildings of historic significance. The level of impact resulting from the new buildings will vary depending on the height, scale and location of the new building, but in all cases the impact will be long term. The two proposed new buildings (Parcel 2A and Parcel 3) will not have a high visual impact on the streetscape of Patrick Street and Rutland Street, due to their scale in relation to adjacent buildings. These parcels are also replacing late-20th century buildings of low-quality design and therefore will have a positive impact on the streetscape. Block 1 will have a high long-term visual impact on both Michael and Ellen Street in terms of height and scale, but is proposed for an unoccupied site and will not interrupt any principal views of historic buildings. Block 5 will have a high long-term visual impact primarily on Bank Place, but also on many of the peripheral buildings on the site, on the Granary building and on longer range views, particularly from the north and northwest. The visual impact will also affect buildings of historic significance outside of the development site.

The provision of a plaza to the central area of the site will result in the permanent loss of the rear laneway and high stone walls of the laneway and which comprise remnants of former industrial buildings to this area. The plaza will provide an amenity space for the users and residents of the site, but also to the wider community. It will also allow access to the a previously inaccessible site and allow for views of the rears of the historic buildings for all visitors. The loss of historic fabric will be mitigated by the use of the removed material for repairs to other areas of the site.

The proposals for the Opera Site will result in the re-use and continued life and upkeep of a high number of historic structures which are currently at high risk due to disuse and ongoing condition issues. The retention and conservation of these structures will have a long term positive physical impact and a long term positive visual impact on the historic structures and on the immediate streets and adjacent historic properties.

18.7 Difficulties Encountered in Compiling Information

Information was freely circulated among the design team and no difficulties were encountered with regard to access of required information relating to the proposed scheme for the site.

The structural condition of the buildings has in some cases worsened considerably over recent years and for a number of buildings full access was not possible in order to update the records of the existing buildings during 2018, particularly with regard to the upper floors. However, all buildings had been previously inspected in full by the author, including basements and top floors, and a full assessment of the significance of each building was possible. While the condition of the structures may have worsened since last inspected, the amount of historic fabric surviving to each building and the level of significance of the structures has not changed.

18.8 Cumulative Impacts

The development of the new buildings on the site will have a cumulative visual impact on the historic character of the site as multiple views of the historic buildings and streetscapes are affected by new structures which exceed the roofline of the Georgian buildings. For example, views of the Granary building will be affected by the development of Block 1 when viewed from the north or south, and also by Block 4 when viewed from the northeast (when both new buildings will be visible above the roofline of the Granary).

While the proposed new structures will affect some long-range views, particularly from higher vantage points such as from St. John's Castle, the proposed tower (Parcel 5) will have the highest visual impact when viewed from the immediate locality. This impact is lessened when viewed from further afield and in the context of the skyline of the city.

The generation of traffic during the construction phase and re-organisation of traffic during the operational phase of the project has the potential to impact the architectural heritage in terms of potential vibrations which may exacerbate the condition of vulnerable structures where the condition is already poor. Likewise, demolition of existing structures on the site, or elements of buildings attached to historic buildings to be retained, may cause physical impacts on the historic buildings to be retained.

Removal of internal fabric will result in cumulative physical and visual impacts on the historic structures if fabric is deemed to be in too poor condition for retention, resulting in higher levels of replacement fabric and a reduction of conservation of existing historic elements. This would impact significantly on the historic character of the structures and should be mitigated by informed decisions regarding the necessity of replacement rather than repair of historic fabric.

Positive cumulative impacts will result from the restoration of the facades, roofscapes and windows of the terraced and other historic buildings to be retained, on both the immediate streetscapes and views of the site from adjoining streets.

A number of other projects in the city centre (for example the Hanging Gardens between O Connell St. and Henry St.) and the Bishop's Palace (Henry St.), currently on site or with valid planning permissions, once completed, will result in positive cumulative impacts on the preservation of historic building stock in Limerick where existing buildings of historic and architectural significance are being restored and integrated in to larger schemes, thus ensuring the prolonged use and life of the historic structures. Opera Site, which proposes to retain a high number of historic structures which form the principal elements in four streets, will add significantly to the preservation of the city's historic building stock.

18.9 References

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Historic photographs by Robert French, James P. O' Dea, the A.H. Poole Studio and others (available to view at http://catalogue.nli.ie/)

19 Interactions

19.1 Introduction

This chapter of the EIAR evaluates the potential interactions described within the EIAR, which the proposed development may have on the receiving environment and sensitive receptors.

As a requirement of the Environmental Impact Assessment Directive 2014 (Directive 2014/52/EU), and of best practice guidelines and advice notes, the inter-relationships between individual factors must be identified and assessed.

Article 3 of the Directive requires that the interactions between the following be assessed:

Population and Human Health

Land, soils and geology and

Water

Air Quality and Climate

Noise and Vibration

Microclimate

Traffic and Transport

Waste Management

Material Assets

Biodiversity

Landscape and Visual

Archaeology and Cultural Heritage

Architectural Heritage

The EIAR has addressed each of the elements likely to have potential for environmental impact, during the construction and operational phases of the proposed development within their individual chapters. An examination of specific interactions of the impacts of the proposed development is presented below.

19.1.1 Land, soils, geology and groundwater on

19.1.1.1 Population and Human Heath

There are currently traces of lead in some of the soil on the proposed development site. As a result of the proposed development basement construction, soils contaminated with lead will be removed from the site and disposed of in an appropriately licensed landfill site.

19.1.1.2 Water Quality

The construction of the proposed basements will result in the removal and stockpiling of sediments which, if unmanaged may introduce sediments into the drains and Abbey and Shannon Rivers. Proposals for the management of stockpiles are identified within the EIAR and have been transposed into the CMPP.

19.1.1.3 Air Quality and Climate

In addition to effects associated with water quality due to stockpile management, there will also be effects associated with dust arising. Both the mitigation in the Land, soils and geology chapter and CMPP identify mitigation which will reduce the release of dust and propose a method for monitoring of dust during construction.

19.1.1.4 Waste Management

Based on prior assessments, the soils on the site have been graded and lead contamination has been identified, the waste soils will be disposed of in an appropriately licensed landfill site observing Irish Waste Management legislation.

19.1.1.5 Biodiversity

In addition to sediments released, concrete will also be introduced to the proposed development site, during construction, which has potential to adversely effect on aquatic biodiversity. Due to the proximity of the SAC, it is proposed to pour concrete in designated areas to prevent concrete runoff and the washout of concrete transporting vehicles will take place at an appropriate facility, off site if possible. Alternatively, wash out will take place on site in managed areas.

19.1.2 Water on

19.1.2.1 Population and human health

A flood risk assessment has been completed for the proposed development and to minimise effects of flooding associated with site operation, the finished floor level for the new buildings within the development is 5.32m OD Malin. The design for the basements also incorporates super-elevated entrance/exits to prevent flood water entering the main structure or the basement.

19.1.2.2 Biodiversity

Neither ground water or surface water runoff from the working areas will be permitted to discharge directly to the Abbey River or Shannon River. Run off generated within the site during construction will be filtered and treated to remove hydrocarbons and sediment. To minimise the potential for this type of effect, the monitoring parameters have been identified within Chapter 8 mitigation and have been carried through into the CMPP.

19.1.3 Air Quality and Climate on

19.1.3.1 Population and Human Health

Construction of the proposed development will result in the release of dust emissions that are detrimental to human health. To minimise the potential of this occurrence, monitoring techniques and mitigation are proposed within Chapter 9 and the CMPP.

19.1.3.2 Biodiversity

Due to the proximity of the proposed development to a Natura 2000 site, an assessment of dust deposition was completed and identified there would be no adverse effect to the habitat quality of the Natura 2000 site associated with the air quality associated with the construction of the proposed development.

19.1.4 Noise and Vibration on

19.1.4.1 Population and Human Health

To minimise the adverse effects of noise on the population surrounding the proposed development site, it is proposed to monitor noise emissions on site and use equipment which can be noise reduced to minimise the effects of construction. It is proposed to use acoustic barriers for works which will result in higher outputs or in areas adjacent to the proposed development site which may be occupied during construction. The site hoarding may also be used as acoustic barriers and where there are particularly noise activities (piling), information on anticipated durations should be available to plan works during times of day to minimise nuisance.
Bespoke mitigation strategies will be proposed for each of the historic buildings to ensure that internal noise standard can be achieved to mitigate for external noise prior to occupation.

19.1.4.2 Architectural Heritage

In the context of historic building on site, it is proposed to monitor vibration at these buildings, to manage any effects associated with construction, to maintain the integrity of the buildings.

19.1.5 Microclimate on

19.1.5.1 Population and Human Health

The solar shading and wind effects associated with the proposed development will impact the population around the proposed development and eventual users of the proposed development. Where mitigation is proposed, it is primarally in place to minimise the effects on the populations who use and who surround the proposed development.

