Project No. 13.05/2022

RW Nowlan
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Chartered Planning & Property Advisors

Environmental Impact Assessment Report

Part 1 – Non-Technical Summary

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Part 2 – Main Chapters

RE: Ballykeeffe, Raheen, Co. Limerick SHD Application to An Bord Pleanala

DATE: February 2021

on behalf of: DW Raheen Developments Ltd.

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NON TECHNICAL SUMMARY

Chapter 1 – Introduction

This Environmental Impact Assessment Report ('EIAR') has been prepared by RW Nowlan and Associates on behalf of DW Raheen Developments Ltd., who intend to apply to An Bord Pleanála (ABP) under the Planning and Development Act 2000 (as amended by the Residential Tenancies Act 2016) for a strategic housing scheme located in Raheen, Co. Limerick. The application is being made under the Strategic Housing Provisions of the Planning and Development (Housing) and Residential Tenancies Act, 2016.

The Proposed Development

The applicant, DW Raheen Developments Ltd., is seeking a ten year permission for development of 384 residential house and apartment units on a site of 10.44ha located in Ballykeeffe, Raheen, Co. Limerick.

The site is greenfield land that is enclosed by existing residential development to the south and east, the R510 to the west and open land to the north. Access to the site is provided by an existing entrance off a roundabout on the R510 regional road.

The proposed development will provide as follows:

- 202 no. housing units, comprising a variety of forms to include bungalows, detached, semi-detached and terraced houses. A mix of house sizes are proposed to include 20 no. two bedroom houses, 156 no. three bedroom houses and 26 no. four bedroom houses.
- 182 apartment and duplex units across 25 small scale blocks, 2 to 4 storeys in heights, throughout the development. The apartments and duplexes provide a mix of one, two, three and four bed units, comprising of 10 no. four bedroom duplex units, 10 no. three bedroom duplex units, 6 no. two bedroom duplex units, 18 no. three bedroom apartments, 92 no. two bedroom apartments and 46 no. one bedroom apartments.

The proposed development also includes;

- A childcare facility measuring 761.75m^2, providing 79 childcare places (55 full time and 24 after school places), located at the south-western edge of the development.

- The provision of 377 no. car parking spaces and 311 secured bicycle parking spaces.
- The provision of 3 no. ESB sub-stations, ancillary services and infrastructure works including foul and surface water drainage, attenuation areas, landscaped public open spaces (approximately 29,500m^2, or 28.2% of the total site area), landscaping, lighting, internal roads, cycle paths, and footpaths.

Legislative Context

The proposed development has been screened for EIA in accordance with the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018), in accordance with the EIA Directive. Section 172(1) of the Acts sets out the requirement for EIA. Mandatory EIA is required for Projects listed in Part 1 of Schedule 5 of the Planning and Development Regulations 2001-2020 ("the Regulations"), referred to as Annex I Projects, in accordance with the EIA Directive.

The Project is not listed within Part 1 of Schedule 5 of the Regulations and therefore mandatory EIA is not required in this instance. With respect to Part 2 of Schedule 5 (Annex II Projects), the Project has been assessed against the following relevant criteria;

Class 10 – Infrastructure Projects Class 10(b)(iv): "Urban development which would involve an area greater than 2 hectares in the case of a business district, 10 hectares in the case of other parts of a built-up area and 20 hectares elsewhere".

In summary, this project relates to a site of 10.44 hectares and is located within an area which falls under the definition of "other parts of a built-up area". As the application site exceeds the stated threshold of 10 hectares, it is considered that the proposed development requires an EIAR in respect of this Class.

EIA Guidance

The Environmental Protection Agency (EPA) published its 'Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, August 2017), and these draft guidelines have been used in the compiling of this EIAR.

In preparing this EIAR regard has also been taken of the provisions of the 'Guidelines for Planning Authorities and An Bord Pleanála on Carrying out Environmental Impact Assessment', published by the Department of Housing, Planning and Local Government (DHPLG) in August 2018 to the extent these guidelines are relevant having regard to the enactment of the revised EIA Directive.

The European Commission also published a number of guidance documents in December 2017 in relation to Environmental Impact Assessment of Projects (Directive 2011/92/EU as amended by 2014/52/EU) including 'Guidance on the preparation of the Environmental Impact Assessment Report'. RW Nowlan & Associates has prepared the EIAR with regard to these guidelines also.

Purpose and Scope of the EIAR

This EIAR provides an assessment of the likely significant effects associated with the proposed strategic housing development.

It is important to distinguish the Environmental Impact Assessment (EIA) to be carried out by An Bord Pleanála, from the Environmental Impact Assessment Report (EIAR) accompanying the planning application. The EIA is the assessment carried out by the competent authority, which includes an examination that identifies, describes and assesses in an appropriate manner, in the light of each individual case and in accordance with Articles 4 to 11 of the Environmental Impact Assessment Directive, the direct and indirect effects of the proposed development on the following:

a) population and human health

b) biodiversity, with particular attention to species and habitats protected under Directive

92/43/EEC and Directive 2009/147/EC

c) land, soil, water, air and climate

d) material assets, cultural heritage and the landscape

e) the interaction between the factors referred to in points (a) to (d)

Structure and Content of the EIAR

This EIAR uses the grouped structure method to describe the existing environment, the potential impacts of the proposed development thereon and the proposed mitigation measures. Background information relating to the proposed development, consultation undertaken and a description of the proposed development are presented in separate sections.

The EIAR has been divided in to three parts;

Part 1 – This Non Technical Summary

Part 2 – The Main Body of the EIAR which contains 15 Chapters as follows;

- Introduction
- Alternatives Considered
- Description of Proposed Development
- Population and Human Health
- Biodiversity
- Land, Soil and Geology
- Water and Hydrology
- Air Quality and Climate
- Noise and Vibration
- Landscape and Visual Impact
- Traffic and Transportation
- Material Assets – Waste
- Cultural Heritage
- Interactions and Cumulative Impacts
- Summary of Mitigation and Monitoring Measures

Part 3 – Appendices – The appendices are numbered in accordance with the chapter they relate

Description of Likely Significant Effects and Impacts

This section sets out how the impacts/effects of the development may be described throughout the EIAR.

The criteria for impact characterisation (i.e. for describing effects / impacts) are as per the EPA 2017 EIAR Guidelines. The significance of an impact is determined through comparison of the character of the predicted impact to the sensitivity of the receiving environment / receptor as per the EPA 2017 Guidelines within the following categories;

Quality – Measurements of effects/impacts in terms of whether it is Positive, Neutral or Negative.

Significance – Extent of an impact/effect ranging from Imperceptible to Profound.

Extent and Context – Extent relates to the size of the area, population etc. that may be affected. Context describes how the effect/impact relates to the established baseline conditions.

Probability – How likely it is that an impact/effect will occur.

Duration and Frequency – How long and/or often the impact is expected to occur.

Type – The kind of impact expected i.e. an Indirect Impact is one that is not a direct result of the proposed development but may occur due to additional external factors.

Project Team

The Environmental Impact Assessment Report was completed by a project team led by RW Nowlan & Associates, who also prepared a number of the chapters. In accordance with EIA Directive 2014/52/EU, we confirm that the experts involved in the preparation of this EIAR are fully qualified and competent in their respective fields. Each has extensive proven expertise in the relevant field concerned, thus ensuring that the information provided herein is complete and of high quality. The individual members of the team and their respective inputs and competency are detailed both in Chapter 1 and in their respective chapters throughout the EIAR.

Difficulties Compiling the EIAR

No difficulties, such as technical deficiencies, lack of information or knowledge, were encountered in compiling any specific information contained in the EIAR.

Chapter 2 – Alternatives Considered

This Chapter of the EIAR provides an overview of how the proposed development has evolved to date. A number of alternative development options for the site were analysed, including a 'do nothing' option. The proposed development is located within lands which have been is zoned for Residential Development under the Limerick County Development Plan 2010-2016 and within the newly adopted Southern Environs Local Area Plan 2021-2027. This zoning designation is also proposed to continue in the Draft Limerick Development Plan 2022-2028. As such consideration of alternative sites for the construction of residential units proposed in this development was not considered necessary.

The design process was an iterative process, where findings at each stage of the assessment were used to further refine the design, always with the intention of minimising the potential for environmental impacts. The layout has also evolved through discussions with Limerick City and County Council at pre-application stage, and following receipt of An Bord Pleanála's Opinion at Section 5 pre-application discussion stage.

The proposed development provides for new residential development on lands zoned for residential use under the Limerick County Development Plan 2010-2016 which was subject to the SEA process and also within the Southern Environs Local Area Plan 2021-2027. As such, consideration of alternative sites for the construction of houses and apartments proposed in this residential development was not considered necessary.

During the design process, the layout and design of the proposed development evolved in response to architectural, landscape and environmental requirements and several iterations of the site layout and alternative designs were considered. Any difficulties from an architectural, landscape or environmental viewpoint were assessed and, where necessary, the design was amended to address the issues encountered.

The evolution of the current scheme was informed by consideration of environmental aspects; vehicular and pedestrian movements; maximisation of pedestrian connectivity through the site and protection of adjoining residential amenity. Furthermore, the final scheme has been directly influenced by the technical and specific issues raised in the Board's Opinion.

Chapter 3 – Description of Proposed Development

Site Context

The subject site (10.44 Hectares) is greenfield land zoned for residential development and currently in use as agriculture land. Access to the site is provided by an existing entrance off a roundabout on the R510 regional road. The site is largely circular in shape and is bounded by the following;

North – To the north of the development site are lands zoned for open space. These lands are owned by the applicant, DW Raheen Developments Ltd. A masterplan has been prepared for the future development of these lands should a change in the current zoning designation be achieved in the future.

South – The south of the development site is bounded by the Inis Mor Housing estate and the Ballinvoher housing estate to the south-eastern boundary. The proposed development includes houses on this boundary to reduce any impact of the development on the existing residential population.

East - The eastern boundary of the site is also bordered by the lands owned by the applicant but zoned for open space at present, as seen in the North section above. The south-eastern boundary of the site is characterised by rear garden walls of existing residential dwellings within the Ballinvoher estate

West – To the western boundary of the development site is the R510 Regional Road. The existing roundabout to the south-west will provide the access point to the proposed development. Across the R510 to the west is mainly undeveloped lands with some existing residential housing in the Ard Aulin estate.

Irish Water trunk mains for potable water & sewerage traverse the R510 regional road running from south to north. The River Shannon/Estuary is located approx. 1.5 km to the north and the Ballinacurra Creek is located approx. 1 km to the east. Both have flood protection embankments which significantly reduce any risk of flooding on the subject site. Bunlicky lake is also located approx. 400m to the north of the site.

Proposed Development

The proposed development description is set out in the statutory notices as follows;

DW Raheen Developments Ltd. are seeking a ten year permission for a strategic housing development consisting of the provision of 384 residential house and apartment units on a ca. 10.44 hectare site located in Ballykeeffe, Raheen, Co. Limerick.

The site is greenfield land that is enclosed by existing residential development to the south and east, the R510 to the west and open land to the north. Access to the site is provided by an existing entrance off a roundabout on the R510 regional road.

The proposed development will provide as follows:

- 202 no. housing units, comprising a variety of forms to include bungalows, detached, semi-detached and terraced houses. A mix of house sizes are proposed to include 20 no. two bedroom houses, 156 no. three bedroom houses and 26 no. four bedroom houses.
- 182 apartment and duplex units across 25 small scale blocks, 2 to 4 storeys in heights, throughout the development. The apartments and duplexes provide a mix of one, two, three and four bed units, comprising of 10 no. four bedroom duplex units, 10 no. three bedroom duplex units, 6 no. two bedroom duplex units, 18 no. three bedroom apartments, 92 no. two bedroom apartments and 46 no. one bedroom apartments.

The proposed development also includes;

- A childcare facility measuring 761.75m^2, providing 79 childcare places (55 full time and 24 after school places), located at the south-western edge of the development.
- The provision of 377 no. car parking spaces and 311 secured bicycle parking spaces.
- The provision of 3 no. ESB sub-stations, ancillary services and infrastructure works including foul and surface water drainage, attenuation areas, landscaped public open spaces (approximately 29,500m^2, or 28.2% of the total site area), landscaping, lighting, internal roads, cycle paths, and footpaths.

A Natura Impact Statement (NIS) and Environmental Impact Assessment Report (EIAR) have been prepared in respect of the proposed development.

The proposed housing mix is set out in Table 3.1 below.

Unit Type	Studio	1 Bed	2 Bed	3 Bed	4 Bed	Total
Apartment	-	46	92	18	-	156
Duplex	-	-	6	10	10	26
Houses	-	-	20	156	26	202

Table 3.1: Proposed Dwelling Mix

Phasing

it is proposed to complete the overall development over four no. phases (in which phase 2 and 3 are broken down in to two sub-phases 'A' and 'B') of construction as shown below in Figure 3.1.

Figure 3.1: Proposed Development Phasing

The facilities and number of units to be completed in each phase is set out in Table 3.2 below. Note: In phases where a lower number of units are completed, there may be more substantial road area or services to be developed in that phase.

Phase	Elements to be Complete
Phase 1	45 no. Houses, 30 no. Apartments and 2 no. Duplex units. The creche facility will also be completed in this phase. Total = 77 no. units and creche
Phase 2 – 2A	34 no. Houses. Total = 34 no. units

Phase 2 – 2B	12 no. Houses, 30 no. Apartments and 2 no. Duplex units. Total = 44 no. units
Phase 3 – 3A	78 no. Apartments and 22 no. Duplex units. Total = 100 no. units
Phase 3 – 3B	83 no. Houses and 18 no. Apartments. Total = 101 no. units
Phase 4	28 no. Houses. Total = 28 no. units

Table 3.2: Breakdown of Units Provided in Each Phase of Development

Construction Stage

This application seeks a ten year permission for complete development of the proposed scheme. The relevant construction stage activities are discussed under the following headings;

- Site Establishment and Access
- Site Preparation
- Hoarding
- Site Security
- Working Hours
- Health and Safety
- Construction of New Buildings
- Traffic
- Waste Management
- Noise and Vibration
- Good Housekeeping

Site Establishment and Access

The first activity to be carried out at the site will be the establishment of site facilities and security. The location of the compound, associated haul roads and main site access point will be determined and agreed with the Local Authority prior to commencement of site works. All sub-contractors as well as the main contractor and project managers will occupy offices within the construction compound. The site parking for all staff, contractors and visitors will also be located in this area. The proposed site compound is intended to be accessed directly from the R510 regional road to avoid construction traffic driving through completed phases of the development to access the phase under construction.

Site Preparation

Initially the site will be securely fenced, and a construction compound will be established. Top soil will be stripped back and either stockpiled on site for pending re-use where feasible in landscaped areas or removed off site to a permitted or licensed facility as part of a recovery operation. This will be done in accordance with all relevant statutory requirements.

Site stripping will be kept to a minimum in line with the phasing plan. A project programme will be developed for each phase of the project taking cognisance of the recommendations of the EIAR and NIS.

A Construction and Environmental Management Plan (CEMP,2022) has been prepared by Hutch O'Malley Consulting Engineers and submitted under a separate cover with this application. The CEMP details extensive measures in relation to good practice that shall be implemented during site preparation works.

Hoarding

Construction phases will be closed off using hoarding which will be constructed before any significant development works commence on site for that phase. The proposed hoarding will be standard in nature consisting of mounting posts would be set in concrete, with horizontal rails and metal sheeting. It is intended that where practicable, hoarding will be retained and re-configured for re-use between working areas as construction progresses. Good practice standards will be implemented in relation to construction/removal of hoarding as appropriate throughout the construction phase of development.

Site Security

Security will be the responsibility of the contractor who will provide adequate security to prevent unauthorised entry to or from any working areas. Robust security measures will be put in place to prevent unauthorised access at all times which will include;

- Installation of CCTV and alarm system with remote access, two-way communication and appropriate backup storage;
- Provision of adequate security patrols during out-of-hours and holiday periods;
- Providing manned access control at the main site access.

- Liaison with local community groups, An Garda Síochána and Limerick City and County Council when setting up security plan

Working Hours

The site working hours would be stipulated in the planning conditions attached to a grant of permission. As standard, the working hours envisioned for development on site are the following;

Monday to Friday – 7:00 to 19:00

Saturday – 7:00 to 14:00

Sunday and Holidays – No works on site

It is not intended that any works would be undertaken outside of the above hours of operation. However, should this be absolutely unavoidable in any instance, any working hours outside the normal construction working hours will be agreed with the planning authority.

Health and Safety

In accordance with the statutory requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013, a Health and Safety Plan will be prepared prior to commencement of development. This plan will include measures such as;

- Construction Health & Safety training requirements
- Induction procedures
- Emergency protocols
- Details of welfare facilities
- Risk assessments and Method Statements.

All workers and visitors will be required to wear appropriate personal protective equipment prior to going on to the site and will undergo a safety briefing by a member of the site safety team. All PPE to be level assessed for its appropriateness for particular tasks.

Regular site safety audits will be carried out throughout the construction programme to ensure that the rules and regulations established for the site are complied with at all times.

Construction of New Buildings

The proposed development includes apartment units, duplex units, houses and a creche building. In addition, it is proposed to provide substantial communal and private landscaped open green area including play areas. All buildings will be constructed in accordance with current building regulations and certified by an appropriate Architect during and upon construction completion. Construction materials will be sourced locally where possible.

Traffic

Recommendations in relation to the management of Traffic during the construction phase of development are set out within the Construction and Environmental Management Plan and the Traffic and Transportation Chapter of this EIAR (Chapter11).

Waste Management

A specific Construction and Demolition Resource Waste Management Plan has been prepared by AWN Consulting and is included within this EIAR as Appendix 12.2. This report includes measures to be undertaken to minimise the quantity of waste produced at the site and the measures to handle the waste in such a manner as to minimise the effects on the environment.

Adherence to the Waste Management Plan will ensure that the management of waste arising is dealt with in compliance with the provisions of the Waste Management Acts 1996 – 2015 and amendments. The waste management hierarchy to be adopted will be as follows:

1. Prevention and Minimisation
2. Reuse of Waste
3. Recycling of Waste:
4. Disposal

The Construction Manager will have overall responsibility for ensuring that procedures put in place in relation appropriate waste management requirements are adhered to on site at all times.

Noise and Vibration

Chapter 9 of this EIAR provides a full assessment of the potential impacts in terms of Noise and Vibration during construction phase of the overall development. Recommendations are made in this chapter based on best practice operational and control measures for noise and vibration from construction sites are found within BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2

Good Housekeeping

Full details of the good housekeeping measure to be implemented on site during construction phase are set out within the Construction and Environmental Management Plan (202**2**) prepared by Hutch O'Malley Consulting Engineers and included in this application under a separate cover.

The Construction Manager will have overall responsibility for ensuring that procedures put in place in relation appropriate waste management requirements are adhered to on site at all times.

Operational Stage

The most significant environmental effects are expected to arise during the construction phase. The operational phase of the proposed Project – which will entail aspects associated with the standard operation of a large-scale, residential development with public realm and crèche and residential amenity areas – is therefore relatively benign. Relevant aspects of the operational phase are discussed in the respective specialist chapters, as appropriate.

Chapter 4 – Population and Human Health

This section of the Environmental Impact Assessment Report (EIAR) describes the potential impacts of the proposed development on human beings, population and human health and has been completed in accordance with the guidance set out by the Environmental Protection Agency (EPA) in 'in particular the Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, August 2017).

One of the principal concerns in the development process is that people, as individuals or communities, should experience no diminution in their quality of life from the direct or indirect impacts arising from the construction and operation of a development. Ultimately, all the impacts of a development impinge on human beings, directly and indirectly, positively and negatively. The key issues examined in this section of the EIAR include population, human health, employment and economic activity, land-use, tourism, noise and health and safety.

Potential Impact

Do Nothing Impact

If the proposed residential development were not to proceed, there would be no change to the existing environment. The potential for additional investment and employment in the area in relation to the construction and operation of the proposed residential site would be lost. It is considered that the 'Do Nothing' impact would be permanent, negative, and slight as the proposed development site is zoned for residential development and will contribute to the much-needed housing stock of Limerick.

Population

Construction Phase

During the construction phase of the proposed project, it is unlikely that there will be any significant impact upon the local population. The construction phase will result in a number of workers at the site, however, it is not envisaged that their place of residence will change as a result of the development, it is envisaged that construction workers would travel from their existing place of residence rather than moving, temporarily, to the area surrounding the site.

As a result, the impact on the local population during the construction phase is considered to be neutral, not significant and temporary in nature and therefore, no significant impacts are expected to arise in this regard.

Giving consideration to local residents, it is predicted that there may be some impacts which are likely to be associated with construction traffic, nuisance and disturbance. Such impacts are dealt with separately and assessed elsewhere in the EIAR and are considered to be short term, negative impacts. The level of impact predicted above is considered to align with the normal disturbance associated with the construction industry where a site is efficiently, sensitively and properly managed in the context of surrounding existing neighbouring development.

Operational Phase

The proposal includes 156 no. apartment units, 26 no duplex units and 202 no houses. Table 4.1 below shows the breakdown of unit type proposed. Based on the Average household size identified in the 2016 Census of 2.75, the projected population for the new development is estimated as 1,056 for the apartment, duplex and housing provided.

Unit Type	Studio	1 Bed	2 Bed	3 Bed	4 Bed	Total
Apartment	-	46	92	18	-	156
Duplex	-	-	6	10	10	26
Houses	-	-	20	156	26	202

Table 4.1: Breakdown on Unit Type by Size

The above estimated additional residents will be a significant increase to the existing local population. The development will provide much needed residential accommodation in the Limerick area in line with current Local, Regional and National planning policies.

The introduction of additional residents to the local area will support the existing community and social infrastructure. The proposed childcare facility, designed to accommodate the projected demand for childcare places resulting from the development, will mitigate any pressure upon existing childcare facilities. Please refer to the Childcare Demand Analysis submitted under a separate cover in this application for further details on projected childcare demand resulting from the proposed development.

As such, it is considered that the proposed project will have a positive, significant and permanent impact on the local population.

Land Use and Settlement Patterns

Construction Phase

The proposed development complies with zoning policies contained within the Limerick City Development Plan 2010-2016 (as amended) as well as National and Regional policies relating to land use, compact development and provision of housing.

The construction phase will comprise of earthworks and construction works and will not have any impact on the residential amenities, rights of way or existing pedestrian and cycling routes. There will be some short term negative impact in terms of visual amenity as discussed further in the Landscape and Visual Amenity chapter in this EIAR but this is considered standard to construction activities and will only occur during the construction phase of development.

Operational Phase

The subject site is undeveloped at present and zoned for residential development within the Limerick City Development Plan 2010-2016 and the proposed development would enable 162 no. apartment units, 20 no duplex units and 202 no houses to be provided in a prime location.

As such, it is considered that the proposed development, once complete, will positively impact on land use and settlement patterns in the area through provision of much needed housing on a prime site that is zoned for such development and underutilised at present.

Economic and Employment Activity

Construction Phase

The construction phase of the development will have a positive impact in terms of economic and employment activity in the local area. The most notable benefit will be to the construction and building service sectors. The positive impact to these sectors is predicted to last for the duration of the construction stage over the three phases as outlined in Chapter 3 above. There will also be indirect economic benefits to local service and retail sectors during this time.

The number of workers on site is predicted to fluctuate during different stages of the development process but the construction manager and their team will be present on site during the whole process.

Overall, it is considered that proposed development will result in a positive, short term benefit in terms of economic and employment activity within the local area.

Operational Phase

The operational phase of the development will result in 156 no. apartment units, 26 no duplex units and 202 no houses and a creche. This will likely result in increased spending in the local economy and utilisation of local services. The creche and retail units will also provide a small number of employment opportunities.

It is considered that the operational phase of the development will result in a long term, positive impact on economic and employment activity in the local area.

Social Infrastructure

Construction Phase

It is not anticipated that any social infrastructure will be provided on the site during the construction phase of development. As such, it is considered that there is a neutral impact in terms of social infrastructure in this case.

It is possible that workers on site may utilise local social infrastructure during this time but it is not anticipated that this will be frequent or cause any negative impact.

Operational Phase

As discussed above, the subject site is well served by existing social infrastructure. Residents within the proposed development would support local businesses and provide a boost to the local economy. It was assessed within the Childcare Demand Analysis report submitted under a separate cover in this application that a childcare facility should be provided within the development so as not to burden the local existing facilities which are recorded as close to capacity at present.

It is considered that the proposed development would result in a positive long term impact for the local social infrastructure through increased business and local participation.

Human Health

Construction Phase

The EPA Draft Guidelines (2017) sets out how human health should be considered through assessment environmental pathways through which health could be affected.

The relevant pathways in relation to human health during the construction phase are considered to be air quality, noise and vibration, water and soil. The expected air quality effects are detailed in Chapter 8 along with proposed mitigation measures to ensure the protection of human health. Similarly, the potential noise and vibration related impacts arising from the construction phase and associated mitigation measures are contained in Chapter 9.

As with all construction projects, there will be inherent health and safety risks at this stage of the development. In order to manage this, a Construction and Environmental Management Plan has been prepared by Hutch O'Malley Consulting Engineers (2022) for the application and is submitted under a separate cover, to ensure that the relevant health and safety legislation is complied with at all stages of the construction process.

Operational Phase

Given the nature of the proposed project, it is not likely that any significant impacts on health and safety will arise during the operational phase. The development has been designed to provide a safe environment for future occupiers and visitors. The public realm, inclusive of pedestrian paths, cycle paths, roads and communal open spaces, have been designed in accordance with the best practice and relevant planning policy standards.

Similarly, the proposed residential units are all designed in accordance with the relevant guidelines and standards and are capable of meeting all relevant building standards and regulations. Having regard to the above, it is considered that the proposed project will result in a high standard of health and safety for all residents and visitors.

Once operational, the proposed project will not result in any significant impact on human health and safety.

Mitigation

Construction Phase

The potential impacts upon human environment relate to other environmental factors such as air quality, noise and vibration and traffic. Where required, the related mitigation measures are dealt with in the corresponding chapters of this EIAR. Other than this, no significant adverse effects will arise in respect of the population during the construction or operational phase of this development.

Operational Phase

Once development is complete, the operational phase of the development is predicted to have a positive impact through provision of additional housing stock, a creche facility, small retail units and additional open space.

No risks to human health have been identified during the operation phase of the development. A management company will be put in place upon completion of development to manage the day to day maintenance of the development and ensure health and safety is prioritised within the development for the long term.

Predicted Impacts

Adherence to the mitigation and monitoring measures referred to above and throughout this EIAR will ensure that the proposed project will not give rise to significant adverse effects upon population and human health during the construction and operational phases of the proposed project. It is considered that once complete, the proposed development will have a positive impact for the local area.

Chapter 5 – Biodiversity

The ecological survey was carried out by SLR ecologist Michael Bailey MCIEEM in June 2021, and he also prepared this biodiversity chapter. SLR Technical Director Stuart Wilson MCIEEM CEnv carried out the technical review of the biodiversity chapter.

The site survey methods and ecological evaluation and assessment within this chapter have been undertaken with reference to the relevant parts of the 2019 Guidelines for Ecological Impact Assessment in the UK and Ireland developed by the Chartered Institute of Ecology and Environmental Management (CIEEM, September 2019).

Extensive field surveys were designed to provide a rapid assessment of the ecological features present or potentially present within the proposed development site and its surroundings, and address gaps in the baseline data obtain through desk study and to update existing records, a series of habitat and species surveys were undertaken. The scope and extent of the surveys was determined through review of the desk study information.

The Site ultimately drains to the River Shannon via two existing culverts and is therefore directly connected to the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA. Both of these Natura 2000 sites are considered to be within the zone of influence of the project as the proposed development will discharge to the existing culverts during construction and operation.

The effects of the construction and operation of the proposed housing development are likely to be localised in nature and would typically be limited to the Site or the area immediately adjacent to the Site. A precautionary approach a zone of influence of 2 km has been adopted for the purposes of this report.

The following Natura 2000 sites are located within 2 km of the Site and are considered to be within the zone of influence of the proposed development:

- The River Shannon and River Fergus Estuaries SPA (004077).
- The Lower River Shannon SAC (002165).

The potential impacts of the proposed development along with the proposed mitigation measures are outlined in the following sections.

Do Nothing Impact

In the absence of the proposed development, it is likely that the site would continue to be unmanaged and would be subject to further habitat succession. The Do-Nothing Impact will therefore result in no short-term significant change in the ecological interest of the Site.

Sites Designated for Nature Conservation

Potential Impacts

The hydrogeological review and assessment notes that the turlough is prone to flooding in winter months (to a depth of approximately 30 to 40 cm), but that in general it is reported to be drier in recent times due to drainage of the surrounding land rather than of the turlough itself. Any change in the ground water conditions could affect the characteristics of this turlough

Proposed Mitigation Measures

No specific mitigation is required as this pNHA is sufficiently distant from the Site such that there is no surface or ground water connection between the Site and this pNHA.

Significance of Residual Effects

There will be no residual effects on the turlough from the construction or operational phases of the proposed development.

Hedgerows – WL1

Potential Impacts

It is proposed to remove approximately 13 sections of hedgerow within the application site (refer to Tree Survey Report SLR 2021). This represents a significant proportion of the total length hedgerow within and around the existing application site. No external hedgerows on the boundaries of the proposed development area will be removed.

The removal of hedgerows will be significant at the Local Level.

Proposed Mitigation Measures

No specific mitigation measures are required outside that of the proposed planting scheme as described within the Landscape Specification submitted under a separate cover and the Landscape and Visual Impact Chapter of this EIA Report.

A hedge management plan should be prepared and implemented, as part of the future maintenance of the green spaces within the site.

Significance of Residual Effects

There will be a residual effect due to the loss of this habitat but with replacement planting as part of the landscape scheme for the development the residual effect is not considered significant.

Mixed Broadleaved Woodland - WD1

Potential Impacts

The proposed development will result in the loss of approximately 40 mostly mature/over mature trees.

Proposed Mitigation Measures

In compensation for the loss of trees / shrubs, the proposed development contains considerable proposals for native tree / shrub planting in both the internal designed public spaces, as well as the larger public open spaces along the northern and eastern boundaries. In the larger spaces, groups of trees / small woodland areas are proposed. Trees species proposed include native species such as alder, birch and rowan.

Significance of Residual Effects

When the replanted trees and scrubs trees in the open public spaces have become established, the effect is considered to be short-term and the residual effect is not considered significant.

Birds

Potential Impacts

The proposed development will result in the temporary loss of hedgerows and trees within the development site. This represents loss of potential nesting habitat for commonly occurring bird species.

Various red and amber listed species (see Table 5.2) have been recorded within the zone of influence but not on the Site itself which does not have the habitats to support these bird species.

Proposed Mitigation Measures

In compensation for the loss of trees and hedgerows, the proposed development contains considerable proposals for native tree / shrub planting in both the internal designed public spaces, as well as the larger public open spaces along the northern and eastern boundaries. In the larger spaces, groups of trees / small woodland areas are proposed.

Significance of Residual Effects

Over time the replanted trees and scrubs trees in the open public spaces will reached a certain size and maturity to attract nesting birds, and therefore the effect is considered to be short-term and the residual effect is not considered significant.

Overall it is concluded that the proposed housing development at Raheen will result in localised effects on the ecology of the Site. There will be no effect on any sites designated for nature conservation as a result of the proposed development. The habitats within the Site are commonly occurring, widespread and resilient in Ireland. There will be a loss of hedgerows and mixed broadleaved woodland habitats, and effects on the bird population which are all evaluated as important at the Local level. The landscape plan will aim to re-establish native tree and scrub areas in the public open spaces. The proposed development will not result in any significant effects on the biodiversity of the Site and provided the recommended best practice and mitigation is implemented it is considered that development will not result in any residual significant effects on the biodiversity of the Site.

Chapter 6 – Land, Soil and Geology

This EIAR chapter relating to Land, Soils and Geology was prepared by Paul Gordon (EurGeol PGeo) of SLR Consulting. Paul has a BSc in Geology and an MSc in Environmental Management and has over 20 years' professional experience.

Mitigation measures have been proposed within the Land, Soils and Geology Chapter. The proposed mitigation includes the following;

- A soil management plan will be put in place for the stripping and storage of soils and subsoils

- A spill kit will be retained on site during the construction phase. A spill kit will not be required during the operation phase.

Construction Stage

- During the construction stage, operations will adhere to Transport Infrastructure Ireland (TII) Specification for Road Works Series 600 – Earthworks.
- A Soil Management Plan (SLR, 2021) has also been developed for the proper management and care of soils and subsoils at the site. During the phased and final stages of construction, the stored soils and subsoils will be used to provide landscaping at the site.
- Topsoil will be stored separately to subsoils.
- Subsoils will be stored in such a way as to keep them free from contamination so that they can be used as clean, inert fill.
- Some limestone bedrock is likely to be removed and will be stored appropriately so that it can be used as clean, inert fill.

Operational Stage

During the operational stage it is not expected that there will be any further impacts on land, soil or geology at the site.

It is considered that subject to adherence with the proposed mitigation during the construction stage of development, no significant impacts will result from the proposed development.

Chapter 7 – Water and Hydrology

This chapter relating to Water and Hydrology was prepared by David O'Malley B.Eng Civil (Hons), MIEI, Director of Hutch O'Malley Consulting Engineers. David has been a practicing Consulting Engineer since 2007. He has experience in Structural Engineering, Civil Engineering, Planning Autority/Local Authority, Fire Certification, Noise & Vibration Assessment, Asset Survey/Taking In Charge, Road Safety Audits, Project Management.

The main fluvial watercourses are identified as the River Shannon/Estuary located c.1.5km to the north and the Ballinacurra Creek located c. 1km to the east. Bunlicky Lake which is a man-made lake is located c.400m to the north. Both the River Shannon and Ballinacurra Creek have flood protection embankments.

The site location is on the edge of Limerick City on the edge of groundwater sources; Limerick City South West and Limerick urban south-west part of the Shannon East South River Basin. Both are part of the WFD Limerick City Southwest groundwater body. The Water Framework directive doesn't identify any significant pressure for the groundwater body, however in 2008 it was identified as at risk. As such, it is identified as a protected area under Article 7 Abstraction for Drinking Water.

The transitional waters to the North are identified as 1a At Risk in the WFD, with agricultural influence to the Dock waters and Upper Shannon Estuary highlighted as Significant Risk. Limerick Dock water is also identified as having Hydromorphology pressure.

A Site Investigation Report has been prepared by Priority Geotechnical and is submitted under a separate cover with this application. The report has informed this chapter of the EIAR and details the trial holes and testing undertaken on the subject site. No high water table was encountered in the development footprint, and soil drainage was found to be poor. These are expected results given the fluvial till sub soil and permeability of the aquifer.

The surface water runoff impact from the proposed development is described under three headings;

- Impact of flood levels on proposed development
- Impact of development on lands downstream
- Impact of development on hydrogeological features

Impact of Flood Levels on Proposed Development

Existing ground levels vary from 1.0 M.O.D to 9.5 M.O.D. Proposed development dwelling levels have been established at minimum 5.7 M.O.D to accommodate design levels for foul and storm sewer. The lands lower than 5m OD are proposed to be retained at the current levels and any landscaping proposed is at grade. Therefore, there will be no impact of flooding on proposed development levels.

Impact of Flood Levels on Proposed Lands Downstream

The design approach has been to maintain or reduce the existing runoff rates. By providing the buffer of attenuation tanks, the impact of the development on downstream lands shall be negligible and most likely lead to reduced surface water flow.

Impact of development on hydrogeological features

A Soil Management Plan (SLR, 2021) and a Construction Environmental Management Plan (Hutch, O'Malley, 2022) have been prepared and submitted under a separate cover with this application and have informed this Chapter of the EIAR. It is not intended to repeat the information contained within these reports but it is considered that appropriate plans are in place to ensure control of any adverse silt, hydrocarbon or any other likely contaminants as a result of the proposed development.

Remedial and mitigation measures are set out for both the Construction Phase and Operational Phase of the development in relation to Water and Hydrology. The predicted impact of the proposed development following the implementation of the remedial and mitigation measures is as follows;

- Construction Phase - Implementation of the measures outlined will ensure that the potential impacts of the proposed development on water and the hydrogeological environment do not occur during the construction phase. The predicted impact, post mitigation measures, will be negligible.
- Operational Phase - As surface water drainage design has been carried out in accordance with appropriate policy methodologies, predicted impacts on the water and hydrogeological environment arising from the operational phase will be negligible.

Chapter 8 – Air Quality and Climate

This chapter was completed by Dr. Avril Challoner who is a Senior Environmental Consultant in the Air Quality section of AWN Consulting. She holds a BEng (Hons) in Environmental Engineering from the National University of Ireland Galway, HDip in Statistics from Trinity College Dublin and has completed a PhD in Environmental Engineering (Air Quality) in Trinity College Dublin. She is a Chartered Scientist (CSci), Member of the Institute of Air Quality Management and specialises in the fields of air quality, EIA and air dispersion modelling. She has experience with preparing air quality and climate impact assessments for EIARs for various residential, mixed-use, commercial and industrial developments.

Meteorological Data

A key factor in assessing temporal and spatial variations in air quality are the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels). Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted.

Shannon Airport meteorological station, which is located approximately 27 km west of the proposed development at the closest point, collects meteorological data in the correct format for the purposes of this assessment and has a data collection of greater than 90%. Long-term hourly observations at Shannon Airport meteorological station provide an indication of the prevailing wind conditions for the region. For data collated during five representative years (2016 – 2020), the predominant wind direction is south-westerly, with generally moderate wind speeds

Baseline Air Quality

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality in Ireland is "*Air Quality In Ireland 2020*" (EPA, 2021a). The EPA website details the range and scope of monitoring undertaken throughout Ireland and provides both monitoring data and the results of previous air quality assessments (EPA, 2021b). The EPA data provides a long-term data set for background air quality at a variety of locations throughout Ireland. The use of existing long-term data is considered best practice in air quality assessments (TII, 2011).

As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA, 2021b). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000, is defined as Zone D.

In terms of air monitoring and assessment, the proposed development is in Zone C (EPA 2022). The long-term EPA monitoring data has been used to determine background concentrations for the key pollutants in the region of the proposed development. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating etc.).

Worst Case Scenario

In terms of construction phase impacts, worst-case assumptions regarding volumes of excavation materials and number of vehicle movements have been used in order to determine the highest level of mitigation required in relation to potential dust impacts.

Worst-case traffic data was used in the assessment of construction and operational phase impacts. In addition, conservative background concentrations were used in order to ensure a robust assessment. Thus, the predicted results of the construction and operational stage assessment are worst-case, and the significance of effects is most likely overestimated.

Mitigation

Design Mitigation

The proposed development has been designed so as to reduce the impact on climate as much as possible during operation. The Building Lifecycle Report prepared as part of the proposed project and submitted under separate cover with this planning application details a number of design measures that have been considered in order to reduce the impact on climate wherever possible.

Construction Phase Mitigation

Air Quality

The pro-active control of fugitive dust will ensure the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released. A dust management plan will be implemented onsite. The main contractor will be responsible for the coordination and ongoing monitoring of the dust management plan.

Climate

Impacts to climate during the construction stage are predicted to be imperceptible however, good practice measures can be incorporated to ensure potential impacts are lessened.

Operational Phase Mitigation

The impact of the proposed development on air quality and climate is predicted to be imperceptible with respect to the operational phase in the long term. Therefore, no additional site specific mitigation measures are required beyond the site specific incorporated design mitigation.

Overall, it is considered that subject to adherence with the proposed mitigation measures, the impact of the development on Air Quality and Climate during construction phase will be short-term, negative and imperceptible at nearby receptors while at operational phase it will be imperceptible, negative and long-term.

Chapter 9 – Noise and Vibration

This assessment has been prepared by Mike Simms BE MEngSc MIOA MIET, Senior Acoustic Consultant at AWN, who has worked in the field of acoustics for 20 years. He has extensive experience in all aspects of environmental surveying, noise modelling and impact assessment for various sectors including, energy, industrial, commercial and residential.

This report includes a description of the receiving ambient noise climate in the vicinity of the subject site and an assessment of the potential noise and vibration impact associated with the proposed development, during both the short-term construction phase and the permanent operational phase, on its surrounding environment. The assessment of direct, indirect and cumulative noise and vibration impacts on the surrounding environment have been considered as part of the assessment.

In accordance with the Limerick Noise Action Plan (NAP), a complete assessment of inward noise impact has been incorporated into this EIAR chapter to comply with the appropriate policies.

An environmental noise survey has been conducted at the site in order to quantify the existing noise environment. The survey was conducted in general accordance with ISO 1996: 2017: *Acoustics – Description, measurement and assessment of environmental noise*.

In addition to the noise survey, proprietary noise calculation software has been used for the purposes of this impact assessment to calculate road traffic noise levels at various facades across the development site. The results of the noise survey were used to calibrate the noise model. It is concluded that the development site may be categorised as 'low to medium' risk and as such an Acoustic Design Strategy will be required to demonstrate that suitable care and attention has been applied in mitigating and minimising noise impact to such an extent that an adverse noise impact will be avoided in the final development.

Potential Impacts

The potential impacts of the proposed development are considered for the short-term construction phase and long-term operational phase.

Construction Stage

The largest noise and vibration impact of the proposed development will occur during the construction phase due to the operation of various plant machinery and HGV movement to, from and around the site. However, the construction phase can be classed as a short-term phase.

Taking account of the distance to the nearest sensitive off-site buildings, it is not anticipated that there will be any disturbance caused in relation to vibration. The potential vibration impact during the construction phase if of short-term, neutral and imperceptible impact.

Operational Stage

The main potential outward noise impact to the surrounding will be from additional vehicles on the surrounding road network and building services and mechanical plant serving the development.

Mitigation measures are included, where relevant, to ensure the proposed development is constructed and operated in an environmentally sustainable manner in order to ensure minimal impact on the receiving environment.

Residual Impacts

Construction Phase

For the nearest noise sensitive locations within 50m of the proposed development, negative, significant and temporary effects are likely. For the majority of noise sensitive locations at greater distances from the proposed development, negative, moderate and short-term effects are likely.

Operational Phase

With the application of mitigation measures for building services noise the range of potential noise levels is not expected to add significantly to the existing noise environment. The resultant noise effect from this source will be of neutral, not significant, permanent impact.

The predicted change noise levels associated with additional traffic is predicted to be of imperceptible impact along the existing road network. In the context of the existing noise environment, the overall effects from noise contribution of increased traffic is considered to be of neutral, imperceptible and permanent effect to nearby noise sensitive locations.

Chapter 10 – Landscape and Visual Impact

This chapter has been prepared by Cass Roche, the principal of PC Roche and Associates. Cass is a qualified Landscape Architect with over 20 years of experience. He holds a Diploma in Physical Planning from Trinity College Dublin, along with continued professional development courses in Computer Aided Design and Town Planning Development from University College Dublin. He is also a lecturer of Landscape Planning and Garden Design at Beechfield College. Cass is a full member of the Landscape Institute London.

The objective of this assessment is to demonstrate how the proposed development would sit within its physical landscape. It summarizes the impact of the proposed development on the landscape character, the visual amenity of the current site, and the adjoining environs. An outline of the guidelines and methodology utilised to assess the impacts and describe the receiving environment (baseline) and its potential impacts of the development is included.

A description of the site and surrounding lands demonstrate the landscape character and assist in assessing its visibility from significant viewpoints in the locality. This has been demonstrated through photomontages to give a perspective of how the proposed development would appear from several vantage points. The description of each viewpoint, along with consideration of mitigation measures to offset or ameliorate impacts are considered and the resultant residual impacts are outlined.

Chapter 11 – Traffic and Transportation

This chapter of the EIAR has been prepared on behalf of DW Raheen Developments Limited, by Matthew Steele BA (Hons) MSc FCILT FRGS MCIHT and Pamela Townley BSc (Hons), both Directors of TTRSA with over twenty years experience of assessing the traffic and transport impacts of development.

The main significance criteria when assessing traffic and transport impacts is the performance of affected junctions. Other criteria include, for example: any increase in road traffic collisions (which may result in environmental impacts due to spillage); likely damage to the road structure; and, measurable increases in noise and atmospheric pollutants.

The results of the assessment are summarised. The results show that in planning terms the proposed development will not have a material impact on the operation of the junctions assessed, whilst in environmental terms, the impact is slight.

To fully assess the impact of the proposed development on the local highway network, the operation of the following junctions has been assessed for the opening and future assessment years both without the development, and with the development, using ARCADY junction models (which are recognised by TII as being an appropriate software package for this type of assessment):

- The R510/Ard Aulin/site access roundabout junction;
- The R510/Mungret Road/Father Russell Road roundabout junction;
- The R510/N69/N18 roundabout junction; and,
- The N69/N18/Dock Road roundabout junction

The results of the assessment are summarised and the results show that in planning terms the proposed development will not have a material impact on the operation of the junctions assessed, whilst in environmental terms, the impact is slight.

The assessment predicts that the Mungret Road arm of the existing R510/Mungret Road/Father Russell Road (Quinn's Cross) roundabout junction will be operating 96% of capacity in the 2042 PM peak hour with the proposed development. This is due to the interaction of the roundabout with the zebra crossings present at this junction. If the congestion occurs as predicted within the traffic modelling, it can be mitigated through the replacement of the existing zebra crossings with light controlled pedestrian crossings.

Taking into account the analysis contained within this chapter, and mitigation measures proposed, the residual short-term and long-term traffic and transport related environmental impacts of the proposed development are <u>not significant</u>.

Chapter 12 – Material Assets – Waste Management

AWN Consulting Ltd. carried out an assessment of the potential impacts associated with waste management during the construction and operational phases of the proposed development. The receiving environment is largely defined by Limerick City and County Council as the local authority responsible for setting and administering waste management activities in the area through regional and development zone specific policies and regulations.

During the construction and demolition phase, typical C&D waste materials will be generated which will be source segregated on-site into appropriate skips/containers, where practical and removed from site by suitably permitted waste contractors to authorised waste facilities. Where possible, materials will be reused on-site to minimise raw material consumption. Source segregation of waste materials will improve the re-use opportunities of recyclable materials off-site. Completion of the construction of new foundations and the installation of underground services will require the excavation of between c.126,000m^3 of material, it is anticipated that this excavated material will be able to be reused onsite with a negligible amount needing to be exported off-site. Excavated material which is to be taken offsite will be taken for offsite reuse, recovery, recycling and/or disposal.

A carefully planned approach to waste management and adherence to the site-specific Construction and Demolition Resource Waste Management Plan (Appendix 19.1) during the construction phase will ensure that the effect on the environment will be **short-term, neutral** and **imperceptible**.

During the operation phase, waste will be generated from the residents as well as the commercial tenant. Dedicated communal waste storage areas have been allocated throughout the development for residents. The residential waste storage areas have been appropriately sized to accommodate the estimated waste arisings in both apartments, individual houses and shared residential areas. The commercial tenant (Childcare Facility) has their own commercial WSA allocated, separate from residential WSAs. The waste storage areas have been allocated to ensure a convenient and efficient management strategy with source segregation a priority. Waste will be collected from the designated waste collection areas by permitted waste contractors and removed off-site for re-use, recycling, recovery and/or disposal.

An Operational Waste Management Plan has been prepared which provides a strategy for segregation (at source), storage and collection of wastes generated within the development during the operational phase including dry mixed recyclables, organic waste, mixed non-recyclable waste and glass as well as providing a strategy for management of waste batteries, WEEE, printer/toner cartridges, chemicals, textiles, waste cooking oil, furniture and abandoned bicycles (Appendix 19.2). The Plan complies with all legal requirements, waste policies and best practice guidelines and demonstrates that the required storage areas have been incorporated into the design of the development.

Provided the mitigation measures outlined in Chapter 19 are implemented and a high rate of reuse, recycling and recovery is achieved, the predicted effect of the operational phase on the environment will be **long-term, neutral** and **imperceptible**.

Chapter 13 – Cultural Heritage

This Chapter was prepared by Rose Cleary. Rose graduated in 1980 with a BA degree in archaeology from University College Cork and subsequently undertook masters research on the Newgrange prehistoric pottery assemblage. Her research interests lie in prehistoric pottery, with a particular interest in ceramic technology, petrology studies and charactisation of clay sources. She is also involved in long-term research on the prehistoric archaeology of north Munster, with particular reference to the Lough Gur landscape. She has extensive fieldwork experience, having undertaken excavations at numerous prehistoric sites in that region. She has published widely on projects connected to pipeline and infrastructural projects, including urban regeneration schemes in Cork City.

The archaeological assessment is based on documentary and cartographic records and a site inspection. This information is used to predict the archaeological potential of the development site in terms of archaeological remains. Cartographic and documentary evidence indicates that there are no recorded archaeological monuments on the site. The site inspection did not detect any previously unknown archaeological sites. The nearest upstanding site is a small enclosure (RMP LI013-010) in Ballykeeffe townland to the west of the development. A seventeenth century house (RMP LI013-224) in the adjacent townland of Skehacreggaun is now levelled. A Holy Well (RMP LI013-009-006) also in Skehacreggaun townland was archaeologically excavated in 2004. There is therefore no direct impact on the known archaeological landscape.

There is no predicted impacts on any recorded archaeological site or feature. The proposed development may however, directly impact on previously unrecorded sub-surface archaeological remains. Archaeological mitigation measures and monitoring is recommended to mitigate any potential adverse impact on archaeological remains.

Chapter 14 – Interactions and Cumulative Impacts

In preparing the EIAR, each of the specialist consultants have and will continue to liaise with each other and will consider the likely interactions between effects predicted as a result of the proposed Project during the preparation of the proposals for the subject site and this ensures that mitigation measures are incorporated into the design process.

This chapter of the EIAR seeks to identify where the environmental factors examined in the above sections may be inter-related.

Population and Human Health

All environmental factors have the potential to impact on Population and Human Health. The potential impacts and appropriate mitigation measures have been examined in Chapter 4 of this EIAR. The most likely interactions with human health are considered to be the following chapters;

1. Land, Soils, and Geology
2. Water and Hydrology
3. Air Quality and Climate
4. Noise and Vibration
5. Landscape and Visual Impact
6. Material Assets – Waste
7. Traffic and Transportation

It is considered that once all mitigation measure recommended within this EIAR are incorporated within the final development, there will be no adverse impact on Population and Human Health.

Biodiversity

The habitats present within the Site are commonly occurring throughout Ireland and are evaluated to be either important at the Site and Local level or not important. Areas of potential interactions are considered;

1. Land, Soils and Geology;
2. Landscape and Visual Impact;
3. Water and Hydrology

The proposed development will not result in any significant effects on the biodiversity of the Site and provided the recommended best practice and mitigation is implemented it is considered that development will not result in any residual significant effects on the biodiversity of the Site

Land, Soil and Geology

Subject to implementation and adherence with mitigation measures proposed, there are no significant interactions or impacts relating to Land, Soil and Geology anticipated as a result from the proposed development.

Water and Hydrology

The earthworks for the site has the potential to impact on the surface water quality, by silt generated from runoff or chemicals/oils from construction vehicles carrying out the works. Potential health effects arise mainly through the potential for soil and ground contamination. The protection of the water environment will help to ensure that Human Health is not significantly impacted by the implementation of the SHD. The key areas of interaction in this case are identified as;

1. Population and Human Health;
2. Land, Soils and Geology;
3. Biodiversity

Subject to the implementation of the proposed mitigation measures during construction and operational phase of the development, there are no significant impacts predicted in relation to Water and Hydrology.

Air Quality and Climate

The most significant potential impacts to air quality are predicted to occur within the construction phase of the development. It is predicted that the impact on air quality from the operational phase of the development will not be significant. The most notable areas of interaction with Air Quality and Climate are:

- Population and Human Health
- Biodiversity
- Traffic and Transportation

Subject to adherence to the proposed mitigation measures, no significant adverse impacts are anticipated to result from the proposed development.

Noise and Vibration

Noise and vibration interacts particularly with human health, especially during the construction phase of the project where there is potential disruption due to increased activity on site and associated construction traffic. Additional noise is also associated with the operational phase where additional traffic is predicted.

The key areas of interaction are therefore considered to be:

Article I. Population and Human Health
Article II. Roads and Traffic

Subject to adherence to the proposed mitigation measures, no significant adverse impacts are anticipated.

Landscape and Visual Impact

The long-term effects of the proposed development will have a positive effect the landscape of the local area and is to include use of native species planting. The proposed project generates visual significant effects as the subject site is currently undeveloped lands with existing hoarding surrounding the site. The key areas of interaction are considered to be:

1) Population and Human Health
2) Biodiversity

Subject to adherence to the proposed mitigation measures, no significant adverse impacts are anticipated in relation to Landscape and Visual Impact.

Traffic and Transportation

The changes to traffic in the surrounding area during both the construction and operational phase of the development have the potential to effect air quality and also noise levels due to increased traffic travelling to the site.

The key identified interactions in this case are;

1. Air Quality and Climate;
2. Noise and Vibration

Subject to the adherence with the proposed mitigation measures, no significant impacts relating to Traffic and Transportation are predicted.

Material Assets - Waste

The construction and operational phases of the proposed development will generate waste which has the potential to interact with human health. The identified areas of interaction are therefore considered to be:

1. Population and Human Health

Subject to adherence to the proposed mitigation measures relating to the orderly management of waste during construction and operational phase of the development, no significant adverse impacts are anticipated.

Cultural Heritage

There are no interactions identified between Cultural Heritage and other environmental factors examined within this EIAR.

Cumulative Impacts

This Chapter also identifies potential cumulative impact upon the environment arising from the proposed project, in combination with other developments (committed or planned projects) in the surrounding area. Cumulative impact is defined by the EU Guidelines as:

"Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project. For example:

- Incremental noise from a number of separate developments;
- Combined effect of individual impacts, e.g. noise, dust and visual, from one development on a particular receptor; and
- Several developments with insignificant impacts individually but which together have a cumulative effect."

Each environmental issue assessed within this EIAR has been considered in respect to the cumulative impact of the proposed project with the surrounding area. No cumulative impacts have been identified.

Chapter 15 – Summary of Mitigation and Monitoring Measures

This Chapter provides a consolidated list of all of the environmental commitments/ mitigation measures and monitoring that have been recommended by the various specialists throughout the Chapters of this EIAR. The mitigation and monitoring measures have been recommended on the basis that they are considered necessary to protect the environment during both the construction and operational phases of the proposed project.

1.0 INTRODUCTION

This Environmental Impact Assessment Report ('EIAR') has been prepared by RW Nowlan and Associates on behalf of DW Raheen Developments Ltd., who intend to apply to An Bord Pleanála (ABP) under the Planning and Development Act 2000 (as amended by the Residential Tenancies Act 2016) for a strategic housing scheme located in Raheen, Co. Limerick. The application is being made under the Strategic Housing Provisions of the Planning and Development (Housing) and Residential Tenancies Act, 2016.

1.1 SUMMARY OF PROPOSED DEVELOPMENT

The ca. 10.44 hectare site is greenfield land that is enclosed by existing residential development to the south and east, the R510 road to the west and open land to the north. The northern boundary is formed by a former and disused railway line. The land to the north of that is enclosed by the National Road N18. The western boundary is formed by the regional road R510 with residential dwellings across the road. Most of the southeastern boundary is formed by boundary walls of established residential development. The lands are relatively flat and there are no restrictions on the future development of the lands for residential development. An existing roundabout provides vehicular access to the site. The dedicated arm of the roundabout for this access is currently blocked off.
The site has been zoned for residential development within the Limerick County Development Plan 2010-2016 and the Southern Environs Plan 2021-2027. The proposed development is a residential development that provides a mixture of houses, duplex units and apartments.

The site is located in Ballykeeffe, Raheen, Co. Limerick as shown on Figure 1.1 below.

Figure 1.1: Site Location

The proposed development description is set out in the statutory notices as follows;

DW Raheen Developments Ltd. are seeking a ten year permission for a strategic housing development consisting of the provision of 384 residential house and apartment units on a ca. 10.44 hectare site located in Ballykeeffe, Raheen, Co. Limerick.

The site is greenfield land that is enclosed by existing residential development to the south and east, the R510 to the west and open land to the north. Access to the site is provided by an existing entrance off a roundabout on the R510 regional road.

The proposed development will provide as follows:

202 no. housing units, comprising a variety of forms to include bungalows, detached, semi-detached and terraced houses. A mix of house sizes are proposed to include 20 no. two bedroom houses, 156 no. three bedroom houses and 26 no. four bedroom houses.

182 apartment and duplex units across 25 small scale blocks, 2 to 4 storeys in heights, throughout the development. The apartments and duplexes provide a mix of one, two, three and four bed units, comprising of 10 no. four bedroom duplex units, 10 no. three bedroom duplex units, 6 no. two bedroom duplex units, 18 no. three bedroom apartments, 92 no. two bedroom apartments and 46 no. one bedroom apartments.

The proposed development also includes;

A childcare facility measuring 761.75m^2, providing 79 childcare places (55 full time and 24 after school places), located at the south-western edge of the development.

The provision of 377 no. car parking spaces and 311 secured bicycle parking spaces.

The provision of 3 no. ESB sub-stations, ancillary services and infrastructure works including foul and surface water drainage, attenuation areas, landscaped public open spaces (approximately 29,500m^2, or 28.2% of the total site area), landscaping, lighting, internal roads, cycle paths, and footpaths.

A Natura Impact Statement (NIS) and Environmental Impact Assessment Report (EIAR) have been prepared in respect of the proposed development.

1.2 LEGISLATIVE CONTEXT

The consolidated European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the ‘EIA Directive’), has been transposed into Irish planning legislation by the Planning and Development Acts 2000 to 2019 and the Planning and Development Regulations 2001 to 2019. The EIA Directive was amended by Directive 2014/52/EU which has been transposed into Irish law pursuant to the provisions of amendments made to Part X of the Planning and Development Act 2000 and European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018), as amended.

Accordingly, this EIAR has been prepared in compliance with the EIA Directive as amended by Directive 2014/52/EU and Irish implementing legislation, including Part X of the Planning and Development Act 2000, as amended and Planning and Development Regulations 2001 (S.I. No. 600 of 2001), as amended in particular as amended by the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018).

The European Union Directive 2011/92/EU, amended by EU Directive 2014/52/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive'), requires Member States to ensure that a competent authority carries out an assessment of the likely significant effects of certain types of project, as listed in the Directive, prior to development consent being given for the project. The Environmental Impact Assessment (EIA) of the proposed development will be undertaken by An Bord Pleanála as the competent authority, in compliance with the provisions of EU and Irish law and guidance.

1.3 EIA SCREENING

The relevant classes/scales of development that normally require Environmental Impact Assessment (EIA) are set out in Schedule 5 (Part 2) of the Planning and Development Regulations 2001, as amended. Section 172 of the Planning & Development Act 2000, as amended, provides the legislative basis for mandatory EIA. It states the following:

"An environmental impact assessment shall be carried out by a planning authority or the Board, as the case may be, in respect of an application for consent for proposed development where either:

(a) the proposed development would be of a class specified in –

(i) Part 1 of Schedule 5 of the Planning and Development Regulations 2001, and either –

I. such development would exceed any relevant quantity, area or other limit specified in that Part, or

II. no quantity, area or other limit is specified in that Part in respect of the development concerned,

or

(ii) Part 2 of Schedule 5 of the Planning and Development Regulations 2001 and either –

I. such development would exceed any relevant quantity, area or other limit specified in that Part, or

II. no quantity, area or other limit is specified in that Part in respect of the development concerned,

Accordingly, Schedule 5 of the Planning & Development Regulations 2001, as amended sets out a number of classes and scales of development that require EIA.

With regards to the proposed strategic housing development, the provisions of Part 2 of Schedule 5 require an EIA to be undertaken where it is proposed to carry out the following - “Construction of more than 500 dwelling units”, as per paragraph 10 (b)(i) of Part 2 of the Schedule and urban development which would involve an area greater than either 2ha (business district), 10 ha (built up area) or 20ha (elsewhere) as per paragraph 10(b)(iv).

The proposed residential development does not exceed the 500 unit threshold in paragraph 10(b)(i). In respect of paragraph 10(b)(iv), the site is not located in a business district but does propose urban development of an area greater than 10 hectares. Therefore, the proposed development does equal or exceed the relevant quantity, area or other limit specified in Part 2 of Schedule 5 and is subject to mandatory EIA. This application relates to site of 10.44 hectares and is located within an area which falls under the definition of “other parts of a built-up area”. As the application site exceeds the stated threshold within paragraph 10(b)(iv) of 10 hectares, it is considered that the proposed development requires an EIAR in respect of this application.

The EIAR provides information on the receiving environment and assesses the likely significant effects of the project and proposes mitigation measures to avoid or reduce these effects. The function of the EIAR is to provide information to allow the competent authority to conduct the Environmental Impact Assessment (EIA) of the proposed development.

1.4 CONTENT OF AN EIAR

Article 5 of the EIA Directive provides that, where an EIA is required, the developer shall prepare and submit an environmental impact assessment report (EIAR) previously referred to as an Environmental Impact Statement (EIS). The information to be provided by the developer shall include at least:

a) a description of the project comprising information on the site, design, size and other relevant features of the project;

b) a description of the likely significant effects of the project on the environment;

c) a description of the features of the project and/or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment;

d) a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment;

e) a non-technical summary of the information referred to in points (a) to (d); and (f) any additional information specified in Annex IV relevant to the specific characteristics of a particular project or type of project and to the environmental features likely to be affected.

In addition, article 94 of Schedule 6 to, the Planning and Development Act 2000 to 2019 sets out the information to be contained in an EIAR, with which this EIAR complies.

1.5 EIA GUIDANCE

The Environmental Protection Agency (EPA) published its ‘Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports’ (EPA, August 2017), and these draft guidelines have been used in the compiling of this EIAR.

In preparing this EIAR regard has also been taken of the provisions of the ‘Guidelines for Planning Authorities and An Bord Pleanála on Carrying out Environmental Impact Assessment’, published by the Department of Housing, Planning and Local Government (DHPLG) in August 2018 to the extent these guidelines are relevant having regard to the enactment of the revised EIA Directive.

The European Commission also published a number of guidance documents in December 2017 in relation to Environmental Impact Assessment of Projects (Directive 2011/92/EU as amended by 2014/52/EU) including ‘Guidance on the preparation of the Environmental Impact Assessment Report’. RW Nowlan & Associates has prepared the EIAR with regard to these guidelines also.

1.6 PURPOSE AND SCOPE OF THE EIAR

As part of the Environmental Impact Assessment process, the developer of the project must prepare and submit an Environmental Impact Assessment Report (hereafter referred to as the EIAR). This is the first step of the EIA process, as mentioned in Article 1(2)(g) of European Union Directive

2011/92/EU, as amended by Directive 2014/52/EU on assessment of the effects of certain public and private Projects on the environment (“the EIA Directive”). The EIAR is the document prepared by the developer that presents the output of the assessment. It contains information regarding the project, the likely significant effect of the project, the baseline scenario, the reasonable alternatives considered by the developer, the features and measures to mitigate adverse significant effects as well as a Non-Technical Summary and any additional information specified in Annex IV of the EIA Directive. Article 5 of the EIA Directive sets out what must be included in the EIA Report, and how to ensure that it is both of a sufficient high quality and complete. This EIAR provides an assessment of the likely significant effects associated with the proposed strategic housing development.

It is important to distinguish the Environmental Impact Assessment (EIA) to be carried out by An Bord Pleanála, from the Environmental Impact Assessment Report (EIAR) accompanying the planning application. The EIA is the assessment carried out by the competent authority, which includes an examination that identifies, describes and assesses in an appropriate manner, in the light of each individual case and in accordance with Articles 4 to 11 of the Environmental Impact Assessment Directive, the direct and indirect effects of the proposed development on the following:

a) population and human health

b) biodiversity, with particular attention to species and habitats protected under Directive

92/43/EEC and Directive 2009/147/EC

c) land, soil, water, air and climate

d) material assets, cultural heritage and the landscape

e) the interaction between the factors referred to in points (a) to (d)

1.7 STRUCTURE AND CONTENT OF THE EIAR

This EIAR uses the grouped structure method to describe the existing environment, the potential impacts of the proposed development thereon and the proposed mitigation measures. Background information relating to the proposed development, consultation undertaken and a description of the proposed development are presented in separate sections. The grouped format sections describe the impacts of the proposed development in terms of human beings and population, biodiversity, soils and geology, water, air and climate, noise, landscape, cultural heritage and material assets – waste management, traffic and transport and cultural heritage together with the interaction of the foregoing.

The chapters of this EIAR are as follows:

1. Introduction
2. Alternatives Considered
3. Description of Proposed Development
4. Population and Human Health
5. Biodiversity
6. Land, Soil and Geology
7. Water and Hydrology
8. Air Quality and Climate
9. Noise and Vibration
10. Landscape and Visual Impact
11. Traffic and Transportation
12. Material Assets – Waste
13. Cultural Heritage
14. Interactions and Cumulative Impacts
15. Summary of Mitigation and Monitoring Measures

The EIAR also includes a non-technical summary, which is a condensed and easily comprehensible version of the EIAR document. The non-technical summary is laid out in a similar format to the main EIAR document and comprises a description of the proposed development followed by the existing environment, impacts and mitigation measures presented in the grouped format. The Non Technical Summary (Part 1) and the Main Chapters (Part 2) along with Appendices to Chapters (Part 3). For ease of reference, smaller appendices have been included within the main body of Part 2. Where appendices are included within Part 2, they are referenced in the Main Body Table of Contents above.

1.8 DESCRIPTION OF LIKELY SIGNIFICANT EFFECTS AND IMPACTS

The impact assessment methodology is detailed in respect of the various EIAR topics in the respective specialist Chapters herein. Unless otherwise stated, as shown in Table 1.1 below.

Criteria	Term	Description
	Positive	A change which improves the quality of the environment.

Quality	Neutral	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
	Negative	A change which reduces the quality of the environment.
Significance	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	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
	Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
	Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
	Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment
	Profound	An effect which obliterates sensitive characteristics
Extent and Context	Extent	Describe the size of the area, number of sites and the proportion of a population affected by an effect
	Context	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions
Probability	Likely	Effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented

	Unlikely	Effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented
Duration and Frequency	Momentary	Effects lasting from seconds to minutes
	Brief	Effects lasting less than a day
	Temporary	Effects lasting less than a year
	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
	Reversible	Effects that can be undone, for example through remediation or restoration
	Frequency	Describes how often the effect will occur (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)
Type	Indirect	Impacts on the environment, which are not a direct result of the project, often produced away from the project site or because of a 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 the subject project not be carried out
	Worst Case	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 effect is of greater significance than the sum of its constituents

Table 1.1: Impact Classification Terminology (EPA, 2017)

1.9 PROJECT TEAM

The companies and staff listed in Table 1.2 below were responsible for completion of the EIAR in respect of the proposed development. The EIAR project team comprises a multidisciplinary team of experts with extensive experience in the assessment of projects and in their relevant area of expertise. The qualifications and experience of the principal staff from each company involved in the preparation of this EIAR are summarised in Table 1.2 below. Each chapter of this EIAR has been prepared by a competent expert in the subject matter as detailed below.

Consultant	**Members Involved with EIAR Preparation**	**Experience**	**Inputs**
RW Nowlan & Associates (RWN) **37 Lower Baggot Street,** **Dublin 2**	Hendrick van der Kamp Kirsty McDonnell	Hendrik W van der Kamp - The former Head of the planning school in Technological University Dublin. Fellow and Past-president of the Irish Planning Institute and Honorary President of the European Council of Spatial Planners. Senior Planning Inspector with An Bord Pleanala from 1989 to 1995. In that role he has conducted oral hearings for large scale projects and carried out the assessment of numerous large scale residential and mixed use development schemes throughout the country. Planning consultant to advise Fingal County Council on planning matters in 2003. Instrumental in developing their methodology for delivering community infrastructure as part of large scale housing development through a collaborative approach with private developers. He has been consulted by the	Project Management and EIAR Chapters; 1 Introduction 2 Alternatives Considered 3 Description of Proposed Development 4 Population and Human Health 14 Interactions and Cumulative Impacts 15 Summary of Mitigation and Monitoring Measures

		Government on a number of occasions on planning matters. He acted as the Minister's appointee on the Technical Assessment Board for Architects between 2009 and 2015. In 2013 he was appointed to carry out an Independent Review of the Minister's Planning Review Report. In 2016 he was appointed as independent Inspector to review a Draft Ministerial Direction on Wind Farm Policy. He was member of advisory groups of both the National Spatial Strategy and the National Planning Framework. Kirsty McDonnell - Qualified with a Masters in Regional and Urban Planning from University College Dublin. Experience coordinating large scale Strategic Housing Development applications through all stages from initial design through submission to An Bord Pleanala. Kirsty is a member of the Irish Planning Institute.	
SLR Consulting **7 Dundrum Business Park,** **Windy Arbour,** **Dublin 14**	Michael Bailey Stuart Wilson Paul Gordon	Michael Bailey holds a BSc (Hons) in Biology and Ecology from the University of Ulster, and an MSc in Quantitative Conservation Biology from the University of the Witwatersrand, Johannesburg, South Africa. Michael is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM). He has prepared Appropriate Assessments and Ecological Impact Assessments for a wide range of projects in Ireland and the UK. Stuart Wilson is a Technical Director at SLR with twenty-five years professional experience as an ecologist and environmental impact assessment practitioner.	EIAR Chapters; 5 Biodiversity 6 Land, Soil and Geology

		Stuart has extensive experience as Competent Expert in habitats regulations assessment (HRA) having acted in this role for Highways England for the last 13 years. As part of this he has been a competent authority, technically assured HRA reports and authored/implemented the Design Manual for Roads & Bridges LA 115 Habitats Regulations assessment. Stuart has a BSc (Hons) degree in Environmental Biology from University of Essex and an MSc degree in Environmental Impact Assessment from the University of Wales, Aberystwyth. He is a full member of the Chartered Institute of Ecology and Environmental Management (MCIEEM) and is a Chartered Environmentalist (CEnv) with the Society for the Environment. Paul Gordon (EurGeol PGeo) of SLR Consulting. Paul has a BSc in Geology and an MSc in Environmental Management and has over 20 years' professional experience.	
Hutch O'Malley Consultant Engineers **'The Railway Station'** **Attyflin,** **Patrickswell,** **Co. Limerick**	David O'Malley	David O'Malley B.Eng Civil (Hons), MIEI. has been practicing as a Consulting Engineer since 2007. David has extensive experience in Structural Engineering, Civil Engineering, Planning Autority/Local Authority, Fire Certification, Noise & Vibration Assessment, Asset Survey/Taking In Charge, Road Safety Audits, Project Management.	EIAR Chapter 7 – Water and Hydrology
AWN	Mike Simms	Mike Simms BE MEngSc MIOA MIET, Senior Acoustic Consultant	EIAR Chapters;

The Tecpro Building, **Clonshaugh Business & Technology Park,** **Dublin 17**	Chonaill Bradley Avril Challoner	at AWN, who has worked in the field of acoustics for 20 years. He has extensive experience in all aspects of environmental surveying, noise modelling and impact assessment for various sectors including, energy, industrial, commercial and residential. Chonaill Bradley (Bsc ENV AssocCIWM) is a Senior Environmental Consultant in the Environment Team at AWN. He holds a BSc in Environmental Science from Griffith University, Australia. He is an Associate Member of the Institute of Waste Management (CIWM). Chonaill has over seven years' experience in the environmental consultancy sector and specialises in waste management. Dr. Avril Challoner who is a Senior Environmental Consultant in the Air Quality section of AWN Consulting. She holds a BEng (Hons) in Environmental Engineering from the National University of Ireland Galway, HDip in Statistics from Trinity College Dublin and has completed a PhD in Environmental Engineering (Air Quality) in Trinity College Dublin. She is a Chartered Scientist (CSci), Member of the Institute of Air Quality Management and specialises in the fields of air quality, EIA and air dispersion modelling. She has experience with preparing air quality and climate impact assessments for EIARs for various residential, mixed-use, commercial and industrial developments.	8 Air Quality and Climate 9 Noise and Vibration 12 Material Assets - Waste

PC Roche & Associates **Dublin,** **Ireland**	Cass Roche	Cass Roche is the principle of PC Roche and Associates and a qualified landscape architect with the following qualifications; Diploma in Physical Planning, Trinity College. Membership of Landscape Institute, London. Supplementary professional development courses include a Computer Aided Design and a Town Planning Development Course in UCD. Cass is also a lecturer in Landscape Planning and Garden Design at Beechfield College.	EIAR Chapter; 10 Landscape and Visual Impact
TTRSA **Barran,** **Blacklion,** **County Cavan**	Matthew Steele Pamela Townley	Matthew Steele BA (Hons) MSc FCILT FRGS MCIHT is a Director of TTRSA with over 20 years of professional experience Traffic and Transport assessments. Pamela Townley BSc (Hons) is a Directors of TTRSA with over twenty years experience of assessing the traffic and transport impacts of development.	EIAR Chapter; 11 Traffic and Transportation
Rose Cleary	Rose Cleary	Rose Cleary graduated in 1980 with a BA degree in archaeology from University College Cork and subsequently undertook masters research on the Newgrange prehistoric pottery assemblage. Her research interests lie in prehistoric pottery, with a particular interest in ceramic technology, petrology studies and charactisation of clay sources. She is also involved in long-term research on the prehistoric archaeology of north Munster,	EIAR Chapter; 13 Cultural Heritage

		with particular reference to the Lough Gur landscape. She has extensive fieldwork experience, having undertaken excavations at numerous prehistoric sites in that region. She has published widely on projects connected to pipeline and infrastructural projects, including urban regeneration schemes in Cork city	

Table 1.2: Project Team Qualifications

1.10 DIFFICULTIES IN COMPILING THE EIAR

RW Nowlan & Associates is responsible for the preparation of this EIAR. No difficulties, such as technical deficiencies, lack of information or knowledge, were encountered in compiling any specific information contained in the EIAR.

2.0 ALTERNATIVES CONSIDERED

2.1 INTRODUCTION

Article 5 of the Environmental Impact Assessment (EIA) Directive as amended by Directive 2014/52/EU states that the information provided in an Environmental Impact Assessment Report (EIAR) should include a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the final choice, taking into account the environmental effects.

The primary obligation under Article 5(1)(d) of the EIA Directive is upon the developer to provide a description of the 'reasonable alternatives' considered in the course of the application process. In this regard, the Directive states:

'(d) a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment'

The consideration of alternatives is an effective means of avoiding environmental impacts. As set out in the 'Draft Guidelines on The Information to be Contained in Environmental Impact Assessment Reports' (EPA, 2017), the presentation and consideration of reasonable alternatives investigated is an important part of the overall EIA process.

This chapter of the EIAR contains a description of the reasonable alternatives that were considered in respect of the development of the site in terms other land-use options, unit numbers, unit types, design, and site layout.

It is important to acknowledge that although the consideration of alternatives is an effective means of avoiding environmental impacts, there are difficulties and limitations when considering alternatives.

Indeed, as is clear from the provisions of the EIA Directive itself, the requirement is to consider "reasonable alternatives" which are relevant to the project and its characteristics. In general terms, issues such as hierarchy, non-environmental factors and certain site-specific issues may also be relevant to the consideration of reasonable alternatives by the developer.

2.2 ALTERNATIVE LOCATIONS

The proposed development is located within lands which have been is zoned for Residential Development under the Limerick County Development Plan 2010-2016 and within the newly adopted Southern Environs Local Area Plan 2021-2027. This zoning designation is also proposed to continue in the Draft Limerick Development Plan 2022-2028. As such consideration of alternative sites for the construction of residential units proposed in this development was not considered necessary. It is considered that the proposed site is a suitably zoned residential development site, available to the applicant for the proposed development. During the design process for the proposed development several iterations of the site layout and alternative designs were considered. This planning application demonstrates that the subject site and the surrounding area have the environmental capacity to accommodate the proposed development without any significant risk of impact upon environmental sensitivities due to the site location.

2.3 DO-NOTHING ALTERNATIVE

The 'Do-Nothing' alternative considers the likely scenario that would arise, assuming the proposed Project were not progressed, i.e. if nothing were done. Note that this Chapter discusses the Do-Nothing scenario in terms of development (or lack thereof) in the absence of the proposed Project. The likely impacts of a Do-Nothing scenario in relation to the various environmental topics (e.g. cultural heritage, biodiversity, traffic and so on) are discussed in the respective chapters of this EIAR.

If the proposed development was not to proceed, the opportunity to develop 182 no. Duplex and apartment units, 202 no. Houses, a childcare facility, open space, landscaping and ancillary works at this long standing residential zoned site would be lost.

Under the "Do Nothing" alternative, the zoned residential lands would not be used for the development of housing. There remains a long-standing housing need in Limerick and Limerick City and County Council have, through the inclusion of the site for residential development in their adopted Plans, given their support for the site to be developed for residential purposes. Therefore, under this "Do Nothing" scenario, the construction of badly needed housing would have to occur on another site in Limerick to fulfil that need. It is entirely possible that any alternative site would be less suitable than the proposed development site.

In circumstances where the utilisation of alternative unzoned lands and the non-utilisation of lands zoned for residential development would represent an unsustainable land use, the "Do-Nothing" alternative was not considered the appropriate option.

2.4 ALTERNATIVE LAYOUTS

This section provides an overview of how the proposed development has evolved to date. The design process was an iterative process, where findings at each stage of the assessment were used to further refine the design, always with the intention of minimising the potential for environmental impacts. The layout has also evolved through discussions with Limerick City and County Council at pre-application stage, and following receipt of An Bord Pleanála's Opinion at Section 5 pre-application discussion stage.

Alternative Layout 1

At initial project inception and feasibility stage, a low-density housing and apartment scheme was explored, based on local market demand for 3 no. bedroom and 4 no. bedroom houses in the area. This initial concept was based on a masterplan for the entirety of the lands owned by the applicant.

It quickly became apparent that this was not feasible based on the northern portion of the site not being zoned for residential development. This iteration of the design proposed mainly low density housing units with some apartment units throughout the development. This design was also deemed unfeasible at an early stage when planning policies relating to density and housing mix were examined. It was further considered that a mix of typologies would be required not just to increase the residential density at the site, but to provide a mix of typologies that could meet the needs of different demographics and tenure typologies.

Alternative Layout 2

The second iteration of the design was the first version that only included the currently zoned section of the site, with an area of approx. 9.5 hectares. This design included mainly houses and duplex units with a large apartment building located to the north of the site. The apartment location was considered due to the large area of open space to the north which could provide strong views and amenity areas for residents. This design was presented to Limerick City and County Council at the early stages of the project. The Local Authority advised that the location of the apartment building would not be favoured due to the distance from the apartments to the access point off the roundabout on the R510. The design was reassessed and the apartment building shown in Alternative Layout 2 was ultimately removed from the development. At this stage of the design process, the permeability of the site was not optimal to encourage sustainable transport modes and needed to be re-examined.

Alternative Layout 3

By the third iteration of the site design, it is considered that improvements had been made in terms of the mix of typologies within the development. This was achieved through mixing housing, duplex units and small scale apartment blocks throughout the development and creating character areas to distinguish individual areas of the development and promote community development. At this stage of the process, two considerable build to rent apartment blocks were also included at the south western side of the development. Improvements were also made in terms of accessibility with the introduction of a main road which loops around the entire development to which the smaller access roads join. This resulted in more logical mobility through the site in terms of road traffic, cyclists and pedestrians.

Alternative Layout 4

Alternative layout number four is relatively similar to the final iteration of the design. Some apartment units were relocated to the western boundary which allowed for increased residential amenity areas to be provided for residents. This was considered best practice as typically residents in apartments would have less private open space than residents of the houses with private gardens. At this stage, the landscaping proposals were also improved to ensure long term sustainability of the development.

Final Layout

The proposed project constitutes the final alternative, and preferred, option. The build to rent element of the development has been removed in response to local market indicators showing a preference for build to sell apartment options. The design has been progressed via an iterative process with design amendments arising from consultation with An Bord Pleanála and Limerick City and County Council during the pre-application process. The current design takes account of both planning and environmental considerations. The full description of the final proposed development is outlined in Chapter 3 below.

2.5 CONCLUSIONS

The proposed development provides for new residential development on lands zoned for residential use under the Limerick County Development Plan 2010-2016 which was subject to the SEA process and also within the Southern Environs Local Area Plan 2021-2027. As such, consideration of alternative sites for the construction of houses and apartments proposed in this residential development was not considered necessary.

During the design process, the layout and design of the proposed development evolved in response to architectural, landscape and environmental requirements and several iterations of the site layout and alternative designs were considered. Any difficulties from an architectural, landscape or environmental viewpoint were assessed and, where necessary, the design was amended to address the issues encountered.

The evolution of the current scheme was informed by consideration of environmental aspects; vehicular and pedestrian movements; maximisation of pedestrian connectivity through the site and protection of adjoining residential amenity. Furthermore, the final scheme has been directly influenced by the technical and specific issues raised in the Board's Opinion.

3.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

3.1 INTRODUCTION

The ca. 10.44 hectare site is greenfield land that is enclosed by existing residential development to the south, east and west and open land to the north. The northern boundary is formed by a former and disused railway line. The land to the north of that is enclosed by the National Road N18. The western boundary is formed by the regional road R510. Most of the southeastern boundary is formed by boundary walls of established residential development. The lands are relatively flat and there are no restrictions on the future development of the lands for residential development. An existing roundabout provides vehicular access to the site. The dedicated arm of the roundabout for this access is currently blocked off. The site has been zoned for residential development within the Limerick County Development Plan 2010-2016 and the Southern Environs Plan 2021-2027. The proposed development is a residential development that provides a mixture of houses, duplex units and apartments.

3.2 CHARACTERISTICS OF THE SITE

The subject site is greenfield land zoned for residential development and currently in use as agriculture land. Access to the site is provided by an existing entrance off a roundabout on the R510 regional road. The site is largely circular in shape and is bounded by the following;

North – To the north of the development site are lands zoned for open space. These lands are owned by the applicant, DW Raheen Developments Ltd. A masterplan has been prepared for the future development of these lands should a change in the current zoning designation be achieved in the future.

South – The south of the development site is bounded by the Inis Mor Housing estate and the Ballinvoher housing estate to the south-eastern boundary. The proposed development includes houses on this boundary to reduce any impact of the development on the existing residential population.

East - The eastern boundary of the site is also bordered by the lands owned by the applicant but zoned for open space at present, as seen in the North section above. The south-eastern boundary of the site is characterised by rear garden walls of existing residential dwellings within the Ballinvoher estate

West – To the western boundary of the development site is the R510 Regional Road. The existing roundabout to the south-west will provide the access point to the proposed development. Across the R510 to the west is mainly undeveloped lands with some existing residential housing in the Ard Aulin estate.

Irish Water trunk mains for potable water & sewerage traverse the R510 regional road running from south to north. The River Shannon/Estuary is located approx. 1.5 km to the north and the Ballinacurra Creek is located approx. 1 km to the east. Both have flood protection embankments which significantly reduce any risk of flooding on the subject site. Bunlicky lake is also located approx. 400m to the north of the site.

The site is assessed as relatively flat with no major geological structures within or near the site. The GSI geology map Sheet 17 illustrates that the entire site and surrounding area is underlain by Visean Limestone.

3.3 PROPOSED DEVELOPMENT

The proposed development description is set out in the statutory notices as follows;

DW Raheen Developments Ltd. are seeking a ten year permission for a strategic housing development consisting of the provision of 384 residential house and apartment units on a ca. 10.44 hectare site located in Ballykeeffe, Raheen, Co. Limerick.

The site is greenfield land that is enclosed by existing residential development to the south and east, the R510 to the west and open land to the north. Access to the site is provided by an existing entrance off a roundabout on the R510 regional road.

The proposed development will provide as follows:

202 no. housing units, comprising a variety of forms to include bungalows, detached, semi-detached and terraced houses. A mix of house sizes are proposed to include 20 no. two bedroom houses, 156 no. three bedroom houses and 26 no. four bedroom houses.