19.1.5.2 Landscape and Visual

The planting scheme proposed for Bank Place and the Granary Courtyard has been devised to minimise the effects of wind associated with the proposed development. The result of this is there are larger numbers of trees proposed within the Bank Place planting scheme as part of the inherent mitigation associated with the proposed development.

19.1.5.3 Architectural Heritage

As a result of the wind mitigation, some of the settings of the architectural heritage associated with the proposed development may be altered. However, these views will already be altered as a result of the new elements of the proposed development.

19.1.6 Traffic and transport on

19.1.6.1 Population and Human Health

Chapter 13 identifies requirements of a construction traffic management plan, to minimise conflicts between site deliveries and local traffic peak times. The plan will also identify haul routes to minimise disruption to pedestrians, cyclists, general traffic and public transport. The plan will also provide information about how sustainable travel will be facilitated for employees to and from the site.
A Mobility Management Plan is also proposed to manage sustainable travel during operation and a Delivery Service Plan will be used to manage the number of deliveries to the site, thereby minimising local traffic disruption for the general population.

19.1.7 Waste Management on

19.1.7.1 Population and Human Health

During construction, a specialist asbestos removal contractor is required to safely remove asbestos material from the proposed development site and dispose in an appropriately licensed landfill site. During operation, waste management plans are proposed for building users to identify material for recycling and where to store waste.

19.1.8 Material Assets on

19.1.8.1 Population and Human Health

The material assets on the site provide services which are used by the general population, during construction, there may be requirements to turn off services to facilitate connections. The general population must be aware of these breaks in services and they must be timed to minimise effects on the local population.

19.1.9 Landscape on

19.1.9.1 Biodiversity

The proposed development will result in planting taking place on the site to enhance the quality of the public and private spaces. The planting proposed must include native species to attract insects which in turn will attract wildlife to the proposed development.

19.1.10 Cultural Heritage on

19.1.10.1 Water Quality

Part of the cultural heritage mitigation will result on further excavation, which will be to a lesser extent than the basement excavation, however water quality mitigation is required to minimise the effects of the excavation on the surrounding water environment.

19.1.11 Architectural Heritage on

19.1.11.1 Landscape and visual

Once the development has been completed, the historic buildings which are part of the proposed development site will be restored and functional. The restoration of these buildings will enhance the local visual amenity for the surrounding area.

19.1.12 Summary

In summary, no significant negative impacts are predicted from the interactions of the elements of the proposed development when viewed in light of their associated mitigation measures. The interactions are summarised in Table 19.1

Table 19.1 – Potential Interactions of Environmental Effects

Key Environmental Interactions Matrix	Population and Human Heath	Land use etc.	Water	Air Quality and Climate	Noise and vibration	Micorclimate	Landscape and Visual	Traffic and Transport	Waste Management	Material Assets	Biodiversity	Archaeology and Cultural Heritage	Architectural Heritage
Population and Human Health													
Landuse etc.	✓		✓	✓	✓				✓	✓	✓		
Water	✓										✓		
Air Quality and Climate	✓												
Noise and Vibration	✓												✓
Microclimate	✓						✓						✓
Landscape and Visual											✓		
Traffic and Transport	✓												
Waste Management	✓												
Material Assets													
Biodiversity													
Archaeology and Cultural Heritage		✓											
Architectural Heritage							✓						

20 Mitigation & Monitoring

20.1 Introduction

The mitigation and monitoring proposed in each of the EIAR chapters has been collated into a single table for reference (Table 20.1).

Table 20.1: Mitigation and Monitoring Table

EIAR TOPIC	PROPOSED IMPACT	CONSTRUCTION	OPERATION
Population and Human Health	Effects on pedestrians and cyclists	During construction, temporary signage and alternative route consideration (for pedestrians and cyclists) shall be provided pre construction. As the nature of the proposed development is a mixed use development with construction and operational phase jobs and major retail opportunities, no further mitigation measures are required.	
Lands, Soils, Geology and Groundwater	Requirements of Construction Methodology and Phasing Management Plan	The Construction Methodology and Phasing Management Plan (CMPP) (which accompanies this application) establishes specific control measures to minimise the impact of construction works on the environment as part of the implementation of the mitigation measures and to ensure that consistent standards of environmental protection are established and maintained throughout the project works. During the early stages of construction, site clearance and excavation of made ground and subsoil to facilitate construction of basements, laying of foundations and realignment of drainage channels etc. will be undertaken.	
	Management of Excavation	Controlling working practices will avoid repetitive handling of excavated made ground and subsoils, minimise vehicle movements, limit the size of stockpiles and will reduce the	

EIAR TOPIC	PROPOSED IMPACT	CONSTRUCTION	OPERATION
		compaction and erosion of material and generation of dust. The location of plant and materials and the implementation of a construction traffic management plan will minimise compaction and erosion of soil. If temporary storage of excavated made ground and subsoils is required it will be managed to prevent potential negative impact on the receiving environment and the stockpiled material will be covered and stored away from any surface water drains. It will be necessary to designate areas within the site where stockpiles will be established in order to facilitate the efficient transfer of material within the site. It will be necessary to position spoil and temporary stockpiles in locations which are at least 15 m distant from drainage systems. All excavated materials will be inspected for signs of possible contamination, such as staining or strong odours. Should any unusual staining or odour be noticed, this made ground / subsoil will be segregated and samples analysed for the presence of possible contaminants in order to determine an appropriate disposal outlet. Excavated made ground and subsoil will be disposed to licensed / permitted waste management facilities, as appropriate for the waste classification of the material, see also Chapter 14. Excavation shall be restricted in times of high winds and heavy rainfall to minimise the potential for dust generation or uncontrolled sediment movement. Good construction practices will also be used during the construction phase, such as	

EIAR TOPIC	PROPOSED IMPACT	CONSTRUCTION	OPERATION
		wheel washers and dust suppression on site roads (to be captured within the proposed sustainable urban drainage system (SUDS), and at site access points.	
	Importation of fill to site	The source of aggregate, fill material and topsoil imported to site will be carefully selected and vetted in order to ensure that it is of a reputable origin and that it is "clean" (i.e. will not contaminate the environment).	
	Management of spills and leaks	Due to the presence of a locally important aquifer beneath the site, shallow groundwater, adjacent surface water bodies, the presence of surface water drainage and nearby rivers which are designated as an SAC, mitigation measures at the construction site will be employed in order to prevent spillages to ground of fuels, and to prevent consequent soil or groundwater quality impacts such that: • No oils/fuels will be stored on the proposed development site for the purpose of refuelling on the site; • General maintenance and refuelling of plant, will be restricted to impermeable bunded areas with a minimum 110% storage capacity and away from surface waters or areas where any spillages could easily reach surface water; • Leaking or empty oil drums shall be removed from site immediately and disposed of via an appropriately licensed waste disposal contractor; • All hazardous substances on-site shall be controlled within enclosed storage compounds that shall be fenced-off and locked when not in use to prevent theft	

EIAR TOPIC	PROPOSED IMPACT	CONSTRUCTION	OPERATION
		and vandalism; • Refuelling of plant and machinery shall take place at least 15 m away from drains or dewatering points using a mobile fuel bowser and restricted to designated areas on hard standing; only double-bunded fuel bowsers shall be used; vehicles shall not be left unattended during refuelling operations; road vehicles will not be refuelled at the site; • Fixed plant shall be self-bunded; mobile plant shall be in good working order, kept clean, fitted with drip trays where appropriate and subject to regular inspection; water runoff from designated refuelling areas shall be channelled to an oil-water separator, or an alternative treatment system, prior to discharge; • Spill kits and oil absorbent material shall be carried with mobile plant and located at vulnerable locations around the site to reduce risk of spillages entering the sub-surface or groundwater environment; booms shall be held on-site for works near drains or dewatering points; and • Operatives will be trained in the proper handling of materials, the sensitive nature of the wider drainage system, and the consequences of accidental spillage.	
	Management of concrete on site	Measures for protection of soil and groundwater from wet concrete will include measures to prevent discharge of alkaline wastewaters or wash water to the surface water drainage system or to the underlying subsoil and groundwater, such that: • Ready mixed concrete will be	

EIAR TOPIC	PROPOSED IMPACT	CONSTRUCTION	OPERATION
		brought to the proposed development site by truck; • Concrete pouring will take place within a designated area to prevent concrete runoff in soil and groundwater; and • Washout of concrete transporting vehicles shall take place at an appropriate facility; off-site or where on-site wash out will be captured for disposal off-site.	
	Water Quality Management	Mitigation measures in the water quality management plan shall minimise impacts and monitor effects upon the water environment during construction. Mitigation measures within the water quality management plan will include: • Procedures for investigating environmental incidents and incident notification procedures; • Assessment of earthworks that are likely to give rise to sediment-laden run-off, the routes this is likely to take, and the methods to prevent silt entering the Shannon and Abbey Rivers; • Procedures for dewatering the site during construction works, including licensing requirements, monitoring requirements, discharge points and maintenance requirements of water treatment plant; • Establishment of contingency measures to cater for impacts to unknown services underlying the construction site (for example, old sewers, culverts); • How mud and dust will be controlled and the frequency for road cleaning and dust suppression required at different times of the year;	