182 apartment and duplex units across 25 small scale blocks, 2 to 4 storeys in heights, throughout the development. The apartments and duplexes provide a mix of one, two, three and four bed units, comprising of 10 no. four bedroom duplex units, 10 no. three bedroom duplex units, 6 no. two

bedroom duplex units, 18 no. three bedroom apartments, 92 no. two bedroom apartments and 46 no. one bedroom apartments.

The proposed development also includes;

A childcare facility measuring 761.75m^2, providing 79 childcare places (55 full time and 24 after school places), located at the south-western edge of the development.

The provision of 377 no. car parking spaces and 311 secured bicycle parking spaces.

The provision of 3 no. ESB sub-stations, ancillary services and infrastructure works including foul and surface water drainage, attenuation areas, landscaped public open spaces (approximately 29,500m^2, or 28.2% of the total site area), landscaping, lighting, internal roads, cycle paths, and footpaths.

A Natura Impact Statement (NIS) and Environmental Impact Assessment Report (EIAR) have been prepared in respect of the proposed development.

The proposed housing mix is set out in Table 3.1 below.

Unit Type	Studio	1 Bed	2 Bed	3 Bed	4 Bed	Total
Apartment	-	46	92	18	-	156
Duplex	-	-	6	10	10	26
Houses	-	-	20	156	26	202

Table 3.1: Proposed Dwelling Mix

The application for the proposed development seeks a ten year planning permission. Having regard to the large scale of the development and the number of units in the overall scheme, it is considered that this such a duration is appropriate. As such, it is proposed to complete the overall development over four no. phases (in which phase 2 and 3 are broken down in to two sub-phases ‘A’ and ‘B’) of construction as shown below in Figure 3.1.

Figure 3.1: Proposed Development Phasing

The facilities and number of units to be completed in each phase is set out in Table 3.2 below. Note: In phases where a lower number of units are completed, there may be more substantial road area or services to be developed in that phase.

Phase	Elements to be Complete
Phase 1	45 no. Houses, 30 no. Apartments and 2 no. Duplex units. The creche facility will also be completed in this phase. Total = 77 no. units and creche
Phase 2 – 2A	34 no. Houses. Total = 34 no. units
Phase 2 – 2B	12 no. Houses, 30 no. Apartments and 2 no. Duplex units. Total = 44 no. units
Phase 3 – 3A	78 no. Apartments and 22 no. Duplex units. Total = 100 no. units
Phase 3 – 3B	83 no. Houses and 18 no. Apartments. Total = 101 no. units
Phase 4	28 no. Houses. Total = 28 no. units

Table 3.2: Breakdown of Units Provided in Each Phase of Development

3.4 CONSTRUCTION STAGE

This application seeks a ten year permission for complete development of the proposed scheme. The relevant construction stage activities are discussed below.

Site Establishment and Access

The first activity to be carried out at the site will be the establishment of site facilities and security. The location of the compound, associated haul roads and main site access point will be determined and agreed with the Local Authority prior to commencement of site works. All sub-contractors as well as the main contractor and project managers will occupy offices within the construction compound. The site parking for all staff, contractors and visitors will also be located in this area. The proposed site compound is intended to be accessed directly from the R510 regional road to avoid construction traffic driving through completed phases of the development to access the phase under construction. Figure 3.2 below illustrates the intended access point. However, it should be noted that this is to be agreed with Limerick City and County Council prior to commencement of development.

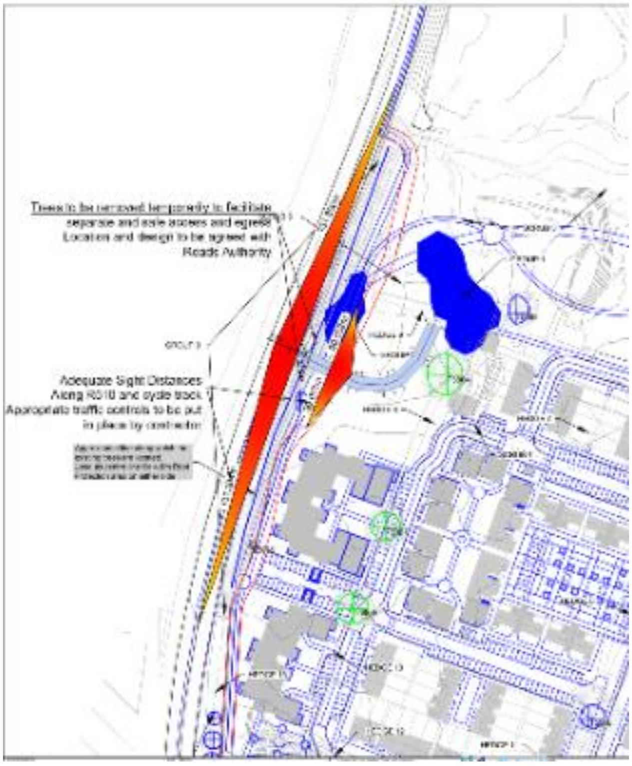

Figure 3.2: Proposed Site Compound Access. Source: Hutch O'Malley Drawing no C37

The compound will be used as a storage area for the various components, fuels and materials required for construction. Any fuels will be stored in self bunded tanks. The compound will be fenced off to ensure site security is maintained. The compound may be situated in an area of future landscaping within the proposed development so as not to interfere with the areas where structures are to be constructed. Any area used will be reinstated in accordance with the grant of planning at the end of the construction period. Until such time as the construction of the first phase of construction work is complete, the new access road will not be open to members of the public.

Site Preparation

Initially the site will be securely fenced, and a construction compound will be established. Top soil will be stripped back and either stockpiled on site for pending re-use where feasible in landscaped areas or removed off site to a permitted or licensed facility as part of a recovery operation. This will be done in accordance with all relevant statutory requirements.

Site stripping will be kept to a minimum in line with the phasing plan. A project programme will be developed for each phase of the project taking cognisance of the recommendations of the EIAR and NIS.

Recommendations included within the Construction and Environmental Management Plan in this regard include the following;

Site clearance not to be undertaken during wet conditions when rainfall of more than 1mm/hr is forecast within the next 24 hour period.

Fuels, Lubricants, hydraulic fluid, solvents and oils to be carefully handled and spill kits provided. All such fluids to be stored in bunded containment to minimum 110% capacity.

Accidental spillages to be immediately contained and contaminated soil removed from site.

Waste fluids to be collected and removed from site.

Dedicated wash down area to be provided for concrete trucks.

The use of vehicles with caterpillar tracks within contaminated areas will be avoided to minimise the risk of spreading contaminated material.

A suitably qualified ecologist will be on site to monitor and oversee the implementation of invasive species management plans.

Hoarding

Construction phases will be closed off using hoarding which will be constructed before any significant development works commence on site for that phase. The proposed hoarding will be standard in nature consisting of mounting posts would be set in concrete, with horizontal rails and metal sheeting. It is intended that where practicable, hoarding will be retained and re-configured for re-use between working areas as construction progresses.

The following measures will be applied to the installation and maintenance of the site hoarding;

- Maintenance of adequate hoarding to an acceptable condition to prevent unauthorised access to works areas;
- Maintain appropriate sightlines to ensure safety of vehicles and pedestrians;
- Temporary fencing may be used for short term works areas.

Site Security

Security will be the responsibility of the contractor who will provide adequate security to prevent unauthorised entry to or from any working areas. Robust security measures will be put in place to prevent unauthorised access at all times which will include;

Installation of CCTV and alarm system with remote access, two-way communication and appropriate backup storage;

Provision of adequate security patrols during out-of-hours and holiday periods;

Providing manned access control at the main site access.

Liaison with local community groups, An Garda Síochána and Limerick City and County Council when setting up security plan

Working Hours

The site working hours would be stipulated in the planning conditions attached to a grant of permission. As standard, the working hours envisioned for development on site are the following;

Monday to Friday – 7:00 to 19:00

Saturday – 7:00 to 14:00

Sunday and Holidays – No works on site

It is not intended that any works would be undertaken outside of the above hours of operation. However, should this be absolutely unavoidable in any instance, any working hours outside the normal construction working hours will be agreed with the planning authority.

Health and Safety

In accordance with the statutory requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013, a Health and Safety Plan will be prepared prior to commencement of development. This plan will include measures such as;

- Construction Health & Safety training requirements
- Induction procedures
- Emergency protocols
- Details of welfare facilities
- Risk assessments and Method Statements.

All workers and visitors will be required to wear appropriate personal protective equipment prior to going on to the site and will undergo a safety briefing by a member of the site safety team. All PPE to be level assessed for its appropriateness for particular tasks.

Regular site safety audits will be carried out throughout the construction programme to ensure that the rules and regulations established for the site are complied with at all times.

Construction of New Buildings

The proposed development includes apartment units, duplex units, houses and a creche building. In addition, it is proposed to provide substantial communal and private landscaped open green area including play areas. All buildings will be constructed in accordance with current building regulations and certified by an appropriate Architect during and upon construction completion. Construction materials will be sourced locally where possible.

Traffic

Recommendations in relation to the management of Traffic during the construction phase of development are set out within the Construction and Environmental Management Plan and the Traffic and Transportation Chapter of this EIAR (Chapter11). The proposed development will generate additional traffic to and from the site during construction phase i.e. workers, deliveries and during the operational phase where the new residential units are occupied. Full details of the measures to be implemented can be found in Chapter 11 below.

Waste Management

A specific Construction and Demolition Resource Waste Management Plan has been prepared by AWN Consulting and is included within this EIAR as Appendix 12.2. This report includes measures to be undertaken to minimise the quantity of waste produced at the site and the measures to handle the waste in such a manner as to minimise the effects on the environment.

Adherence to the Waste Management Plan will ensure that the management of waste arising is dealt with in compliance with the provisions of the Waste Management Acts 1996 – 2015 and amendments. The waste management hierarchy to be adopted will be as follows:

1. Prevention and Minimisation

2. Reuse of Waste

3. Recycling of Waste:

4. Disposal

Typical waste materials that will be generated from the demolition and construction works will include:

- Soil and stones
- Concrete, bricks, tiles and ceramics
- Wood, glass and plastics

- Metals
- Paper and cardboard
- Mixed C&D waste
- Chemicals (solvents, paints, adhesives, detergents etc.)

The management of all hazardous waste arisings, if they occur, shall be coordinated in liaison with Health and Safety Management.

The main waste storage area will be located in the site compound. A dedicated and secure area containing bins, and/or skips, and storage areas, into which all waste materials generated by construction site activities, will be established within the development. Waste materials generated will be segregated at the site compound, where it is practical to do so. All waste receptacles leaving site will be covered or enclosed. The appointed waste contractor will collect and transfer the wastes as receptacles are filled.

The Construction Manager will have overall responsibility for ensuring that procedures put in place in relation appropriate waste management requirements are adhered to on site at all times.

Noise and Vibration

Chapter 9 of this EIAR provides a full assessment of the potential impacts in terms of Noise and Vibration during construction phase of the overall development. Recommendations are made in this chapter based on best practice operational and control measures for noise and vibration from construction sites are found within BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2 including recommendations in relation to construction site practices including:

- selection of quiet plant;
- control of noise sources;
- screening (boundary, and or localised plant screening);
- hours of work;
- liaison with the public, and;
- monitoring.

Please refer to Chapter 9 below for further information in this regard.

Good Housekeeping

Full details of the good housekeeping measure to be implemented on site during construction phase are set out within the Construction and Environmental Management Plan (2022) prepared by Hutch O'Malley Consulting Engineers and included in this application under a separate cover. These measures include;

General maintenance of working areas and cleanliness of welfare facilities and storage areas;

Provision of site layout map showing key areas such as first aid posts, material storage, spill kits, material and waste storage, welfare facilities etc.;

Maintain all plant, material and equipment required to complete the construction work in good order, clean and tidy;

Keep construction compounds, access routes and designated parking areas free and clean of excess dirt, rubbish piles, scrap wood, etc. at all times;

Details of site managers, contact numbers (including out of hours) and public information signs (including warning signs) will be provided at the boundaries of the working areas;

Provision of adequate welfare facilities for site personnel;

Installation of appropriate security, lighting, fencing and hoarding at each working area;

Effective prevention of oil, grease or other objectionable matter being discharged from any working area;

Provision of appropriate waste management at each working area and regular collections to be arranged;

Excavated material generated during construction will be reused on site, if deemed acceptable;

Maintenance of wheel washing facilities and other contaminant measures as required in each working area;

No discharge of site run-off or water discharge without agreement of the relevant authorities.

No discharge of site run-off or water discharge will be acceptable on to public roads or into third party lands.

3.5 OPERATIONAL STAGE

The most significant environmental effects are expected to arise during the construction phase. The operational phase of the proposed Project – which will entail aspects associated with the standard operation of a large-scale, residential development with public realm and crèche and residential amenity areas – is therefore relatively benign. Relevant aspects of the operational phase are discussed in the respective specialist chapters, as appropriate.

4.0 POPULATION AND HUMAN HEALTH

4.1 INTRODUCTION

This section of the Environmental Impact Assessment Report (EIAR) describes the potential impacts of the proposed development on human beings, population and human health and has been completed in accordance with the guidance set out by the Environmental Protection Agency (EPA) in 'in particular the Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, August 2017). The full description of the proposed development is provided in Chapter 3 of this EIAR.

One of the principal concerns in the development process is that people, as individuals or communities, should experience no diminution in their quality of life from the direct or indirect impacts arising from the construction and operation of a development. Ultimately, all the impacts of a development impinge on human beings, directly and indirectly, positively and negatively. The key issues examined in this section of the EIAR include population, human health, employment and economic activity, land-use, tourism, noise and health and safety.

4.2 METHODOLOGY

The assessment considers attributes and characteristics associated with population, community and residential settlement, economic activities and employment, community infrastructure and tourism and recreation. It has been carried out in accordance with the following guidance, and tailored accordingly based on professional judgement:

Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessments (Department of Housing, Planning and Local Government – August, 2018);

Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, Draft August 2017);

Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2002);

Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment (European Union, 2017);

Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DHPLG, 2018).

An extensive desktop study was carried out to characterise the environment in relation to human beings including the receiving population, to identify neighbouring industry and dwellings and to assist in the characterisation of land use. The following sources were referred to:

Central Statistics Office (CSO). Census data from 2011 and 2016;

CSO Small Area Population (SAP) Statistics;

ESRI (2021) - Quarterly Economic Commentary, Winter 2020

DoHPLG (2017) - Rebuilding Ireland – Action Plan for Housing and Homelessness

Google Maps and Places (2021)

A Childcare Demand Analysis Report (2021) prepared by RW Nowlan & Associates is submitted under separate cover as part of the planning application and has been referred to in the preparation of this Chapter.

This assessment has also considered the potential indirect and direct socio-economic impacts of the construction and operation of the proposed Project.

Receptors were identified and assessed for sensitivity, magnitude and significance to provide an appropriate and adequate assessment of how they could be impacted by the construction and operational Phases of the proposed project. Impacts have been characterised in terms of quality, significance and duration, in accordance with the definitions set out in Section 1.5.1 in Chapter 1, as per the EPA 2017 EIAR guidelines.

4.3 CHARACTERISTICS OF PROPOSED DEVELOPMENT

The ca. 10.44 hectare site is greenfield land that is enclosed by existing residential development to the south, east and west and open land to the north. The northern boundary is formed by a former and disused railway line. The land to the north of that is enclosed by the National Road N18. The western boundary is formed by the regional road R510. Most of the southeastern boundary is formed by boundary walls of established residential development. The lands are relatively flat and there are

no restrictions on the future development of the lands for residential development. An existing roundabout provides vehicular access to the site. The dedicated arm of the roundabout for this access is currently blocked off.
The site has been zoned for residential development within the Limerick County Development Plan 2010-2016 and the Southern Environs Plan 2021-2027. The proposed development is a residential development that provides a mixture of houses, duplex units and apartments.

The proposed development description is set out in the statutory notices as follows;

DW Raheen Developments Ltd. are seeking a ten year permission for a strategic housing development consisting of the provision of 384 residential house and apartment units on a ca. 10.44 hectare site located in Ballykeeffe, Raheen, Co. Limerick.

The site is greenfield land that is enclosed by existing residential development to the south and east, the R510 to the west and open land to the north. Access to the site is provided by an existing entrance off a roundabout on the R510 regional road.

The proposed development will provide as follows:

202 no. housing units, comprising a variety of forms to include bungalows, detached, semi-detached and terraced houses. A mix of house sizes are proposed to include 20 no. two bedroom houses, 156 no. three bedroom houses and 26 no. four bedroom houses.

182 apartment and duplex units across 25 small scale blocks, 2 to 4 storeys in heights, throughout the development. The apartments and duplexes provide a mix of one, two, three and four bed units, comprising of 10 no. four bedroom duplex units, 10 no. three bedroom duplex units, 6 no. two bedroom duplex units, 18 no. three bedroom apartments, 92 no. two bedroom apartments and 46 no. one bedroom apartments.

The proposed development also includes;

A childcare facility measuring 761.75m^2, providing 79 childcare places (55 full time and 24 after school places), located at the south-western edge of the development.

The provision of 377 no. car parking spaces and 311 secured bicycle parking spaces.

The provision of 3 no. ESB sub-stations, ancillary services and infrastructure works including foul and surface water drainage, attenuation areas, landscaped public open spaces (approximately 29,500m^2, or 28.2% of the total site area), landscaping, lighting, internal roads, cycle paths, and footpaths.

A Natura Impact Statement (NIS) and Environmental Impact Assessment Report (EIAR) have been prepared in respect of the proposed development.

The proposed housing mix is set out in Table 4.1 below.

Unit Type	Studio	1 Bed	2 Bed	3 Bed	4 Bed	Total
Apartment	-	46	92	18	-	156
Duplex	-	-	6	10	10	26
Houses	-	-	20	156	26	202

Table 4.1: Proposed Dwelling Mix

The application for the proposed development seeks a ten year planning permission. Having regard to the large scale of the development and the number of units in the overall scheme, it is considered that this such a duration is appropriate.

Given the large scale of the proposed development, it is vital to ensure that human health and safety is a priority through all stages of development. In this regard, it was deemed necessary to set out the baseline environment below before examining the potential impact of the proposed development. This Chapter has been informed by the following other Chapters contained within this EIAR;

- Chapter 6: Land, Soil and Geology
- Chapter 7: Water and Hydrology
- Chapter 8: Air Quality and Climatic
- Chapter 9: Noise and Vibration
- Chapter 10: Landscape and Visual Impact Assessment
- Chapter 11: Traffic and Transportation
- Chapter 12: Material Assets: Waste

4.4 RECEIVING ENVIRONMENT

In order to assess the likely significant impacts of the proposed development on population and human health, an analysis of recent Census data was undertaken relating to the economic, demographic and social characteristics of the study area. For the purposes of this demographic analysis, the study area comprises 2 No. distinct enumeration areas identified by the Central Statistics Office (CSO) of relevance to the subject development, as follows:

Figure 1 The local Electoral Division (ED) study area to which the subject site belongs and any other ED's within 1km radius of the site. The site is located within the Ballycummin ED which extends greater than the 1km radius so this is the only ED included, and

2) The larger combined Limerick City and County Local Authority administrative boundary.

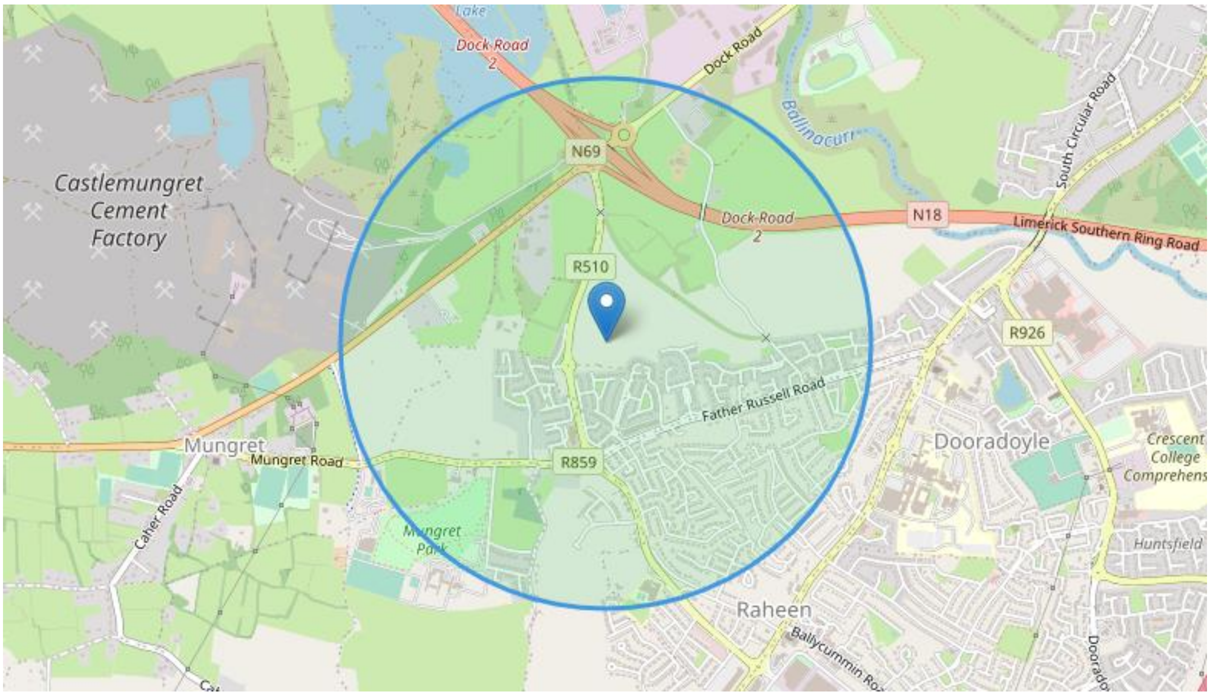

Figure 4.1: 1km Radius from Subject Site

Population Trends

The CSO Census data illustrates that the population of the Irish State increased between 2011 and 2016 by 3.8%, bringing the total population of the Irish State to 4,761,865 (see Table 4.2 below). The rate of growth slowed from 8.2% in the previous census, attributable to the slower economic activity in the early part of the Census period resulting in a reduced level of immigration, albeit offset to a degree by strong natural increase. The economy has recovered in recent years with consequent population growth predominantly attributed to natural increase, greater economic activity, increased job opportunities and continued immigration.

Area	2011 Population	2016 Population	% Change
State	4,588,252	4,761,865	+3.8%
Limerick City and County	191,809	194,899	+1.6%
Study Area	17,490	18,388	4.9%

Table 4.2: Demographic Change from 2011 to 2016

The age breakdown within the study area is largely the same as that seen at the County Level with the exceptions that the 25-64 age cohort is higher in the study are and the 65+ age cohort is lower in the study area as shown in Table 4.3 below.

Age	Study Area (2016)		Limerick City and County (2016)	
Population	**Population**	**% Total**	**Population**	**% Total**
Preschool (0-4 years)	1,630	9%	13,135	7%
Primary (5-12 years)	2,242	12%	21,500	11%
Secondary (13-18 years)	1,290	7%	15,243	8%
Young Adult (19-24 years)	1,056	6%	15,550	8%
Adults (25-64 years)	10,426	57%	102,053	52%
Older Adults (65+ years)	1,744	9%	27,418	14%
Total	18,388	100%	194,899	100%

Table 4.3: Population by Age

Land Use and Settlement Patterns

The subject site of the proposed project is largely an undeveloped site with basic infrastructure (roads and services) in place, bounded by hoarding and not in use by the public.

The proposed development will ensure that all excavations are filled with soil and stone, and the entire site is left in a safe state. Once complete the landscaped areas will offer a useful amenity area for residents as well as for people in the locality. The proposed new development will provide much needed housing stock for the city of Limerick. The land is zoned within the Limerick City Development Plan 2010-1016 and the Southern Environs Local Area Plan 2021-2027 for residential development

The site is largely circular in shape and is bounded by the following;

North – To the north of the development site are lands zoned for open space. These lands are owned by the applicant, DW Raheen. A masterplan has been prepared for the future development of these lands should a change in the current zoning designation be achieved in the future.

South – The south of the development site is bounded by the Inis Mor Housing estate and the Ballinvoher housing estate to the south-eastern boundary. The proposed development includes houses on this boundary to reduce any impact of the development on the existing residential population.

East - The eastern boundary of the site is also bordered by the lands owned by the applicant but zoned for open space at present, as seen in the North section above.

West – To the western boundary of the development site is the R510 Regional Road. The existing roundabout to the south-west will provide the access point to the proposed development. Across the R510 to the west is mainly undeveloped lands with some existing residential housing in the Ard Aulin estate.

Economic and Employment Activity

The Economic and Social Research Institute’s (ESRI) Quarterly Economic Commentary (Winter 2020) suggested that there would be significant recovery in the Irish economy in Q3 of 2021, as COVID-19 restrictions are eased and the vaccination program ramps up for the general population. At the beginning of the COVID-19 crisis, it was unclear how the supply and demand sides of the economy would be impacted in comparison to the previous financial crisis of 2008.

The unemployment rate was expected to settle around 20% at the end of 2020, an increase from the average of 5% at the start of the year; however, the GDP was expected to increase by 3.4 per cent as a result of strong export performance bolstered by medicinal and pharmaceutical products and ICT services. There is also potential for recovery of domestic sources of growth in 2021 due to increased consumption, which could result in an overall output growth of nearly 5% when combined with continued growth of the exports sector.

In the last census (2016), the status of the population in the Study Area aged 15+ was relatively similar to that of Limerick City and County. The exceptions to this are that there was a much higher percentage of the population recorded as at work in the study are at 60% than in Limerick City and County which was recorded as 50%. Subsequently, there was a lower percentage of the population in the study area recorded as retired at 11% than in Limerick City and County which was recorded at 15%. The unemployment rate in Limerick was slightly lower than that recorded within the State in 2016.

Status	Limerick City and County Council	% of total	Study Area	% of total
At work	77,185	50%	8,392	60%
Looking for first regular job	1,481	1%	108	<1%
Unemployed having lost or given up previous job	11,454	7%	879	6%
Student	20,161	13%	1,562	11%
Looking after home/family	12,677	8%	953	7%
Retired	23,139	15%	1,588	11%
Unable to work due to permanent sickness or disability	8,494	5%	532	4%
Other	714	1%	49	<1%
Total	155,305	100%	14,063	100%

Table 4.4: Status of Population Aged 15+. Source: CSO.ie

It must be noted that the figures recorded in Table 4.4 at the last census are likely to have significantly changed in light of the ongoing Covid 19 pandemic and as such, must be taken as a representation of the average difference recorded between Limerick City and County and the Study Area.

Travel Patterns

The subject site is served by the 301 bus route with stops within 1 km from the subject site. Within two kilometres of the subject site, there are bus stops served by the 13, 14, 304, 304a, 304x, 314 and the 320 bus routes. The bus services are provided by Transport for Ireland and Bus Eireann. Table 4.5 details the travel modes recorded within the study area and Limerick City and County within the last census (2016) for the population over aged 5 years.

Mode	Limerick City and County	%	Study Area	%
On Foot	17,537	14%	1,301	10%
Bicycle	1,888	2%	196	2%
Bus, Minibus or Coach	8,611	7%	1,166	9%
Train, Dart or Luas	221	>1%	21	>1%
Motorcycle or Scooter	234	>1%	34	>1%
Car Driver	52,228	43%	6,167	49%
Car Passenger	26,130	21%	2,699	21%
Van	5,053	4%	342	3%
Other (Incl. Lorry)	524	>1%	20	>1%
Work from Home	3,912	3%	195	2%
Not Stated	5,826	5%	422	3%
Total	122,164	100%	12,563	100%

Table 4.5: Travel Modes Recorded in 2016 Source: CSO.ie

While the above Table 4.5 shows that travel modes are very similar between Limerick City and County and the study area in most regards, however, the percentage of people travelling by car was higher within the study area than the overall average of Limerick City and County.

Social Infrastructure

The subject site is considered well served in terms of services and local infrastructure to support the proposed development. There are a wide variety of services within easy walking distance to support the additional population. The current social infrastructure provision is highlighted in Figure 4.2 and also discussed below under a number of headings.

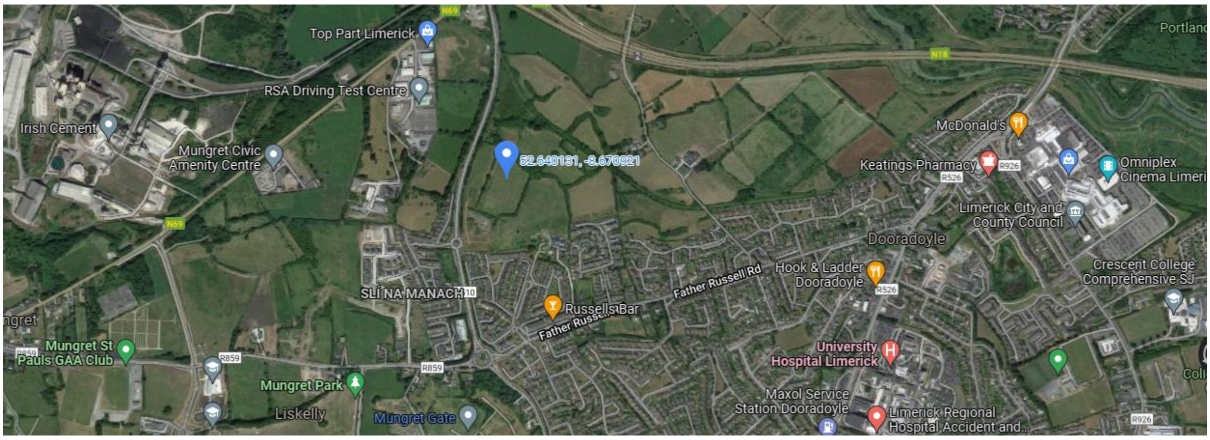

Figure 4.2: Social Infrastructure in the Vicinity of the Subject Site

Retail and Grocery – There are many options in relation to grocery shopping in close proximity to the subject site. To the south of the subject site is a Spar and Green Chilli Asian Foods store (5 minute walk), Tricia's Grocery to the south east (5 minute walk), Tesco is located approx. 2km to the east. In relation to other retail services, to the east of the subject site is the Crescent Shopping Centre which provides a wider range of retail offerings.

Services – There are a number of services within walking distance of the site including; Omniplex Cinema, Keatings Pharmacy, Crescent Shopping Centre, Mungret Civic Amenity Centre, Russell's Bar, hair and beauty salons, TBB Fitness, and Top Part Limerick.

Religious – Mungret Monastery is within walking distance from the subject site, located 1 km to the south of the site. St Paul's Catholic Church is located 2 km to the south east of the site and The Church of Jesus Christ of Latter-Day Saints is also located 2.8km to the south east of the subject site.

Medical – The subject site is located 2.5 km from the University Hospital Limerick. Additional medical services such as the Shannon Doc Limerick Health Clinic are also approx. 2 km from the subject site.

Sport – Mungret St. Paul's GAA Club and Mungret Regional Football Club are located 1.8 km to the west of the proposed development site. Garryowen Football club is located approx. 3 km to the east of the subject site.

Open Space – While the proposed developed would provide large areas of high quality open space for the enjoyment of the new residents and existing local population, there are a number of other open space opportunities currently available in the immediate area. These include; Mungret Park and Portland Park within walking distance from the subject site.

4.5 POTENTIAL IMPACT

Do Nothing Impact

If the proposed residential development were not to proceed, there would be no change to the existing environment. The potential for additional investment and employment in the area in relation to the construction and operation of the proposed residential site would be lost. It is considered that the 'Do Nothing' impact would be permanent, negative, and slight as the proposed development site is zoned for residential development and will contribute to the much-needed housing stock of Limerick.

Population

Construction Phase

During the construction phase of the proposed project, it is unlikely that there will be any significant impact upon the local population. The construction phase will result in a number of workers at the site, however, it is not envisaged that their place of residence will change as a result of the development, it is envisaged that construction workers would travel from their existing place of residence rather than moving, temporarily, to the area surrounding the site.

As a result, the impact on the local population during the construction phase is considered to be neutral, not significant and temporary in nature and therefore, no significant impacts are expected to arise in this regard.

Giving consideration to local residents, it is predicted that there may be some impacts which are likely to be associated with construction traffic, nuisance and disturbance. Such impacts are dealt with separately and assessed elsewhere in the EIAR and are considered to be short term, negative impacts. The level of impact predicted above is considered to align with the normal disturbance associated with the construction industry where a site is efficiently, sensitively and properly managed in the context of surrounding existing neighbouring development.

Operational Phase

The proposal includes 156 no. apartment units, 26 no duplex units and 202 no houses. Table 4.6 below shows the breakdown of unit type proposed. Based on the Average household size identified in the 2016 Census of 2.75, the projected population for the new development is estimated as 1,056 for the apartment, duplex and housing provided.

Unit Type	Studio	1 Bed	2 Bed	3 Bed	4 Bed	Total
Apartment	-	46	92	18	-	156
Duplex	-	-	6	10	10	26
Houses	-	-	20	156	26	202

Table 4.6: Breakdown on Unit Type by Size

The above estimated additional residents will be a significant increase to the existing local population. The development will provide much needed residential accommodation in the Limerick area in line with current Local, Regional and National planning policies.

The introduction of additional residents to the local area will support the existing community and social infrastructure. The proposed childcare facility, designed to accommodate the projected demand for childcare places resulting from the development, will mitigate any pressure upon existing childcare facilities. Please refer to the Childcare Demand Analysis submitted under a separate cover in this application for further details on projected childcare demand resulting from the proposed development.

Land Use and Settlement Patterns

Construction Phase

The proposed development complies with zoning policies contained within the Limerick City Development Plan 2010-2016 (as amended) as well as National and Regional policies relating to land use, compact development and provision of housing.

The construction phase will comprise of earthworks and construction works and will not have any impact on the residential amenities, rights of way or existing pedestrian and cycling routes. There will be some short term negative impact in terms of visual amenity as discussed further in the Landscape and Visual Amenity chapter in this EIAR but this is considered standard to construction activities and will only occur during the construction phase of development.

Operational Phase

The subject site is undeveloped at present and zoned for residential development within the Limerick City Development Plan 2010-2016 and the proposed development would enable 162 no. apartment units, 20 no duplex units and 202 no houses to be provided in a prime location.

As such, it is considered that the proposed development, once complete, will positively impact on land use and settlement patterns in the area through provision of much needed housing on a prime site that is zoned for such development and underutilised at present.

Economic and Employment Activity

Construction Phase

The construction phase of the development will have a positive impact in terms of economic and employment activity in the local area. The most notable benefit will be to the construction and building service sectors. The positive impact to these sectors is predicted to last for the duration of the construction stage over the three phases as outlined in Chapter 3 above. There will also be indirect economic benefits to local service and retail sectors during this time.

The number of workers on site is predicted to fluctuate during different stages of the development process but the construction manager and their team will be present on site during the whole process.

Overall, it is considered that proposed development will result in a positive, short term benefit in terms of economic and employment activity within the local area.

Operational Phase

The operational phase of the development will result in 156 no. apartment units, 26 no duplex units and 202 no houses and a creche. This will likely result in increased spending in the local economy and utilisation of local services. The creche and retail units will also provide a small number of employment opportunities.

It is considered that the operational phase of the development will result in a long term, positive impact on economic and employment activity in the local area.

Social Infrastructure

Construction Phase

It is not anticipated that any social infrastructure will be provided on the site during the construction phase of development. As such, it is considered that there is a neutral impact in terms of social infrastructure in this case.

It is possible that workers on site may utilise local social infrastructure during this time but it is not anticipated that this will be frequent or cause any negative impact.

Operational Phase

As discussed above, the subject site is well served by existing social infrastructure. Residents within the proposed development would support local businesses and provide a boost to the local economy. It was assessed within the Childcare Demand Analysis report submitted under a separate cover in this application that a childcare facility should be provided within the development so as not to burden the local existing facilities which are recorded as close to capacity at present.

It is considered that the proposed development would result in a positive long term impact for the local social infrastructure through increased business and local participation.

Human Health

Construction Phase

The EPA Draft Guidelines (2017) sets out how human health should be considered through assessment environmental pathways through which health could be affected.

The relevant pathways in relation to human health during the construction phase are considered to be air quality, noise and vibration, water and soil. The expected air quality effects are detailed in Chapter 8 along with proposed mitigation measures to ensure the protection of human health. Similarly, the potential noise and vibration related impacts arising from the construction phase and associated mitigation measures are contained in Chapter 9.

As with all construction projects, there will be inherent health and safety risks at this stage of the development. In order to manage this, a Construction and Environmental Management Plan has been prepared by Hutch O'Malley Consulting Engineers (2022) for the application and is submitted under a separate cover, to ensure that the relevant health and safety legislation is complied with at all stages of the construction process.

Operational Phase

Given the nature of the proposed project, it is not likely that any significant impacts on health and safety will arise during the operational phase. The development has been designed to provide a safe environment for future occupiers and visitors. The public realm, inclusive of pedestrian paths, cycle paths, roads and communal open spaces, have been designed in accordance with the best practice and relevant planning policy standards.

Similarly, the proposed residential units are all designed in accordance with the relevant guidelines and standards and are capable of meeting all relevant building standards and regulations. Having regard to the above, it is considered that the proposed project will result in a high standard of health and safety for all residents and visitors.

Once operational, the proposed project will not result in any significant impact on human health and safety.

4.6 MITIGATION

Construction Phase

The potential impacts upon human environment relate to other environmental factors such as air quality, noise and vibration and traffic. Where required, the related mitigation measures are dealt with in the corresponding chapters of this EIAR. Other than this, no significant adverse effects will arise in respect of the population during the construction or operational phase of this development.

Operational Phase

Once development is complete, the operational phase of the development is predicted to have a positive impact through provision of additional housing stock, a creche facility, small retail units and additional open space.

No risks to human health have been identified during the operation phase of the development. A management company will be put in place upon completion of development to manage the day to day maintenance of the development and ensure health and safety is prioritised within the development for the long term.

4.7 PREDICTED IMPACTS

Adherence to the mitigation and monitoring measures referred to above and throughout this EIAR will ensure that the proposed project will not give rise to significant adverse effects upon population and human health during the construction and operational phases of the proposed project. It is considered that once complete, the proposed development will have a positive impact for the local area.

5.0 BIODIVERSITY

5.1 INTRODUCTION

5.1.1 This biodiversity chapter forms part of the Environmental Impact Assessment Report (EIAR) prepared for the proposed residential development at Ballykeeffe, Raheen, Co. Limerick.

Site Description

5.1.2 The proposed development site ("the Site) is located at Ballykeeffe, Raheen, west of Limerick City and is approximately centred at Irish Transverse Mercator (ITM) Grid Reference: 554668, 654560. The Site measures approximately 10.44 hectares with access gained from an existing entrance off a roundabout on the R510 regional road. The site is bounded to the west by the R510 and to the east by a disused railway. Residential developments lie adjacent to the southern boundary.

5.1.3 The River Shannon/Estuary is approximately 1.5 km north of the Site while Ballinacurra Creek is approximately 1 km east. Bunlicky Lake, a manmade lake, is 400 m north of the Site. The River Shannon and Ballinacurra Creek are protected by earthen flood protection embankments (JBA, 2020).

5.1.4 The Site is greenfield land currently under agricultural use. The surrounding area is characterised by a mixture of agricultural, residential and commercial land use.

Brief Project Description

5.1.5 This project description has been provided by Lawlor, Burns & Associates.

> "The proposed development consists of the provision of 384 residential house and apartment units on a 10.44 hectare site located in Ballykeeffe, Raheen, Co. Limerick. The site is greenfield land that is enclosed by existing residential development to the south, east and west and open land to the north. Access to the site is provided by an existing entrance off a roundabout on the R510 regional road".

Purpose of this Report

5.1.6 The purpose of this Biodiversity chapter is to identify and describe the important ecological features and conditions at the Site and to identify potential significant effects associated with the proposed development. Where necessary appropriate mitigation, compensation and enhancement measures will be set out to reduce identified effects.

5.1.7 This chapter forms part of the EIAR that will be submitted with the planning application to assist the competent authority, in this case An Bord Pleanála to carry out an Environmental Impact Assessment (EIA) of the proposed housing development at Ballykeeffe, Raheen.

Evidence of Technical Competence and Experience

5.1.8 The ecological survey was carried out by SLR ecologist Michael Bailey MCIEEM in June 2021, and he also prepared this biodiversity chapter. SLR Technical Director Stuart Wilson MCIEEM CEnv carried out the technical review of the biodiversity chapter.

5.1.9 Michael Bailey holds a BSc (Hons) in Biology and Ecology from the University of Ulster, and an MSc in Quantitative Conservation Biology from the University of the Witwatersrand, Johannesburg, South Africa. Michael is a full member of the Chartered Institute of Ecology and Environmental Management (MCIEEM). He has prepared Appropriate Assessments and Ecological Impact Assessments for a wide range of projects in AFRICA, Ireland and the UK in the last 15 years.

5.1.10 Stuart Wilson is a Technical Director at SLR with twenty-five years professional experience as an ecologist and environmental impact assessment practitioner. Stuart has extensive experience as Competent Expert in habitats regulations assessment (HRA) having acted in this role for Highways England for the last 13 years. As part of this he has been a competent authority, technically assured HRA reports and authored/implemented the Design Manual for Roads & Bridges LA 115 Habitats Regulations assessment. Stuart has a BSc (Hons) degree in Environmental Biology from University of Essex and an MSc degree in Environmental Impact Assessment from the University of Wales, Aberystwyth. He is a full member of the Chartered Institute of Ecology and Environmental Management (MCIEEM) and is a Chartered Environmentalist (CEnv) with the Society for the Environment.

Relevant Legislation and Policy

Legislation

5.1.11 The main pieces of legislation in terms of ecology in regard to developments such as this are as follows;

- The EIA Directive (2014/52/EU).
- Planning and Development Acts 2000 to 2020 - PART XAB.
- The Habitats Directive (92/43/EEC).

- The Birds Directive (2009/147/EC)
- European Communities (Birds and Natural Habitats) Regulations 2011 – 2015.
- The Wildlife Acts 1976 to 2018.
- The Flora (Protection) Order 2015.

The details of these are summarised in Appendix 5A: Relevant Legislation and Planning Policy**,** of this report.

Local Policy

5.1.12 The relevant local planning policies have been extracted from the Limerick Development Plan 2010-2016 (as extended) and are presented in Appendix 5A of this report. These policies are specific to "Chapter 11: Landscape, Biodiversity & Recreation" of the city development plan and are concerned with the policies and objectives relating to biodiversity and designated sites.

5.2 DETAILED DESCRIPTION OF THE DEVELOPMENT

5.2.1 DW Raheen Developments Ltd. are seeking a ten-year permission for a strategic housing development consisting of the provision of 384 residential house and apartment units on a ca. 10.44-hectare site located in Ballykeeffe, Raheen, Co. Limerick.

5.2.2 The site is greenfield land that is enclosed by existing residential development to the south and east, the R510 to the west and open land to the north. Access to the site is provided by an existing entrance off a roundabout on the R510 regional road.

The proposed development will provide as follows:

5.2.3 202 no. housing units, comprising a variety of forms to include bungalows, detached, semi-detached and terraced houses. A mix of house sizes are proposed to include 20 no. two bedroom houses, 156 no. three bedroom houses and 26 no. four bedroom houses.

182 apartment and duplex units across 25 small scale blocks, 2 to 4 storeys in heights, throughout the development. The apartments and duplexes provide a mix of one, two, three and four bed units, comprising of 10 no. four bedroom duplex units, 10 no. three bedroom duplex units, 6 no. two bedroom duplex units, 18 no. three bedroom apartments, 92 no. two bedroom apartments and 46 no. one bedroom apartments.

5.2.4 The proposed development also includes:

A childcare facility measuring 761.75m2, providing 79 childcare places (55 full time and 24 after school places), located at the south-western edge of the development.

The provision of 377 no. car parking spaces and 311 secured bicycle parking spaces.

The provision of 3 no. ESB sub-stations, ancillary services and infrastructure works including foul and surface water drainage, attenuation areas, landscaped public open spaces (approximately 29,500m2, or 28.2% of the total site area), landscaping, lighting, internal roads, cycle paths, and footpaths.

5.3 Methodology

5.3.1 The site survey methods and ecological evaluation and assessment within this chapter have been undertaken with reference to the relevant parts of the 2019 Guidelines for Ecological Impact Assessment in the UK and Ireland developed by the Chartered Institute of Ecology and Environmental Management (CIEEM, September 2019). Although this is recognised as current good practice for ecological assessment, the guidance itself recognises that it is not a prescription about exactly how to undertake an ecological impact assessment (EcIA) but rather, they "*provide guidance to practitioners for refining their own methodologies*". For the full guidance, refer to https://www.cieem.net/data/files/ECIA%20Guidelines.pdf . The approach to impact assessment also has regard to advice set out in the EPA draft guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR) published in August 2017.

Important Ecological Features

5.3.2 Ecological features can be important for a variety of reasons and the rationale used to identify them is explained in the text. Importance may relate, for example, to the quality or extent of the site or habitats therein; habitat and / or species rarity; the extent to which such habitats and / or species are threatened throughout their range, or to their rate of decline.

Determining Importance

5.3.2 The importance of an ecological feature should be considered within a defined geographical context. The following frame of reference has been used in this case, relying on known/ published accounts of distribution and rarity where available, and professional experience:

- International (European).
- National (Ireland).
- Regional (Munster).
- County (Limerick).
- Townland (Park).
- Local (intermediate area between Site and Townland), and
- Site (the red line boundary of the development).

5.3.4 The above frame of reference is applied to the ecological features identified during the desk study and surveys to inform this report.

5.3.5 In assigning a level of value to a species, it is necessary to consider its distribution and status, including a consideration of trends based on available historical records. Examples of relevant lists and criteria include species of European conservation importance (as listed on Annexes II, IV and V of the Habitats Directive or Annex 1 of the Birds Directive), species protected under the Wildlife Acts 1976 - 2020 and Birds of Conservation Concern in Ireland 4 (Gilbert *et al.* 2021).

5.3.6 The approach to impact assessment, as set out in CIEEM guidelines, only requires that ecological features (habitats, species, ecosystems and their functions/processes), that are considered to be important and potentially affected by the proposed development are carried forward to detailed assessment. It is not necessary to carry out detailed assessment of receptors that are sufficiently widespread, unthreatened and resilient to impacts from the proposed development and will remain viable and sustainable. Therefore, for the purposes of this report, only ecological features of Local importance or greater and/or subject to legal protection have been subject to detailed assessment.

Impact Assessment

5.3.7 Where appropriate the impact assessment process involves the following steps:

- identifying and characterising potential impacts.
- incorporating measures to avoid and mitigate (reduce) these impacts;
- assessing the significance of any residual effects after mitigation;
- identifying appropriate compensation measures to offset significant residual effects (if required); and
- identifying opportunities for ecological enhancement.

5.3.8 When describing impacts, reference has been made to the following characteristics, as appropriate:

- Positive or negative;
- Extent;
- Magnitude;
- Duration;
- Timing;
- Frequency; and

- Reversibility.

5.3.9 The impact assessment process considers both direct and indirect impacts: direct ecological impacts are changes that are directly attributable to a defined action, e.g. the physical loss of habitat occupied by a species during the construction process. Indirect ecological impacts are attributable to an action, but which affect ecological resources through effects on an intermediary ecosystem, process or feature, e.g. the creation of roads which cause hydrological changes, which, in the absence of mitigation, could lead to the drying out of wet grassland.

- Consideration of conservation status is important for evaluating the effects of impacts on individual habitats and species and assessing their significance: Habitats – conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and its typical species within a given geographical area.
- Species – conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area.

Significant Effects

5.3.10 The 2018 CIEEM guidance sets out information in paragraphs 5.24 through to 5.28 of the guidance document which describes the concept of ecological significance. Significant effects are qualified with reference to an appropriate geographic scale, and the scale of significance of an effect may or may not be the same as the geographic context in which the feature is considered important.

5.3.11 A significant effect, for the purposes of EcIA, is defined as an effect that either supports or undermines biodiversity conservation objectives for '*important ecological features*' or for biodiversity in general. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy) or more wide-ranging (enhancement of biodiversity). Effects can be considered significant at a wide range of scales from international to local.

5.3.12 The nature of the identified effects on each assessed feature is characterised. This is considered, along with available research, professional judgement about the sensitivity of the feature affected, and professional judgement about how the impact is likely to affect the site, habitat, or population's structure and continued function. Where it is concluded that an effect would be likely to reduce the importance of an assessed feature, it is described as significant. The degree of significance of the effect takes into account the geographic context of the feature's importance and the degree to which its interest is judged to be affected.

Cumulative Effects

5.3.13 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 can occur where a proposed development results in individually insignificant impacts that, when considered in-combination with impacts of other proposed or permitted plans and projects, can result in significant effects.

5.3.14 Other plans and projects that should be considered when establishing cumulative effects are:

- proposals for which consent has been applied but which are awaiting determination;
- projects which have been granted consent, but which have not yet been started or which have been started but are not yet completed (i.e. under construction);
- proposals which have been refused permission, but which are subject to appeal, and the appeal is undetermined;
- constructed developments whose full environmental effects are not yet felt and therefore cannot be accounted for in the baseline; or
- developments specifically referenced in a National Policy Statement, a National Plan or a Local Plan.

Avoidance, Mitigation, Compensation & Enhancement

5.3.15 Where potentially significant effects have been identified, the mitigation hierarchy has been applied, as recommended in the CIEEM Guidelines. The mitigation hierarchy sets out a sequential approach beginning with the avoidance of impacts where possible, the application of mitigation measures to minimise unavoidable impacts and then compensation for any remaining impacts. Once avoidance and mitigation measures have been applied, residual effects are then identified along with any necessary compensation measures, and incorporation of opportunities for enhancement.

5.3.16 It is important to clearly differentiate between avoidance mitigation, compensation and enhancement and these terms are defined here as follows:

- Avoidance is used where an impact has been avoided, e.g. through changes in scheme design;
- Mitigation is used to refer to measures to reduce or remedy a specific negative impact in situ;
- Compensation describes measures taken to offset residual effects, i.e. where mitigation in situ is not possible; and

- Enhancement is the provision of new benefits for biodiversity that are additional to those provided as part of mitigation or compensation measures, although they can be complementary.

Desk Study

5.3.17 A desk study was carried out in June 2021 to collate the available existing ecological information on the Site. The Site and the surrounding area were viewed using existing available satellite imagery using Google maps[1] and Bing maps[2] .

5.3.18 The National Parks and Wildlife Service (NPWS)[3] and the National Biodiversity Data Centre (NBDC)[4] online resources were accessed for information on sites designated for nature conservation and on protected habitats and species known from the 2 km grid square R55M. Only records for the past 10 years are considered within this report as older records are unlikely to still be relevant given their age and the changes in land management that is likely to have occurred in the intervening period. Environmental Protection Agency (EPA) Maps[5] were accessed for other environmental information, such as surface water features, relevant to preparation of this report.

5.3.19 Limerick City and County Council's website[6] was accessed for information on relevant planning policy, while the planning portal[7] was accessed for information on other proposed or permitted developments within the Site and immediate surrounding area.

5.3.20 Birds of Conservation Concern in Ireland (BoCCI), published by BirdWatch Ireland and the RSPB NI, is a list of priority bird species for conservation action on the island of Ireland. The BoCCI lists birds which breed and/or winter in Ireland and classifies them into three separate lists; Red, Amber and Green; based on the conservation status of the bird and hence their conservation priority. Birds on the Red List are those of highest conservation concern, Amber List are of medium conservation

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[1] https://www.google.ie/maps (last accessed 24 June 2021)
[2] https://www.bing.com/maps (last accessed 24 June 2021)
[3] https://www.npws.ie/(last accessed 24 June 2021)
[4] https://maps.biodiversityireland.ie/ (last accessed 24 June 2021)
[5] http://gis.epa.ie/(last accessed 24 June 2021)
[6] https://www.limerick.ie/ (last accessed 24 June 2021)

[7] http://eplan.limerick.ie/searchtypes (last accessed 24 June 2021)

concern and Green List are not considered threatened. The BirdWatch Ireland website[8] was accessed for information on birds of conservation concern.

5.3.21 All bird species are protected under the Wildlife Acts 1976 – 2018 but for the purposes of this report only records of species within the last 10 years that are Red or Amber-listed on BoCCI or listed on Annex 1 of the Birds Directive are included from records held by the NBDC and NPWS web searches (see Table 2 in Section 4.18).

5.3.22 The conservation status of mammals, amphibians, reptiles, fish and protected flora within Ireland and Europe is using one or more of the following documents: Wildlife Acts (1976 - 2012), the Red List of Terrestrial Mammals (Marnell et al., 2009), Ireland Red Lists No.5: Amphibians, Reptiles and Freshwater Fish (King et al. 2011), The Flora (Protection) Order, 2015 (S.I. No. 356 of 2015) and the EU Habitats Directive 92/43/EEC.

5.3.23 The documents reviewed to assist the preparation of this report include: the Natura Impact Statement for the project (SLR, 2021a), Tree Survey Report (SLR, 2021b), Civil Engineering Report (Hutch O'Malley, 2022), Construction Environmental Management Plan (CEMP) (Hutch O'Malley, 2022), design drawings and proposed development information supplied by the client.

Zone of Influence

5.3.24 The 'zone of influence' for a project is the area over which ecological features may be subject to significant effects because of the proposed project and associated activities. This is likely to extend beyond the project site, for example where there are ecological or hydrological links beyond the site boundaries. The zone of influence will vary for different ecological features depending on their sensitivity to an environmental change (CIEEM, 2019).

5.3.25 Irish guidance (DoEHLG, 2010)[9] states, for the zone of influence of plans, that "*A distance of 15 km is currently recommended in the case of plans derives from UK guidance* (Scott Wilson et al, 2006)". The guidance goes on to state that "*for projects, the distance could be much less than 15 km, and in some cases less than 100 m, but this must be evaluated on a case-by-case basis with reference to the nature, size and location of the project, the sensitivities of the ecological receptors, and the potential for in-combination effects*."

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[8] https://birdwatchireland.ie/(last accessed 24 June 2021)

[9] *Appropriate Assessment of Plans and Projects in Ireland -Guidance for Planning Authorities*

5.3.26 The zone of influence in this case is identified through a review of the nature and scale of the project, the project location relative to designated site for conservation (Natura 2000 sites and Natural Heritage Areas), presence of ecological and landscape connectivity, such as along waterways, hedgerows and treelines between the Site and designated sites, known impacts and effects likely to arise as a result of this type of project, distance from and the qualifying interests of the designated sites.

Field Surveys

5.3.27 Extensive field surveys were designed to provide a rapid assessment of the ecological features present or potentially present within the proposed development site and its surroundings, and address gaps in the baseline data obtain through desk study and to update existing records, a series of habitat and species surveys were undertaken. The scope and extent of the surveys was determined through review of the desk study information.

Habitat Survey

5.3.28 Habitats were identified and classified using '*A Guide to Habitats in Ireland*' (Fossitt, 2000) during the visit. The dominant plant species present in each habitat type were recorded. Species nomenclature follows Parnell & Curtis (2012) for scientific and English names of vascular plants.

5.3.29 Incidental sightings or evidence of birds, mammals or amphibians were also noted during the habitat survey and the habitats were evaluated for their suitability to support such species.

Bat Survey

5.3.30 Following the review of available baseline information it was determined that the proposed development had the potential to negatively impact upon bats and their habitats.

The bat habitats were evaluated for their potential to support foraging, commuting and roosting bats using Bat Conservation Trust Guidelines (Collins, 2016) Appendix B, as recommended by CIEEM, for use in the UK and Republic of Ireland.

5.3.32 A Preliminary Roost Assessment (PRA) of the larger trees on site was undertaken during daylight hours where the trees within the Site were visually inspected from ground level for Potential Roost Features (PRF) such as holes and cavities, cracks and splits in major limbs, loose bark, ivy cover and dense epicormic growth. Binoculars and a high-powered torch were used to search for the presence of potential roost features.

5.3.33 The bat survey also made an evaluation of the habitats within the Site for their potential to support foraging and commuting bats.

Limitations

Desk Study

5.3.34 Desk study data is unlikely to be exhaustive, especially in respect of species, and is intended mainly to set a context for the study. It is therefore possible that important habitats or protected species not identified during the data search do in fact occur within the vicinity of the site. Interpretation of maps and aerial photography has been carried out using recent imagery, but it has not been possible to verify the accuracy of any statements relating to land use and habitat context outside of the field study area.

5.4 BASELINE ECOLOGICAL CONDITIONS

5.4.1 This section of the chapter sets out the baseline ecological conditions at the Site using the findings of the desk study and surveys.

Zone of Influence

5.4.2 The Site ultimately drains to the River Shannon via two existing culverts and is therefore directly connected to the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA. Both of these Natura 2000 sites are considered to be within the zone of influence of the project as the proposed development will discharge to the existing culverts during construction and operation.

5.4.3 The effects of the construction and operation of the proposed housing development are likely to be localised in nature and would typically be limited to the Site or the area immediately adjacent to the Site. However, given that the proposed development will discharge surface water to the canal, and there is a surface water pathway linking the Site to the sites designated for nature conservation, applying a precautionary approach a zone of influence of 2 km has been adopted for the purposes of this report. The sites designated for nature conservation within 2 km of the Site are shown on Figure 5.1.

Sites Designated for Nature Conservation

5.4.4 The proposed development is not within, or immediately adjacent to any sites designated for nature conservation (Figure 5.1). Sites that have been designated for nature conservation within the identified zone of influence of 2 km are discussed in this section.

Natura 2000 Sites

5.4.5 The potential for effects on Natura 2000 sites is addressed in the AA screening report and NIS prepared for the proposed development (SLR 2021).

5.4.6 The following Natura 2000 sites are located within 2 km of the Site and are considered to be within the zone of influence of the proposed development:

- The River Shannon and River Fergus Estuaries SPA (004077).
- The Lower River Shannon SAC (002165).

5.4.7 The Site is within 770 m of the Lower River Shannon SAC and within 604 m of the River Shannon and River Fergus Estuaries SPA (Figure 5.1). The Site is considered to be connected via surface water pathways to both of these Natura 2000 sites. The Site is not connected, via hydrological pathways or ecological features, to any other Natura 2000 sites within 15km of the Site (Table 5.1).

Table 5.1: Natura 2000 Sites within 15km of the Proposed Development Site

Natura 2000 Site	**Site Code**	**Location at Closest Point to Project Site**
The Lower River Shannon SAC	002165	604m north
The River Shannon and River Fergus Estuaries SPA	004077	770m north
Askeaton Fen Complex SAC	002279	11.5km south west
Curraghchase Woods SAC	000174	14.1km south west
Glenomra Woods SAC	001013	14.7km north

5.4.8 The potential impacts of the development that could affect the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA identified in the NIS are as follows:

- Discharge of surface water to the canal during construction and operation of the development .
- Disturbance of species due to noise and lighting associated with construction and operation of the development.

5.4.9 The construction and operation of the proposed residential development at Raheen has potential to release contaminated surface water. The contaminants may enter the River Shannon via the existing surface water network and has the potential to cause negative effects on aquatic species and habitats associated with the SAC and SPA, through the deterioration of water quality, changes in water chemistry and reduction in habitat.

5.4.10 The AA screening report identified potential for effects on otter, a mobile qualifying interest of the Lower River Shannon SAC, due to disturbance during construction and operation of the proposed development. There are no other qualifying interests of the SAC or SPA likely to be affected.

5.4.11 Following implementation of appropriate mitigation measures, as described in the NIS, the proposed development is not predicted to give rise to adverse effects on the integrity of the Lower River Shannon SAC or the River Shannon and River Fergus Estuaries SPA, either alone or in-combination with other projects or plans.

5.4.12 The NIS concluded that the proposed housing development, either individually or in combination with other plans or projects, will not have an adverse effect on the integrity of any Natura 2000 sites. Therefore, Natura 2000 sites are scoped out and excluded from any further consideration in this report.

Proposed Natural Heritage Areas / Natural Heritage Areas

5.4.13 There are no Natural Heritage Areas (NHA) located within the zone of influence for the proposed development. There are two proposed Natural Heritage Area (pNHA) within 2 km of the Site and therefore, within the zone of influence.

5.4.14 Inner Shannon Estuary, South Shore pNHA (000435) is located approximately 0.83 km southwest of the Site. This pNHA is located along the north shore of the Shannon. A detailed site synopsis is unavailable for the site. However, the site designation is concurrent with the Lower River Shannon

SAC and the River Shannon and River Fergus Estuaries SPA. Potential impacts on this Natura 2000 site, and therefore on this pNHA, have been addressed in the NIS for the development.

5.4.15 Loughmore Turlough pNHA (000438) is located adjacent to the main Limerick /Cork Road (N20). It lies in a shallow basin, elongated in an east-west direction. The hydrogeological review and assessment notes that the turlough is prone to flooding in winter months (to a depth of approximately 30 to 40 cm), but that in general it is reported to be drier in recent times due to drainage of the surrounding land rather than of the turlough itself.

5.4.16 Both of these pNHA sites are considered to be of National importance. They are located within 2 km of the Site (i.e. within the potential zone of influence) and are therefore given further consideration in this report.

Rare and Protected Flora and Fauna

5.4.17 The NBDC database was searched for records within the 2 km grid square R55M within which the Site is located. The records returned are of varying ages so for the purposes of preparing this report only the relevant records dated within the last 10 years have been considered, with the exception of bats (Table 5.2).

5.4.18 The desk-study records indicated the potential for presence of bird and bat species, however, the absence of recent (within 15 years) records of species from the NBDC database does not necessarily imply that a species does not occur within the search area, rather it has not formally been recorded as present. Similarly, the presence of a record for a protected species within the 2 km grid squares does not mean that the species is present within the Site.

Table 5.2. Rare and/or Protected Species Recorded Within 2 km Grid Square R55M

Species recorded	Date of last record	No. Records	Conservation Status	Dataset
Common Frog *Rana temporaria*	2010	2	Habitats Directive: Annex IV, Wildlife Acts 1976 to 2018	Irish National Frog Database
Common Coot *Fulica atra*	2013	1	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Goldeneye *Bucephala clangula*	2011	1	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011

Species recorded	Date of last record	No. Records	Conservation Status	Dataset
Greenshank *Tringa nebularia*	2011	1	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Kestrel *Falco tinnunculus*	2011	1	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Kingfisher *Alcedo atthis*	2011	1	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Linnet *Carduelis cannabina*	2011	1	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Pochard *Aythya ferina*	2011	1	Birds Directive: Annex I BoCCI: Red List	Bird Atlas 2007 - 2011
Redshank *Tringa totanus*	2011	1	Birds Directive: Annex I BoCCI: Red List	Bird Atlas 2007 - 2011
Common Sandpiper *Actitis hypoleucos*	2011	1	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Snipe *Gallinago gallinago*	2011	1	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Starling *Sturnus vulgaris*	2011	1	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Swift *Apus apus*	2011	1	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Dunlin *Calidris alpina*	2011	1	Birds Directive: Annex I BoCCI: Red List	Bird Atlas 2007 - 2011
Greylag Goose *Anser anser*	2011	1	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
House Sparrow *Passer domesticus*	2011	1	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Northern Lapwing *Vanellus vanellus*	2011	1	Birds Directive: Annex I BoCCI: Red List	Bird Atlas 2007 - 2011
Sky Lark *Alauda arvensis*	2011	2	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011

Species recorded	Date of last record	No. Records	Conservation Status	Dataset
Sand Martin *Riparia riparia*	2011	2	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Spotted Flycatcher *Muscicapa striata*	2011	1	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Barn Swallow *Hirundo rustica*	2011	2	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Black-headed Gull *Larus ridibundus*	2011	3	Birds Directive: Annex I BoCCI: Red List	Bird Atlas 2007 - 2011
Mute Swan *Cygnus olor*	2011	2	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Curlew *Numenius arquata*	2011	1	Birds Directive: Annex I BoCCI: Red List	Bird Atlas 2007 - 2011
Teal *Anas crecca*	2011	1	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Great Cormorant *Phalacrocorax carbo*	2011	5	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Great Crested Grebe *Podiceps cristatus*	2011	2	Birds Directive: Annex I BoCCI: Amber List	Bird Atlas 2007 - 2011
Daubenton's Bat *Myotis daubentoniid*	2005	1	Habitats Directive: Annex IV Wildlife Acts 1976 to 2018	National Bat Database of Ireland
Leisler’s Bat *Nyctalus leisleri*	2005	1	Habitats Directive: Annex IV Wildlife Acts 1976 to 2018	National Bat Database of Ireland
Common Pipistrelle *Pipistrellus pipistrellus*	2005	1	Habitats Directive: Annex IV Wildlife Acts 1976 to 2018	National Bat Database of Ireland
Soprano Pipistrelle *Pipistrellus pygmaeus*	2005	1	Habitats Directive: Annex IV Wildlife Acts 1976 to 2018	National Bat Database of Ireland

Field Surveys

5.4.19 The Site was visited on 17 June 2021 and a walkover survey was carried out by SLR ecologist Michael Bailey. Weather conditions were clear and dry with a gentle breeze. The temperature was ca. 15°C. The objective of the site visit was to describe and evaluate the ecological features within the Site.

5.4.20 The habitats and species recorded within the proposed development site are described, classified and evaluated in this section of the report, and shown on Figure 5.2 and described further in the sections below.

Habitats

5.4.21 Habitats present within the Site, as recorded during the walkover survey, are described in this section. Habitat classification follows that of '*A Guide to Habitats in Ireland'* (Fossitt, 2000). A habitat map for the site is provided as Figure 5.2 at the end of this report.

Scrub (WS1)

5.4.22 Scrub (WS1) is present in several areas within the Site. They are typically composed of Black willow *Salix viminalis*, blackthorn *Prunus spinosa*, guelder-rose *Viburnum opulus*, ivy *Hedra helix , young* ash *Fraxinus excelsior,* elder *Sambucus nigra*, hawthorn *Crataegus monogyna,* dog rose *Rosa canina*, butterfly bush *Buddleja davidii* and bramble (*Rubus fruticosus*).

5.4.23 The scrub within the Site is a poor example of this habitat type due to the lack of diversity in plant species and aerial photography indicates that it has formed relatively recently (<10 years). Scrub habitat within the Site is evaluated as important at the Site level and is scoped out of further assessment.

Mixed Broadleaved Woodland (WD1)

5.4.24 Mixed Broadleaved Woodland (WD1) is present in a small area in the north of the Site (Plate 1). This area is comprised of 14 large mature trees including sycamore *Acer pseudoplatanus*, beech *Fagus sylvatica*, and ash. There is an understorey of smaller trees, hazel (Corylus colurna) and hawthorn along the edge of the group, and the tree report the individual trees are not of great form/structure and are potentially prone to failure (SLR 2021).

5.4.25 The area of mixed broadleaved woodland within the Site is small, with low diversity of species. This habitat type is commonly occurring throughout Ireland although in the urban setting less so. Mixed broadleaved woodland habitat within the Site is evaluated as important at the Local level.

Recolonising Bare Ground (ED3)

5.4.26 There are a number of small areas of recolonising bare ground (Plate 2) present near the access point to the Site and an area near the woodland towards the north of the Site where the vegetation is more established.

5.4.27 Species recorded include common species such as cleavers *Gallium aparine*, bush vetch *Vicia sepium*, common knapweed *Centaurea nigra*, ribwort plantain *Plantago lanceolata*, common field speedwell *Veronica persica*, bramble *Rubus fruticosus* agg., ivy *Helix hedera*, cut-leaved cranesbill *Geranium dissectum*, ground ivy *Glechoma hederacea*, spear thistle *Cirsium vulgare,* common ragwort *Senecio jacobaea,* curly-leaved dock *Rumex crispus*, nettle *Urtica dioica,* dandelion *Taraxacum* sp., white clover *Trifolium repens,* creeping buttercup *Ranunculus repens*, daisy *Bellis perennis,* creeping cinquefoil *Potentilla reptans* and rape *Brassica napus*.

5.4.28 This habitat is transient in nature and arises from disturbing areas. This habitat is common and widespread across Ireland. This habitat is assessed as important at the Site level and is scoped out of further assessment.

Improved Agricultural Grassland (GA1)

5.4.29 Improved agricultural grassland (Plate 3) comprises five fields within the Site boundary and have been cultivated and managed for the production of pastureland for cattle and horses. These fields have been planted with perennial ryegrass *Lolium perenne* and are largely homogenous in nature. Any plant diversity present in this habitat is primarily confined to its marginal areas where the fields meet linear habitats such as hedgerows (WL1).

5.4.30 Improved agricultural grassland is one of the most common and widespread habitats occurring in Ireland. Improved agricultural grassland habitat is species poor and highly modified by agricultural practices. This habitat is evaluated as not important and is scoped out of further consideration in this assessment

Hedgerow (WL1)

5.4.31 There are several hedgerows marking the boundaries between the individual fields throughout the site. They were broken up into smaller sections for the purpose of this tree survey, to illustrate changes in height, width, dominating species and/or understorey.

5.4.32 These hedgerows have been unmaintained for years, so that in some areas the individual trees/shrubs have grown up to be tall, widely spreading and gappy. All hedgerows contain hawthorn and blackthorn, which are also typically the dominant species. The hedgerow towards the eastern boundary is dominated by hazel and elm. In most cases there is a dense understorey of bramble and ivy, with the bramble forming wide bands along the edge of some of the hedgerows.

5.4.33 Hedgerows within the application site provide ecological connectivity to the larger hedgerow network in the surrounding area. Hedgerows within the application site are evaluated as important at the Local Level.

Spoil and Bare Ground (ED2)

5.4.34 There are some small areas near the access point to the Site where some building rubble and large concrete pipes have been discarded or stored prior to removal off-site. They are closely associated with the surrounding area of recolonising bare ground and if left for any length of time these areas are also likely to become colonised with vegetation.

5.4.35 This habitat is transient in nature and is common and widespread across Ireland. This habitat is assessed as not important and is scoped out of further assessment.

Marshland (GM1)

5.4.36 There is an area of Marshland at the northern most part of the Site and a majority of this habitat lies outside the Site boundary, however, it receives some surface water which flows off the adjacent agricultural fields.

5.4.37 The substrate is alluvial silty, sandy loam and the ground was wet in places with standing water in the area closest to the drainage ditch which runs along the western boundary of this habitat, and which links to the local drainage channels and ultimately the Shannon River 600m further north-west.

5.4.38 The vegetation was species rich and dominate by rushes J*uncu*s spp and sedges *Care*x spp with wide-spread yellow iris *iris pseudacorus*, with other flowering plants including cuckoo flower

Cardamine pratensis, heath spotted orchid *dactylorhiza maculate* (Plate 4), fen bedstraw *Galium uliginosum*, and marsh valerian *Valerian dioica*.

5.4.39 This area did not contain tall hydrophilous herb species characteristic of the Annex 1 habitat e.g. dominant meadowsweet *Filipendula ulmaria,* and no horsetail *Equisetum arvense*, bindweed *Calystegia sepium* or purple loosestrife *Lythrum salicaria* were noted.

5.4.40 This habitat is common in Ireland and is well represented along the River Shannon estuary area. As most of this habitat will not be affected by the proposed development it is assessed as important at the Site level only and is scoped out of further assessment.

Protected Flora

5.4.41 A review of the Lower River Shannon SAC Site Synopsis and Conservation Objectives supporting document for 'Water courses of plain to montane levels with *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' (NPWS, 2012) revealed records of the nationally rare triangular club-rush *Schoenoplectus triqueter* present in the innermost parts of the estuaries and the tidal channels including the Ballinacurra Creek which is located 800m east of the Site and which is hydrologically linked to the Site. However, this plant grows on the mud banks along the lower reaches of tidal sections of the River Shannon and is therefore not likely to be present in any of the habitats found on or adjacent to the Site.

5.4.42 The proposed development will connect into the public sewerage system and will only discharge clean surface water run–off into the existing culvert which ultimately links to the Ballinacurra Creek and the River Shannon and this will not affect the water quality in the creek or river. Therefore, there is no potential for effects on triangular club-rush within the creek or river and it is scoped out of further consideration within this report.

Amphibians

5.4.43 Common frog *Rana temporia* and smooth newt *Lissotriton vulgaris* are protected under the Wildlife Acts 1976 to 2018. Species protected under the Wildlife Act are those listed on Schedule 5. Since the publication of the Wildlife Act 1976, the list of Schedule 5 species has been extended through the publication of Wildlife Act 1976 (Protection of Wild Animals) Regulations in 1980 and 1990. Common frog and smooth newt were added to the Wildlife Act 1976 by regulations made in SI 282/1980.

5.4.44 While there is limited suitable habitat for common frog and smooth newt is present within the marsh area to the north, no evidence of these species was recorded within the Site, however, the survey was conducted outside the main amphibian breeding season.

5.4.45 As the proposed development is not likely to affect the water quality in the marsh area, there should be no effect on the local amphibian population. Amphibians are scoped out and not considered further in this report.

Birds

5.4.46 Birds recorded during the field survey in June 2020 included wood pigeon *Columba palumbus,* hooded crow *Corvus cornix, m*agpie *Pica pica,* robin *Erithacus rubecula,* blackbird *Turdus merula, s*ong thrush *Turdus philomelos, jackdaw Corvus monedula, chaffinch Fringilla coelebs, wren Troglodytes troglodytes* and starling *Sturnus vulgaris.* All species recorded during the field visit are typical in a wide range of habitats, are commonly occurring throughout Ireland and all, except the starling which is amber-listed, are Green-listed (least concern) species on BoCCI. The bird assemblage of the Site would be evaluated as important at the Site level.

Mammals

Otter

5.4.47 Otters, and their breeding and resting places, are protected under the Wildlife Acts. Otter is also listed in Annex II and Annex IV of the EU Habitats Directive. Otter are a qualifying interest for the Lower River Shannon SAC and are present in the river and the lower reaches of the Ballinacurra Creek.

5.4.48 The culvert and drain located along the north-eastern boundary of the Site was inspected during field surveys. No evidence of otter was recorded, and the drain is not suitable for use by otter.

Bats

5.4.49 Habitats within the site were evaluated for bat foraging, commuting and roosting suitability using using Bat Conservation Trust Good Practice Guidelines (Collins, 2016) Appendix B, and criteria outlined in *Bat Surveys for Professional Ecologists*, (Bat Conservation Trust, 2016) which is recognised as good practice guidance by the Chartered Institute of Ecology and Environmental Management (CIEEM) in Ireland as well as the UK. There are no equivalent guidelines available specifically for Ireland and much of the available guidance for bats in Ireland is older, out of date and lacks the detail of the BCT publication.

5.4.50 Trees within the proposed site were also evaluated for their potential to support roosting bats. Trees inspected were not of sufficient size and age and lacked potential roost features that may be used by bats. Trees within the Site were evaluated as negligible suitability to support roosting bats (see also SLR Tree Survey Report 2021).

5.4.51 Woodland, hedgerow and scrub habitats within the Site are moderately suitable for foraging and commuting bats. These habitats provide connectivity with the wider landscape.

5.4.52 The bat assemblage of the Site would be evaluated as important at the Local level.

Other Mammals

5.4.53 Fox *Vulpes vulpes* scat was recorded within the Site but no other signs of fox were noted. Fox is not legally protected in Ireland and is a commonly occurring species in a wide range of habitats.

5.4.54 There were no other mammal signs noted within the Site and other mammals, such as badger *Meles meles*, are excluded from further consideration in this report.

Invasive Species

5.4.55 The NBDC database was searched for records of invasive species within the 2 km grid square R55M within which the Site is located. There were no recent records, dated within the last 10 years, returned for any plant species listed under the Third Schedule of the EC Birds and Natural Habitats Regulations 2011.

5.4.56 No plant or animal invasive species listed under the Third Schedule of the Habitats Directive and subject to restrictions under Regulations 49 and 50 were observed during the ecological site walkover in June 2021. Invasive species are scoped out of further consideration in this report.

Summary of Important Ecological Features

5.4.57 Table 5.3 summarises all important ecological features for which detailed assessment is required. The geographical scale of importance for the ecological features within the Site are summarised along with their legal status and a rationale, where appropriate, for not carrying forward any features for detailed assessment. Note that for the Designated Sites, European designated sites such as SAC and SPA have been omitted for this table as they have been subject to a separate Appropriate Screening Assessment, which found that the proposed housing development would not significantly affect the qualifying interests for these sites.

Table 5.3: Summary of Important Ecological Features Subject to Detailed Assessment

Ecological Feature		Scale of importance	Comments on Legal Status and/or Importance
Designated sites	Inner Shannon Estuary, South Shore pNHA (000435) and Loughmore Turlough pNHA (000438)	National	Both of these sites are pNHAs so are considered to be of National importance. They are located within 2 km of the Site (i.e. within the potential zone of influence).
Habitats	WL1 – Hedgerows	Local	Referenced in several policies, objectives and goals of Limerick City Development Plan 2010-2016.
	WD1 – Mixed Broadleaved Woodland	Local	Referenced in several policies, objectives and goals of Limerick City Development Plan 2010-2016.
Species	Birds	Local	Wildlife Acts 1976 – 2018 confers protection on breeding birds. Referenced also in several policies, objectives and goals of Referenced in several policies, objectives and goals of the Limerick City Development Plan 2010-2016, relating to protected habitats and species. Various red and amber listed species have been recorded within the zone of influence but not on the Site itself.
	Bats	Local	Wildlife Acts 1976 – 2018 and Annex IV of the Habitats Directive confers protection on all Irish bat species and their roosts. Referenced in several policies and objectives of the Limerick City Development Plan 2010-2016, relating to protected habitats and species.

5.5 ASSESSMENTS OF EFFECTS AND MITIGATION MEASURES

5.5.1 The potential effects resulting from the proposed development and proposed mitigation measures are discussed in the following sections. The following design principles and "designed-in" mitigation have informed the assessment of impacts.

- Within the design of the project, good practice environmental and pollution control measures are employed with regard to current best practice guidance such as, but not limited to, the following:
- CIRIA C532, 'Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors' (CIRIA, 2001).
- CIRIA C741, 'Environmental Good Practice on Site Guide' (CIRIA, 2015).
- There is an indirect surface water connection between the Site and the Ballinacurra Creek which flows into the River Shannon estuary. However, all surface water runoff within the Site will be directed to the existing attenuation area prior to discharge to receiving waters via existing culverts. Park Canal and there will be no discharge of untreated water to the canal during construction or operation.
- The Landscape Plan prepared for the development has been designed to recreate and enhance the natural conditions on the Site insofar as is possible.

5.5.2 Taking the above into account, the potential impacts of the proposed development are outlined in the following sections.

Do Nothing Impact

5.5.3 In the absence of the proposed development, it is likely that the site would continue to be unmanaged and would be subject to further habitat succession. The Do-Nothing Impact will therefore result in no short-term significant change in the ecological interest of the Site.

Sites Designated for Nature Conservation

Potential Impacts

5.5.4 The hydrogeological review and assessment notes that the turlough is prone to flooding in winter months (to a depth of approximately 30 to 40 cm), but that in general it is reported to be drier in recent times due to drainage of the surrounding land rather than of the turlough itself. Any change in the ground water conditions could affect the characteristics of this turlough

Proposed Mitigation Measures

5.5.5 No specific mitigation is required as this pNHA is sufficiently distant from the Site such that there is no surface or ground water connection between the Site and this pNHA.

Significance of Residual Effects

5.5.6 There will be no residual effects on the turlough from the construction or operational phases of the proposed development.

Hedgerows – WL1

Potential Impacts

5.5.7 It is proposed to remove approximately 13 sections of hedgerow within the application site (refer to Tree Survey Report SLR 2021). This represents a significant proportion of the total length hedgerow within and around the existing application site. No external hedgerows on the boundaries of the proposed development area will be removed.

5.5.8 The removal of hedgerows will be significant at the Local Level.

Proposed Mitigation Measures

5.5.9 No specific mitigation measures are required outside that of the proposed planting scheme as described within the Landscape Specification submitted under a separate cover and the Landscape and Visual Impact Chapter of this EIA Report.

5.5.10 A hedge management plan should be prepared and implemented, as part of the future maintenance of the green spaces within the site.

Significance of Residual Effects

5.5.11 There will be a residual effect due to the loss of this habitat but with replacement planting as part of the landscape scheme for the development the residual effect is not considered significant.

Mixed Broadleaved Woodland - WD1

Potential Impacts

5.5.12 The proposed development will result in the loss of approximately 40 mostly mature/over mature trees.

Proposed Mitigation Measures

5.5.13 In compensation for the loss of trees / shrubs, the proposed development contains considerable proposals for native tree / shrub planting in both the internal designed public spaces, as well as the larger public open spaces along the northern and eastern boundaries. In the larger spaces, groups of trees / small woodland areas are proposed. Trees species proposed include native species such as alder, birch and rowan.

Significance of Residual Effects

5.5.14 When the replanted trees and scrubs trees in the open public spaces have become established, the effect is considered to be short-term and the residual effect is not considered significant.

Birds

Potential Impacts

5.5.15 The proposed development will result in the temporary loss of hedgerows and trees within the development site. This represents loss of potential nesting habitat for commonly occurring bird species.

5.5.16 Various red and amber listed species (see Table 5.2) have been recorded within the zone of influence but not on the Site itself which does not have the habitats to support these bird species.

Proposed Mitigation Measures

5.5.17 In compensation for the loss of trees and hedgerows, the proposed development contains considerable proposals for native tree / shrub planting in both the internal designed public spaces, as well as the larger public open spaces along the northern and eastern boundaries. In the larger spaces, groups of trees / small woodland areas are proposed.

Significance of Residual Effects

5.5.18 Over time the replanted trees and scrubs trees in the open public spaces will reached a certain size and maturity to attract nesting birds, and therefore the effect is considered to be short-term and the residual effect is not considered significant.

Cumulative Effects

5.5.19 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 can occur where a project results in individually insignificant impacts that, when considered in-combination with impacts of other proposed or permitted plans and projects, can result in significant effects (CIEEM, 2018).

5.5.20 The following plans were reviewed for strategies and objectives that may act in-combination with the proposed development:

- Limerick City Development Plan 2010 – 2016 (as extended).
- Limerick County Development Plan 2010 – 2016 (as extended)
- Limerick City Biodiversity Plan 2011 – 2016.

5.5.21 Limerick City and County Council planning portal was accessed to examine planning applications in the vicinity of the Site for potential to act in-combination with the proposed development.

5.5.22 There are no strategies or objectives in the City Development Plan or in the Biodiversity Action Plan, that are likely to result in significant effects when considered in-combination with the proposed housing development.

5.5.23 The planning applications in the immediate area of the Site consisted of private house extensions, one-off and small-scale housing and community developments and change of use. It is not considered likely that these projects could act in-combination with the proposed works to result in cumulative effects on Natura 2000 sites.

5.5.24 The proposed development is not likely to result in significant residual effects. Therefore, there is no potential for cumulative or in-combination effects with other plans and projects.

Proposed Monitoring

5.5.25 The proposed development is not likely to result in significant residual effects and monitoring is therefore not required.

5.6 CONCLUSIONS

5.6.1 The proposed housing development at Raheen will result in localised effects on the ecology of the Site.

5.6.2 There will be no effect on any sites designated for nature conservation as a result of the proposed development.

5.6.3 The habitats within the Site are commonly occurring, widespread and resilient in Ireland.

5.6.4 There will be a loss of hedgerows and mixed broadleaved woodland habitats, and effects on the bird population which are all evaluated as important at the Local level. The landscape plan will aim to re-establish native tree and scrub areas in the public open spaces.

5.6.5 The proposed development will not result in any significant effects on the biodiversity of the Site and provided the recommended best practice and mitigation is implemented it is considered that development will not result in any residual significant effects on the biodiversity of the Site.