EIAR TOPIC	PROPOSED IMPACT	CONSTRUCTION	OPERATION
		• How shallow groundwater and the bedrock aquifer will be protected from potential contamination through the implementation of measures to prevent impact from spills and leaks; and • Identify whether shallow groundwater monitoring wells on site will be maintained and protected during construction works; decommissioned; or removed completely as part of excavation works, to prevent them from acting as direct pathways for contamination to enter the groundwater body beneath the site.	
	Provision of training	Induction training shall be provided to site construction personnel to inform them of their responsibilities and liabilities with reference to water quality and contamination issues, for example, workshops prior to commencement of site works, environmental toolbox talks during the works, and by use of notice boards in site offices to display important information.	
Water	Requirements of Construction Methodology and Phasing Management Plan	The Contractor will take all precautions to prevent the pollution or silting of watercourses from the construction of the proposed development. The Contractor will apply following mitigation: • Prior to excavation of the basement, the proposed foul and storm water sewers in Michael Street will be laid and commissioned to allow the existing combined sewer to be diverted. During the construction of the new sewers, surface water arising from the development will continue to discharge to the combined sewer. Surface	

EIAR TOPIC	PROPOSED IMPACT	CONSTRUCTION	OPERATION
		water collected will be treated by sedimentation prior to discharge to the existing combined sewer. Total Suspended Solids (TSS) and colour will be monitored daily by a hand held multi parameter sonde. • Maintain and monitor the performance of the surface water drainage network throughout the construction of the proposed development noting that the proposed storm sewer will include a permanent hydrocarbon separator which will treat runoff from Michael Street. • Cover all temporary stockpiles generated during construction to minimise run-off. • Locate spoil and temporary stockpiles in locations which are at least 15 m from drainage systems. • Neither ground water or surface water runoff from the working areas will be permitted to discharge directly to the Abbey River or Shannon River. Run off generated within the site during construction will be filtered and treated to remove hydrocarbons and sediment. Total Suspended Solids (TSS), pH/EC and colour will be monitored daily by a hand held multi parameter sonde. In addition, the outlet from the sedimentation pond will incorporate a turbidity monitor with alarm at high level. In the event of surface water failing to meet the required standards, as set out in the discharge licence, water will be recirculated to the inlet of the sediment pond to provide further time for settlement. A penstock will be provided on the outlet from the sediment pond to	

EIAR TOPIC	PROPOSED IMPACT	CONSTRUCTION	OPERATION
		control discharge from the site. In the event of surface water failing to meet the required standards, as set out in the discharge licence, water will be recirculated to the inlet of the sediment pond to provide further time for settlement. A penstock will be provided on the outlet from the sediment pond to control discharge from the site. • Avoid direct or indirect discharges of untreated surface or ground water generated during the proposed development, to any surface water. • Dewater all working areas at the end of each working day, if necessary, using pumping and transport of water off site in tankers if volumes prevent effective treatment prior to discharge. • Where the Contractor utilises pumping to drain works areas, a backup pump and generator must be provided on site for use in the event of the primary pump failing. • Use wheel washers and dust suppression on site roads (to be captured within the proposed SUDS system) and undertake daily plant maintenance checks and corrective actions where required. • Establish contingency measures to cater for impacts to unknown services underlying the construction site (for example, old sewers or culverts). • Identify whether shallow groundwater monitoring wells on site will be maintained and protected during construction works; decommissioned; or removed completely as part of excavation works, to	

EIAR TOPIC	PROPOSED IMPACT	CONSTRUCTION	OPERATION
		prevent them from acting as direct pathways for contamination to enter the groundwater body beneath the site. • Ready mixed concrete will be brought to the proposed development site by truck. • The pouring of concrete shall take place within a designated area to prevent concrete runoff into the soil/ground water media. • Proposed surface water drainage network outfall: – Outfall construction will avoid the pouring of concrete. – The proposed pipe will be installed by coring through the quay wall. – The Contractor's method statement for the works will be reviewed by a suitably qualified ecologist. – The works to provide the outfall will be supervised by the suitably qualified ecologist to advise and direct the Contractor on compliance with the method statement. • Washout of concrete transporting vehicles shall take place at an appropriate facility, offsite or where onsite wash out will be captured, for disposal off-site. All design and construction will be carried out in accordance with the Construction Industry Research and Information Association (CIRIA) C532 Control of Water Pollution from Construction Sites Guidance for Consultants and Contractors. Daily monitoring of the excavation/earthworks, the water	

EIAR TOPIC	PROPOSED IMPACT	CONSTRUCTION	OPERATION
		treatment and pumping system will be completed by a suitably qualified person during the demolition / basement excavation and construction phases. Preventative measures will be implemented to ensure no entrained sediment, or deleterious matter directly into any drains or watercourses. If high levels of silt or other contamination is noted in the pumped water or the treatment systems, all construction works will be stopped. No works will recommence until the issue is resolved and the cause of the elevated source is remedied. The primary flood risk to the site is associated with coastal flooding. The Contractor will provide a ramp to the development site as a mitigation measure to prevent any flood waters to enter the main structure or the underground structure during the Construction Stage. As coastal flooding is somewhat predictable (usually 24-36 hours in advance) the Contractor shall take note of when coastal flooding warnings are issued for the Limerick City area. In the event that a flood warning is issued, all plant and construction materials must be moved and stored in parts of the site that are located within Flood Zone C or above the estimated 1 in 1000 year return period coastal flood event (CFRAM). Therefore, in the event of floodwaters inundating the site, no materials will be washed from the site into nearby watercourses.	
	Requirements for Spill Control Measures	No oils/ fuels will be stored on the proposed development site for the purpose of refuelling on the site. On-site plant will be refuelled by	

EIAR TOPIC	PROPOSED IMPACT	CONSTRUCTION	OPERATION
		an external Contractor who will call to site as required. Road vehicles will not be refuelled at the site. Minor spills and leaks may occur from road vehicles and the onsite excavator. Any oils or fuels onsite will be removed by an experienced and authorised contractor. Fixed plant shall be self-bunded; mobile plant shall be in good working order, kept clean, fitted with drip trays where appropriate and subject to regular inspection. Spill kits and oil absorbent material shall be carried with mobile plant and located at vulnerable locations around the site to reduce the risk of spillages entering the sub-surface or groundwater environment; booms shall be held on site for works near drains or dewatering points. The Contractor will train all operatives in the proper handling of materials, the sensitive nature of the wider drainage system, and the consequences or accidental spillage. The following steps provide the procedure to be followed by the Contractor(s) in the event of any significant spill or leak: • Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers; • If applicable, eliminate any sources of ignition in the immediate vicinity of the incident; • Contain the spill using the spill control materials, track mats or other material as required. Do not spread or flush away the spill; • If possible, cover or bund off any vulnerable areas where	

EIAR TOPIC	PROPOSED IMPACT	CONSTRUCTION	OPERATION
		appropriate such as drains or watercourses; • If possible, clean up as much as possible using the spill control materials; • Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited; • Notify the Contractor immediately giving information on the location, type and extent of the spill so that they can take appropriate action and further investigate the incident to ensure it has been contained adequately; • Verify if necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring, where necessary proposing additional the necessary; and, • The Contractor will notify LCCC and (if LCCC deem it appropriate) Inland Fisheries Ireland.	
	Water Quality Monitoring Requirements	The Contractor will produce and commence a Water Quality Monitoring Programme (WQMP) at least one month in advance of the construction programme including any enabling works to establish a baseline dataset, and continue throughout construction. The regularity of, and specification for water quality monitoring in this section has been agreed following consultation with IFI during EIAR production. The baseline water quality dataset will include sampling at low tide, sampling at high tide, and (where possible should such	

EIAR TOPIC	PROPOSED IMPACT	CONSTRUCTION	OPERATION
		events overlap with the pre-construction monitoring period) periods of elevated rainfall. The WQMP will sample surface water discharge upstream and downstream from the proposed outfall to the Abbey River, in similar habitat and flow conditions, to enable siltation and other contaminants from the proposed development to be detected and distinguished from ‘background’ levels (including natural and man-made activities. The WQMP will include relevant parameters from the European Communities (Quality of Salmonid Waters) Regulations, 1988 S.I. No. 293 as amended including Suspended Solids, pH, Dissolved Oxygen, Biochemical Oxygen Demand, hydrocarbons, Nitrites, Nitrates and heavy metals. Testing for pH, turbidity and/or Total Suspended Solids will be carried out daily in-situ sing a calibrated multi-parameter sonde (to 0.1 NTU accuracy), and fortnightly for all other parameters. The WQMP will inform the Contractor’s adaptive management of the temporary construction-phase drainage works, having regard for any consents or planning conditions. The Contractor will provide WQMP results to the Ecologist and LCCC at least fortnightly (but immediately after a known silt release or other pollution incident), along with a record of any corrective actions taken by the Contractor to improve or repair performance of silt fencing or other surface water protection measures. Highest standards of site	