5.7 References

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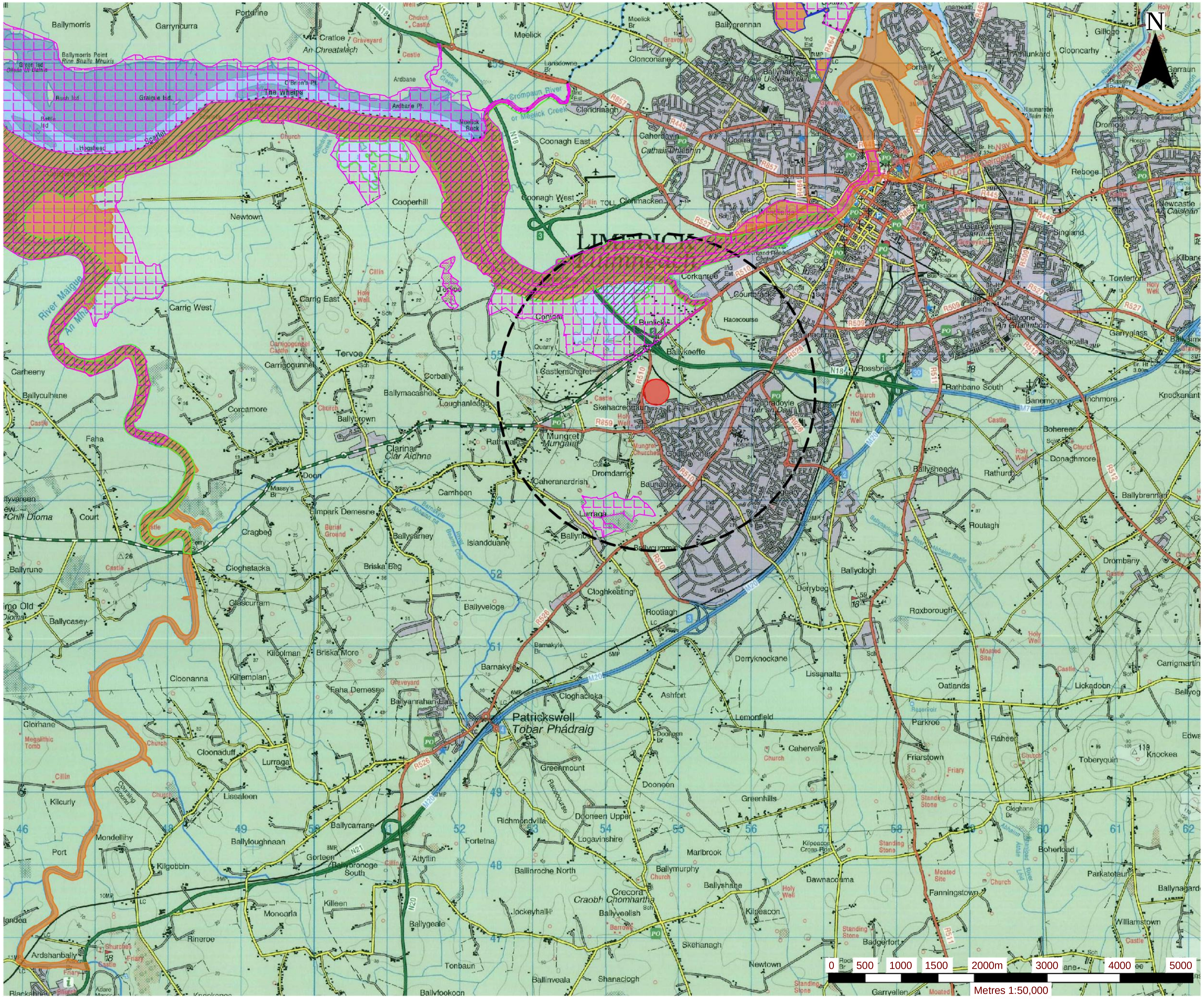
Figures

Figure 1 - Sites Designated for Nature Conservation



NOTES

1. Extract from Ordnance Survey Map No. 55.

2. Ordnance Survey Ireland Licence No. SU 0000720
(c) Ordnance Survey Ireland and Government of Ireland.

LEGEND

🟥	LOCATION OF PROJECT SITE
▨	2KM RADIUS FROM PROJECT SITE
🟧	002165 - LOWER RIVER SHANNON SAC
▨	004077 - RIVER SHANNON & RIVER FERGUS ESTUARIES SPA
▦	RIVER SHANNON ESTUARIES & LOUGHMORE COMMONTURLOUGH pNHA

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LAWLOR BURNS
BIODIVERSITY ASSESSMENT

RAHEEN DEVELOPMENTS

**DESIGNATED SITES WITHIN 2KM
OF THE PROJECT SITE**

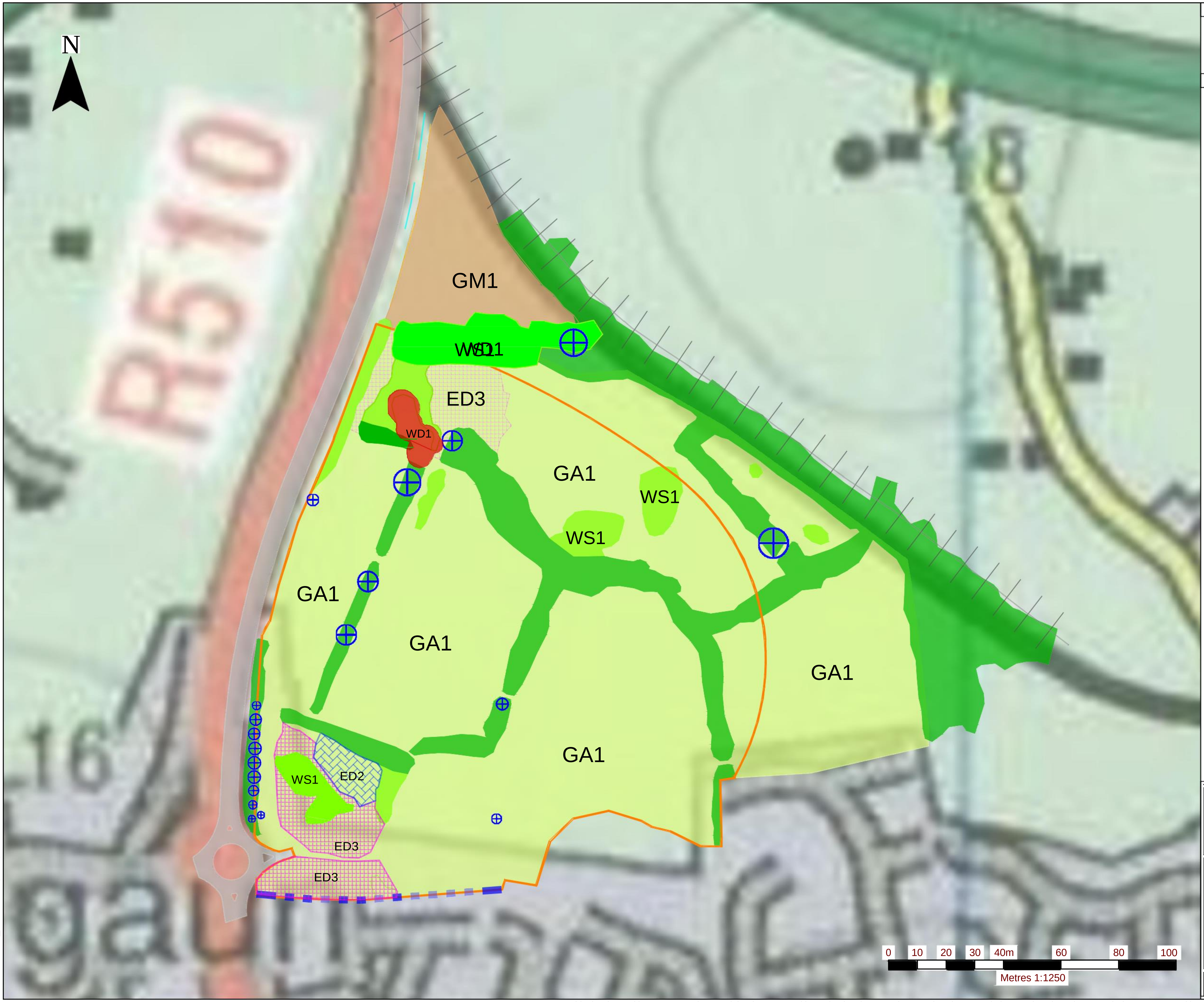
FIGURE 1

Scale
1:50,000 @ A3

Date
APRIL 2020

501.00672.00003.0.FIG 1.Designated Sites.dwg

Figure 2 - Habitat Map



NOTES

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LEGEND

▭	BOUNDARY WITHIN WHICH CONSTRUCTION WORKSWILL TAKE PLACE
🟩	GA1 IMPROVED AGRICULTURAL GRASSLAND
🟩	WL1 HEDGEROWS
▨	ED2 SPOIL AND BARE GROUND
▦	ED3 RECOLONISING BARE GROUND
🟩	WS1 SCRUB AREA
🟫	GM1 MARSHALAND
🟥	WD1 MIXEDBROADLEAVED WOODLAND
┅	BL1 STONE WALLS AND OTHER STONEWORK
⊕	INDIVIDUAL TREES
┼	RAILWAY LINE

SLR

DW RAHEEN DEVELOPMENTS LTD.

PROPOSED RESIDENTIAL DEVELOPEMT
AT BALLYKEEFFE, RAHEEN, LIMERICK

HABITAT MAP

FIGURE 2

Scale
1:2500 @ A3

Date
DECEMBER 2021

00672.00003_Habitat Map.dwg

PLATES

Plates 5.1 – 5.4

 Plate 5.1: Mixed Broadleaved Woodland (WD1) with agricultural grassland (GA1) and Scrub habitat (WS1) in the foreground.	 Plate 5.2: Recolonising Bare Ground (ED3) near entrance to the Site
 Plate 5.3: Improved agricultural grassland (GA1) with hedgerow (WL1) in the background	 Plate 5.4: Marshland (GM1) with iris and heath spotted orchid in bloom

Appendix 5.1

Relevant Legislation and Planning Policy

Relevant Legislation[10]

EIA Directive

The EIA Directive, Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment as amended by Council Directive 97/11/EC of 3 March 1997, Directive 2003/35/EC of 26 May 2003 and Directive 2009/31/EC of 23 April 2009, now codified in Directive 2011/92/EU of 13 December 2011 and amended in Directive 2014/52/EU of 16 April 2014, is designed to ensure that projects likely to have significant effects on the environment are subject to a comprehensive assessment of environmental effects prior to development consent being given. The EIA Directive was first transposed into Irish law by the European Communities (Environmental Impact Assessment) Regulations, 1989 (S.I. No. 349 of 1989) which amended the Local Government (Planning and Development) Act, 1963 (and other legislation) to provide for environmental impact assessment.

Habitats and Birds Directive

The Habitats Directive ensures the conservation of a wide range of rare, threatened or endemic animal and plant species. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora was adopted in 1992 and aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements. It forms the cornerstone of Europe's nature conservation policy with the Birds Directive and establishes the EU wide Natura 2000 ecological network of protected areas, safeguarded against potentially damaging developments.

The Natura 2000 network of protected areas is known as Special Areas of Conservation (SAC) and Special Protection Areas (SPA). In general terms, they are considered to be of exceptional importance in terms of rare, endangered or vulnerable habitats and species within the European Community. The requirements of the Habitats Directive have been transposed into Irish law through the European Communities (Birds and Natural Habitats) Regulations 2011 [S.I. No. 477/2011]. This legislation affords protection to both Special Protection Areas and Special Areas of Conservation.

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[10] Please note that the summary of relevant legislation provided here is intended for general guidance only. The original legislation should be consulted for definitive information.

Special Areas of Conservation (SAC) are designated under the Conservation of Natural Habitats and of Wild Fauna and Flora Directive 92/43/EEC (Habitats Directive) which is transposed into Irish law by the EC (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011). Special Protection Areas (SPA) are classified under the Birds Directive (2009/147/EC on the Conservation of Wild Birds). Article 6(3) of the Habitats Directive requires an 'appropriate assessment' to be undertaken for any plan or project that is likely to have a significant effect on the conservation objectives of a Natura 2000 site. An 'appropriate assessment' is an evaluation of the potential impacts of a plan or project on the integrity of a Natura 2000 site, and the incorporation, where necessary, of measures to mitigate or avoid negative effects.

National Legislation

Flora and fauna in Ireland are protected at a national level by the Wildlife Acts 1976 to 2018 and the Floral (Protection) Order 2015. Natural Heritage Areas (NHA) are areas that are considered to be important for the habitats present or for the species of plants and animals supported by those habitats. Under the Wildlife Amendment Act 2000, NHAs are legally protected from damage from the date they were formally proposed for designation. Section 19(1) of the Act states that 'Where there is a subsisting natural heritage area order in respect of any land, no person shall carry out, or cause or permit to be carried out, on that land any works specified in the order or any works which are liable to destroy or to significantly alter, damage or interfere with the features by reason of which the designation order was made'.

In addition, a list of proposed NHAs (pNHAs) was published in 1995 but to date these have not had their status confirmed. Prior to statutory designation, pNHAs are subject to limited protection under various agri-environment and forestry schemes and under local authority planning strategies such as County Development Plans.

Relevant Planning Policy

The planning policy and legislation that is relevant to the development.

Limerick City Development Plan 2010-2016 (as extended)

The relevant local planning policies have been extracted from Volume 1 of the Limerick City Development Plan 2010-2016 (as extended). These policies are specific to "*Chapter 11: Landscape, Biodiversity & Recreation*" and are concerned with the policies and objectives relating to biodiversity.

Biodiversity Plan

Policy LBR.7 It is the policy of Limerick City Council to adopt and implement a Limerick City Biodiversity Plan within the lifetime of this Draft Development Plan providing scope for all designated areas and Protected Species within Limerick City and any relevant additional actions relating to natural heritage in the Heritage Plan.

Designated Areas & Protected Species

Policy LBR.8 It is the policy of Limerick City Council to apply the precautionary principle in relation to proposed development in environmentally sensitive areas to ensure all potential adverse impacts on any designated natural heritage area and any NATURA 2000 sites arising from any proposed development or land use activity are avoided, remedied or mitigated.

The Shannon River Basin Management Plan

Policy LBR.9 It is the policy of Limerick City Council to ensure that proposals along the River Shannon and other waterways associated with the River Shannon catchment within Limerick City will achieve an appropriate balance of uses commensurate with the sensitivity of the natural environment and avoiding adverse impacts on European conservation sites and sensitive natural receptors associated with the River Shannon.

Trees & Urban Woodlands

Policy LBR.10 It is the policy of Limerick City Council:

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 plantings through planning permissions in order to benefit local biodiversity;

To strengthen the protection of trees in the City and protect tree lined settings;

To preserve, maintain and increase the general tree cover in the City by extending planting at identified locations and identifying new sites suitable for the creation of small woodland areas;

To make use of tree preservation orders to protect important trees or groups of trees which may be at risk;

To protect and maintain existing important wetland habitats from development risk, encroachment of incompatible uses, and proposals for filling to ensure sustainability, enhancement of local biodiversity and retention of flood plain storage areas.

Amenity Walkway Routes

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.

Appendix 5.2

Bat Conservation Trust's Good Practice Guidelines 3rd Edition (Collins 2016).

Guidelines for assessing the potential suitability of proposed development sites for bats.

Suitability	Description of Roosting Habitats	Description of Communing and Foraging Habitats
Negligible	A building, structure, tree or other feature with negligible habitat features likely to be used by bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	A building or structure with one or more potential roost features that could be used by individual bats opportunistically, but do not provide enough space, shelter, protection or appropriate conditions (for example temperature, humidity, height above ground, light levels, levels of disturbance) and/or suitable surrounding habitat to be used on a regular basis, or by larger numbers of bats. Buildings in this category are unlikely to support a maternity colony or be used by hibernating bats. A tree of sufficient size and age to contain potential roost features but with none seen from the ground, or features seen with only very limited roosting potential (i.e. some small cracks or crevices, low ivy cover).	Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or un-vegetated stream, but isolated and not very well connected to the surrounding landscape by other habitat and/or features. Suitable but isolated habitat that could be used by small numbers of foraging bats.
Moderate	A building, structure, tree or other feature with one or more potential roost sites that could be used by bats due to their size, shelter, protection or appropriate conditions (for example temperature, humidity, height above ground, light levels, levels of disturbance) and surrounding habitat but unlikely to support a roost of high conservation value status. Buildings, structures and trees falling into this category would not be expected to support a maternity colony, or significant hibernation or transitory roost.	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.

High	A building, structure, tree or other feature with one or more potential roost sites that are obviously suitable for use by large numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection or appropriate conditions (for example temperature, humidity, height above ground, light levels, levels of disturbance) and surrounding habitat. Buildings, structures and trees falling into this category may be expected to support a maternity colony, or significant hibernation or a significant transitory roost.	Continuous high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such a broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roost.

6.0 LAND, SOIL AND GEOLOGY

6.1 INTRODUCTION

6.1.1 Background

This section of the Environmental Impact Assessment Report (EIAR) provides a description of the existing land, soils and geological setting at the regional and local scale, an assessment of the impact of the proposed development on the land, soils and geological features of the area and also other geological aspects of the development.

Planning is being sought a strategic housing development consisting of the provision of 384 residential houses and apartments in Ballykeeffe, Raheen, Co. Limerick. A detailed project description is included in Chapter 3 of this EIAR. The main features of the proposed development are:

- 202 no. Detached, terraced houses and bungalows;
- 182 no. apartment and duplex units;
- A childcare facility;
- Car and bicycle parking spaces; and
- 3 no. ESB sub-stations, ancillary services, open spaces, and landscaping.

The site is greenfield land, enclosed by residential development to the south, east and west. The western side of the site is defined by the R510 regional road, from which there is an existing entrance to the site. There is an overall application area of c.10.44 hectares.

6.1.2 Scope of Work / EIA Scoping

This EIAR is based on a desk study of the site / surrounding lands using published geological data, site investigation borehole drilling and slit trenching, and a site investigation report carried out by Priority Geotechnical, Ref. JMS/Rp/P21161 (see Appendix 6.1).

6.1.3 Author

This EIAR chapter relating to Land, Soils and Geology was prepared by Paul Gordon (EurGeol PGeo) of SLR Consulting. Paul has a BSc in Geology and an MSc in Environmental Management and has over 20 years' professional experience.

6.1.4 Limitations / Difficulties Encountered

No difficulties were encountered in the preparation of this chapter of the EIAR.

6.2 REGULATORY BACKGROUND

6.2.1 EU Directives

The following European Union (EU) Directive relate to Land, Soils and Geology at the site in this EIAR:

- Environmental Impact Assessment Directive (2011/92/EU);
- Environmental Impact Assessment Directive (2014/52/EU);
- The management of waste from extractive industries (2006/21/EC); and
- Environmental Liability Directive (2004/35/EC).

The EU EIA Directive regulates the information impact assessment process and information in this EIAR. The management of waste Directive and the Environmental Liability Directive regulates the activities at the site.

6.2.2 Irish Legislation

The following legislation relating to Land, Soils and Geology at the site in this EIAR:

- No. 349 of 1989, European Communities (Environmental Impact Assessment) Regulations, and subsequent amendments (S.I. No. 84 of 1994, S.I. No. 352 of 1998, S.I. No.; 93 of 1999, S.I. No. 450 of 2000 and S.I. No. 538 of 2001);
- S.I. No. 473 of 2011, European Union (Environmental Impact Assessment and Habitats) Regulations 2011;
- S.I. No. 584 of 2011, European Union (Environmental Impact Assessment and Habitats) (No.2) Regulations 2011;
- The Planning and Development Acts, 2000 to 2009; and
- The Planning and Development (Amendment) Act 2010, S.I. 600 of 2001 Planning and Development Regulations and subsequent amendments including, S.I. No. 364 of 2005 and S.I. 685 of 2006.

The above legislation regulates the information contained in an EIAR and planning at the site.

6.2.3 Planning Policy and Development Control

The following Planning Policy and Development Control relating to Land, Soils and Geology at the site in this EIAR is set out in the:

- Limerick County Development Plan 2010-2016 (extended); and
- Limerick Southern Environs Local Area Plan 2021-2027.

The county development plan sets out conservation objectives in relation to soils, geology, geomorphology and geological heritage in the County.

The draft Limerick Development Plan 2022-2028 was also consulted. It sets out similar objectives to the 2010-2016 (extended) development plan.

6.2.4 Guidelines

This Land, Soils and Geology section of the EIAR has been prepared with regard to the following guidelines:

- Environmental Protection Agency (2017) *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Draft dated May 2017*. Environmental Protection Agency, Johnstown Castle Estate, Co. Wexford
- DoEHLG (2010) Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities;
- Environmental Protection Agency (2002) Guidelines on the information to be contained in Environmental Impact Statements;
- Environmental Protection Agency (2003) Advice Notes on current practice (in the preparation of Environmental Impact Statements);
- Geological Survey of Ireland, Irish Concrete Federation (2008) Geological Heritage Guidelines for the Extractive Industry;
- Institute of Geologists of Ireland (2002) Geology in Environmental Impact Statements, A Guide;
- Institute of Geologists of Ireland (2013) Guidelines for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements;

- National Roads Authority (2008) Environmental Impact Assessment of National Road Schemes - A Practical Guide;
- National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.
- National Roads Authority (2006) A Guide to Landscape Treatments for National Road Schemes in Ireland; and
- Transport Infrastructure Ireland (March, 2013). Specification for Road Works Series 600 –Earthworks.

6.2.5 Technical Standards

The following Technical Standard is used to describe subsoils and rock in this EIAR where required:

- British Standards (2015). Code of Practice for Site Investigations BS5930:2015.

6.3 RECEIVING ENVIRONMENT

6.3.1 Study Area

The study area for this Land, Soils and Geology section of the EIAR comprises two principal geographic areas:

- the proposed development site; and
- the immediate surrounding area within 1km of the site.

6.3.2 Baseline Study Methodology

The baseline study undertaken for Land, Soils and Geology, here involves a review of published literature and information, a Site Investigation and a Site Investigation report (see **Appendix 6.1**), including photographic records.

This section describes the receiving environment at and in the immediate vicinity of the site using the available baseline information gathered, specifically the:

- **Context** of the receiving environment - location/ magnitude/ spatial extent and trends of the environmental factors;
- **Character** of the receiving environment - distinguishing aspects of the environment being considered here;

- **Significance** of the receiving environment - the quality, value or designation is assigned to the existing environment; and
- **Sensitivity** of the receiving environment - how sensitive is the aspect of the environment to change.

The baseline study is a qualitative assessment of the available information, based on professional experience.

6.3.3 Sources of Information

The following sources of information were consulted in the preparation of the receiving environment baseline study for Land, Soils and Geology:

- Geological Survey of Ireland (www.gsi.ie);
- Teagasc soil and subsoil mapping for Irish Forestry Soils Project (www.epa.ie);
- Irish Soils Information System (www.teagasc.ie/soils);
- Irish Geological Heritage Programme (www.gsi.ie); and
- Ordnance Survey of Ireland (www.osi.ie).

A total of 10 cable percussion boreholes and three rotary boreholes were conducted as part of a site investigation in 2021, and they provide information on the site soils and geology.

There were 13 slit trenches excavated as part of the 2021 site investigation, providing further information on soils and geology at the proposed site.

6.3.4 Land Baseline

Within the EIA EU Directive (2014/52/EU) Land is recognised as a 'natural resource' and the Directive also refers to the importance of the sustainable use of soil and the need to address the unsustainable increase in settlement areas over time ('land take'). Therefore, the issues of land as both a natural resource and land take must be considered in an assessment.

The introduction section to the EU Directive (2014/52/EU) notes that the:

'final document of the United Nations Conference on Sustainable Development held in Rio de Janeiro on 20-22 June 2012, which recognises the economic and social significance of good land management, including soil, and the need for urgent action to reverse land degradation. Public and private projects

should therefore consider and limit their impact on land, particularly as regards land take, and on soil, including as regards organic matter, erosion, compaction and sealing; appropriate land use plans and policies at national, regional and local level are also relevant in this regard'.

Land can be considered to be a resource with a beneficial use to society, for example agricultural land use, or urban residential land use; unnecessary land take may result in the loss of this resource which has the potential to have adverse social and economic consequences for society.

The site is currently used for agriculture, primarily for grazing.

The Limerick Southern Environs Local Area Plan 2021-2027 identifies the proposed development site as being zoned for new residential use.

In terms of land take, the proposed development will make the land permanently unavailable for agriculture.

The draft Limerick Development Plan 2022-2028 contains similar objectives to the current plan. The draft plan recognises the proposed development as being a Tier 1 area, zoned for new residential.

6.3.5 Soils Baseline

Soil is defined as the top layer of the earth's crust and is formed by mineral particles, organic matter, water, air and living organisms. Soil is an extremely complex, variable and living medium and its characteristics are a function of parent subsoil or bedrock materials, climate, relief and the actions of living organisms over time.

Soil formation is an extremely slow process and can take thousands of years to evolve; soil can be considered essentially as a non-renewable resource.

As the interface between the earth, the air and the water, soil performs many vital functions; it supports food and other biomass production (forestry, biofuels etc.) by providing anchorage for vegetation and storing water and nutrients long enough for plants to absorb them. Soil also stores, filters and transforms other substances including carbon and nitrogen, and has a role supporting habitats serving as a platform for human activity.

National Soils

The Irish Soil Information System (ISIS) project was undertaken by the EPA and Teagasc, and has gathered together existing information and data from soil survey work in Ireland, which has been augmented with a new field data, leading to the production of a new national soil map at a scale of 1:250,000 (www.teagasc.ie/soils).

The ISIS project has identified a number of Soil Associations across Ireland, which are each comprised of a range of soil types (or '*Series*'), each of them different in properties, with different environmental and agronomic responses. For each soil type, the properties have been recorded in a database maintained by Teagasc.

The soil association in the vicinity of the site is classified as the Elton Soil Association (1000x), see **Figure 6.1**, which is characterised by '*Fine loamy drift with limestones*. The Elton Soil Association is described as comprising *Luvisols and Surface Water Gleys on drift with mixed limestone and siliceous stones'*[11].

The Elton Soil Association is predominantly found in limestone lowland areas of Ireland and is extensive in Co. Limerick (Creamer *et. al.*, 2018). The Luvisols in this association are generally moderately drained, while the surface water gleys are generally moderately to poorly drained.

There is a small area in the north of the site classified as having derived from Tidal Marsh.

The Site Investigation (SI) Report (see **Appendix 6.1**) reports topsoil as 'dark brown, organic, slightly sandy gravelly CLAY being 100mm to 250mm thick.' The SI report also records the presence of made ground, described as 'soft to stiff, slightly sandy slightly CLAY/SILT and clayey sandy GRAVEL with Cobble and Boulder content(s)'.

Natural deposits of clay and silt were also encountered. Depth to bedrock at the site varied from 2.0m to 10.0m.

Examination of the photographic record of the trenches confirms the descriptions recorded above.

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[11] EPA Report No. 130 (2014), Irish Soil Information System: Synthesis Report Appendix 3 - Soil Association List

6.3.6 Subsoils Baseline

Regional Subsoils

The Quaternary (Subsoil) deposits were deposited during the last 2 million years, and essentially comprise the unconsolidated materials overlying bedrock. The two main types of quaternary subsoils in Ireland are glacial till, deposited at the base of ice sheets, and Sand & Gravel deposits associated with the melting of the ice sheets which are generally termed glaciofluvial outwash sands and gravels. Other extensive quaternary subsoils in Ireland include peat, river alluvium and coastal process deposits. Most Quaternary subsoils in Ireland were deposited since the maximum of the last glaciation, the Midlandian, which occurred approximately 17,000 years ago.

The subsoils across Ireland have been mapped on a national basis by Teagasc as part of the EPA Soil and Subsoil Mapping Project for the Irish Forestry Soils (IFS) project. The subsoil mapping was undertaken at a national basis using existing Quaternary Geology maps, Publications, remote sensing, field mapping and sampling.

The subsoils in the vicinity of the site have been mapped under the IFS project as glacial till deposits underlying most of the site, and marine estuarine material underlying a small portion of the north of the site, see **Figure 6.2**. The glacial till deposits are described as having derived from limestone**.**

6.3.7 Bedrock Geology Baseline

The GSI geology map Sheet 17 (Shannon Estuary) shows that the entire site and surrounding area is underlain by Visean Limestone (undifferentiated), see **Figure 6.3**.

The Visean Limestones are described in the GSI Geological Memoirs (1995) as a 'e dark-grey to black thinly-bedded cherty argillaceous wackestones and packstones, locally rich in foraminifera and crinoids'.

No major geological structures are noted at or near the site.

Rotary core drilling at the site records the presence of limestone, at depths varying from 2.0m to 10.0m below ground level. The borehole logs are summarised in **Table 6.1**. A photographic record accompanying the drill logs confirms the descriptions.

Table 6.1 Summary of Rotary Drilling

Borehole No.	Depth to top of bedrock (m)	Total depth (m)	Bedrock Description
RC01	2.8	6.0	Strong, grey fossilferous limestone. Slight to moderate weathering.
RC02	2.0	5.0	Strong, grey fossilferous limestone. Slight to moderate weathering.
RC03	9.8	12.7	Strong, grey fossilferous limestone. Slight to moderate weathering.

6.3.8 Karst Baseline

According to the GSI, the bedrock in the vicinity of the site is classified as a Locally Important Aquifer which is generally moderately productive. The aquifer is not classified as a karstic aquifer by the GSI.

The GSI database shows that no karst features are recorded at the proposed site. There is a turlough recorded in Ballycummin townland, c. 1.4km southwest of the site. Due to the separation distance and nature of the proposed project, the proposed development will have no effect on the turlough and is not considered further.

6.3.9 Geological Heritage Baseline

Objective EH04 of the County Development Plan states that '*It is the objective of the Council to seek the conservation and protection of features of geological interest within the County, particularly those that would have been recognised in the past as Areas of Scientific Interest or by the Geological Survey of Ireland as being of particular value*.'

Limerick remains unaudited for geological heritage, but consultation with the GSI database of unaudited sites indicates that there are no geological heritage sites at or in the vicinity of the proposed development site.

6.3.10 Sensitive Receptors

In terms of land, soils and geology baseline considered here, the current landuse at the site is agriculture and the soils, subsoils do not have any particular status.

The Limestone bedrock geology at the site is extensive in the area and is therefore not considered to be a sensitive receptor.

There are no geological heritage sites or sites of County Geological Interest present at the site.

6.4 IMPACT ASSESSMENT

6.4.1 Evaluation Methodology

The evaluation of impacts of the proposed development is based on a methodology similar to that outlined in the '*Guidelines for the Assessment of Geology, Hydrology and Hydrogeology for National Road Schemes' published by the National Roads Authority* (2009) and the *Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements published by the IGI (2013).*

6.4.2 Evaluation of Impacts

This assessment focuses on the potential impact of the construction of 384 residential units on the proposed development site.

The importance of existing land, soil and geology attributes identified at the application site is assessed in **Table 6.2** below.

Table 6.2: Importance of Attributes in Vicinity of Application Site

Attribute	Status / Occurrence	Importance of attribute
Land	The land at the site is grassland and therefore has an existing agricultural landuse. The land at present has no particular status in terms of its use or suitability for agriculture. The land has been identified as a Tier 1 location for residential development in Limerick Southern Environs area.	**Moderate** at a local level. There is an established landuse at the site based on soils that support grazing of livestock.

Attribute	Status / Occurrence	Importance of attribute
Soils	The soils at the site belong to the Elton series and are relatively widespread in Co. Limerick and other counties.	**Moderate** at a local level. The Elton Series soil association is moderately useful in an agricultural context.
Subsoils	The glacial till subsoils at the site are derived from limestone; a very widespread subsoil across the limestone lowlands of Ireland.	**Low to moderate** – the subsoils support the overlying soils.
Geology	The Visean limestones at the site are widespread throughout the Lower Carboniferous limestone of Ireland. The bedrock does not have any particular status.	**Low to moderate** – the Visean limestones are a resource for construction material in other parts of the county.

The magnitude of these impacts on the land, soils and geology attributes is assessed in **Table 6.3** below.

Table 6.3: Significance of Impacts on Land, Soil and Geology with no Mitigation

Attribute	Impact of Proposal on Land, Soil and Geology	Magnitude of potential impact
Land	Permanent loss of moderately productive agricultural land.	**Small to moderate** – Limerick contains a high proportion of good quality land and the loss of this land to agriculture would be low at a local level
	Permanent addition of residential land in a Tier 1 zoned area of the Southern Environs.	**Moderate to high beneficial** - residential land in an area recognised as important to the development of Limerick City.

Attribute	Impact of Proposal on Land, Soil and Geology	Magnitude of potential impact
Topsoil	Removal of topsoil, making it unavailable for use in agriculture/horticulture but it will be reused for landscaping of the development.	**Small to moderate** – the soils are moderately useful in an agricultural context.
Subsoils	Removal of some subsoil, making it unavailable to support agricultural soils, but it will be reused in the formation level for / landscaping of the development.	**Small to moderate** – the subsoils are moderately useful in an agricultural context.
Geology	Limestone bedrock will be inaccessible at the site. Some bedrock will be removed and reused on site where possible. Any unused bedrock will be disposed of at an approved facility.	**Negligible** – the limestone is of low to moderate value but is rendered largely inaccessible due to its location, overlain by topsoil and subsoil.

Indirect Impacts

There will be no indirect impacts on land, soils or geology as a result of the construction of residential units at the site.

6.4.3 Unplanned Events (i.e. Accidents)

Unplanned events within the application site, such as accidents, have the potential to impact on the land, soils and geology adjoining the site.

Ground instability, particularly the stability of excavations during the construction phase has the potential for collapse. Construction at the site will adhere to the Safety, Health and Welfare at Work (Construction) Regulations 2013, which will mitigate against any dangers arising from excavation works.

Fuel spills have the potential to contaminate soils, subsoils, bedrock and groundwater. No significant quantities of fuel or oil will be stored on site and there will be a spill kit retained on site at all times, in line with the measures set out in the Construction Environmental Management Plan (CEMP, Hutch O'Malley (2022) for the development.

With the implementation of the Safety, Health and Welfare at Work (Construction) Regulations 2013, and the measures set out in the CEMP, it is considered unlikely that excavation and construction would result in an impact on the land, soils and geology at the site.

6.4.4 Human Health

From a land, soils and geology perspective, any potential impacts on human health from the excavation of soils and subsoils and the construction of residential units at the site would not be via the landuse, soils and geology pathways but via other pathways such as air and water, which are addressed in the relevant chapters of this EIAR.

6.4.5 Cumulative Impacts

There is a light industrial/commercial estate to the northwest, across the R510 road, with some existing related planning permissions. No cumulative impacts have been identified on land, soil or geology associated with the proposed development at the site.

6.4.6 Interaction with Other Impacts

No interactions with other impacts have been identified for the land, soils or geology attributes associated with the proposed development.

6.4.7 'Do-nothing Scenario'

Under the 'do nothing scenario' there will be no impact on the land, soils and geology of the site. Residential units in an area zoned for new housing will not be constructed.

6.5 MITIGATION MEASURES

A soil management plan will be put in place for the stripping and storage of soils and subsoils.
A spill kit will be retained on site during the construction phase (refer to the CEMP). A spill kit will not be required during the operation phase.

6.5.1 Construction Stage

During the construction stage, operations will adhere to Transport Infrastructure Ireland (TII) Specification for Road Works Series 600 – Earthworks.

A Soil Management Plan (SLR, 2021) has also been developed for the proper management and care of soils and subsoils at the site. During the phased and final stages of construction, the stored soils and subsoils will be used to provide landscaping at the site.

Topsoil will be stored separately to subsoils.

Subsoils will be stored in such a way as to keep them free from contamination so that they can be used as clean, inert fill.

Some limestone bedrock is likely to be removed and will be stored appropriately so that it can be used as clean, inert fill.

6.5.2 Operational Stage

During the operational stage it is not expected that there will be any further impacts on land, soil or geology at the site.

6.6 RESIDUAL IMPACT ASSESSMENT

The residual impacts on land, soil and geology are those impacts which remain following the implementation of the mitigation measures outlined above.

6.6.1 Construction Stage

Construction at the site in line with the Safety, Health and Welfare at Work (Construction) Regulations 2013 and the measures set out in the CEMP will limit the potential for unplanned events such as instability of excavations or contamination of soils through fuel spills.

Adherence to the Soil Management Plan will ensure that soils are preserved during this stage. Soils will be used for landscaping purposes and there will be no loss of productive soils.

Subsoils will be used as clean, inert fill where appropriate, thereby retaining a beneficial use.

There will be no impact on the underlying bedrock.

6.6.2 Operational Stage

The land use will have changed permanently from agricultural to residential. The underlying bedrock will be rendered inaccessible by the existence of the residential units, noting that is currently inaccessible through the presence of overlying soils. No other residual impacts on land, soil or geology are anticipated.

6.6.3 Monitoring

Monitoring during the construction phase is recommended, to ensure adherence to the measures set out in the Soil Management Plan (SLR, 2021) and the Construction Environmental Management Plan (Hutch O'Malley, 2022).

During the operational phase, there will be no monitoring measures required in respect of land, soils and geology.

6.7 REFERENCES

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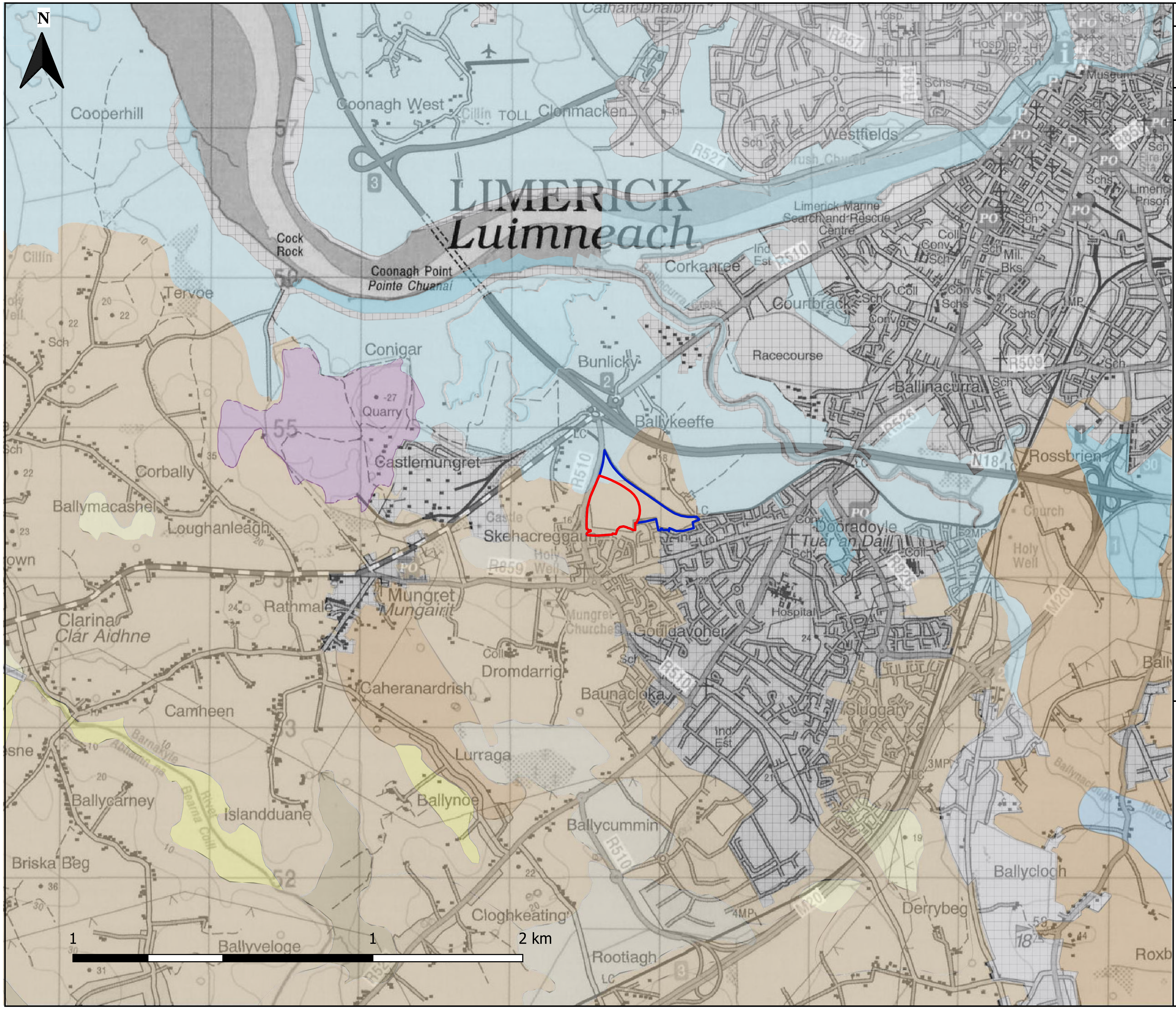
FIGURES

Figure 6.4 - Soil Association Map



NOTES

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2. Soil data ©Teasasc
3. Base Mapping OSi Discovery Series SheetS: 58, 65

LEGEND

- — Applicant's Land Interest
- — Planning Application Area

- 🟫 Elton
- 🟦 Lake
- ▨ Peat
- 🟪 Rock
- ⬜ Tidal marsh
- ▦ Urban

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RAHEEN DEVELOPMENTS

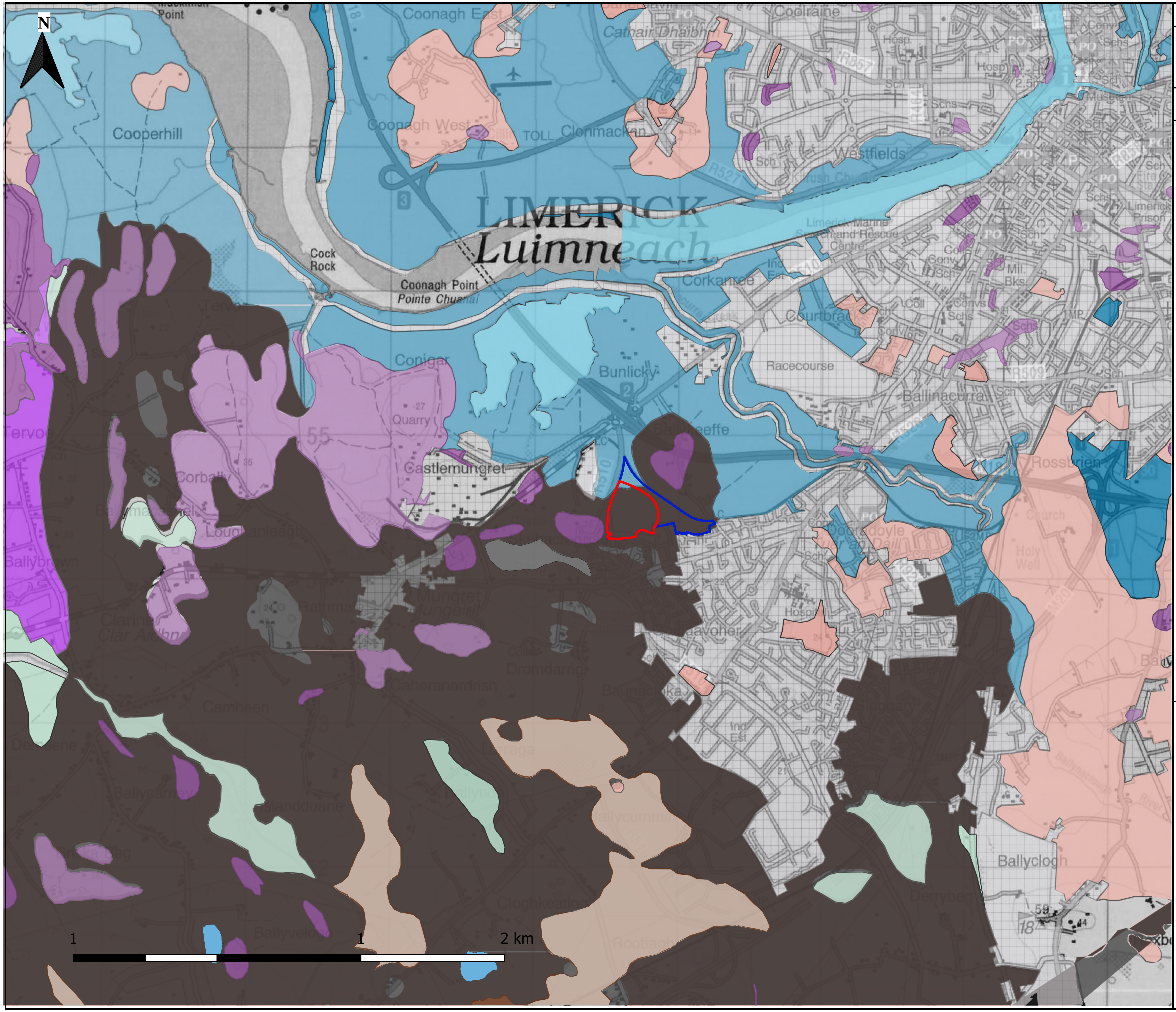
SOIL ASSOCIATION MAP

FIGURE 6-1

Scale	Date
1:25000 @ A3	FEBRUARY 2022

SLR Projects\00672 Lawlor Burns\00003 Raheen Development

Figure 6.5 - National Subsoils Map



SLR Projects\00672 Lawlor Burns\00003 Raheen Development

NOTES

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LEGEND

— Applicants Land Interest
— Planning Application Area

▢ Karstified Limestone Bedrock
▨ Made Ground
■ Estuarine Sediments
■ Basic Igneous Till
■ Limestone Till
■ Water Body

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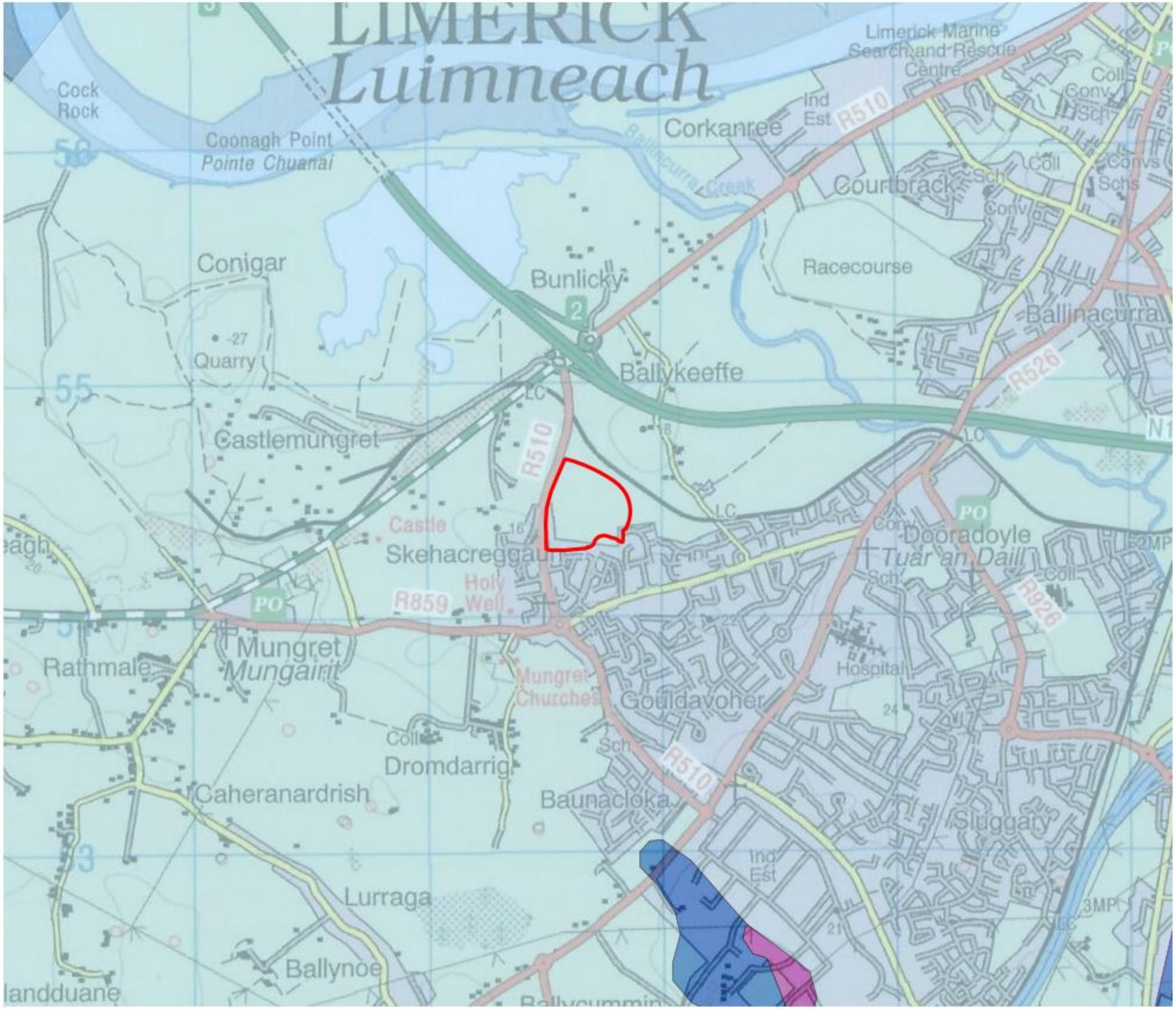
SUBSOILS MAP

FIGURE 6-2

Scale	Date
1:25000 @ A3	FEBRUARY 2022

Figure 6.6 - Geology Map



NOTES

Basemap: Ordnance Survey Ireland Licence no. SU 0000720
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Soils Mapping © Tegasc/EPA

LEGEND

🟥 Site Outline

Bedrock Geology

- 🟪 Basalt
- ⬜ Visean Limestones (undifferentiated)
- 🟦 Volcaniclastic Rocks

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BALLYKEEFE, RAHEEN,
LIMERICK

BEDROCK GEOLOGY MAP

FIGURE 6-3

SCALE	DATE
1:25.000 @ A3	FEBRUARY 2022

7.0 WATER AND HYDROLOGY

7.1 INTRODUCTION

This chapter of the Environmental Impact Assessment Report (EIAR) describes the hydrological environment at the site of the proposed development, and specifically the potential effects of the surface water runoff from the development on the area. The benefiting lands, which are to the north of the development site, are maintained by the Office of Public Works (OPW) to provide flood protection to benefiting lands. The attached flood study from JBA establishes flood risk levels in the vicinity of the development for suitable return periods. Flood prevention, impact assessment and the design of the storage attenuation area have been based on recommendations as outlined in the **OPW planning and policy** guidelines which are as follows:

All new development must be designed and constructed to meet the following minimum flood design standards:-

For Urban areas or where developments (existing, proposed or anticipated) are involved-the 100 year flood.
A flood impact assessment and proposals for the storage or attenuation of run / off discharges (including foul drains) to ensure the development does not increase the flood risk in the relevant catchment must accompany applications for Planning Permission for development of areas exceeding 1 hectare."

This chapter relating to Water and Hydrology was prepared by David O'Malley B.Eng Civil (Hons), MIEI, Director of Hutch O'Malley Consulting Engineers. David has been a practicing Consulting Engineer since 2007. He has experience in Structural Engineering, Civil Engineering, Planning Autority/Local Authority, Fire Certification, Noise & Vibration Assessment, Asset Survey/Taking In Charge, Road Safety Audits, Project Management.

A standalone Frood Risk Assessment has been undertaken by JBA Consulting

7.2 STUDY METHODOLOGY

The flood study report establishes that the lands to be developed are outside of but adjoining Zones A&B. It is noted that these flood zones are only a planning tool to establish areas to be risk assessed and studied. In this development they do not represent the actual risk.

The method engaged for the drainage design establishes Q for a set of critical return periods for the development. Suitable protection measures are designed for water conditioning.

It should be noted that the analysis does not include surface water runoff from other areas of the site that does not form part of the current planning application as these are to remain under similar conditions as they currently operate.

7.3 RECEIVING ENVIRONMENT

The subject site is located in Ballykeeffe, Raheen, Co. Limerick, to the west of Limerick City. The site is accessed via an existing roundabout off the R510 which also defines the western side of the site. The site is bound by existing residential dwellings to the south and south-east. The lands to the north are open space also within the ownership of the applicant, DW Raheen Developments Ltd. Figure 7.1 below identifies the location of the subject site. Additional location imagery is included as Appendix 7.1 to this chapter.

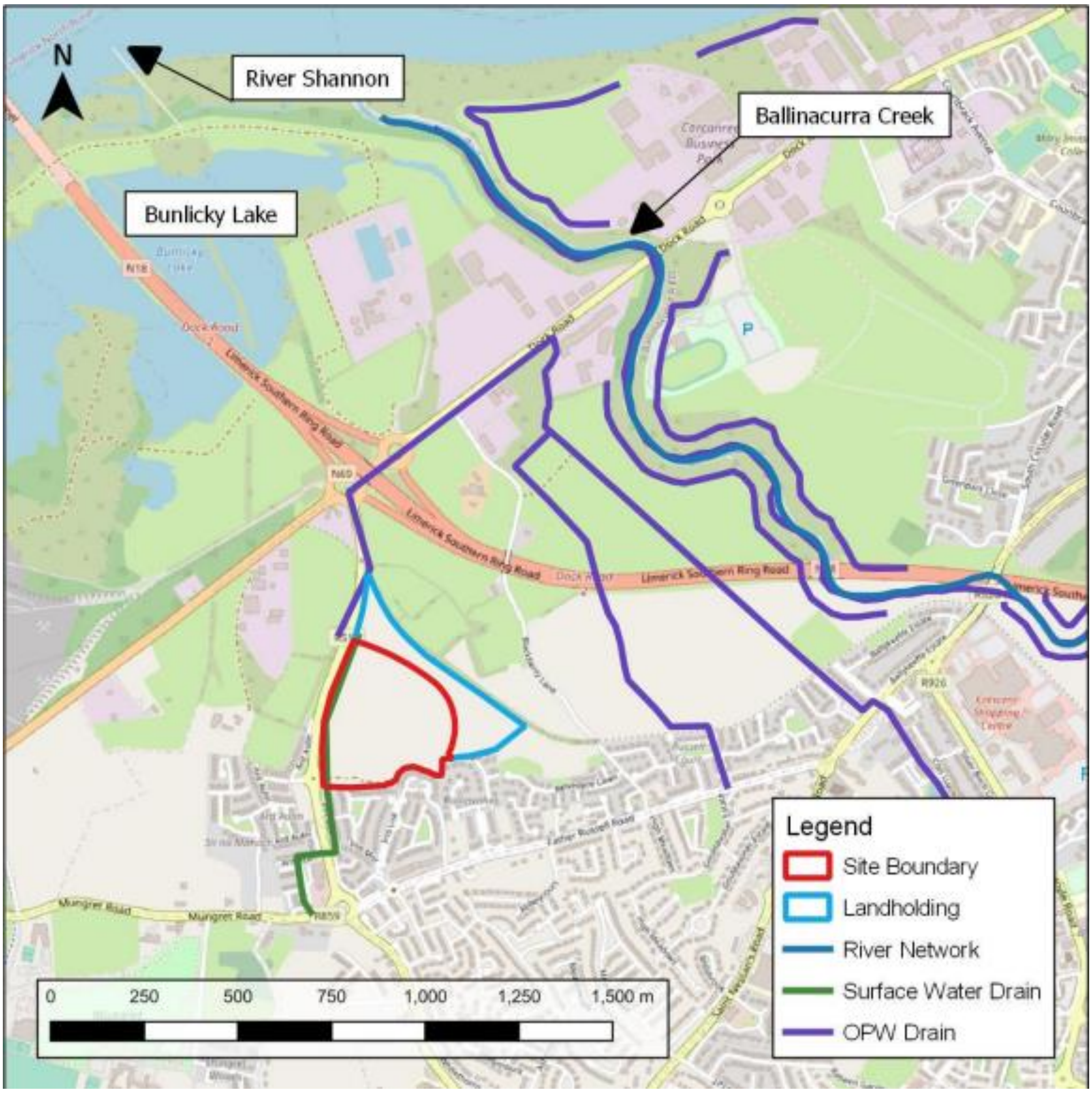


Figure 7.1 – Site Location (Extract from FRA Report)

The main fluvial watercourses are identified as the River Shannon/Estuary located c.1.5km to the north and the Ballinacurra Creek located c. 1km to the east, as seen in Figure 7.1 above. Bunlicky Lake which is a man-made lake is located c.400m to the north. Both the River Shannon and Ballinacurra Creek have flood protection embankments.

It is proposed to discharge surface water runoff from the proposed development within the ownership of the applicant into a channel which flows along the North Western boundary of the site. The stream is known as OPW channel C1/1/1, there are two connections to this system; one large culvert under the rail line and a smaller pipe under the R510. The channel is maintained by the OPW and generally provides flooding immunity for benefiting lands for a three-year return period. This river channel disperses into a significant network of back drains that lead to the Ballinacurra Creek and Bunlicky Lake.

7.3.1 Available Information - Broad area

The site location is on the edge of Limerick City on the edge of groundwater sources; Limerick City South West and Limerick urban south-west part of the Shannon East South River Basin. Both are part of the WFD Limerick City Southwest groundwater body. The Water Framework directive doesn't identify any significant pressure for the groundwater body, however in 2008 it was identified as at risk. As such, it is identified as a protected area under Article 7 Abstraction for Drinking Water.

The transitional waters to the North are identified as 1a At Risk in the WFD, with agricultural influence to the Dock waters and Upper Shannon Estuary highlighted as Significant Risk. Limerick Dock water is also identified as having Hydromorphology pressure.

7.3.2 Available Information - Site Specific

A Site Investigation Report has been prepared by Priority Geotechnical and is submitted under a separate cover with this application. The report has informed this chapter of the EIAR and details the trial holes and testing undertaken on the subject site. No high water table was encountered in the development footprint, and soil drainage was found to be poor. These are expected results given the fluvial till sub soil and permeability of the aquifer.

7.4 CHARACTERISTICS OF THE PROPOSAL

The proposed development will provide as follows:

- 202 no. housing units, comprising a variety of forms to include bungalows, detached, semi-detached and terraced houses. A mix of house sizes are proposed to include 20 no. two bedroom houses, 156 no. three bedroom houses and 26 no. four bedroom houses.
- 182 apartment and duplex units across 25 small scale blocks, 2 to 4 storeys in heights, throughout the development. The apartments and duplexes provide a mix of one, two, three and four bed units, comprising of 10 no. four bedroom duplex units, 10 no. three bedroom duplex units, 6 no. two bedroom duplex units, 18 no. three bedroom apartments, 92 no. two bedroom apartments and 46 no. one bedroom apartments.

The proposed development also includes;

- A childcare facility measuring 761.75m^2, providing 79 childcare places (55 full time and 24 after school places), located at the south-western edge of the development.
- The provision of 377 no. car parking spaces and 311 secured bicycle parking spaces.
- The provision of 3 no. ESB sub-stations, ancillary services and infrastructure works including foul and surface water drainage, attenuation areas, landscaped public open spaces (approximately 29,500m^2, or 28.2% of the total site area), landscaping, lighting, internal roads, cycle paths, and footpaths.

The proposed development is 10.44 hectares in area, with approximately 4.6 hectares contributing to impermeable surface water runoff.

The site will be positively drained via gullies and channels into a network of surface water pipes which will be sized for a five-year return period and designed with the drainage hydraulic software programme, results of which are detailed in the Civil Engineering Report. The downstream outfalls will be constructed with concrete retaining headwalls at the point of connection to the river. The surface water runoff values for the development have been factored into the 200-year flood levels for the Shannon to ascertain the impact of a full inundation of the floodplain on the discharge from the system.

7.5 PREDICTED IMPACT OF THE PROPOSED DEVELOPMENT

The surface water runoff impact from the proposed development can be dealt with under three headings.

- Impact of flood levels on proposed development

- Impact of development on lands downstream

- Impact of development on hydrogeological features

The hydraulic modelling undertaken as part of this application shows peak flows from the proposed development occurring at the same time as flooding of the overall catchment. Normally, runoff from impermeable areas downstream have a much shorter time of concentration than that occurring from the overall catchment. The area is substantially protected and a significant distance from the protection banks, with a significant flood plain in the surrounding area. This hydraulic analysis has been designed as a worse case scenario, even though statistically the occurrence would be extremely low or even improbable.

7.5.1 Impact of Flood Levels on Proposed Development

Existing ground levels vary from 1.0 M.O.D to 9.5 M.O.D. Proposed development dwelling levels have been established at minimum 5.7 M.O.D to accommodate design levels for foul and storm sewer. The lands lower than 5m OD are proposed to be retained at the current levels and any landscaping proposed is at grade. Therefore, there will be no impact of flooding on proposed development levels.

7.5.2 Impact of Flood Levels on Proposed Lands Downstream

The design approach has been to maintain or reduce the existing runoff rates. By providing the buffer of attenuation tanks, the impact of the development on downstream lands shall be negligible and most likely lead to reduced surface water flow.

7.5.3 Impact of development on hydrogeological features

A Soil Management Plan (SLR, 2021) and a Construction Environmental Management Plan (Hutch, O'Malley, 2022) have been prepared and submitted under a separate cover with this application and have informed this Chapter of the EIAR. It is not intended to repeat the information contained within these reports but it is considered that appropriate plans are in place to ensure control of any adverse silt, hydrocarbon or any other likely contaminants as a result of the proposed development.

7.6 REMEDIAL AND MITIGATION MEASURES

7.6.1 Construction Phase

Procedures and Best Practice outlined within the specific Construction Environmental Management Plan will be implemented and maintained throughout the construction phase of development.

Best practice in design and construction will be employed for the installation of surface runoff water drainage and during site clearance and construction. As a failsafe to provide sitewide protection to the downstream water features, a silt trap shall be installed along the 3 m OD contour as indicated in the construction plan drawing 18112-C37. Other environmental protection procedures as per the Construction Environmental Management Plan and Soil Management Plan SMP shall also be used by the contractor, with special attention given to the temporary storage of all materials.

Measures, as recommended in the guidance of The Construction Industry Research and Information Association, that will be implemented to minimise the risk of spills and contamination of soils and waters include:

- Careful consideration will be given to the location of any fuel storage facilities. These will be designed in accordance with guidelines produced by CIRIA, and will be fully bunded.
- All vehicles and plant will be regularly inspected for fuel, oil and hydraulic fluid leaks. Suitable equipment to deal with spills will be maintained on site.
- Where at all possible, soil excavation will be completed during dry periods and undertaken with excavators and dump trucks. Topsoil and subsoil will not be mixed together.
- Ensure that all areas where liquids are stored or cleaning is carried out are in a designated impermeable area that is isolated from the surrounding area, e.g. by a roll-over bund, raised kerb, ramps or stepped access.
- Use collection systems to prevent any contaminated drainage entering surface water drains, watercourses or groundwater, or draining onto the land. Minimise the use of cleaning chemicals.
- Use trigger-operated spray guns, with automatic water-supply cut-off.
- Use settlement lagoons or suitable absorbent material such as flocculent to remove suspended solids such as mud and silt.
- Ensure that all staff are trained and follow vehicle cleaning procedures. Post details of the procedures in the work area for easy reference.
- Due to the impact of increased flooding from development and in order to eliminate its impact; it is proposed to attenuate the surface water runoff by providing storage attenuation using hydrobrakes to limit the outflow to the river to greenfield runoff rates in accordance to flood estimation for small catchments from the Institute of Hydrology Report Report 124. The result of the flood estimation shows that the permissible outflow for the 10.44 hectares is to be limited to 57 litres / sec in a 1:100yr event (Calculations are contained within the submitted Civil Engineering Report, Hutch, O'Malley, 2022).

7.6.2 Operation Phase

Pipelines constructed and tested to appropriate Irish and International standards will reduce the potential for surface water leaks to groundwater.

The mitigation measures to be implemented during the operational phase of the proposed development will include the implementation of proper operation and maintenance regimes for the surface water drainage system in accordance with the recommendations of guidelines such as The Construction Industry Research and Information Association (CIRIA) and The SuDS Manual, to reduce the risk of human or mechanical error causing a pluvial flood risk from blockages, etc.

7.6.3 Do Nothing Scenario

There are no predicted impacts should the proposed development not proceed. However, as the site is zoned for residential development, it is likely that should another development be undertaken on the site, the impacts are predicted to be similar to those described for the subject development.

7.7 Predicted Impact of the Proposed Development

This section describes the predicted impact of the proposed development following the implementation of the remedial and mitigation measures, as set out.

Construction Phase - Implementation of the measures outlined will ensure that the potential impacts of the proposed development on water and the hydrogeological environment do not occur during the construction phase. The predicted impact, post mitigation measures, will be negligible.

Operational Phase - As surface water drainage design has been carried out in accordance with appropriate policy methodologies, predicted impacts on the water and hydrogeological environment arising from the operational phase will be negligible.

7.8 Monitoring

The Resident Engineer on site will be responsible for ensuring that all personnel monitor the contractor’s water pollution control practices and maintain compliance with the approved project waste management plan. This includes reviewing the contractor’s plan, reviewing written inspection reports, and conducting field inspections.

7.9 Difficulties Encountered

7.9.1 No particular difficulties were encountered during preparation of this chapter of the EIAR.

APPENDIX 7.1 Location Images

Image 1 - GroundWater Polygon Map

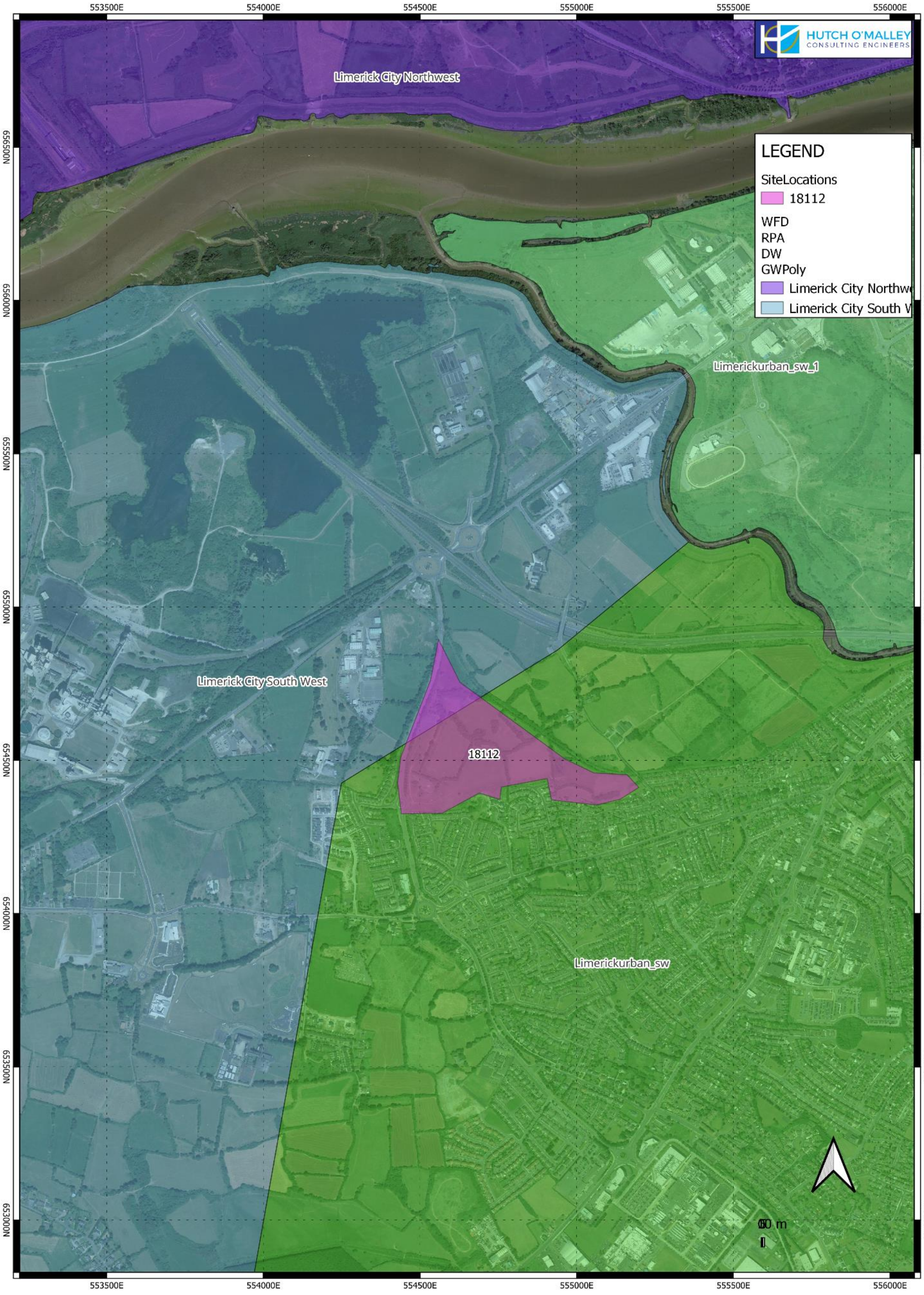


Image 2 - GSI wells database

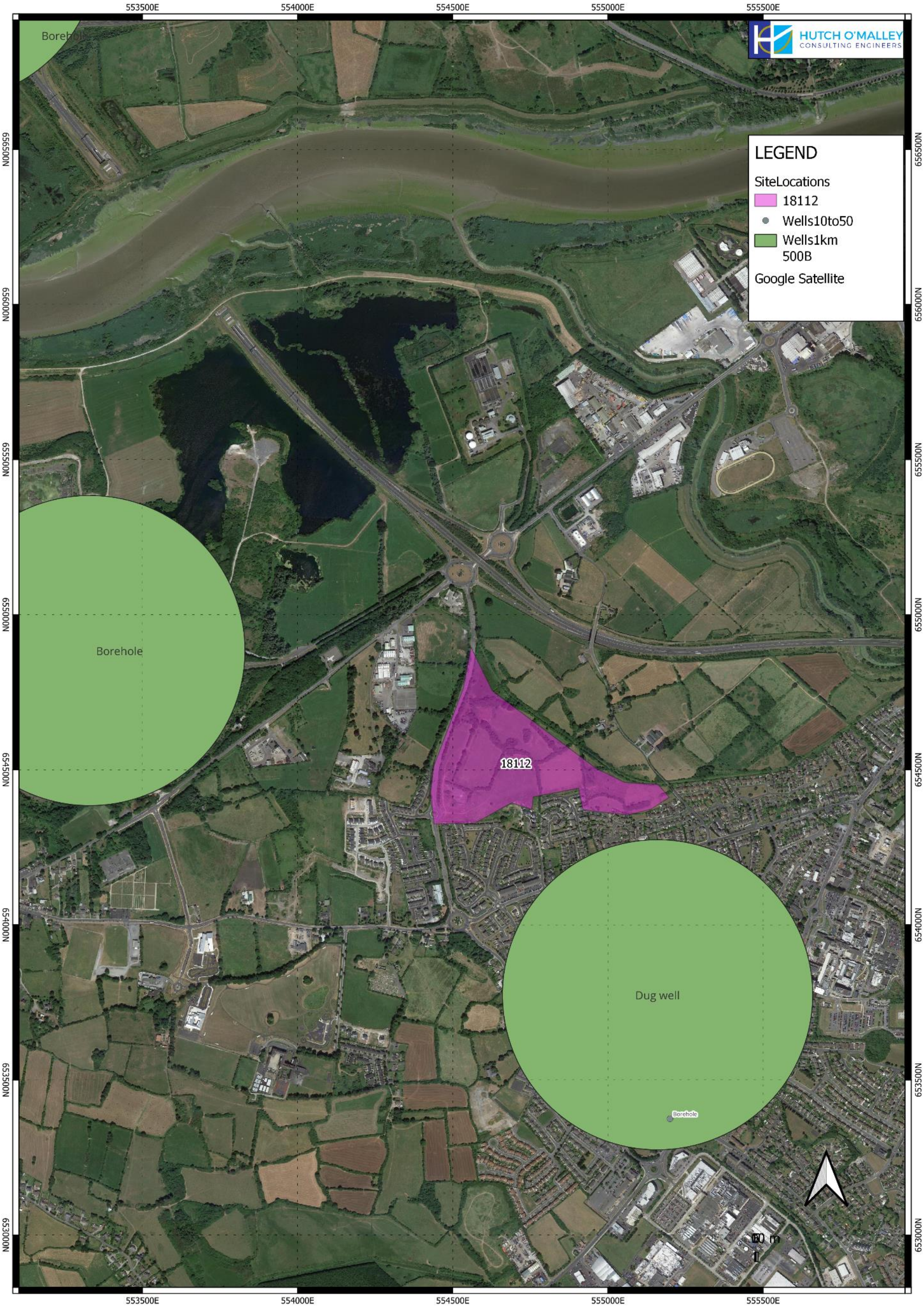


Image 3 - WFD 2008 Risk marking

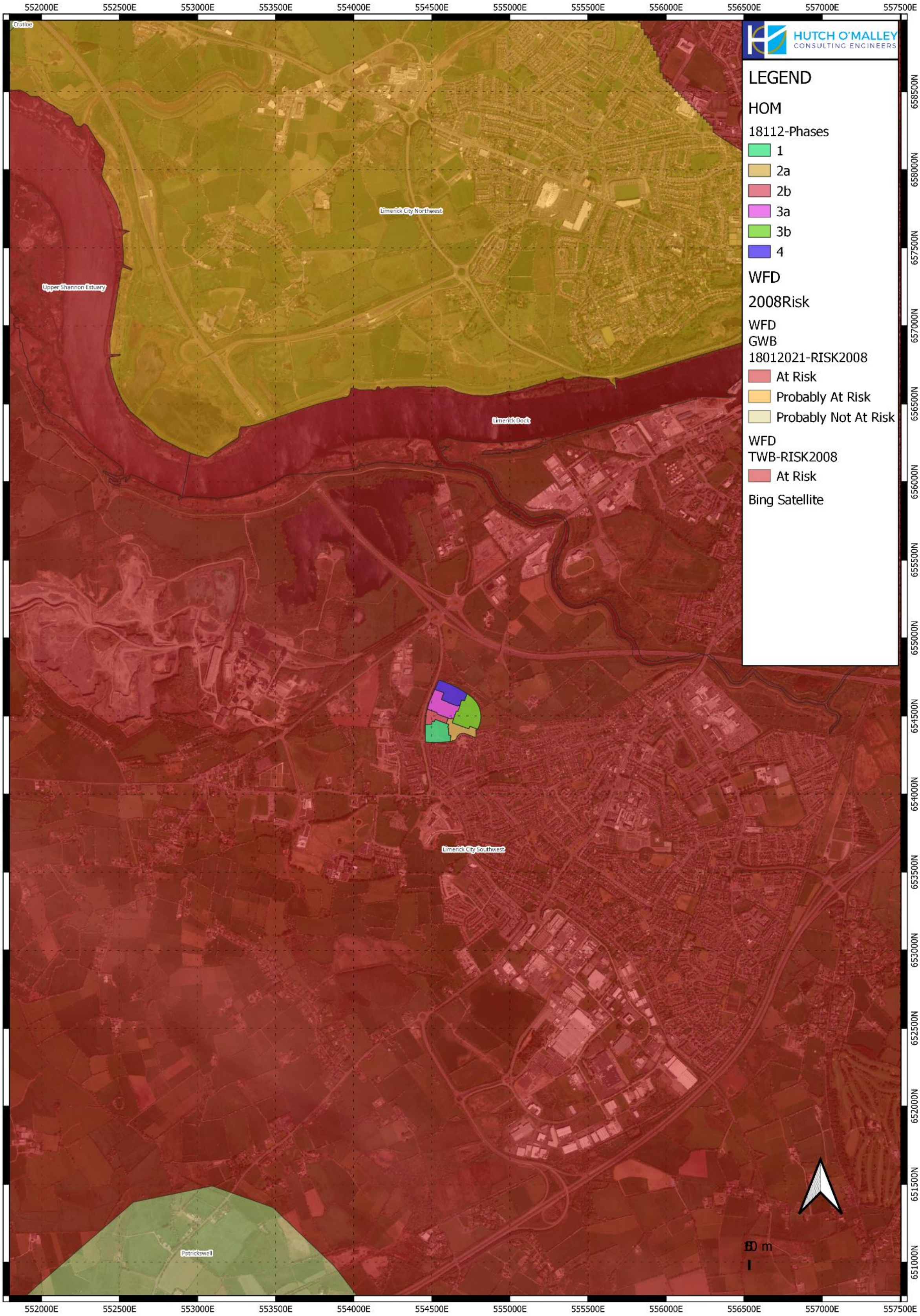


Image 4 - WFD 2008 Risk marking

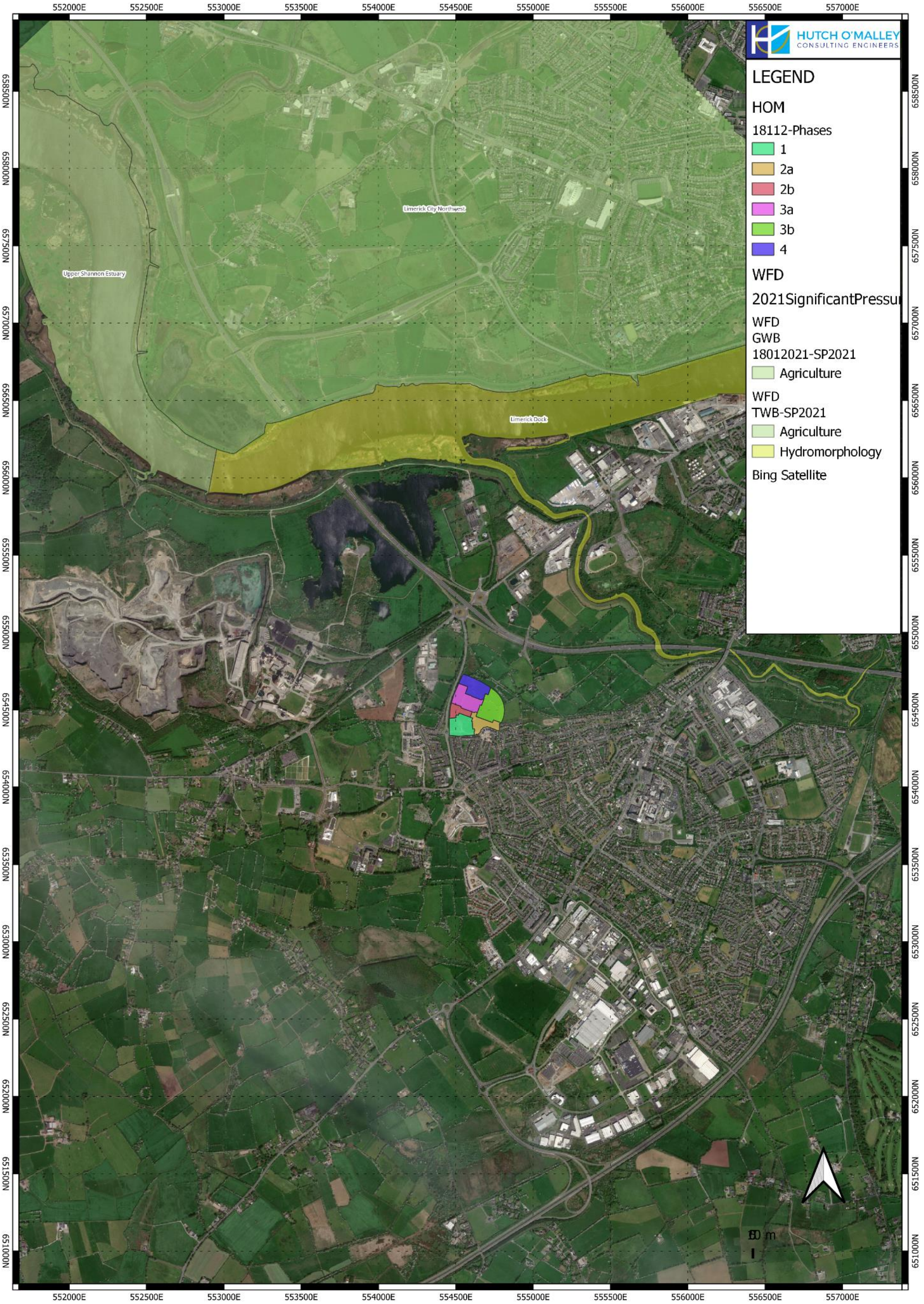


Image 5 - WFD Significant Pressure Areas

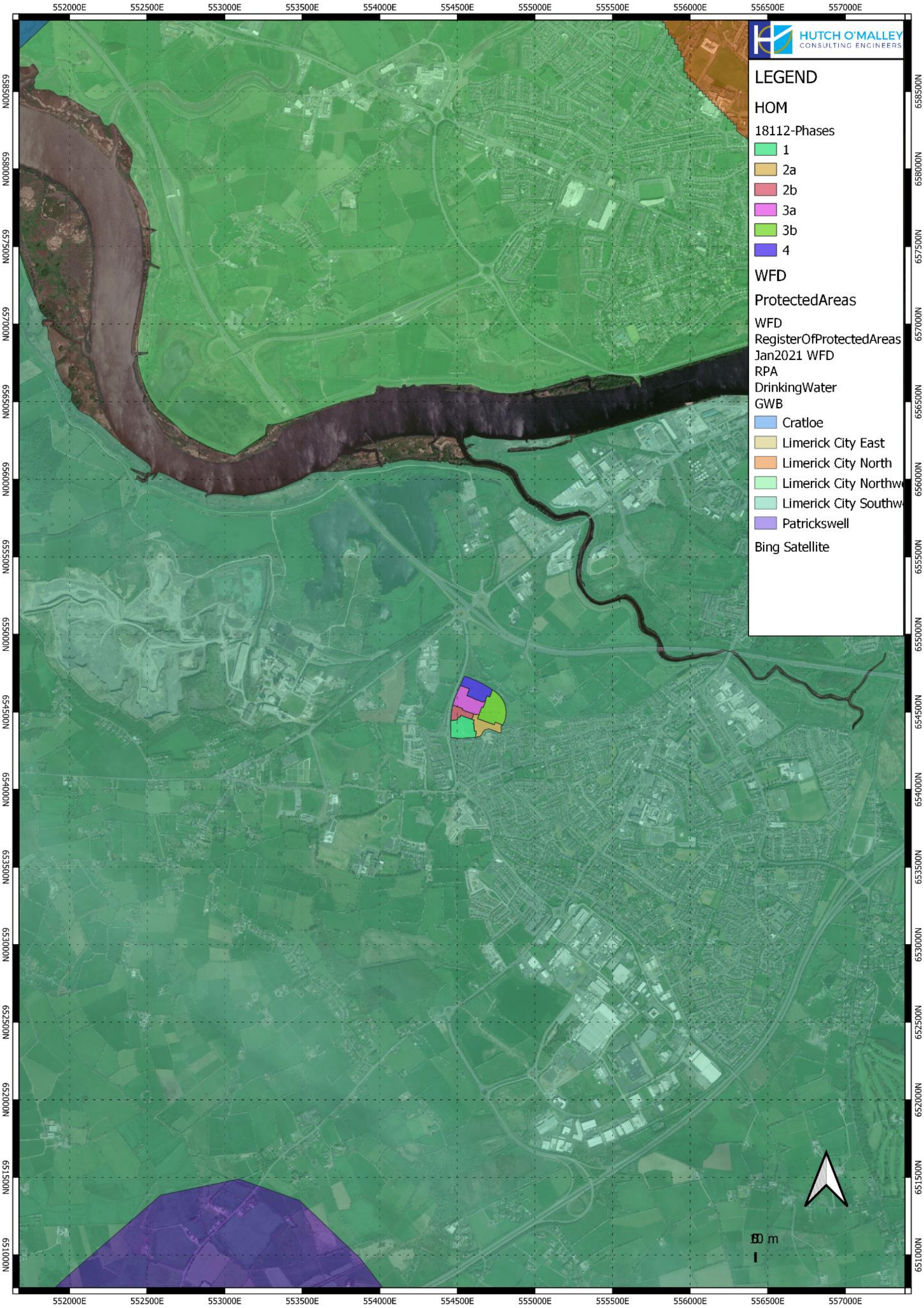
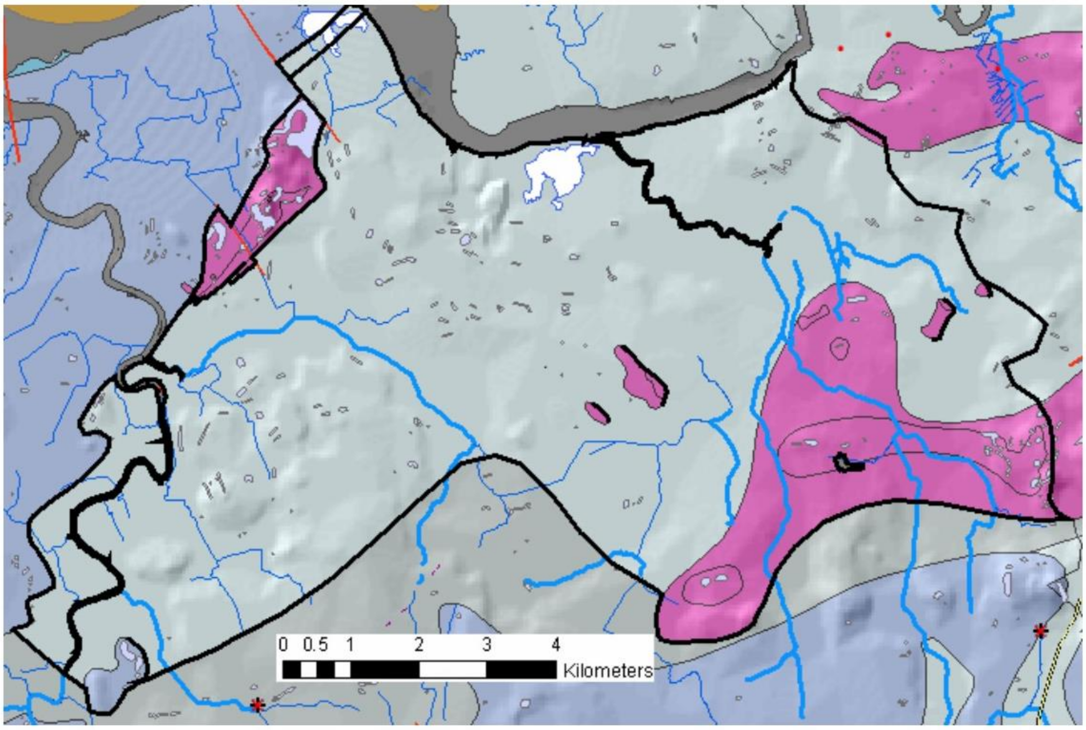


Image 6 – Rock Units In GWB

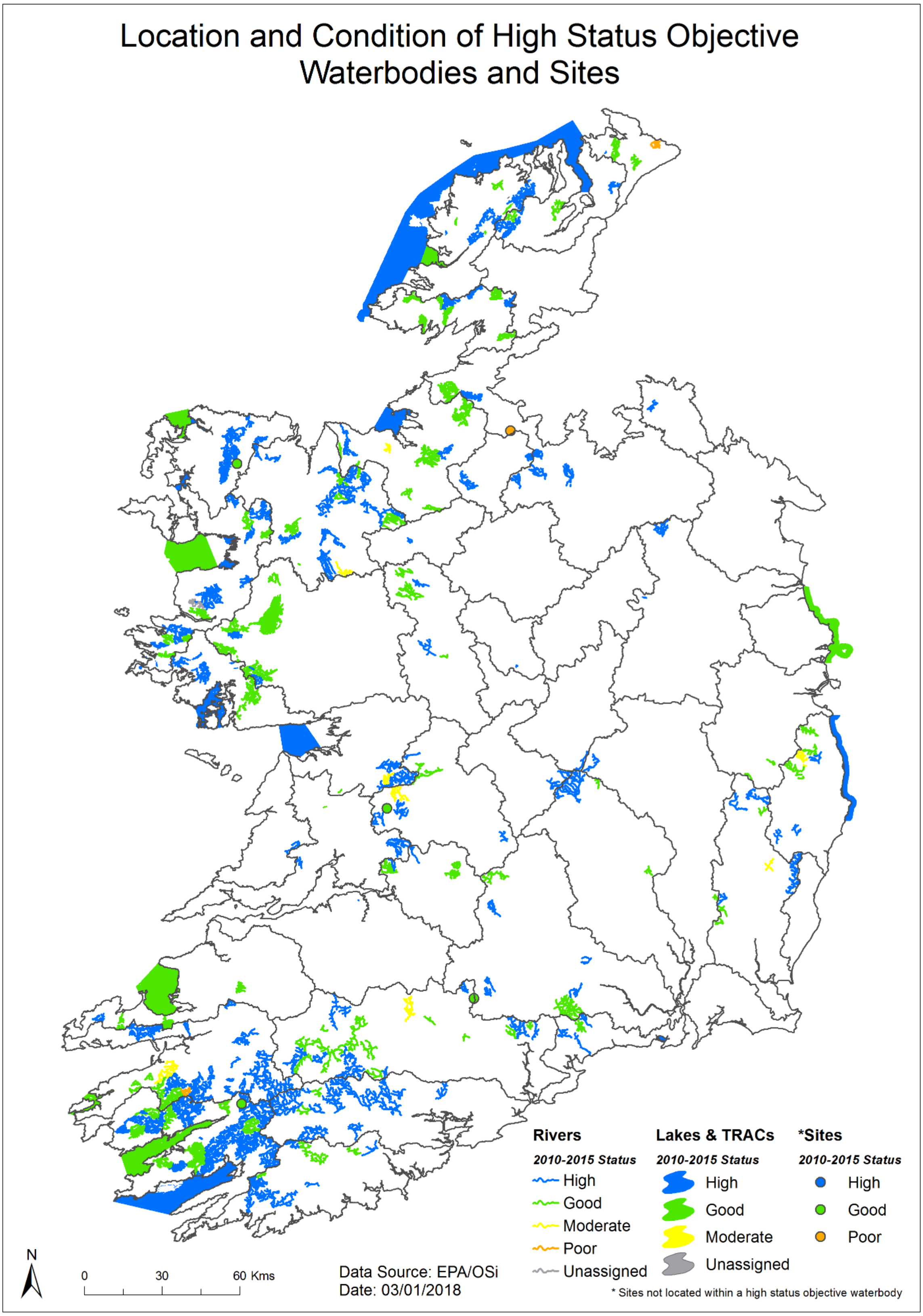
Draft 3 Limerick City South West GWB Description – 5th January 2004



Rock units in GWB

Rock unit name and code	Description	Rock unit group
Visean Limestones (Undifferentiated)		Dinantian Pure Bedded Limestones
Volcaniclastic Rocks (V)		Basalts and other Volcanic rocks
Basalt (B)		Basalts and other Volcanic rocks
Waulsortian Limestones (WA)	Massive unbedded lime-mudstone	Dinantian Pure Unbedded Limestones

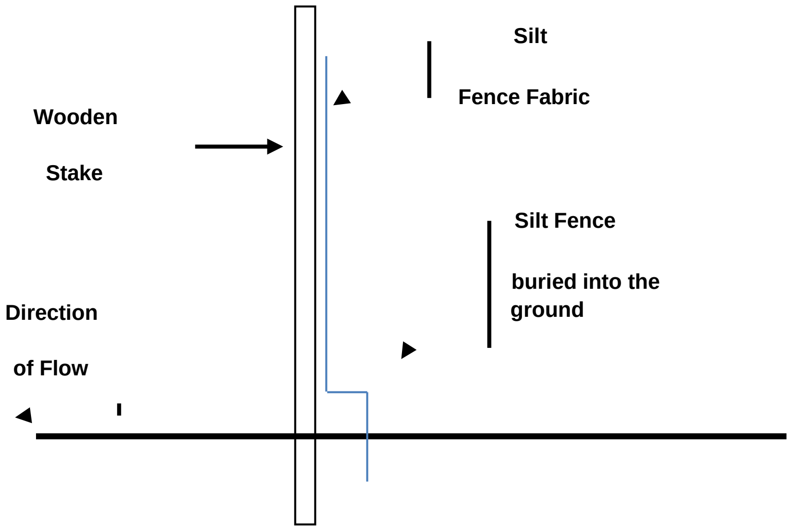
Image 7 - 2018 High Status WFD


Location and Condition of High Status Objective Waterbodies and Sites

Data Source: EPA/OSi
Date: 03/01/2018

* Sites not located within a high status objective waterbody

Image 8 – Silt Fence Detail



8.0 AIR QUALITY AND CLIMATE

8.1 Introduction and Methodologies

This chapter assesses the likely air quality and climate impacts associated with the proposed strategic housing development (SHD) in Ballykeeffe, Raheen, Co. Limerick. The SHD consists of the provision of 384 residential house and apartment units on a ca. 10.44 hectare site.