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		management will be maintained and utmost care and vigilance followed to prevent accidental contamination or unnecessary disturbance to the site and surrounding environment during construction. A named person will be given the task of overseeing the pollution prevention measures.	
	Construction Phase Materials Handling and Storage	Materials will be stored within the site compound and outside of areas identified as being at risk of flooding.	
	Disposal of Materials	All material to be disposed of off-site will be disposed of to a disposal facility licensed in accordance with Irish Waste Management Legislation. Where material is to be stockpiled on site prior to disposal, the contractor will control all run-off to prevent contamination of surrounding watercourses. Contaminated soil will be assessed to determine its constituents and disposed of offsite in accordance with Irish Waste Management Legislation.	
	Control of Concrete in relation to Water Quality	Ready-mixed concrete will be brought to the Proposed Development site by truck. Measures for protection of watercourses from wet concrete shall be included in the CMPP. This will include measures to prevent discharge of alkaline wastewaters or contaminated storm water to the underlying subsoil / groundwater or nearby surface watercourses. The pouring of concrete shall take place within a designated area to prevent concrete runoff into the soil / groundwater media. Washout of concrete transporting vehicles shall take place at an	

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		appropriate facility, offsite where possible, alternatively, where wash out takes place on-site, it shall be carried out in carefully managed on- site wash out areas.	
	Foul sewer controls	Foul sewage arising from temporary toilets and sanitary facilities on the Proposed Development site will initially be discharged to an on-site receptacle which will be emptied by tanker on a regular basis for disposal. This arrangement will be in place until the construction of on-site facilities connected to the existing Irish Water wastewater network. It is anticipated that due to the scale of the Proposed Development that a canteen will be provided on site during construction. Provisions will be made for a grease trap at the canteen drain outlet and this drain will connect to the on-site receptacle and later to the foul sewer. Drumming of waste cooking oil within the canteen will also be provided.	
	Water supply during operation		The water system will be metered to determine water consumption and facilitate leakage detection.
	Flood Risk		The proposed development is located within Flood Zone B and the associated water level in the area is 4.72 m OD Malin. The proposed finished floor level for new buildings within the development is 5.32 m OD Malin. This level includes a climate change and land movement allowance of 600mm and is above the 1 in 200 year return period coastal flood event level. In addition, all critical infrastructure within the buildings will be at a

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			minimum level of 5.16 m OD Malin. All existing buildings to be retained are located within Flood Zone C. The design incorporates super-elevated entrance/exits for the development as a mitigation measure to prevent any flood waters to enter the main structure or the underground structure. In case of emergency there is vehicular access for Fire and Ambulance services to the building via Rutland Street, Patrick Street and Ellen Street westbound as these roads are outside of the areas identified as being at risk of flooding by the CFRAM project. The above measures incorporated into the proposed development design will minimise potential adverse effects due to flooding and drainage.
	Storm water drainage		The proposed storm water drainage system has been designed to ensure that there will be no increase in water levels or flow rates downstream of the proposed outfall. The system includes two attenuation tanks which will store run-off when the inflow rate exceeds 9.4the greenfield runoff rate. The system also includes a Class I Bypass Hydrocarbon Separator to remove hydrocarbons which may be suspended in runoff. To minimise sediment build up within the storm water drainage network, trapped inlets will be used at all points of entry and key manholes will have sumps to collect material. A regular maintenance regime, including monitoring, will be put in place to remove any excess build-up of material. A Class I Bypass Hydrocarbon Separator has also been provided to treat surface

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			water collected in the new gullies on Michael Street. LCCC, shall establish a maintenance company that will be responsible for the regular maintenance and monitoring of all infrastructure installed as part of the development. This includes the surface water drainage, gullies and petrol interceptor on Michael Street. Future third party Connection to the infrastructure in Michael Street will only be permitted if the same standard can be given with regards maintenance and monitoring. On behalf of LCCC, Limerick Twenty Thirty will be responsible for funding of the company and should units be sold (or resold) or leased (or subsequently lease), the sale shall incorporate a legal obligation on each unit owner to fund this management company on a pro rata basis.
	Foul sewage provision during operation		All foul water from the Proposed Development will discharge to the existing Irish Water combined sewer network.
Air Quality and Climate	Fugitive emissions of dust	Demolition, earthworks and construction activities have been defined as a medium risk, while trackout activities have been defined as a small risk of dust impacts. IAQM guidance specifies that the highest category of risk should be applied to all activities when assigning mitigation measures to reduce dust emission from each of these four activities to low/negligible level. Procedures to assess deposition of dust shall undertaken on site. Due to the proximity of human and ecological receptors, measurement data shall be obtained from at least three points on the site boundary. A sampling campaign, including baseline	

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		measurements (prior to construction), of sticky pads will consist of a suitable approach to collecting a catalogue of emitted dust particles. In addition to this the following section describes measures for the purpose of dust suppression that will be included in the CMPP which are considered standard practice.	
	Measures Specific to Demolition (medium risk):	Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust); Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as water can be directed to where it is needed; Avoid explosive blasting, using appropriate manual or mechanical alternatives; and Bag and remove biological debris or damp down such material before demolition.	
	Measures Specific to Earthworks:	Ensure excavated soil is stored in appropriate areas and removed from site as soon as practicable Use Hessian, mulches or tackifiers where it is not possible to cover with topsoil, as soon as practicable; and Only remove the cover in small areas during work and not all at once.	
	Measures Specific to Construction:	Avoid scabbling (roughening of concrete surfaces) Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case	

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		ensure that appropriate additional control measures are in place;	
	Measures Specific to Trackout:	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site; Avoid dry sweeping of large areas; Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport; and Implement a wheel washing system to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable.	
	Carbon reduction mitigation	Mitigation measures to reduce the impact which the proposed development may have on climate change will include the measures which are consistent with good practice regarding sustainable building design, safe bicycle storage and electric car charge points.	
Noise and Vibration	Best Practical Means for noise reduction during construction.	The contractor will follow Best Practicable Means (BPM) to reduce the noise and vibration impact on the local community, including: • Fixed and semi-fixed ancillary plant such as generators, compressors etc. to be positioned so as to cause minimum noise disturbance. If necessary, acoustic barriers or enclosures to be provided for specific items of fixed plant; • Use of site boundary acoustic barriers/hoarding to screen neighbouring receptors; • All plant used on site will comply with the EC Directive on Noise Emissions for	

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		Outdoor Equipment (2000/14/EC), where applicable; • Operation of plant in accordance with the manufacturer’s instructions; • All major compressors to be ‘sound reduced’ models fitted with properly lined and sealed acoustic covers which are kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools to be fitted with mufflers or silencers of the type recommended by the manufacturers; • All plant used on site will be regularly maintained, paying particular attention to the integrity of silencers and acoustic enclosures; • Machines in intermittent use to be shut down in the intervening periods between work or throttled down to a minimum; • Drop heights of materials from lorries and other plant will be kept to a minimum; • Adherence to the codes of practice for construction working and piling given in BS 5228 and the guidance given therein for minimising noise emissions from the site; • Provision of rest periods during any prolonged noisy activities; • prohibition of the use of stereos and radios on site; • Compliance with normal construction working hours of 08:00-19:00 Monday to Friday, 08:00-13:00 on Saturdays, with no working on Sundays or bank holidays, however if out of hours work is deemed necessary, it is subject to approval by LCCC; and	

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		• Keeping local residents informed and provision of a contact name and number for any queries or complaints.	
	Use of site hoarding	The site perimeter will have site hoarding which will provide some attenuation of noise to receptors on lower floors (first floor and below). Such hoarding will provide a conservative reduction of approximately 5dB. During particularly noise works, consideration shall be given to the implementation of mobile noise barriers. As with site hoarding, mobile noise barriers will only provide attenuation of noise at lower floor levels. With the use of such barriers, noise levels at lower floor levels of NSRs could be reduced by up to 10 dB. With the use of mobile noise barriers, noise levels during the majority of construction activities will be reduced to below the threshold values. Where the threshold values are exceeded, this shall not be by more than 6 dB (during the construction of access roads/car parking).	
	Vibration	Consideration will be given to the times of day and duration of piling works to reduce potential annoyance as far as possible. Prior notification of piling works, along with information on anticipated durations and the negligible likelihood of damage to property, will provide reassurance to nearby residents.	
	Internal noise levels		Options for mitigation include: • Double-glazing • Secondary glazing • Uprated single-glazing

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Landscape and visual	Inherent design mitigation	The principal mitigation for the proposed development is inherent in the design of its architecture, public realm and open space, which has evolved through an iterative process of assessment and consultation. There are no operational management measures required in respect of townscape and visual issues.	
	Construction methods to reduce effects on visual amenity	During the demolition and construction works of each, measures such as site hoardings and cleaning roads to remove any track out will be undertaken to reduce temporary effects on visual amenity. No additional mitigation is proposed further to that incorporated into the design.	
	Landscaping proposals		The Central Plaza: A contemporary main plaza space located in the centre of the development providing a structural element to the site layout. It will be a focus for daily activity and seasonal events. Bank Place: New tree planting proposed across this new public space. Trees will be clear stemmed to 3m and lopped at 9m. The Granary: Provides a hidden space to be discovered. Its character is inherently influenced by the adjoining Granary building. Surrounding Streetscape improvements: Public realm and street scape improvements to the surrounding streets anchor the site into its setting. Roof Gardens: There are two private roof gardens included in the development providing amenity space to the adjoining buildings.

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Traffic and Transport	The Construction Traffic Management Plan	The plan provides: • Location of site and materials compound; • Location of areas for construction site offices and staff facilities; • Details of site hoarding and security; • Construction traffic will be limited to certain routes and times of the day, with the aim of keeping disruption to pedestrians, cyclist, general traffic and public transport to a minimum; • During peak network hours (0800 – 0900 and 1700-1800) construction traffic movements will be discouraged; • The daily construction programme will be planned to minimise the number of disruptions to the local highway network by staggering HGV movements to avoid site queueing; • Measures to prevent spillage of spoil or materials on the public highway including the use of on-site wheel washing facilities and street cleaning measures; • Any traffic management plans that may be required for a road closure or pedestrian footpath closure, including appropriate signage advance public notice procedures; • monitoring and mitigation measures to minimise noise, dust and vibration impacts on any identified sensitive receptors;	
	Further mitigation plans proposed		7. Mobility Management Plan (MMP) An MMP is a long-term management strategy for

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	during operation		supporting sustainable and active travel for the development. The benefits of an MMP include – Reduction in car usage and less congestion experienced on the roads surrounding the development. This is turn improves the road safety characteristics; – Environmental improvements through reduced congestion, emissions, pollution and noise; – Increase opportunities for active healthy travel such as walking and cycling; – Reduced demand for parking through the promotion of active travel and car sharing; 8. Delivery Service Plan (DSP) A DSP is a strategy for managing and reducing the number of deliveries and service trips to a development, particularly during peak and sensitive network periods. The benefits include:

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			– Reduced costs associated with the consolidation and reduction in deliveries; – Improvements to road safety and ricks of accidents associated with reduction in delivery goods movements; – Environmental improvements due to reduced congestion, emissions, pollution and noise; 9. Pedestrian Crossing Facilities The proposed development incorporates several improved and new crossing opportunities on roads surrounding the development that will improve pedestrian facilities and enhance road safety for those vulnerable road users.

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			10. Cycling Facilities The development provides secure, sheltered and accessible cycle parking facilities for both staff and visitors that will encourage cycling as a mode of choice when accessing the development. In addition to this a new Limerick Bike docking facility will be incorporated into the public realm scheme on Bank Place that will further enhance the sustainable choices for all users. 11. Public Transport A new bus stop facility will be provided at Bank Place that will provide improved public transport connections to the development and this area of the city. 12. Review of signal timing at the two signalised junctions in the study area to improve conditions for all users.
Waste		In developing the C&D WMP, the contractor shall also take into account the requirements of Limerick 2030 Strategic Developments and Environmental Policy requirements, which includes minimising the quantity of waste and, in particular, eliminating waste disposed to landfill. Construction will comply with the objectives of the SRWMP, including incorporating a system for the management of wastes in accordance with the waste management hierarchy that prioritises waste prevention and minimisation, followed by waste reuse and recycling. Disposal of waste shall only be considered as a last resort. The contractor will incorporate the reuse and recycling target of 70% for	

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		construction and demolition waste (excluding soil and stones) contained within the SRWMP. Prior to the transfer of a waste off-site under a particular EWC Code for the first time, the contractor shall advise LCCC or its representatives of the proposed classification and shall only transfer the waste following agreement from LCCC or its representatives. The contractor shall ensure that waste materials generated during the works are clearly identified as either hazardous or non-hazardous wastes, with reference to guidance from the Environmental Protection Agency where required and shall establish waste storage areas for the different types of waste that may arise. For each waste stream identified by the contractor, and for each additional waste stream that may arise during the course of the works, the contractor shall identify the following: • The appropriate EWC Code; • A suitable waste collection contractor in possession of a valid waste collection permit for the collection of the particular waste within Limerick city; • The waste recovery or disposal site, including the transfer station where the waste may be transferred to upon leaving the site in possession of a valid Waste Facility Permit or Waste Licence, as appropriate; and • The recovery or disposal method for the waste. Only waste contractors in possession of a valid Waste Collection Permit shall collect	

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		wastes from the site. The contractor responsible for the waste shall ensure that the waste collection contractor: • Is permitted to collect the particular waste; • Is permitted to collect waste within Limerick City; • Uses a waste collection vehicle identified on the waste collection permit; and • Transfers the waste to a waste facility identified on the waste collection permit. Prior to the commencement of the project, the contractor shall determine the quantity of waste expected to arise from its works, and LCCC or its representatives shall be advised accordingly.	
	Asbestos Removal	Following risk assessment, a number of demolition options for the safe cleaning and removal of ACMs prior to demolition of the buildings were identified. A specialist asbestos removal contractor, whose staff are trained in asbestos removal as required under the Safety Health and Welfare at Work (Exposure to Asbestos) regulations 2006 (S.I. No. 386 of 2006), will remove ACMs as far as reasonably practicable, prior to demolition or refurbishment works commencing. ACM waste to be removed from site for disposal will be in sealed bags/containers and labelled appropriately.	
	Excavated material management	The contractor shall develop a Soil Management Plan (SMP) set out within the C&D WMP. The SMP shall outline proposals for the management and reuse of excavated materials from the site, where permitted in accordance with the relevant legislation; and, provided that the reuse meets	

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		engineering requirements, for material used within the works. Where the contractor proposes to maximise the reuse of excavated soil in order to minimise the generation of waste, it shall set out how it proposes to manage and document this reuse to the satisfaction of LCCC or its representatives. This shall include the following: • Identification and recording of the location from where the material was excavated; • Delineation of areas where excavated soil is intended for disposal as waste, and where it is intended for reuse (where permitted); • Delineation of areas of contaminated and uncontaminated soil (if present); • Sampling of excavated soil (the number and location of soil samples); • Details of the proposed laboratory to carry out the testing; • The suite of parameters for which the soil is to be tested; and • The criteria for assessing whether the soil is contaminated or uncontaminated. The contractor shall establish the controls necessary to manage the generation, handling and storage of waste at the site. These controls may rely on other plans within the CMPP, for example: the protection of stockpiles of contaminated soil against rainwater ingress and leachate runoff; the bunding of hazardous waste storage areas	

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		containing liquids (e.g. oils, paints); and the management of waste collection vehicles both within the site and when leaving the site (dust and noise). The SMP shall indicate waste soil classifications to enable LCCC or appointed contractor to identify appropriate disposal/transfer routes for proposed excavated material, based on the nature of the material i.e. made ground or natural soil. Service clearance, foundation excavation and pile arisings will/may be generated during the works. These shall be segregated, stockpiled on site and sampled. Soil waste classification shall be completed on these materials in order to identify an appropriate waste receiving facility. Prior to the transfer of material from the site for export or to a specific waste permitted/licensed site, the appropriate waste classification data shall be submitted to the permit/licence holder to confirm the suitability of the material in writing for transfer to their facility. In order to control off-site soil movements and undertake appropriate waste disposal/recovery, a comprehensive docketing system shall be detailed in the site construction waste management plan and implemented on site. A daily record (including preparing and reconciling waste transfer notes) of soil excavation at the site shall be maintained by the appointed contractor. Documentation to be maintained in relation to soil wastes includes the following:	

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		• The names of the agent(s) and the transporter(s) of the wastes; • The name(s) of the person(s) responsible for the ultimate recovery or disposal of the wastes; • The ultimate destination(s) of the wastes; • Written confirmation of the acceptance and recovery or disposal of any hazardous waste consignments; • The tonnages and EWC (European Waste Catalogue) Code for the waste soil materials; • Details of each individual consignment dispatched from site: – Description of waste (grid cell number, stockpile number or type and origin of soil) – Date and time of dispatch from site – Name of haulage company – Details of Contractor and Haulier docket numbers – Vehicle registration number and driver name – Volume/weight of waste removed – Name of waste receiving facility – Date and time of arrival at waste receiving facility – Details of any rejected consignments • The Waste Transfer Forms for hazardous soil wastes transferred from the site (stamped at receiving facility); • The Trans-frontier Shipment of Waste forms for	