This chapter was completed by Dr. Avril Challoner who is a Senior Environmental Consultant in the Air Quality section of AWN Consulting. She holds a BEng (Hons) in Environmental Engineering from the National University of Ireland Galway, HDip in Statistics from Trinity College Dublin and has completed a PhD in Environmental Engineering (Air Quality) in Trinity College Dublin. She is a Chartered Scientist (CSci), Member of the Institute of Air Quality Management and specialises in the fields of air quality, EIA and air dispersion modelling. She has experience with preparing air quality and climate impact assessments for EIARs for various residential, mixed-use, commercial and industrial developments.

8.1.1 Methodology

This chapter has been prepared having regard to the following guidelines;

- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (Department of Housing, Planning & Local Government, 2018)
- Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report (European Commission, 2017)
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports – Draft (EPA, 2017)

8.1.2 Relevant Legislation & Guidance

8.1.2.1 Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or “Air Quality Standards” are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Appendix 8.1).

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2011 (S.I. No. 180/2011), which incorporate EU Directive 2008/50/EC, which has set limit values for a number of pollutants. The limit values for NO_2, PM_{10} and $PM_{2.5}$ are of relevance to this assessment (see Table 8-1). Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directive are used which are triggers for particular actions (see Appendix 8.1).

Pollutant	**Regulation** Note 1	**Limit Type**	**Value**
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 µg/m^3
		Annual limit for protection of human health	40 µg/m^3
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 µg/m^3
		Annual limit for protection of human health	40 µg/m^3
Particulate Matter (as $PM_{2.5}$)	2008/50/EC	Annual limit for protection of human health	25 µg/m^3

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Table 8-1 Ambient Air Quality Standards

8.1.2.2 Dust Deposition Guidelines

The concern from a health perspective is focussed on particles of dust which are less than 10 microns (PM_{10}) and less than 2.5 microns ($PM_{2.5}$) and the EU ambient air quality standards outlined in Table 8-1 have set ambient air quality limit values for PM_{10} and $PM_{2.5}$.

With regards to larger dust particles that can give rise to nuisance dust, there are no statutory guidelines regarding the maximum dust deposition levels that may be generated during the construction phase of a development in Ireland. Furthermore, no specific criteria have been stipulated for nuisance dust in respect of this development.

With regard to dust deposition, the German TA-Luft standard for dust deposition (non-hazardous dust) (German VDI, 2002) sets a maximum permissible emission level for dust deposition of 350 mg/(m^2*day) averaged over a one-year period at any receptors outside the site boundary. Recommendations from the Department of the Environment, Heritage & Local Government (DEHLG, 2004) apply the Bergerhoff limit value of 350 mg/(m^2*day) to the site boundary of quarries. This limit value can also be implemented with regard to potential dust impacts from construction of the proposed development.

8.1.2.3 Climate Agreements

Ireland is party to both the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. The Paris Agreement, which entered into force in 2016, is an important milestone in terms of international climate change agreements and includes an aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to GHG emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made in the Paris Agreement on elevating adaption onto the same level as action to cut and curb emissions.

In order to meet the commitments under the Paris Agreement, the EU enacted *Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No. 525/2013* (the Regulation). The Regulation aims to deliver, collectively by the EU in the most cost-effective manner possible, reductions in GHG emissions from the Emission Trading Scheme (ETS) and non-ETS sectors amounting to 43% and 30%, respectively, by 2030 compared to 2005. Ireland's obligation under the Regulation is a 30% reduction in non-ETS greenhouse gas emissions by 2030 relative to its 2005 levels.

In 2015, the Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015) (Government of Ireland, 2015) was enacted (the Act). The purpose of the Act was to enable Ireland '*to pursue, and* *achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050*' (3.(1) of No. 46 of 2015). This is referred to in the Act as the '*national transition objective*'. The Act made provision for a national mitigation plan, and a national adaptation framework. In addition, the Act provided for the establishment of the Climate Change Advisory Council with the function to advise and make recommendations on the preparation of the national mitigation and adaptation plans and compliance with existing climate obligations.

The first Climate Action Plan (CAP) was published by the Irish Government in June 2019 (Government of Ireland, 2019a). The Climate Action Plan 2019 outlined the current status across key sectors including Electricity, Transport, Built Environment, Industry and Agriculture and outlined the various broadscale measures required for each sector to achieve ambitious decarbonisation targets. The 2019 CAP also detailed the required governance arrangements for implementation including carbon-proofing of policies, establishment of carbon budgets, a strengthened Climate Change Advisory Council and greater accountability to the Oireachtas. The Government published the second Climate Action Plan in November 2021 (Government of Ireland, 2021a). The plan contains similar elements as the 2019 CAP and aims to set out how Ireland can reduce our greenhouse gas emissions by 51% by 2030 (compared to 2018 levels) which is in line with the EU ambitions, and a longer-term goal of to achieving net-zero emissions no later than 2050. The 2021 CAP outlines that emissions from the Built Environment sector must be reduced to 4 - 5 $MtCO_2e$ by 2030 in order to meet our climate targets. This will require further measures in addition to those committed to in the 2019 CAP. This will include phasing out the use of fossil fuels for the space and water heating of buildings, improving the fabric and energy of our buildings, and promoting the use of lower carbon alternatives in construction.

Following on from Ireland declaring a climate and biodiversity emergency in May 2019, and the European Parliament approving a resolution declaring a climate and environment emergency in Europe in November 2019, the Government approved the publication of the General Scheme in December 2019, followed by the publication of the Climate Action and Low Carbon Development (Amendment) Bill 2021 (hereafter referred to as the 2021 Climate Bill) in March 2021. The Climate Act was signed into Law on the 23rd July 2021, giving statutory effect to the core objectives stated within the CAP.

The purpose of the 2021 Climate Act (Government of Ireland, 2021b), is to provide for the approval of plans "*for the purpose of pursuing the transition to a climate resilient, biodiversity rich and climate neutral economy by no later than the end of the year 2050*". The 2021 Climate Act will also "*provide for carbon budgets and a decarbonisation target range for certain sectors of the economy*". The 2021

Climate Act defines the carbon budget as "*the total amount of greenhouse gas emissions that are permitted during the budget period*".

The 2021 Climate Act removes any reference to a national mitigation plan and instead refers to both the Climate Action Plan, as published in 2019, and a series of National Long Term Climate Action Strategies. In addition, the Environment Minister shall request that each Local Authority produce a climate action plan lasting five years, specifying the mitigation measures and the adaptation measures to be adopted by the Local Authority.

Limerick City and County Council Climate Change Adaptation Strategy 2019-2024 (Limerick City and County Council 2021) outlines a number of goals and plans to prepare for and adapt to climate change in the key sectors of infrastructure and built environment, land use and development, drainage and flood management, natural resources and cultural infrastructure and community, health and wellbeing. Some of the measures promoted within the Adaptation Strategy relevant to infrastructure and built environment include integrating climate considerations into the design, planning, tendering process and construction of new developments and ensuring climate change is considered in locating future developments, the promotion of climate resilient and sustainable design and construction, the promotion of green infrastructure, adequate assessment of the potential flooding related risks and appropriate mitigation measures required for new developments.

Under amendments to Part L of the Building Regulations from November 2019 all new buildings were required to comply with the Near Zero Energy Building (NZEB) regulations. This aims to make new residential buildings 70% more energy efficient than the 2005 levels. The Part L Technical Guidance Document was updated by the Minister for Housing, Local Government & Heritage in July 2021. The amendments to Part L give effect to the European Union (Energy Performance of Buildings) Regulations 2019, published on 3 May 2019 (S.I. 183 of 2019). The regulations transpose Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings (recast), as amended by Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018. The Directive sets requirements for Member States to improve the energy performance of buildings and make an important contribution to the reduction of greenhouse gas emissions. The improved efficiency of buildings will help in reducing Ireland's GHG emissions and thus help to mitigate climate change. The regulations require that at least 20% of the total energy use of buildings is sourced from renewables. There is also a requirement to reduce the heat loss from buildings and avail of heat gain through the fabric of the building in addition to providing energy efficient space and water heating systems. The NZEB requirements will result in a typical Building Energy Rating (BER) of A2 which represents a 70% improvement in carbon emissions levels on the emissions levels of buildings from 2005.

8.1.3 Construction Phase Methodology

8.1.3.1 Air Quality

During the construction phase the main focus in relation to air quality impacts will be from potential fugitive dust emissions from site activities. The Institute of Air Quality Management in the UK (IAQM) guidance document '*Guidance on the Assessment of Dust from Demolition and Construction*' (2014) outlines an assessment method for predicting the impact of dust emissions from demolition, earthworks, construction and haulage activities based on the scale and nature of the works and the sensitivity of the area to dust impacts. The IAQM methodology has been applied to the construction phase of this development in order to predict the likely risk of dust impacts in the absence of mitigation measures and to determine the level of site-specific mitigation required. The use of UK guidance is considered best practice in the absence of applicable Irish guidance.

As per the IAQM guidance (2014) high sensitivity receptors are regarded as residential properties where people are likely to spend the majority of their time or areas where users would expect a high level of amenity. Commercial properties, parks and places of work are regarded as medium sensitivity while low sensitivity receptors are places where people are present for short periods or do not expect a high level of amenity. Ecological sites can also be dust sensitive, according to the IAQM guidance high sensitivity ecological areas are defined as "locations with an international or national designation *and* the designated features may be affected by dust soiling".

Traffic emissions associated with construction vehicles accessing the site also have the potential to impact air quality during the construction phase. The air quality assessment has been carried out following procedures described in the publications by the EPA (2015; 2017) and using the methodology outlined in the guidance documents published by the UK Highways Agency (2019a) and UK Department of Environment Food and Rural Affairs (DEFRA) (2016; 2018). TII reference the use of the UK Highways Agency and DEFRA guidance and methodology in their document *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (2011). This approach is considered best practice in the absence of Irish guidance and can be applied to any development that causes a change in traffic.

The UK Highways Agency Design Manual for Roads and Bridges (DMRB) guidance (UK Highways Agency, 2019a), states that road links meeting one or more of the following criteria can be defined as being 'affected' by a proposed development and should be included in the local air quality assessment.

- Annual average daily traffic (AADT) changes by 1,000 or more;
- Heavy duty vehicle (HDV) AADT changes by 200 or more;
- A change in speed band;
- A change in carriageway alignment by 5m or greater.

Traffic data for the proposed development was provided by TTRSA to inform this assessment. None of the impacted road links meet the above scoping criteria for the construction phase and therefore, a detailed assessment is not required as there is no potential for significant impacts to air quality.

8.1.3.2 Climate

The impact of the construction phase of the development on climate was determined by a qualitative assessment of the nature and scale of greenhouse gas generating construction activities associated with the proposed development.

The UK Highways Agency has published an updated DMRB guidance document in relation to climate impact assessments *LA 114 Climate* (UK Highways Agency 2019b). This guidance is specific to road projects but can be used for any project that causes a change in traffic. The following scoping criteria are used to determine whether a detailed climate assessment is required for a proposed project. If any of the road links impacted by the proposed development meet or exceed the below criteria, then further assessment is required.

- A change of more than 10% in AADT;
- A change of more than 10% to the number of heavy-duty vehicles; and
- A change in daily average speed of more than 20 km/hr.

Traffic data for the proposed development was provided by TTRSA to inform this assessment. None of the impacted road links meet the above scoping criteria for the construction phase climate impacts and therefore, a detailed assessment is not required as there is no potential for significant impacts to climate.

8.1.4 Operational Phase Methodology

8.1.4.1 Air Quality

Operational phase traffic has the potential to impact local air quality as a result of increased vehicle movements associated with the proposed development. The UK Highways Agency scoping criteria detailed in Section 8.1.3.1 was used to determine if any road links are affected by the proposed development and require inclusion in an air dispersion modelling assessment. As there are road links present that exceed the scoping threshold, the assessment will proceed to a qualitative model.

The guidance states a proportionate number of representative receptors which are located in areas which will experience the highest concentrations or greatest improvements as a result of the proposed development are to be included in the modelling (UK Highways Agency, 2019a). The TII guidance (2011) defines sensitive receptor locations as: residential housing, schools, hospitals, places of worship, sports centres and shopping areas, i.e. locations where members of the public are likely to be regularly present. Therefore, according to the scoping criteria in Section 8.1.3.1 the local road links with sensitive receptors within 200 m which can be classed as ‘affected’ should proceed to an air dispersion modelling of operational phase traffic emissions due to the potential for impacts to air quality.

In 2019 the UK Highways Agency DMRB air quality guidance was revised with LA 105 Air Quality replacing a number of key pieces of guidance (HA 207/07, IAN 170/12, IAN 174/13, IAN 175/13, part of IAN 185/15). This revised document outlines a number of changes for air quality assessments in relation to road schemes but can be applied to any development that causes a change in traffic. Previously the DMRB air quality spreadsheet was used for the majority of assessments in Ireland with detailed modelling only required if this screening tool indicated compliance issues with the EU air quality standards. Guidance from TII (TII, 2011) recommends the use of the UK Highways Agency DMRB spreadsheet tool for assessing the air quality impacts from road schemes. However, the DMRB spreadsheet tool was last revised in 2007 and accounts for modelled years up to 2025. Vehicle emission standards up to Euro V are included but since 2017, Euro 6d standards are applicable for the new fleet. In addition, the model does not account for electric or hybrid vehicle use. Therefore, this is a somewhat outdated assessment tool. The LA 105 guidance document states that the DMRB spreadsheet tool may still be used for simple air quality assessments where there is unlikely to be a breach of the air quality standards. Due to its use of a “dirtier” fleet, vehicle emissions would be considered to be higher than more modern models and therefore any results will be conservative in nature and will provide a worst-case assessment.

The 2019 UK Highways Agency DMRB air quality revised guidance *LA 105 Air Quality* states that modelling should be conducted for NO_2 for the base, opening and design years for both the do minimum (do nothing) and do something scenarios. Modelling of PM_{10} is only required for the base year to demonstrate that the air quality limit values in relation to PM_{10} are not breached. Where the air quality modelling indicates exceedances of the PM_{10} air quality limits in the base year then PM_{10} should be included in the air quality model in the do minimum and do something scenarios. Modelling of $PM_{2.5}$ is not required as there are currently no issues with compliance with regard to this pollutant. The modelling of PM_{10} can be used to show that the project does not impact on the $PM_{2.5}$ limit value as if compliance with the PM_{10} limit is achieved then compliance with the $PM_{2.5}$ limit will also be achieved. Historically modelling of carbon monoxide (CO) and benzene was required however, this is no longer needed as concentrations of these pollutants have been monitored to be significantly below their air quality limit values in recent years, even in urban centres (EPA, 2021a). The key pollutant reviewed in this assessment is NO_2. Concentrations of PM_{10} have been modelled for the base year to indicate that there are no potential compliance issues.

Conversion of NO_x to NO_2

NO_X ($NO + NO_2$) is emitted by vehicles exhausts. The majority of emissions are in the form of NO, however, with greater diesel vehicles and some regenerative particle traps on HGV's the proportion of NO_X emitted as NO_2, rather than NO is increasing. With the correct conditions (presence of sunlight and O_3) emissions in the form of NO, have the potential to be converted to NO_2.

Transport Infrastructure Ireland states the recommended method for the conversion of NOx to NO_2 in *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (2011). The TII guidelines recommend the use of DEFRAs NOx to NO_2 calculator (2020) which was originally published in 2009 and is currently on version 8.1. This calculator (which can be downloaded in the form of an excel spreadsheet) accounts for the predicted availability of O_3 and proportion of NOx emitted as NO for each local authority across the UK. O_3 is a regional pollutant and therefore concentrations do not vary in the same way as concentrations of NO_2 or PM_{10}.

The calculator includes Local Authorities in Northern Ireland and the TII guidance recommends the use of 'Armagh, Banbridge and Craigavon' as the choice for local authority when using the calculator. The choice of Craigavon provides the most suitable relationship between NO_2 and NO_x for Ireland. The "All Non-Urban UK Traffic" traffic mix option was used.

Update to NO_2 Projections using DMRB

In 2011 the UK DEFRA published research (Highways England, 2013) on the long term trends in NO_2 and NO_X for roadside monitoring sites in the UK. This study marked a decrease in NO_2 concentrations between 1996 and 2002, after which the concentrations stabilised with little reduction between 2004 and 2010. The result of this is that there now exists a gap between projected NO_2 concentrations which UK DEFRA previously published and monitored concentrations. The impact of this ‘gap’ is that the DMRB screening model can under-predict NO_2 concentrations for predicted future years. Subsequently, the UK Highways Agency published an Interim advice note (IAN 170/12) in order to correct the DMRB results for future years. This methodology has been used in the current assessment to predict future concentrations of NO_2 as a result of the proposed development.

Data for the Do Nothing (DN) and Do Something (DS) scenarios for the base year 2020 opening year 2027 and design year 2042 were provided. The traffic data is detailed in Table 8-2. Background concentrations have been included as per Section 8.2.2 of this chapter based on available EPA background monitoring data (EPA, 2021a). The locations of the sensitive receptors modelled are shown in Table 8-3 and Figure 8.1.

Link Number	Road Name	Speed (kph)	Base Year	Do-Nothing		Do-Something	
			2020	2027	2042	2027	2042
1	N69 (to west of N69/N18 roundabout)	50	13888 (10.9%)	15736 (12%)	17902 (13.4%)	15785 (11.9%)	17951 (13.3%)
2	Dock Road (to the east of the N69/N18 roundabout)	50	21166 (8.3%)	23981 (9.1%)	27282 (10.2%)	24396 (9%)	27697 (10.1%)
3	Development arm of the site access roundabout (Predicted)	30	0 (0.5%)	0 (0%)	0 (0%)	2282 (0.5%)	2282 (0.5%)
4	R510 (to the north of site access roundabout)	50	12684 (3.3%)	14371 (3.7%)	16349 (4.1%)	15228 (3.4%)	17206 (3.9%)
5	R510 (to south of the site access roundabout)	50	12852 (3.2%)	14562 (3.5%)	16567 (4%)	15940 (3.2%)	17945 (3.7%)
6	R510 (to the south of the Quinn's Cross roundabout)	50	16132 (3%)	18278 (3.3%)	20795 (3.8%)	19181 (3.2%)	21698 (3.6%)
7	Ard Aulin	30	811 (0.5%)	919 (0.6%)	1046 (0.6%)	965 (0.5%)	1092 (0.6%)
8	Mungret Road	50	9547 (1.6%)	10816 (1.8%)	12306 (2%)	10934 (1.8%)	12424 (2%)
9	Father Russell Road	50	10576 (1.6%)	11983 (1.8%)	13633 (2%)	12342 (1.7%)	13992 (2%)

Table 8-2 Traffic Data Used in Local Air Quality Modelling Assessment

Name	Receptor Type	X (ITM)	Y (ITM)
1	Residential	554468	654316
2	Residential	554494	654180
3	Residential	554685	653902
4	Residential	554422	654466

Table 8-3 Sensitive Air Quality Receptors

Figure 8.1 Sensitive Receptors for Operational Traffic Assessment

8.1.4.2 Climate

Ireland has annual GHG targets which are set at an EU level and need to be complied with in order to reduce the impact of climate change. Impacts to climate as a result of GHG emissions are assessed against the targets set out by the EU under *Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No. 525/2013*. Which has set a target of a 30% reduction in non-ETS sector emissions by 2030 relative to 2005 levels.

As per the EU guidance document *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment* (European Commission, 2013) the climate baseline is first established by reference to EPA data on annual GHG emissions (see Section 8.2.3). Thereafter the impact of the proposed development on climate is determined. Emissions from road traffic associated with the proposed development have the potential to emit carbon dioxide (CO_2) which will impact climate.

The UK Highways Agency scoping criteria detailed in Section 8.1.3.2 was used to determine if any road links are affected by the proposed development and require inclusion in a climate modelling assessment.

The proposed development will not increase traffic by more than 10% AADT on any public road links, therefore, the scoping criteria are not met and a detailed climate assessment is not required as there is no potential for significant impacts to climate as a result of traffic emissions.

The EU guidance (2013) also states indirect GHG emissions as a result of a development must be considered, this includes emissions associated with energy usage. The Building Lifecycle Report prepared in relation to the proposed development outlines a number of measures in relation to energy usage from the proposed development primarily in relation to heat and electricity. A number of measures have been incorporated into the overall design of the development to reduce the impact to climate where possible.

8.1.4.3 Ecology

For routes that pass within 2 km of a designated area of conservation (either Irish or European designation) the TII requires consultation with an ecologist (2011). However, in practice the potential for impact to an ecological site is highest within 200m of the proposed scheme or development and when significant changes in AADT (>5%) occur. Only sites that are sensitive to nitrogen deposition should be included in the assessment. In addition, the UK Highways Agency (2019a) states that a detailed assessment does not need to be conducted for areas that have been designated for geological features or watercourses.

Transport Infrastructure Ireland's Guidelines for Assessment of Ecological Impacts of National Road Schemes (2009) and Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities (DEHLG, 2010) provide details regarding the legal protection of designated conservation areas.

If both of the following assessment criteria are met, an assessment of the potential for impact due to nitrogen deposition should be conducted:

- A designated area of conservation is located within 200 m of the proposed development; and
- A significant change in AADT flows (>5%) will occur.

The Inner Shannon Estuary pNHA (Site Code: 000435) is within 200m of road links directly impacted by the proposed development. As such an assessment of the impact with regards to nitrogen deposition was conducted. Dispersion modelling and prediction was carried out at typical traffic speeds at these locations. Ambient NOx concentrations were predicted for the opening year (2027) and design year (2042) along a transect of up to 200m within the SAC in line with the UK Highways Agency (2019a) and TII (2011) guidance. The road contribution to dry deposition along the transect was also calculated using the methodology outlined in Appendix 9 of the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (2011).

8.2 Description of Existing Environment

8.2.1 Meteorological Data

A key factor in assessing temporal and spatial variations in air quality are the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels). Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$ - PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

Shannon Airport meteorological station, which is located approximately 27 km west of the proposed development at the closest point, collects meteorological data in the correct format for the purposes of this assessment and has a data collection of greater than 90%. Long-term hourly observations at Shannon Airport meteorological station provide an indication of the prevailing wind conditions for the region. For data collated during five representative years (2016 – 2020), the predominant wind direction is south-westerly, with generally moderate wind speeds (see Figure 8.2) (Met Eireann, 2022).

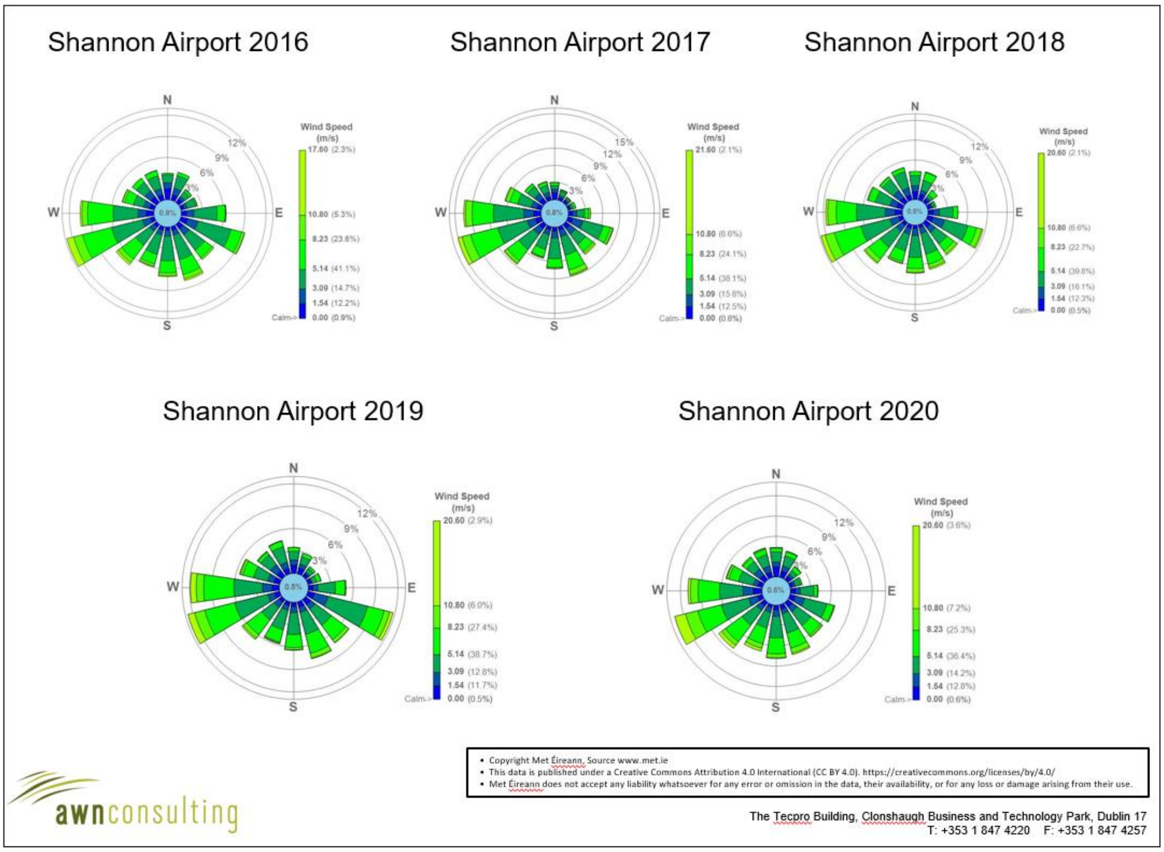


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Figure 8.2 Shannon Airport Windrose 2016 – 2020 (Met Eireann, 2022)

8.2.2 Baseline Air Quality

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality in Ireland is "*Air Quality In Ireland 2020*" (EPA, 2021a). The EPA website details the range and scope of monitoring undertaken throughout Ireland and provides both monitoring data and the results of previous air quality assessments (EPA, 2021b). The EPA data provides a long-term data set for background air quality at a variety of locations throughout Ireland. The use of existing long-term data is considered best practice in air quality assessments (TII, 2011).

As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA, 2021b). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000, is defined as Zone D.

In 2020 the EPA reported (EPA 2021a) that Ireland was compliant with EU legal air quality limits at all locations, however this was largely due to the reduction in traffic due to Covid-19 restrictions. The EPA report details the effect that the Covid-19 restrictions had on stations, which included reductions of up to 50% at some monitoring stations which have traffic as a dominant source. The report also notes that CSO figures show that while traffic volumes are still slightly below 2019 levels, they have significantly increased since 2020 levels. 2020 concentrations are therefore predicted to be an exceptional year and not consistent with long-term trends. For this reason they have not been included in the baseline section.

In terms of air monitoring and assessment, the proposed development is in Zone C (EPA 2022). The long-term EPA monitoring data has been used to determine background concentrations for the key pollutants in the region of the proposed development. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating etc.).

Long-term NO_2 monitoring was carried out at two urban Zone C locations – Kilkenny and Portlaoise (EPA 2021a). The NO_2 annual average from 2015 to 2019 at the two locations was 8 µg/m^3. Monitoring was also recorded for two years at a suburban traffic location in Dundalk with 2018-2019 annual average NO_2 concentrations of 13 µg/m^3. Hence long-term average concentrations measured at these locations were significantly lower than the annual average limit value of 40 µg/m^3. Based on the above information, a conservative estimate of the background NO_2 concentration for the proposed development is 13 µg/m^3.

Long-term PM_{10} monitoring is carried out at three suburban Zone C locations, Galway, Ennis and Portlaoise. The average PM_{10} concentration measured at the sites in 2015-2019 was 14 µg/m^3. Monitoring for PM_{10} was commenced in Dundalk in 2018, with 2018-2019 annual average PM_{10} concentrations of 15 µg/m^3. Ennis is the closest site to the proposed development and had a 5-year average concentration of 16.7 µg/m^3. Hence, long-term average PM_{10} concentrations in the vicinity of the proposed development are predicted to be lower than the annual average limit value of 40 µg/m^3.Based on the above information a conservative estimate of the background PM_{10} concentration for the Zone C region of the proposed development is 17 µg/m^3.

Continuous $PM_{2.5}$ monitoring is carried out at the two Zone C suburban locations of Bray and Ennis which showed annual average concentrations of 9 µg/m^3 over 2015 to 2019. The concentrations at Ennis over the five years were higher than at Bray, with the 5-year average concentration of 11 µg/m^3. Based on the above information a conservative estimate of the background $PM_{2.5}$ concentration for the Zone C region of the proposed development is 11 µg/m^3. Hence, long-term average $PM_{2.5}$

concentrations for the proposed development are predicted to be lower than the annual average limit value of 25 µg/m^3.

Background concentrations for the Opening Year 2027 and Design Year of 2042 have been calculated for the local air quality assessment. These have used current estimated background concentrations and the year on year reduction factors provided by Transport Infrastructure Ireland in the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (2011) and the UK Department for Environment, Food and Rural Affairs LAQM.TG(16) (2018).

8.2.3 Climate Baseline

Anthropogenic emissions of greenhouse gases in Ireland included in the EU 2020 strategy are outlined in the most recent review by the EPA which details provisional emissions up to 2020 (EPA 2021b). The data published in 2021 states that Ireland has exceeded its 2020 annual limit set under the EU's Effort Sharing Decision (ESD), 406/2009/EC1 by an estimated 6.73 Mt. For 2020, total national greenhouse gas emissions are 57.7million tonnes carbon dioxide equivalent (Mt CO_2eq) with 44.38 MtCO_2eq of emissions associated with the ESD sectors for which compliance with the EU targets must be met. Agriculture is the largest contributor in 2020 at 37.1% of the total, with the transport sector accounting for 17.8% of emissions of CO_2.

GHG emissions for 2020 are estimated to be 3.6% lower than those recorded in 2019. Emission reductions have been recorded in 6 of the last 10 years. However, compliance with the annual EU targets has not been met for five years in a row. Emissions from 2016 – 2020 exceeded the annual EU targets by 0.29 MtCO_2eq, 2.94 MtCO_2eq, 5.57 MtCO_2eq, 6.85 MtCO_2eq and 6.73 MtCO_2eq respectively. Agriculture is consistently the largest contributor to emissions with emissions from the transport and energy sectors being the second and third largest contributors respectively in recent years.

The EPA 2020 GHG Emissions Projections Report for 2020 – 2040 (EPA, 2021c) notes that there is a long-term projected decrease in greenhouse gas emissions as a result of inclusion of new climate mitigation policies and measures that formed part of the National Development Plan (NDP) which was published in 2018 and the Climate Action Plan published in 2019. Implementation of these are classed as a "With Additional Measures scenario" for future scenarios. A change from generating electricity using coal and peat to wind power and diesel vehicle engines to electric vehicle engines are envisaged under this scenario. While emissions are projected to decrease in these areas, emissions from agriculture are projected to grow steadily due to an increase in animal numbers. However, over the period 2013 to 2020 Ireland is projected to cumulatively exceed its compliance obligations with the

EU's Effort Sharing Decision (Decision No. 406/2009/EC) 2020 targets by approximately 12.2 $MtCO_2eq$ under the "With Existing Measures" scenario and under the "With Additional Measures" scenario (EPA, 2021c). The projections indicate that Ireland can meet its non-ETS EU targets over the period 2021 – 2030 assuming full implementation of the 2019 Climate Action Plan and the use of the flexibilities available.

After the publication of the 2021 Climate Act in July 2021 and the 2021 CAP, carbon budgets and sectoral ceilings for the built environment sector will be adopted in the coming months and will be outlined in the 2022 CAP which will allow a comparison with the net CO_2 project GHG emissions.

8.2.4 Construction Dust Sensitivity

In line with the IAQM guidance document (2014) prior to assessing the impact of dust from a proposed development, the sensitivity of the area must first be assessed as outlined below. Both receptor sensitivity and proximity to proposed works areas are taken into consideration. For the purposes of this assessment, high sensitivity receptors are regarded as residential properties where people are likely to spend the majority of their time. Commercial properties and places of work are regarded as medium sensitivity while low sensitivity receptors are places where people are present for short periods or do not expect a high level of amenity.

In terms of receptor sensitivity to dust soiling, there are more than 10 no. high sensitivity residential receptors within 20 m of the site boundary. Based on the IAQM criteria outlined in Table 8-4, the worst-case sensitivity of the area to dust soiling is considered to be high.

Receptor Sensitivity	**Number Of Receptors**	**Distance from source (m)**			
		<20	**<50**	**<100**	**<350**
High	>100	High	High	Medium	Low
	10-100	**High**	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 8-4 Sensitivity of the Area to Dust Soiling Effects on People and Property

In addition to sensitivity to dust soiling, the IAQM guidelines also outline the assessment criteria for determining the sensitivity of the area to human health impacts. The criteria take into consideration the current annual mean PM_{10} concentration, receptor sensitivity based on type and the number of receptors affected within various distance bands from the construction works. A conservative estimate of the current annual mean PM_{10} concentration in the vicinity of the proposed development is 17 µg/m^3 and there are less than 100 no. high sensitivity receptors within 20 m of the site boundary. Based on the IAQM criteria outlined in Table 8-5, the worst-case sensitivity of the area to human health impacts is considered low.

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number Of Receptors	Distance from source (m)				
			<20	**<50**	**<100**	**<200**	**<350**
High	< 24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	**Low**	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	< 24 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	< 24 µg/m^3	>1	Low	Low	Low	Low	Low

Table 8-5 Sensitivity of the Area to Human Health Impacts

The IAQM guidance (2014) also outlines the criteria for determining the sensitivity of an ecological receptor to dust impacts. The sensitivity is determined based on the distance to the source, the designation of the site, (European, National or local designation) and the potential dust sensitivity of the ecologically important species present.

Only ecological sites within 50 m of the proposed development site need to be considered in relation to dust impacts (IAQM, 2014). There are no designated ecological sites within 50m of the boundary of the site. According to the IAQM criteria in Table 8-6 the sensitivity of the area to dust related ecological impacts is not appliable.

Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table 8-6 Sensitivity of the Area to Dust Related Ecological Impacts

8.3 Do Nothing Scenario

The Do-Nothing scenario includes retention of the current site without the proposed development in place. In this scenario, ambient air quality at the site will remain as per the baseline and will change in accordance with trends within the wider area (including influences from potential new developments in the surrounding area, changes in road traffic, etc).

As the site is zoned for development, in the absence of the proposed development it is likely that a development of a similar nature would be constructed in the future in line with national policy and the development plan objectives. Therefore, the construction and operational phase impacts outlined in this assessment are likely to occur in the future even in the absence of the proposed development.

8.4 Likely Significant Effects

8.4.1 Construction Phase

8.4.1.1 Air Quality

The greatest potential impact on air quality during construction phase of the proposed development is from construction dust emissions and the potential for nuisance dust. While construction dust tends to be deposited within 350m of a construction site, the majority of the deposition occurs within the first 50m. The extent of any dust generation depends on the nature of the dust (soils, peat, sands, gravels, silts etc.) and the nature of the construction activity. In addition, the potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction. A review of Shannon Airport meteorological data (see Section 8.2.1) indicates that the prevailing wind direction is south-westerly and wind speeds are generally moderate in nature. In addition, dust generation is considered negligible on days where rainfall is greater than 0.2 mm. A review of historical 30-year average data for Shannon Airport meteorological station indicates that on average 211 days per year have rainfall over 0.2 mm (Met Eireann, 2021) and therefore it can be determined that over 57% of the time dust generation will be reduced. It is important to note that the potential impacts associated with the construction phase of the proposed development are short-term in nature.

In order to determine the level of dust mitigation required during the proposed works, the potential dust emission magnitude for each dust generating activity needs to be taken into account, in conjunction with the previously established sensitivity of the area (see Section 8.2.4). The major dust generating activities are divided into four types within the IAQM guidance to reflect their different potential impacts. These are:

- Demolition;
- Earthworks;
- Construction; and
- Trackout (movement of heavy vehicles).

Demolition

There is no demolition associated with the proposed development.

Earthworks

Earthworks typically involve excavating material, loading and unloading of materials, tipping and stockpiling activities. Activities such as levelling the site and landscaping works are also considered under this category. Following the IAQM guidance (2014), dust emission magnitude from earthworks can be classified as small, medium and large and are described below.

Large: Total site area > 10,000 m^2, potentially dusty soil type (e.g. clay which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds > 8 m in height, total material moved >100,000 tonnes;

Medium: Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 – 8 m in height, total material moved 20,000 – 100,000 tonnes; and

Small: Total site area < 2,500 m^2, soil type with large grain size (e.g. sand), < 5 heavy earth moving vehicles active at any one time, formation of bunds < 4 m in height, total material moved < 20,000 tonnes, earthworks during wetter months.

Under the IAQM guidance (2014) the proposed earthworks can be classified as large. This results in an overall high risk of dust soiling impacts and a low risk of human health impacts as a result of earthworks activities prior to mitigation (see Table 8-7).

Sensitivity of Area	**Dust Emission Magnitude**		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 8-7 Risk of Dust Impacts - Earthworks

Construction

Dust emission magnitude from construction can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

Large: Total building volume > 100,000 m^3, on-site concrete batching, sandblasting;

Medium: Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), on-site concrete batching;

Small: Total building volume < 25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

The dust emission magnitude from construction associated with the proposed development works can be classified as large due to the total building volume involved exceeding 100,000 m^3. The gross floor area of the overall development is circa 41,033 m^2. Assuming an average floor to floor height of 2.5m this would equate to a gross buildings volume of >100,000 m^3. Therefore, there is an overall high risk of dust soiling impacts and a low risk of human health impacts as a result of the proposed construction activities prior to mitigation (Table 8-8).

Sensitivity of Area	**Dust Emission Magnitude**		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 8-8 Risk of Dust Impacts – Construction

Trackout

Factors which determine the dust emission magnitude associated with trackout are vehicle size, vehicle speed, number of vehicles, road surface material and duration of movement. Dust emission magnitude from trackout can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

Large: > 50 HGV (> 3.5 t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length > 100 m;

Medium: 10 - 50 HGV (> 3.5 t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 - 100 m;

Small: < 10 HGV (> 3.5 t) outward movements in any one day, surface material with low potential for dust release, unpaved road length < 50 m.

Dust emission magnitude from trackout can be classified as large under IAQM guidance as there is likely to be more than 100m of unpaved site road during the peak construction period. This is a conserative categorisation, as the number of HGVs outward movements daily is likely to be less than 10. This results in an overall high risk of dust soiling impacts, a low risk of human health impacts as a result of the proposed trackout activities prior to mitigation (see Table 8-9).

Sensitivity of Area	**Dust Emission Magnitude**		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Table 8-9 Risk of Dust Impacts – Trackout

Summary of Dust Emission Risk

The risk of dust impacts as a result of the proposed development are summarised in Table 8-10 for each activity. The magnitude of risk determined is used to prescribe the level of site specific mitigation required for each activity in order to prevent significant impacts occurring.

Overall, in order to ensure that no dust nuisance occurs during the demolition, earthworks, construction and trackout activities, a range of dust mitigation measures associated with a high risk of dust impacts must be implemented. In the absence of mitigation dust impacts from construction works are predicted to be short-term, localised, negative and slight.

Potential Impact	Dust Emission Magnitude			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Dust Soiling	N/A	High Risk	High Risk	High Risk
Human Health	N/A	Low Risk	Low Risk	Low Risk
Ecology	N/A	N/A	N/A	N/A

Table 8-10 Summary of Dust Impact Risk used to Define Site-Specific Mitigation

There is also the potential for traffic emissions to impact air quality in the short-term over the construction phase. Particularly due to the increase in HGVs accessing the site. The construction stage traffic provided has been reviewed and a detailed air quality assessment has been scoped out as none of the road links impacted by the proposed development satisfy the UK HA LA 105 assessment criteria in Section 8.1.3.1. It can therefore be determined that the construction stage traffic will have a neutral, imperceptible, localised and short-term impact on air quality due to the minor increase in site related traffic as a result of the proposed development.

8.4.1.2 Climate

There is the potential for a number of greenhouse gas emissions to atmosphere during the construction of the development. Construction vehicles, generators etc., will give rise to CO_2 and N_2O emissions. The Institute of Air Quality Management document *Guidance on the Assessment of Dust from Demolition and Construction* (IAQM, 2014) states that site traffic and plant is unlikely to make a significant impact on emissions. Therefore, the impact on climate is assessed to be neutral, localised, imperceptible and short term.

8.4.1.3 Human Health

Dust emissions from construction activities have the potential to impact human health through PM_{10} and $PM_{2.5}$ emissions. The overall sensitivity of the area to human health impacts from dust emissions is considered low as per Section 8.2.4. It has been established that there is a low risk of human health impacts from construction dust emissions. Therefore, in the absence of mitigation human health impacts are considered short-term, localised, negative and imperceptible.

8.4.2 Operational Phase

8.4.2.1 Air Quality

The impact of the proposed development has been assessed by modelling emissions from the traffic generated as a result of the development. The impact of NO_2 emissions for the opening and design years was predicted at the nearest sensitive receptors to the development. This assessment allows the significance of the development, with respect to both relative and absolute impacts, to be determined.

Transport Infrastructure Ireland's document '*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes'* (2011) detail a methodology for determining air quality impact significance criteria for road schemes and this can be applied to any development that causes a change in traffic. The degree of impact is determined based on both the absolute and relative impact of the proposed development. Results are compared against the 'Do-Nothing' scenario, which assumes that the proposed development is not in place in future years, in order to determine the degree of impact. Impacts were assessed at 4 no. worst-case sensitive receptors (R1 to R4) within 200m of the road links impacted by the proposed development (see Table 8-3 and Figure 8.1). These three residential properties and a school are a representative sample of sensitive receptors on the impacted roads.

The results of the assessment of the impact of the proposed development on NO_2 in the opening year 2027 are shown in Table 8-12 and for design year 2042 are shown in Table 8-13. The annual average concentration is in compliance with the limit value at all worst-case receptors in 2027 and 2042. Concentrations of NO_2 are at most 39% of the annual limit value in 2027 and 2042. There are some increases in traffic levels between the opening and design years, therefore any reduction in concentrations is due to reduced background concentrations. In addition, the hourly limit value for NO_2 is 200 $\mu g/m^3$ and is expressed as a 99.8th percentile (i.e. it must not be exceeded more than 18 times per year). The maximum 1-hour NO_2 concentration is not predicted to be exceeded in any modelled year (Table 8-14).

The impact of the proposed development on annual mean NO_2 concentrations can be assessed relative to "Do Nothing (DN)" levels. Relative to baseline levels, there are predicted to be some small increases in NO_2 concentrations at the worst-case receptors assessed. Concentrations will increase by at most 1% of the annual NO_2 limit value at receptor R1 in 2027. Changes in concentrations are similarly low for the Design Year 2042, concentrations at receptor R2 will increase by 0.8%. Using the assessment criteria outlined in Appendix 8.2 the impact of the proposed development in terms of NO_2 is considered negligible. Therefore, the overall impact of NO_2 concentrations as a result of the proposed development is long-term, negative and imperceptible.

Concentrations of PM_{10} were modelled for the baseline year of 2020. The modelling showed that concentrations were in compliance with the annual limit value of 40 µg/m^3 at all receptors assessed, therefore, further modelling for the opening and design years was not required. Concentrations increases due to modelled traffic reached at most 0.13 µg/m^3. When a background concentration of 17 µg/m^3 is included the overall impact is 44% of the annual limit value at the worst case receptor.

The impact of the proposed development on ambient air quality in the operational stage is considered long-term, localised, negative and imperceptible.

Receptor	**Impact Opening Year 2027**				
	DN	**DS**	**DS - DN**	**Magnitude**	**Description**
1	14.1	14.5	0.41	Small	Negligible
2	15.5	15.6	0.11	Imperceptible	Negligible
3	15.0	15.0	0.02	Imperceptible	Negligible
4	15.4	15.6	0.15	Imperceptible	Negligible

Table 8-12 Predicted Annual Mean NO_2 Concentrations – Opening Year 2027 (µg/m^3).

Receptor	**Impact Design Year 2042**				
	DN	**DS**	**DS - DN**	**Magnitude**	**Description**
1	13.9	14.3	0.3	Imperceptible	Negligible
2	15.4	15.4	0.0	Imperceptible	Negligible
3	14.9	14.9	0.0	Imperceptible	Negligible
4	15.4	15.5	0.1	Imperceptible	Negligible

Table 8-13 Predicted Annual Mean NO_2 Concentrations – Design Year 2042 (µg/m^3).

Receptor	Opening Year 2027		Design Year 2042	
	DN	DS	DN	DS
R1	49.3	50.7	48.8	49.9
R2	54.1	54.5	53.9	54.1
R3	52.5	52.6	52.0	52.1
R4	54.0	54.5	53.9	54.1

Table 8-14 Predicted 99.8th percentile of Daily Maximum 1-hour NO_2 Concentrations (µg/m^3).

8.4.2.2 Human Health

Traffic related air emissions have the potential to impact human health if they do not comply with the ambient Air Quality Standards detailed in Table 8-1. There are no exceedances of these limit values predicted. Therefore, in the absence of mitigation human health impacts are considered long-term, localised, negative and imperceptible.

8.4.2.3 Air Quality Impact on Designated Sites

The impact of NO_X (i.e. NO and NO_2) emissions resulting from the traffic associated with the proposed SHD at the Inner Shannon Estuary pNHA (Site Code 000435) was assessed. The N69 is the closest road to the pNHA, it is not impacted by an increase of more than 5% change in AADT. However, the R510 has an impact of up to 5.9% AADT and is within 200m of the pNHA. When modelling the impact on the pNHA, the contribution of both the R510 and N69 are included. Ambient NO_X concentrations were predicted for the assessment years of 2027 and 2042 along a transect of up to 200m, starting from 2 m which is the distance from the closest road (N69) to the designated areas boundaries and are given in Table 8-16 for 2027 and Table 8-17 for 2042 for the pNHA. The road contribution to dry deposition along the transect is also given and was calculated using the methodology of TII (2011).

The predicted annual average NO_X levels in the Inner Shannon Estuary pNHA are above the limit value of 30 µg/m^3 for the "*Do Nothing*" and the "*Do Something*" (i.e. the proposed development) scenarios, with NO_X concentrations reaching 130% of the limit value in the DN and DS, including background levels.

The impact of the proposed development can be assessed relative to "*Do Nothing*" levels, the impact of the proposed SHD leads to an increase in NO_X concentrations of at most 0.1 µg/m^3 within the pNHA. Appendix 9 of the TII guidelines (2011) states that where the scheme or development is expected to cause an increase of more than 2 µg/m^3 and the predicted concentrations (including background) are close to, or exceed the standard, then the sensitivity of the habitat to NO_X should be assessed by the project ecologist. Concentrations within the pNHA are not predicted to increase by 2 µg/m^3 or more, as such it was not necessary for the sensitivity of the habitat to NO_X to be assessed by an ecologist as there is no potential for significant impacts to ecology from NO_X emissions.

The contribution to the NO_2 dry deposition rate along the 200m transect within the pNHA is also detailed in Table 8-16 for 2027 and Table 8-17 for 2042. The maximum increase in the NO_2 dry deposition rate is 0.005 Kg(N)/ha/yr. This is well below the critical load for inland and surface water habitats of 5 - 10Kg(N)/ha/yr (TII, 2011).

It can be determined that the impact from air quality on the designated sites is negative, long-term and imperceptible.

Distance to Road	**NO_X Concentration (µg/m^3)**			**NO_2 Dry Deposition Rate Imp**
(m)	**Do Nothing**	**Do Something**	**Change in Concentration**	**(Kg N ha^{-1} yr^{-1})**
2	36.75	36.85	0.10	0.0050
12	33.59	33.67	0.08	0.0040
22	29.46	29.52	0.06	0.0040
32	26.46	26.51	0.05	0.0030
42	24.24	24.28	0.04	0.0020
52	22.53	22.56	0.03	0.0020
62	21.21	21.23	0.02	0.0010
72	20.16	20.18	0.02	0.0000
82	19.34	19.35	0.01	0.0010
92	18.69	18.70	0.01	0.0000
102	18.19	18.20	0.01	0.0000
112	17.80	17.81	0.01	0.0010
122	17.52	17.53	0.01	0.0010
132	17.28	17.28	0.01	0.0010
142	17.09	17.10	0.01	0.0000
152	16.96	16.97	0.00	0.0000
162	16.88	16.88	0.00	0.0000

172	16.81	16.81	0.00	0.0000
182	16.69	16.69	0.00	0.0000
192	16.58	16.57	0.00	0.0000

Table 8-16 Predicted Air Quality Impact on Designated Sites 2027

Distance to Road	NO_X Concentration (µg/m^3)			NO_2 Dry Deposition Rate Imp
(m)	Do Nothing	Do Something	Change in Concentration	(Kg N ha^{-1} yr^{-1})
2	38.91	38.93	0.02	0.000
12	35.41	35.43	0.02	0.001
22	30.85	30.86	0.01	0.001
32	27.54	27.55	0.01	0.001
42	25.08	25.08	0.01	0.000
52	23.19	23.20	0.01	0.000
62	21.72	21.73	0.00	0.000
72	20.57	20.57	0.00	0.001
82	19.66	19.66	0.00	0.000
92	18.94	18.94	0.00	0.001
102	18.38	18.39	0.00	0.000
112	17.96	17.97	0.00	0.000
122	17.65	17.65	0.00	0.001
132	17.38	17.38	0.00	0.000
142	17.18	17.18	0.00	0.000
152	17.04	17.04	0.00	0.000
162	16.94	16.94	0.00	0.000
172	16.86	16.86	0.00	0.000
182	16.73	16.73	0.00	0.000
192	16.60	16.60	0.00	0.000

Table 8-17 Predicted Air Quality Impact on Designated Sites 2042

8.4.3 Climate

The proposed development will not increase traffic by more than 10% AADT on any road links, therefore, the scoping criteria set out in Section 8.1.3.2 are not met and a detailed climate assessment is not required as there is no potential for significant impacts to climate as a result of traffic emissions. The impact to climate from traffic emissions associated with the proposed development are long-term, neutral and imperceptible.

Climate change has the potential to alter weather patterns and increase the frequency of rainfall in future years. A Flood Risk Assessment (FRA) has been conducted by JBA Consulting as part of the Application Documents. This assessment concluded that the sources of flooding the site has been shown to reside within Flood Zone A (defended - tidal) and Flood Zone B (fluvial/tidal).

The FRA notes that the effects of climate change will result in increased sea level and subsequently increased flood levels. Climate change could increase the flooding depth around the site as well as the frequency of the defences being overtopped, making them more vulnerable to breach. By designing to accommodate the breach scenario, there is additional protection against climate change.

The FRA also confirmed that the site finished floor levels take into account climate change, as have the attenuation systems. Attenuation systems have been initially sized with a 10% increase in rainfall depths as per Greater Dublin Strategic Drainage Strategy (GDSDS) climate change requirements. In addition, full simulation of the network and attenuation systems has been carried out with a 20% increase for the 100-year 6-hour storm event, which is in accordance with the climate change requirements of the Southern Environs Local Area Plan 2021-2027 Strategic Flood Risk Assessment.

8.4.4 Cumulative

Should the construction phase of the proposed development coincide with the construction of any other permitted developments within 350m of the site then there is the potential for cumulative dust impacts to the nearby sensitive receptors according to the IAQM guidance (IAQM, 2014).

However appropriate dust mitigation measures, as outlined in Appendix 8.3, will be applied throughout the construction phase of the proposed development which will avoid significant cumulative impacts on air quality from coinciding construction phases. With appropriate mitigation measures in place, the predicted cumulative impacts on air quality associated with the construction phase of the proposed development are deemed short-term and not significant.

Cumulative impacts have been incorporated into the traffic data supplied for the operational stage air and climate modelling assessments where such information was available. The results of the modelling assessment (Section 8.4.2) show that there is a long-term, negative and imperceptible impact to air quality during the operational stage and a long-term, neutral and imperceptible impact to climate during the operational stage.

8.4.5 Worst-case Scenario

In terms of construction phase impacts, worst-case assumptions regarding volumes of excavation materials and number of vehicle movements have been used in order to determine the highest level of mitigation required in relation to potential dust impacts (see Section 8.4.1.1).

Worst-case traffic data was used in the assessment of construction and operational phase impacts. In addition, conservative background concentrations were used in order to ensure a robust assessment. Thus, the predicted results of the construction and operational stage assessment are worst-case, and the significance of effects is most likely overestimated.

There are no likely risks of major accidents and disasters in relation to air quality associated with the proposed development due to the nature and scale of the development.

8.5 Mitigation Measures and Monitoring

8.5.1 Incorporated Design Mitigation

The proposed development has been designed so as to reduce the impact on climate as much as possible during operation. The Building Lifecycle Report prepared as part of the proposed project and submitted under separate cover with this planning application details a number of design measures that have been considered in order to reduce the impact on climate wherever possible. Such measures include:

- The development will be in compliance with the requirements of the Near Zero Energy Building (NZEB) Standards;
- A renewable energy rating (RER) of 20% will be achieved to comply with Part L (2019) of the NZEB regulations;
- Minimising heat loss where possible;
- Provision of electric car charging points;
- Exhaust air heat pumps;
- Photovoltaic (PV) systems; and
- Design of glazing to maximise solar heat gain.

These measures will aid in reducing the impact to climate during the operational phase of the proposed development in line with the goals of the Limerick City and County Council - Climate Change Adaptation Strategy 2019-2024.

In addition, adequate attenuation and drainage have been incorporated into the design of the development to avoid potential flooding impacts as a result of increased rainfall events in future years. This includes for drainage system and attenuation storage design allow for a climate related increase in rainfall intensities.

8.5.2 Construction Phase Mitigation

8.5.2.1 Air Quality

The pro-active control of fugitive dust will ensure the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released. A dust management plan will be implemented onsite. The main contractor will be responsible for the coordination and ongoing monitoring of the dust management plan. The key aspects of controlling dust are listed below. Full details of the dust management plan can be found in Appendix 8.3. These measures will be incorporated into the overall Construction Environmental Management Plan (CEMP) for the site.

In summary the measures which will be implemented will include:

- Drop heights from conveyors, loading shovels, hoppers and other loading equipment will be minimised, if necessary fine water sprays will be employed.
- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads will be restricted to essential site traffic.
- Any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.
- When conditions are such that there is a risk of trackout of dust (i.e. very dry or muddy), vehicles exiting the site shall make use of a wheel wash facility prior to entering onto public roads.
- Vehicles using site roads will have their speed restricted through speed limit implementation, and this speed restriction will be enforced rigidly. On any site roads, this will be 20 kmph.
- Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary.
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.
- During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust and other dust generating activities will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

8.5.2.2 Climate

Impacts to climate during the construction stage are predicted to be imperceptible however, good practice measures can be incorporated to ensure potential impacts are lessened. These include:

- Prevention of on-site or delivery vehicles from leaving engines idling, even over short periods.

- Ensure all plant and machinery are well maintained and inspected regularly.
- Minimising waste of materials due to poor timing or over ordering on site will aid to minimise the embodied carbon footprint of the site.

8.5.3 Operational Phase Mitigation

The impact of the proposed development on air quality and climate is predicted to be imperceptible with respect to the operational phase in the long term. Therefore, no additional site specific mitigation measures are required beyond the site specific incorporated design mitigation as described in Section 8.5.1.

8.5.4 Monitoring

Monitoring of construction dust deposition at locations along the site boundary close to the nearby sensitive receptors during the construction phase of the proposed development is recommended to ensure mitigation measures are working satisfactorily. This can be carried out using the Bergerhoff method in accordance with the requirements of the German Standard VDI 2119. The Bergerhoff Gauge consists of a collecting vessel and a stand with a protecting gauge. The collecting vessel is secured to the stand with the opening of the collecting vessel located approximately 2m above ground level. The TA Luft limit value is 350 mg/(m^2*day) during the monitoring period between 28 - 32 days.

There is no monitoring recommended for the operational phase of the development as impacts to air quality and climate are predicted to be imperceptible.

8.6 Residual Impact Assessment

8.6.1 Construction Phase

With the implementation of the dust mitigation measures, associated with a high risk of dust impacts, outlined in Section 8.5.2 and Appendix 8.3 dust impacts from construction will be localised, imperceptible, negative and short-term but will not pose a nuisance at nearby receptors.

Best practice mitigation measures are proposed for the construction phase of the proposed development which will focus on the pro-active control of dust and other air pollutants to minimise generation of emissions at source. The mitigation measures that will be put in place during construction of the proposed development will ensure that the impact of the development complies with all EU ambient air quality legislative limit values (see Table 8-1) which are based on the protection of human health. Therefore, the impact of construction of the proposed development is likely to be negative, short-term and imperceptible with respect to human health.

8.6.2 Operational Phase

The proposed development has been designed to reduce the impact on climate where possible. The proposed development will comply with the NZEB standards. Electric vehicle car charging points have been incorporated into the development and increased bicycle parking has been provided to promote a modal shift and thus reduce GHG emissions.

8.6.3 Cumulative

Cumulative construction phase impacts will result from dust emissions impacting people and property within 350m of the proposed development site and neighbouring sites. Impacts are predicted to be negative, short-term and imperceptible at nearby receptors once the dust mitigation measures outlined in Appendix 8.3 are implemented.

According to the IAQM guidance (2014) site traffic, plant and machinery are unlikely to have a significant impact on climate. Therefore, cumulative impacts are not predicted.

Operational phase impacts involve an increase in traffic related pollutants in the local area. The traffic data for the proposed development in conjunction with other nearby permitted and proposed developments was found to have an imperceptible, negative and long-term impact on local air quality and climate.

8.7 Interactions

Air quality does not have a significant number of interactions with other topics. The most significant interactions are between population and human health and air quality. An adverse impact due to air quality in either the construction or operational phase has the potential to cause health and dust nuisance issues. The mitigation measures that will be put in place at the proposed development will ensure that the impact of the proposed development complies with all ambient air quality legislative limits and therefore the predicted impact is short term and imperceptible with respect to population and human health in the construction phase and long term and imperceptible with respect to the operational phase.

Interactions between air quality and traffic can be significant. With increased traffic movements and reduced engine efficiency, i.e. due to congestion, the emissions of vehicles increase. The impacts of the proposed development on air quality are assessed by reviewing the change in annual average daily traffic on roads close to the site. In this assessment, the impact of the interactions between traffic and air quality are considered to be imperceptible due to the low level changes in traffic associated with the proposed development.

The construction and operation of the proposed development will lead to emissions to atmosphere which have the potential to impact on sensitive flora, fauna and water. However, the effect of these emissions is predicted not to be significant for both the construction and operational phase. Construction phase mitigation measures will minimise dust emissions which have the potential to impact on flora, fauna and water. In the operational phase, impacts meet the criteria set down for ecological sensitive site as discussed in Section 8.4.2.3. Traffic related NOx emissions associated with the proposed development were modelled as part of the assessment and it can be concluded that the impact to ecology will be imperceptible. Therefore the interactions between air quality and flora, fauna and water are neutral for both the construction and operational phase.

With the appropriate mitigation measures to prevent fugitive dust emissions (see Section 8.5.2 and Appendix 8.3), it is predicted that there will be no significant interactions between air quality and land and soils. No other significant interactions with air quality have been identified.

8.8 Difficulties Encountered

There were no difficulties encountered when completing this assessment.

8.9 Consultation

Having regard to the nature of the proposed development together with the available guidelines for completing air quality and climate assessments, sufficient information existed to scope the content of this chapter and consultation was not deemed necessary.

8.10 References and Sources

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Institute of Air Quality Management (IAQM) (2016) Guidance on the Assessment of Dust from Demolition and Construction Version 1.1

Limerick City and County Council' (2021) Climate Change Adaptation Strategy 2019-2024

Met Éireann (2022) Met Eireann website: https://www.met.ie/

The Scottish Office (1996) Planning Advice Note PAN50 Annex B: Controlling The Environmental Effects Of Surface Mineral Workings Annex B: The Control of Dust at Surface Mineral Workings

Transport Infrastructure Ireland (2011) Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes

UK Highways Agency (2007) Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 - HA207/07 (Document & Calculation Spreadsheet)

UK Highways Agency (2019a) UK Design Manual for Roads and Bridges (DMRB), Volume 11, Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1 LA 105 Air quality

UK Highways Agency (2019b) UK Design Manual for Roads and Bridges (DMRB) Volume 11

Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 14 LA 114 Climate

UK Office of Deputy Prime Minister (2002) Controlling the Environmental Effects of Recycled and Secondary Aggregates Production Good Practice Guidance

USEPA (1997) Fugitive Dust Technical Information Document for the Best Available Control Measures

World Health Organisation (2006) Air Quality Guidelines - Global Update 2005 (and previous Air Quality Guideline Reports 1999 & 2000)

APPENDIX 8.1 Ambient Air Quality Standards

National standards for ambient air pollutants in Ireland have generally ensued from Council Directives enacted in the EU (& previously the EC & EEC) (see Table 12-1). The initial interest in ambient air pollution legislation in the EU dates from the early 1980s and was in response to the most serious pollutant problems at that time which was the issue of acid rain. As a result of this sulphur dioxide, and later nitrogen dioxide, were both the focus of EU legislation. Linked to the acid rain problem was urban smog associated with fuel burning for space heating purposes. Also apparent at this time were the problems caused by leaded petrol and EU legislation was introduced to deal with this problem in the early 1980s.

In recent years the EU has focused on defining a basis strategy across the EU in relation to ambient air quality. In 1996, a Framework Directive, Council Directive 96/62/EC, on ambient air quality assessment and management was enacted. The aims of the Directive are fourfold. Firstly, the Directive's aim is to establish objectives for ambient air quality designed to avoid harmful effects to health. Secondly, the Directive aims to assess ambient air quality on the basis of common methods and criteria throughout the EU. Additionally, it is aimed to make information on air quality available to the public via alert thresholds and fourthly, it aims to maintain air quality where it is good and improve it in other cases.

As part of these measures to improve air quality, the European Commission has adopted proposals for daughter legislation under Directive 96/62/EC. The first of these directives to be enacted, Council Directive 1999/30/EC, has been passed into Irish Law as S.I. No 271 of 2002 (Air Quality Standards Regulations 2002), and has set limit values which came into operation on 17th June 2002. Council Directive 1999/30/EC, as relating to limit values for sulphur dioxide, nitrogen dioxide, lead and particulate matter, is detailed in Table 13.1. The Air Quality Standards Regulations 2002 detail margins of tolerance, which are trigger levels for certain types of action in the period leading to the attainment date. The margin of tolerance varies from 60% for lead, to 30% for 24-hour limit value for PM_{10}, 40% for the hourly and annual limit value for NO_2 and 26% for hourly SO_2 limit values. The margin of tolerance commenced from June 2002, and started to reduce from 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by the attainment date. A second daughter directive, EU Council Directive 2000/69/EC, has published limit values for both carbon monoxide and benzene in ambient air. This has also been passed into Irish Law under the Air Quality Standards Regulations 2002.

The most recent EU Council Directive on ambient air quality was published on the 11/06/08 which has been transposed into Irish Law as S.I. 180 of 2011. Council Directive 2008/50/EC combines the previous Air Quality Framework Directive and its subsequent daughter directives. Provisions were also made for the inclusion of new ambient limit values relating to $PM_{2.5}$. The margins of tolerance specific to each pollutant were also slightly adjusted from previous directives. In regards to existing ambient air quality standards, it is not proposed to modify the standards but to strengthen existing provisions to ensure that non-compliances are removed. In addition, new ambient standards for $PM_{2.5}$ are included in Directive 2008/50/EC. The approach for $PM_{2.5}$ was to establish a target value of 25 µg/m^3, as an annual average (to be attained everywhere by 2010) and a limit value of 25 µg/m^3, as an annual average (to be attained everywhere by 2015), coupled with a target to reduce human exposure generally to $PM_{2.5}$ between 2010 and 2020. This exposure reduction target will range from 0% (for $PM_{2.5}$ concentrations of less than 8.5 µg/m^3 to 20% of the average exposure indicator (AEI) for concentrations of between 18 - 22 µg/m^3). Where the AEI is currently greater than 22 µg/m^3 all appropriate measures should be employed to reduce this level to 18 µg/m^3 by 2020. The AEI is based on measurements taken in urban background locations averaged over a three year period from 2008 - 2010 and again from 2018-2020. Additionally, an exposure concentration obligation of 20 µg/m^3 was set to be complied with by 2015 again based on the AEI.

Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions. The Alert Threshold is defined in Council Directive 96/62/EC as “a level beyond which there is a risk to human health from brief exposure and at which immediate steps shall be taken as laid down in Directive 96/62/EC”. These steps include undertaking to ensure that the necessary steps are taken to inform the public (e.g. by means of radio, television and the press).

The Margin of Tolerance is defined in Council Directive 96/62/EC as a concentration which is higher than the limit value when legislation comes into force. It decreases to meet the limit value by the attainment date. The Upper Assessment Threshold is defined in Council Directive 96/62/EC as a concentration above which high quality measurement is mandatory. Data from measurement may be supplemented by information from other sources, including air quality modelling.

An annual average limit for both NO_X (NO and NO_2) is applicable for the protection of vegetation in highly rural areas away from major sources of NO_X such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex VI of EU Directive 1999/30/EC identifies that monitoring to demonstrate compliance with the NO_X limit for the protection of vegetation should be carried out distances greater than:

5 km from the nearest motorway or dual carriageway
5 km from the nearest major industrial installation
20 km from a major urban conurbation

As a guideline, a monitoring station should be indicative of approximately 1000 km^2 of surrounding area.

Under the terms of EU Framework Directive on Ambient Air Quality (96/62/EC), geographical areas within member states have been classified in terms of zones. The zones have been defined in order to meet the criteria for air quality monitoring, assessment and management as described in the Framework Directive and Daughter Directives. Zone A is defined as Dublin and its environs, Zone B is defined as Cork City, Zone C is defined as 23 urban areas with a population greater than 15,000 and Zone D is defined as the remainder of the country. The Zones were defined based on among other things, population and existing ambient air quality.

EU Council Directive 96/62/EC on ambient air quality and assessment has been adopted into Irish Legislation (S.I. No. 33 of 1999). The act has designated the Environmental Protection Agency (EPA) as the competent authority responsible for the implementation of the Directive and for assessing ambient air quality in the State. Other commonly referenced ambient air quality standards include the World Health Organisation. The WHO guidelines differ from air quality standards in that they are primarily set to protect public health from the effects of air pollution. Air quality standards, however, are air quality guidelines recommended by governments, for which additional factors, such as socio-economic factors, may be considered.

APPENDIX 8.2 Transport Infrastructure Ireland Significance Criteria

Magnitude of Change	**Annual Mean NO_2 / PM_{10}**	**No. days with PM_{10} concentration > 50 µg/m^3**	**Annual Mean $PM_{2.5}$**
Large	Increase / decrease ≥4 µg/m^3	Increase / decrease >4 days	Increase / decrease ≥2.5 µg/m^3
Medium	Increase / decrease 2 - <4 µg/m^3	Increase / decrease 3 or 4 days	Increase / decrease 1.25 - <2.5 µg/m^3
Small	Increase / decrease 0.4 - <2 µg/m^3	Increase / decrease 1 or 2 days	Increase / decrease 0.25 - <1.25 µg/m^3
Imperceptible	Increase / decrease <0.4 µg/m^3	Increase / decrease <1 day	Increase / decrease <0.25 µg/m^3

Table A12.2.1 Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Absolute Concentration in Relation to Objective/Limit Value	**Change in Concentration** Note 1		
	Small	**Medium**	**Large**
Increase with Scheme			
Above Objective/Limit Value With Scheme (≥40 µg/m^3 of NO_2 or PM_{10}) (≥25 µg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (36 - <40 µg/m^3 of NO_2 or PM_{10}) (22.5 - <25 µg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (30 - <36 µg/m^3 of NO_2 or PM_{10}) (18.75 - <22.5 µg/m^3 of $PM_{2.5}$)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<30 µg/m^3 of NO_2 or PM_{10}) (<18.75 µg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [Note 1]		
	Small	**Medium**	**Large**
Above Objective/Limit Value With Scheme (≥40 μg/m^3 of NO_2 or PM_{10}) (≥25 μg/m^3 of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value With Scheme (36 - <40 μg/m^3 of NO_2 or PM_{10}) (22.5 - <25 μg/m^3 of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value With Scheme (30 - <36 μg/m^3 of NO_2 or PM_{10}) (18.75 - <22.5 μg/m^3 of $PM_{2.5}$)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value With Scheme (<30 μg/m^3 of NO_2 or PM_{10}) (<18.75 μg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Beneficial

[Note 1] Well Below Standard = <75% of limit value.

Table A12.2.2 Air Quality Impact Significance Criteria For Annual Mean Nitrogen Dioxide and PM_{10} and $PM_{2.5}$ Concentrations at a Receptor

APPENDIX 8.3 Dust Management Plan

The objective of dust control at the site is to ensure that no significant nuisance occurs at nearby sensitive receptors. In order to develop a workable and transparent dust control strategy, the following management plan has been formulated by drawing on best practice guidance from Ireland, the UK (IAQM (2014), The Scottish Office (1996), UK Office of Deputy Prime Minister (2002) and BRE (2003)) and the USA (USEPA (1997)).

Site Management

The aim is to ensure good site management by avoiding dust becoming airborne at source. This will be done through good design and effective control strategies.

At the construction planning stage, the siting of activities and storage piles will take note of the location of sensitive receptors and prevailing wind directions in order to minimise the potential for significant dust nuisance (see Figure 13.1 for the windrose for Casement Aerodrome). As the prevailing wind is predominantly westerly to south-westerly, locating construction compounds and storage piles downwind (to the east) of sensitive receptors will minimise the potential for dust nuisance to occur at sensitive receptors.

Good site management will include the ability to respond to adverse weather conditions by either restricting operations on-site or quickly implementing effective control measures before the potential for nuisance occurs. When rainfall is greater than 0.2mm/day, dust generation is generally suppressed (UK Office of Deputy Prime Minister (2002), BRE (2003)). The potential for significant dust generation is also reliant on threshold wind speeds of greater than 10 m/s (19.4 knots) (at 7m above ground) to release loose material from storage piles and other exposed materials (USEPA, 1986). Particular care should be taken during periods of high winds (gales) as these are periods where the potential for significant dust emissions are highest. The prevailing meteorological conditions in the vicinity of the site are favourable in general for the suppression of dust for a significant period of the year. Nevertheless, there will be infrequent periods were care will be needed to ensure that dust nuisance does not occur. The following measures shall be taken in order to avoid dust nuisance occurring under unfavourable meteorological conditions:

The Principal Contractor or equivalent must monitor the contractors’ performance to ensure that the proposed mitigation measures are implemented and that dust impacts and nuisance are minimised;

During working hours, dust control methods will be monitored as appropriate, depending on the prevailing meteorological conditions;
The name and contact details of a person to contact regarding air quality and dust issues shall be displayed on the site boundary, this notice board should also include head/regional office contact details;
It is recommended that community engagement be undertaken before works commence on site explaining the nature and duration of the works to local residents and businesses;
A complaints register will be kept on site detailing all telephone calls and letters of complaint received in connection with dust nuisance or air quality concerns, together with details of any remedial actions carried out;
It is the responsibility of the contractor at all times to demonstrate full compliance with the dust control conditions herein;
At all times, the procedures put in place will be strictly monitored and assessed.

The dust minimisation measures shall be reviewed at regular intervals during the works to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures. In the event of dust nuisance occurring outside the site boundary, site activities will be reviewed and satisfactory procedures implemented to rectify the problem. Specific dust control measures to be employed are described below.

Demolition

Prior to demolition blocks should be soft striped inside buildings (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
During the demolition process, water suppression should be used, preferably with a hand-held spray.
Only the use of cutting, grinding or sawing equipment fitted or used in conjunction with a suitable dust suppression technique such as water sprays/local extraction should be used.
Drop heights from conveyors, loading shovels, hoppers and other loading equipment should be minimised, if necessary fine water sprays should be employed.

Site Roads / Haulage Routes

Movement of construction trucks along site roads (particularly unpaved roads) can be a significant source of fugitive dust if control measures are not in place. The most effective means of suppressing dust emissions from unpaved roads is to apply speed restrictions. Studies show that these measures can have a control efficiency ranging from 25 to 80% (UK Office of Deputy Prime Minister, 2002).

A speed restriction of 20 km/hr will be applied as an effective control measure for dust for on-site vehicles using unpaved site roads;
Access gates to the site shall be located at least 10m from sensitive receptors where possible;
Bowsers or suitable watering equipment will be available during periods of dry weather throughout the construction period. Research has found that watering can reduce dust emissions by 50% (USEPA, 1997). Watering shall be conducted during sustained dry periods to ensure that unpaved areas are kept moist. The required application frequency will vary according to soil type, weather conditions and vehicular use;
Any hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only.

Land Clearing / Earth Moving

Land clearing / earth-moving works during periods of high winds and dry weather conditions can be a significant source of dust.

During dry and windy periods, and when there is a likelihood of dust nuisance, watering shall be conducted to ensure moisture content of materials being moved is high enough to increase the stability of the soil and thus suppress dust;
During periods of very high winds (gales), activities likely to generate significant dust emissions should be postponed until the gale has subsided.

Storage Piles

The location and moisture content of storage piles are important factors which determine their potential for dust emissions.

Overburden material will be protected from exposure to wind by storing the material in sheltered regions of the site. Where possible storage piles should be located downwind of sensitive receptors;
Regular watering will take place to ensure the moisture content is high enough to increase the stability of the soil and thus suppress dust. The regular watering of stockpiles has been found to have an 80% control efficiency (UK Office of Deputy Prime Minister, 2002);
Where feasible, hoarding will be erected around site boundaries to reduce visual impact. This will also have an added benefit of preventing larger particles from impacting on nearby sensitive receptors.

Site Traffic on Public Roads

Spillage and blow-off of debris, aggregates and fine material onto public roads should be reduced to a minimum by employing the following measures:
Vehicles delivering or collecting material with potential for dust emissions shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust;
At the main site traffic exits, a wheel wash facility shall be installed if feasible. All trucks leaving the site must pass through the wheel wash. In addition, public roads outside the site shall be regularly inspected for cleanliness, as a minimum on a daily basis, and cleaned as necessary.

Summary of Dust Mitigation Measures

The pro-active control of fugitive dust will ensure that the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released, will contribute towards the satisfactory performance of the contractor. The key features with respect to control of dust will be:

The specification of a site policy on dust and the identification of the site management responsibilities for dust issues;
The development of a documented system for managing site practices with regard to dust control;
The development of a means by which the performance of the dust minimisation plan can be regularly monitored and assessed; and
The specification of effective measures to deal with any complaints received.

9.0 NOISE AND VIBRATION

9.1 Introduction

This document prepared by AWN Consulting Ltd. (AWN) to assess the potential noise and vibration impacts of the proposed development in the context of current relevant standards and guidance.

This assessment has been prepared by Mike Simms BE MEngSc MIOA MIET, Senior Acoustic Consultant at AWN, who has worked in the field of acoustics for 20 years. He has extensive experience in all aspects of environmental surveying, noise modelling and impact assessment for various sectors including, energy, industrial, commercial and residential.