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		hazardous soil wastes transferred abroad; and • The results of any analysis conducted on excavated soil. Waste transfer notes will be issued in triplicate. On dispatch, the note shall be signed by the issuing operative and one copy retained at the site office. The remaining two copies shall accompany the load and signed or stamped by the receiving facility. One of these signed copies shall be returned to the site office for reconciliation. It is noted that a suitably licensed hauler shall be appointed to transfer waste soil from site.	
	Operational waste management		Waste generated during the operational phase of the proposed redevelopment will be primarily limited to activities in office and commercial buildings, apartments and hotels. Mitigation measures proposed to manage impacts arising from waste generated during operation of the proposed redevelopment are set out below: • On-site segregation of all waste materials into appropriate categories including: – organic waste; – cardboard and paper; – plastic; – glass; – metals; and – mixed non-recyclables. • All waste materials will be stored in bins or other suitable receptacles in a designated, easily accessible areas of the proposed redevelopment;

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			• Where possible, a high percentage of waste leaving the proposed redevelopment will be recycled, with the exception of those waste streams where appropriate recycling facilities are currently not available; • Any waste classed as hazardous will be stored in a designated area and will be removed off site by a licensed hazardous waste contractor; • All waste leaving the proposed redevelopment will be transported by suitable permitted contractors and taken to suitably licensed or permitted facilities; and • Waste records and copies of relevant documentation will be maintained.
Material Assets	Services continuity during construction	All services are maintained unless this is agreed in advance with the relevant service provider and LCCC. There may be some power outages required when making new connections. These will be facilitated in out of hour times to minimise impact on existing buildings and infrastructure. All works in the vicinity of services apparatus will be carried out in ongoing consultation with the relevant utility company and/or LCCC and will be in compliance with any requirements or guidelines they may have. Where new services are required, the contractor will apply to the relevant utility company for a connection permit where appropriate and will adhere to their requirements.	
Biodiversity	Requirement for Method Statements	The Contractor shall produce site-specific Method Statements for review and agreement with the Ecologist and Inland Fisheries Ireland, to demonstrate	

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		adherence to specific, tried-and-tested pollution control measures .	
	Other Pollution Control Measures	The Contractor shall take all necessary precautions to prevent the pollution or silting of watercourses from the construction of the proposed development. The Contractor will take the following mitigation: • Prior to excavation of the basement, the proposed foul and storm water sewers in Michael Street will be laid and commissioned to allow the existing combined sewer to be diverted. During the construction of the new sewers, surface water arising from the development will continue to discharge to the combined sewer. Surface water collected will be treated by sedimentation prior to discharge to the existing combined sewer. Total Suspended Solids (TSS) and colour will be monitored daily by a hand held multi parameter sonde. • Neither ground water or surface water runoff from the working areas will be permitted to discharge directly to the Abbey River or Shannon River. Run off generated within the site during construction will be filtered and treated to remove hydrocarbons and sediment. Total Suspended Solids (TSS), pH/EC and colour will be monitored daily by a hand held multi parameter sonde. In addition, the outlet from the sedimentation pond will incorporate a turbidity monitor with alarm at high level. In the event of surface water failing to meet the required standards, as set out in the discharge licence, water will be recirculated to	

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		the inlet of the sediment pond to provide further time for settlement. A penstock will be provided on the outlet from the sediment pond to control discharge from the site. • No pouring of concrete will occur during the construction of the outfall, albeit localized grouting would be required (see Section 16.5.1.2). • Maintain and monitor the performance of the surface water drainage network throughout the construction of the proposed development (as per monitoring is set out under 16.9.1), noting that the proposed storm sewer will include a permanent hydrocarbon separator which will treat runoff from Michael Street. • In the event of surface water failing to meet the required standards, as set out in the discharge licence, water will be recirculated to the inlet of the sediment pond to provide further time for settlement. A penstock will be provided on the outlet from the sediment pond to control discharge from the site. • Where the Contractor utilises pumping to drain works areas, a back-up pump and generator shall be provided on site for use in the event of the primary pump failing. • Cover all temporary stockpiles generated during construction to minimise run-off; • Locate spoil and temporary stockpiles in locations which are at least 15 m from drainage systems, the Abbey River and the River Shannon' • Avoid direct or indirect discharges of untreated	

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		surface or ground water generated during the proposed development, to any surface water; • Dewater all working areas at the end of each working day, if necessary using pumping and transport of water off-site in tankers if volumes prevent effective attenuation and treatment prior to discharge; and, • Use wheel washers and dust suppression on site roads (to be captured within the proposed SUDS system) and undertake daily plant maintenance checks and corrective actions where required. • Establish contingency measures to cater for potential impacts to unknown services underlying the construction site (for example, old sewers, culverts) • Identify whether shallow groundwater monitoring wells on site will be maintained and protected during construction works; decommissioned; or removed completely as part of excavation works, to prevent them from acting as direct pathways for contamination to enter the groundwater body beneath the site • Excavation: – All excavated materials will be inspected for signs of possible contamination, such as staining or strong odours; – Should any unusual staining or odour be noticed, this made ground / subsoil will be segregated and samples analysed for	

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		the presence of possible contaminants in order to determine an appropriate disposal outlet; and, – Excavated made ground and subsoil will be disposed to licensed / permitted waste management facilities, as appropriate for the waste classification of the material. • Importation of fill: – The Contractor will vet the source of aggregate, fill material and topsoil imported to site in order to ensure that it is of a reputable origin and that it is “clean” (i.e. it will not contaminate the environment). – The Contractor and/or LCCC will implement procurement procedures to ensure that aggregate, fill material and topsoil are acquired from reputable sources with suitable environmental management systems as well as regulatory and legal compliance. • Disposal of materials – All material to be disposed of off-site to a facility licensed having regard for Irish Waste management legislation. Where material is to be stockpiled on site prior to disposal, the Contractor will control all run-off to prevent contamination of surrounding watercourses. – Contaminated soil will be assessed to determine its constituents and	

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		disposed of offsite having regard for Irish waste management legislation; and, – The Contractor will dispose of all alkaline wastewaters and contaminated storm water off-site having regard for Irish waste management legislation. • Control of concrete: – Ready-mixed concrete will be brought to the proposed development site by truck. – The pouring of concrete shall take place within a designated area to prevent concrete runoff into the drainage network, watercourses, or soil / groundwater media. – During construction no pouring of concrete will occur during the construction of the outfall. Works to locally grout and otherwise repair Charlotte Quay, following installation of the proposed outfall will be supervised by the Ecologist or other suitably experienced ecologist who will advise and direct the Contractor such that contaminated surface water does not enter the Abbey River. – Washout of concrete transporting vehicles shall take place at an appropriate facility, offsite or where onsite wash out will be captured, for disposal off-site.	
	Minimising pollution risks associated	The Contractor will provide a ramp to the development site as a mitigation measure to prevent any	

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	with flooding	flood waters to enter the main structure or the underground structure during the Construction Stage. As coastal flooding is somewhat predictable the Contractor shall take note of when coastal flooding warnings are issued for the Limerick City area (usually c. 24-36 hours in advance). In the event that a flood warning is issued, all plant and construction materials must be moved and stored within areas only at risk from the 1 in 0.1% AEP coastal flood event (i.e. areas within 'Flood Zone C' as defined by OPW and DoEHLG (2009), which includes parts of Patrick Street, Ellen Street and Rutland Street). In this way, in the event of floodwaters inundating the site, no materials will be washed from the site into nearby watercourses.	
	Spill Control Measures	No oils/fuels will be stored on the proposed development site for the purpose of refuelling on the site. On-site plant will be refuelled by an external Contractor who will call to site as required. Road vehicles will not be refuelled at the site. Minor spills and leaks may occur from road vehicles. Any oils or fuels onsite will be removed by an experienced and authorised contractor. Fixed plant shall be self-bunded; mobile plant shall be in good working order, kept clean, fitted with drip trays where appropriate and subject to regular inspection. Drip trays will be covered, and the Contractor will empty their contents regularly as required, and dispose of off-site having regard for relevant waste legislation. Spill kits and oil absorbent	

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		material shall be carried with mobile plant and located at vulnerable locations around the site to reduce risk of spillages entering the sub-surface or groundwater environment; booms shall be held on-site for works near drains or dewatering points The Contractor will train all operatives in the proper handling of materials, the sensitive nature of the River Shannon, Abbey River (and the drainage system which is hydrologically connected to these Rivers), and the consequences of accidental spillages. The following steps provide the procedure to be followed by the Contractor(s) in the event of any significant spill or leak. • Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers; • If applicable, eliminate any sources of ignition in the immediate vicinity of the incident; • Contain the bulk of the spill immediately using a spill kit before placing the contaminated absorbent material and the contaminated soil in a stockpile outside the 1% Annual Exceedance Probability (AEP) floodplain (and at least 10 m from, and downslope of any drainage system or The Abbey River or River Shannon), • Place all contaminated material on and cover with plastic to prevent leachate generation, until such time as it can be removed off-site by an appropriately licensed waste management company; • If possible, cover or bund off	