This report includes a description of the receiving ambient noise climate in the vicinity of the subject site and an assessment of the potential noise and vibration impact associated with the proposed development, during both the short-term construction phase and the permanent operational phase, on its surrounding environment. The assessment of direct, indirect and cumulative noise and vibration impacts on the surrounding environment have been considered as part of the assessment.

Mitigation measures are included, where relevant, to ensure the proposed development is constructed and operated in an environmentally sustainable manner in order to ensure minimal impact on the receiving environment.

9.2 Assessment Methodology

The assessment of impacts has been undertaken with reference to the most appropriate guidance documents relating to environmental noise and vibration which are set out within the relevant sections of this report. In addition to specific guidance documents for the assessment of noise and vibration impacts which are discussed further in the relevant sections, the following guidelines were considered and consulted for the purposes of this report:

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

The study has been undertaken using the following methodology:

- An environmental noise survey has been undertaken in the vicinity of the subject site in order to characterise the existing baseline noise environment;
- A review of the most applicable standards and guidelines has been conducted in order to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed development;
- Predictive calculations have been performed during the construction phase of the project at the nearest sensitive locations to the development site;
- Predictive calculations have been performed to assess the potential impacts associated with the operational of the development at the most sensitive locations surrounding the development site; and
- A schedule of mitigation measures has been proposed to reduce, where necessary, the identified potential outward impacts relating to noise and vibration from the proposed development.

9.2.1 Construction Phase Criteria

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local Authorities typically control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*.

The approach adopted here calls for the designation of an NSL into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. A threshold noise value is applied to each category. Exceedances (construction noise only) of the threshold value, at the facade of a sensitive receptor during construction, indicates a potential significant noise impact associated with the construction activities. The threshold values recommended by BS5228-1 are set out in Table 9.1.

Assessment category and threshold value period (L_{Aeq})	**Threshold value, in decibels (dB)**		
	Category A Note A	**Category B** Note B	**Category C** Note C
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends Note D	55	60	65

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A Note A	Category B Note B	Category C Note C
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

Table 9.1 Example Threshold of Significant Effect at Dwellings

Note A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

Note B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.

Note C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.

Note D) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

It should be noted that this assessment method is only valid for residential properties.

For the appropriate period (e.g. daytime) the ambient noise level is determined and rounded to the nearest 5 dB. Based on review of existing noise levels obtained from the noise survey, relevant BS5228-1 threshold values at the various assessment locations are presented in Table 9.2.

Period	Construction Noise Threshold Value $L_{Aeq,1hr}$ (dB)	Baseline Noise Category
Daytime (07:00 – 19:00) and Saturdays(07:00 – 13:00)	65	A
Evening(19:00 to 23:00hrs)	55	A
Night time (23:00 to 07:00hrs)	45	A

Table 9.2 Rounded Baseline Noise Levels and Associated Categories

See Section 9.5.1.1 for the assessment in relation to this development. If the construction noise level exceeds the appropriate category value, then a potential significant effect is deemed to occur.

Guidance on the degree of significance is presented the UK document *Design Manual for Roads and Bridges (2020) LA 111 Sustainability & Environmental Appraisal. Noise and Vibration Rev 2*. The approach is as follows:

- to determine the threshold value for construction noise according to the method from BS5228 described above and

- to compare the predicted construction noise level with the existing noise levels and the threshold value according to the criteria in the table below.

Potentially this procedure is to be followed separately for each noise-sensitive location, however in this instance as the existing noise levels at all survey locations correspond to Category A according to table above, all noise-sensitive locations are considered together.

Similarly, for this proposed development the vast majority of construction works will take place within the 'Daytime' period, i.e. 07:00 – 19:00 on Mondays to Fridays and 07:00 – 13:00 on Saturdays.

The magnitude of the construction noise impact according the DMRB is mapped to the EPA significance terms as detailed in Table 9.3:

Construction Noise Level	Magnitude of Impact (DMRB)	EPA Significance of Effect
Below or equal Baseline Noise Level	Negligible	Not Significant
Above Baseline and below or equal to threshold	Minor	Slight – Moderate
Above threshold and below or equal to threshold + 5dB	Moderate	Moderate – Significant
Above threshold + 5dB	Major	Significant – Very Significant

Table 9.3 Description of Construction Noise Impacts based on DMRB

9.2.1.1 Construction Vibration

Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. In both instances, it is appropriate to consider the magnitude of vibration in terms of Peak Particle Velocity (PPV).

9.2.1.1.1 Building Damage

It is acknowledged that humans are particularly sensitive to vibration stimuli and that any perception of vibration may lead to concern. In the case of road traffic, vibration is perceptible at around 0.5 mm/s and may become disturbing or annoying at higher magnitudes. However, higher levels of vibration are typically tolerated for single events or events of short duration. For example, rock breaking and piling, two of the primary sources of vibration during construction, are typically tolerated at vibration levels up to 12 mm/s and 5 mm/s respectively. This guidance is applicable to the daytime only; it is unreasonable to expect people to be tolerant of such activities during the night.

Guidance relevant to acceptable vibration within buildings is contained in the following documents:

- British Standard BS 7385: 1993: Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration, and;
- British Standard BS 5228-2: 2009+A1:2014: Code of practice for noise and vibration control on construction and open sites – Vibration.

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15 mm/s at low frequencies rising to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings.

BS 5228 recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. Below these values minor damage is unlikely. Where continuous vibration is such as to give rise to dynamic magnification due to resonance, the guide values may need to be reduced by up to 50%. BS 5288-2 also comments that important buildings which are difficult to repair might require special consideration on a case by case basis.

BS 5228-2 recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak particle velocity of 15 mm/s for transient vibration at frequencies below 15 Hz and 20 mm/s at frequencies above than 15 Hz. Below these vibration magnitudes minor damage is unlikely, although where there is existing damage these limits may be reduced by up to 50%. In addition, where continuous vibration is such that resonances are excited within structures the limits discussed above may need to be reduced by 50%.

Suggested levels of allowable vibration (in terms of peak particle velocity) at the closest part of a sensitive property to the source of vibration are summarized in Table 9.4.

Line (see Figure 3)	Type of Building	Peak component particle velocity in frequency range of predominant pulse	
		4Hz to 15Hz	15Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings.	50 mm/s at 4Hz and above	
2	Unreinforced or light framed structures. Residential or light commercial building types.	15 mm/s at 4Hz increasing to 20 mm/s at 15Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Table 9.4 Transient Vibration Guide Values for Cosmetic Building Damage

Note 1 Values referred to are at the base of the building.

Note 2 For Line 2, at frequencies below 4Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.

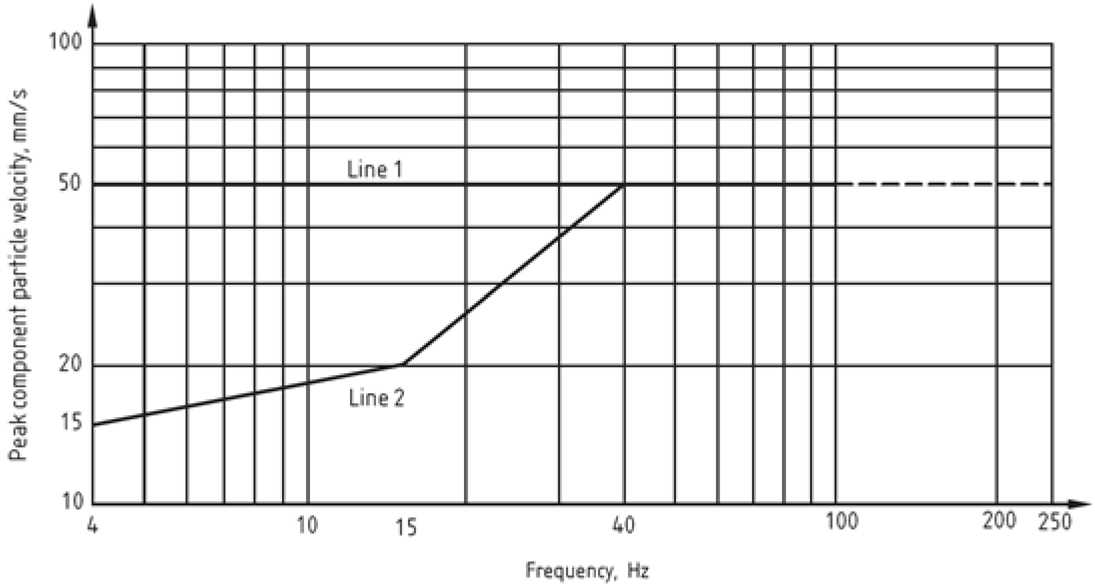

Figure 9.1: Transient Vibration Guide Values for Cosmetic Damage

The guide values contained in Table 9.4 relate to predominantly transient vibration which does not give rise to resonant responses in structures, and to low rise buildings.

9.2.1.1.2 Human Perception

It is acknowledged that humans are particularly sensitive to vibration stimuli and that any perception of vibration may lead to concern. In the case of traffic, vibration is perceptible at around 0.5mm/s and may become disturbing or annoying at higher magnitudes. Higher levels of vibration, however, are typically tolerated for single events or events of short duration. For example, during piling, one of the primary sources of vibration during construction, vibration levels may typically be tolerated at up to

2.5mm/s. This guidance is applicable to the daytime only; it is unreasonable to expect people to be tolerant to such activities during the night-time (or if they are trying to sleep during the daytime).

BS 5228-2 also provides a useful guide relating to the assessment of human response to vibration in terms of the peak particle velocity (PPV). Table 9.5 below summarises the range of vibration values and the associated potential effects on humans.

Vibration Level, PPV	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies. At lower frequencies people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1 mm/s	It is likely that a vibration level of this magnitude in residential environments will cause complaint.
10 mm/s	Vibration is likely to be intolerable for any more than a brief exposure to this level

Table 9.5 Guidance on effects of human response to PPV magnitudes

Expected vibration levels from the construction works will be discussed further in Section 9.5.1.1.

9.2.2 Operational Phase Criteria

9.2.2.1 Building Services Plant Noise

The most appropriate standard used to assess the impact of a new continuous source (i.e. plant items) to a residential environment and that often applied but Dublin City Council is BS 4142 *Methods for rating and assessing industrial and commercial sound* (2014). This standard describes a method for assessing the impact of a specific noise source at a specific location with respect to the increase in "background" noise level that the specific noise source generates. The standard provides the following definitions that are pertinent to this application:

Specific sound level, $L_{Aeq, Tr}$	is equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T. This level has been determined with reference to manufacturers information for specific plant items.
Rating level $L_{Ar,T}$	is the specific noise level plus adjustments for the character features of the sound (if any), and;

Background noise level	is the sound A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T. This level is expressed using the LA90 parameter. These levels were measured as part of the baseline survey.

The assessment procedure in BS4142: 2014 is outlined as follows:

1. determine the specific noise level;
2. determine the rating level as appropriate;
3. determine the background noise level, and;
4. subtract the background noise level from the specific noise level in order to calculate the assessment level.

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific source will have an adverse impact or a significant adverse impact. A difference of +10dB or more is a likely to be an indication of a significant adverse impact. A difference of around +5dB is likely to be an indication of an adverse impact, dependent on the context. Where the rated plant noise level is equivalent to the background noise level, noise impacts are typically considered to be neutral.

9.2.2.2 Additional traffic on surrounding roads

There are no specific guidelines or limits relating to traffic related sources along the local or surrounding roads. Given that traffic from the development will make use of existing roads already carrying traffic volumes, it is appropriate to assess the calculated increase in traffic noise levels that will arise because of vehicular movements associated with the development. In order to assist with the interpretation of the noise associated with additional vehicular traffic on public roads, Table 9.6, taken from DMRB, offers guidance as to the likely degree of impact associated with any long-term change in traffic noise level.

Change in Sound Level (dB)	Subjective Reaction	DMRB Magnitiude of Impact	EPA Significance of Effect
0	Inaudible	No impact	Imperceptible
0.1 – 2.9	Barely Perceptible	Negligible	Not significant
3 – 4.9	Perceptible	Minor	Slight, Moderate
5 – 9.9	Up to a doubling of loudness	Moderate	Significant

10+	Doubling of loudness and above	Major	Very significant

Table 9.6 Significance in Change of Noise Level

The guidance outlined in Table 9.6 will be used to assess the predicted increases in traffic levels on public roads associated with the proposed development and comment on the likely long-term impacts during the operational phase.

9.2.2.3 Inward Noise Impact

9.2.2.3.1 Limerick Noise Action Plan (NAP)

The Limerick Noise Action Plan (NAP) was finalised in October 2018. The NAP states that in order to give effect to National Policy Objective 65 of the National Planning Framework 2040, that the following strategic approach will be adopted by the Council:

“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 are applied, in line with "Professional Practice Guidance on Planning & Noise: New Residential Developments" (2017) (ProPG) and that predicted internal and external noise levels are in keeping with World Health Organisation recommendations and guidance.”

In addition, the following is provided

“All new applications for residential developments will be assessed in accordance with this policy and where there is the likelihood of an adverse noise impact that planning applications should be supplemented by an Acoustic Design Statement carried out by appropriately qualified acousticians and competent persons. The Acoustic Design Statement should demonstrate that all facets of the "Professional Practice Guidance on Planning & Noise" have been followed”.

In accordance with this NAP policy, a complete assessment of inward noise impact has been incorporated into this EIAR chapter to comply with the requirements of this policy.

9.2.2.3.2 ProPG: Planning & Noise

The Professional Guidance on Planning & Noise (ProPG) document was published in May 2017. The document was prepared by a working group comprising members of the Association of Noise

Consultants (ANC), the Institute of Acoustics (IOA) and the Chartered Institute of Environmental Health (CIEH). Although not a UK or Irish government document, since its publication it has been generally considered as a best practice guidance and has been widely adopted in the absence of equivalent Irish guidance.

The ProPG outlines a systematic risk-based 2-stage approach for evaluating noise exposure on prospective sites for residential development. The two primary stages of the approach can be summarised as follows:

- Stage 1 - Comprises a high-level initial noise risk assessment of the proposed site considering either measured and or predicted noise levels; and,
- Stage 2 – Involves a full detailed appraisal of the proposed development covering four "key elements" that include:

  Element 1 - Good Acoustic Design Process;

  Element 2 - Noise Level Guidelines;

  Element 3 - External Amenity Area Noise Assessment, and;

  Element 4 - Other Relevant Issues.

A key component of the evaluation process is the preparation and delivery of an Acoustic Design Statement (ADS) which is intended for submission to the planning authority. This document is intended to clearly outline the methodology and findings of the Stage 1 and Stage 2 assessments, so as the planning authority can make an informed decision on the permission. ProPG outlines the following possible recommendations in relation to the findings of the ADS:

A. Planning consent may be granted without any need for noise conditions;

B. Planning consent may be granted subject to the inclusion of suitable noise conditions;

C. Planning consent should be refused on noise grounds in order to avoid significant adverse effects ("avoid"); or,

D. Planning consent should be refused on noise grounds in order to prevent unacceptable adverse effects ("prevent").

Section 3.0 of the ProPG provides a more detailed guide on decision making to aid local authority planners on how to interpret the findings of an accompanying Acoustic Design Statement (ADS).

A summary of the ProPG approach is illustrated in Figure 9.2.

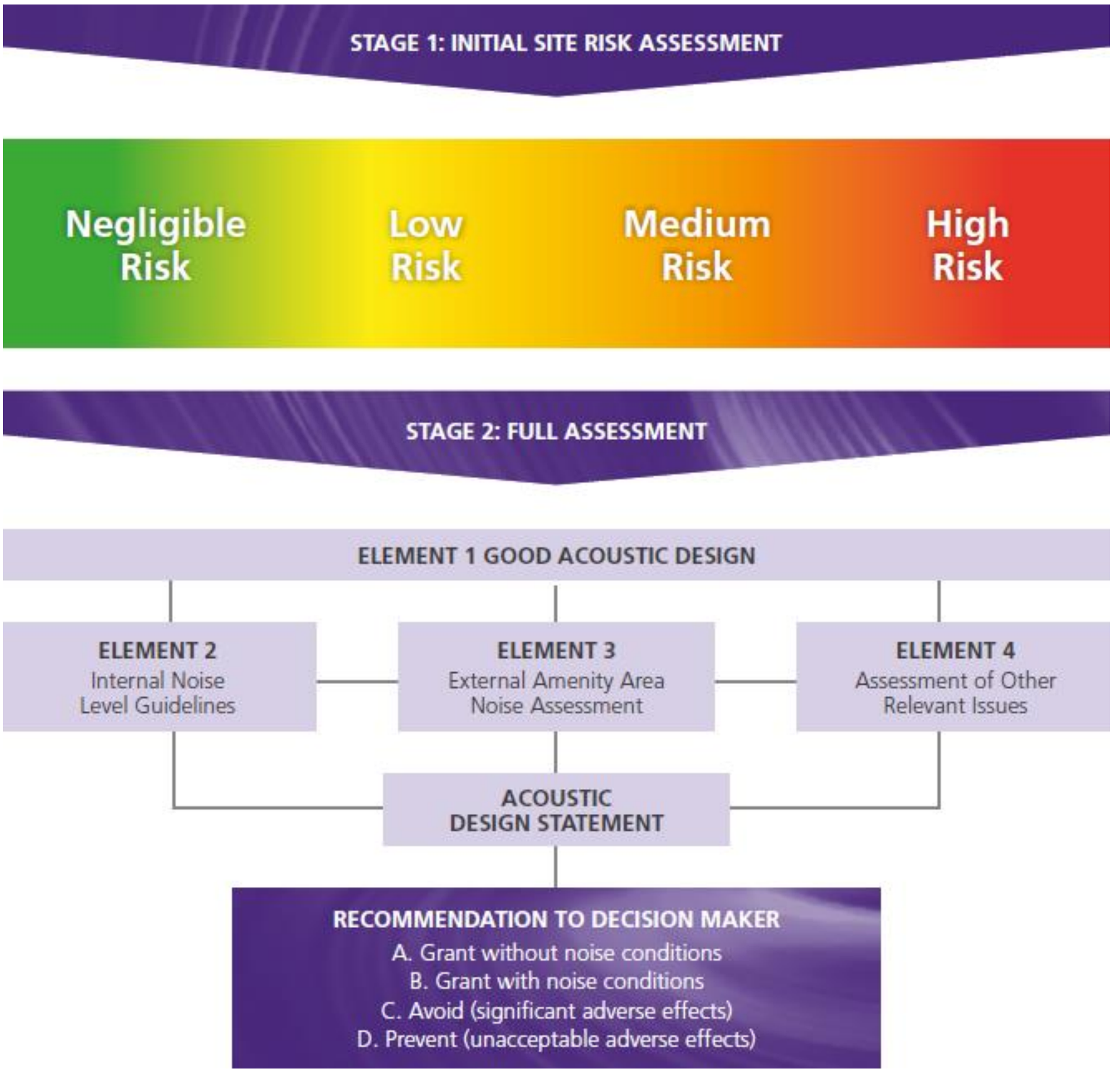

Figure 9.2: ProPG Approach (Source: ProPG)

9.2.2.3.3 WHO Environmental Noise Guidelines for Europe

The World Health Organisation (WHO) have published in October 2018 Environmental Noise Guidelines for the European Region. The objective of these guidelines is to provide recommendations for protecting human health from exposure to environmental noise from transportation, wind farm and leisure sources of noise. The guidelines present recommendations for each noise source type in terms of L_{den} and L_{night} levels above which there is risk of adverse health risks.

However, it should be noted that the WHO guideline values referred to here are recommended to serve as the basis for a policy-making process to allow evidence based public health orientated recommendations. They are not intended to be noise limits and the WHO document states the following regarding the implementation of the guidelines,

> "The WHO guideline values are evidence-based public health-oriented recommendations. As such, they are recommended to serve as the basis for a policy-making process in which policy options are considered. In the policy decisions on reference values, such as noise limits for a possible standard or legislation, additional considerations – such as feasibility, costs, preferences and so on – feature in and can influence the ultimate value chosen as a noise limit. WHO acknowledges that implementing the guideline recommendations will require coordinated effort from ministries, public and private sectors and nongovernmental organizations, as well as possible input from international development and finance organizations. WHO will work with Member States and support the implementation process through its regional and country offices."

It is therefore not intended to refer to the WHO guidelines in an absolute sense as part of this assessment and it will be a decision for national and local policy makers to adopt the WHO guidelines and propose noise limits for use.

9.2.2.3.4 ProPG: Stage 1 - Noise Risk Assessment

The initial noise risk assessment is intended to provide an early indication of any acoustic issues that may be encountered. It calls for the categorisation of the site as a negligible, low, medium or high risk based on the pre-existing noise environment. Figure 9.3 presents the basis of the initial noise risk assessment, it provides appropriate risk categories for a range of continuous noise levels either measured and/or predicted on site.

It should be noted that a site should not be considered a negligible risk if more than 10 L_{AFmax} events exceed 60 dB during the night period and the site should be considered a high risk if the L_{AFmax} events exceed 80 dB more than 20 times a night.

Paragraph 2.9 of ProPG states that,

> "The noise risk assessment may be based on measurements or prediction (or a combination of both) as appropriate and should aim to describe noise levels over a "typical worst case" 24 hour day either now or in the foreseeable future."

In this instance it is proposed to develop a 3D computer noise model of the development site and predict the noise levels across the entire site in order to investigate the initial noise risk. The noise model will use the measured noise levels during the survey, discussed in Section 9.3.2, to validate the model. Furthermore, the model allows the site to be assessed taking into account the changes in topography that are required to allow development. This is to comply with the requirements of paragraph 2.8 of ProPG which states,

> *"The risk assessment should not include the impact of any new or additional mitigation measures that may subsequently be included in development proposals for the site and proposed as part of a subsequent planning application. In other words, the risk assessment should include the acoustic effect of any existing site features that will remain (e.g. retained buildings, changes in ground level) and exclude the acoustic effect of any site features that will not remain (e.g. buildings to be demolished, fences and barriers to be removed) if development proceeds."*

In this instance there are no buildings to be demolished on the site. The site topography is not expected to change significantly during construction.

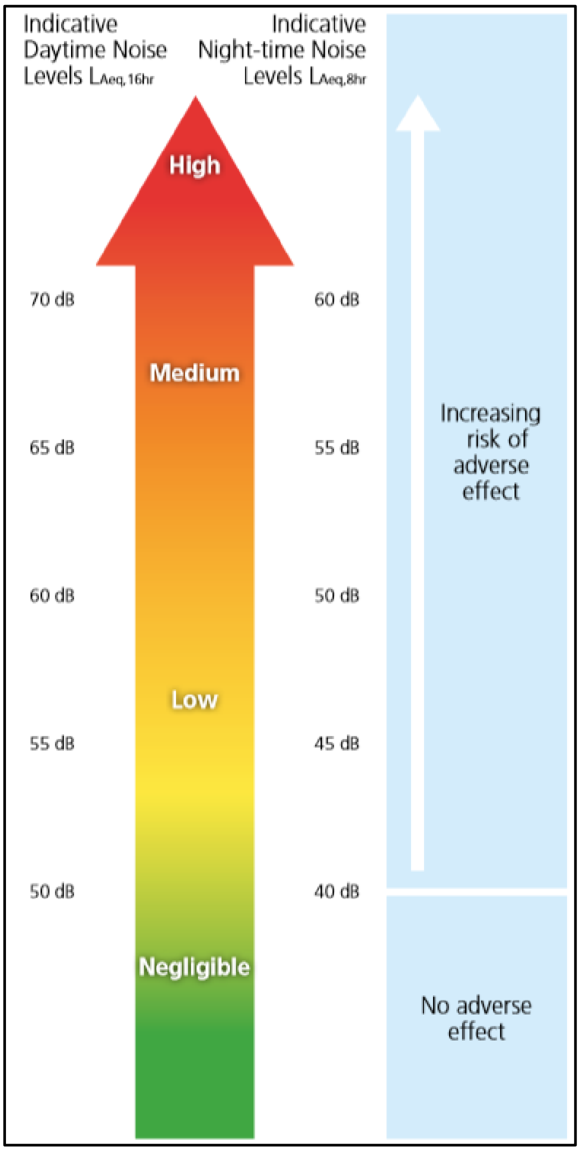

Figure 9.3: ProPG Stage 1 - Initial Noise Risk Assessment

9.3 Receiving Environment

9.3.1 Environmental Noise Surveys

An environmental noise survey has been conducted at the site in order to quantify the existing noise environment. The survey was conducted in general accordance with ISO 1996: 2017: *Acoustics – Description, measurement and assessment of environmental noise*.

9.3.1.1 Noise Survey Locations

Three attended locations were chosen to inform the assessment impact of the proposed development:

- AT1: By the roundabout on the R510 at the entrance to the proposed development.
- AT2: At the eastern edge of the proposed housing, close to the existing houses at Whitethorns and Ballinvoher.
- AT3: At the northern edge of the proposed housing are at the point which is closest to the R510 and the M7

These locations are shown in Figure 9.4:

Figure 9.4: Noise Survey Locations

Figure 9.5: Microphone position at AT2 (see yellow ellipse)

Figure 9.6: Microphone position at AT3

9.3.1.2 Noise Measurement Parameters

The noise survey results are presented in terms of the following parameters:

L_{Aeq}	is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period.
L_{AFmax}	is the instantaneous maximum sound level measured during the sample period using the 'F' time weighting.
L_{A10}	is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.
L_{A90}	is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to 2x10^{-5} Pa.

9.3.1.3 Survey Periods

The attended noise survey was carried out on Tuesday 2 November 2021. Noise levels were measured over 15-minute periods on a cyclic basis at each measurement location.

The weather during the survey period was dry with varying cloud cover. Wind speeds were moderate; however they were not considered to have had a detrimental effect on the noise measurements.

The main objective of the noise survey was to inform for the assessment of the inward noise impact; the daytime measurements covered a weekday mid-morning period and the night-time measurement covered the period where people are preparing for sleep. As the main source of noise is the R510 road, measurements of night-time noise at AT2 were not necessary.

9.3.1.4 Personnel and Instrumentation

AWN installed and collected the noise monitoring equipment. The following instrumentation was used in conducting the noise and surveys:

Equipment	Type	Serial Number	Calibration Date
Sound Level Meter	Rion NL-52	386771	Feb 2021

Table 9.7: Instrumentation Details

9.3.1.5 Attended Noise Measurements

The survey results for the attended monitoring are given in Table 9.

Location	**Start Time**	**Measured Noise Levels (dB re. 2x10^{-5} Pa)**			
		L_{Aeq}	**L_{AFmax}**	**L_{A10}**	**L_{A90}**
AT1	11:22	58	72	60	54
	12:33	58	75	61	48
	13:45	61	78	65	48
	22:38	55	67	56	46
	23:16	56	66	55	45
AT2	11:45	53	74	62	51
	12:58	58	73	61	51
	14:17	55	74	58	48
AT3	11:00	62	71	66	52
	12:10	58	70	62	52
	13:23	58	70	61	51
	22:17	52	62	59	46
	22:57	52	69	60	46

Table 9.8: Attended Noise Survey Results

At AT1 and AT3, the noise environment was dominated by traffic movements along the R510, with distant traffic on the N18 audible during lulls. Birdsong was also audible.

At AT2, the main source of noise was distant traffic on the R510 and the N18, along with birdsong from the immediate surroundings of the location.

9.3.2 Road Noise Model

In addition to the noise survey discussed in the previous section, proprietary noise calculation software has been used for the purposes of this impact assessment to calculate road traffic noise levels at various facades across the development site. The selected software, Brüel & Kjær Type 7810 Predictor, calculates noise levels in accordance with the UK’s Calculation of Road Traffic Noise (CRTN 1988) which is the recommended procedure for Irish National routes as per Transport Infrastructure Ireland’s (TII) Guidelines for the Treatment of Noise and Vibration in National Road Schemes (2004).

The resultant noise level is calculated taking into account a range of factors affecting the propagation of sound, including:

- The magnitude of the noise source in traffic flow and average velocity;
- The distance between the source and receiver;
- The presence of obstacles such as screens or barriers in the propagation path;
- The presence of reflecting surfaces; and,
- The hardness of the ground between the source and receiver.

In order to determine the noise levels at the various façades of the proposed development, the following information was included in the model:

- Site layout drawings of proposed development, and;
- OS mapping of surrounding environment.

The results of the noise survey were used to calibrate the noise model. In this instance the noise model results are within 1dB of the measured values indicating good agreement between the model and the measurements. Figure 9.7 shows a 3D view of the noise developed model.

Predicted noise levels for day and night periods over the site, in the absence of the proposed development are presented in Figure 9.8 and Figure 9.9. These are used to evaluate the Noise Risk at the site.

Figure 9.1 3D Noise model of site

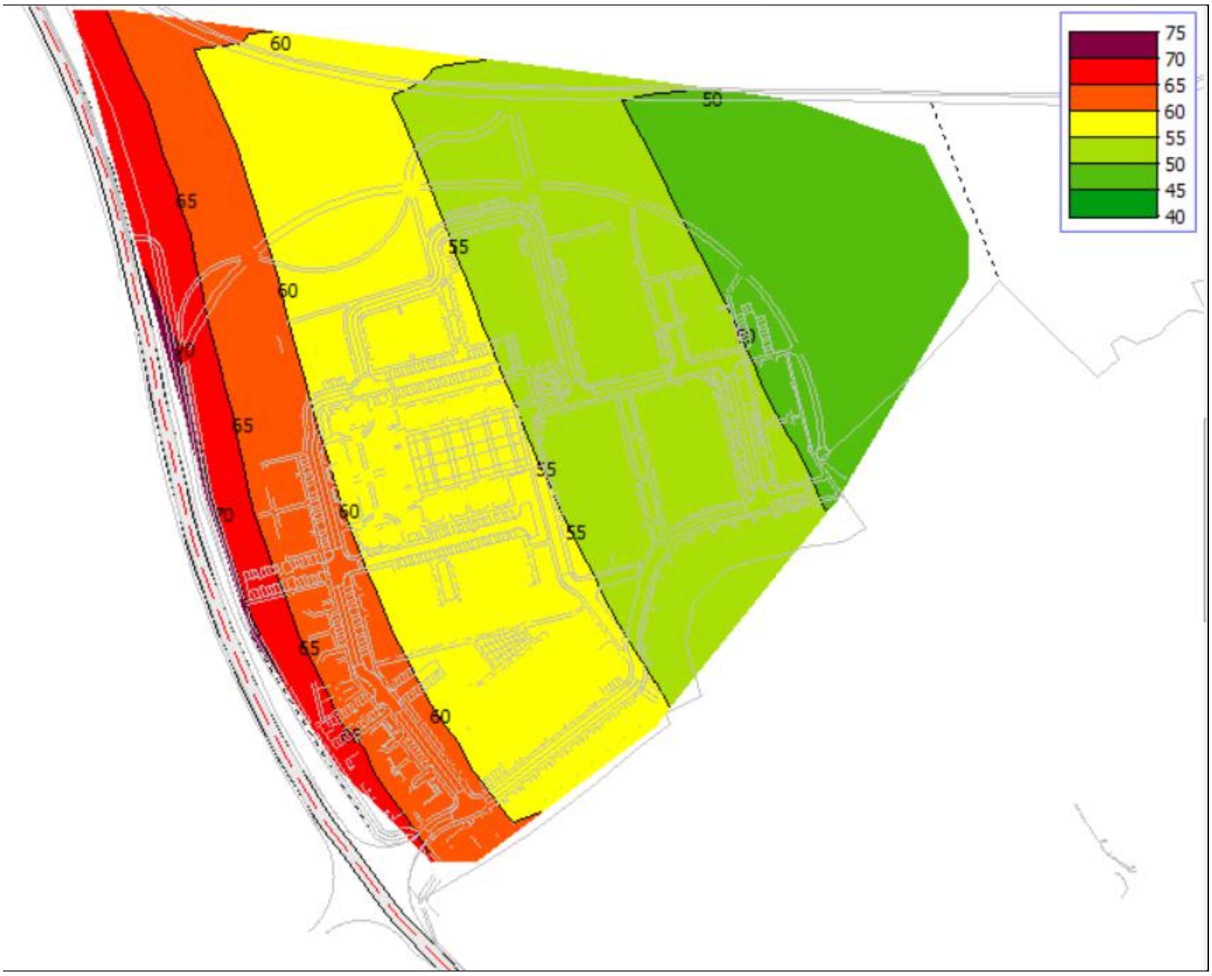

Figure 9.2 Daytime noise contours in dB(A) over existing site – in the absence of the development

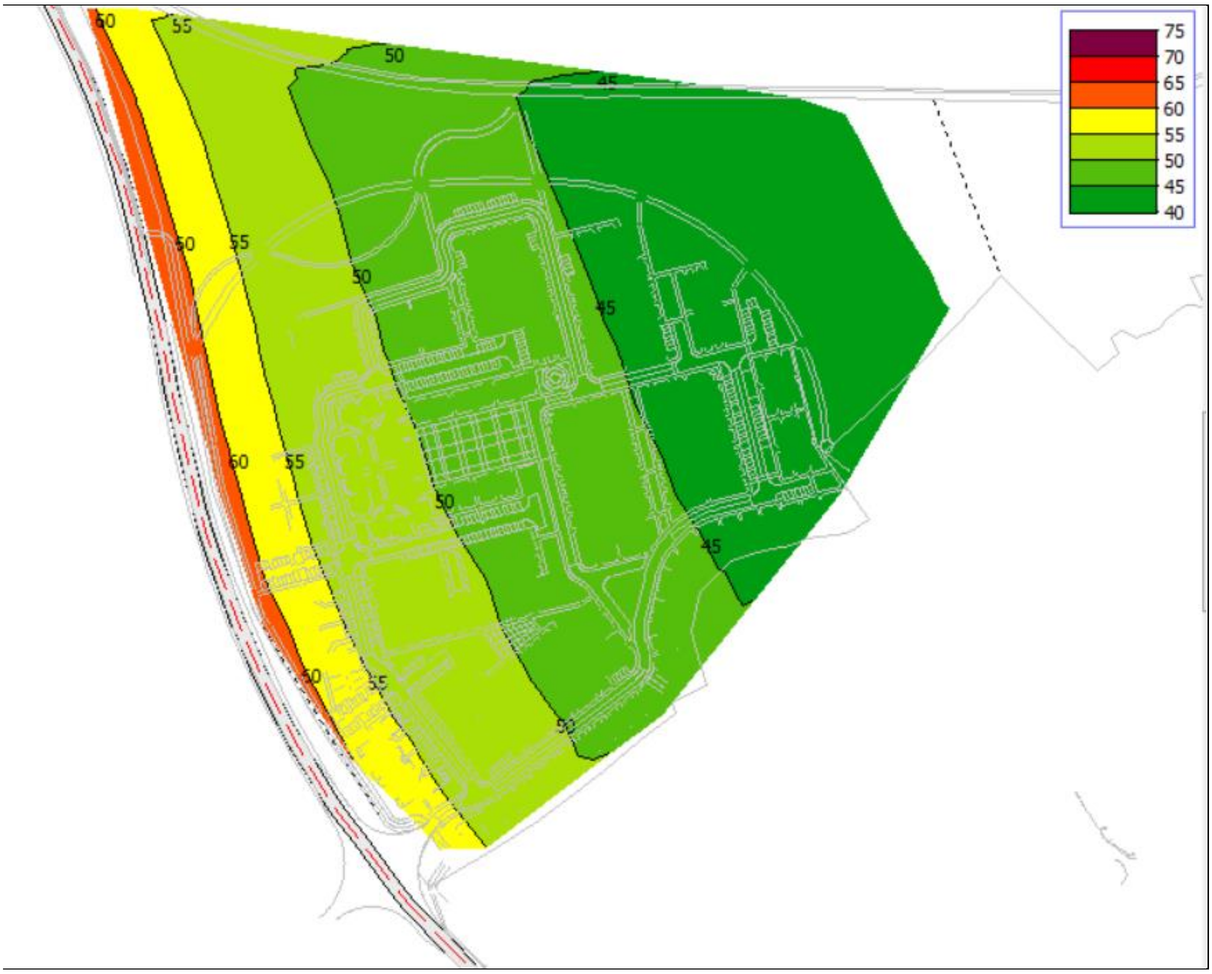

Figure 9.3 Night noise contours over in dB(A) existing site – in the absence of the development

Figure 9.10 and Figure 9.11 show the predicted noise level contours over the site with the proposed development in place. Daytime noise levels range from 65 to 70 dB L_{day} at the western edge of the site, to below 50 L_{day} at the eastern part of the site.

Similarly, night noise levels range from 60 to 65 dB L_{night} at the western edge of the site, to below 45 dB L_{night} at the eastern part of the site.

For the purposes of developing noise mitigation measures, the façades in the site are assigned in 'zones' based on the predicted noise level. Figure 9.12 place the façades into Zones A and B, depending on the noise level. At other façades, mitigation measures in respect of noise are not deemed required.

Figure 9.10 Daytime predicted noise contours (Background Imagery from Google Earth)

Figure 9.11 3D Night-time predicted noise contours

Figure 9.12 Façade zoning for noise mitigation measures

9.3.3 Future Noise Environment

It is important to note that the noise model is based on the measured noise levels and is representative of current traffic volumes. It is acknowledged that an increase in road traffic volumes would give rise to a corresponding increase in noise levels. With road traffic noise, typically a 25% increase in volumes would be expected to give rise to a 1 dB increase in noise levels.

In order to present a worst-case scenario, all predicted façade noise levels and mitigation measures will include a 2 dB increase to account for future traffic growth

9.3.4 Summary of Assumed Façade Noise Levels on Developed Site

Based on a review of the survey data, the following noise levels are assumed to be incident on the east façades of the development on Zones A and B: The night-time

Façades	Octave Band Centre Frequency (Hz)						Overall dB(A)
	125	250	500	1k	2k	4k	
Zone A Daytime L_{Aeq}	65	66	65	69	61	50	71
Zone A Night-time L_{Aeq}	60	58	58	60	54	48	63
Zone A Night-time L_{Amax}	70	70	79	74	73	72	81
Zone B Daytime L_{Aeq}	51	56	56	60	53	41	62
Zone B Night-time L_{Aeq}	47	50	51	56	49	40	58
Zone B Night-time L_{Amax}	67	69	70	75	68	60	77

Table 9.1 Assumed Noise Levels Facades

Noise Risk Assessment Conclusion

Giving consideration to the noise levels presented in the previous sections, the initial site noise risk assessment has concluded that the level of risk across the site is Low Risk at the eastern and central areas of the site to Medium Risk along the western boundary. ProPG states the following with respect to various levels of risk:

Negligible Risk	*These noise levels indicate that the development site is likely to be acceptable from a noise perspective, and the application need not normally be delayed on noise grounds.*
Low Risk	*At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.*

Medium Risk	*As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.*

Given the above it can be concluded that the development site may be categorised as 'low to medium' risk and as such an Acoustic Design Strategy will be required to demonstrate that suitable care and attention has been applied in mitigating and minimising noise impact to such an extent that an adverse noise impact will be avoided in the final development.

It should be noted that ProPG states the following with regard to how the initial site noise risk is to be used,

> *"2.12 It is important that the assessment of noise risk at a proposed residential development site is not the basis for the eventual recommendation to the decision maker. The recommended approach is intended to give the developer, the noise practitioner, and the decision maker an early indication of the likely initial suitability of the site for new residential development from a noise perspective and the extent of the acoustic issues that would be faced. Thus, a site considered to be high risk will be recognised as presenting more acoustic challenges than a site considered as risk. A site considered as negligible risk is likely to be acceptable from a noise perspective and need not normally be delayed on noise grounds. A potentially problematical site will be flagged at the earliest possible stage, with an increasing risk indicating the increasing importance of good acoustic design."*

Therefore, following the guidance contained in ProPG does not preclude residential development on sites that are identified as having medium or indeed high-risk noise levels. It merely identifies the fact that a more considered approach will be required to ensure the developments on the higher risk sites are suitable designed to mitigate the noise levels. The primary goal of the approach outlined in ProPG is to ensure that the best possible acoustic outcome is achieved for a particular site.

9.4 Characteristics of the Proposed Development

The ca. 10.44 hectare site is greenfield land that is enclosed by existing residential development to the south, east and west and open land to the north. The northern boundary is formed by a former and disused railway line. The land to the north of that is enclosed by the National Road N18. The western boundary is formed by the regional road R510. Most of the southeastern boundary is formed by boundary walls of established residential development. The lands are relatively flat and there are no restrictions on the future development of the lands for residential development. An existing roundabout provides vehicular access to the site. The dedicated arm of the roundabout for this access is currently blocked off.

The site has been zoned for residential development within the Limerick City Development Plan 2010-2016 and the Southern Environs Plan 2021-2027. The proposed development is a residential development that provides a mixture of houses, duplex units and apartments.

The proposed development description is set out in the statutory notices as follows;

DW Raheen Developments Ltd. are seeking a ten year permission for a strategic housing development consisting of the provision of 384 residential house and apartment units on a ca. 10.44 hectare site located in Ballykeeffe, Raheen, Co. Limerick.

The site is greenfield land that is enclosed by existing residential development to the south and east, the R510 to the west and open land to the north. Access to the site is provided by an existing entrance off a roundabout on the R510 regional road.

The proposed development will provide as follows:

- 202 no. housing units, comprising a variety of forms to include bungalows, detached, semi-detached and terraced houses. A mix of house sizes are proposed to include 20 no. two bedroom houses, 156 no. three bedroom houses and 26 no. four bedroom houses.
- 182 apartment and duplex units across 25 small scale blocks, 2 to 4 storeys in heights, throughout the development. The apartments and duplexes provide a mix of one, two, three and four bed units, comprising of 10 no. four bedroom duplex units, 10 no. three

bedroom duplex units, 6 no. two bedroom duplex units, 18 no. three bedroom apartments, 92 no. two bedroom apartments and 46 no. one bedroom apartments.

The proposed development also includes;

- A childcare facility measuring 761.75m^2, providing 79 childcare places (55 full time and 24 after school places), located at the south-western edge of the development.
- The provision of 377 no. car parking spaces and 311 secured bicycle parking spaces.
- The provision of 3 no. ESB sub-stations, ancillary services and infrastructure works including foul and surface water drainage, attenuation areas, landscaped public open spaces (approximately 29,500m^2, or 28.2% of the total site area), landscaping, lighting, internal roads, cycle paths, and footpaths.

A Natura Impact Statement (NIS) and Environmental Impact Assessment Report (EIAR) have been prepared in respect of the proposed development.

9.5 Potential Impact of the Proposed Development

The potential impacts of the proposed development are considered for the short-term construction phase and long-term operational phase. These are set out in the following sections.

9.5.1 Proposed Development

9.5.1.1 Construction Stage

The largest noise and vibration impact of the proposed development will occur during the construction phase due to the operation of various plant machinery and HGV movement to, from and around the site. However, the construction phase can be classed as a short-term phase (approximately seven years in duration).

The nearest noise-sensitive locations to the site are the residential properties to the east of the site at The Park, which are and east, each of which is approximately 25 m from the closest point of the site boundary. Based on the results of the baseline noise surveys undertaken, the ambient daytime noise level at these properties was found to be between 61 and 63 dB $L_{Aeq,T}$.

Thresholds for significant noise from construction can be determined by referring to Table 8.1 (BS 5228-1) and the baseline ambient noise levels, as outlined in the assessment criteria section.

The daytime significance threshold for construction noise at the site is set at 65 dB $L_{Aeq,T}$. A night-time threshold is not included as construction work will not be taking place at night.

BS 5228-1 contains noise level data for various construction machinery. The noise levels relating to site clearance, ground excavation and loading lorries (dozers, tracked excavators and wheeled loaders) reach a maximum of 81 dB $L_{Aeq,T}$ at a distance of 10 m. For this assessment, a worst-case scenario is assumed of 3 no. such items with a sound pressure level (SPL) of 81 dB at 10 m operating simultaneously along the closest works boundary. This would result in a total noise level of 86 dB at 10 m and an equivalent combined sound power level of 114 dB L_{WA}. This worst-case scenario is the typical assumption made for developments of this size, on the basis that it is unlikely that more than 3 no. items of such plant/equipment would be operating simultaneously in such close proximity to each other.

Guidance on the approximate attenuation achieved by barriers surrounding the site is also provided in BS 5228-1. It states that when the top of the plant is just visible to the receiver over the noise barrier, an approximate attenuation of 5 dB can be assumed, while a 10 dB attenuation can be assumed when the noise screen completely hides the sources from the receiver.

The latter scenario can be assumed in this case due to the proximity of the noise-sensitive locations, i.e. a barrier height will be chosen so as to completely hide the source. Table 9.10 shows the potential noise levels calculated at various distances based on the assumed sound power level and attenuation provided by the barrier of 10 dB.

Description of Noise Source	Sound Power Level (dB Lw(A))	Calculated noise levels at varying distances (dB LAeq,T)				
		10	**20**	**30**	**50**	**100**
3 no. items each with SPL of 81 dB at 10 m operating simultaneously.	114	76	70	66	62	56

Table 9.10 Potential construction noise levels at varying distances assuming attenuation of 10 dB from site barrier

The calculated noise levels in Table 9.10 show that there is potential for the maximum permissible daytime noise level to be exceeded at distances up to 30 m from the works. This indicates that additional mitigation measures will be required to prevent likely significant impacts at residential properties. These measures are detailed in Section 9.6.1.

9.5.1.1.1 Construction Vibration

Potential for vibration impacts during the construction phase programme are likely to be limited given the ground breaking, piling and excavations required. There is potential for piling to be used for building and basement foundations for office and apartment buildings. For the purposes of this assessment the expected vibration levels during piling assuming augured or bored piles have been determined through reference to published empirical data. The British Standard BS 5228 – Part 2: Vibration, publishes the measured magnitude of vibration of rotary bored piling using a 600mm pile diameter for bored piling into soft ground over rock, (Table D.6, Ref. No. 106):

- 0.54 mm/s at a distance of 5 m, for auguring;
- 0.22 mm/s at a distance of 5 m, for twisting in casing;
- 0.42 mm/s at a distance of 5m, for spinning off, and;
- 0.43 mm/s at a distance of 5 m, for boring with rock auger.

Considering the low vibration levels at very close distances to the piling rigs, vibration levels at the nearest buildings are not expected to pose any significance in terms of cosmetic or structural damage. In addition, the range of vibration levels is typically below a level which would cause any disturbance to occupants of nearby buildings.

In this instance, taking account of the distance to the nearest sensitive off-site buildings, vibration levels at the closest neighbouring buildings are expected to be orders of magnitude below the limits set out in Table 9.4 to avoid any cosmetic damage to buildings. Vibration levels are also expected to be below a level that would cause disturbance to building occupants, as set out in Table 9.5. The potential vibration impact during the construction phase if of short-term, neutral and imperceptible impact.

9.5.1.2 Operational Stage

The main potential noise outward noise impact to the surrounding will be from additional vehicles on the surrounding road network and building services and mechanical plant serving the development.

Potential impacts from each of these sources are discussed below.

9.5.1.2.1 Building Services Plant

It is expected that the principal items of building and mechanical services plant will be for heating and ventilation of the buildings. These items and their location will be selected at the detailed design stage to ensure that noise emissions to sensitive receivers both external and within the development itself will be within the relevant criteria set. The effects are considered neutral, not significant and permanent.

9.5.1.2.2 Additional Vehicular Traffic on Surrounding Roads

During the operational phase of the proposed development, there will be an increase in vehicular traffic associated with the site and other planned developments on surrounding roads.

The predicted change in noise levels due to an increase in road traffic has been calculated for each of these roads. Projected traffic data used for the purpose of this assessment includes committed and planned developments in the vicinity of the project site as listed in Chapter 11 of this EIAR.

For the purposes of assessing potential noise impact, it is appropriate to consider the relative increase in noise level associated with traffic movements on existing roads surrounding the subject site with and without development using the Annual Average Daily Traffic (AADT) data.

The impact from the increase in traffic from the proposed development has been assessed for the year 2027 and the year of 2042 relative to the Do Nothing scenario along the sections of road detailed in Table 9.11.

In terms of the overall traffic data as described by the AADT parameter, in order to increase traffic noise levels by 1dB, traffic volumes would need to increase by the order of 25% approximately. A review of the potential traffic level increases attributable to the proposed development indicates that the development will not give rise to increases of this magnitude on the surrounding road network.

Road Link	**Noise level Increase (dB L_{A10}) between Do Nothing and Do Something based on AADT Traffic Data**	
	2027	**2042**
N69 (to west of N69/N18 roundabout)	0.0	0.0
Dock Road (to the east of the N69/N18 roundabout)	0.1	0.1
R510 (to the north of site access roundabout)	0.3	0.2
R510 (to south of the site access roundabout)	0.4	0.3
R510 (to the south of the Quinn's Cross roundabout)	0.2	0.2
Ard Aulin	0.2	0.2
Mungret Road	0.0	0.0

Road Link	Noise level Increase (dB L_{A10}) between Do Nothing and Do Something based on AADT Traffic Data	
	2027	2042
Father Russell Road	0.1	0.1

Table 9.11: Predicted Change In Noise Level associated with Vehicular Traffic

The predicted increase in traffic flows associated with the development in the years 2027 and will 2042 will result in an increase less than 1dB along all roads receiving traffic from the proposed development will have a negligible effect. The effect is therefore neutral, imperceptible and permanent.

9.5.2 Do-Nothing Impact

In the absence of the proposed development being constructed, the noise environment at the nearest noise sensitive locations and within the development site will remain largely unchanged resulting in a neutral impact in the long-term.

9.5.3 Cumulative

On review of the Limerick City Council planning register there is no other proposed development of scale in the local area which would require the cumulative assessment for noise and vibration impacts.

9.5.4 Inward Impact: ProPG Stage 2 – Full Acoustic Assessment

9.5.4.1 Element 1 – Good Acoustic Design Process

9.5.4.1.1 ProPG Guidance

In practice, good acoustic design should deliver the optimum acoustic design for a particular site without adversely affecting residential amenity or the quality of life of occupants or compromising other sustainable design objectives. It is important to note that ProPG specifically states that good acoustic design is not equivalent to overdesign or “gold plating” of all new development but that it seeks to deliver the optimum acoustic environment for a given site.

Section 2.23 of the ProPG outlines the following checklist for Good Acoustic Design:

- Check the feasibility of relocating, or reducing noise levels from relevant sources;
- Consider options for planning the site or building layout;
- Consider the orientation of proposed building(s);
- Select construction types and methods for meeting building performance requirements;
- Examine the effects of noise control measures on ventilation, fire regulation, health and safety, cost, CDM (construction, design and management) etc;
- Assess the viability of alternative solutions; and,
- Assess external amenity area noise.

In the context of the proposed development, each of the considerations listed above have been addressed in the following subsections.

9.5.4.1.2 Application of GAD Process to Proposed Application

Relocation or Reduction of Noise from Source

The main noise sources are located outside the redline boundary of the site and therefore it is beyond the scope of this development to introduce any noise mitigation at source.

Planning, Layout and Orientation

The layout of the site places a set of taller buildings along the western boundary. The screening effect of these larger buildings reduces noise levels in the open areas and private gardens in the centre of the site.

Select Construction Types for meeting Building Regulations

Masonry constructions will be used in constructing the external walls of the development. This construction type offers high levels of sound insulation performance. However, as is typically the case the glazed elements and any required ventilation paths to achieve compliance with Part F of the

Building Regulations will be the weakest elements in the façade in terms of sound insulation performance.

Consideration will therefore be given to the provision of upgraded glazing and acoustic ventilators where required. For units where it will not be possible to achieve the desirable internal acoustic environments with windows open, the proposal here will be to provide dwelling units with glazed elements and ventilators that have good acoustic insulation properties so that when the windows are closed the noise levels internally are good. Inhabitants will be able to open the windows if they wish, however, doing so will increase the internal noise level. This approach to mitigation is supported in ProPG where it states the following (note emphasis has been added in bold),

"2.22 Using fixed unopenable glazing for sound insulation purposes is generally unsatisfactory and should be avoided; **occupants generally prefer the ability to have control over the internal environment using openable windows, even if the acoustic conditions would be considered unsatisfactory when open**. Solely relying on sound insulation of the building envelope to achieve acceptable acoustic conditions in new residential development, when other methods could reduce the need for this approach, is not regarded as good acoustic design. Any reliance upon building envelope insulation with closed windows should be justified in supporting documents "

Note 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded

2.34 Where the LPA accepts that there is a justification that the internal target noise levels can only be practically achieved with windows closed, which may be the case in urban areas and at sites adjacent to transportation noise sources, special care must be taken to design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort without unduly compromising other aspects of the living environment. In such circumstances, internal noise levels can be assessed with windows closed but with any

> façade openings used to provide "whole dwelling ventilation" in accordance with Building Regulations Approved Document F (e.g. trickle ventilators) in the open position (see Supplementary Document 2). Furthermore, in this scenario the internal L_{Aeq} target noise levels should not generally be exceeded."

It is very important to note that it is impractical to achieve the good internal noise levels with windows open across the vast majority of development sites in close proximity to major infrastructure such as roads or airports. Such sites would need to be classified as having a negligible risk in accordance with the ProPG noise risk assessment approach. For this reason, there are no guidance documents either at a local level or an international level that AWN is aware of which would support the approach of achieving the ideal internal noise levels only in the open window scenario. It is therefore considered entirely correct and justifiable to provide building facades with a moderate degree of sound insulation such that with windows closed but vents opened a good internal acoustic environment is achieved.

Impact of noise control measures on fire, health and safety etc

The good acoustic design measures that have been implemented on site, e.g. upgrading the glazing along certain façades are not considered to have effects on fire risk issues or health and safety.

Assess Viability of Alternative Solutions

The option of introducing additional noise screening along the boundary of the site was considered. In this instance, it was concluded that the effectiveness of measured of this type would be limited given the lines-of-sight from apartments at upper floors to the surrounding road network.

Assess External Amenity Area Noise

ProPG provides the following advice with regards to external noise levels for amenity areas in the development:

> "The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$."

The values are largely based on WHO guideline values. In Figure 9.10, it is shown that the areas between buildings and much of the open amenity space are predicted to have noise levels generally within this range.

Good acoustic design principles employed have ensured that there is open space available in the quietest part of the site, which will be available to all occupants of the proposed development.

Summary

Considering the constraints of the site, in so far as possible and without limiting the extent of the development area, the principles of Good Acoustic Design have been applied to the development.

In terms of viable alternatives to acoustic treatment of façade elements, currently it is not considered likely that there will be further options for mitigation outside of proprietary acoustic glazing and ventilation.

9.5.4.2 Element 2 – Internal Noise Guidelines

9.5.4.2.1 Internal Noise Criteria

Element 2 of the ProPG document sets out recommended internal noise targets derived from BS 8233 (2014). The recommended indoor ambient noise levels are set out in Table 9.12 and are based on annual average data, that is to say they omit occasional events where higher intermittent noisy events may occur, such as New Year's Eve.

Activity	Location	(07:00 to 23:00hrs)	(23:00 to 07:00hrs)
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hr}$	-
Sleeping	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax,T}$*

Table 9.12: ProPG Internal Noise Levels

*Note The document comments that the internal L_{AFmax},T noise level may be exceeded no more than 10 times per night without a significant impact occurring.

In addition to these absolute internal noise levels ProPG provides guidance on flexibility of these internal noise level targets. For instance, in cases where the development is considered necessary or desirable, and noise levels exceed the external noise guidelines, then a relaxation of the internal L_{Aeq} values by up to 5 dB can still provide reasonable internal conditions.

9.5.4.2.2 Discussion on Open/Closed Windows

In the first instance, it is important to note the typical level of sound reduction offered by a partially open window falls in the region of 10 to 15 dB. .

Considering the design goals outlined in Table 9.12 and a sound reduction across an open window of 15 dB, the free-field noise levels that would be required to ensure that internal noise levels do not exceed good (i.e. at or below the internal noise levels) or reasonable internal noise levels (i.e. 5 dB above the internal noise levels) have been summarised in Table 9.13.

Level Desired	**Day** **07:00 to 23:00hrs**	**Night** **23:00 to 07:00hrs**
Good (i.e. at or below the internal noise levels)	50 – 55 dB $L_{Aeq,16hour}$	45 dB $L_{Aeq,8hour}$
Reasonable (i.e. 5 dB above the internal noise levels)	55 – 6 0dB $L_{Aeq,16hour}$	50 dB $L_{Aeq,8hour}$

Table 9.13: External Noise Levels Required to Achieve Internal Noise Levels

For the buildings closest to the western boundary of the site the external noise levels are such that there are façades where it will not be possible to achieve the desired good internal noise levels with windows open, therefore appropriate acoustic specifications to windows and passive vents will be provided to ensure the rooms are adequately ventilated and achieve the good internal noise levels detailed here.

However, for the buildings in the central and eastern parts of the site, the noise levels are such the good acoustic conditions are possible with windows open.

9.5.4.2.3 Proposed Façade Treatment

The British Standard BS EN 12354-3: 2000: Building acoustics – Estimation of acoustic performance of buildings from the performance of elements – Part 3: Airborne sound insulation against outdoor sound provides a calculation methodology for determining the sound insulation performance of the external envelope of a building. The method is based on an elemental analysis of the building envelope and can take into account both the direct and flanking transmission paths.

The Standard allows the acoustic performance of the building to be assessed taking into account the following:

- Construction type of each element (i.e. windows, walls, etc.);
- Area of each element;
- Shape of the façade, and;
- Characteristics of the receiving room.

The principals outlined in BS EN 12354-3 are also referred to in BS8233 and Annex G of BS8233 provides a calculation method to determine the internal noise level within a building using the composite sound insulation performance calculated using the methods outlined in BS EN 12354-3. The methodology outlined in Annex G of BS8233 has been adopted here to determine the required performance of the building facades.

9.5.4.2.4 Glazing

As is the case in most buildings, the glazed elements of the building envelope are typically the weakest element from a sound insulation perspective. In this instance the facades in Zones A and B will be provided with glazing that, when closed, achieve the minimum sound insulation performance as set out in Table 9.14.

Zone	Octave Band Centre Frequency (Hz)						R_w
	125	250	500	1k	2k	4k	
A	26	27	34	40	38	46	37
B	24	20	25	35	38	35	31

Table 9.14: Sound Insulation Performance Requirements for Glazing, SRI (dB)

The acoustic specification listed in Table 9.14 can be achieved using a double-glazed unit with slightly thicker than standard glass. This performance could also be achieved using a suitably specified triple glazing window.

It is important to note that the acoustic performance specifications detailed herein are minimum requirements which apply to the overall glazing system. In the context of the acoustic performance specification the ‘glazing system’ is understood to include any and all of the component parts that form part of the glazing element of the façade, i.e. glass, frames, seals, openable elements etc.

9.5.4.2.5 Wall Construction

In general, all wall constructions (i.e. block work or concrete) offer a high degree of sound insulation, much greater than that offered by the glazing systems. Therefore, noise intrusion via the wall construction will be minimal. The calculated internal noise levels across the building façade have assumed a minimum sound reduction index of 50 dB R_w for this construction.

9.5.4.2.6 Ventilation

The ventilation strategy for the development will be in accordance with Part F of the Building Regulations and will be finalised at the detail design stage. Options which will be considered to achieve compliance with background ventilation requirements will be adjustable hit and miss acoustic ventilators or trickle vents built into the façade or window frames respectively. It is recommended that the wall vents in Zones A and B are specified to achieve a sound insulation performance as set out in Table 9.15. This specification can be achieved by a range of proprietary vents in either through frame trickle vent or through wall vents

Zone	Octave Band Centre Frequency (Hz)						R_w
	125	250	500	1k	2k	4k	
A	39	34	40	46	60	64	44
B	29	30	37	39	36	42	39

Table 9.15: Sound Insulation Performance Requirements for Vents, SRI (dB)

9.5.4.2.7 Roof

There is the potential for the roof structure to allow the passage of sound into the rooms. In order to control potential sound transmission via this route the ceiling / roof construction will need to provide a sound reduction in excess of that required for the windows.

For the proposed houses with pitched tiled roofs, a suitable sound reduction performance would be provided by a standard tiled or slated roof with a single 12.5mm layer plasterboard ceiling and heat insulation layer above the ceiling.

For the proposed apartments, the reinforced concrete roof with thermal insulation and plasterboard ceiling below will also provide suitable sound insulation.

Any penetrations through the ceiling constructions must be as small as possible and made good by fully filling with plaster or with an acoustic sealant.

9.5.4.2.8 Internal Noise Levels

Taking into account the external façade levels and the specified building envelope the internal noise levels have been calculated. In all instances the good internal noise criteria are achieved for daytime and night-time periods.

9.5.4.3 Element 3 – External Amenity Area Noise Assessment

As previously discussed, Figure 9.10 illustrates that the inhabitants will have access to an outdoor amenity area at the especially in the north-eastern area of the site, which achieves a noise level ≤55dB $L_{Aeq,16hr}$ which is recommended in ProPG.

9.5.4.4 Element 4 – Assessment of Other Relevant Issues

Element 4 gives consideration to other factors that may prove pertinent to the assessment, these are defined in the document as:

- 4(i) compliance with relevant national and local policy
- 4(ii) magnitude and extent of compliance with ProPG
- 4(iii) likely occupants of the development
- 4(iv) acoustic design v unintended adverse consequences
- 4(v) acoustic design v wider planning objectives

Each is discussed in turn below.

9.5.4.4.1 Compliance with Relevant National and Local Policy

There are no National policy documents relating to the acoustic design of residential dwellings. Locally the Limerick Noise Action Plan specifies that the guidance contained within ProPG should be used in assessing the noise impact on new residential developments within the Limerick City and County areas.

This Acoustic Design Statement has been prepared in compliance with the requirements of ProPG and therefore complies with the requirements of local policy.

9.5.4.4.2 Magnitude and Extent of Compliance with ProPG

As discussed within this report the following conclusions have been drawn with regards to the extent of compliance with ProPG:

- All dwellings as part of the development have been designed to achieve the good level of internal noise levels specified within ProPG with windows closed but with the mechanical ventilation systems providing suitable levels of ventilation, and;
- All external amenity areas have been shown to have an external noise level that complies with the recommended criterion set out in ProPG. In addition, the majority of external

areas also comply with the more onerous noise criterion for external spaces aspired to in the Limerick Noise Action Plan.

Based on the preceding it is concluded that the proposed development is in full compliance with the requirements of ProPG.

9.5.4.4.3 Likely Occupants of the Development

The criteria adopted as part of this assessment are based on those recommended for permanent dwellings and are therefore considered robust and appropriate for the likely occupants.

9.5.4.4.4 Acoustic Design v Unintended Adverse Consequences

Unintended adverse consequences did not occur on this project.

9.5.4.4.5 Acoustic Design v Wider Planning Objectives

With reference to the Limerick Noise Action Plan (NAP) 2018, this assessment has demonstrated the noise insulation measures required to ensure that the proposed dwelling units achieve a good internal noise environment.

9.6 Mitigation Measures (Ameliorative, Remedial or Reductive Measures)

In order to ameliorate the likely noise impacts, a schedule of noise control measures has been formulated for both construction and operational phases.

9.6.1 Construction Stage

With regard to construction activities, best practice operational and control measures for noise and vibration from construction sites are found within BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2.

BS5228 includes guidance on several aspects of construction site practices, including, but not limited to:

- selection of quiet plant;
- control of noise sources;
- screening (boundary, and or localised plant screening);
- hours of work;
- liaison with the public, and;
- monitoring.

Detailed comment is offered on these items in the following paragraphs. Noise control measures that will be considered include the selection of quiet plant, enclosures and screens around noise sources, limiting the hours of work and noise monitoring.

9.6.1.1 Selection of Quiet Plant

This practice is recommended in relation to sites with static plant such as compressors and generators. It is recommended that these units be supplied with manufacturers' proprietary acoustic enclosures where possible. The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item should be selected wherever possible.

9.6.1.2 Noise Control at Source

If replacing a noisy item of plant is not a viable or practical option, consideration should be given to noise control "at source". This refers to the modification of an item of plant or the application of improved sound reduction methods in consultation with the supplier. For example, resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can often be controlled by fixing resilient materials in between the surfaces in contact.

BS5228 states that "as far as reasonably practicable sources of significant noise should be enclosed". In applying this guidance, constraints such as mobility, ventilation, access and safety must be taken into account. Items suitable for enclosure include pumps and generators.

BS5228 makes a number of recommendations in relation to "*use and siting of equipment*". These are all directly relevant and hence are reproduced below. These recommendations will be adopted on site.

> "Plant should always be used in accordance with manufacturers' instructions. Care should be taken to site equipment away from noise-sensitive areas. Where possible, loading and unloading should also be carried out away from such areas.
>
> Machines such as cranes that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum. Machines should not be left running unnecessarily, as this can be noisy and waste energy.
>
> Plant known to emit noise strongly in one direction should, when possible, be orientated so that the noise is directed away from noise-sensitive areas. Attendant operators of the plant can also benefit from this acoustical phenomenon by sheltering, when possible, in the area with reduced noise levels.
>
> Acoustic covers to engines should be kept closed when the engines are in use and idling. The use of compressors that have effective acoustic enclosures and are designed to operate when their access panels are closed is recommended.*
>
> Materials should be lowered whenever practicable and should not be dropped. The surfaces on to which the materials are being moved could be covered by resilient material."

Other forms of noise control at source relevant to the development works are set out below:

- For mobile plant items such as cranes, dump trucks, excavators and loaders, the installation of an acoustic exhaust and or maintaining enclosure panels closed during operation can reduce noise levels by up to 10dB. Mobile plant should be switched off when not in use and not left idling.
- For percussive tools such as pneumatic concrete breakers and tools a number of noise control measures include fitting muffler or sound reducing equipment to the breaker 'tool' and ensure any leaks in the air lines are sealed. Erect localised screens around breaker or drill bit when in operation in close proximity to noise sensitive boundaries.

- For concrete mixers, control measures should be employed during cleaning to ensure no impulsive hammering is undertaken at the mixer drum.
- For all materials handling ensure that materials are not dropped from excessive heights, lining drops chutes and dump trucks with resilient materials.
- Demountable enclosures can also be used to screen operatives using hand tools/ breakers and will be moved around site as necessary.
- All items of plant should be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

9.6.1.3 Screening

Typically screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to all other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen and its position relative to both the source and receiver.

Screening may be a useful form of noise control when works are taking place at basement and ground level to screen noise levels at ground floor adjacent buildings.

In addition, careful planning of the site layout should also be considered. The placement of site buildings such as offices and stores and in some instances materials such as aggregate can provide a degree of noise screening if placed between the source and the receiver. The use of localised mobile (mobile hoarding screens and / or acoustic quilts) to items of plant with the potential to generate high levels of noise are an effective noise control measure. These options should be considered when percussive works are taking place in close proximity to the nearest sensitive perimeter buildings.

9.6.1.4 Liaison with the Public

A designated noise liaison should be appointed to site during construction works. All noise complaints should be logged and followed up in a prompt fashion by the liaison officer. In addition, prior to particularly noisy construction activity, e.g. demolition, breaking, piling, etc., the liaison officer should inform the nearest noise sensitive locations of the time and expected duration of the noisy works.

9.6.1.5 Hours of Work

Construction works will be undertaken within the times below, taken from the Section 6 of the Construction and Environmental Management Plan:

- Monday to Friday 07:00 to 19:00hrs
- Saturday 07:00 to 14:00hrs
- Sunday and Public Holidays No noisy work on site.

9.6.2 Operational Stage

9.6.2.1 Building Services Plant

During the detailed design of the development, the selection and location of mechanical and electrical plant will be undertaken in order to ensure the noise emission limits set out in Section 9.2.2.1 above are not exceeded. Plant items in the proposed development are limited to domestic heating and ventilation equipment and therefore no specific mitigation measures are required.

9.6.2.2 Additional Traffic on Surrounding Roads

During the operational phase of the development, noise mitigation measures with respect to the (outward) impact of traffic from the development are not deemed necessary.

9.6.2.3 Inward Impact

At detailed design stage, a glazing and vent specifications fulfilling the requirements in Section 9.5.4.2 will ensure suitable internal noise levels.

9.7 Residual Impact of the Proposed Development

This section summarises the likely noise impact associated with the proposed development, taking into account the mitigation measures.

9.7.1 Construction Phase

During the construction phase of the project there will be a short-term noise impact on nearby noise sensitive properties from site activities and the close proximity of adjacent buildings. The application of binding noise limits, hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration are kept to minimised. For the nearest noise sensitive locations within 50m of the proposed development, negative, significant and temporary effects are likely.

For the majority of noise sensitive locations at greater distances from the proposed development, negative, moderate and short-term effects are likely.

9.7.2 Operational Phase

9.7.2.1 Building Services Plant

With the application of mitigation measures for building services noise as described in Section 6.2.1, the range of potential noise levels is not expected to add significantly to the existing noise environment. The resultant noise effect from this source will be of neutral, not significant, permanent impact.

9.7.2.2 Additional Traffic on Surrounding Roads

The predicted change noise levels associated with additional traffic is predicted to be of imperceptible impact along the existing road network. In the context of the existing noise environment, the overall effects from noise contribution of increased traffic is considered to be of neutral, imperceptible and permanent effect to nearby noise sensitive locations.

10 LANDSCAPE AND VISUAL IMPACT

10.1 INTRODUCTION

PC Roche & Associates have been engaged to complete the Landscape and Visual Impact Assessment chapter of an EIAR to support an SHD application to be submitted to An Bord Pleanala for 384 residential dwelling unit, a creche, landscape works and all ancillary development on lands at Ballykeeffe, Raheen, Limerick.

This chapter has been prepared by Cass Roche, the principal of PC Roche and Associates. Cass is a qualified Landscape Architect with over 20 years of experience. He holds a Diploma in Physical Planning from Trinity College Dublin, along with continued professional development courses in Computer Aided Design and Town Planning Development from University College Dublin. He is also a lecturer of Landscape Planning and Garden Design at Beechfield College. Cass is a full member of the Landscape Institute London.

The Landscape and Visual Impact Assessment of the proposed development examines the impact of the proposed development on the receiving environment in terms of both the physical landscape and the visual appearance.

10.2 METHODOLOGY

The methodology used for the landscape and visual assessment was as follows;

Desktop Evaluation – A desktop survey was undertaken which included an examination of detailed maps, Ordinance Survey data, Topographical Survey data, aerial photography. This also included the Limerick County Development Plan 2010-2016 and the Southern Environs Plan 2021-2017.

Site Inspection – The site was inspected on various dates from 2019-2021 with September 2021 the most recent visit. Site visits included photographical surveys of the subject site and the surrounding area.

Evaluation of Design - The Landscape plan and visual impact was developed in close consultation with the project Design Team to determine appropriate locations for different scales of development (open space, houses, apartment blocks etc). This was conducted on a continuous basis as the development design evolved to the final design concept.

Guidance Documents

The structure for assessing the landscape impact of the proposed development is based upon the following guidelines:

- Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports – *EPA, July 2017*
- Guidelines for Landscape and Visual Impact Assessment – *Landscape Institute & I.E.M.A., UK 2013)*
- Limerick County Development Plan 2010-2016 (as amended) – *Limerick City and County Council 2010*
- Southern Environs Local Area Plan 2021 – 2027 – *Limerick City and County Council*

The criteria for describing the significance, quality and duration of the effects of the proposed development are outlined in Table 10.1 below as provided within the 2017 EPA report *Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*:

Significance of Effects	**Criteria**
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 or intensity alters a sensitive aspect of the environment.

Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment
Profound Effects	An effect which obliterates sensitive characteristics.
Quality of Effects	**Criteria**
Positive Effects	A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).
Neutral Effects	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
Negative/Adverse Effects	A change which reduces the quality of the environment (for example, lessoning species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).
Duration and Frequency of Effects	**Criteria**
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 that can be undone, for example through remediation or restoration.

Table 10.1: Assessment Criteria Relating to Assessment of Landscape and Visual Impact.

In terms of visual impact, classification of the magnitude of change takes into account the size or scale of the intrusion of development into the view (relative to the other elements and features in the composition, i.e. its relative visual dominance), the degree to which it contrasts or integrates with the other elements and the general character of the view, and the way in which the change will be experienced (e.g. in full view, partial or peripheral, or glimpses). It also takes into account the geographical extent of the change, the duration and the reversibility of the visual effects. Five categories are used to classify magnitude of change to a view. These range from Very High to Negligible as shown in Table 10.2.

Magnitude of Change	Description
Very High	Full or extensive intrusion of the development in the view, or partial intrusion that obstructs valued features or characteristics, or introduction of elements that are completely out of character in the context, to the extent that the development becomes the dominant the composition and defines the character of the view and the visual amenity.
High	Extensive intrusion of the development in the view, or partial intrusion that obstructs valued features, or introduction of elements that may be considered uncharacteristic in the context, to the extent that the development becomes co-dominant with other elements in the composition and affects the character of the view and the visual amenity.
Medium	Partial intrusion of the development in the view, or introduction of elements that may be prominent but not necessarily uncharacteristic in the context, resulting in change to the composition but not necessarily the character of the view or the visual amenity.
Low	Minor intrusion of the development into the view, or introduction of elements that are not uncharacteristic in the context, resulting in minor alteration to the composition and character of the view but no change to visual amenity.
Negligible	Barely discernible intrusion of the development into the view, or introduction of elements that are characteristic in the context, resulting in slight change to the composition of the view and no change in visual amenity.

Table 10.2: Magnitude of Visual Change

Visual receptor sensitivity is a function of two main considerations: Susceptibility of the visual receptor to change. This depends on the occupation or activity of the people experiencing the view, and the extent to which their attention or interest is focussed on the views or visual amenity they experience at that location. Value attached to the view. This depends to a large extent on the subjective opinion of the visual receptor but also on factors such as policy and designations (e.g. scenic routes, protected views), or the view or setting being associated with a heritage asset, visitor attraction or having some other cultural status (e.g. by appearing in arts). For the purpose of assessment, five categories are used to classify a viewpoint's sensitivity as shown in Table 10.3.

Sensitivity	Description
Very High	Viewers at iconic viewpoints - towards or from a landscape feature or area - that are recognised in policy or otherwise designated as being of high value or national value. This may also include residential viewers who are focussed to a large extent on the view.
High	Viewers at viewpoints that are recognised in policy or otherwise designated as being of value, or viewpoints that are highly valued by people that experience them regularly (such as views from houses or outdoor recreation features) and views which are valued by the local community. This would include tourist attractions, and heritage features of regional or county value, and viewers travelling on scenic routes.
Medium	Viewers at viewpoints representing people travelling at slow or moderate speed through or past the affected landscape in cars or on public transport, where they are partly but not entirely focused on the landscape, or where the landscape has some valued views. The views are generally not designated, but which include panoramic views or views judged to be of some scenic quality, which demonstrate some sense of naturalness, tranquillity or some rare element in the view.
Low	Viewers at viewpoints reflecting people involved in activities not focused on the landscape e.g. people at their place of work or engaged in similar activities such as shopping, etc. The view may present an attractive backdrop to these activities but there is no evidence of that the view is valued, and not regarded as an

	important element of these activities. Viewers travelling at high speeds (e.g. motorways) may also be considered of low susceptibility.
Negligible	Viewpoints reflecting people involved in activities not focused on the landscape e.g. people at their place of work or engaged in similar activities such as shopping where the view has no relevance or is of poor quality and not valued.

Table 10.3: Sensitivity of Visual Receptor

The significance of effects can be measured as a function of the magnitude of change (i.e. the degree of change from the baseline) and the sensitivity of the receptor. Table 10.4 below is a guide in determining the significance of effects. It is noted that the assessor's judgement and common sense are also factors when determining significance of effects.

		Sensitivity of the Resource				
		Very High	**High**	**Medium**	**Low**	**Negligible**
Magnitude of Change	**Very High**	Profound	Profound-Very Significant	Very Significant-Significant	Moderate	Slight
	High	Profound-Very Significant	Very Significant	Significant	Moderate-Slight	Slight-Not Significant
	Medium	Very Significant-Significant	Significant	Moderate	Slight	Not Significant
	Low	Moderate	Moderate-Slight	Slight	Not Significant	Imperceptible
	Negligible	Slight	Slight-Not Significant	Not Significant	Imperceptible	Imperceptible

Table 10.4: Significance of Effect

The criteria outlined in Table 10.1, Table 10.2, Table 10.3 and Table 10.4 above landscape and visual assessment methodology will be utilised in conjunction with a professional evaluation of the proposed development to determine the likely significant effects of the project and the degree of effect. The term ‘study area’ as used in this report refers to the site itself and its wider landscape context in the study of the physical landscape and landscape character. This may extend for approximately 1km in all directions from the site in order to achieve an understanding of the overall landscape. In terms of the visual assessment, the study of visual amenity may extend outside the study area, from areas where views of the site are available, but the majority of visual effects for a development of this nature would be most significant within 100m.

10.3 BASELINE ENVIRONMENT

The proposed development site is located within Ballykeeffe, Raheen, Limerick. The site forms part of a larger land ownership of the applicant as detailed on the separate Masterplan drawing submitted.

Figure 10.1: Site Location Context

North – To the north of the development site are lands zoned for open space. These lands are owned by the applicant, DW Raheen Developments Ltd. A masterplan has been prepared for the future development of these lands should a change in the current zoning designation be achieved in the future. It is considered that in terms of visual impact, receptors to the north are low sensitivity given that there are no existing residential dwellings and views from the north will mainly occur when travelling down the R510. Mature trees are to be retained along the R510 to shield the development and reduce visual impact.

South – The south of the development site is bounded by the Inis Mor Housing estate and the Ballinvoher housing estate to the south-eastern boundary. The subject site level is lower than that of the Ballinvoher estate. However, it is considered that views from the south of the development site will be highly sensitive given the proximity of the houses to the proposed development. The proposed development along the southern boundary includes two storey dwellings and to the south east, dormer bungalows which will significantly reduce the visual impact of the development when viewed from the south. It is also noted that the higher buildings (four storey maximum) are located away from the southern boundary which will also reduce the potential visual impact.

East - The eastern boundary of the site is also bordered by the lands owned by the applicant but zoned for open space at present, as seen in the North section above. To the south-east, the site adjoins the Ballinvoher residential estate.

West – To the western boundary of the development site is the R510 Regional Road. The existing roundabout to the south-west will provide the access point to the proposed development. Across the R510 to the west is mainly undeveloped lands with some existing residential housing in the Ard Aulin estate. Views from the west are considered to be moderately sensitive to the proposed development, particularly from the existing residential dwellings. The development proposal includes retention of the mature trees along the western boundary of the subject site which will act as an important screen when viewed from the west.

There are no protected views recorded within the proposed site or within the immediate surrounding area.

10.4 SENSITIVITY OF LANDSCAPE

In landscape terms this site is categorised as being within the Limerick County Council Administrative Area and is not included in any other Landscape Character Assessment designations. In September 2015, in accordance with Section 28 of the Electoral, Local Government and Planning and Development Act 2013, 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 County Development Plan will continue to have effect until a new Development Plan for Limerick City and County is adopted.

There are no protected views or prospects and no Tree Preservation Orders within the site. Furthermore, the site is zoned for development within the Development Plan and the Southern Environs Local Area Plan. Within the site the ecological assessment has identified some habitats as being of Local Importance. There are no Natura 2000 Protected Areas or nationally designated NHA or pNHA within the site.

It is considered that the subject site has Low Sensitivity in terms of development. While the proposed development would significantly change the existing landscape of the site, this is deemed typical of any residential development that would occur on a site zoned for such a use.

10.5 VISUAL SENSITIVITY

Visual receptors have greater potential sensitivity to change in the landscape. This sensitivity is reduced by the following existing factors:

- The distances from the site to some of the visual receptors is relatively large and therefore the sensitivity is accordingly diminished.
- There are visual barriers for many of the receptors, including fencing, existing hedgerows/trees, tree planting, etc. Sensitivity of views is also mitigated by the residential zoning designation of the lands.

Sensitivity of visual receptors is therefore considered to be low other than when considering existing residential dwellings to the south, southeast and in some cases from the west across the R510 road where there are direct views of the development.

10.6 CHARACTERISTICS OF PROPOSED DEVELOPMENT

The proposed development is set out in the statutory notices as follows;

DW Raheen Developments Ltd. are seeking a ten year permission for a strategic housing development consisting of the provision of 384 residential house and apartment units on a ca. 10.44 hectare site located in Ballykeeffe, Raheen, Co. Limerick.

The site is greenfield land that is enclosed by existing residential development to the south and east, the R510 to the west and open land to the north. Access to the site is provided by an existing entrance off a roundabout on the R510 regional road.

The proposed development will provide as follows:

202 no. housing units, comprising a variety of forms to include bungalows, detached, semi-detached and terraced houses. A mix of house sizes are proposed to include 20 no. two bedroom houses, 156 no. three bedroom houses and 26 no. four bedroom houses.

182 apartment and duplex units across 25 small scale blocks, 2 to 4 storeys in heights, throughout the development. The apartments and duplexes provide a mix of one, two, three and four bed units, comprising of 10 no. four bedroom duplex units, 10 no. three bedroom duplex units, 6 no. two bedroom duplex units, 18 no. three bedroom apartments, 92 no. two bedroom apartments and 46 no. one bedroom apartments.

The proposed development also includes;

A childcare facility measuring 761.75m^2, providing 79 childcare places (55 full time and 24 after school places), located at the south-western edge of the development.

The provision of 377 no. car parking spaces and 311 secured bicycle parking spaces.

The provision of 3 no. ESB sub-stations, ancillary services and infrastructure works including foul and surface water drainage, attenuation areas, landscaped public open spaces (approximately 29,500m^2, or 28.2% of the total site area), landscaping, lighting, internal roads, cycle paths, and footpaths.

A Natura Impact Statement (NIS) and Environmental Impact Assessment Report (EIAR) have been prepared in respect of the proposed development.

The development is primarily residential in nature and includes bungalows, two storey houses, apartments and duplex units. The highest proposed building is set at four storeys. The four storey elements of the design are located along the western boundary and within the centre of the development, intentionally away from the southern and eastern boundaries with the existing residential dwellings. The four storey elements are highlighted in orange, teal and purple on Figure 10.2 below which is an extract from drawing no. 1704-10-101 as submitted within the architectural drawing pack under a separate cover.

Figure 10.2: Extract from Drawing No. 1704-10-101 Site Plan

Landscaping works within the proposed development are extensive with approx. 28% of the overall development given to open space. The largest area of open space is located to the north-west of the site and contains a playground and dog run area. The proposed landscaping plan is submitted under a separate cover with an extract shown in Figure 10.3 below.

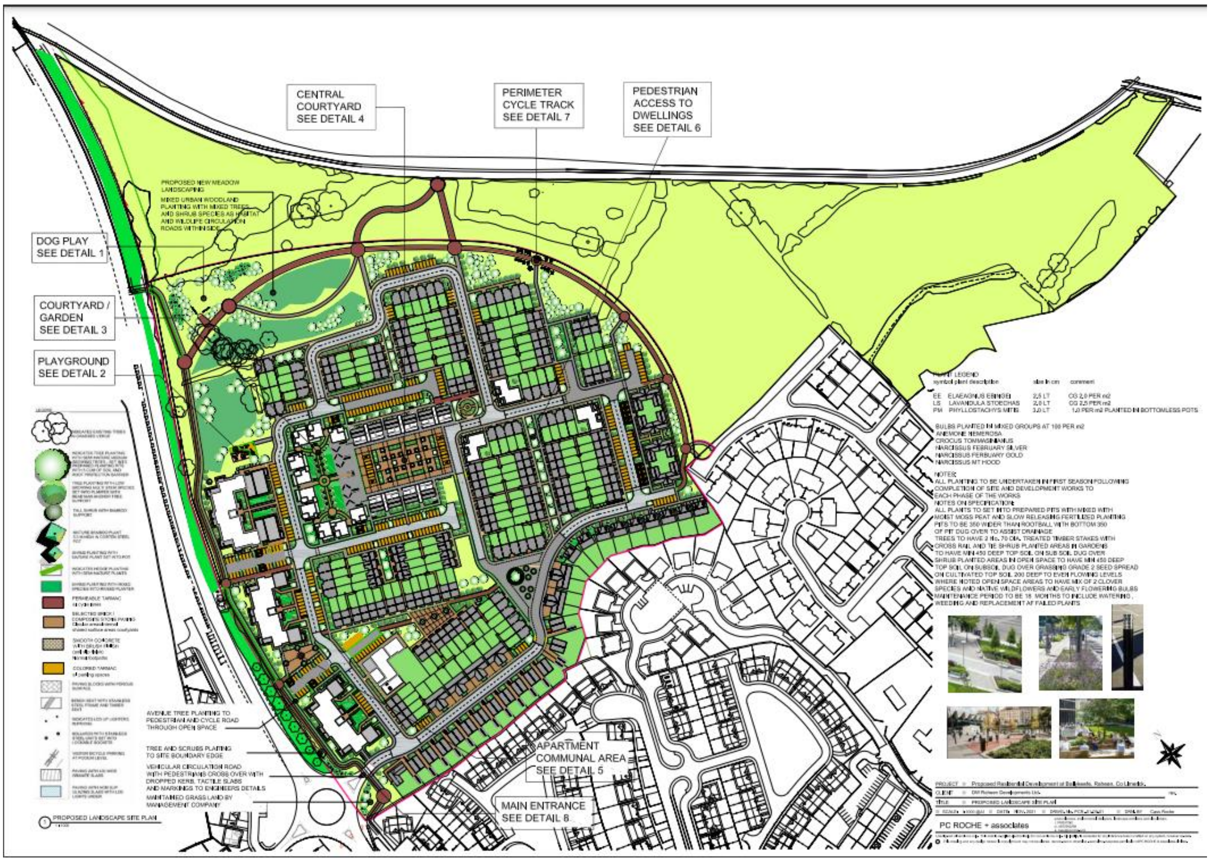

Figure 10.3: Proposed Landscaping Plan (Extract from submitted Drawing No. PCR-01-09-01)

It is acknowledged that while all development will result in some impact on landscape and visual impact by its very nature, the landscaping and potential visual impact has informed the design of the proposed development throughout the design process in an effort to provide a sustainable development, minimising potential impacts.

10.7 ASSESSMENT OF VISUAL IMPACT

7 No. Photomontages have been prepared to illustrate the visual & physical character of the proposed residential development within the surrounding landscape. All views have been taken from publicly accessible places where a visual impact can arise. The photomontages have been prepared around the site to demonstrate the appearance of the buildings and proposed landscape. The impact of the

development on each viewpoint is described below. Figure 10.4 shows a key plan of where each of the viewpoints has been taken.

Figure 10.4: Viewpoint Key Plan

Viewpoint No. 1

Viewpoint No. 1	
Location	North from the Inis Mór estate
Description of Existing View	The subject site is not visible from within the residential estate except from those houses which adjoin the southern boundary of the subject site. The subject site can be viewed from the rear upper windows of the adjoining houses.
Sensitivity of Visual Receptor	High – Visual receptors will be local residents within the Inis Mór estate who are considered to be of High sensitivity.

Proposed View Description	The development will be visible from this location once complete. Houses which adjoin the site will back on to the development and the proposed two storey houses will be visible, as in a typical suburban development with adequate separation distances exceeding the 22m requirement between first floor windows.
Magnitude of Change	Medium – While the development will be visibly obvious for the adjoining houses, it is considered characteristic of suburban development
Significance of Effect	Significant – The site is zoned for residential development and it is likely that any such development in this location would change the view from this viewpoint.

Viewpoint No. 2

Viewpoint No. 2	
Location	South along the R510 road
Description of Existing View	The subject site is obscured by existing trees along the R510 road, particularly when the trees are in bloom. At present, hoarding is in place surrounding the subject site which further obscures any view from this viewpoint
Sensitivity of Visual Receptor	Low – The site is visible from the R510 as travellers are passing at speed along the road.

Proposed View Description	The four storey apartment buildings along the eastern side of the development are visible, particularly when the existing trees have no leaves. Although visible, the development is within the existing character of the area.
Magnitude of Change	Low – The development provides a minor intrusion to the existing view but is within character for the area.
Significance of Effect	Not significant - Defined as '*An effect which causes noticeable changes in the character of the environment but without significant consequences*'.

Viewpoint No. 3

Viewpoint No.	
Location	View east from the Ard Aulin estate
Description of Existing View	The existing view of the subject site from this location consists of hoarding which is currently in place to secure the site.
Sensitivity of Visual Receptor	High – Due to the proximity to the subject site, the sensitivity at this location is considered to be high.

Proposed View Description	The proposed view includes the four storey apartment buildings on the eastern side of the site as well as some two storey houses. The proposed view is considered typical in terms of residential development and within character of the surrounding area.
Magnitude of Change	Medium – While the development is prominent at this location, it is within the character of the surrounding residential development.
Significance of Effect	Significant and neutral effect – The site is zoned for residential development and it is likely that any such development in this location would change the view from this viewpoint.

Viewpoint No. 4

Viewpoint No. 4	
Location	View north from the public footpath along the R510 road
Description of Existing View	The existing view is obscured by hedging and trees along the eastern side of the R510. The site is obscured from this location.
Sensitivity of Visual Receptor	Low-Medium – Views from this location are passing in nature as cars/pedestrians/cyclists are travelling along the R510 road.

Proposed View Description	From this viewpoint, the proposed four storey apartment buildings to the west of the development site are visible. The existing trees and hedging along the R510 provide screening to the development. Viewpoint No. 4 was taken when the trees are without leaves and as such, the development would be more effectively screened during seasons when the trees are in bloom.
Magnitude of Change	Low – The apartments along the eastern boundary of the development will result in a minor alteration to the composition of the existing view.
Significance of Effect	Not Significant – Defined as '*An effect which causes noticeable changes in the character of the environment but without significant consequences*'.

Viewpoint No.5

Viewpoint No. 5	
Location	View to the north from the Inis Mór estate which adjoins the R510 road.
Description of Existing View	The subject site is not visible from this location other than by those that adjoin the site. The current view from the adjoining houses is that of hoarding surrounding the site for security. From the upstairs rear windows of the adjoining houses, the site is visible as undeveloped agricultural lands with sporadic tree and hedging on the site.

Sensitivity of Visual Receptor	High – Visual receptors will be local residents within the Inis Mór estate who are considered to be of High sensitivity.
Proposed View Description	From the wider Inis Mór estate, the top floor of the four storey apartment buildings will be visible from the road and pathways. In terms of the adjoining houses on the boundary with the subject site, lower density and height development is proposed on the southern side of the development to reduce the visual impact on these houses to that typical of suburban residential development. From upstairs rear windows, the four storey apartment buildings will be visible.
Magnitude of Change	Medium – This is defined as '*Minor intrusion of the development into the view, or introduction of elements that are not uncharacteristic in the context, resulting in minor alteration to the composition and character of the view but no change to visual amenity'*
Significance of Effect	The effect is considered Significant, and the quality of the effect is Neutral. The proposed development represents a response to the zoning of the site for residential development and in this regard, the nature of the visual effect is not unusual

Viewpoint No.6

Viewpoint No. 6	
Location	North-West from the Father Russell Road
Existing View	The subject site is not visible from this location. The view shown is that of a small, local retail/service centre with predominantly two storey building.
Sensitivity of Visual Receptor	Low – The activity of the current retail/service provision in this area are considered to have low sensitivity.

Proposed View Description	The subject site is not visible at this location and as such, the view will not change.
Magnitude of Change	There will be no change experienced at this location.
Significance of Effect	There is no significance of effect to be considered at this location.

Viewpoint No.7

Viewpoint No. 7	
Location	North-West from Ballinvoher Estate
Description of Existing View	The existing view at this location consists of hoarding surrounding the development site for security.
Sensitivity of Visual Receptor	High – Visual receptors will be local residents within the Ballinvoher estate who are considered to be of High sensitivity.

Proposed View Description	The proposed views include single storey retirement homes and dormer bungalows. The reduced height of the dwellings in this area of the site somewhat reduces the visual impact at this location. The subject site is also at a lower level than the Ballinvoher estate which also reduces the visual impact of the new development.
Magnitude of Change	Medium – While the development will be obvious at this location, it introduces elements that are within the character of the area.
Significance of Effect	The effect is considered Significant, and the quality of the effect is Neutral. The proposed development represents a response to the zoning of the site for residential development and in this regard, the nature of the visual effect is not unusual.

10.8 POTENTIAL IMPACTS

The potential impacts are the impacts that the development could have without consideration of landscape mitigation or amelioration in place. For the sake of clarity Landscape Impacts and Visual Impacts will be assessed separately. Impacts are considered under the following headings: -

- Short-Term Impacts – Construction phase up to seven years
- Short-Term Impacts – Operation phase up to seven years
- Medium-Term Impacts – Operational phase from seven to fifteen years
- Long-Term Impacts – Operational phase from 15 to sixty years

These effects have been compiled to identify any areas where the proposed development may be injurious to the scenic and visual character of the area and represent the potential impact rather than the eventual long-term effect. For this section, it is assumed that no specific landscape works are carried out with the construction of the development and that the open spaces are as existing i.e. grassed areas. This enables recognition of potential, rather than actual, impacts which facilitates the identification of suitable landscape mitigation measures.

Do Nothing Scenario

The 'Do Nothing' impact refers to potential impacts should the proposed development not proceed. In relation to the subject site, it would remain in agricultural use and the opportunity to develop 384 dwelling units, creche facility, open space, landscaping and ancillary development would be lost. However, the subject site is zoned for residential development and it is anticipated that even if the proposed development were not to move ahead, another development proposal on the subject site would be likely in the future in line with the zoning objectives on the site. There are no landscape or visual impacts associated with the 'Do Nothing' scenario.

Construction Phase Landscape

This landscape will undergo a significant change from the existing agricultural use to a construction site. Construction is to take place over a seven year period in four no. phases. There will be significantly negative impacts on the landscape associated with the construction works of this development. This will be due to the site clearance and the building processes required to erect the proposed development and associated works. Negative impacts in this case are considered short-term in nature and only the current, under construction, phase of development will produce negative impact.

Construction Phase Visual

During the construction phase, the following elements of the proposed development have the potential to cause visual impacts;

- Construction works entrances into the proposed development

- Temporary site works – hoarding, lighting, cranes, car parking, storage areas
- Construction traffic – dust and emissions
- Tree and vegetation clearance
- Groundworks – cut and fill excavations

The visual impacts at construction phase on the 7 no. views as detailed in section 10.7 above are described in table 10.5 below.

View	Quality	Significance	Magnitude	Probability	Duration	Sensitivity
No.1	Negative	Significant	Medium	Likely	Short-Term	High
No.2	Negative	Not significant	Low	Likely	Short-Term	Low
No.3	Negative	Significant	Medium	Likely	Short-Term	High
No.4	Negative	Not-Significant	Low	Likely	Short-Term	Low-Medium
No.5	Negative	Significant	Medium	Likely	Short-Term	High
No.6	Negative	No effect	No change	Likely	Short-Term	Low
No.7	Negative	Significant	Medium	Likely	Short-Term	High

Table 10.5: Construction Phase Likely Impacts Without Mitigation

Operational Phase Landscape

Following construction, the main landscape impacts of the proposed development are associated with the change in land use from agricultural lands to a more intensified, residential use, as set out in the Limerick City and County Council zoning designation. This is considered to be a slight negative impact, as the existing landscape is classified as low sensitivity given the overgrown nature of the landscape at present. Although this is considered a short-term impact, it would likely persist into the medium and long term in the absence of mitigation measures.

Operation Phase Visual

During the operational phase the principal elements which have potential to give rise to visual impact are:

- Road entrance to the proposed development off existing roundabout
- Height of proposed buildings
- New structures, roads, lighting, boundaries and pathways
- Proposed tree and shrub planting
- Change of character due to intensification of use, from agricultural lands to residential use

10.9 MITIGATION

Consideration was given to the avoidance of impacts wherever possible during the design of the proposed scheme. Mitigation and avoidance measures have been designed into the proposed development and the landscaping plan and are an integral factor reducing the potential for adverse landscape effects of the proposed development. The landscape illustrates a variety of design proposals, which will introduce a positive aesthetic quality to the area. However, as with any development some degree of impact is inevitable and wherever possible measures have been proposed to mitigate any possible adverse impacts.

10.9.1 Construction Phase

During the construction phase, site hoarding will be erected to restrict views of the site during construction. Hours of construction activity will also be restricted in accordance with local authority guidance. Tree protection measures will be installed to the existing trees and hedges identified for retention on site within the Arboricultural assessment submitted under a separate cover.

Visual impact during the construction phase will be mitigated somewhat through appropriate site management measures and work practices to ensure the site is kept tidy, dust is kept to a minimum, and that public areas are kept free from building material and site rubbish.

10.9.2 Operation Phase

Mitigation measures during the operational phase of the development are as follow;

All planting is to be undertaken in the first season following completion of site and development works of each phase of development.

Native trees, shrubs and wildflowers will be used where possible throughout the development.

Where possible, screening of proposed structures with tree lines and woodland planting is proposed.

Detailed landscape design details mitigating the impact of the development are included within the Landscape drawings prepared by PC Roche & Associates and submitted under a separate cover.

10.10 RESIDUAL IMPACTS

Given the zoning policy for the subject site, development of this site is inevitable and it is considered likely that any proposed viable development will give rise to similar impact as those described above. While none of the proposed measures, as discussed in the previous section, can fully mitigate against the intensification of land use, as it changes from agriculture use into a residential development, the proposal will be of benefit both locally and to the wider surrounding area by:

Increasing the quantity and quality of planning within the site.

Provision of extensive open space and public amenity areas which were previously inaccessible to the public including a playground and dog-run area.

Long-term maintenance of the landscape.

Whilst it is inevitable that there will be some negative impacts arising from a development of this scale, it is considered that the benefits substantially outweigh the limited negative aspects of the proposal, resulting in the potential for moderate, positive, and permanent residual impacts.

10.11 MONITORING

10.11.1 Construction Phase

Landscape tender drawings and specifications will be produced at detailed design stage to ensure that the landscape works are implemented in accordance with best practice. This document will include tree work procedures, soil handling, planting and maintenance. The contract works will be supervised by a suitably qualified landscape architect.

10.11.2 Operational Phase

Operational phase monitoring will include weed control, maintenance and replacement planting where necessary. Periodic visits will be required to ensure that any defects that may occur are rectified, that the landscape proposals are successfully establishing and being correctly maintained.

10.12 CUMULATIVE EFFECTS

It is not considered that there will be any cumulative impacts on landscape and visual impact as there are no developments of scale proposed within the immediate area of the site or from where the site is visible. However, any future development within the vicinity of the subject site could have the possibility of impacting on the same sensitive receptors as identified above. This could lead to potential impacts of a slightly higher level of significance on the identified receptors when assessed cumulatively. The impact of future development cannot be fully quantified at this stage but would likely involve visual impact and potential loss of vegetation.

10.13 INTERACTIONS

The assessment of the landscape and visual impact associated with the proposed development will interact with other areas of assessment contained within this EIAR. It is considered that areas of interaction are Population and Human Health and Biodiversity.

The interactions were considered as follows:

Population and Human Health – The landscape and visual impact associated with human beings focuses on the effects to dwellings. The proposed development generates visual effects; the significance of effects and associated mitigation are discussed in sections 10.7, 10.8 and 10.9 of this chapter.

Biodiversity – The long-term effects of the proposed development will have a positive impact on the tree cover associated with the development and the inclusion of native species of shrub planting.

11.0 TRAFFIC AND TRANSPORTATION

11.1 INTRODUCTION

This chapter of the EIAR has been prepared on behalf of DW Raheen Developments Limited, by Matthew Steele BA (Hons) MSc FCILT FRGS MCIHT and Pamela Townley BSc (Hons), both Directors of TTRSA with over twenty years experience of assessing the traffic and transport impacts of development.

The chapter provides an assessment of the traffic and transport related impacts of '*A ten year permission for a strategic housing development consisting of the provision of 384 residential house and apartment units on a ca. 10.44 hectare site located in Ballykeefe, Raheen, Co. Limerick*'. The proposed development depicted on Gleeson McSweeney Drawing No. 1704-10-SLP-T, dated September 2021(Figure 11.1)[12], on which the assessment contained within this chapter is based,will be accessed via an existing roundabout junction on the R510 regional road.

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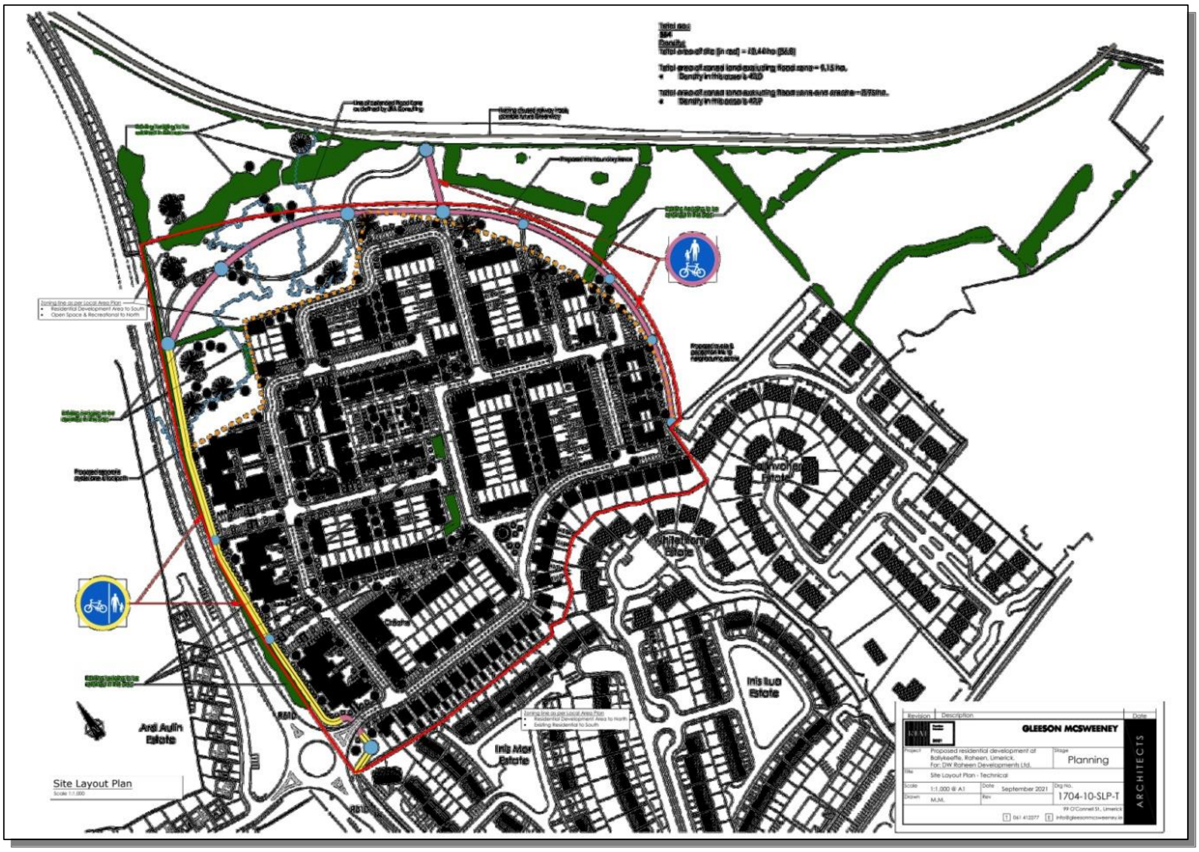
[12] Any OSI copyrighted content is used in accordance with TTRSA OSI Licence ref. CYAL50240155

Figure 11.1 – The Proposed Development



11.2 METHODOLOGY

The methodology adopted for the production of this chapter is detailed within this section, including: relevant legislation and guidance; consultation; the approach to assessment; and, significance criteria.

11.2.1 Legislation and Guidance

Relevant guidance on assessing the impact of a development on roads, traffic and transport is contained within: the TTA guidelines produced by Transport Infrastructure Ireland (TII)[13]; and, the Environmental Protection Agency (EPA) Guidelines on the information to be contained in

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[13] Transport Infrastructure Ireland (2014) PE-PDV-02045 Traffic and Transport Assessment Guidelines accessible at [www.tiipublications.ie/library/PE-PDV-02045-01.pdf]

Environmental Impact Assessment Reports[14]. The latter states that traffic impact should be assessed for the construction phase, operational phase, and for unplanned events such as traffic collisions (road safety).

The development site is an area covered by the Limerick City Development Plan 2010-2016 (as extended)[15], and the development management standards contained within the Development Plan therefore apply. The guidance and standards contained within the Design Manual for Urban Roads and Streets (DMURS)[16] also apply to this development, and in part, supersede the development management standards contained within the Development Plan.

The chapter is also written with cognisance of the Draft Limerick Shannon Metropolitan Area Transport Strategy[17].

11.2.2 Consultations

Prior to the preparation of this chapter of the EIAR, consultation discussions have been held between Hutch O'Malley Consulting Civil & Structural Engineers and Limerick City and County Council. These discussions covered a number of topics including related to the technical specifications relevant to the design of the proposed development.

11.2.3 Approach to Assessment

The traffic and transport impacts of the proposed development have been assessed by utilising the following approach based on the aforementioned TTA guidelines. The assessment combines:

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[14] Environmental Protection Agency (2017) Guidelines on the information to be contained in Environmental Impact Assessment Reports

[15] www.limerick.ie/sites/default/files/media/documents/2018-10/Limerick%20City%20Development%20Plan%202010-2016%20%28Including%20Variations%202-6%29%202018-10-02.pdf

[16] DTTAS (2019) Design Manual for Urban Roads and Streets (2nd Edition) accessible at [www.dmurs.ie]

[17] NTA (2020) Draft Limerick Shannon Metropolitan Area Transport Strategy accessible at [www.nationaltransport.ie/wp-content/uploads/2020/09/Draft_LSMATS_Report.pdf]

- Desktop study, for example of assessing traffic collision data made publicly available by the Road Safety Authority, and reviewing and processing traffic movement data made available by DW Raheen Developments Limited;
- Site based field work;
- Traffic modelling, including:
    - the factoring of traffic count data to construction, opening and future assessment years;
    - predicting the number of daily and peak hour trips during the operational phase of the development;
    - using this aforementioned information to model the capacity of the following junctions using ARCADY traffic modelling software package: the R510/Ard Aulin/site access roundabout junction; the R510/Mungret Road/Father Russell Road roundabout junction; the R510/N69/N18 roundabout junction; and the N69/N18/Dock Road roundabout junction.
- Reviewing the environmental impact of traffic related to the operation of the proposed development, including road safety; and,
- Recommending mitigation measures to ensure that any potential roads, traffic and transport effects are kept to a minimum.

11.2.4 Significance Criteria

The main significance criteria when assessing traffic and transport impacts is the performance of affected junctions. Other criteria include, for example: any increase in road traffic collisions (which may result in environmental impacts due to spillage); likely damage to the road structure; and, measurable increases in noise and atmospheric pollutants. When assessing significance criteria, it is always important to remain cognisant of sensitive receptors such as facilities catering for the young or elderly, where the occupants can be more susceptible to the adverse effects of exposure to environmental impacts.

11.3 THE RECEIVING ENVIRONMENT

11.3.1 R510 Regional Road

As noted in Section 11.1, the proposed development will be accessed via an existing roundabout junction on the R510 regional road. In the vicinity of the proposed development site, the R510 is formed from a single carriageway, demarcated with northbound and southbound lanes. To the north of the site access roundabout the carriageway is bounded by shoulders and wide verges, and to the south of the site access roundabout the carriageway is bounded by segregated cycle tracks. The posted speed limit is 50km/h.

11.3.2 Traffic Volumes

The traffic assessment within this chapter utilises video-based Manual Classified Traffic Counts surveys (MCC) undertaken over a 12-hour period (07:00-19:00) on Tuesday 3rd March 2020[18] by Idaso Ltd., and made available to TTRSA by DW Raheen Developments Limited. The MCC cover the following junctions:

- R510/Ard Aulin/site access roundabout junction;
- R510/Mungret Road/Father Russell Road roundabout junction;
- R510/N69/N18 roundabout junction; and,
- N69/N18/Dock Road roundabout junction.

From these traffic count surveys, the local AM and PM peak hours assessed within this report are 08:00-08:59 and 17:00-17:59, respectively.

For the purpose of the traffic assessment contained in this chapter, Passenger Car Unit (PCU) data provided by Idaso within the aforementioned traffic count surveys has been used. This PCU data assigns factors of: 0.2 for pedal cycles; 0.4 for motorcycles; 1.0 for cars and light goods vehicles (LGV) including those towing trailers; 1.5 for rigid Heavy Commercial Vehicles (HCVs); 2.3 for articulated

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[18] Industry best practice considers that traffic counts have a validity of three years as long as traffic growth and development impact in the intervening period are taken into account

HCVs; and, 2.0 for buses and coaches. The MCC data, including PCU values are included within Appendix 11.1.

It should be noted that the traffic counts do not include any pedestrian crossing movements.

11.3.3 Background Traffic Growth

Subject to planning being granted, it is assumed for the purpose of this traffic assessment contained within this chapter, that the proposed development will be fully constructed during 2027. Local traffic has been growthed to a construction year of 2023, an opening year of 2027, and future assessment years of 2032 and 2042using the TII Project Appraisal Guidelines[19] link based central growth factors for the Limerick Metropolitan Area, taking into account 3.3% HCV traffic, the latter reflecting the current percentage of HCVs surveyed at the R510 site access roundabout junction. The following growth factors have been applied:

- From 2020 to 2023 a factor of 1.055;
- From 2020 to 2027 a factor of 1.133;
- From 2020 to 2032 a factor of 1.199; and,
- From 2020 to 2042a factor of 1.289.

The impact of this traffic growth is detailed within traffic calculations (input data) for the ARCADY traffic modelling included within Appendix 11-2.

11.3.4 Proposed Transport Schemes

As part of preparing this chapter, a review has been undertaken of proposed transport schemes in the vicinity of the proposed development site. A number of schemes are currently active within the area, including those related to the Mungret Masterplan/Mungret Link Streets Project and associated Local Infrastructure Housing Activation Fund (LIHAF) Link Roads. National Transport Authority Sustainable Transport Measures Grant funding was also announced on 11th February 2021 for the development of

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[19] Transport Infrastructure Ireland (2021) PE-PAG-02017 Traffic Demand Projections

the Father Russell Road Cycle Scheme. The proposed development will not be directly impact by, or impact on, the delivery of these schemes.

11.3.5 Other planned (committed) developments

As part of the preparation of this TTA, information contained within both the Limerick City and County Council Planning Enquiry system, and the An Bord Pleanála website in relation to Strategic Housing Development applications, have been reviewed to (9th March 2022). This area of the Limerick is currently rapidly developing, partly driven by the LIHAF, which is a key element of Pillar 3 of Rebuilding Ireland: An Action Plan for Housing & Homelessness. Infrastructure in the area is being improved as detailed in Section 11.3.4, and a number of planning applications have recently been granted, primarily in the area to the South of Mungret Road and West of the R510. These include for reference:

- Planning reference number: 20738 – a 1000 pupil post primary school;
- Planning reference number: 201114 – 96 residential units;
- Planning reference number: 201115 – 96 residential units;
- Planning reference number: 201195 – 66 residential units;
- Planning reference number: 21532 – 7 supporting housing units; and,
- Planning reference number: 218000 – a Part VIII development of 253 residential units.

The impact of infrastructure improvements and development traffic within the area of the proposed development has been assessed by Limerick City and County Council (in association with MHL) as part of their traffic modelling associated with the Mungret Strategic Masterplan. The traffic modelling within this Chapter has therefore been limited to the relative impact of the proposed development.

11.4 CHARACTERISTICS OF PROPOSED DEVELOPMENT

As noted in Section 11.1, the proposed development is '*a strategic housing development consisting of the provision of 384 residential house and apartment units on a ca. 10.44 hectare site located in Ballykeefe, Raheen, Co. Limerick*'. The development site is currently greenfield land that is enclosed by existing residential development to the south, east and west, and by open land to the north. The proposed development site will be served via an existing roundabout junction on the R510 regional road.

11.4.1 Site access junction geometry

The site access for the proposed development is currently constructed as a fourth arm off the existing R510 roundabout which also serves the Ard Aulin residential estate. The construction currently terminates at the site boundary adjacent to the site access. The site layout drawing for the proposed development (Figure 11.1) indicates a continuation of a 6m wide site access road in a west to east orientation. A segregated pedestrian footpath and cycle track, which crosses the site access, is shown inside the site boundary adjoining the R510.

11.4.2 Internal layout

The site layout drawing for the proposed development (Figure 11.1) indicates that the internal layout of the proposed development is formed from a network of interconnected 5.5m and 6m wide 'local streets' with additional pedestrian permeability. The block sizes are in accordance with those recommended within DMURS.

11.4.3 Internal pedestrian access provision

The site layout drawing for the proposed development (Figure 11.1) indicates a network of 2m wide pedestrian routes being provided throughout the development, with additional pedestrian connectivity also being provided to the existing Inis Mor and Ballinvoher residential estates. Potential future connectivity is also indicated to any future greenway on the railway alignment that previously served the Irish Cement site.

11.4.4 Bicycle parking

TTRSA have been informed by DW Raheen Developments Ltd. that 311 secured bicycle parking spaces will be provided within the proposed development.

11.4.5 Car parking

TTRSA have been informed by DW Raheen Developments Ltd. that 377 car parking spaces will be provided within the proposed development, including 52 within the curtilage of some houses.

11.4.6 Service vehicles

The site layout drawing for the proposed development (Figure 11.1) indicates that turning heads, suitable for turning standard fire appliances and typical 3-axle refuse vehicles, are provided at the eastern ends of the two east-west orientated cul-de-sac roads within the proposed development.

11.5 POTENTIAL IMPACTS

11.5.1 Traffic Impact

Traffic impact is typically assessed in terms of the impact of the traffic generated by a development on the operation of the local road network. Threshold levels for an increase in traffic volumes requiring assessment are typically ten percent, although it is usual to assess the performance of any access junction as the point of maximum impact, to ensure that the junction is capable of operating within capacity inclusive of the traffic generated by the development. Traffic modelling software is used to facilitate this assessment.

11.5.2 Construction phase trip generation and impact

Construction traffic will access the site via the existing roundabout junction on the R510 regional road. TTRSA have been informed that due to the nature of the development and programme for construction, is anticipated that less than 10 two-way HCV trips will enter and exit the site per day during the construction phase of the development and that no diversions will be required. A construction phase traffic management plan will also be agreed with Limerick City and County Council covering for example, timings of HCV deliveries and facilities on site for the washing of vehicles. The overall level of construction phase trip generation including HCV and workforce trips is significantly less than the threshold for assessment detailed in Section 11.5.1 and in environmental terms will be imperceptible (no measurable impact).

11.5.3 Operational phase trip generation

Each mixed-use development is unique in its composition, therefore a range of approaches have been applied to estimate trip generation. Trip rates for the proposed houses are based on existing trip rates for the Ard Aulin residential estate. Trip rates for the proposed apartments are based on existing trip rates for apartments within Limerick City. Trip rates for the proposed crèche are based on typical trip rates for crèche developments, consistent with industry standard databases such as TRICS and TRAVL.Peak hour arrival (in) and departure (out) trip rates for each element of the development are detailed in Table 11.1, and the number of peak hour trips generated are detailed in Table 11.2.

Table 11.1 – Weekday peak hour vehicular trip rates for the proposed development in PCUs

Use	Rate per GFA/Units	AM Peak Hour In	AM Peak Hour Out	PM Peak Hour In	PM Peak Hour Out
Houses	1 unit	0.217	0.538	0.411	0.271
Apartments	1 unit	0.106	0.207	0.183	0.014
Crèche	100m^2	6.399	5.250	3.281	3.610

Table 11.2 – Weekday peak hour vehicular trips generated by the (entire) proposed development in PCUs

Use	Dev GFA/Units	AM Peak Hour In	AM Peak Hour Out	PM Peak Hour In	PM Peak Hour Out
Houses	202units	44	109	83	55
Apartments	182units	19	38	33	3
Crèche	762m^2	49	40	25	27
Total development		90	120	78	76

11.5.4 Impact of Mobility Management Plan measures on operational phase trip generation

A Mobility Management Plan (MMP) has been prepared for the proposed development, and is included within Appendix 11.4. If the measures included within the MMP action plan are implemented in full, the trip generation detailed in Table 11.2 would be expected to decrease by 6.2% in the opening year of 2027 and 23.1% by the MMP target year of 2031.

11.5.5 Operational phase trip distribution and assignment

For the purpose of the traffic assessment contained within this chapter, trips to and from the proposed development have been distributed and assigned taking account of existing proportional AM and PM peak hour traffic movements at the junctions contained within the assessment. This approach takes into account a number of factors including the distance to and availability of facilities, and commuting based trips. The distribution and assignment of trips is detailed within traffic calculations (input data) for the ARCADY traffic modelling included within Appendix 11.2.

A large percentage of the trips associated with the crèche are likely to be internal to the development, for example parents within families living within the development choosing to utilise the crèche within the development. These trips do not impact on the existing road network. In terms of the traffic modelling detailed within Section 11.5.6, 50% of trips related to the crèche have been considered to be internal to the development.

11.5.6 Relative operational phase impact of development in traffic volumes

The TII Traffic and Transport Assessment Guidelines recognise thresholds for assessment as being where traffic to and from a development exceeds 10% of the existing traffic flow on an adjoining road, or where traffic to and from a development exceeds 5% of the existing traffic flow on an adjoining road where congestion exists or the location is sensitive. In relation to the proposed development, these threshold values are not exceeded, with the exception of the existing R510/Ard Aulin/site access roundabout junction. The impact of the development in percentage terms for the peak hours in the 2042 future assessment year is as follows:

- 10.3% at the R510/Ard Aulin/site access roundabout junction;
- 3.0% at the R510/Mungret Road/Father Russell Road roundabout junction;
- 1.4% at the R510/N69/N18 roundabout junction; and,
- 1.1% at the N69/N18/Dock Road roundabout junction.

11.5.7 Assessment of operational phase junction operation

To fully assess the impact of the proposed development on the local highway network, the operation of the following junctions have all been assessed for the opening and future assessment years both without the development, and with the development, using ARCADY junction models (which are recognised by TII as being an appropriate software package for this type of assessment):

- The R510/Ard Aulin/site access roundabout junction;
- The R510/Mungret Road/Father Russell Road roundabout junction;
- The R510/N69/N18 roundabout junction; and,
- The N69/N18/Dock Road roundabout junction

Traffic movements related to all scenarios are detailed within traffic calculations (input data) for the ARCADY traffic modelling included within Appendix 11-2.

The assessments have all been undertaken using PCU values. The criteria used to assess the performance of a junction for a given traffic demand within the aforementioned traffic modelling software are:

- Ratio of Flow to Capacity (RFC) is a measure of junction performance in terms of saturation. A value of 1.00, which can also be considered as 100% saturation, represents an arm of the junction operating at maximum capacity, in that any increase in the rate of vehicles arriving on the link will result in significant additional queue lengths. Traditionally a figure of 0.85 or 85% is the maximum acceptable degree of saturation for priority and roundabout junctions. Junctions with RFC values above these 'maximums' are considered to be congested.
- Queue lengths (measured in PCUs) are primarily used to check for blocking back through adjacent junctions.

The results of the assessment are summarised in Tables 11.3, 11.4, 11.5, 11.6, and 11.7, and the modelling output files are presented in Appendix 11-3. The results shown in Table 11.3, 11.5, 11.6 and

11.7 show that in planning terms the proposed development will not have a material impact on the operation of the junctions assessed, whilst in environmental terms, the impact is slight.

Table 11.4 predicts that the Mungret Road arm of the existing R510/Mungret Road/Father Russell Road (Quinn's Cross) roundabout junction will be operating 96% of capacity in the 2042 PM peak hour with the proposed development. This is due to the interaction of the roundabout with the zebra crossings present at this junction. If the congestion occurs as predicted within the traffic modelling, it can be mitigated through the replacement of the existing zebra crossings with light controlled pedestrian crossings, resulting in the RFC and queue values in Table 11.5.

Table 11.3 – Summary of ARCADY output for the existing R510/Ard Aulin/site access roundabout junction

	AM					PM				
	Set ID	Queue (PCU)	Delay (s)	RFC	LOS	Set ID	Queue (PCU)	Delay (s)	RFC	LOS
	2027 Without Development									
Arm A	D1	0.4	2.64	0.29	A	D7	0.5	2.81	0.34	A
Arm B		0.0	0.00	0.00	A		0.0	0.00	0.00	A
Arm C		0.7	3.57	0.39	A		0.9	4.17	0.47	A
Arm D		0.1	4.24	0.08	A		0.0	4.41	0.04	A
	2032 Without Development									
Arm A	D2	0.5	2.71	0.31	A	D8	0.6	2.90	0.36	A
Arm B		0.0	0.00	0.00	A		0.0	0.00	0.00	A
Arm C		0.7	3.71	0.41	A		1.0	4.40	0.50	A
Arm D		0.1	4.36	0.09	A		0.1	4.56	0.05	A
	2042 Without Development									
Arm A	D3	0.5	2.81	0.33	A	D9	0.7	3.04	0.39	A
Arm B		0.0	0.00	0.00	A		0.0	0.00	0.00	A
Arm C		0.8	3.92	0.44	A		1.2	4.76	0.54	A
Arm D		0.1	4.55	0.10	A		0.1	4.78	0.05	A
	2027 With Proposed Development									
Arm A	D4	0.5	2.76	0.31	A	D10	0.6	2.93	0.36	A
Arm B		0.2	5.92	0.16	A		0.1	5.90	0.10	A
Arm C		0.8	3.89	0.42	A		1.0	4.45	0.50	A
Arm D		0.1	4.49	0.09	A		0.1	4.59	0.05	A
	2032 With Proposed Development									
Arm A	D5	0.5	2.83	0.33	A	D11	0.6	3.03	0.38	A
Arm B		0.2	6.11	0.16	A		0.1	6.11	0.11	A
Arm C		0.8	4.05	0.45	A		1.1	4.72	0.52	A
Arm D		0.1	4.63	0.09	A		0.1	4.75	0.05	A
	2042 With Proposed Development									
Arm A	D6	0.6	2.94	0.35	A	**D12**	**0.7**	**3.18**	**0.41**	**A**
Arm B		0.2	6.38	0.17	A		**0.1**	**6.42**	**0.11**	**A**
Arm C		1.0	4.30	0.48	A		**1.3**	**5.13**	**0.56**	**A**
Arm D		0.1	4.85	0.11	A		**0.1**	**4.99**	**0.06**	**A**

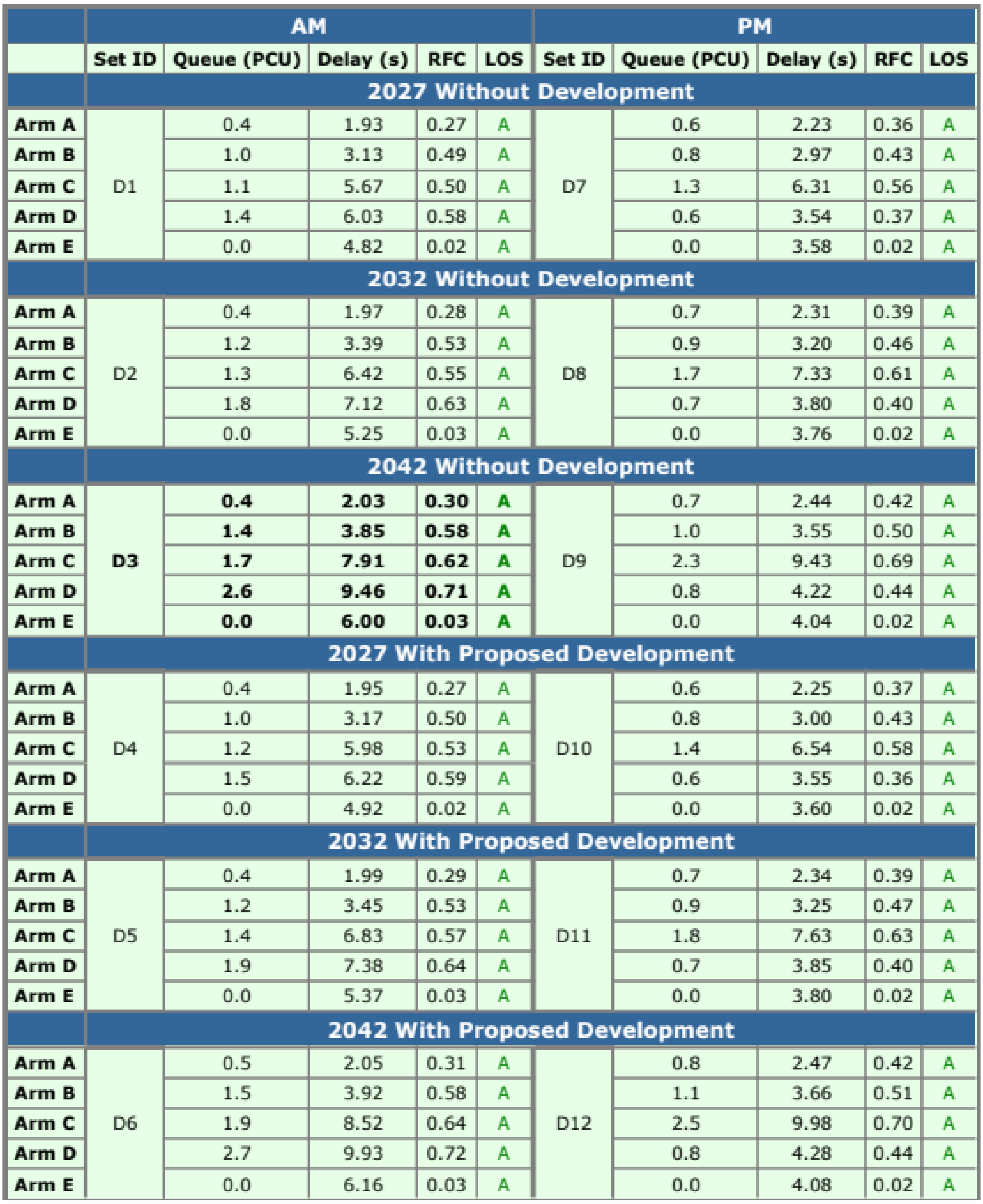
Table 11.4 – Summary of ARCADY output for the existing R510/Mungret Road/Father Russell Road (Quinn's Cross) roundabout junction

	AM					PM				
	Set ID	Queue (PCU)	Delay (s)	RFC	LOS	Set ID	Queue (PCU)	Delay (s)	RFC	LOS
	2027 Without Development									
Arm A	D1	0.6	3.88	0.38	A	D7	0.7	3.68	0.40	A
Arm B		0.8	4.93	0.43	A		0.8	4.53	0.44	A
Arm C		1.1	4.98	0.52	A		1.8	6.60	0.64	A
Arm D		1.4	6.29	0.58	A		0.4	4.33	0.30	A
	2032 Without Development									
Arm A	D2	0.7	4.14	0.41	A	D8	0.8	3.90	0.43	A
Arm B		0.9	5.35	0.47	A		0.9	4.86	0.47	A
Arm C		1.3	5.44	0.56	A		2.2	7.57	0.68	A
Arm D		1.7	7.08	0.62	A		0.5	4.60	0.33	A
	2042 Without Development									
Arm A	D3	0.9	4.54	0.45	A	D9	0.9	4.24	0.47	A
Arm B		1.1	6.04	0.52	A		1.1	5.38	0.51	A
Arm C		1.6	6.19	0.61	A		3.0	9.47	0.74	A
Arm D		2.2	8.50	0.68	A		0.6	5.02	0.36	A
	2027 With Proposed Development									
Arm A	D4	0.8	4.15	0.42	A	D10	0.8	3.83	0.42	A
Arm B		0.9	5.20	0.45	A		0.8	4.66	0.45	A
Arm C		1.2	5.21	0.54	A		2.0	6.95	0.65	A
Arm D		1.5	6.65	0.59	A		0.5	4.43	0.31	A
	2032 With Proposed Development									
Arm A	D5	0.9	4.45	0.45	A	D11	0.9	4.06	0.45	A
Arm B		1.0	5.67	0.49	A		1.0	5.00	0.48	A
Arm C		1.4	5.72	0.58	A		2.4	8.04	0.70	A
Arm D		1.8	7.54	0.64	A		0.5	4.71	0.33	A
	2042 With Proposed Development									
Arm A	D6	1.0	4.93	0.49	A	**D12**	**1.7**	**7.53**	**0.62**	**A**
Arm B		1.2	6.46	0.54	A		**3.5**	**17.06**	**0.77**	**C**
Arm C		1.7	6.57	0.63	A		**19.5**	**63.56**	**0.96**	**F**
Arm D		2.4	9.18	0.70	A		**1.3**	**11.41**	**0.57**	**B**

Table 11.5– Summary of ARCADY output for the R510/Mungret Road/Father Russell Road (Quinn's Cross) roundabout junction replacing the existing zebra crossings with light controlled pedestrian crossings

	AM					PM				
	Set ID	Queue (PCU)	Delay (s)	RFC	LOS	Set ID	Queue (PCU)	Delay (s)	RFC	LOS
	2027 Without Development									
Arm A	D1	0.6	3.88	0.38	A	D7	0.7	3.68	0.40	A
Arm B		0.8	4.93	0.43	A		0.8	4.53	0.44	A
Arm C		1.1	4.98	0.52	A		1.8	6.60	0.64	A
Arm D		1.4	6.29	0.58	A		0.4	4.33	0.30	A
	2032 Without Development									
Arm A	D2	0.7	4.14	0.41	A	D8	0.8	3.90	0.43	A
Arm B		0.9	5.35	0.47	A		0.9	4.86	0.47	A
Arm C		1.3	5.44	0.56	A		2.2	7.57	0.68	A
Arm D		1.7	7.08	0.62	A		0.5	4.60	0.33	A
	2042 Without Development									
Arm A	D3	0.9	4.54	0.45	A	D9	0.9	4.24	0.47	A
Arm B		1.1	6.04	0.52	A		1.1	5.38	0.51	A
Arm C		1.6	6.19	0.61	A		3.0	9.47	0.74	A
Arm D		2.2	8.50	0.68	A		0.6	5.02	0.36	A
	2027 With Proposed Development									
Arm A	D4	0.8	4.15	0.42	A	D10	0.8	3.83	0.42	A
Arm B		0.9	5.20	0.45	A		0.8	4.66	0.45	A
Arm C		1.2	5.21	0.54	A		2.0	6.95	0.65	A
Arm D		1.5	6.65	0.59	A		0.5	4.43	0.31	A
	2032 With Proposed Development									
Arm A	D5	0.9	4.45	0.45	A	D11	0.9	4.06	0.45	A
Arm B		1.0	5.67	0.49	A		1.0	5.00	0.48	A
Arm C		1.4	5.72	0.58	A		2.4	8.04	0.70	A
Arm D		1.8	7.54	0.64	A		0.5	4.71	0.33	A
	2042 With Proposed Development									
Arm A	D6	1.0	4.93	0.49	A	**D12**	**1.1**	**4.99**	**0.52**	**A**
Arm B		1.2	6.46	0.54	A		**1.3**	**6.22**	**0.56**	**A**
Arm C		1.7	6.57	0.63	A		**4.1**	**13.05**	**0.80**	**B**
Arm D		2.4	9.18	0.70	A		**0.7**	**5.66**	**0.39**	**A**

Table 11.6 – Summary of ARCADY output for the existing R510/N69/N18 roundabout junction



	AM					PM				
	Set ID	Queue (PCU)	Delay (s)	RFC	LOS	Set ID	Queue (PCU)	Delay (s)	RFC	LOS
	2027 Without Development									
Arm A	D1	0.4	1.93	0.27	A	D7	0.6	2.23	0.36	A
Arm B		1.0	3.13	0.49	A		0.8	2.97	0.43	A
Arm C		1.1	5.67	0.50	A		1.3	6.31	0.56	A
Arm D		1.4	6.03	0.58	A		0.6	3.54	0.37	A
Arm E		0.0	4.82	0.02	A		0.0	3.58	0.02	A
	2032 Without Development									
Arm A	D2	0.4	1.97	0.28	A	D8	0.7	2.31	0.39	A
Arm B		1.2	3.39	0.53	A		0.9	3.20	0.46	A
Arm C		1.3	6.42	0.55	A		1.7	7.33	0.61	A
Arm D		1.8	7.12	0.63	A		0.7	3.80	0.40	A
Arm E		0.0	5.25	0.03	A		0.0	3.76	0.02	A
	2042 Without Development									
Arm A	**D3**	**0.4**	**2.03**	**0.30**	**A**	D9	0.7	2.44	0.42	A
Arm B		**1.4**	**3.85**	**0.58**	**A**		1.0	3.55	0.50	A
Arm C		**1.7**	**7.91**	**0.62**	**A**		2.3	9.43	0.69	A
Arm D		**2.6**	**9.46**	**0.71**	**A**		0.8	4.22	0.44	A
Arm E		**0.0**	**6.00**	**0.03**	**A**		0.0	4.04	0.02	A
	2027 With Proposed Development									
Arm A	D4	0.4	1.95	0.27	A	D10	0.6	2.25	0.37	A
Arm B		1.0	3.17	0.50	A		0.8	3.00	0.43	A
Arm C		1.2	5.98	0.53	A		1.4	6.54	0.58	A
Arm D		1.5	6.22	0.59	A		0.6	3.55	0.36	A
Arm E		0.0	4.92	0.02	A		0.0	3.60	0.02	A
	2032 With Proposed Development									
Arm A	D5	0.4	1.99	0.29	A	D11	0.7	2.34	0.39	A
Arm B		1.2	3.45	0.53	A		0.9	3.25	0.47	A
Arm C		1.4	6.83	0.57	A		1.8	7.63	0.63	A
Arm D		1.9	7.38	0.64	A		0.7	3.85	0.40	A
Arm E		0.0	5.37	0.03	A		0.0	3.80	0.02	A
	2042 With Proposed Development									
Arm A	D6	0.5	2.05	0.31	A	D12	0.8	2.47	0.42	A
Arm B		1.5	3.92	0.58	A		1.1	3.66	0.51	A
Arm C		1.9	8.52	0.64	A		2.5	9.98	0.70	A
Arm D		2.7	9.93	0.72	A		0.8	4.28	0.44	A
Arm E		0.0	6.16	0.03	A		0.0	4.08	0.02	A

Table 11.7 – Summary of ARCADY output for the existing N69/N18/Dock Road roundabout junction

	AM					PM				
	Set ID	Queue (PCU)	Delay (s)	RFC	LOS	Set ID	Queue (PCU)	Delay (s)	RFC	LOS
	2027 Without Development									
Arm A	D1	0.0	4.18	0.02	A	D7	0.0	3.09	0.01	A
Arm B		0.8	2.85	0.42	A		1.0	3.26	0.48	A
Arm D		1.4	2.88	0.57	A		0.6	1.95	0.37	A
Arm E		0.6	4.28	0.35	A		0.4	3.10	0.29	A
	2032 Without Development									
Arm A	D2	0.0	4.54	0.02	A	D8	0.0	3.22	0.01	A
Arm B		0.8	3.05	0.45	A		1.1	3.55	0.52	A
Arm D		1.6	3.12	0.60	A		0.7	2.01	0.39	A
Arm E		0.7	4.74	0.39	A		0.5	3.29	0.32	A
	2042 Without Development									
Arm A	D3	0.0	5.11	0.03	A	D9	0.0	3.43	0.01	A
Arm B		1.1	3.45	0.50	A		1.4	4.06	0.57	A
Arm D		1.9	3.58	0.65	A		0.7	2.12	0.42	A
Arm E		0.8	5.56	0.44	A		0.6	3.57	0.35	A
	2027 With Proposed Development									
Arm A	D4	0.0	4.26	0.02	A	D10	0.0	3.12	0.01	A
Arm B		0.8	2.89	0.42	A		1.0	3.32	0.49	A
Arm D		1.4	2.93	0.58	A		0.6	1.96	0.37	A
Arm E		0.6	4.38	0.36	A		0.4	3.14	0.30	A
	2032 With Proposed Development									
Arm A	D5	0.0	4.63	0.02	A	D11	0.0	3.26	0.01	A
Arm B		0.9	3.10	0.46	A		1.2	3.62	0.53	A
Arm D		1.6	3.18	0.61	A		0.7	2.03	0.39	A
Arm E		0.7	4.87	0.40	A		0.5	3.33	0.32	A
	2042 With Proposed Development									
Arm A	D6	0.0	5.16	0.01	A	**D12**	**0.0**	**3.47**	**0.01**	**A**
Arm B		1.0	3.41	0.50	A		**1.4**	**4.15**	**0.58**	**A**
Arm D		2.0	3.61	0.66	A		**0.8**	**2.13**	**0.42**	**A**
Arm E		0.9	5.74	0.45	A		**0.6**	**3.62**	**0.36**	**A**

11.5.8 Road Structure Impact

Road structure impact is initially assessed by a simple visual inspection for cracking, deformation and disintegration in the vicinity of the site[20]. If following this visual assessment, and taking account of the types and volumes of traffic likely to be generated from a proposed development, the structural ability of the road to carry the traffic is in question, tests can be undertaken to determine the structural strength of the carriageway. Current guidance for such testing is detailed in the TII publication 'Pavement Assessment, Repair and Renewal Principles' Ref. AM-PAV-06050[21] published in March 2020.

11.5.9 Road Safety Impact

Road safety impact is typically assessed in terms of the collision record on the local road network in the vicinity of a development. Safety related geometrical measurements are also assessed, for example, visibility to and from access points and junctions.

Consultation of the Road Safety Authority online collision data (for the period 2005 to 2016 inclusive), the latest publicly available, indicates that no collisions resulting in injury have been reported at the existing R510/Ard Aulin/development site access roundabout junction.

A Stage 1/2 Road Safety Audit (RSA) of the design of the proposed development was prepared in March 2020 by Roadplan Consulting (Document Reference: 20023-01-001) and updated in 2022. TTRSA understand that this RSA will be submitted as part of the planning application for the proposed development.

11.5.10 Traffic Noise Impact

The environmental impact of traffic noise is assessed in terms of L^{den} and L^{night}. L^{den} is the equivalent continuous noise level over a whole 24-hour period, but with noise in the evening (19:00 to 23:00) increased by 5 dB(A) and noise at night (23:00 to 07:00) increased by 10 dB(A) to reflect the greater noise-sensitivity of people at those times. L^{night} is the equivalent continuous noise level over the night-

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[20] DTTAS (2013) Urban Flexible Roads Manual : Pavement Surface Condition Index Volume 2 of 3

[21] Transport Infrastructure Ireland (2020) AM-PAV-06050 Pavement Assessment, Repair and Renewal Principles

time period (23:00 to 07:00). L^{night} does not contain any night-time noise weighting. Traffic noise is generated by a combination of noise sources including vehicle engines and the interactions between vehicles and the road surface. Traffic noise is therefore a factor of the number and type of vehicles using a particular route. Whilst a noise source such as a HCV passing a noise receptor such as house is likely to generate a momentary noise at a level of between 80dBA and 85dBA, when averaged over an extended period, such as a day, the impact of an individual vehicle in terms of a change in the averaged noise levels is negligible.

Noise impact related to the development are covered in more detail in Chapter 9.

11.5.11 Traffic Related Atmospheric Pollutant Impact

Traffic related atmospheric pollutant emissions cause impacts at both the local and national/international level. At the local level the principal pollutants are nitrogen dioxide (NO2) and fine particulate matter (both PM10 and PM2.5). TII state in their publication '*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*'[22]that '*empirical evidence has shown that there is no risk of emissions from road traffic leading to exceedences of the relevant air quality standards for any other pollutants, at even the most heavily-trafficked locations*'. At the national/international level emissions can lead to: nitrogen deposition; the formation of ozone; and, climate change. Air quality standards have been defined by EU Directive and transposed into national legislation.

Nitrous oxide emissions increased nationally as a result of the introduction of catalytic converters to the vehicle fleet, but will decrease as an increasing proportion of the vehicle fleet becomes fully electric. The impact of nitrous oxide deposition on flora and fauna is covered in considerable detail in Chapter 11 of the 'WHO Air Quality Guidelines – Second Edition'[23] (Effects of nitrogen containing air pollutants: critical levels). The guidelines propose that the '*critical level for NO_x (NO + NO_2, expressed as NO_2 in µg/m3) is 30 µg/m^3 as an annual mean and 75 µg/m^3 as a 24-hour mean*'. Evidential

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[22] Transport Infrastructure Ireland (2011) Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes

[23] WHO (2000) Air quality guidelines for Europe, 2nd edition

monitoring has shown that to exceed the annual mean critical level in close proximity to a road (<10m from the road edge) requires an annual average daily traffic (AADT) flow of between 50,000 and 60,000 vehicles.

Air quality impacts related to the development are covered in more detail in Chapter 8.

11.6 MITIGATION

11.6.1 Construction phase mitigation measures

It is noted in Section 11.5.2 that a construction phase traffic management plan will be agreed with Limerick City and County Council covering for example, timings of HCV deliveries and facilities on site for the washing of vehicles, and that the impact of construction phase trip generation will be imperceptible (no measurable impact). As such, no additional construction phase mitigation measures are proposed.

11.6.2 Operational phase mitigation measures

The predicted impact of the operational phase of the proposed development is slight. The following mitigation measures are therefore recommended to minimise the impact of the development is as small as possible:

- To minimise the impact of the development on the capacity and operation of the local road network, the action plan contained within the Mobility Management Plan prepared for the development (Appendix 11.4) should be implemented;
- To minimise the impact of traffic noise within the development, low-noise (porous) asphalt should be specified for the surfacing of internal roads within the development; and,
- To minimise the impact of development related traffic on local air quality, electric vehicle charging points should be installed within the development, with infrastructure such as cable ducting being provided to increase the proportion of such charging points over time.

- If the relative impact of the proposed development results in additional queuing and delay at the existing R510/Mungret Road/Father Russell Road (Quinn's Cross) roundabout junction as shown in Table 11.4, alterations should be made to the existing pedestrian crossing facilities at this junction. Such alterations would need to be fully designed and assessed through additional traffic modelling and road safety audit.

11.7 DO-NOTHING SCENARIO

The assessment containing in Section 11.5 includes a do nothing (without development) scenario which details the impact of changes to the existing traffic and transportation in the surrounding area. It is considered that because the subject site is zoned for residential development, it is likely that should the proposed development not proceed, that residential development will take place on the proposed development site in the future with similar traffic and transport related impacts as the proposed development.

11.8 CUMULATIVE IMPACTS AND INTERACTIONS

The assessment containing in Section 11.5 includes the cumulative impacts of the proposed development, combined with traffic related impact of factors such as population and economic growth, changes to development patterns and employment locations, and other specific planned developments.

11.9 RESIDUAL IMPACTS

Taking into account the analysis contained within Section 11.5 of this chapter, and mitigation measures contained in Section 11.6 of this chapter, the residual short-term and long-term traffic and transport related environmental impacts of the proposed development are <u>not significant</u>.

11.10 DIFFICULTIES ENCOUNTERED IN COMPILING INFORMATION

No difficulties (technical deficiencies or lack of know-how) were encountered in compiling this chapter. Due to the scale and nature of the development, the traffic assessment contained within this chapter uses a fixed demand matrix which reflects current behaviour. Changes in the nature of existing trips such as re-timing, re-routeing, and/or changes in the mode of transport used, may result in a lesser impact than stated within this chapter.

12.0 MATERIAL ASSETS – WASTE MANAGEMENT

12.1 INTRODUCTION

This Chapter of the EIAR comprises an assessment of the likely impact of the proposed Development on the waste generated from the development as well as identifying proposed mitigation measures to minimise any associated impacts.

This Chapter was prepared by Chonaill Bradley (Bsc ENV AssocCIWM) of AWN Consulting. Chonaill Bradley is a Senior Environmental Consultant in the Environment Team at AWN. He holds a BSc in Environmental Science from Griffith University, Australia. He is an Associate Member of the Institute of Waste Management (CIWM). Chonaill has over seven years' experience in the environmental consultancy sector and specialises in waste management.

A site-specific Construction and Demolition Resource Waste Management Plan (C&D RWMP) has been prepared by AWN Consulting Ltd to deal with waste generation during the excavation and construction phases of the proposed Development and has been included as Appendix 12.1. The C&D RWMP was prepared in accordance with the Environmental Protection Agency's (EPA) document 'Best Practice Guidelines for the Preparation of Resource and Waste Management Plans for Construction & Demolition Projects' (2021) and the 'Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects' document produced by the National Construction and Demolition Waste Council (NCDWC) in conjunction with the Department of the Environment, Heritage and Local Government (DoEHLG) 2006.

A separate Operational Waste Management Plan (OWMP) has also been prepared for the operational phase of the proposed Development and is included as Appendix 12.2 of this Chapter.

The Chapter has been prepared in accordance with EPA Guidelines on the Information to be contained in EIAR (2017, Draft).

These documents will ensure the sustainable management of wastes arising at the Development Site in accordance with legislative requirements and best practice standards.

12.2 METHODOLOGY

The assessment of the impacts of the proposed Development, arising from the consumption of resources and the generation of waste materials, was carried out taking into account the methodology specified in relevant guidance documents, along with an extensive document review to assist in identifying current and future requirements for waste management; including national and regional waste policy, waste strategies, management plans, legislative requirements and relevant reports. A summary of the documents reviewed, and the relevant legislation is provided in the C&D RWMP and in the OWMP provided in Appendices 12.1 and 12.2.

This Chapter is based on the proposed Development, as described in Chapter 3 (Description of Proposed Development) and considers the following aspects:

- Legislative context;
- Construction phase (including site preparation and excavation); and
- Operational phase.

A desktop study was carried out which included the following:

- Review of applicable policy and legislation which creates the legal framework for resource and waste management in Ireland;
- Description of the typical waste materials that will be generated during the Construction and Operational phases; and
- Identification of mitigation measures to prevent waste generation and promote management of waste in accordance with the waste hierarchy.

Estimates of waste generation during the construction and operational phases of the proposed Development have been calculated. The waste types and estimated quantities are based on published data by the EPA in the *National Waste Reports and National Waste Statistics*, data recorded from similar previous developments, Irish and US EPA waste generation research as well as other available research sources.

Mitigation measures are proposed to minimise the effect of the proposed Development on the environment during the construction and operational phases, to promote efficient waste segregation and to reduce the quantity of waste requiring disposal. This information is presented in Section 12.5.

A detailed review of the existing ground conditions on a regional, local and site-specific scale are presented in Chapter 6 of this EIAR (Land, Soils and Geology). A dedicated Soil Management Plan (SLR, 2021) has also been prepared and submitted under a separate cover.

12.2.1 LEGISLATION AND GUIDANCE

Waste management in Ireland is subject to EU, national and regional waste legislation and control, which defines how waste materials must be managed, transported and treated. The overarching EU legislation is the Waste Framework Directive (2008/98/EC) which is transposed into national legislation in Ireland. The cornerstone of Irish waste legislation is the Waste Management Act 1996 (as amended). European and national waste management policy is based on the concept of 'waste hierarchy', which sets out an order of preference for managing waste (prevention > preparing for reuse > recycling > recovery > disposal) (Figure 19.1).

Figure 12.1: Waste Hierarchy (Source: European Commission)

The Irish government issues policy documents which outline measures to improve waste management practices in Ireland and help the country to achieve EU targets in respect of recycling and disposal of waste. The most recent policy document, *Waste Action Plan for a Circular Economy – Waste Management Policy in Ireland (WAPCE)*, was published in 2020 and shifts focus away from waste disposal and moves it back up the production chain. The move away from targeting national waste targets is due to the Irish and international waste context changing in the years since the launch of the previous waste management plan, *A Resource Opportunity,* in 2012. The need to embed climate action in all strands of public policy aligns with the goals of the European Green Deal.

One of the first actions to be taken from the WAPCE was the development of the *Whole of Government Circular Economy Strategy 2022-2023 'Living More, using Less'* (2021) to set a course for Ireland to transition across all sectors and at all levels of Government toward circularity and was issued in December 2021.

The strategy for the management of waste from the construction phase is in line with the requirements of the DoEHLG's *Best Practice Guidelines for the Preparation of Waste Management*

Plans for Construction and Demolition Projects (2021) and the EPA's *Best Practice Guidelines for the Preparation of Resource and Waste Management Plans for Construction & Demolition Projects' (2006)*. The guidance document, *Construction and Demolition Waste Management: A Handbook for Contractors and Site Managers* (FÁS & Construction Industry Federation, 2002), was also consulted in the preparation of this assessment.

There are currently no Irish guidelines on the assessment of operational waste generation, and guidance is taken from industry guidelines, plans and reports including the *Southern Region (SR) Waste Management Plan 2015 – 2021*, *BS 5906:2005 Waste Management in Buildings – Code of Practice*, the Limerick City and County Council (LCCC) Limerick City and County of Limerick (Segregation, Storage and Presentation of Household and Commercial Waste) Bye-Laws (2019)", the EPA National Waste Database Reports 1998 – 2019 and the EPA National Waste Statistics Web Resource.

12.2.2 TERMINOLOGY

Note that the terminology used herein is generally consistent with the definitions set out in Article 3 of the Waste Framework Directive. Key terms are defined as follows:

Waste - Any substance or object which the holder discards or intends or is required to discard.

Prevention - Measures taken before a substance, material or product has become waste, that reduce:

b) the quantity of waste, including through the re-use of products or the extension of the life span of products;
c) the adverse impacts of the generated waste on the environment and human health; or
d) the content of harmful substances in materials and products.

Reuse - Any operation by which products or components that are not waste are used again for the same purpose for which they were conceived.

Preparing for Reuse - Checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing.

Treatment - Recovery or disposal operations, including preparation prior to recovery or disposal.

Recovery - Any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy. Annex II of the Waste Framework Directive sets out a non-exhaustive list of recovery operations.

Recycling - Any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.

Disposal - Any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy. Annex I sets out a non-exhaustive list of disposal operations.

12.3 BASELINE ENVIRONMENT

The development will principally consist of a mixed-use development of apartments, houses, incorporating common areas and a childcare facility at a site located at site located in Ballykeeffe, Raheen, Co. Limerick.

In terms of waste management, the receiving environment is largely defined by LCCC as the local authority responsible for setting and administering waste management activities in the area. This is governed by the requirements set out in the *SR Waste Management Plan 2015 – 2021*, which sets out the following targets for waste management in the region:

- A 1% reduction per annum in the quantity of household waste generated per capita over the period of the plan;
- Achieve a recycling rate of 50% of managed municipal waste by 2020; and
- Reduce to 0% the direct disposal of unprocessed residual municipal waste to landfill (from 2016 onwards) in favour of higher value pre-treatment processes and indigenous recovery practices.

The Regional Plan sets out the strategic targets for waste management in the region and sets a specific target for C&D waste of "70% preparing for reuse, recycling and other recovery of construction and demolition waste" (excluding natural soils and stones and hazardous wastes) to be achieved by 2020. Ireland achieved 84 per cent material recovery of such waste in 2019, and therefore surpassed the 2020 target and is currently surpassing the 2025 target. The National Waste Statistics update published by the EPA in November 2021 identifies that Ireland's current against "Preparing for reuse and recycling of 50% by weight of household derived paper, metal, plastic & glass (includes metal and plastic estimates from household WEEE)" was met for 2020 at 51% however they are currently not in line with the 2025 target.

The Limerick County Development Plan 2010-2016 (as Extended) and the Draft Limerick Development Plan 2022-2028 (2021) also set out policies and objectives for the LCCC area which reflect those set out in the regional waste management plan.

In terms of physical waste infrastructure, LCCC no longer operates any municipal waste landfill in the area. There are a number of waste permitted and licensed facilities located in the Southern Waste Region and within Ireland for the management of waste from the construction industry as well as municipal sources. These include soil recovery facilities, inert C&D waste facilities, hazardous waste treatment facilities, municipal waste landfills, material recovery facilities, waste transfer stations and two waste-to-energy facilities.

12.3.1 CHRACTERISTICS OF THE PROPOSED DEVELOPMENT

A full description of the proposed Development can be found in Chapter 3 (Description of Proposed Development). The characteristics of the proposed Development that are relevant in terms of waste management are summarised below.

12.3.1.1 Demolition Phase

The site is a greenfield site and there will be no demolition associated with this proposed development.

12.3.1.2 Construction Phase

During the construction phase, waste will be produced from surplus materials such as broken or off-cuts of timber, plasterboard, concrete, tiles, bricks, etc. Waste from packaging (cardboard, plastic, timber) and oversupply of materials may also be generated. The appointed Contractor will be required to ensure that oversupply of materials is kept to a minimum and opportunities for reuse of suitable materials is maximised.

In addition, topsoil, subsoil and clay will require excavation to facilitate site levelling, construction of foundations, along with the installation of underground services. The Project Engineers (Hutch, O'Malley Consulting Engineers) have estimated that c. 126,000m^3 of material will require excavation. It is envisaged that the majority of this material will be reused on-site with negligible soil being removed from the site. These estimates will be refined prior to commencement of construction.

If the material that requires removal from Site is deemed to be a waste, removal and reuse / recycling / recovery / disposal of the material will be carried out in accordance with the Waste Management Act 1996 (as amended), the Waste Management (Collection Permit) Regulations 2007 (as amended) and the Waste Management (Facility Permit & Registration) Regulations 2007 (as amended). The volume of waste requiring recovery / disposal will dictate whether a Certificate of Registration (COR), permit or licence is required for the receiving facility. Alternatively, the material may be classed as by-product under Article 27 classification (European Communities (Waste Directive) Regulations 2011, S.I. No. 126 of 2011). For more information in relation to the envisaged management of by-products, refer to the C&D RWMP (Appendix 12.1).

In order to establish the appropriate reuse, recovery and / or disposal route for the soils and stones to be removed off-site, it will first need to be classified. Waste material will initially need to be classified as hazardous or non-hazardous in accordance with the EPA publication *Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous* (2019). Environmental soil analysis will be carried out prior to removal of the material on a number of the soil samples in accordance with the requirements for acceptance of waste at landfills (Council Decision 2003/33/EC Waste Acceptance Criteria). This legislation sets limit values on landfills for acceptance of waste material based on properties of the waste, including potential pollutant concentrations and leachability. It is anticipated that any surplus material will be suitable for acceptance at either inert or non-hazardous soil recovery facilities / landfills in Ireland or, in the unlikely event of hazardous material being encountered, be transported for treatment / recovery or exported abroad for disposal in suitable facilities.

Waste will also be generated from construction phase workers e.g. organic / food waste, dry mixed recyclables (waste paper, newspaper, plastic bottles, packaging, aluminium cans, tins and Tetra Pak cartons), mixed non-recyclables and, potentially, sewage sludge from temporary welfare facilities provided on-site during the Construction phase. Waste printer / toner cartridges, waste electrical and electronic equipment (WEEE) and waste batteries may also be generated in small volumes from site offices.

Further detail on the waste materials likely to be generated during the excavation and construction works are presented in the project-specific C&D RWMP (Appendix 12.1). The C&D RWMP provides an estimate of the main waste types likely to be generated during the Construction phase of the proposed Development. These are summarised in Table 12.1.

Table 12.1: Estimated off-site Reuse, Recycle and Disposal Rates for Construction Waste

Waste Type	Tonnes	Reuse		Recycle / Recovery		Disposal	
		%	Tonnes	%	Tonnes	%	Tonnes
Mixed C&D	805.7	10	80.6	80	644.5	10	80.6
Timber	683.6	40	273.4	55	376.0	5	34.2
Plasterboard	244.1	30	73.2	60	146.5	10	24.4
Metals	195.3	5	9.8	90	175.8	5	9.8
Concrete	146.5	30	43.9	65	95.2	5	7.3
Other	366.2	20	73.2	60	219.7	20	73.2
Total	**2441.5**		**554.2**		**1657.8**		**229.5**

12.3.1.3 Operational Phase

As noted in Section 12.1, an OWMP has been prepared for the proposed Development and is included as Appendix 12.2. The OWMP provides a strategy for segregation (at source), storage and collection of all wastes generated within the building during the operational phase including dry mixed recyclables (DMR), organic waste and mixed non-recyclable waste (MNR), as well as providing a strategy for management of waste glass, batteries, WEEE, printer / toner cartridges, chemicals, textiles, waste cooking oil and furniture.

The total estimated waste generation for the proposed Development for the main waste types, based on the AWN waste generation model (WGM), is presented in Table 12.2, below, and is based on the uses and areas as advised by the Project Architects. Further unit breakdowns can be found in Appendix 12.2.

Table 12.2: Estimated Waste Generation During Operational Phase

Waste Type	Waste Volume (m^3/week)	
	Residential Units Combined	**Childcare Facility Unit (Individual)**
Organic Waste	6.78	0.05
DMR	48.06	1.91
Glass	1.31	0.01
MNR	25.27	1.04
Total	**81.42**	**3.01**

The residents and tenants will be required to provide and maintain appropriate waste receptacles within their units to facilitate segregation at source of these waste types. The location of the bins within the units will be at the discretion of the residents. As required, the residents and tenants will need to bring these segregated wastes from their units to their allocated Waste Storage Areas (WSAs). WSAs can be viewed on the plans submitted with the application under separate cover.

The OWMP seeks to ensure that the proposed Development contributes to the targets outlined in the *SR Waste Management Plan 2015 – 2021* and the LCCC City and County of Limerick (Segregation, Storage and Presentation of Household and Commercial Waste) Bye-Laws (2019).

Mitigation measures proposed to manage impacts arising from wastes generated during the operational phase of the proposed Development are summarised below.

12.4 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

If the proposed Development was not to go ahead (i.e. in the Do-Nothing scenario) there would be no excavation or construction or operational waste generated at this Site. There would, therefore, be a *neutral* effect on the environment in terms of waste.

This section details the potential waste effects associated with the proposed Development.

12.4.1 Construction Phase

The proposed Development will generate a range of non-hazardous and hazardous waste materials during site excavation and construction. General housekeeping and packaging will also generate waste materials, as well as typical municipal wastes generated by construction employees, including food waste. Waste materials will be required to be temporarily stored on-site pending collection by a waste contractor. If waste material is not managed and stored correctly, it is likely to lead to litter or pollution issues at the Development Site and in adjacent areas. The indirect effect of litter issues is the presence of vermin in areas affected. In the absence of mitigation, the effect on the local and regional environment is likely to be ***short-term, significant*** and ***negative****.*

The use of non-permitted waste contractors or unauthorised waste facilities could give rise to inappropriate management of waste, resulting in indirect negative environmental impacts, including pollution. It is essential that all waste materials are dealt with in accordance with regional and national legislation, as outlined previously, and that time and resources are dedicated to ensuring efficient waste management practices. In the absence of mitigation, the effect on the local and regional environment is likely to be ***Long-term, significant*** and ***negative****.*

Wastes arising will need to be taken to suitably registered / permitted / licenced waste facilities for processing and segregation, reuse, recycling, recovery, and / or disposal, as appropriate. There are numerous licensed waste facilities in the EMR which can accept hazardous and non-hazardous waste materials, and acceptance of waste from the Development Site would be in line with daily activities at these facilities. At present, there is sufficient capacity for the acceptance of the likely C&D waste arisings at facilities in the region. The majority of construction materials are either recyclable or recoverable. However, in the absence of mitigation, the effect on the local and regional environment is likely to be ***short-term, significant*** and ***negative***.

There is a quantity of excavated material which will need to be excavated to facilitate the proposed Development. A detailed review of the existing ground conditions on a regional, local site-specific scale are presented in Chapter 6. It is anticipated that that c. 126,000m^3 of material will require excavation on site and it is envisaged that the majority of this material will be reused on-site in with negligible soil being removed from the site. Correct classification and segregation of the excavated material is required to ensure that any potentially contaminated materials are identified and handled in a way that will not impact negatively on workers as well as on water and soil environments, both on and off-site. However, in the absence of mitigation, the effect on the local and regional environment is likely to be ***short-term, significant*** and ***negative***.

12.4.2 Operational Phase

The potential impacts on the environment of improper, or a lack of, waste management during the operational phase would be a diversion from the priorities of the waste hierarchy which would lead to small volumes of waste being sent unnecessarily to landfill. In the absence of mitigation, the effect on the local and regional environment is likely to be ***Long-term, significant*** and ***negative***.

The nature of the development means the generation of waste materials during the operational phase is unavoidable. Networks of waste collection, treatment, recovery and disposal infrastructure are in place in the region to manage waste efficiently from this type of development. Waste which is not suitable for recycling is typically sent for energy recovery. There are also facilities in the region for segregation of municipal recyclables which is typically exported for conversion in recycled products (e.g. paper mills and glass recycling).

If waste material is not managed and stored correctly, it is likely to lead to litter or pollution issues at the Development Site and in adjacent areas. The knock-on effect of litter issues is the presence of vermin in affected areas. However, in the absence of mitigation, the effect on the local and regional environment is likely to be ***short-term, significant*** and ***negative****.*

Waste contractors will be required to service the proposed Development on a regular basis to remove waste. The use of non-permitted waste contractors or unauthorised facilities could give rise to inappropriate management of waste and result in negative environmental impacts or pollution. It is essential that all waste materials are dealt with in accordance with regional and national legislation, as outlined previously, and that time and resources are dedicated to ensuring efficient waste management practices. However, in the absence of mitigation, the effect on the local and regional environment is likely to be ***Long-term, significant*** and ***negative****.*

12.5 MITIGATION MEASURES

This section outlines the measures that will be employed in order to reduce the amount of waste produced, manage the wastes generated responsibly and handle the waste in such a manner as to minimise the effects on the environment.

12.5.1 Construction Phase

The following mitigation measures will be implemented during the construction phase of the proposed Development:

As previously stated, a project specific C&D RWMP has been prepared in line with the requirements of the requirements of the *Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects* (DoEHLG, 2006), and is included as Appendix 12.1. Adherence to the high-level strategy presented in this C&D RWMP will ensure effective waste management and minimisation, reuse, recycling, recovery and disposal of waste material generated during the excavation and construction phases of the proposed Development.

- Prior to commencement, the appointed Contractor(s) will be required to refine / update the C&D RWMP (Appendix 12.1) in agreement with LCCC, or submit an addendum to the

C&D RWMP to LCCC, detailing specific measures to minimise waste generation and resource consumption, and provide details of the proposed waste contractors and destinations of each waste stream.

- The Contractor will be required to fully implement the C&D RWMP throughout the duration of the proposed construction phase.

A quantity of topsoil, sub soil and clay which will need to be excavated to facilitate the proposed Development. Project Engineers have estimated that c. 126,000m^3 of material will require excavation on site. It is envisaged that the majority of this material will be reused on-site in with negligible soil being removed from the site. Correct classification and segregation of the excavated material is required to ensure that any potentially contaminated materials are identified and handled in a way that will not impact negatively on workers as well as on water and soil environments, both on and off-site.

In addition, the following mitigation measures will be implemented:

- Building materials will be chosen with an aim to 'design out waste';
- On-site segregation of waste materials will be carried out to increase opportunities for off-site reuse, recycling and recovery. The following waste types, at a minimum, will be segregated:
    Concrete rubble (including ceramics, tiles and bricks);
    Plasterboard;
    Metals;
    Glass; and
    Timber.
- Left over materials (e.g. timber off-cuts, broken concrete blocks / bricks) and any suitable construction materials shall be re-used on-site, where possible;
- All waste materials will be stored in skips or other suitable receptacles in designated areas of the site;

- Any hazardous wastes generated (such as chemicals, solvents, glues, fuels, oils) will also be segregated and will be stored in appropriate receptacles (in suitably bunded areas, where required);
- A Waste Manager will be appointed by the main Contractor(s) to ensure effective management of waste during the excavation and construction works;
- All construction staff will be provided with training regarding the waste management procedures;
- All waste leaving site will be reused, recycled or recovered, where possible, to avoid material designated for disposal;
- All waste leaving the site will be transported by suitably permitted contractors and taken to suitably registered, permitted or licenced facilities; and
- All waste leaving the site will be recorded and copies of relevant documentation maintained.
- Nearby sites requiring clean fill material will be contacted to investigate reuse opportunities for clean and inert material, if required. If any of the material is to be reused on another site as by-product (and not as a waste), this will be done in accordance with Article 27 of the EC (Waste Directive) Regulations (2011). EPA approval will be obtained prior to moving material as a by-product. However, it is not currently anticipated that Article 27 will be used.

These mitigation measures will ensure that the waste arising from the construction phase of the proposed Development is dealt with in compliance with the provisions of the Waste Management Act 1996, as amended, associated Regulations and the Litter Pollution Act 1997, and the *EMR Waste Management Plan 2015 – 2021*. It will also ensure optimum levels of waste reduction, reuse, recycling and recovery are achieved and will promote more sustainable consumption of resources.

12.5.2 Operational Phase

The following mitigation measures will be implemented during the operational phase of the proposed development:

- As previously stated, a project specific OWMP has been prepared and is included as Appendix 12.2.
- The Operator / Buildings Manager of the Site during the operational phase will be responsible for ensuring – allocating personnel and resources, as needed – the ongoing implementation of this OWMP, ensuring a high level of recycling, reuse and recovery at the Site of the proposed Development.

In addition, the following mitigation measures will be implemented:

- The Operator / Buildings Manager will ensure on-Site segregation of all waste materials into appropriate categories, including (but not limited to):
    - Organic waste;
    - Dry Mixed Recyclables;
    - Mixed Non-Recyclable Waste;
    - Glass;
    - Waste electrical and electronic equipment (WEEE);
    - Batteries (non-hazardous and hazardous);
    - Cooking oil;
    - Light bulbs;
    - Cleaning chemicals (pesticides, paints, adhesives, resins, detergents, etc.);
    - Furniture (and from time to time other bulky waste); and
    - Abandoned bicycles.
- The Operator / Buildings Manager will ensure that all waste materials will be stored in colour coded bins or other suitable receptacles in designated, easily accessible locations. Bins will be clearly identified with the approved waste type to ensure there is no cross contamination of waste materials;
- The Operator / Buildings Manager will ensure that all waste collected from the Site of the proposed Development will be reused, recycled or recovered, where possible, with the exception of those waste streams where appropriate facilities are currently not available; and

- The Operator / Buildings Manager will ensure that all waste leaving the Site will be transported by suitable permitted contractors and taken to suitably registered, permitted or licensed facilities.

These mitigation measures will ensure the waste arising from the proposed Development during the operational phase is dealt with in compliance with the provisions of the Waste Management Act 1996, as amended, associated Regulations, *the Litter Pollution Act 1997*, the *SR Waste Management Plan 2015 – 2021* and the LCCC "City and County of Limerick (Segregation, Storage and Presentation of Household and Commercial Waste) Bye-Laws (2019)". It will also ensure optimum levels of waste reduction, reuse, recycling and recovery are achieved.

12.6 RESIDUAL IMPACTS

The implementation of the mitigation measures outlined in Section 12.5 will ensure that high rates of reuse, recovery and recycling are achieved at the Site of the proposed Development during the construction and operational phases. It will also ensure that European, National and Regional legislative waste requirements with regard to waste are met and that associated targets for the management of waste are achieved.

12.6.1 Construction Phase

A carefully planned approach to waste management as set out in Section 12.5 and adherence to the C&D RWMP during the construction phase will ensure that the predicted effect on the environment will be ***short-term*****,** ***imperceptible*** **and** ***neutral*****.**

12.6.2 Operational Phase

During the operational phase, a structured approach to waste management as set out in Section 12.5 and adherence to the OWMP will promote resource efficiency and waste minimisation. Provided the mitigation measures are implemented and a high rate of reuse, recycling and recovery is achieved, the predicted effect of the operational phase on the environment will be ***long-term, imperceptible*** **and** ***neutral*****.**

12.6.3 Conclusion

Assuming the full and proper implementation of the mitigation measures set out herein and in the C&D RWMP (Appendix 12.1) and the OWMP (Appendix 12.2), no likely significant negative effects are predicted to occur as a result of the construction or operational of the proposed Development.