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		any vulnerable areas where appropriate such as drains; • Notify a fully licensed waste Contractor immediately giving information on the location, type and extent of the spill so that they can take appropriate action to further investigate the incident to ensure it has been contained adequately, and so that the fully licensed waste Contractor can, subject to the appropriate permits, dispose of the contamination off-site having regard for relevant legislation; and, • Notify LCCC and (if LCCC deem it appropriate) Inland Fisheries Ireland (IFI).	
	Emergency Response and Environmental Training	The Contractor will produce an Emergency Response Plan (ERP) based on the Contractor's own Risk Assessment, which will be reviewed by the Employer's Representative Team, Including the Ecologist. The ERP will include: • The Contractor's proposed training of relevant staff, including cover staff, in the implementation of the ERP and the use of spill kits; • Details of procedures to be undertaken by the Contractor in the event of the release of any sediment into a watercourse, or any spillage of chemicals, fuel or other hazardous wastes, non-compliance incidents with any permit or licence, or other such risks that could lead to a pollution incident, including flood risks; • Confirmation of the number and specification of spill kits which shall be carried by the Contractor; • Information on clean-up procedures as specified above under 'Spill Control	

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		Measures'.	
	Minimising habitat loss in protected sites	A Mobile Elevated Working Platform (MEWP), parked on Charlotte's Quay, will allow Contractors to access the limestone wall from the Abbey River side of the existing quay wall, whilst avoiding instream works. The Contractors will use a coring method (i.e. drilling from north to south), which will avoid any material from entering the Abbey River. This will avoid any disturbance to QI bryophyte communities located c.1 m below the proposed outfall location. There will be no pouring of concrete for the installation of the proposed outfall, albeit Contractors will be permitted to locally grout the finished outfall. The Ecologist will review and input to the method statement produced by the Contractor to ensure the method statement contains the specific measures identified in the previous paragraph. The Ecologist or other similarly experienced ecologist will then supervise the works to Charlotte Quay and direct or advise the Contractor as appropriate, to ensure the method statement and mitigation are implemented, and bryophyte communities and water quality of the Lower River Shannon SAC are protected.	
	Minimising effects of construction on specific species.	**Bats (Roosting)** The mitigation will be compiled into a derogation licence application and submitted to the Wildlife Licencing Unit (WLU) of the NPWS. The licence application will take account of any comments by relevant parties including the NPWS received in the course of An Bord Pleanála determination, and any relevant planning conditions. The mitigation in the derogation licence application will have regard for relevant guidance	

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		including the NPWS Bat Mitigation Guidelines for Ireland (Kelleher & Marnell, 2006). All measures in the derogation licence application will be subject to change having regard for the requirements of the NPWS including any licence conditions. Prior to construction, the Ecologist will notify the Contractor, who in turn shallmake all site personnel aware of, the structure to the rear of 9 Rutland Street known to contain roosting bats. The Ecologist will also notify the Contractor of the strict legal protection applicable to bats and their roosts, and input to the construction programme including phasing of structural works, having regard for relevant licence conditions. A notice will be erected at 9 Rutland Street to identify it as a legally protected bat roost to ensure no works take place unless clear instruction is given from the Ecologist that it is safe and legally compliant to do so. Contractors will receive training by the Ecologist to advise them what to do in the event that bats (whether live or dead) are discovered in structures during works (i.e. stop works when it is safe to do so and contact the Ecologist). Subject to any licence conditions, any works to 9 Rutland Street will be carried out outside the summer months (i.e. from 1st September to 1st May only). This has been determined to be appropriate for a summer roost, which is not a proven maternity site, having regard for NPWS guidance (Kelleher & Marnell, 2006). This timeline may change subject to the requirements of the	

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		NPWS and conditions of any derogation licence issued by them. The Contractor(s) will be informed of any such changes to timelines. Even when carried out during the recommended season, works to 9 Rutland Street will be completed with the expectation that bats may be found, and having regard for any licence conditions. Caution will be exercised during the removal of any roofing material from 9 Rutland Street as bats may be underneath even in winter. Where required, the Contractor will remove tiles of 9 Rutland Street by hand. If bats are found, all works will cease, until the Ecologist has been contacted, and the Ecologist has in turn contacted the NPWS WLU. As shown in Figure 16.3 (and Drawing OPRA-ACM-Z3B-ZZ-DR-AR-13001), a total of 1 no. 'bat brick' to the specification of "Habibat Bat Box - Custom Brick Facing[50]" or equivalent and 1 no. 'bat tile' to the specification of Habibat Bat Access slate[51] or equivalent have been included in the design of 4 and 5 Rutland Street respectively, which is located close to the existing roost site in 9 Rutland Street. The bat brick and tile have been incorporated into 4 and 5 Rutland Street in a location where there is no obstruction to bat flight. Uplighting will be excluded from the façade of these structures. Prior to commencement of construction, the Ecologist will be consulted regarding the phasing of demolition of the roost at 9 Rutland Street. Where the	

[50] Available from: http://www.nhbs.com/title/183578/habibat-bat-box-custom-brick-facing . Accessed December 2018.
[51] Available from http://www.nhbs.com/title/192461/habibat-bat-access-slate. Accessed December 2018.

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		Ecologist deems it necessary, or as per any licence requirements, provision may be made for a temporary roosting structure in the vicinity of 9 Rutland Street (e.g. bat box to appropriate specification), to ensure continuity of roosting provision until the (permanent) bat brick and tile are installed. As annotated on Figure 16.3 (and Drawing OPRA-ACM-Z3B-ZZ-DR-AR-13001), Breathable Roofing Membranes (BRMs) will not be installed into the roof of 4 or 5 Rutland Street. Only bituminous roofing felt that does not contain polypropylene filaments, or similar to be agreed with a bat ecologist, will be used. For example, bitumen felt type 1F, which is reinforced hessian. Water tanks sited within roof spaces will be permanently covered to prevent future accidental drowning of bats. **Bats (Foraging)** No planting is proposed in addition to that in the landscape planting plan which includes, in Bank Place, native Alder trees and some flowering plants (e.g. *Salvia nemorosa*) would provide nectar for bees and insects. These in turn, would provide food for birds and bats. Mitigation to minimise the potential impacts of lighting on foraging and roosting bats is proposed in Section 16.5.2.3. **Nesting Birds (including Swifts)** Structural works to building exteriors will not be carried out between March and August inclusive, unless otherwise agreed with the Ecologist. Where the construction programme does not allow this seasonal restriction	

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		to be observed, buildings will be surveyed by a suitably experienced ecologist for the presence of nesting birds prior to commencement of demolition works. In the case of roof-nesting gulls, a Mobile Elevated Working Platform may be required to visually inspect roofs, if adequate views are not available from ground level or adjacent buildings. Nesting bird surveys will follow the species-specific guidance in the British Trust for Ornithology's Field Guide to Monitoring Nests (Ferguson et al, 2011). Where nests are found within structures to which works are proposed, or within the potential ZoI of indirect disturbance as determined by a suitably experienced ecologist, the suitably experienced ecologist will advise the Contractor(s) if a licence is required from the NPWS to permit disturbance and/or removal of any nests, or if works must be delayed until nesting has been shown to have finished, following survey by a suitably experienced ecologist. Structural works to buildings found not to contain nests, shall be completed within three days of bird surveys, or repeat nesting surveys will be required. **Nesting Swifts (Additional Measures)** As shown in Figure 16.3 (and Drawing OPRA-ACM-Z3B-ZZ-DR-AR-13001), one swift brick with starling barrier to the specification of 16S Schwegler Swift Box (with Starling Barrier)[52]" or equivalent has been incorporated into the design of the	

[52] Available from http://www.nhbs.com/title/177997/16s-schwegler-swift-box-with-starling-barrier Accessed 31st May 2017.