12.7 MONITORING

The management of waste during the construction phase will be monitored by the Contactor's appointed Waste Manager to ensure compliance with the above-listed mitigation measures, and relevant waste management legislation and local authority requirements, including maintenance of waste documentation.

The management of waste during the operational phase will be monitored by the Operator / Buildings Manager to ensure effective implementation of the OWMP internally and by the nominated waste contractor(s).

12.7.1 Construction Phase

The objective of setting targets for waste management is only achieved if the actual waste generation volumes are calculated and compared. This is particularly important during the excavation and construction works, where there is a potential for waste management objectives to become secondary to other objectives, i.e. progress and meeting construction schedule targets. The C&D RWMP specifies the need for a Waste Manager to be appointed, who will have responsibility for monitoring the actual waste volumes being generated and ensuring that contractors and sub-contractors are segregating waste as required. Where targets are not being met, the Waste Manager will identify the reasons for this and work to resolve any issues. Recording of waste generation during the construction phase of the proposed Development will enable better management of waste contractor requirements and identify trends. The data should be maintained to advise on future Developments.

12.7.2 Operational Phase

During the operational phase, waste generation volumes will be monitored by the Operator / Buildings Manager against the predicted waste volumes outlined in the OWMP. There may be opportunities to reduce the number of bins and equipment required in the WSAs, where estimates have been too conservative. Reductions in bin and equipment requirements will improve efficiency and reduce waste contactor costs.

12.8 INTERACTIONS

This section discusses interactions between this Chapter and other specialist environmental topics considered in this EIAR.

12.8.1 Land, Soils and Geology

During the construction phase, excavated soil, stone and clay (c. 126,000 m^3) will be generated from the excavations required to facilitate site levelling, construction of the basements and construction of new foundations. It is estimated that a negligible amount of excavated material will need to be removed off-site. Where material has to be taken off-site, it will be taken for reuse or recovery, where practical, with disposal as a last resort. Adherence to the mitigation measures in Chapter 12 and the requirements of the C&D RWMP (Appendix 12.1), will ensure the effect is ***long-term*, *imperceptible*** and ***neutral.***

12.8.2 Traffic & Transportation

Local traffic and transportation will be impacted by the additional vehicle movements generated by removal of waste from the Site during the construction and operational phases of the proposed Development. The increase in vehicle movements as a result of waste generated during the construction phase will be *temporary* in duration. There will be an increase in vehicle movements in the area as a result of waste collections during the operational phase but these movement will be imperceptible in the context of the overall traffic and transportation increase. Traffic-related impacts during the construction and operational phases are addressed in Chapter 11 (Traffic and Transportation). Provided the mitigation measures detailed in Chapter 12 and the requirements of the

OWMP (included as Appendix 12.2) are adhered to, the predicted effects are ***short to long-term, imperceptible*** and ***neutral*.**

12.8.3 Population & Human Health

The potential impacts on human beings are in relation to incorrect management of waste during construction and / or operation, which could result in littering and presence of vermin – with associated potential for negative impacts on human health and residential amenity. A carefully planned approach to waste management and adherence to the project specific C&D RWMP and OWMP (Appendices 12.1 and 12.2, respectively), will ensure appropriate management of waste and avoid any negative impacts on the local population. The effects should be ***long-term*, *imperceptible* and *neutral***.

12.9 CUMULATIVE IMPACTS

12.9.1 Construction Phase

There are existing residential and commercial developments close by, along with the multiple permissions remaining in place for small scale development in the local area. In a worst-case scenario, multiple developments in the area could be developed concurrently or overlap in the construction phase. Due to the high number of waste contractors in the Limerick region there would be sufficient contractors available to handle waste generated from a large number of these sites simultaneously, if required. Similar waste materials would be generated by all the developments.

Other developments in the area will be required to manage waste in compliance with national and local legislation, policies and plans which will mitigate against any potential cumulative effects associated with waste generation and waste management. As such the effect will be ***short-term, not significant*** and ***neutral***.

12.9.2 Operational Phase

There are existing residential and commercial developments close by the proposed development. All of the current and potential developments will generate similar waste types during their operational phases. Authorised waste contractors will be required to collect waste materials segregated, at a minimum, into recyclables, organic waste and non-recyclables. An increased density of development in the area is likely improve the efficiencies of waste collections in the area.

Other developments in the area will be required to manage waste in compliance with national and local legislation, policies and plans which will minimise/mitigate any potential cumulative impacts associated with waste generation and waste management. As such the effect will be a **long-term, imperceptible** and **neutral**.

12.10 DIFFICULTIES ENCOUNTERED IN COMPILING THE CHAPTER

Until final materials and detailed construction methodologies have been confirmed, it is difficult to predict with a high level of accuracy the construction waste that will be generated from the proposed works as the exact materials and quantities may be subject to some degree of change and variation during the construction process.

There is a number of licensed, permitted and registered waste facilities in the Limerick region and in the surrounding counties. However, these sites may not be available for use when required or may be limited by the waste contractor selected to service the development in the appropriate phase. In addition, there is potential for more suitably placed waste facilities or recovery facilities to become operational in the future which may be more beneficial from an environmental perspective.

The ultimate selection of waste contractors and waste facilities would be subject to appropriate selection criteria proximity, competency, capacity, serviceability, and cost.

12.11 REFERENCES

Waste Management Act 1996 as amended. Sub-ordinate and associated legislation include:

- European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011) as amended.
- Waste Management (Collection Permit) Regulations 2007 (S.I. No. 820 of 2007) as amended.
- Waste Management (Facility Permit and Registration) Regulations 2007 (S.I No. 821 of 2007) as amended.
- Waste Management (Licensing) Regulations 2000 (S.I No. 185 of 2000) as amended.
- European Union (Packaging) Regulations 2014 (S.I. No. 282 of 2014) as amended.
- Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997) as amended.
- Waste Management (Landfill Levy) Regulations 2015 (S.I. No. 189 of 2015).
- European Union (Waste Electrical and Electronic Equipment) Regulations 2014 (S.I. No. 149 of 2014).
- European Union (Batteries and Accumulators) Regulations 2014 (S.I. No. 283 of 2014) as amended.
- Waste Management (Food Waste) Regulations 2009 (S.I. No. 508 of 2009) as amended.
- European Union (Household Food Waste and Bio-waste) Regulations 2015 (S.I. No. 191 of 2015).
- Waste Management (Hazardous Waste) Regulations 1998 (S.I. No. 163 of 1998) as amended.
- Waste Management (Shipments of Waste) Regulations 2007 (S.I. No. 419 of 2007) as amended.
- European Communities (Shipments of Hazardous Waste exclusively within Ireland) Regulations 2011 (S.I. No. 324 of 2011).
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Litter Pollution Act 1997 (S.I. No. 12 of 1997) as amended.

Planning and Development Act 2000 (S.I. No. 30 of 2000) as amended.

Protection of the Environment Act 2003, (No. 27 of 2003) as amended.

13.0 CULTURAL HERITAGE

13.1 INTRODUCTION

This section of the Environmental Impact Assessment provides a review of potential impacts on the cultural heritage of a proposed strategic housing development within a 10.44ha site in Limerick City (Figs 13.1–13.4). The site is on the south-west side of the city in an area that has existing residential, retail and commercial developments. The development comprises 383 houses including apartment blocks (Fig. 13.5). The development will include all associated site works.

This Chapter was prepared by Rose Cleary. Rose graduated in 1980 with a BA degree in archaeology from University College Cork and subsequently undertook masters research on the Newgrange prehistoric pottery assemblage. Her research interests lie in prehistoric pottery, with a particular interest in ceramic technology, petrology studies and charactisation of clay sources. She is also involved in long-term research on the prehistoric archaeology of north Munster, with particular reference to the Lough Gur landscape. She has extensive fieldwork experience, having undertaken excavations at numerous prehistoric sites in that region. She has published widely on projects connected to pipeline and infrastructural projects, including urban regeneration schemes in Cork City.

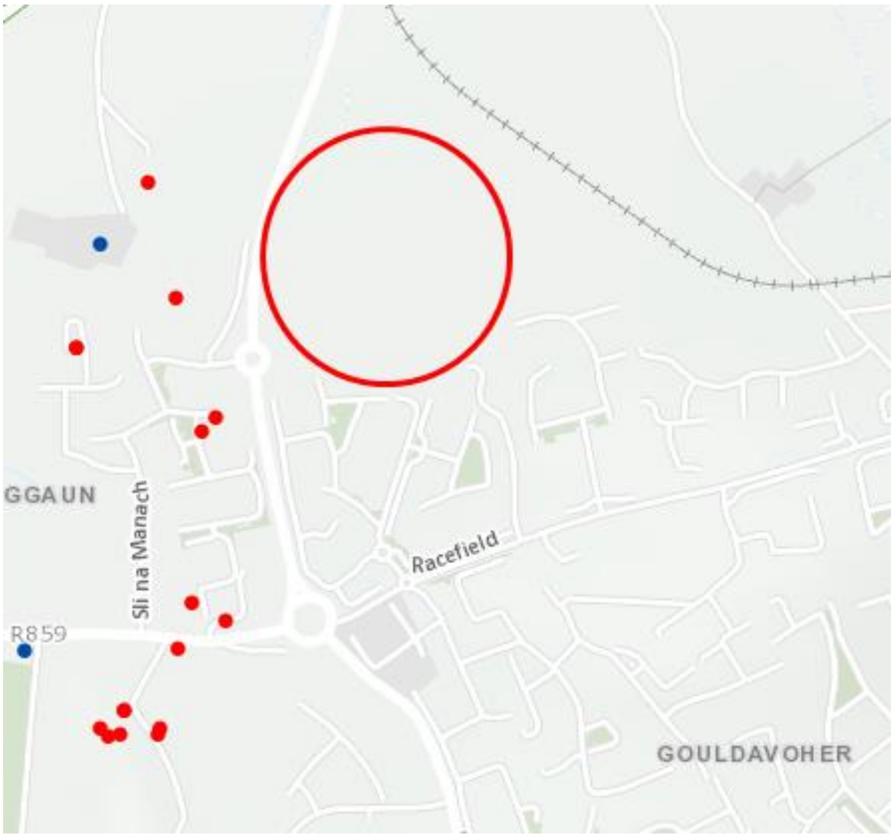

Figure 13.1: Site Location – Encircled

Figure 13.2: Site Location – Outlined in red

Figure 13.3: Development Site – Outlined in red

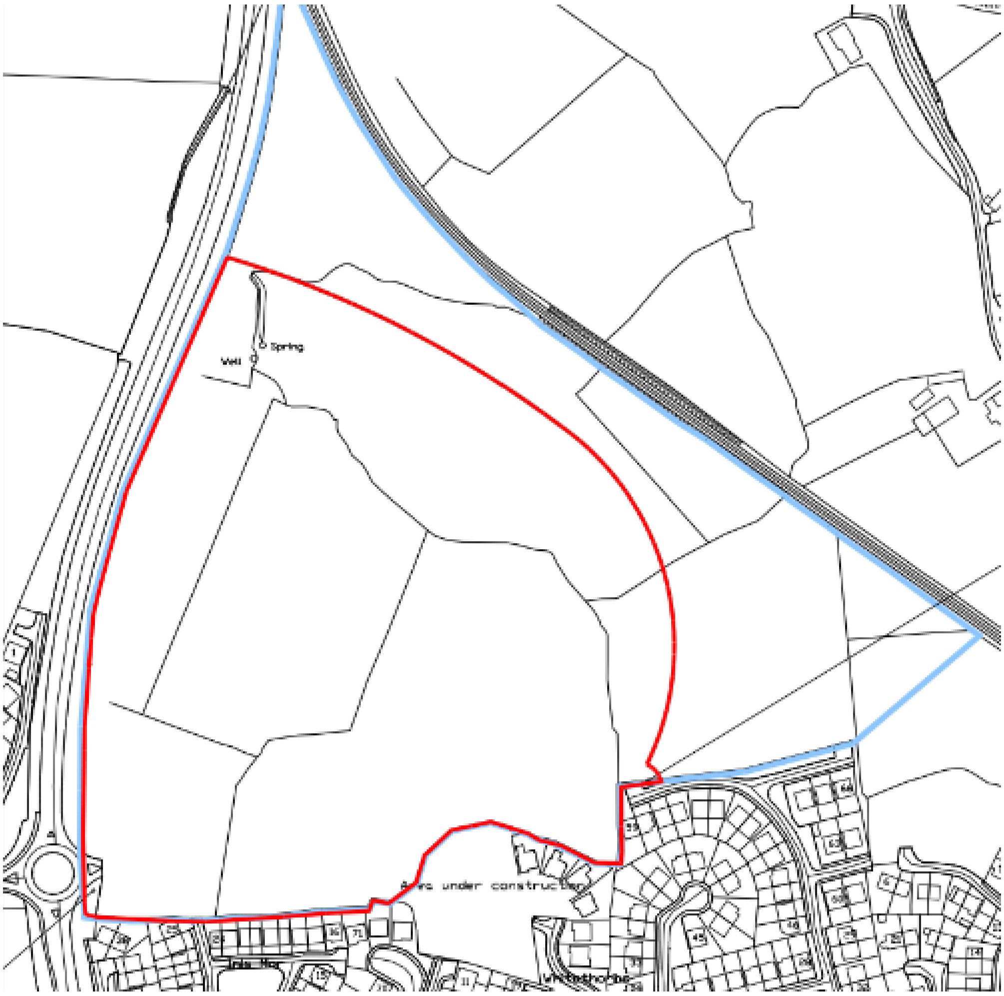

Figure 13.4: Site Location – Detail

Figure 13.5: Layout of proposed development

Cultural Heritage includes visible archaeological monuments and sub-surface archaeological remains. The monuments and sub-surface sites are the vestiges of past human interaction with the landscape. Knowledge of these sites is achieved by survey and excavation and by comparison with similar sites within the archaeological record. The architectural record, both upstanding and levelled is included in Cultural Heritage and includes structures, the curtilage and setting context of structures; groups of structures and buildings and places of historic, archaeological, artistic, cultural, scientific, social or technical interest.

Guidelines for the compilation of Archaeological, Architectural and Cultural Heritage Assessments include EU Directives and Planning and Development Acts[24].

13.2 Methodology

This report was compiled using a desk-top study and field inspection. The archaeological component of this report is guided by *The National Monuments Acts and Amendments* 1930–2004; *Local Government Planning and Development Act* [2000]; *Frameworks and Principles for the Protection of the Archaeological Heritage* (DAHGI 1999) and *Policy and Guidelines on Archaeological Excavations* (DAHGI 1999).

Architectural Heritage is protected by the *Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act* (1999). National policies are outlined in the *Architectural Heritage Protection Guidelines for Planning Authorities* (DoEHLG 2004) and *Action of Architecture 2002–2005* Government Policy on Architecture. These guidelines inform this assessment.

1. The desk-top study included a review of the available Ordnance Survey Maps; the Sites and Monuments Record (SMR); the Record of Monuments and Places (RMP), aerial photographs and the available archaeological and historical literature for the area.

2. A site inspection was carried out in August 2021.

3. The report assesses the proximity of known archaeological, architectural sites and sites of potential historic value in the environs of the development site. There are no recorded archaeological sites or buildings listed in the Architectural Inventory within the curtilage of the development landbank.

Desk-top study

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[24] EU Directive 85/337/EEC [Amended Directives 97/11/EC, 2003/35/EC; 2009/31/EC; 2011/92/EU; 2014/52/EU2]; Planning and Development Acts 2000–2015 and Planning and Development Regulations 2001–2015.

The desk-top provides an over-arching review of the archaeological, architectural and cultural heritage of the landscape within the proposed development zone. This is informed by the following records:

- Sites and Monuments Database (www.archaeology.ie) provides the record of archaeological sites in the Limerick region.
- Lists of Monuments in State Ownership which will require Ministerial Consent to carry out works in the vicinity of the monument.
- Lists of Monuments subject to preservation orders.
- Register of Historic Monuments. The National Monuments Act (Amendment 2005) requires two-months written notice to the Minister (Department of Housing, Heritage and Local Government) in advance of proposed works in relation to a registered archaeological or historic site listed in the register.
- National Inventory of Architectural Heritage (NIAH) for Co. Limerick. This includes building surveys and historic garden surveys of sites dating from 1700 AD to the modern period.
- Limerick County Development Plan. This includes the Record of Protected Structures and architectural conservation areas.
- Database of Irish Archaeological Excavation Reports (www.excavations.ie). This provides extra information on potential archaeological finds which may occur during on-site groundworks and guides the mitigation strategies.
- Aerial Photographs (Digital Globe; Google Earth).
- Ordnance Survey mapping (1:50000 [Discovery Series]; 1:5000; OS 6” scale [First and Second editions]; OS 25” scale).
- Published literature on the historic landscape of the area (see references).

13.3 The Receiving Environment

13.3.1 Present Landscape

The development is located on the south-west site of Limerick City (Figs 13.1–13.4). The site is greenfield, irregular in shape, bounded on the west by the R510, on the east and north by farmland and on the south by modern housing (Fig. 13.3). The First Edition (1840) and Second Edition Ordnance Survey (1905) maps (Figs 13.6–13.7) confirm the landscape on the development site was rural in the nineteenth and early twentieth centuries and remained so until the 1960s when housing was developed to cater for the expanding population of Limerick City. The area was under the control of Limerick County Council until 2014 when Limerick City and County Councils were amalgamated.

Ordnance survey mapping (1840; 1905) shows the fields on the development site were irregular in shape with curved boundaries on the north side and the layout is similar today (Fig. 13.3). The western boundary is a modern post-and-rail fence with trees along the fence, separating the landbank from the R510 (Fig. 8). A concrete block wall around housing on the south side of the development forms the southern boundary. The east and north sides are mature hedgerows and two hedgerows aligned north/south form intermediary field boundaries within the landbank (Figs 13.3 and 13.10).

Vegetation cover on the site is mostly low grassland (Figs 13.11–13.12) with some areas of high weed-covered ground on the west side (Fig. 13.13). A dump of modern debris[25] is located on the south-west end (Figs 13.3 and 13.14). A gravel track leads from the south-west end towards the east (Fig. 13.15) and a second track skirts the west side of the dumped material.

The townland name Ballykeeffe is an Anglicization of *Béal an Chaoith* (the Mouth of the Swamp). The name probably derives from the proximity of the north end of the townland to Ballinacurra Creek, which is tidal and prone to flooding along the river banks.

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[25] Concrete, stones, gravel, timber, etc.

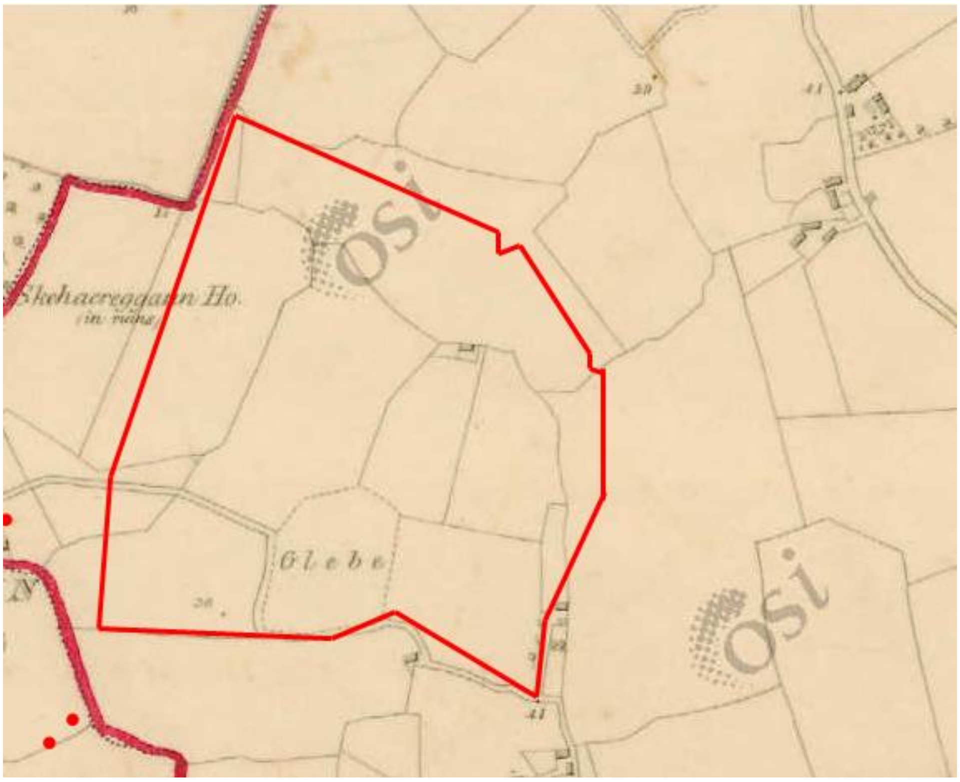

Figure 13.6: First Edition Ordnance Survey map (1840); Development site outlined in red

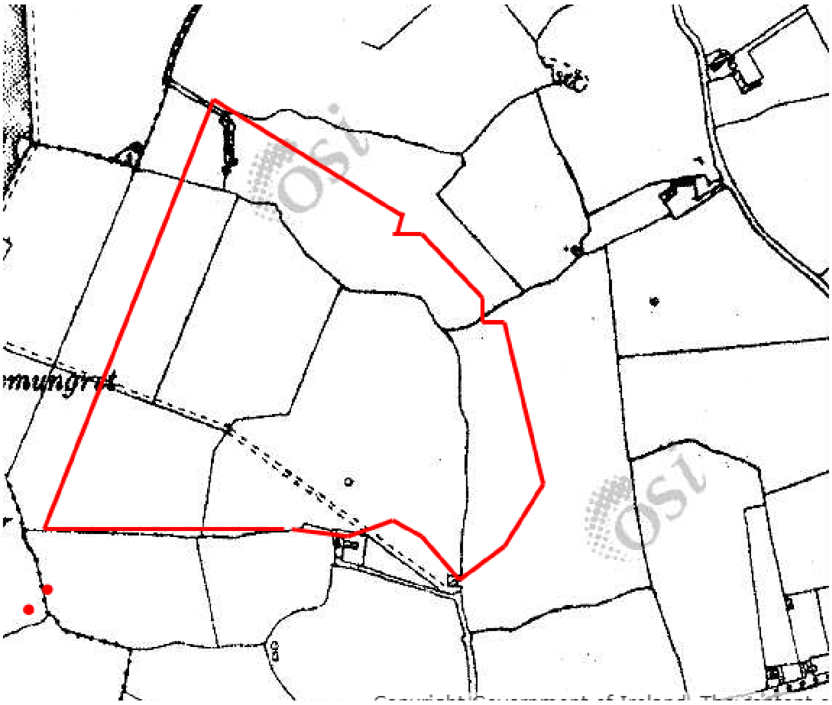

Figure 13.7: Second Edition Ordnance Survey map (1905); Development Site outlined in red

Figure 13.8: Western boundary with post and rail fence (arrowed)

Figure 13.9: Southern block wall boundary

Figure 13.10: Mature hedgerows aligned north/south within the landbank

Figure 13.11: Development site (Looking West)

Figure 13.12: Development site (Looking North)

Figure 13.13: High vegetation on west of landbank (Looking West)

Figure 13.14: Deposited building material on south-west side of development

Figure 13.15: Gravel trackway extending from entrance (at roundabout) towards the north-east

13.3.2. Archaeological and Historical Background

The development site was mapped by the Ordnance Survey in the early 1840s and in 1905 (Figs 13.6–13.7) and no archaeological sites were recorded on the development landbank. The site was also inspected prior to the commencement of building and no anomalies were detected to indicate previously-unknown archaeological sites. Grass cover was mostly low and conducive to the detection of surface indications of archaeological sites.

The development site is located within the modern boundary of Limerick City but about 4 km west of the historic core of Viking and Medieval settlement. A small enclosure (RMP[26] LI013-010) in Ballykeeffe

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[26] RMP = Record of Monuments and Places; LI = Limerick

townland is west of the development site (Fig. 13.16) and *c.* 10m in diameter and now tree covered. The site is of unknown date or function. There are five recorded archaeological sites to the west of the development in the adjacent townland of Skehacreggaun (Fig. 13.16). A seventeenth century house (RMP LI013-224) no longer survives above ground. A Holy Well (RMP LI013-224) to the south-west of the development is recorded as 'Toberpatrick' (Patrick's Well) on the 1840 Ordnance Survey map. The well was not in use as a place of pilgrimage when Ó Danachair (1955, 214) described the site. Ó Danachair noted that a local legend suggested the well became de-sanctified when a woman washed clothes at the well. O' Connor (2003) recorded that the well was close to a pilgrim path linking Mungret Abbey and Templemungret to the north. The well was fully excavated in 2004 and no longer exists.

Three sites were uncovered during archaeological monitoring in the course of a housing development in Skehacreggaun townland and relatively close to the development site. A corn-drying kiln (RMP LI013-225) was dated to the medieval period (10th to 14th centuries) and related to agricultural activity. A nearby pit (RMP LI013-226) was also excavated and is of unknown date or function. A cluster of archaeological features (RMP LI013-242) to the west of the development were uncovered during archaeological test trenching in 2007 in advance of a housing development. These included a souterrain, possible hut site, an enclosure, a kiln and pits. The features remain unexcavated but possibly date to the early medieval period (4th to 10th century) and represent a settlement site.

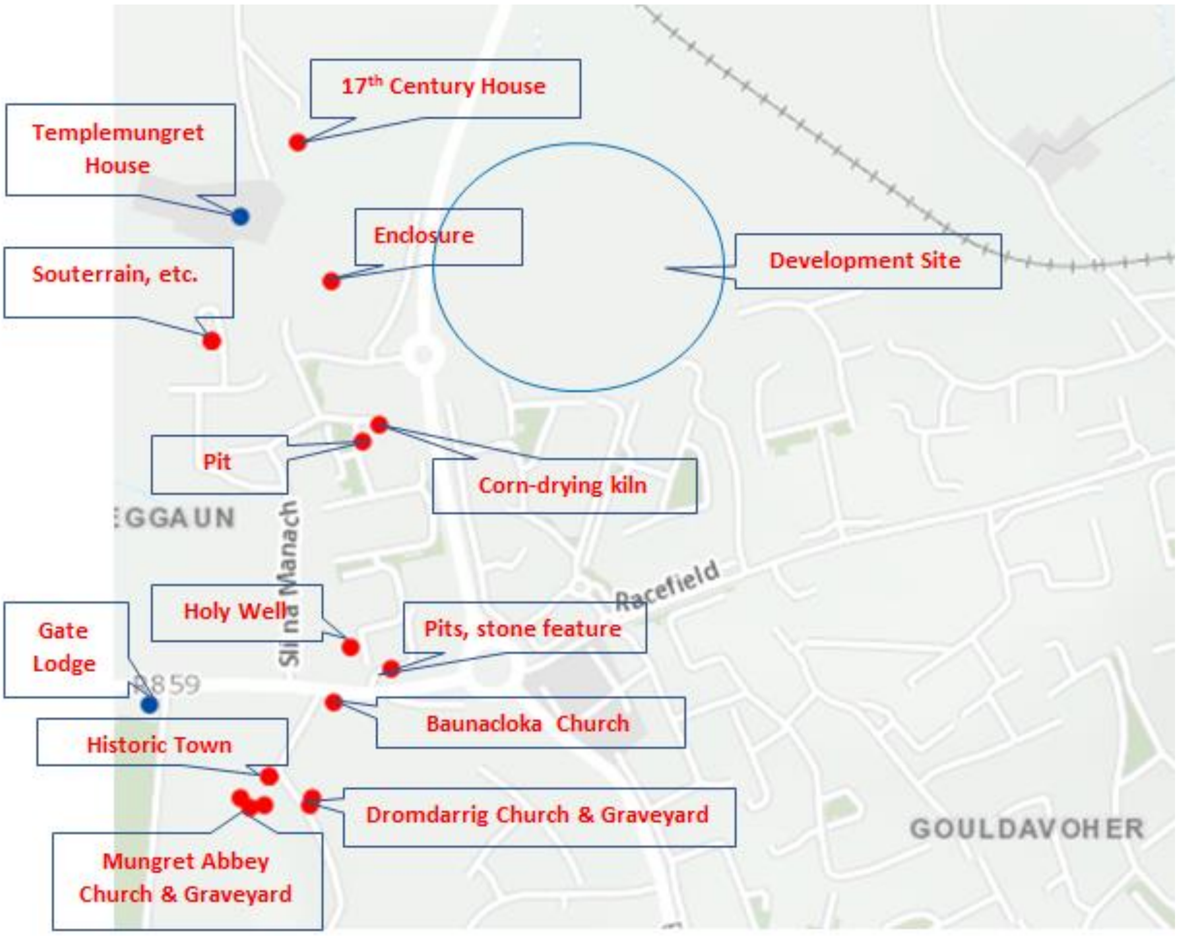

Figure 13.16: Archaeological and architectural sites in hinterland of development.

The site is north of the early monastic site of Mungret. This is a complex of two early stone churches, a later church and possibly a nucleated settlement immediately north of the churches. The monastery was founded by Neasán of Mungret (Mungairit) in the sixth century (Ó Riain 2011). The original church of St. Neasán was probably a wooden building of which nothing now survives above ground. The site is considered to be one of the most important Early Christian monasteries in Munster from the eight century onwards and became the episcopal seat and principal church for the diocese of Limerick after 1152 (Gwynn and Hadcock 1970). The lands were granted to the Bishop of Limerick after the Norman invasion. The proto-urban settlement ('historic town') that developed around the monastery declined in the fourteenth century, similar to other medieval villages due to a series of events including The Black Death, other pestilences and famines.

The monastic site includes two pre-Norman churches and a church recorded by the Ordnance Survey as 'Mungret Abbey'. Baunacloka Church (RMP LI013-009-001) is the northernmost in the complex and is rectangular in plan. The church is described in the Urban Archaeology Survey of Co. Limerick (Bradley *et al* 1989) as pre-Norman (before 1169) and Westropp (1904–05) dated the church to the tenth century. Dromdarrig Church (RMP LI013-009-002) and graveyard (RMP LI013-009-003) are on the east side of the monastic site. The church, similar to Baunacloka Church is dated by Westropp (1904–05) to the tenth century. A small graveyard associated with the church contains some nineteenth century gravestones and is still in use as a burial ground. A third church (RMP LI013-009-005) to the west and also in Dromdarrig townland is recorded on the First Edition Ordnance Survey map (1840) as 'Mungret Abbey'. This site includes the church ('The Abbey'), graveyard (RMP LI013-009-004) and a bullaun stone (RMP LI013-009-009). The church is linked to an Augustinian foundation by Leask (1933; 1971). The church has a two-storey residential tower with a belfry on the west end and recorded by the Urban Archaeology Survey of Co. Limerick (Bradley *et al* 1989) as a medieval parish church and not an abbey. There are building phases evident in the stonework and architectural form which date to the thirteenth and fifteenth centuries. Lewis (1837) recorded a gateway and a tower on the site of the abbey; the gateway does not survive and the tower may be the medieval parish church belfry. The graveyard is extensive and remains in use. A bullaun stone is located to the south-west of the medieval parish church and is of a type frequently found near ancient churches or monasteries. The stones have a central depression and are usually filled with rainwater and seen as either curing or cursing stones. A ruined Church of Ireland church also stands on the west side of the graveyard.

One field on the development landbank is recorded on the First Edition Ordnance Survey (1840) as 'Glebe' (Fig. 13.6). Glebe land is part of an ecclesiastical landholding used as a benefice to support the clergy. A Glebe field is also recorded on the 1840 Ordnance Survey map near Baunacloka Church.

13.3.3. Architecture – Protected Structures

There are two protected structures in the environs of the development (Fig. 13.16). Templeville House (Architectural Inventory Reg. No. 21901310) is west of the development and still in use as a residence. The house was built in the 1880s. The Gate Lodge (Architectural Inventory Reg. No. 21901317) for Mungret College (Architectural Inventory Reg. No. 21901316) is to the south-west of the development

(Fig. 13.16) and was built in 1860. Mungret College itself was built in 1858 and was a former agricultural college and latterly a secondary school (1882–1974).

13.4 Characteristics of the proposed development

The development comprises the construction of 384 residential house and apartment units (Fig. 13.5) on a *c.* 10.44ha site on the south-west side of Limerick City. The proposed development will provide the following:

- 202 no. housing units, comprising a variety of forms to include bungalows, detached, semi-detached and terraced houses. A mix of house sizes are proposed to include 20 no. two bedroom houses, 156 no. three bedroom houses and 26 no. four bedroom houses.
- 182 apartment and duplex units across 25 small scale blocks, 2 to 4 storeys in heights, throughout the development. The apartments and duplexes provide a mix of one, two, three and four bed units, comprising of 10 no. four bedroom duplex units, 10 no. three bedroom duplex units, 6 no. two bedroom duplex units, 18 no. three bedroom apartments, 92 no. two bedroom apartments and 46 no. one bedroom apartments.

The proposed development also includes:

- A childcare facility measuring 761.75m^2, providing 79 childcare places (55 full time and 24 after school places), located at the south-western edge of the development.
- The provision of 377 no. car parking spaces and 311 secured bicycle parking spaces.
- The provision of 3 no. ESB sub-stations, ancillary services and infrastructure works including foul and surface water drainage, attenuation areas, landscaped public open spaces (approximately 29,500m^2, or 28.2% of the total site area), landscaping, lighting, internal roads, cycle paths, and footpaths.

13.5 Review of potential impact of development on the archaeological and historic landscape

Archaeological Impact

The archaeological assessment is based on documentary and cartographic records and a site inspection. This information is used to predict the archaeological potential of the development site in terms of archaeological remains. Cartographic and documentary evidence indicates that there are no recorded archaeological monuments on the site. The site inspection did not detect any previously unknown archaeological sites. The nearest upstanding site is a small enclosure (RMP LI013-010) in Ballykeeffe townland to the west of the development. A seventeenth century house (RMP LI013-224) in the adjacent townland of Skehacreggaun is now levelled. A Holy Well (RMP LI013-009-006) also in Skehacreggaun townland was archaeologically excavated in 2004. There is therefore no direct impact on the known archaeological landscape.

Archaeological excavations in Skehacreggaun townland to the west of the development site in advance of housing developments recorded three previously unknown archaeological sites including a corn-drying kiln (RMP LI013-225), a pit (RMP LI013-226) and a cluster of features comprising an enclosure, possible hut site, souterrain and a kiln (RMP LI013-242). These sites may be associated with agricultural activity connected to the nearby Mungret monastic site to the south of the development. The proximity of the development at Ballykeeffe to the monastic site of Mungret may indicate that historic settlement and/or agricultural activity such as corn-drying kilns may remain below the modern surface. It is possible that other sub-surface archaeological sites exist in and around the development landbank which will only be uncovered during the groundworks phase of construction.

In order to prevent accidental damage to or loss of archaeological features, a series of mitigation strategies is presented below.

13.6 Mitigation Strategies

The proposed development area does not include any recorded archaeological sites. It is possible that sub-surface archaeological sites exist below the modern surface. It is therefore recommended that:

1. All ground disturbance should be monitored by a suitably qualified archaeologist. The monitoring archaeologist should be empowered to halt the development if buried archaeological features or finds are uncovered. If archaeological remains are uncovered, these sites become an archaeological site and are protected by the National Monuments legislation. Further work on the site will require consultation with the archaeological staff of The Heritage Service, National Monuments Division, Department of Housing, Local Government and Heritage.
2. Any newly discovered site must be archaeologically resolved. Provision, including financial and time should be made from at the outset of the project to facilitate any excavation or recording of archaeological material that may be uncovered during the developmental works.
3. All test pits for engineering purposes should also be archaeologically monitored to prevent accidental damage to buried archaeological features and to record any accidental discovery of features and/or finds.

13.7 Predicted Impacts

There is no predicted impact on any recorded archaeological site or feature. The proposed development may however, directly impact on previously unrecorded sub-surface archaeological remains. Archaeological monitoring is recommended to mitigate any potential adverse impact on archaeological remains. This is carried out during the groundworks stage.

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14.0 INTERATIONS AND CUMULATIVE IMPACTS

14.1 INTRODUCTION

Schedule 6 Item 2(d) of the Planning and Development Regulations, 2001 as amended requires that projects are examined with regard to the inter-relationship of aspects referred to in Item 2(d) of Schedule 6.

The Environmental Protection Agency "Guidelines on the Information to be Contained in Environmental Impact Statements", define a Cumulative Impact as "The addition of many small impacts to create one larger, more significant, impact", while a Synergistic Impact is defined as "Where the resultant impact is of greater significance than the sum of its constituents". This EIAR report seeks to identify all potential impacts of the subject scheme.

In preparing the EIAR, each of the specialist consultants have and will continue to liaise with each other and will consider the likely interactions between effects predicted as a result of the proposed Project during the preparation of the proposals for the subject site and this ensures that mitigation measures are incorporated into the design process.

This chapter of the EIAR seeks to identify where the environmental factors examined in the above sections may be inter-related. This chapter also examines whether there would be any cumulative impact of the proposed development in combination with other planned projects in the surrounding area.

14.2 SUMMARY OF PRINCIPLE INTERACTIONS

14.2.1 POPULATION AND HUMAN HEALTH

All environmental factors have the potential to impact on Population and Human Health. The potential impacts and appropriate mitigation measures have been examined in Chapter 4 of this EIAR. The most likely interactions with human health are considered to be the following chapters;

Land, Soils, and Geology

Water and Hydrology

Air Quality and Climate

Noise and Vibration

Landscape and Visual Impact

Material Assets – Waste

Traffic and Transportation

It is considered that once all mitigation measure recommended within this EIAR are incorporated within the final development, there will be no adverse impact on Population and Human Health.

14.2.2 BIODIVERSITY

The habitats present within the Site are commonly occurring throughout Ireland and are evaluated to be either important at the Site and Local level or not important. Areas of potential interactions are considered;

- Land, Soils and Geology;
- Landscape and Visual Impact;
- Water and Hydrology

The proposed development will not result in any significant effects on the biodiversity of the Site and provided the recommended best practice and mitigation is implemented it is considered that development will not result in any residual significant effects on the biodiversity of the Site.

14.2.3 LAND, SOIL AND GEOLOGY

Subject to implementation and adherence with mitigation measures proposed, there are no significant interactions or impacts relating to Land, Soil and Geology anticipated as a result from the proposed development.

14.2.4 WATER AND HYDROLOGY

The earthworks for the site has the potential to impact on the surface water quality, by silt generated from runoff or chemicals/oils from construction vehicles carrying out the works. Potential health effects arise mainly through the potential for soil and ground contamination. The protection of the water environment will help to ensure that Human Health is not significantly impacted by the implementation of the SHD. The key areas of interaction in this case are identified as;

Population and Human Health;

Land, Soils and Geology;

Biodiversity

Subject to the implementation of the proposed mitigation measures during construction and operational phase of the development, there are no significant impacts predicted in relation to Water and Hydrology.

14.2.5 AIR QUALITY AND CLIMATE

The most significant potential impacts to air quality are predicted to occur within the construction phase of the development. It is predicted that the impact on air quality from the operational phase of the development will not be significant. The most notable areas of interaction with Air Quality and Climate are:

Population and Human Health

Biodiversity

Traffic and Transportation

Subject to adherence to the proposed mitigation measures, no significant adverse impacts are anticipated to result from the proposed development.

14.2.6 NOISE AND VIBRATION

Noise and vibration interacts particularly with human health, especially during the construction phase of the project where there is potential disruption due to increased activity on site and associated construction traffic. Additional noise is also associated with the operational phase where additional traffic is predicted.

The key areas of interaction are therefore considered to be:

Population and Human Health

Roads and Traffic

Subject to adherence to the proposed mitigation measures, no significant adverse impacts are anticipated.

14.2.7 LANDSCAPE AND VISUAL IMPACT

The long-term effects of the proposed development will have a positive effect the landscape of the local area and is to include use of native species planting. The proposed project generates visual significant effects as the subject site is currently undeveloped lands with existing hoarding surrounding the site. The key areas of interaction are considered to be:

Population and Human Health

Biodiversity

Subject to adherence to the proposed mitigation measures, no significant adverse impacts are anticipated in relation to Landscape and Visual Impact.

14.2.8 TRAFFIC AND TRANSPORATION

The changes to traffic in the surrounding area during both the construction and operational phase of the development have the potential to effect air quality and also noise levels due to increased traffic travelling to the site.

The key identified interactions in this case are;

Air Quality and Climate;

Noise and Vibration

Subject to the adherence with the proposed mitigation measures, no significant impacts relating to Traffic and Transportation are predicted.

14.2.9 MATERIAL ASSETS – WASTE

The construction and operational phases of the proposed development will generate waste which has the potential to interact with human health. The identified areas of interaction are therefore considered to be:

Population and Human Health

Subject to adherence to the proposed mitigation measures relating to the orderly management of waste during construction and operational phase of the development, no significant adverse impacts are anticipated.

14.2.10 CULTURAL HERITAGE

There are no interactions identified between Cultural Heritage and other environmental factors examined within this EIAR.

14.3 CUMULATIVE IMPACTS

14.3.1 INTRODUCTION

This Chapter has regard to the potential cumulative impact upon the environment arising from the proposed project, in combination with other developments (committed or planned projects) in the surrounding area. Cumulative impact is defined by the EU Guidelines as:

"Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project. For example:

Incremental noise from a number of separate developments;

Combined effect of individual impacts, e.g. noise, dust and visual, from one development on a particular receptor; and

Several developments with insignificant impacts individually but which together have a cumulative effect."

14.3.2 COMMITTED PROJECTS

Planning Reg. Ref. 20738 – construction of a new 1000 pupil post-primary school circa 11,379sqm over 3 storey levels with rooftop plantroom and 450sqm photovoltaic panels. Incorporating Teaching spaces, Social spaces, Multi-purpose hall, Special Education Needs unit & ESB substation. A new site entrance & internal road with set-down area, car parking for 90no. spaces, covered bicycle stand, 6no. ballcourts, playing field, landscaping, new boundary treatments. Main access will be via new roadway with cycle lane and footpath which will be formed off the planned new distributor road with spur connection as granted permission 19/8011 and all associated site works on a 10acres site. Permission was granted on 28th January 2021.

Planning Reg. Ref. 201115 - construction of 96 no. residential units: 1 no. 4 bedroom detached unit, 2no. 4 bedroom semi-detached units, 2no. 3 bedroom semi-detached units, 14no. 3 bedroom terraced units, 3no. 2 bedroom terraced units, 4no. 3 bedroom apartments, 19no. 2 bedroom apartments, 1 no. 1 bed apartments, 2no. 3 bed duplex apartments, 48no. 2 bed duplex apartments. Provision of Creche and Community Building including external play area(Gross Floor Area - 787 sq.m, Creche 610 sq.m & Community Building 177 sq.m). Provision of shared communal and private open space, car parking, bicycle parking store(64 sq.m) and racks, bin storage, vehicular and pedestrian access, public lighting, site landscaping, services, signage, ESB substation and all associated site development works. Development to include access onto the Mungret Road(R859). Permission was granted on 27th May 2021.

Planning Reg. Ref. 201195 - the construction of 66no. residential units comprising 12no. 2-bed semi-detached bungalows, 27 no. 3-bed 2 storey semi-detached/terraced dwelling houses, 18no. 1-bed apartments and 9no. 2-bed apartments, with associated secure bicycle parking and bin storage. Vehicular access to the proposed development will be via Baunacloka Heights, which is part of the Mungret Gate development currently under construction. The development will also include two pedestrian accesses onto the R510 and all associated site works including 97no. car parking spaces, foul and storm drainage with attenuation, public lighting, landscaping and amenity areas. Permission was granted on the 20th May 2021.

Planning Reg. Ref. 21532 - the construction of supported housing for older people consisting of 7 no. 2 bed single storey units in two terraces of 3 and 4 units arranged around a landscaped central communal courtyard, amendments to parking layout and bin storage previously permitted under planning permission reference 16/1196, two pedestrian links onto Quinns Cross Roundabout and all associated site services and ancillary site works. Permission was granted on 26th November 2021.

Each environmental issue assessed within this EIAR has been considered in respect to the cumulative impact of the proposed projects with the above referenced developments.

14.3.3 PLANNED PROJECTS

Planning Reg. Ref. 218000 - A Part 8 planning application was submitted in February 2021 for the construction of 253 no. residential units including 36 no. two bed houses; 110 no. three bed houses; 26 no. four bed houses; 2 no. six bed community dwellings; 37 no. two bed apartment units; and 42 no. one bed apartment units, with renewable energy design measures (which may be provided externally) for each housing unit. The residential units are structured such that (a) 146 no. houses and apartments are intended for private sale/rental; (b) 50 no. houses and apartments are affordable units intended for private sale/rental; (c) 2 no. detached units are intended as community dwellings; and (d) 55 no. apartments are intended as Independent Living for Older Persons of which 25 no. apartments intended as Social – Rental units, a crèche facility with capacity to accommodate 70 no. children, a community facility with ancillary café of 35 sqm net floor area, 2 no. local retail and retail service units, of 80 sqm net floor area situated fronting the public square and positioned within the Independent Living for Older Persons complex, public toilet, landscaping works including provision of playground/kick about areas, new pedestrian and cycle connections and public square, associated site and infrastructural works including provision for water services, foul and surface water drainage and associated connections and attenuation proposals including permeable paving and swales, 2 no. ESB substations, external plant and services, car/bicycle parking and all associated site development works. The development will be accessed from the proposed Mungret Link Road with 5 no units only, accessed from the existing Mungret Woods Housing Development. Part of the site is currently being used as a temporary school and that part of the development (crèche, community centre and 12 no. apartments) shall not progress until such time as the school vacates those lands and removes the portacabins in accordance with the terms of their permission (17/357). The development also necessitates demolition of an agricultural building. Permission was granted on 13th July 2021.

Each environmental issue assessed within this EIAR has been considered in respect to the cumulative impact of the proposed project with the above referenced development.

14.4 CONCLUSION

Having regard to the above, this EIAR considers the total impact associated with the proposed project, in combination with committed and planned development within the area surrounding the site. Each chapter that covers an environmental aspect has regard to any potential cumulative impacts arising from the proposed project in combination with the above identified projects. There are no committed developments of scale within the immediate area of the subject site but it is acknowledged that for some environmental considerations, cumulative effects must be considered for projects outside of the immediate area as listed above. It is considered that no significant cumulative impacts are likely to arise.

15.0 SUMMARY OF MITIGATION AND MONITORING MEASURES

15.1 INTRODUCTION

The EPA Guidelines note that “for ease of reference and clarity and to facilitate enforcement, all such measures contained in an EIAR can be included in a compendium of mitigation and monitoring commitments (only). This may be a separate section or Appendix to the EIAR. Such a compendium should comprise a list of relevant measures but should not elaborate on the reasoning or expected effectiveness of those measures as the elaboration will take place within the main body of the EIAR”. This Chapter provides a consolidated list of all of the environmental commitments/ mitigation measures and monitoring that have been recommended by the various specialists throughout the Chapters of this EIAR.

The mitigation and monitoring measures have been recommended on that basis that they are considered necessary to protect the environment during both the construction and operational phases of the proposed project.

15.2 MITIGATIONA NAD MONITORING MEASURES SUMMARY

Table 15.1: Summary of Mitigation Measures Proposed

Mitigation No.	Mitigation Measure	Phase
	Biodiversity	
	Mitigation	
1	Hedgerows: No specific mitigation measures are required outside that of the proposed planting plans contained within the Landscape Specifications submitted with this application. A hedge management plan should be prepared and implemented, as part of the future maintenance of the green spaces within the site.	Construction & Operational

2	Mixed Broadleaved Woodland – WD1: In compensation for the loss of trees / shrubs, the proposed development contains considerable proposals for native tree / shrub planting in both the internal designed public spaces, as well as the larger public open spaces along the northern and eastern boundaries. In the larger spaces, groups of trees / small woodland areas are proposed. Trees species proposed include native species such as alder, birch and rowan.	Construction
3	Birds: In compensation for the loss of trees and hedgerows, the proposed development contains considerable proposals for native tree / shrub planting in both the internal designed public spaces, as well as the larger public open spaces along the northern and eastern boundaries. In the larger spaces, groups of trees / small woodland areas are proposed.	Construction
Land, Soil, Geology		
Mitigation		
4	During the construction stage, operations will adhere to Transport Infrastructure Ireland (TII) Specification for Road Works Series 600 – Earthworks.	Construction
5	A Soil Management Plan (SLR, 2021) has also been developed for the proper management and care of soils and subsoils at the site. During the phased and final stages of construction, the stored soils and subsoils will be used to provide landscaping at the site.	Construction
6	Topsoil will be stored separately to subsoils.	Construction
7	Subsoils will be stored in such a way as to keep them free from contamination so that they can be used as clean, inert fill.	Construction

8	Some limestone bedrock is likely to be removed and will be stored appropriately so that it can be used as clean, inert fill.	Construction
Monitoring		
9	Monitoring during the construction phase is recommended, to ensure adherence to the measures set out in the Soil Management Plan(SLR, 2021) and the Construction Environmental Management Plan (Hutch O'Malley, 2022)	Construction
Water and Hydrology		
Mitigation		
10	Procedures and Best Practice outlined within the specific Construction Environmental Management Plan will be implemented and maintained throughout the construction phase of development.	Construction
11	Best practice in design and construction will be employed for the installation of surface runoff water drainage and during site clearance and construction. As a failsafe to provide sitewide protection to the downstream water features, a silt trap shall be installed along the 3 m OD contour as indicated in the construction plan drawing 18112-C37. Other environmental protection procedures as per the Construction Environmental Management Plan and Soil Management Plan SMP shall also be used by the contractor, with special attention given to the temporary storage of all materials.	Construction
12	Measures, as recommended in the guidance of The Construction Industry Research and Information	Construction

	Association, that will be implemented to minimise the risk of spills and contamination of soils and waters include: Careful consideration will be given to the location of any fuel storage facilities. These will be designed in accordance with guidelines produced by CIRIA, and will be fully bunded. All vehicles and plant will be regularly inspected for fuel, oil and hydraulic fluid leaks. Suitable equipment to deal with spills will be maintained on site. Where at all possible, soil excavation will be completed during dry periods and undertaken with excavators and dump trucks. Topsoil and subsoil will not be mixed together. Ensure that all areas where liquids are stored or cleaning is carried out are in a designated impermeable area that is isolated from the surrounding area, e.g. by a roll-over bund, raised kerb, ramps or stepped access. Use collection systems to prevent any contaminated drainage entering surface water drains, watercourses or groundwater, or draining onto the land. Minimise the use of cleaning chemicals. Use trigger-operated spray guns, with automatic water-supply cut-off. Use settlement lagoons or suitable absorbent material such as flocculent to remove suspended solids such as mud and silt. Ensure that all staff are trained and follow vehicle cleaning procedures. Post details of the procedures in the work area for easy reference.	

13	Due to the impact of increased flooding from development and in order to eliminate its impact; it is proposed to attenuate the surface water runoff by providing storage attenuation using hydrobrakes to limit the outflow to the river to greenfield runoff rates in accordance to flood estimation for small catchments from the Institute of Hydrology Report Report 124. The result of the flood estimation shows that the permissible outflow for the 10.44 hectares is to be limited to 57 litres / sec in a 1:100yr event (Calculations are contained within the submitted Civil Engineering Report, Hutch, O'Malley, 2022)	Construction
14	Pipelines constructed and tested to appropriate Irish and International standards will reduce the potential for surface water leaks to groundwater.	Operational
15	The mitigation measures to be implemented during the operational phase of the proposed development will include the implementation of proper operation and maintenance regimes for the surface water drainage system in accordance with the recommendations of guidelines such as The Construction Industry Research and Information Association (CIRIA) and The SuDS Manual, to reduce the risk of human or mechanical error causing a pluvial flood risk from blockages, etc.	Operational
Monitoring		
16	The Resident Engineer on site will be responsible for ensuring that all personnel monitor the contractor's water pollution control practices and maintain compliance with the approved project waste management plan. This includes reviewing the	Construction

	contractor's plan, reviewing written inspection reports, and conducting field inspections.	
	Air Quality and Climate	
	Mitigation	
17	*Air Quality* The pro-active control of fugitive dust will ensure the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released. A dust management plan will be implemented onsite. The main contractor will be responsible for the coordination and ongoing monitoring of the dust management plan. The key aspects of controlling dust are listed below. These measures will be incorporated into the overall Construction Environmental Management Plan (CEMP) for the site. The measures which will be implemented will include: Drop heights from conveyors, loading shovels, hoppers and other loading equipment will be minimised, if necessary fine water sprays will be employed. Hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads will be restricted to essential site traffic. Any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.	Construction

	When conditions are such that there is a risk of trackout of dust (i.e. very dry or muddy), vehicles exiting the site shall make use of a wheel wash facility prior to entering onto public roads. Vehicles using site roads will have their speed restricted through speed limit implementation, and this speed restriction will be enforced rigidly. On any site roads, this will be 20 kmph. Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary. Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods. During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions. At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust and other dust generating activities will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.	

18	*Climate* Impacts to climate during the construction stage are predicted to be imperceptible however, good practice measures can be incorporated to ensure potential impacts are lessened. These include: Prevention of on-site or delivery vehicles from leaving engines idling, even over short periods. Ensure all plant and machinery are well maintained and inspected regularly. Minimising waste of materials due to poor timing or over ordering on site will aid to minimise the embodied carbon footprint of the site.	Construction
Monitoring		
19	Monitoring of construction dust deposition at locations along the site boundary close to the nearby sensitive receptors during the construction phase of the proposed development is recommended to ensure mitigation measures are working satisfactorily. This can be carried out using the Bergerhoff method in accordance with the requirements of the German Standard VDI 2119. The Bergerhoff Gauge consists of a collecting vessel and a stand with a protecting gauge. The collecting vessel is secured to the stand with the opening of the collecting vessel located approximately 2m above ground level. The TA Luft limit value is 350 mg/(m2*day)during the monitoring period between 28-32 days.	Construction
Noise and Vibration		
Mitigation		

20	Selection of Quiet Plant This practice is recommended in relation to sites with static plant such as compressors and generators. It is recommended that these units be supplied with manufacturers' proprietary acoustic enclosures where possible. The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item should be selected wherever possible.	Construction
21	Noise Control at Source If replacing a noisy item of plant is not a viable or practical option, consideration should be given to noise control "at source". Noise control at source relevant to the development works are set out as: For mobile plant items such as cranes, dump trucks, excavators and loaders, the installation of an acoustic exhaust and or maintaining enclosure panels closed during operation can reduce noise levels by up to 10dB. Mobile plant should be switched off when not in use and not left idling. For percussive tools such as pneumatic concrete breakers and tools a number of noise control measures include fitting muffler or sound reducing equipment to the breaker 'tool' and ensure any leaks in the air lines are sealed. Erect localised screens around breaker or drill bit when in operation in close proximity to noise sensitive boundaries.	Construction

	For concrete mixers, control measures should be employed during cleaning to ensure no impulsive hammering is undertaken at the mixer drum. For all materials handling ensure that materials are not dropped from excessive heights, lining drops chutes and dump trucks with resilient materials. Demountable enclosures can also be used to screen operatives using hand tools/ breakers and will be moved around site as necessary. All items of plant should be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.	
22	Screening Typically screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to all other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen and its position relative to both the source and receiver. Screening should be established where appropriate as a useful form of noise control when works are taking place at basement and ground level to screen noise levels at ground floor adjacent buildings.	Construction
23	Liaison with the Public A designated noise liaison should be appointed to site during construction works. All noise complaints should	Construction

	be logged and followed up in a prompt fashion by the liaison officer. In addition, prior to particularly noisy construction activity, e.g. demolition, breaking, piling, etc., the liaison officer should inform the nearest noise sensitive locations of the time and expected duration of the noisy works.	
24	Hours of Work Construction works will be undertaken within the times below, taken from the Section 6 of the Construction and Environmental Management Plan: Monday to Friday 07:00 to 19:00hrs Saturday 07:00 to 14:00hrs Sunday and Public Holidays No noisy work on site.	Construction
25	During the detailed design of the development, the selection and location of mechanical and electrical plant will be undertaken in order to ensure the noise emission limits set out are not exceeded. Plant items in the proposed development are limited to domestic heating and ventilation equipment and therefore no specific mitigation measures are required.	Operational
26	At detailed design stage, appropriate glazing and venting will be determined to ensure suitable internal noise levels.	Operational
Landscape and Visual Impact		
Monitoring		
27	During the construction phase, site hoarding will be erected to restrict views of the site during construction.	Construction

	Hours of construction activity will also be restricted in accordance with local authority guidance. Tree protection measures will be installed to the existing trees and hedges identified for retention on site within the Arboricultural assessment submitted under a separate cover. Visual impact during the construction phase will be mitigated somewhat through appropriate site management measures and work practices to ensure the site is kept tidy, dust is kept to a minimum, and that public areas are kept free from building material and site rubbish.	
28	All planting is to be undertaken in the first season following completion of site and development works of each phase of development.	Operational
29	Native trees, shrubs and wildflowers will be used where possible throughout the development.	Operational
30	Where possible, screening of proposed structures with tree lines and woodland planting is proposed.	Operational
	Monitoring	
31	Landscape tender drawings and specifications will be produced at detailed design stage to ensure that the landscape works are implemented in accordance with best practice. This document will include tree work procedures, soil handling, planting and maintenance. The contract works will be supervised by a suitably qualified landscape architect.	Construction

32	Operational phase monitoring will include weed control, maintenance and replacement planting where necessary. Periodic visits will be required to ensure that any defects that may occur are rectified, that the landscape proposals are successfully establishing and being correctly maintained.	Operational
	Traffic and Transportation	
	Mitigation	
33	A construction phase traffic management plan will be agreed with Limerick City and County Council covering for example, timings of HCV deliveries and facilities on site for the washing of vehicles	Construction
34	To minimise the impact of the development on the capacity and operation of the local road network, the action plan contained within the Mobility Management Plan prepared for the development should be implemented	Operational
35	To minimise the impact of traffic noise within the development, low-noise (porous) asphalt should be specified for the surfacing of internal roads within the development	Operational
36	To minimise the impact of development related traffic on local air quality, electric vehicle charging points should be installed within the development, with infrastructure such as cable ducting being provided to increase the proportion of such charging points over time.	Operational
37	If the relative impact of the proposed development results in additional queuing and delay at the existing R510/Mungret Road/Father Russell Road (Quinn's Cross)	Operational

	roundabout junction, alterations should be made to the existing pedestrian crossing facilities at this junction. Such alterations would need to be fully designed and assessed through additional traffic modelling and road safety audit.	
Material Assets – Waste		
Mitigation		
38	A project specific Construction and Demolition Resource Waste Management Plan (C&D RWMP) has been prepared in line with the requirements of the requirements of the *Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects* (DoEHLG, 2006. Adherence to the high-level strategy presented in this C&D RWMP will ensure effective waste management and minimisation, reuse, recycling, recovery and disposal of waste material generated during the excavation and construction phases of the proposed Development. Prior to commencement, the appointed Contractor(s) will be required to refine / update the C&D RWMP in agreement with LCCC, or submit an addendum to the C&D RWMP to LCCC, detailing specific measures to minimise waste generation and resource consumption, and provide details of the proposed waste contractors and destinations of each waste stream. The Contractor will be required to fully implement the C&D RWMP throughout the duration of the proposed construction phase.	Construction

39	Correct classification and segregation of all excavated material is required to ensure that any potentially contaminated materials are identified and handled in a way that will not impact negatively on workers as well as on water and soil environments, both on and off-site.	Construction
40	The following additional mitigation measures will be implemented: Building materials will be chosen with an aim to 'design out waste'; On-site segregation of waste materials will be carried out to increase opportunities for off-site reuse, recycling and recovery. The following waste types, at a minimum, will be segregated: Concrete rubble (including ceramics, tiles and bricks); Plasterboard; Metals; Glass; and Timber. Left over materials (e.g. timber off-cuts, broken concrete blocks / bricks) and any suitable construction materials shall be re-used on-site, where possible; All waste materials will be stored in skips or other suitable receptacles in designated areas of the site; Any hazardous wastes generated (such as chemicals, solvents, glues, fuels, oils) will also be segregated and will be stored in appropriate	Construction

	receptacles (in suitably bunded areas, where required); A Waste Manager will be appointed by the main Contractor(s) to ensure effective management of waste during the excavation and construction works; All construction staff will be provided with training regarding the waste management procedures; All waste leaving site will be reused, recycled or recovered, where possible, to avoid material designated for disposal; All waste leaving the site will be transported by suitably permitted contractors and taken to suitably registered, permitted or licenced facilities; and All waste leaving the site will be recorded and copies of relevant documentation maintained. Nearby sites requiring clean fill material will be contacted to investigate reuse opportunities for clean and inert material, if required. If any of the material is to be reused on another site as by-product (and not as a waste), this will be done in accordance with Article 27 of the EC (Waste Directive) Regulations (2011). EPA approval will be obtained prior to moving material as a by-product. However, it is not currently anticipated that Article 27 will be used.	
41	A project specific Operational Waste Management Plan (OWMP) has been prepared for this project. The Operator / Buildings Manager of the Site during the	Operational

	operational phase will be responsible for ensuring – allocating personnel and resources, as needed – the ongoing implementation of this OWMP, ensuring a high level of recycling, reuse and recovery at the Site of the proposed Development.	
42	The Operator / Buildings Manager will ensure on-Site segregation of all waste materials into appropriate categories, including (but not limited to): Organic waste; Dry Mixed Recyclables; Mixed Non-Recyclable Waste; Glass; Waste electrical and electronic equipment (WEEE); Batteries (non-hazardous and hazardous); Cooking oil; Light bulbs; Cleaning chemicals (pesticides, paints, adhesives, resins, detergents, etc.); Furniture (and from time to time other bulky waste); and Abandoned bicycles.	Operational
43	The Operator / Buildings Manager will ensure that all waste materials will be stored in colour coded bins or other suitable receptacles in designated, easily	Operational

	accessible locations. Bins will be clearly identified with the approved waste type to ensure there is no cross contamination of waste materials.	
44	The Operator / Buildings Manager will ensure that all waste collected from the Site of the proposed Development will be reused, recycled or recovered, where possible, with the exception of those waste streams where appropriate facilities are currently not available.	Operational
45	The Operator / Buildings Manager will ensure that all waste leaving the Site will be transported by suitable permitted contractors and taken to suitably registered, permitted or licensed facilities.	Operational
	Monitoring	
46	The objective of setting targets for waste management is only achieved if the actual waste generation volumes are calculated and compared. This is particularly important during the excavation and construction works, where there is a potential for waste management objectives to become secondary toother objectives, i.e. progress and meeting construction schedule targets. The C&DRWMP specifies the need for a Waste Manager to be appointed, who will have responsibility for monitoring the actual waste volumes being generated and ensuring that contractors and sub-contractors are segregating waste as required. Where targets are not being met, the Waste Manager will identify the reasons for this and work to resolve any issues. Recording of waste generation during the construction phase of the proposed Development will enable better management of waste contractor	Construction

	requirements and identify trends. The data should be maintained to advise on future Developments.	
47	During the operational phase, waste generation volumes will be monitored by the Operator /Buildings Manager against the predicted waste volumes outlined in the OWMP. There maybe opportunities to reduce the number of bins and equipment required in the WSAs, where estimates have been too conservative. Reductions in bin and equipment requirements will improve efficiency and reduce waste contactor costs.	Operational
	Cultural Heritage	
	Mitigation	
48	All ground disturbance should be monitored by a suitably qualified archaeologist. The monitoring archaeologist should be empowered to halt the development if buried archaeological features or finds are uncovered. If archaeological remains are uncovered, these sites become an archaeological site and are protected by the National Monuments legislation. Further work on the site will require consultation with the archaeological staff of The Heritage Service, National Monuments Division, Department of Housing, Local Government and Heritage.	Pre Construction / Construction
49	Any newly discovered site must be archaeologically resolved. Provision, including financial and time should be made from at the outset of the project to facilitate any excavation or recording of archaeological material that may be uncovered during the developmental works.	Pre Construction / Construction
50	All test pits for engineering purposes should also be archaeologically monitored to prevent accidental	Pre Construction / Construction

	damage to buried archaeological features and to record any accidental discovery of features and/or finds.	
Monitoring		
51	Archaeological monitoring is recommended to mitigate any potential adverse impact on archaeological remains. All ground disturbance should be monitored by a suitably qualified archaeologist. The monitoring archaeologist should be empowered to halt the development if buried archaeological features or finds are uncovered. If archaeological remains are uncovered, these sites become an archaeological site and are protected by the National Monuments legislation. Further work on the site will require consultation with the archaeological staff of The Heritage Service, National Monuments Division, Department of Housing, Local Government and Heritage. All test pits for engineering purposes should also be archaeologically monitored to prevent accidental damage to buried archaeological features and to record any accidental discovery of features and/or finds.	Pre Construction / Construction

Project No. 13.05/2022

RW Nowlan & Associates
Chartered Planning & Property Advisors

Environmental Impact Assessment Report

Part 3 - Appendices

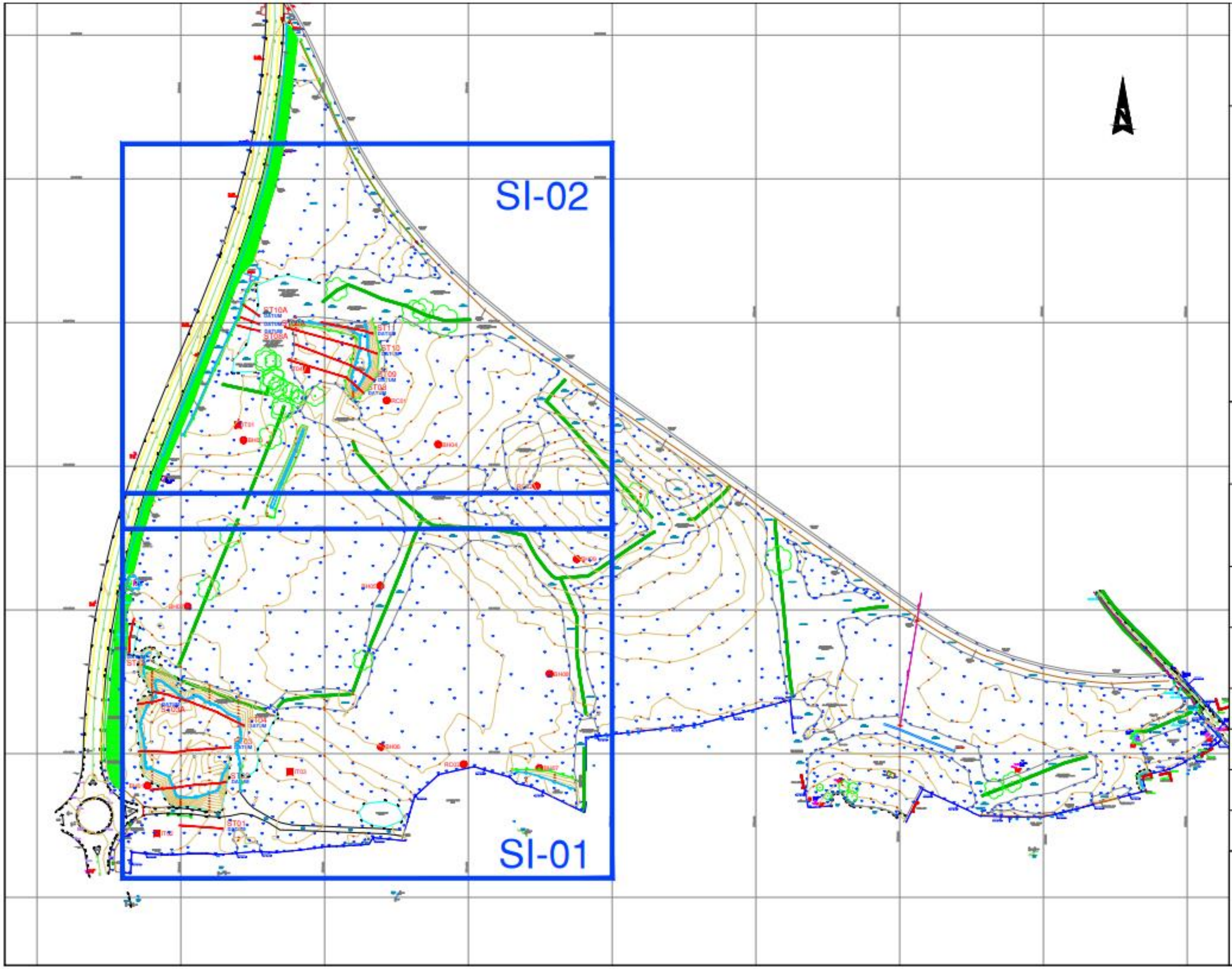
RE: Ballykeeffe, Raheen, Co. Limerick
SHD Application to An Bord Pleanala

DATE: February 2021

on behalf of: DW Raheen Developments Ltd.

Table of Contents

APPENDIX 6.1 RAHEEN SI LOGS – PRIORITY GEOTECHNICAL



Priority Geotechnical Site

JOB NAME:

Raheen Housing

Sheet Title:

EXPLORATORY LOCATION LAYOUT

JOB NUMBER:

P21161

DRAWING NUMBER:

P21161-SI-A

DRAWN BY:

G.C.

DATE:

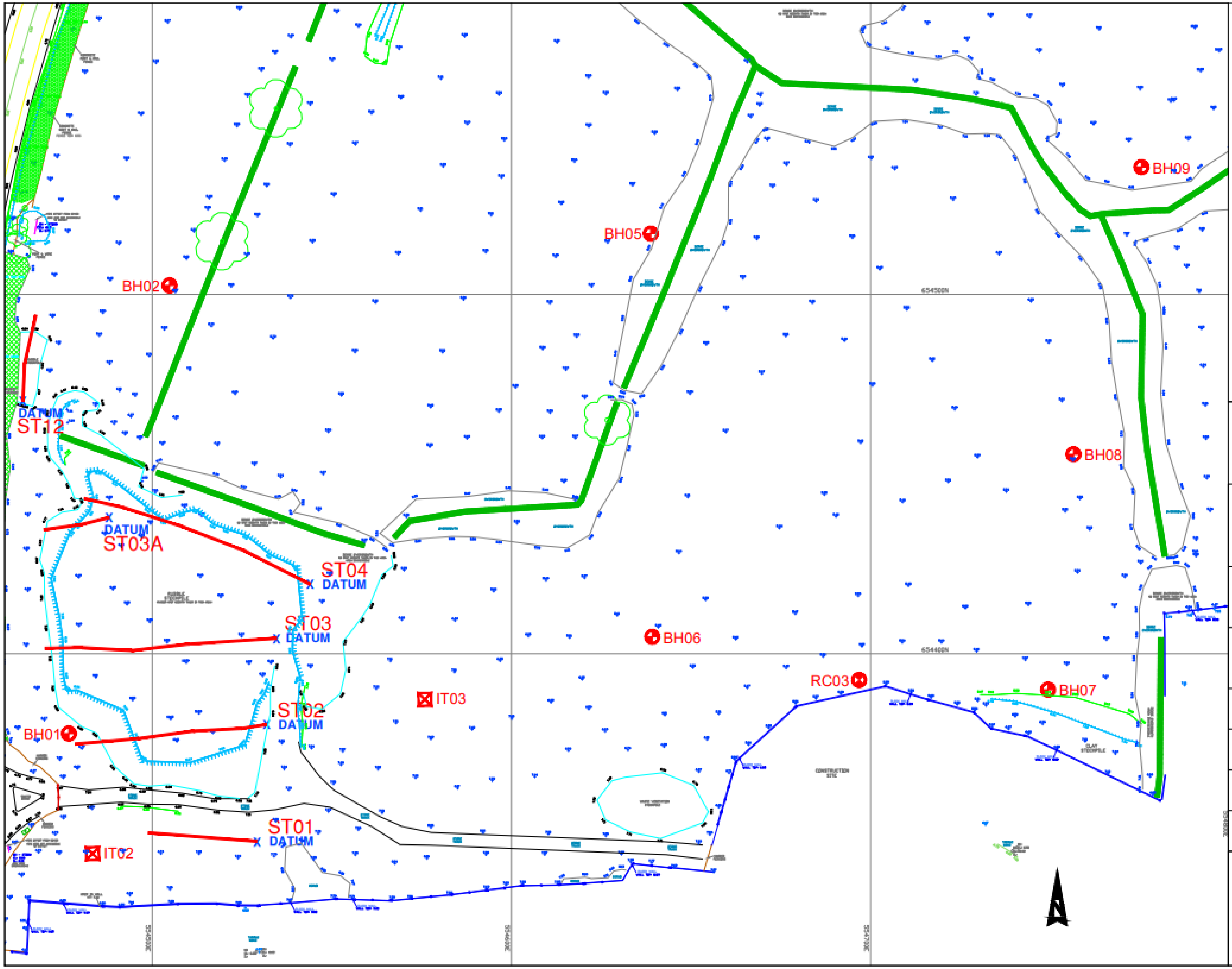
20/07/2021

SCALE:	APPROVED:
1:2500 ON A3	GH

REVISION:

D01

pgl priority geotechnical



KEY:

ST00 DATUM	Denotes Slit Trench and Datum location
☒ IT00	Denotes Infiltration Test location
● BH00	Denotes Borehole location
● RC00	Denotes Rotary Core location

JOB NAME:
Raheen Housing

Sheet Title:
EXPLORATORY LOCATION PLAN

JOB NUMBER:
P21161

DRAWING NUMBER:
P21161-SI-01

DRAWN BY:
G.C.

DATE:
20/07/2021

SCALE:	APPROVED:
1:1000 ON A3	GH

REVISION:
D01

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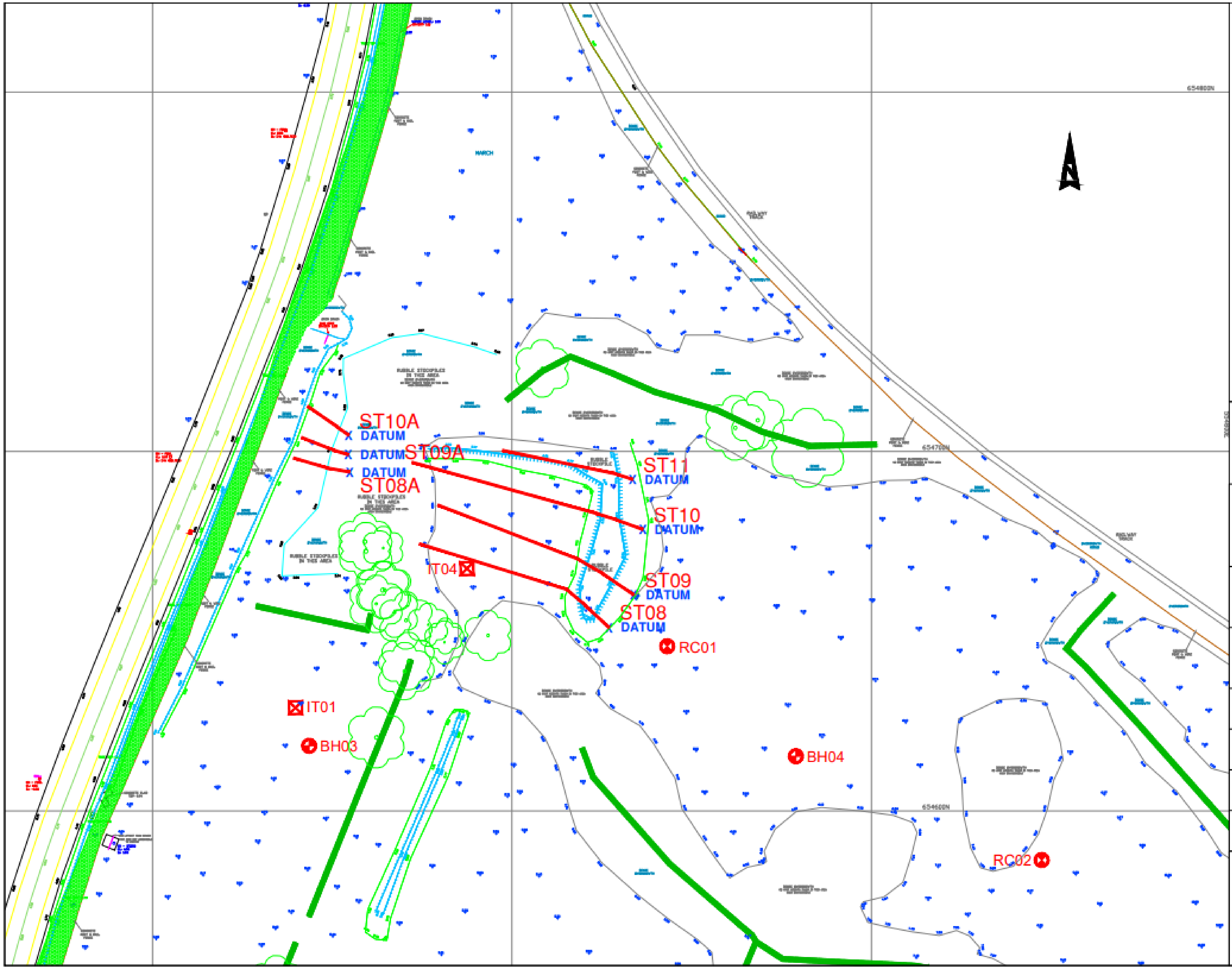

KEY:

ST00 DATUM	Denotes Slit Trench and Datum location
☒ IT00	Denotes Infiltration Test location
● BH00	Denotes Borehole location
● RC00	Denotes Rotary Core location

JOB NAME:
Raheen Housing

Sheet Title:
EXPLORATORY LOCATION PLAN

JOB NUMBER:
P21161

DRAWING NUMBER:
P21161-SI-02

DRAWN BY:
G.C.

DATE:
20/07/2021

SCALE:
1:1000 ON A3

APPROVED:
GH

REVISION:
D01

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KEY TO SYMBOLS ON EXPLORATORY HOLE RECORDS

All linear dimensions are in metres or millimetres

DESCRIPTIONS

**	Drillers Description
Friable	Easily crumbled

SAMPLES

U( )	Undisturbed 102mm diameter sample, ( ) denotes number of blows to drive sampler
U( )F, U( )P	F- not recovered, P-partially recovered
U38	Undisturbed 38mm diameter sample
P(F), (P)	Piston sample - disturbed
B	Bulk sample - disturbed
D	Jar Sample - disturbed
W	Water Sample
CBR	California Bearing Ratio mould sample
ES	Chemical Sample for Contamination Analysis
SPTLS	Standard Penetration Test S lump sample from split sampler

CORE RECOVERY AND ROCK QUALITY

TCR	Total Core Recovery (% of Core Run)
SCR	Solid Core Recovery (length of core having at least one full diameter as % of core run)
RQD	Rock Quality Designation (length of solid core greater than 100mm as % of core run)

Where there is insufficient space for the TCR, SCR and RQD, the results may be found in the remarks column

If	Fracture Spacing in mm (Minimum/Average/Maximum) NI - non intact, NR - no recovery
AZCL	Assumed Zone of Core Loss
NI	Non intact

GROUNDWATER

▽	Groundwater strike
▼	Groundwater level after standing period
Date/Water	Date of shift (day/month)/Depth to water at end of previous shift shown above the date and depth to water at beginning of shift given below the date

INSITU TESTING

S	Standard Penetration Test - split barrel sampler
C	Standard Penetration Test - solid 60^{0} cone
SW	Self Weight Penetration
Ivp, HVp (R)	In Situ Vane Test, Hand Vane Test (R) demonstrates remoulded strength
K(F), (C), (R), (P)	Permeability Test
HP	Hand Penetrometer Test

MEASURED PROPERTIES

N	Standard Penetration Test - blows required to drive 300mm after seating drive
x/y	Denotes x blows for y mm within the Standard Penetration Test
x*/y	Denotes x blows for y mm within the seating drive
c_u	Undrained Shear Strength (kN/m^2)
CBR	California Bearing Ratio

ROTARY DRILLING SIZES

Index Letter	Nominal Diameter (mm)	
	Borehole	Core
N	75	54
H	99	76
P	120	92
S	146	113

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Drilled By PC

Logged By

Borehole No. **BH01** Sheet 1 of 1

Project Name: Raheen Housing Development

Project No. P21161

Co-ords: 554477E - 654378N

Hole Type CP

Location: Raheen, Co.Limerick

Level: 6.86 m OD

Scale 1:50

Client: Gary Lawlor

Date: 27/07/2021 - 27/07/2021

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.00 - 1.00	B					Brown, slightly sandy gravelly CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular. Cobbles are 63mm to 160mm dia, sub-angular.
		0.90	SPT (C)	50 (25 for 75mm/50 for 0mm)	1.00	5.86		
								End of Borehole at 1.000m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
1.00	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
0.90	1.00	01:00	Chisel

Remarks:

Borehole terminated at 1.00m bgl, obstruction. See also BH01A.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	27/07/2021 08:00	0.00	Start of shift.
Dry	27/07/2021 18:00	1.00	End of borehole.

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Drilled By	PC	Borehole No.	**BH01A**
Logged By	CS		Sheet 1 of 1
Project Name:	Raheen Housing Development	**Project No.**	P21161
Co-ords:	554477E - 654378N	**Hole Type**	CP
Location:	Raheen, Co.Limerick		
Level:	6.86 m OD	**Scale**	1:50
Client:	Gary Lawlor		
Date:	27/07/2021 - 27/07/2021		

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Brown, very silty sandy GRAVEL with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 140mm dia, sub-angular, Limestone lithology.
		1.00	SPT (C)	50 (25 for 0mm/50 for 0mm)	1.10	5.76		
								End of Borehole at 1.100m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
1.10	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
1.00	1.10	01:00	Chisel.

Remarks:

Borehole terminated at 1.10m bgl, obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	27/07/2021 08:00	0.00	Start of shift.
	27/07/2021 18:00	1.10	End of shift.

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Drilled By	PC
Logged By	CS
Borehole No.	**BH02**
	Sheet 1 of 1

Project Name:	Raheen Housing Development	**Project No.**	P21161
Co-ords:	554505E - 654502N	**Hole Type**	CP
Location:	Raheen, Co.Limerick		
Level:	5.52 m OD	**Scale**	1:50
Client:	Gary Lawlor		
Date:	26/07/2021 - 26/07/2021		

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.00 - 1.00	B					Brown red, slightly sandy gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
		1.00 - 2.00 1.00	B SPT (C)	N=26 (5,5/6,6,7,7)	1.00	4.52		Medium dense to dense, brown red, very clayey very sandy GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded, Limestone lithology. Cobbles are 63mm to 200mm dia, sub-angular, Limestone lithology.
		2.00	SPT (C)	54 (6,8/54 for 150mm)				
					2.50	3.02		End of Borehole at 2.500m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
2.50	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
2.40	2.50	01:00	Chisel.

Remarks:

Borehole terminated at 2.50m bgl, obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	26/07/2021 08:00	0.00	Start of shift.
	26/07/2021 18:00	2.50	End of shift.

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Drilled By	PC	Borehole No.	**BH03**
Logged By	CS		Sheet 1 of 1

Project Name:	Raheen Housing Development	**Project No.** P21161	**Co-ords:**	554544E - 654618N	**Hole Type** CP
Location:	Raheen, Co.Limerick		**Level:**	4.17 m OD	**Scale** 1:50
Client:	Gary Lawlor		**Date:**	26/07/2021 - 26/07/2021	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.00 - 1.00	B					Brown red, slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded, Limestone lithology. Cobbles are 63mm to 120mm dia, sub-angular to sub-rounded, Limestone lithology.
		1.00 - 2.00 1.00	B SPT (C)	N=23 (3,4/5,5,6,7)	1.00	3.17		Stiff, light brown, slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded, Limestone lithology. Cobbles are 63mm to 120mm dia, sub-angular to sub-rounded, Limestone lithology.
		2.00 - 3.00 2.00	B SPT (C)	N=30 (7,8/7,7,8,8)	2.00	2.17		Medium dense to dense, brown black, very clayey very sandy GRAVEL with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 160mm dia, sub-angular to sub-rounded.
		3.00	SPT (C)	15 (10,11/15 for 75mm)				
					3.50	0.67		End of Borehole at 3.500m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
3.50	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
3.35	3.50	01:00	Chisel.