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		façade of No. 5 Rutland Street. Grids will be installed on any ventilation holes on the building exterior, and this must be implemented from September to April inclusive during the non-breeding season to avoid unwanted occupation by birds of other sites in buildings during the breeding season.	
	Role of the Ecologist	The Employer's Representative (ER) Team shall engage a suitably experienced ecologist (the Ecologist). The Ecologist will be a full member of a relevant professional institute such as the Chartered Institute of Ecology and Environmental Management (CIEEM), have relevant experience in the management of ecological constraints during construction, and hold or have held a protected species licence (s) in the Republic of Ireland. The Ecologist shall be appointed sufficiently in advance of construction to arrange for any mitigation requirements (including licensing) to be incorporated into the Contractor's site-specific Method Statements and programme. The Contractor will accommodate the Ecologist, whose role will be to: • Communicate relevant findings to LCCC, and other stakeholders as relevant; • Advise the Contractor on phasing of relevant works (including structural works in relation to nesting birds and roosting bats); • Review Contractor Method Statements for compliance with the mitigation in this EIAR, and any licenses to avoid damage or disturbance	

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		to designate sites or protected species; and, • Attend site meetings and input to Contractor toolbox talks prior to commencement of construction.	
	Bird strike mitigation		In the absence of evidence to the contrary, in the light of best available scientific knowledge, *flashing green lights [emphasis added]* shall be installed on the proposed tower at Bank Place, and be maintained in good working order throughout building operation. Prior to procurement of the proposed (flashing, green) lighting system, an ecologist with relevant credentials in the technical field of bird collision mitigation will review this measure, in the light of peer-reviewed scientific evidence published since the production of this NIS. In the event where new scientific evidence on lighting mitigation for bird collision conflicts with this measure, the ecologist will advise the relevant planning authority as appropriate and advise on any changes in light colour or other parameters required to minimise the potential for strike risk.
	Bat mitigation		Uplighting has not been included on the façade of 4 and 5 Rutland Street. The lighting specification proposed at Bank Place on the northern boundary of the proposed development site where it borders the Abbey River has been amended to have a maximum Kelvin value of 3000, low-pressure sodium lights in preference to high pressure sodium lights or mercury lamps, and luminaires mounted on the horizontal with an upward light

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			ratio of 0%.
Archaeological and Cultural Heritage	Identifying archaeology under buildings once demolished.	A targeted programme of archaeological test trenching will be carried out following the demolition of structures proposed for removal and prior to any intrusive enabling works, including the insertion of the secant piled walled around the perimeter of the site. The programme of testing will allow for an assessment of the presence, location, extent, value and sensitivity of potential archaeological remains at the site. This work will be carried out by a qualified archaeologist, under licence from the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht. Archaeological mitigation, such as monitoring or excavation, may be required dependant on the results of this investigation. Full provision will be made available for the resolution of any archaeological remains, both on site and during the post excavation process, should this be deemed the appropriate manner in which to proceed.	
Architectural Heritage	Mitigation for Parcel 3B – 4 and 5 Rutland Street	The shopfront and limestone door case to No. 5 to be retained and restored to best conservation practice. The modern shopfront to No. 4 will be replaced. Removal of the existing shopfront to be monitored to ascertain whether earlier joinery is retained behind. Limestone window sills to the front elevation of No. 4 to be retained. Rear return to No. 5 to be retained. Balconies to be glazed to rear elevation of No. 5 to minimise visual impacts. Aluminium and uPVC windows to be replaced with multiple pane	

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		timber sash windows. All surviving historic internal fittings to No. 5 Rutland Street to be retained, including in particular the staircase (to be repaired), architraves, dado rails and ceiling plasterwork. The proposed new doorways off the landings of the staircase in to No. 4 are proposed in order to allow for the retention of the original floor plan of No. 5 to each floor level.	
	Building specific mitigation for Parcel 3A/4 – 8 and 9 Rutland Street, Town Hall (Protected Structure)	The buildings will be interconnected at ground and third floor levels only where existing levels allow, in order to retain the original floor levels of all three buildings. The main rooms of the town hall will be restored with later partitions removed and the floor plan retained. The existing open well staircase and vaulted cellars to the basement of the town hall will be also be retained. The staircases to Nos. 8 and 9 will be retained as will existing floor levels which will maintain the relationship to the windows of the front elevation.	
	Building specific mitigation for Parcel 2B (9 Ellen Street)	Best conservation practice will be followed for the repair of stonework, roofs and other external fabric. Timber sash windows to the Ellen Street elevation will help to restore the historic character of the building and will have a positive impact on the streetscape. The large internal spaces will be retained with little subdivision or partition which will retain the character of the building internally. Surviving features such	

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		as columns, colonnade, existing panelled doors and flagged basement area etc. will be retained.	
	Building specific mitigation for Parcel 6 (The Granary – Protected Structure)	Proposed works will avoid any physical impact on the vaulted ceiling over the ground floor, carriage arch to Bank Place, or main street elevations. The proposed new external staircase to the courtyard shall be designed to minimise loss of existing fabric to the west elevation and to require minimal intervention to the walls of the granary for construction. Best conservation practice shall be followed for any works carried out to the historic building, including to its structure, roof and external stonework. Landscaping materials for the proposed works to the courtyard of the granary shall be sensitive to the character of the historic building.	
	General mitigation associated with historic buildings on the Opera site	An accredited Conservation Architect will be appointed to oversee all works on the site and should be present from the commencement of the project. No works, including opening up, stripping out or demolition works shall be carried out to the existing buildings on the site without the appointment of a Conservation Architect. All existing records and documentation of the existing buildings shall be updated by the findings of opening up and stripping out works. There may be some instances where the scope of recording work will be widened to include detailed record drawings and some material and finishes analysis. Only once these	

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		inspections and records have been completed shall the contractor continue with any demolition work as allowed in the planning permission. Prior to commencement of works, a method statement will be provided by the Conservation Architect for the recording and dismantling of the doorcase at 6 Rutland Street to include details for safe storage and reinstatement in location indicated on the planning drawings. Other items and features of architectural heritage value to be removed from site will be recorded in detail prior to dismantling. This to include the area to the rear of the Town Hall and the gateway adjacent to the Granary Building. Prior to the commencement of works, a detailed methodology will be prepared by the Conservation Architect and Structural Engineer appointed to the project for the existing buildings on the site, during and after demolition works, from damage caused by vibration, construction traffic, water ingress and other factors which may accelerate their deterioration in condition. With the exception of No. 6 Patrick Street, all existing Georgian buildings will be retained to the Opera Site. Areas of physical impact on the existing buildings in the form of demolition are concentrated in a small number of areas, principally to the rear elevations where additions and alterations to the original buildings have accumulated over the years. The principal elevations of the	

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		historic buildings will be repaired using best conservation practice. The external stone work and brick work of the historic buildings will be repaired and repointed as necessary, using a suitable mortar mix as per Conservation Architect's instruction. The historic roofscapes of all existing buildings are to be retained, including brick parapets, pitched roofs and brick/stone chimney stacks. All proposed new building elements are designed to the rear of these buildings and will not necessitate alterations to the historic roofs. There are a small number of surviving historic timber sashes to the buildings. These sashes will be repaired where possible and the surviving glazing bars used to provide suitable profiles for replacement sash windows for the front elevations of the Georgian terraced buildings. The existing historic buildings to the site (with the exception of the granary building) are in poor, or extremely poor, repair with regard to their structure and/or historic fabric. All buildings have been carefully inspected, and those found to retain significant historic internal fabric have been recorded and will be repaired in a sensitive manner, with internal fittings and fabric reused where condition allows. Existing floor levels to all historic buildings are to be retained, allowing for a meaningful relationship internally between the floor plans, individual rooms and the historic fenestration pattern. All historic buildings will retain small retail uses to the ground floor, having active shopfronts,	

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		and will retain independent access from the street to the upper floors, regardless of whether the buildings have been integrated with new buildings to the rear. Where historic shopfronts, or elements of shopfronts, survive, these will be retained and repaired. Existing laneways and carriage arches from the streets to the interior of the site will be maintained and remain open to provide access to the buildings and public plaza within the site. Historic fabric found to these laneways, such as cobblestones or setts, wheel guards, decorative grills or other street furniture should be preserved and reused in situ. All new buildings are designed in a contemporary manner and will allow the existing historic buildings to be easily read within the new streetscapes. Proposed alterations to the rears of historic buildings will have a light touch, minimising damage to the historic fabric of the rear elevations, and with maximum glazing to allow views of the original rear elevations. The proposed materials for the new buildings reference the existing historic building fabric on the site without attempting to reproduce any architectural details of the historic buildings, allowing the Georgian buildings to retain their own character and significance. The variety of materials used in the construction of the historic buildings which includes ashlar limestone, rubble stone and brick is reflected in the contemporary materials proposed as finished to the new structures. Detailed fabric analysis and	

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		recording of the historic fabric of the individual buildings should be carried out prior to the commencement of work in order to establish the nature and location of significant surviving fabric and architectural features. These records shall include drawings (elevations, plans and sections) at appropriate scales and in addition to recording historic fabric should detail condition issues such as deflections in brickwork, cracking to masonry (internal and external), fissures in ceilings and faults to flooring. These records shall be supplemented by photographs illustrating the issues. This detailed analysis of the condition of the buildings will supplement the existing structural condition reports and assist in determining the extent of historic fabric which can be retained and in pricing remedial works.	
Microclimate	Wind Mitigation		The proposed wind mitigation includes: • Porous Gate to Western Courtyard • Tower skirt • Southern Courtyard planting • Canopy above carpark entrance/exit • Planting in the eastern courtyard • Retention of a door to the eastern courtyard Trees in Bank Place

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