Remarks:

Borehole terminated at 3.50m bgl, obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	26/07/2021 08:00	0.00	Start of shift.
Dry	26/07/2021 18:00	3.50	End of borehole.

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Drilled By	PC	Borehole No. **BH04**
Logged By	CS	Sheet 1 of 1

Project Name: Raheen Housing Development	**Project No.** P21161	**Co-ords:** 554679E - 654615N		**Hole Type** CP
Location: Raheen, Co.Limerick		**Level:** 5.73 m OD		**Scale** 1:50
Client: Gary Lawlor		**Date:** 27/07/2021 - 27/07/2021		

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Brown red, slightly sandy CLAY. Sand is fine to coarse.
		1.00 - 2.00 1.00	B SPT (C)	N=23 (4,5/5,6,6,6)	1.00	4.73		Stiff, brown red, slightly sandy SILT. Sand is fine to coarse. Gravel is fine to coarse, sub-angular. Cobbles are 63mm dia, sub-rounded, Limestone lithology.
		2.00 - 2.60 2.00	B SPT (C)	N=26 (5,6/6,7,6,7)	2.00	3.73		Stiff, brown red, slightly sandy gravelly CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. cobbles are 63mm to 120mm diam sub-angular to sub-rounded, Limestone lithology.
		2.70	SPT (C)	50 (25 for 0mm/50 for 0mm)	2.80	2.93		End of Borehole at 2.800m

1
2
3
4
5
6
7
8
9

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
2.80	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
2.70	2.80	01:00	Chisel

Remarks:

Borehole terminated at 2.80m bgl, obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	27/07/2021 08:00	0.00	Start of shift.
Dry	27/07/2021 18:00	2.80	End of borehole.

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Drilled By	PC
Logged By	CS
Borehole No.	**BH05**
	Sheet 1 of 1

Project Name:	Raheen Housing Development	**Project No.**	P21161
Co-ords:	554639E - 654517N	**Hole Type**	CP
Location:	Raheen, Co.Limerick		
Level:	5.29 m OD	**Scale**	1:50
Client:	Gary Lawlor		
Date:	28/07/2021 - 28/07/2021		

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.00 - 1.00	B					Stiff, brown, slightly sandy gravelly CLAY with medium cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 180mm dia, sub-angular, Limestone lithology. Boulders are 200mm dia, sub-angular, Limestone lithology.
		1.00 - 2.00	B					
		1.00	SPT (C)	N=44 (8,9/10,10,11,13)				
		2.00	SPT (C)	50 (11,12/50 for 0mm)				
					2.50	2.79		End of Borehole at 2.500m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
2.50	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
2.40	2.50	01:00	Chisel.

Remarks:

Borehole terminated at 2.50m bgl, obstructin.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	28/07/2021 08:00	0.00	Start of shift.
Dry	28/07/2021 18:00	2.50	End of borehole.

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Drilled By PC	Borehole No.	
Logged By CS	**BH06**	Sheet 1 of 1

Project Name:	Raheen Housing Development	**Project No.** P21161	**Co-ords:**	554639E - 654405N	**Hole Type** CP
Location:	Raheen, Co.Limerick		**Level:**	5.47 m OD	**Scale** 1:50
Client:	Gary Lawlor		**Date:**	23/07/2021 - 23/07/2021	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description	
		Depth (m bgl)	Type	Results					
		0.00 - 1.00	B					Brown, slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular. Roots present.	
		1.00 - 2.00 1.00	B SPT (C)	N=26 (5,6/6,7,7,6)	1.00	4.47		Stiff, brown mottled grey, slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 80mm dia, sub-angular to sub-rounded, Limestone lithology.	1
		2.00 - 3.00 2.00	B SPT (C)	N=33 (7,8/8,7,9,9)					2
		3.00	SPT (C)	50 (8,10/50 for 75mm)					3
					3.20	2.27		End of Borehole at 3.200m	
									4
									5
									6
									7
									8
									9

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
3.20	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
3.10	3.20	01:00	Chisel.

Remarks:

Borehole terminated at 3.20m bgl, obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	23/07/2021 08:00	0.00	Start of shift.
Dry	24/07/2021 18:00	3.20	End of shift.

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Drilled By PC
Logged By CS

Borehole No.
BH07
Sheet 1 of 1

Project Name:	Raheen Housing Development	**Project No.** P21161	**Co-ords:**	554749E - 654390N	**Hole Type** CP
Location:	Raheen, Co.Limerick		**Level:**	5.58 m OD	**Scale** 1:50
Client:	Gary Lawlor		**Date:**	28/07/2021 - 28/07/2021	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Brown, slightly sandy gravelly SILT with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 110mm dia, sub-rounded, Limestone lithology.
		1.00 - 1.60 1.00	B SPT (C)	N=31 (4,5/6,6,9,10)	1.00	4.58		Stiff, brown, slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 110mm dia, sub-rounded, Limestone lithology.
		1.60	SPT (C)	50 (25 for 75mm/50 for 0mm)	1.80	3.78		End of Borehole at 1.800m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
1.80	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
1.70	1.80	01:00	Chisel.

Remarks:

Borehole terminated at 1.80m bgl, obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	28/07/2021 08:00	0.00	Start of shift.
Dry	28/07/2021 18:00	1.80	End of shift.

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	Logged By CS		

Project Name:	Raheen Housing Development	**Project No.** P21161	**Co-ords:**	554756E - 654455N	**Hole Type** CP
Location:	Raheen, Co.Limerick		**Level:**	5.60 m OD	**Scale** 1:50
Client:	Gary Lawlor		**Date:**	23/07/2021 - 26/07/2021	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description	
		Depth (m bgl)	Type	Results					
		0.00 - 1.00	B					Stiff, red brown, slightly sandy gravelly SILT with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm to 83mm dia, sub-angular to sub-rounded, Limestone lithology.	
		1.00 - 2.00 1.00	B SPT (C)	N=37 (8,8/9,9,10,9)					1
		2.00	SPT (C)	50 (25 for 5mm/50 for 0mm)	2.20	3.40		End of Borehole at 2.200m	2
									3
									4
									5
									6
									7
									8
									9

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
2.20	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
2.00	2.20	01:00	Chisel.

Remarks:

Borehole terminated at 2.20m bgl, obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	23/07/2021 08:00	0.00	Start of shift.
Dry	23/07/2021 18:00	1.00	End of shift.
Dry	26/07/2021 08:00	1.00	Start of shift.
Dry	26/07/2021 18:00	2.20	End of borehole.

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Project Name:	Raheen Housing Development	**Project No.** P21161	**Co-ords:** 554775E - 654535N	**Hole Type** CP
Location:	Raheen, Co.Limerick		**Level:** 8.46 m OD	**Scale** 1:50
Client:	Gary Lawlor		**Date:** 27/07/2021 - 27/07/2021	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description	
		Depth (m bgl)	Type	Results					
		0.00 - 1.00	B					Stiff, brown, slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse, gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are 63mm dia, sub-angular to sub-rounded.	
		1.00 - 1.40 1.00	B SPT (C)	 61 (8,10/61 for 225mm)					1
					1.50	6.96		End of Borehole at 1.500m	
									2
									3
									4
									5
									6
									7
									8
									9

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
1.50	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
1.40	1.50	01:00	Chisel

Remarks:

Borehole terminated at 1.50m bgl, obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	27/07/2021 08:00	0.00	Start of shift.
	27/07/2021 18:00	1.50	End of shift.

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Drilled By:	GW	Borehole No.	**RC01**
Logged By:	MF	Sheet 1 of 1	
Project Name:	Raheen Housing Development	**Project No.**	P21161
Co-ords:	554643E - 654646N	**Hole Type**	RC
Location:	Raheen, Co.Limerick	**Scale**	1:50
Level:	4.25 m OD		
Client:	Gary Lawlor	**Dates:**	15/07/2021 15/07/2021

Well	Water Strike (m)	**Depth (m)**	Type /Fs (min, max, avg)	**Coring (%)** TCR	SCR	RQD	**Depth (m) / FI (/m)**	**Level (mOD)**	**Legend**	**Stratum Description**
		N=22 (6,5/6,5,5,6) (C)								Open hole boring. Driller described: Stiff, Clay.
							2.80	1.45		
							3.00	1.25		Open hole boring. Driller described: Rock. Assumed Limestone lithology. Lithology: Strong, grey, fossiliferous LIMESTONE. Becoming darker in colour and coarser grained at 5.0m bgl. Weathering: Slightly to moderately weathered. Clay infill seen on fractures. Fractures: Two sets identified. Set 1 has a dip of 90 degrees, an undulating rough fracture surface and are closely spaced.
		50 (25 for 0mm/50 for 0mm) (C) 3.00 - 4.50	20mm 370mm 120mm	81	75	57	10/m			
		4.50 - 6.00	35mm 180mm 60mm 20mm 210mm 100mm	95	80	20	8/m 14/m			
							6.00	-1.75		End of Borehole at 6.000m

Groundwater:

Struck (m bgl)	Level (m bgl)	After (min)	Sealed	Comment
				None encountered.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
6.00	76	131

Equipment:	Soilmec PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 6.00m bgl, required depth.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	15/07/2021 08:00	0.00	Star of shift.
Dry	15/07/2021 18:00	6.00	End of borehole.

Type	Quantity Nr.	Remarks
Environmental analysis, Waste acceptance criteria (WAC)	11	See attached results
Asbestos screening and identification	04	See attached results
Point Load Is_{50}	06	0.9MPa to 9.7MPa

Please note that all samples shall be retained for a period no longer than 28 days from the date of this report. Thereafter all remaining samples shall be appropriately disposed of unless a written instruction to the contrary is received by PGL prior to the date of this reporting and within the 28 day period outlined above. Laboratory testing will result in a reduction of sample quantity and in some cased the use of the full sample mass. Samples already tested may not be suitable or available for further testing.

Ground and groundwater conditions

The details of the ground conditions encountered are provided for on the attached exploratory records. The records provide descriptions, in accordance with BS 5930 (2015) and Eurocode 7, Geotechnical Investigation and Testing, Identification and classification of soils, Part 1, Identification and description (EN ISO 14688-1: 2002),– Identification and Classification of Soil, Part 2: Classification Principles (EN ISO 14688-2:2004) and Identification and Classification of Rock, Part 1: Identification & Description (EN ISO 14689-1:2004) of the materials encountered, *in situ* testing and details of the samples taken, together with any observations made during the site investigation.

Groundwater conditions observed in the excavations are those appertaining to the period of the investigation. Groundwater levels may be subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc. It should be noted that the borehole casing and the duration over which an excavation remains open may not permit the recording of equilibrium groundwater levels for any one groundwater water strike for volume flows in stiff glacial deposits. The groundwater regime should be assessed from standpipe well installations, where available. A single (1) groundwater monitoring standpipe was installed at RC03, the remaining exploratory locations were backfilled with gravel, bentonite and arisings.

No groundwater was recorded during the period of works.

SUMMARY OF BACKFILL

⁘ GRAVEL Backfill to installation/ borehole

▩ ARISINGS Backfill

☰ uPVC slotted pipe

▧ BENTONITE Backfill to installation/ borehole

SUMMARY OF STANDPIPE INSTALLATIONS

Location	Depth Top (m bgl)	Depth Base (m bgl)	Pipe
RC03	0.0	3.0	Plain
	3.0	12.7	Slotted

Geotechnical Review

The following geotechnical review provides an overview of the ground conditions identified within the site along with the general characterisation of the deposits encountered. The following sections should be read in conjunction with the exploratory records.

Desk Study - Published Geology

The Geological Survey of Ireland, 1:100,000 mapping (Sheet 17) indicated that the geology of the area was characterised by Visean Limestone (VIS described as undifferentiated Limestone). Vocanistic intrusions, V, Basalt B were identified 1.7km SW of the site. Teagasc sub-soil mapping indicated the superficial deposits were characterised by glacial till derived from Limestones and Made ground. Historical ground investigation indicated stiff to hard gravelly clay soils with numerous boulders extending from ground level (ANCO site, 1980); Investigations undertaken in 1992 identified bedrock at depth 2.5m to 7.0m deep within Raheen Industrial Estate, in the general vicinity.

Ground model

The ground model was such that Topsoil where encountered was described as dark brown, organic, slightly sandy gravelly CLAY being 100mm to 250mm thick. Within slit trench excavations, Made ground deposits described as soft to stiff, slightly sandy slightly CLAY/SILT and clayey sandy GRAVEL with Cobble and Boulder content(s) were encountered to a depth 2.2m below existing ground level (bgl) to 3.8m bgl. Below this natural deposits of organic CLAY was described to 4.0m bgl. Elsewhere, natural deposits of soft to stiff, red brown, slightly sandy slightly gravely CLAY/ SILT were described to depths 1.00m bgl to 2.80m bgl. Localised deposits of medium dense, silty sandy GRAVEL with cobble content were also noted within boreholes. LIMESTIONE was encountered at variable depths 2.00m bgl to 10.00m bgl within the site.

No groundwater was encountered during the period of fieldworks.

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Project Name: Raheen Housing Development	**Project No.** P21161	**Co-ords:** 554747E - 654586N	**Hole Type** RC
Location: Raheen, Co.Limerick		**Level:** 8.99 m OD	**Scale** 1:50
Client: Gary Lawlor		**Dates:** 16/07/2021 16/07/2021	

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description
							0.40	8.59		Open hole boring. Driller described: Sandy Clay
		50 (18 for 75mm/50 for 0mm) (C)					2.00	6.99		Open hole boring. Driller described: Clay with boulder content.
		50 (25 for 0mm/50 for 0mm) (C) 2.00 - 3.50	10mm 135mm 40mm	100	93	33	11/m			
		3.50 - 5.00	20mm 150mm 55mm 20mm 490mm 400mm	100	95	69	11/m 10/m			
							5.00	3.99		Lithology: Medium strong, dark grey, fossiliferous LIMESTONE. Weathering: Slightly weathered with minor clay infill. Fractures: One set identified. Fracture has a dip of 90 degrees, an undulating rough fracture surface and close spacing. Details: Calcite vein seen at 4.5m bgl. Fossils are crinoids.

End of Borehole at 5.000m

Groundwater:

Struck (m bgl)	Level (m bgl)	After (min)	Sealed	Comment
				None encountered.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
5.00	76	131

Equipment: Soilmec PSM.

Method: Compressed air mist.

Remarks:

Borehole terminated at 5.00m bgl, required depth.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	16/07/2021 08:00	0.00	Start of shift.
Dry	16/07/2021 18:00	5.00	End of borehole.

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Project Name: Raheen Housing Development	**Project No.** P21161	**Co-ords:** 554697E - 654393N	**Hole Type** RC
Location: Raheen, Co.Limerick		**Level:** 5.67 m OD	**Scale** 1:50
Client: Gary Lawlor		**Dates:** 15/07/2021 15/07/2021	

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description
		N=19 (3,3/3,6,6,4) (C)								Open hole boring. Driller described: Stiff, Clay
		N=21 (3,4/5,5,6,5) (C)					2.30	3.37		Open hole boring. Driller described: Medium dense, clayey sandy GRAVEL
	▼	25 (10,19/25 for 60mm) (C) 50 (48 for 145mm/50 for 0mm) (C) N=39 (8,10/8,8,11,12) (C)					4.30	1.37		Open hole boring. Driller described: Stiff, Clay with boulder content.

Groundwater:

Struck (m bgl)	Level (m bgl)	After (min)	Sealed	Comment
4.50				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
12.70	76	131

Equipment:	Soilmec PSM.
Method:	Compressed air mist.

Remarks:

Borehole terminated at 12.70m bgl, required depth. 50mm dia. standpipe installed. Response zone from 3.00m to 12.70m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	15/07/2021 08:00	0.00	Start of borehole.
4.5	15/07/2021 18:00	12.70	End of borehole.

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Project Name: Raheen Housing Development	**Project No.** P21161	**Co-ords:** 554697E - 654393N	**Hole Type** RC
Location: Raheen, Co.Limerick		**Level:** 5.67 m OD	**Scale** 1:50
Client: Gary Lawlor		**Dates:** 15/07/2021 15/07/2021	

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description	
		50 (48 for 85mm/50 for 0mm) (C)					9.80	-4.13		Open hole boring. Driller described: Stiff, Clay with boulder content.	
							10.00	-4.33		Open hole boring. Driller described: Rock. Assumed Limestone lithology.	10
		50 (25 for 0mm/50 for 0mm) (C) 10.00 - 11.30	40mm 350mm 100mm	100	100	70	5/m			Lithology: Medium strong, dark grey, fossiliferous LIMESTONE. Weathering: Slightly weathered with minor clay infill. Fractures: One fracture set identified. Set one has a dip of 90 degrees, an undulating rough fracture surface and close spacing.	11
		11.30 - 12.70	40mm 390mm 120mm 10mm 280mm 200mm	100	100	96	5/m 4/m 12.70	-7.03			12
										End of Borehole at 12.700m	13
											14
											15
											16
											17
											18

Groundwater:

Struck (m bgl)	Level (m bgl)	After (min)	Sealed	Comment
4.50				See shift data.

Hole Information:

Hole Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
12.70	76	131

Equipment: Soilmec PSM.

Method: Compressed air mist.

Remarks:

Borehole terminated at 12.70m bgl, required depth. 50mm dia. standpipe installed. Response zone from 3.00m to 12.70m bgl.

Shift Data:

Groundwater (m bgl)	Shift	Hole Depth (m bgl)	Remarks
	15/07/2021 08:00	0.00	Start of borehole.
4.5	15/07/2021 18:00	12.70	End of borehole.

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Trial Pit No
IT01
Sheet 1 of 1

Project Name: Raheen Housing Development	**Project No.** P21161	**Co-ords:** 554540E - 654629N **Level:** 3.97m OD	**Date** 12/07/2021
Location: Raheen, Co.Limerick		**Dimensions (m):** 1.70 × 0.90 **Depth:** 2.00m BGL	**Scale** 1:25
Client: Gary Lawlor			**Logged** RD

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
	0.25 - 0.60 0.25 - 0.60	B D		0.25	3.72		(TOPSOIL) Soft, dark brown, organic slightly sandy CLAY. Sand is fine to medium.
				0.60	3.37		Firm, red brown, slightly gravelly CLAY with low cobble content and low boulder content. Gravel is fine to coarse, angular to sub-rounded, Limestone lithology. Cobbles are 63mm to 200mm dia, sub-angular to rounded, Boulders are 200mm to 280mm dia, sub-angular, Limestone lithology.
	1.00 - 2.00	B					Soft to stiff, light brown, slightly sandy gravelly CLAY with high cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded, Limestone lithology. Cobbles are 63mm to 200mm dia, sub-angular to rounded with a limestone lithology. Boulders are 200mm to 480mm dia, sub-rounded, Limestone lithology.
	1.50 - 2.00	D					
				2.00	1.97		End of Pit at 2.000m

Stability: Moderate.
Plant: 16T track machine.
Backfill: Arising.

Groundwater: none encountered.

Remarks: Trial pit terminated at 2.00m bgl, required depth.

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Trial Pit No
IT02
Sheet 1 of 1

Project Name: Raheen Housing Development	**Project No.** P21161	**Co-ords:** 554483E - 654344N **Level:** 6.76m OD	**Date** 12/07/2021
Location: Raheen, Co.Limerick		**Dimensions (m):** 2.00 × 0.90	**Scale** 1:25
Client: Gary Lawlor		**Depth:** 2.00m BGL	**Logged** RD

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
				0.20	6.56		(TOPSOIL) Brown to light brown, organic gravelly CLAY with medium boulder content and metal inclusions Gravel is fine to coarse, sub-rounded to rounded. Boulders are 200mm ro 400mm dia, sub-angular with Limestone lithology.
	1.00 - 2.00	B					Stiff, grey brown, slightly sandy gravelly CLAY with high cobble content and high boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded, Limestone lithology. Cobbles are angular to rounded with Limestone lithology. Boulders are 200mm to 600mm dia, sub-angular to sub-rounded, Limestone lithology.
	1.50 - 2.00	D					
				2.00	4.76		End of Pit at 2.000m

Stability: Moderate.
Plant: 16T Track machine.
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 2.00m bgl, required depth.

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Trial Pit No
IT03
Sheet 1 of 1

Project Name: Raheen Housing Development
Project No. P21161
Co-ords: 554576E - 654387N
Level: 7.33m OD
Date 12/07/2021
Location: Raheen, Co.Limerick
Dimensions (m): 2.30 0.90
Scale 1:25
Client: Gary Lawlor
Depth: 2.00m BGL
Logged EK

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
							(TOPSOIL) Soft, dark brown, organic slightly sandy CLAY.
	0.20 - 0.60 0.20 - 0.60	B D		0.20	7.13		Firm, red brown, organic, slightly sandy slightly gravelly CLAY with low cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, rounded to sub-rounded.
	1.00 - 2.00 1.00 - 2.00	B D		0.60	6.73		Very soft, light brown, slightly sandy gravelly CLAY with low cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, rounded to sub-angular limestone. Cobbles are rounded to sub-rounded, Limestone lithology. Boulders are sub-rounded, Limestone lithology, 200-400mm dia.
				2.00	5.33		End of Pit at 2.000m

1
2
3
4
5

Stability: Moderate.
Plant: 16T Track machine
Backfill: Arisings.
Groundwater: None encountered.
Remarks: Trial pit terminated at 2.00m bgl, required depth.

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Trial Pit No
IT04
Sheet 1 of 1

Project Name: Raheen Housing Development	**Project No.** P21161	**Co-ords:** 554588E - 654667N **Level:** 4.55m OD	**Date** 12/07/2021
Location: Raheen, Co.Limerick		**Dimensions (m):** 1.80 × 0.90	**Scale** 1:25
Client: Gary Lawlor		**Depth:** 2.00m BGL	**Logged** RD

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
				0.10	4.45		(TOPSOIL) Brown, organic, gravelly CLAY with low cobble content. Gravel is fine to coarse, rounded to sub-angular, Limestone. Cobbles are rounded to sub-angular, Limestone lithology.
	1.00 - 2.00	B					Very soft, light brown, slightly sandy, gravelly CLAY with medium cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, rounded to sub-angular limestone. Cobbles are rounded to sub-angular, Limestone lithology. Boulders are rounded to sub-angular, Limestone lithology, 200-500mm dia.
	1.50 - 2.00	D					
				2.00	2.55		End of Pit at 2.000m

Stability: Moderate.
Plant: 16T Track machine
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 2.00m bgl, required depth reached.

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Trial Pit No
ST01
Sheet 1 of 1

Project Name: Raheen Housing Development	**Project No.** P21161	**Co-ords:** 554529E - 654348N **Level:** 7.50m OD	**Date** 07/07/2021
Location: Raheen, Co.Limerick		**Dimensions (m):** 30.00 2.00	**Scale** 1:25
Client: Gary Lawlor		**Depth:** 3.50m BGL	**Logged** RD

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
▨	0.20 - 1.20	B		0.20	7.30	▨	(TOPSOIL) Soft, dark brown mottled orange, organic slightly sandy slightly gravelly CLAY with low boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded, Limestone lithology.
▨	0.50 - 1.00	D				▨	Soft, light brown, sandy slightly gravelly CLAY with low cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded, Limestone lithology. Cobbles are sub-angular to rounded, Limestone lithology. Boulders range in dia up to 700mm, are sub-rounded to rounded, Limestone lithology.
▨	0.70 - 1.00	ENV				▨	
▨	1.20 - 2.00	B				▨	
▨	1.50 - 2.00	D				▨	
▨	2.00 - 3.00	B		2.00	5.50	▨	Firm, light brown, slightly sandy gravelly CLAY with medium cobble content and high boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded, Limestone lithology. Cobbles are sub-angular to rounded and consist of limestone clasts. Boulders range in dia greater than 1m, are sub-angular to rounded, Limestone lithology.
▨	3.00 - 3.50	D				▨	
				3.50	4.00		End of Pit at 3.500m

Stability: Good. **Plant:** 16T track machine. **Backfill:** Arisings.	**Groundwater:** None encountered.

Remarks: Slit trench terminated at 3.50m bgl. Refer to DWG P21161 ST01 for cross sectional detail.

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Project Name: Raheen Housing Development	**Project No.** P21161	**Co-ords:**554532E - 654380N **Level:** 8.34m OD	**Date** 07/07/2021
Location: Raheen, Co.Limerick		**Dimensions (m):** 54.00 × 2.10	**Scale** 1:25
Client: Gary Lawlor		**Depth:** 4.00m BGL	**Logged** RD

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
							(MADE GROUND) Brown, slightly sandy slightly gravelly SILT with medium cobble content and medium boulder content. Strata contains old piping, rubbish, timber, metal, bricks, plastics, bitumen and a suspected asbestos tile was found. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded and consists of various lithologies. Cobbles are sub-rounded to rounded and consist of various lithologies. Boulders range greater than 1m in dia, are sub-rounded to rounded and consists of various lithologies.
	0.50 - 1.00	B					
	0.80 - 1.00	ENV					
	1.00 - 2.00	B					
	1.50 - 1.70	ENV					
	3.40 - 3.50	B					
				3.80	4.54		Light brown, slightly sandy gravelly CLAY with medium cobble content and high boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, Limestone lithology. Cobbles are are sub-angular to rounded, Limestone lithology. Boulders range in dia greater than 1m, are angular to sub-rounded, Limestone lithology.
				4.00	4.34		End of Pit at 4.000m

Stability: Poor.
Plant: 16T track machine.
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Slit trench terminated at 4.00m bgl. Refer to DWG P21161 ST02 for cross sectional detail.

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Trial Pit No
ST03
Sheet 1 of 1

Project Name: Raheen Housing Development	**Project No.** P21161	**Co-ords:**554535E - 654404N **Level:** 8.56m OD	**Date** 08/07/2021
Location: Raheen, Co.Limerick		**Dimensions (m):** 65.00 × 2.10	**Scale** 1:25
Client: Gary Lawlor		**Depth:** 2.90m BGL	**Logged** RD.

Samples & In Situ Testing

Depth (m)	Type	Results
0.20 - 0.50	B	
0.20 - 0.50	ENV	
0.30 - 0.70	ENV	
0.30 - 1.30	B	
0.50 - 1.00	B	
0.50 - 1.00	ENV	
0.50 - 1.50	B	
0.70 - 1.00	ENV	
0.70 - 1.60	B	
0.80 - 1.00	ENV	
1.00 - 1.50	D	
1.00 - 1.50	D	
2.30 - 2.50	D	
2.50 - 2.80	B	

Depth (m)	Level (m OD)	Stratum Description
0.20	8.36	(TOPSOIL) Dark brown, organic, slightly sandy gravelly CLAY with low boulder content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to rounded. Cobbles are angular to rounded and consist of various lithologies. Boulders range in dia up to 500mm, are angular to sub-rounded and consist of various lithologies.
2.70	5.86	(MADE GROUND) Multiple strata seen that vary in depth along trench. Strata 1: Grey, sandy GRAVEL with a medium cobble content, fabric, brick and bitumen. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, Limestone lithology. Cobbles are angular to sub-rounded, Limestone lithology. Strata 2: Soft, light brown, slightly gravelly CLAY with high cobble content, high boulder content, concrete and bitumen. Gravel is fine to coarse, angular to sub-rounded and consist of various lithologies. Cobbles are angular to sub-rounded and consist of various lithologies. Boulders range in dia up to greater than 1m, are angular to sub-rounded and consist of various lithologies. Strata 3: Brown, slightly sandy slightly gravelly SILT with medium cobble content, low boulder content and minor amounts of general fill. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded and consist of various lithologies. Cobbles are sub-angular to rounded and consist of various lithologies. Boulders range in dia up to 500mm, are sub-rounded to rounded and consist of various lithologies. Strata 4: Grey, light brown, slightly clayey gravelly SAND with high cobble content, low boulder content, piping, fragmented brick and concrete. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, Limestone lithology. Cobbles are sub-angular to sub-rounded and consist of various lithologies. Boulders range in dia up to 400mm and are sub-rounded to rounded. Strata 5: Brown black, slight sandy gravelly CLAY with medium cobble content, high boulder content, high amounts of fill including concrete, rubbish, timber, brick, styrofoam, general waste and construction waste.
2.90	5.66	Red brown black, occasional organics, slightly sandy CLAY. Sand is fine to coarse.

End of Pit at 2.900m

Stability: Poor.
Plant: 16T track machine.
Backfill: Arisings.
Groundwater: None encountered.
Remarks: Slit trench terminated at 2.90m bgl. Refer to DWG P21161 ST03 for cross sectional detail.

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Trial Pit No
ST03A
Sheet 1 of 1

Project Name: Raheen Housing Development	**Project No.** P21161	**Co-ords:** 554488E - 654438N **Level:** 8.52m OD	**Date** 09/07/2021
Location: Raheen, Co.Limerick		**Dimensions (m):** 18.00 × 2.10	**Scale** 1:25
Client: Gary Lawlor		**Depth:** 2.30m BGL	**Logged** RD

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
							(MADE GROUND) Light brown, clayey GRAVEL with high cobble content, high boulder content, timber, concrete, metal and bricks. Gravel is fine to coarse, angular to sub-rounded and consist of various lithologies. Cobbles are angular to sub-rounded and consist of various lithologies. Boulders range greater than 1m in dia, are sub-angular to sub-rounded, Limestone lithology.
	1.00 - 2.00	B					
	1.50 - 1.80	ENV					
	2.20 - 2.30	B		2.20	6.32		Firm, red brown, slightly sandy gravelly SILT with high cobble content and high boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded and consist of limestone clasts. Cobbles are angular to sub-rounded and consist of limestone clasts. Boulders range in dia up to 800mm, are angular to sub-rounded and consist of limestone clasts.
				2.30	6.22		End of Pit at 2.300m

Stability: Poor.
Plant: 16T track machine.
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Slit trench terminated at 2.30m bgl. Refer to DWG P21161 ST03a for cross sectional detail.

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Project Name: Raheen Housing Development	**Project No.** P21161	**Co-ords:** 554627E - 654651N **Level:** 4.00m OD	**Trial Pit No** ST08 Sheet 1 of 1 **Date** 13/07/2021
Location: Raheen, Co.Limerick		**Dimensions (m):** 60.00 × 2.10	**Scale** 1:25
Client: Gary Lawlor		**Depth:** 4.00m BGL	**Logged** RD.

Samples & In Situ Testing

Depth (m)	Type	Results
0.30 - 0.80	B	
0.50 - 1.00	B	
0.50 - 1.00	D	
0.80 - 1.50	B	
0.80 - 1.50	D	
1.00 - 1.50	B	
1.00 - 1.50	D	
1.20 - 1.50	ENV	
1.70 - 2.20	B	
1.70 - 2.20	D	
1.80 - 2.00	B	
1.80 - 2.00	D	

Depth (m)	Level (m OD)	Stratum Description
0.10	3.90	(TOPSOIL) Dark brown, organic gravelly CLAY with high cobble content and low boulder content. Gravel is fine to coarse, sub-angular to rounded and consist of various lithologies. Cobbles are angular to sub-rounded and consist of various lithologies. Boulders range in dia up to 600mm, are angular to sub-angular, Limestone lithology.
3.80	0.20	(MADE GROUND) 5 different strata of MG seen. Strata 1: Firm, light brown, slightly sandy gravelly CLAY with high cobble content, medium boulder content, concrete, timber, wrapping and wiring. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded and consist of various lithologies. Cobbles are angular to sub-angular, Limestone lithology. Boulders range in dia up to 600mm are sub-angular, Limestone lithology. Strata 2: Firm, red brown slightly sandy slightly gravelly CLAY with high cobble content, low boulder content, concrete and rubbish. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded and consists of various lithologies. Cobbles are angular to rounded and consist of various lithologies. Boulders range in dia up to 700mm, are sub-angular to sub-rounded, Limestone lithology. Strata 3: Soft, black, slightly sandy slightly gravelly CLAY with timber, olfactory senses indicate hydrocarbon contamination. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular and consist of various lithologies. Strata 4: Stiff, grey brown orange, gravelly CLAY with high cobble content, medium boulder content, bricks, timber and plastic. Gravel is fine to coarse, angular to sub-rounded and consists of various lithologies. Cobbles are angular to rounded and consist of various lithologies. Boulders range in dia up to 700mm, are angular to sub-rounded, Limestone lithology. Strata 5: Grey brown, slightly gravelly sandy CLAY with medium cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to rounded and consists of various lithologies. Cobbles are angular to rounded and consist of various lithologies. Boulders range in dia up to 600mm, are sub-angular to sub-rounded, Limestone lithology.
4.00	0.00	Soft, black, organic CLAY.

End of Pit at 4.000m

Stability: Poor.
Plant: 16T track machine.
Backfill: Arisings.

Groundwater: 1.80m: Slow rate of flow seen 29m from datum of trench.

Remarks: Slit trench terminated at 4.00m bgl. Refer to DWG P21161 ST08 for cross sectional detail.

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Trial Pit No
ST09
Sheet 1 of 1

Project Name: Raheen Housing Development
Project No. P21161
Co-ords: 554634E - 654660N
Level: 3.63m OD
Date 13/07/2021
Location: Raheen, Co.Limerick
Dimensions (m): 70.00 2.10
Scale 1:25
Client: Gary Lawlor
Depth: 4.00m BGL
Logged RD.

Samples & In Situ Testing

Depth (m)	Type	Results
0.00 - 1.00	B	
0.00 - 1.00	D	
0.20 - 1.20	B	
0.20 - 1.20	D	
0.70 - 1.20	B	
0.70 - 1.20	D	
0.70 - 1.20	ENV	
0.70 - 1.50	B	
0.70 - 1.50	D	
1.00 - 2.00	B	
1.00 - 2.00	D	
1.30 - 2.30	B	
1.30 - 2.30	D	
1.80 - 2.00	B	
1.80 - 2.00	D	

Depth (m)	Level (m OD)	Stratum Description
		(MADE GROUND) Four different strata of Made Ground. Strata 1: Stiff, brown, orange yellow, slightly sandy gravelly CLAY with high cobble content, medium boulder content, plastic, concrete, metal, brick and timber. Sand is fine to coarse. Gravel is fine to coarse, angular to rounded and consists of various lithologies. Cobbles are angular to rounded and consists of various lithologies. Boulders range in dia up to 800mm, are sub-angular to sub-rounded and consist of various lithologies. Strata 2: Soft, grey brown, slightly gravelly sandy CLAY with medium cobble content, medium boulder content, timber, piping and scaffolding. Sand is fine to coarse. Gravel is fine to coarse, angular to rounded and consists of various lithologies. Cobbles are angular to sub-rounded and consist of various lithologies. Boulders range in dia up to 700mm, are sub-angular to sub-rounded and consist of various lithologies. Strata 3: Soft to stiff, light brown, slightly sandy gravelly CLAY with medium cobble content, medium boulder content, plastic, concrete, rope, metal, fabric, rubbish, timber and bricks. Sand is fine to coarse. Gravel is fine to coarse, angular to rounded and consists of various lithologies. Cobbles are angular to sub-rounded and consist of various lithologies. Boulders range in dia up to 700mm, are sub-angular to sub-rounded and consist of limestone clasts. Strata 4: Soft, black, slightly sandy slightly gravelly CLAY with timber, olfactory senses indicate hydrocarbon contamination. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular and consist of various lithologies.
3.80	-0.17	Soft, black, organic, CLAY.
4.00	-0.37	End of Pit at 4.000m

Stability: Very poor.
Plant: 16T track machine.
Backfill: Arisings.
Groundwater: 1.80m: Slow rate of flow seen 26m along trench.
Remarks: Slit trench terminated at 4.00m bgl. Refer to DWG P21161 ST09 for cross sectional detail.

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Trial Pit No
ST09A
Sheet 1 of 1

Project Name:	Raheen Housing Development	**Project No.** P21161	**Co-ords:** 554554E - 654699N **Level:** 8.74m OD	**Date** 15/07/2021
Location:	Raheen, Co.Limerick		**Dimensions (m):** 15.00 x 2.50	**Scale** 1:25
Client:	Gary Lawlor		**Depth:** 3.00m BGL	**Logged** RD.

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
▨						▨	(MADE GROUND) Soft to stiff, light brown, grey, slightly sandy gravelly CLAY with medium cobble content, medium boulder content and occasional plastic, concrete and brick. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded and consists of various lithologies. Cobbles are angular to sub-angular and consist of various lithologies. Boulders range in dia up to 700mm, are sub-angular to sub-rounded and consist of various lithologies.
	1.00 - 2.00 1.00 - 2.00 1.00 - 2.00	B D ENV					
				2.80	5.94		Soft, black organic, CLAY.
				3.00	5.74		End of Pit at 3.000m

Stability: Poor.
Plant: 16T track machine.
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Slit trench terminated at 3.00m bgl. Refer to DWG P21161 ST09A for cross sectional detail.

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Trial Pit No
ST11
Sheet 1 of 1

Project Name: Raheen Housing Development

Project No. P21161

Co-ords: 554634E - 654692N

Level: 5.22m OD

Date 15/07/2021

Location: Raheen, Co.Limerick

Dimensions (m): 45.00 2.50

Depth: 3.50m BGL

Scale 1:25

Client: Gary Lawlor

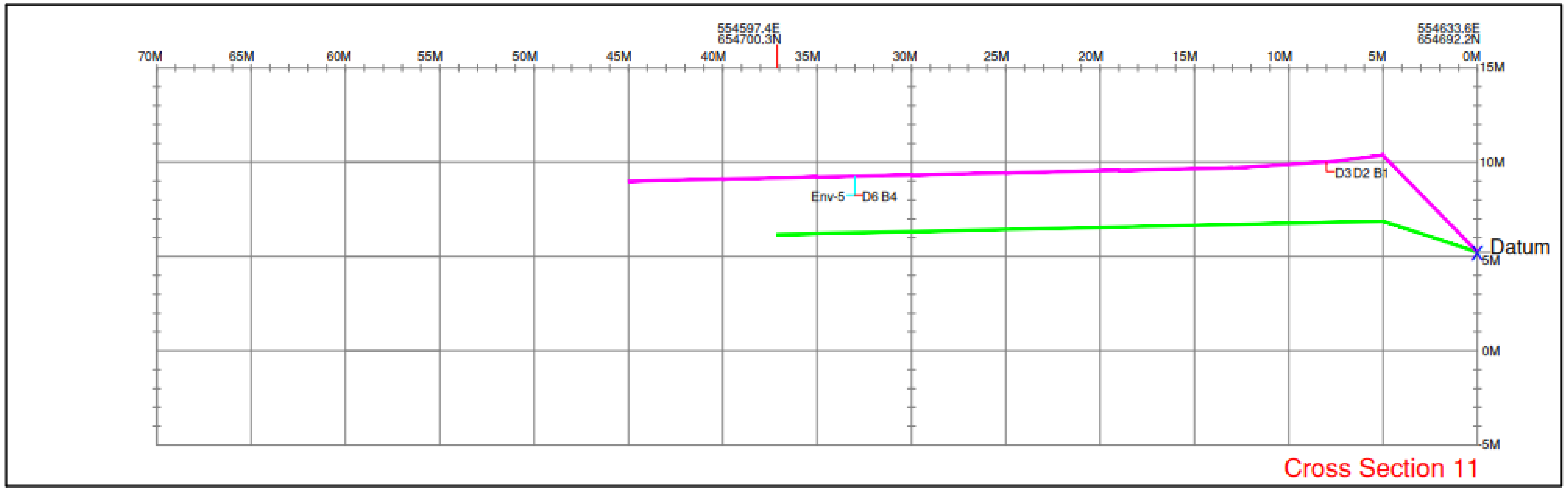
Logged RD.

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
	0.50 - 1.50 0.50 - 1.50 0.50 - 1.50 1.00 - 2.00 1.00 - 2.00	B D ENV B D		3.30	1.92		(MADE GROUND) Brown grey orange, slightly sandy gravelly CLAY with medium cobble content, medium boulder content, occasional metal, timber, rags, concrete and plastic. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded and consists of various lithologies. Cobbles are angular to sub-rounded and consist of limestone clasts. Boulders range in dia up to 700mm, are sub-angular to sub-rounded, Limestone lithology.
				3.50	1.72		Soft, black organic CLAY.
							End of Pit at 3.500m

Stability: Poor.
Plant: 16T track machine.
Backfill: Arisings.

Groundwater: None encountered.

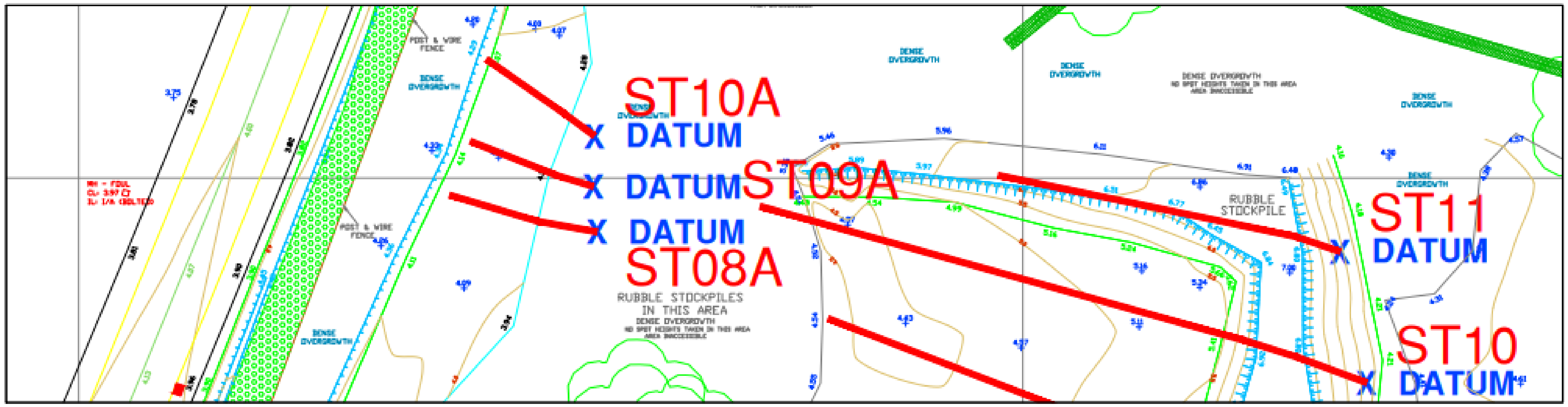
Remarks: Slit trench terminated at 3.50m bgl. Refer to DWG P21161 ST11 for cross sectional detail.



SLIT TRENCH SECTION, 1:200 ON A3

Legend

Ground Profile Pre Works	🟪
Ground Post Backfill Profile	🟩
Bulk (Large) Sample	B
Bulk (Small disturbed) Sample	D
Environmental Sample	Env-



SLIT TRENCH LOCATION PLAN, 1:500 ON A3

SLIT TRENCH NUMBER:
ST11

JOB NAME:
Raheen Housing

JOB NUMBER:
P21161

DRAWING NUMBER:
P21161-ST11

DATUM COORDINATES:

EASTING:	554633.6
NORTHING:	654692.2
LEVEL:	5.221mAOD

KEY:
DATUM: X

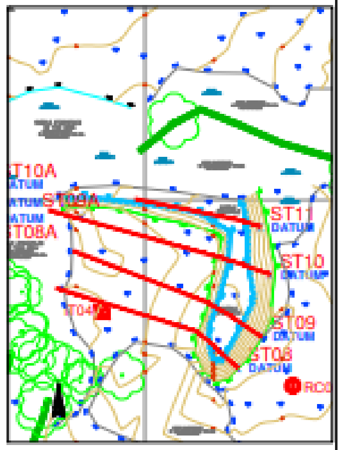
SLIT TRENCH DIMENSIONS:

LENGTH:	37.12m
WIDTH:	0.60m
DEPTH:	0.00m

STRATA SHOWN ON DETAILED LOG

DRAWN BY: Gary Curtin	DATE: 20/07/2021
LOGGED BY: R.D.	DATE: 14-15/07/2021

SCALE: AS STATED	APPROVED: GH	REVISION: D01



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Project Name: Raheen Housing Development	**Project No.** P21161	**Co-ords:** 554464E - 654470N **Level:** 5.68m OD	**Date** 09/07/2021
Location: Raheen, Co.Limerick		**Dimensions (m):** 20.00 × 2.50	**Scale** 1:25
Client: Gary Lawlor		**Depth:** 2.40m BGL	**Logged** RD.

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
	0.00 - 0.50	B					(MADE GROUND) Brown, gravelly SILT with high cobble content, high boulder content, rubbish, plastic, concrete, corrugated iron and multiple large bitumen boulders. Gravel is fine to coarse, angular to sub-rounded and consist of various lithologies. Cobbles are angular to sub-angular and consist of various lithologies. Boulders range in dia greater than 1m, are angular to sub-angular and consist of various lithologies.
	0.50 - 1.50	B					
	1.00 - 1.20	ENV					
	1.30 - 1.50	D					
				2.20	3.48		Firm, light brown, slightly sandy gravelly CLAY with high cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular, Limestone lithology. Cobbles are sub-angular to sub-rounded and consists of Limestone clasts. Boulders range in dia up to 800mm, are sub-angular, Limestone lithology.
				2.40	3.28		End of Pit at 2.400m

Stability: Poor.
Plant: 16T track machine.
Backfill: Arisings.

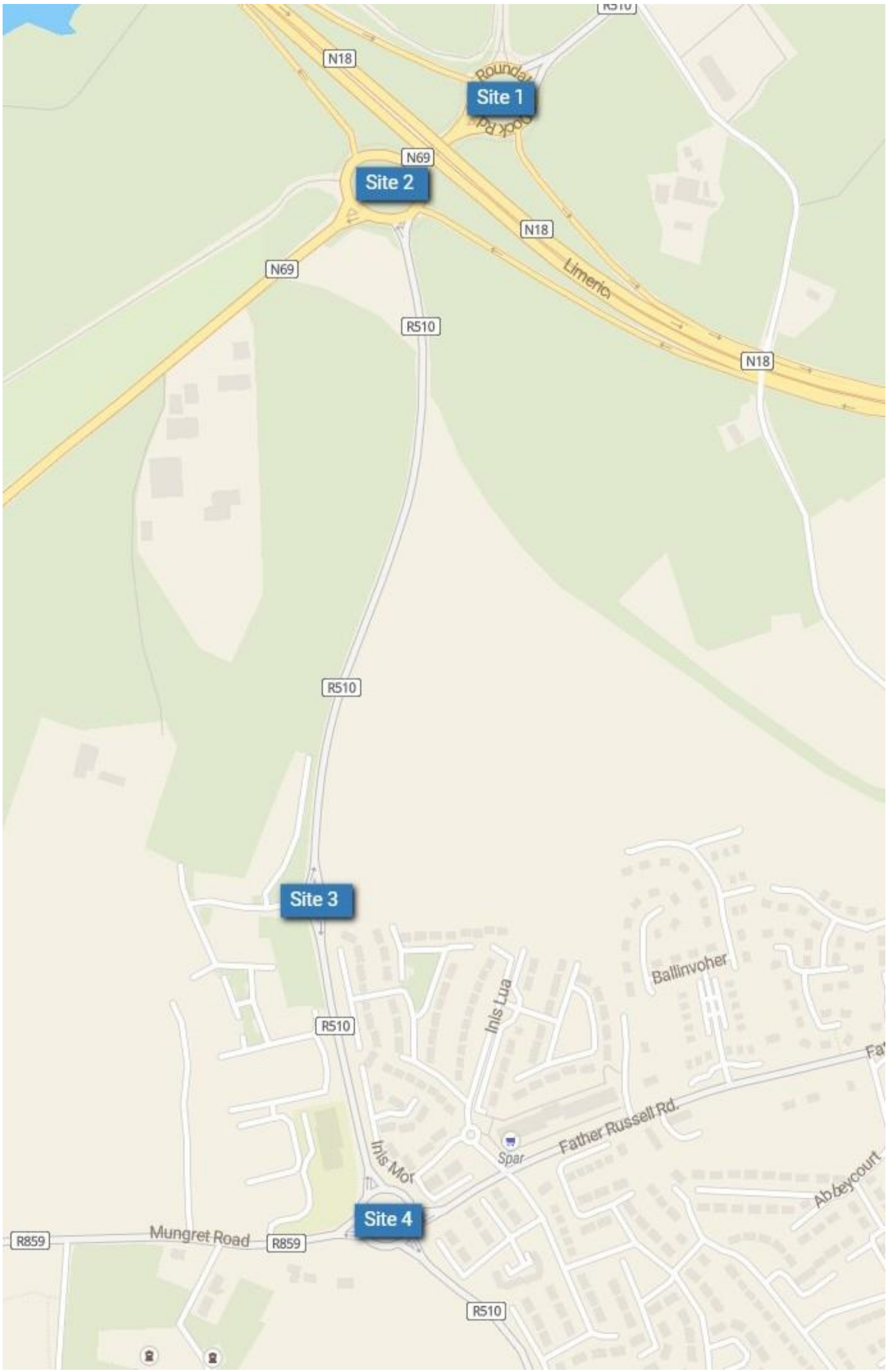
Groundwater: None encountered.

Remarks: Slit trench terminated at 2.40m bgl. Refer to DWG P21161 ST12 for cross sectional detail.

Appendix 11.1 – Traffic Count Data - IDASO

IDASO

Survey Name:	049 20078 Raheen-Limerick
Date:	Tue 03 Mar 2020


R510
N18
Roundab
Site 1
Dock Rd
N69
Site 2
N18
N69
Limeric
R510
N18
R510
Site 3
Ballinvoher
Inis Lua
R510
Father Russell Rd.
Fat
Spar
Inis Mor
Abbeycourt
Site 4
R859
Mungret Road
R859
R510

IDASO

Survey Name: 049 20078 Raheen-Limerick
Site: Site 1
Location: N69 Dock Rd / Slips N18
Date: Tue 03-Mar-2020

	A => A										A => B									
TIME	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
09:45	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	2
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	3	3
10:00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
11:00	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3	3
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	2
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	3	4.3
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
13:30	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	2.5
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	3	3.5
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
17:00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
17:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2

18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
12 TOT	0	0	0	0	0	0	0	0	0	0	0	0	12	0	8	1	1	0	22	23.8

	A => C										A => D									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	2	1	0	0	3	3.5	0	0	1	0	2	1	0	0	4	4.5
H/TOT	0	0	0	0	2	1	1	0	4	5.8	0	0	1	0	2	1	0	0	4	4.5
08:00	0	0	0	0	0	1	0	0	1	1.5	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	1	2	0	3	6.1	0	0	0	0	0	0	1	0	1	2.3
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	1	0	0	1	1.5
H/TOT	0	0	0	0	0	2	3	0	5	9.9	0	0	0	0	0	1	1	0	2	3.8
09:00	0	0	0	0	1	0	1	0	2	3.3	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	1	0	1	0	2	3.3	0	0	0	0	0	0	1	0	1	2.3
10:00	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	1	0	0	1	1.5	0	0	0	0	0	0	0	0	0	0
10:45	0	0	1	0	0	0	2	0	3	5.6	0	0	0	0	1	1	1	0	3	4.8
H/TOT	0	0	1	0	0	1	3	0	5	9.4	0	0	0	0	1	1	1	0	3	4.8
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
11:45	0	0	2	0	0	0	0	0	2	2	0	0	0	0	0	0	1	0	1	2.3
H/TOT	0	0	2	0	1	0	0	0	3	3	0	0	0	0	0	0	1	0	1	2.3
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	3.3
12:30	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	1	1	1	0	3	4.8
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
H/TOT	0	0	0	0	0	0	1	0	1	2.3	0	0	1	0	2	1	2	0	6	9.1
13:00	0	0	0	0	0	2	1	0	3	5.3	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
H/TOT	0	0	0	0	0	2	1	0	3	5.3	0	0	0	0	0	0	1	0	1	2.3
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2	3.3
14:30	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
14:45	0	0	1	0	0	0	1	0	2	3.3	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	1	0	1	0	1	0	3	4.3	0	0	0	0	2	0	1	0	3	4.3
15:00	0	0	0	0	0	0	3	0	3	6.9	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
15:45	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	1	0	0	0	3	0	4	7.9	0	0	0	0	0	0	1	0	1	2.3
16:00	0	0	0	0	4	0	0	0	4	4	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	1	0	0	0	1	1	0	0	1	0	0	1	0	0	2	2.5
16:30	0	0	1	0	3	2	0	0	6	7	0	0	0	0	0	3	1	0	4	6.8
16:45	0	0	1	0	1	1	1	0	4	5.8	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	2	0	9	3	1	0	15	17.8	0	0	1	0	0	4	1	0	6	9.3
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	3.3
17:45	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	1	0	1	0	0	0	2	2	0	0	1	0	0	0	1	0	2	3.3
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 TOT	0	0	8	0	15	9	15	0	47	71	0	0	4	0	7	8	11	0	30	48.3

	A => E										B => A									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1.5
07:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
07:45	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0.4
H/TOT	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	4	3.9
08:00	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	4	6.6
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	0	5	7.6
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	2
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
10:30	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	2
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	0	0	0	5	5
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	2
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	3	4.3
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	3
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
14:30	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2	0	0	4	5
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 TOT	0	0	0	0	0	0	0	0	0	0	0	1	11	0	7	3	3	0	25	29.8

	B => B										B => C									
TIME	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU
07:00	0	0	0	0	0	0	0	0	0	0	0	1	15	1	6	5	7	0	35	46
07:15	0	0	1	0	0	0	0	0	1	1	0	0	24	1	8	7	4	0	44	52.7
07:30	0	0	1	0	1	0	0	0	2	2	0	0	44	0	13	8	9	1	75	91.7
07:45	0	0	2	0	0	0	0	0	2	2	0	0	37	0	15	7	6	1	66	78.3
H/TOT	0	0	4	0	1	0	0	0	5	5	0	1	120	2	42	27	26	2	220	268.7
08:00	0	0	1	0	0	0	0	0	1	1	0	0	60	0	11	5	11	1	88	105.8
08:15	0	0	8	1	2	0	0	0	11	11	0	0	79	0	12	4	10	1	106	122
08:30	0	0	10	0	1	0	0	0	11	11	0	0	83	0	6	3	5	0	97	105
08:45	0	0	3	0	1	2	0	0	6	7	0	0	70	0	16	4	5	1	96	105.5
H/TOT	0	0	22	1	4	2	0	0	29	30	0	0	292	0	45	16	31	3	387	438.3
09:00	0	0	3	1	0	0	0	0	4	4	0	0	52	0	11	7	8	0	78	91.9
09:15	0	0	2	0	3	1	0	0	6	6.5	0	0	43	0	16	5	5	0	69	78
09:30	0	0	6	0	3	0	0	0	9	9	0	0	37	0	12	4	5	0	58	66.5
09:45	0	0	3	0	0	0	0	0	3	3	0	0	28	0	14	5	4	0	51	58.7
H/TOT	0	0	14	1	6	1	0	0	22	22.5	0	0	160	0	53	21	22	0	256	295.1
10:00	0	0	1	0	1	0	0	0	2	2	0	0	37	0	14	5	5	0	61	70
10:15	0	0	3	1	0	0	0	0	4	4	0	0	24	0	11	1	5	0	41	48
10:30	0	0	1	0	0	0	0	0	1	1	0	0	32	1	14	5	4	0	56	63.7
10:45	0	0	2	0	1	0	0	0	3	3	0	0	28	1	12	5	5	0	51	60
H/TOT	0	0	7	1	2	0	0	0	10	10	0	0	121	2	51	16	19	0	209	241.7
11:00	0	0	0	0	0	0	0	0	0	0	0	0	41	1	12	6	6	3	69	82.8
11:15	0	0	0	0	0	0	0	0	0	0	0	0	34	0	13	2	5	1	55	63.5
11:30	0	0	0	0	0	0	0	0	0	0	0	0	39	0	13	7	7	0	66	78.6
11:45	0	0	1	0	0	0	0	0	1	1	0	0	40	1	9	2	3	1	56	61.9
H/TOT	0	0	1	0	0	0	0	0	1	1	0	0	154	2	47	17	21	5	246	286.8
12:00	0	0	0	0	0	0	0	0	0	0	0	0	40	1	12	7	6	0	66	77.3
12:15	0	0	0	0	0	0	1	0	1	2.3	0	0	41	1	5	8	10	0	65	82
12:30	0	0	0	0	0	0	0	0	0	0	0	0	34	1	9	1	7	0	52	61.6
12:45	0	0	1	0	0	0	0	0	1	1	0	0	36	0	14	4	4	0	58	65.2
H/TOT	0	0	1	0	0	0	1	0	2	3.3	0	0	151	3	40	20	27	0	241	286.1
13:00	0	0	0	0	0	0	0	0	0	0	0	0	61	0	14	4	5	0	84	92.5
13:15	0	0	1	0	0	0	0	0	1	1	0	0	44	1	9	3	8	0	65	76.9
13:30	0	0	0	0	0	0	0	0	0	0	0	0	33	0	13	6	5	0	57	66.5
13:45	0	0	0	0	1	0	0	0	1	1	0	0	53	1	10	6	7	0	77	89.1
H/TOT	0	0	1	0	1	0	0	0	2	2	0	0	191	2	46	19	25	0	283	325
14:00	0	0	0	0	0	1	1	0	2	3.8	0	0	56	0	19	5	6	0	86	96.3
14:15	0	0	0	0	0	0	0	0	0	0	0	0	57	0	23	3	8	1	92	104.9
14:30	0	0	0	0	0	0	0	0	0	0	0	0	51	0	12	3	4	0	70	76.7
14:45	0	0	0	0	0	0	1	0	1	2.3	0	0	53	0	7	6	4	0	70	78.2
H/TOT	0	0	0	0	0	1	2	0	3	6.1	0	0	217	0	61	17	22	1	318	356.1
15:00	0	0	5	0	0	0	0	0	5	5	0	1	78	1	14	5	8	0	107	119.3
15:15	0	0	5	0	0	0	0	0	5	5	0	1	94	0	14	2	8	0	119	129.8
15:30	0	0	1	0	0	0	0	0	1	1	0	0	72	0	17	2	6	3	100	111.8
15:45	0	0	3	0	0	0	1	0	4	5.3	0	0	70	1	8	2	2	0	83	86.6
H/TOT	0	0	14	0	0	0	1	0	15	16.3	0	2	314	2	53	11	24	3	409	447.5
16:00	0	0	6	0	0	1	0	0	7	7.5	0	0	53	0	5	3	4	0	65	71.7
16:15	0	0	1	0	1	0	0	0	2	2	0	0	67	0	5	3	3	1	79	85.4
16:30	0	0	2	0	0	0	0	0	2	2	0	0	43	1	16	2	5	1	68	76.5
16:45	0	0	1	0	0	0	0	0	1	1	0	0	61	0	14	1	3	0	79	83.4
H/TOT	0	0	10	0	1	1	0	0	12	12.5	0	0	224	1	40	9	15	2	291	317
17:00	0	0	6	0	0	0	0	0	6	6	0	1	67	2	9	2	7	0	88	97.5
17:15	0	0	0	0	0	0	0	0	0	0	0	0	56	0	11	0	4	0	71	76.2
17:30	0	0	8	0	0	1	0	0	9	9.5	0	0	61	0	7	1	3	0	72	76.4
17:45	0	0	2	0	0	0	0	0	2	2	0	0	78	1	13	4	2	0	98	102.6
H/TOT	0	0	16	0	0	1	0	0	17	17.5	0	1	262	3	40	7	16	0	329	352.7
18:00	0	0	4	0	0	0	0	0	4	4	0	0	63	0	7	5	1	1	77	81.8
18:15	0	0	4	0	1	0	0	0	5	5	0	0	65	1	11	0	1	0	78	79.3
18:30	0	0	4	0	0	0	0	0	4	4	0	0	49	0	4	0	1	1	55	57.3
18:45	0	0	3	0	0	0	0	0	3	3	0	0	37	0	1	1	2	0	41	44.1
H/TOT	0	0	15	0	1	0	0	0	16	16	0	0	214	1	23	6	5	2	251	262.5
12 TOT	0	0	105	3	16	6	4	0	134	142.2	0	4	2420	18	541	186	253	18	3440	3877.5

					B => D										B => E					
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	44	1	6	4	0	0	55	57	0	0	0	0	0	0	0	0	0	0
07:15	1	0	63	0	14	4	3	1	86	92.1	0	0	0	0	0	0	0	0	0	0
07:30	0	2	89	0	17	6	2	0	116	120.4	0	0	0	0	0	0	0	0	0	0
07:45	0	0	106	0	20	2	3	0	131	135.9	0	0	0	0	0	0	0	0	0	0
H/TOT	1	2	302	1	57	16	8	1	388	405.4	0	0	0	0	0	0	0	0	0	0
08:00	0	0	81	1	14	2	0	1	99	101	0	0	0	0	0	0	0	0	0	0
08:15	0	1	79	0	12	4	2	0	98	102	0	0	0	0	0	0	0	0	0	0
08:30	2	0	51	2	9	5	3	1	73	78.8	0	0	0	0	0	0	0	0	0	0
08:45	1	0	55	3	8	4	2	1	74	78.8	0	0	0	0	0	0	0	0	0	0
H/TOT	3	1	266	6	43	15	7	3	344	360.6	0	0	0	0	0	0	0	0	0	0
09:00	0	0	52	2	16	3	1	2	76	80.8	0	0	0	0	0	0	0	0	0	0
09:15	0	0	59	0	16	6	1	1	83	88.3	0	0	0	0	0	0	0	0	0	0
09:30	0	0	47	2	12	5	3	0	69	75.4	0	0	0	0	0	0	0	0	0	0
09:45	0	0	52	0	14	1	2	0	69	72.1	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	210	4	58	15	7	3	297	316.6	0	0	0	0	0	0	0	0	0	0
10:00	0	0	50	1	6	4	3	0	64	69.9	0	0	0	0	0	0	0	0	0	0
10:15	0	0	58	0	15	6	0	0	79	82	0	0	0	0	0	0	0	0	0	0
10:30	0	0	60	1	13	5	2	0	81	86.1	0	0	0	0	0	0	0	0	0	0
10:45	0	0	60	2	12	5	3	1	83	90.4	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	228	4	46	20	8	1	307	328.4	0	0	0	0	0	0	0	0	0	0
11:00	0	0	61	1	9	6	5	1	83	93.5	0	0	0	0	0	0	0	0	0	0
11:15	0	0	65	3	16	6	3	0	93	99.9	0	0	0	0	0	0	0	0	0	0
11:30	0	0	49	1	19	3	3	1	76	82.4	0	0	0	0	0	0	0	0	0	0
11:45	0	0	58	3	21	6	3	0	91	97.9	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	233	8	65	21	14	2	343	373.7	0	0	0	0	0	0	0	0	0	0
12:00	0	0	77	1	15	5	1	0	99	102.8	0	0	0	0	0	0	0	0	0	0
12:15	0	0	66	2	25	9	1	0	103	108.8	0	0	0	0	0	0	0	0	0	0
12:30	0	0	88	1	10	4	2	0	105	109.6	0	0	0	0	0	0	0	0	0	0
12:45	0	1	90	5	8	2	5	0	111	117.9	0	0	0	0	0	0	0	0	0	0
H/TOT	0	1	321	9	58	20	9	0	418	439.1	0	0	0	0	0	0	0	0	0	0
13:00	0	0	106	3	10	1	2	0	122	125.1	0	0	0	0	0	0	0	0	0	0
13:15	0	0	100	0	9	4	2	1	116	121.6	0	0	0	0	0	0	0	0	0	0
13:30	0	0	68	5	12	2	3	0	90	94.9	0	0	0	0	0	0	0	0	0	0
13:45	0	0	87	2	8	4	3	1	105	111.9	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	361	10	39	11	10	2	433	453.5	0	0	0	0	0	0	0	0	0	0
14:00	1	0	96	2	18	4	1	0	122	124.5	0	0	0	0	0	0	0	0	0	0
14:15	1	0	91	4	24	4	4	0	128	134.4	0	0	0	0	0	0	0	0	0	0
14:30	1	0	73	2	10	2	4	0	92	97.4	0	0	0	0	0	0	0	0	0	0
14:45	0	0	77	2	15	3	0	1	98	100.5	0	0	0	0	0	0	0	0	0	0
H/TOT	3	0	337	10	67	13	9	1	440	456.8	0	0	0	0	0	0	0	0	0	0
15:00	0	0	92	1	17	8	1	1	120	126.3	0	0	0	0	0	0	0	0	0	0
15:15	0	0	106	0	16	5	2	1	130	136.1	0	0	0	0	0	0	0	0	0	0
15:30	0	0	110	1	13	8	2	2	136	144.6	0	0	0	0	0	0	0	0	0	0
15:45	0	0	93	1	14	2	1	0	111	113.3	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	401	3	60	23	6	4	497	520.3	0	0	0	0	0	0	0	0	0	0
16:00	3	0	124	0	22	4	2	0	155	157.2	0	0	0	0	0	0	0	0	0	0
16:15	1	0	120	2	16	3	2	1	145	149.3	0	0	0	0	0	0	0	0	0	0
16:30	1	0	128	0	24	4	2	0	159	162.8	0	0	0	0	0	0	0	0	0	0
16:45	0	0	114	2	18	4	2	1	141	146.6	0	0	0	0	0	0	0	0	0	0
H/TOT	5	0	486	4	80	15	8	2	600	615.9	0	0	0	0	0	0	0	0	0	0
17:00	0	0	117	1	16	2	3	0	139	143.9	0	0	0	0	0	0	0	0	0	0
17:15	0	1	120	0	22	3	1	0	147	149.2	0	0	0	0	0	0	0	0	0	0
17:30	0	1	120	1	14	1	1	0	138	139.2	0	0	0	0	0	0	0	0	0	0
17:45	0	2	132	1	5	3	1	0	144	145.6	0	0	0	0	0	0	0	0	0	0
H/TOT	0	4	489	3	57	9	6	0	568	577.9	0	0	0	0	0	0	0	0	0	0
18:00	0	0	145	0	8	1	0	0	154	154.5	0	0	0	0	0	0	0	0	0	0
18:15	0	0	145	1	13	1	2	0	162	165.1	0	0	0	0	0	0	0	0	0	0
18:30	0	2	93	3	8	3	0	0	109	109.3	0	0	0	0	0	0	0	0	0	0
18:45	0	0	73	1	4	3	4	2	87	95.7	0	0	0	0	0	0	0	0	0	0
H/TOT	0	2	456	5	33	8	6	2	512	524.6	0	0	0	0	0	0	0	0	0	0
12 TOT	12	10	4090	67	663	186	98	21	5147	5372.8	0	0	0	0	0	0	0	0	0	0

	C => A										C => B									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	C => C										C => D									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	C => E										D => A									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	2	0	0	5	6
07:30	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	0	0	0	5	5
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	0	6	9.1
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	3	0	8	3	2	0	16	20.1
08:00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
08:15	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	3	4.3
08:30	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	1	0	6	7.3
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
09:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	3.3
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2	0	4	6.6
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	2.5
10:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	3	5.6
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	3	0	6	10.4
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	4	8.4
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	4	0	6	11.7
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	2.5
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
12:45	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	2
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	1	2	0	6	9.1
13:00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	2.5
13:30	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	1	0	4	5.3
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	1	2	0	8	11.1
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	2
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	4.6
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	2	0	5	7.6
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2	2.5
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	2.5
H/TOT	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	4	5
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	4.6
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1.5
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	3	6.1
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1.5
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1.5
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1.5
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1.5
12 TOT	0	0	0	0	0	0	0	0	0	0	1	0	14	0	19	11	21	0	66	98

	D => B										D => C									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	1	68	1	19	4	5	0	98	105.9	0	0	54	0	13	0	5	0	72	78.5
07:15	0	0	89	1	24	10	10	5	139	162	0	0	64	0	11	3	6	1	85	95.3
07:30	0	1	137	0	16	8	10	1	173	190.4	0	0	71	0	14	1	4	0	90	95.7
07:45	0	1	241	1	38	4	9	2	296	311.1	0	0	83	0	12	1	4	0	100	105.7
H/TOT	0	3	535	3	97	26	34	8	706	769.4	0	0	272	0	50	5	19	1	347	375.2
08:00	0	1	248	0	32	4	6	0	291	300.2	0	0	105	0	8	1	8	2	124	136.9
08:15	0	0	224	3	20	4	6	0	257	266.8	0	0	76	0	2	0	3	1	82	86.9
08:30	0	0	218	1	17	5	10	1	252	268.5	0	2	71	0	8	2	7	1	91	100.9
08:45	0	1	185	1	20	5	8	0	220	232.3	0	0	93	0	7	6	1	2	109	115.3
H/TOT	0	2	875	5	89	18	30	1	1020	1067.8	0	2	345	0	25	9	19	6	406	440
09:00	1	0	189	3	33	11	7	2	246	261.8	0	0	49	0	6	1	7	1	64	74.6
09:15	0	0	188	3	32	10	6	1	240	253.8	0	0	48	1	5	0	6	1	61	69.8
09:30	0	0	145	1	30	8	12	1	197	217.6	0	0	42	0	7	0	10	1	60	74
09:45	0	1	123	0	28	17	3	3	175	189.8	0	0	37	1	4	5	3	1	51	58.4
H/TOT	1	1	645	7	123	46	28	7	858	923	0	0	176	2	22	6	26	4	236	276.8
10:00	0	0	107	2	34	7	9	0	159	174.2	0	0	33	1	2	3	6	0	45	54.3
10:15	0	0	118	2	26	10	5	1	162	174.5	0	0	40	0	2	6	5	0	53	62.5
10:30	0	0	136	1	20	13	6	1	177	192.3	0	0	34	0	4	2	8	1	49	61.4
10:45	0	0	123	1	16	12	8	2	162	180.4	0	1	33	0	6	3	7	0	50	60
H/TOT	0	0	484	6	96	42	28	4	660	721.4	0	1	140	1	14	14	26	1	197	238.2
11:00	0	0	101	1	28	7	5	0	142	152	0	0	25	1	7	1	4	0	38	43.7
11:15	0	0	111	0	31	9	8	1	160	175.9	0	0	35	1	3	1	12	0	52	68.1
11:30	1	0	91	3	28	7	10	1	141	157.7	0	0	31	0	4	0	8	0	43	53.4
11:45	0	0	115	0	22	6	6	0	149	159.8	0	0	33	0	3	2	6	0	44	52.8
H/TOT	1	0	418	4	109	29	29	2	592	645.4	0	0	124	2	17	4	30	0	177	218
12:00	0	0	81	1	34	5	6	0	127	137.3	0	0	27	0	5	1	5	3	41	51
12:15	0	0	109	1	17	4	9	1	141	155.7	0	0	25	0	10	5	4	0	44	51.7
12:30	0	0	97	2	27	10	12	0	148	168.6	0	0	48	0	11	3	7	0	69	79.6
12:45	0	0	97	3	27	9	8	0	144	158.9	0	0	36	1	2	2	6	0	47	55.8
H/TOT	0	0	384	7	105	28	35	1	560	620.5	0	0	136	1	28	11	22	3	201	238.1
13:00	0	0	97	0	29	3	10	0	139	153.5	0	1	35	3	1	5	8	1	54	67.3
13:15	1	0	106	1	19	6	6	3	142	155	0	0	36	2	5	0	1	0	44	45.3
13:30	0	0	122	2	19	5	7	1	156	168.6	0	0	29	0	7	0	2	0	38	40.6
13:45	0	1	118	3	36	13	6	1	178	192.7	0	0	30	0	7	2	4	0	43	49.2
H/TOT	1	1	443	6	103	27	29	5	615	669.8	0	1	130	5	20	7	15	1	179	202.4
14:00	0	0	129	0	26	5	8	1	169	182.9	0	0	40	0	8	4	1	1	54	58.3
14:15	0	0	129	1	21	7	5	1	164	175	0	0	34	0	1	1	3	1	40	45.4
14:30	3	1	111	3	28	9	8	1	164	176.9	0	0	50	1	3	0	3	0	57	60.9
14:45	0	0	131	2	23	12	8	0	176	192.4	0	0	36	0	8	1	2	2	49	54.1
H/TOT	3	1	500	6	98	33	29	3	673	727.2	0	0	160	1	20	6	9	4	200	218.7
15:00	0	0	141	2	27	8	13	4	195	219.9	0	0	42	1	8	3	2	0	56	60.1
15:15	0	0	134	1	20	15	12	3	185	211.1	0	0	50	1	5	3	7	0	66	76.6
15:30	0	0	121	1	32	11	0	0	165	170.5	0	0	44	2	6	4	7	2	65	78.1
15:45	1	0	129	1	20	11	12	0	174	194.3	0	0	48	0	16	3	3	0	70	75.4
H/TOT	1	0	525	5	99	45	37	7	719	795.8	0	0	184	4	35	13	19	2	257	290.2
16:00	0	1	139	0	15	5	8	1	169	182.3	0	0	64	2	15	5	9	2	97	113.2
16:15	0	1	125	0	26	4	12	0	168	185	0	0	77	2	12	2	6	0	99	107.8
16:30	0	0	119	2	29	10	8	1	169	185.4	0	0	74	0	14	0	7	0	95	104.1
16:45	0	0	133	1	28	9	6	1	178	191.3	0	0	63	2	18	0	4	0	87	92.2
H/TOT	0	2	516	3	98	28	34	3	684	744	0	0	278	6	59	7	26	2	378	417.3
17:00	0	0	114	1	26	3	8	0	152	163.9	0	0	59	0	16	3	2	1	81	86.1
17:15	0	0	117	0	15	5	6	2	145	157.3	0	0	77	0	13	2	6	0	98	106.8
17:30	0	0	107	0	15	1	8	0	131	141.9	0	0	78	1	16	2	1	0	98	100.3
17:45	0	0	99	1	16	3	5	0	124	132	0	0	75	1	11	2	0	0	89	90
H/TOT	0	0	437	2	72	12	27	2	552	595.1	0	0	289	2	56	9	9	1	366	383.2
18:00	0	0	119	1	17	3	2	0	142	146.1	0	0	60	1	5	1	3	1	71	76.4
18:15	0	1	112	1	14	2	4	2	136	143.6	0	1	52	1	7	0	1	0	62	62.7
18:30	0	0	98	2	12	7	2	0	121	127.1	0	0	52	0	6	0	0	0	58	58
18:45	1	0	105	1	13	2	2	0	124	126.8	0	0	55	0	3	0	0	0	58	58
H/TOT	1	1	434	5	56	14	10	2	523	543.6	0	1	219	2	21	1	4	1	249	255.1
12 TOT	8	11	6196	59	1145	348	350	45	8162	8823	0	5	2453	26	367	92	224	26	3193	3553.2

	D => D										D => E									
TIME	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 TOT	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	0	0	0	0	0

	E => A										E => B									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0	2	0	8	10.6
07:15	0	0	0	0	0	0	0	0	0	0	0	0	7	0	1	0	0	0	8	8
07:30	0	0	1	0	0	0	1	0	2	3.3	0	0	7	0	1	1	0	0	9	9.5
07:45	0	0	0	0	0	0	0	0	0	0	0	0	18	0	1	0	2	0	21	23.6
H/TOT	0	0	1	0	0	0	1	0	2	3.3	0	0	37	0	4	1	4	0	46	51.7
08:00	0	0	0	0	0	1	0	0	1	1.5	0	0	30	1	3	1	0	0	35	35.5
08:15	0	0	1	0	0	0	0	0	1	1	0	0	33	0	1	2	0	0	36	37
08:30	0	0	0	0	0	0	0	0	0	0	0	0	41	0	1	0	0	0	42	42
08:45	0	0	0	0	0	0	0	0	0	0	0	0	26	1	3	3	0	0	33	34.5
H/TOT	0	0	1	0	0	1	0	0	2	2.5	0	0	130	2	8	6	0	0	146	149
09:00	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	16	16
09:15	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	1	0	0	26	26.5
09:30	0	0	0	0	0	0	0	0	0	0	0	0	8	0	1	2	1	0	12	14.3
09:45	0	0	0	0	0	0	0	0	0	0	0	0	13	0	4	0	0	0	17	17
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	62	0	5	3	1	0	71	73.8
10:00	0	0	0	0	0	1	0	0	1	1.5	0	0	10	0	0	0	0	0	10	10
10:15	0	0	0	0	0	0	0	0	0	0	0	0	11	0	1	0	0	0	12	12
10:30	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	1	0	0	9	9.5
10:45	0	0	0	0	0	0	0	0	0	0	0	0	7	0	4	0	0	0	11	11
H/TOT	0	0	0	0	0	1	0	0	1	1.5	0	0	36	0	5	1	0	0	42	42.5
11:00	0	0	0	0	1	0	0	0	1	1	0	0	3	0	1	1	2	0	7	10.1
11:15	0	0	0	0	0	0	0	0	0	0	0	0	8	0	3	1	1	0	13	14.8
11:30	0	0	0	0	0	0	0	0	0	0	0	0	6	0	1	1	1	0	9	10.8
11:45	0	0	0	0	0	0	1	0	1	2.3	0	0	7	0	3	0	0	0	10	10
H/TOT	0	0	0	0	1	0	1	0	2	3.3	0	0	24	0	8	3	4	0	39	45.7
12:00	0	0	0	0	0	0	0	0	0	0	0	0	6	0	1	0	1	0	8	9.3
12:15	0	0	0	0	0	1	0	0	1	1.5	0	0	3	0	0	0	2	0	5	7.6
12:30	0	0	0	0	0	0	0	0	0	0	0	0	6	0	1	1	1	0	9	10.8
12:45	0	0	0	0	0	0	0	0	0	0	0	0	7	0	1	0	1	0	9	10.3
H/TOT	0	0	0	0	0	1	0	0	1	1.5	0	0	22	0	3	1	5	0	31	38
13:00	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	2	0	6	8.6
13:15	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0	3	0	9	12.9
13:30	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	1	2	0	9	12.1
13:45	0	0	0	0	0	0	0	0	0	0	0	0	3	0	2	0	0	1	6	7
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	17	0	4	1	7	1	30	40.6
14:00	0	0	0	0	0	0	0	0	0	0	0	0	10	0	3	0	1	0	14	15.3
14:15	0	0	0	0	0	0	0	0	0	0	0	0	8	0	2	0	0	0	10	10
14:30	0	0	0	0	0	0	0	0	0	0	0	0	8	0	2	1	0	0	11	11.5
14:45	0	0	0	0	0	0	0	0	0	0	0	0	7	0	1	2	1	0	11	13.3
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	33	0	8	3	2	0	46	50.1
15:00	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	1	0	0	7	7.5
15:15	0	0	0	0	0	0	0	0	0	0	0	0	9	0	2	0	1	0	12	13.3
15:30	0	0	0	0	0	0	0	0	0	0	0	0	11	0	1	0	0	0	12	12
15:45	0	0	0	0	0	0	0	0	0	0	0	0	3	0	2	0	0	0	5	5
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	29	0	5	1	1	0	36	37.8
16:00	0	0	0	0	0	0	1	0	1	2.3	0	0	8	0	4	1	3	0	16	20.4
16:15	0	0	0	0	2	2	0	0	4	5	0	0	10	1	1	0	2	0	14	16.6
16:30	0	0	0	0	1	0	0	0	1	1	0	0	13	0	0	0	0	0	13	13
16:45	0	0	0	0	0	0	0	0	0	0	0	0	14	0	2	1	1	0	18	19.8
H/TOT	0	0	0	0	3	2	1	0	6	8.3	0	0	45	1	7	2	6	0	61	69.8
17:00	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	12	12
17:15	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	2	0	0	20	21
17:30	0	0	0	0	0	0	0	0	0	0	0	0	12	1	2	1	0	0	16	16.5
17:45	0	0	0	0	0	0	0	0	0	0	0	0	6	0	1	0	0	0	7	7
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	48	1	3	3	0	0	55	56.5
18:00	0	0	0	0	0	0	0	0	0	0	0	0	18	0	1	0	0	0	19	19
18:15	0	0	0	0	0	0	0	0	0	0	0	0	6	0	1	0	0	0	7	7
18:30	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3	3
18:45	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	4	4
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	31	0	2	0	0	0	33	33
12 TOT	0	0	2	0	4	5	3	0	14	20.4	0	0	514	4	62	25	30	1	636	688.5

	E => C										E => D									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0	0	1	32	0	1	2	2	0	38	41
07:15	0	0	1	0	1	0	0	0	2	2	0	0	66	0	6	0	3	0	75	78.9
07:30	0	0	1	0	0	0	1	0	2	3.3	0	0	78	1	10	0	1	0	90	91.3
07:45	0	0	0	0	0	0	0	0	0	0	0	1	62	0	6	0	3	0	72	75.3
H/TOT	0	0	2	0	1	0	1	0	4	5.3	0	2	238	1	23	2	9	0	275	286.5
08:00	0	0	1	0	0	0	0	0	1	1	0	0	65	0	8	2	0	0	75	76
08:15	0	0	1	0	2	0	0	0	3	3	1	0	61	2	5	0	1	0	70	70.5
08:30	0	0	1	0	1	0	0	0	2	2	0	0	45	0	5	0	3	0	53	56.9
08:45	0	0	3	0	0	0	1	0	4	5.3	0	0	43	0	8	0	0	0	51	51
H/TOT	0	0	6	0	3	0	1	0	10	11.3	1	0	214	2	26	2	4	0	249	254.4
09:00	0	0	2	0	0	0	0	0	2	2	0	0	51	1	5	2	4	0	63	69.2
09:15	0	0	1	0	0	1	0	0	2	2.5	0	0	50	1	2	0	1	0	54	55.3
09:30	0	0	3	0	0	0	0	0	3	3	0	0	38	0	2	1	1	0	42	43.8
09:45	0	0	1	0	2	0	0	0	3	3	0	0	34	2	1	1	2	0	40	43.1
H/TOT	0	0	7	0	2	1	0	0	10	10.5	0	0	173	4	10	4	8	0	199	211.4
10:00	0	0	1	0	0	0	0	0	1	1	0	0	16	0	3	0	0	0	19	19
10:15	0	0	5	0	0	0	0	0	5	5	0	0	26	3	3	1	1	0	34	35.8
10:30	0	0	2	0	0	0	0	0	2	2	0	0	22	0	3	0	3	1	29	33.9
10:45	0	0	0	0	0	1	0	0	1	1.5	0	0	21	0	1	0	0	0	22	22
H/TOT	0	0	8	0	0	1	0	0	9	9.5	0	0	85	3	10	1	4	1	104	110.7
11:00	0	0	1	0	0	0	0	0	1	1	0	0	18	1	4	0	1	0	24	25.3
11:15	0	0	8	0	0	1	0	0	9	9.5	0	0	25	0	4	0	0	1	30	31
11:30	0	0	2	0	0	0	0	0	2	2	0	0	15	0	1	0	3	0	19	22.9
11:45	0	0	0	0	2	1	0	0	3	3.5	0	0	19	0	1	0	0	0	20	20
H/TOT	0	0	11	0	2	2	0	0	15	16	0	0	77	1	10	0	4	1	93	99.2
12:00	0	0	1	0	1	0	0	0	2	2	0	0	26	0	0	1	3	0	30	34.4
12:15	0	0	4	0	1	0	0	0	5	5	0	0	25	0	0	0	0	0	25	25
12:30	0	0	2	1	0	0	0	0	3	3	0	0	19	1	2	0	2	0	24	26.6
12:45	0	0	6	0	0	0	0	0	6	6	0	0	34	0	6	1	0	0	41	41.5
H/TOT	0	0	13	1	2	0	0	0	16	16	0	0	104	1	8	2	5	0	120	127.5
13:00	0	0	4	0	0	0	1	0	5	6.3	0	0	20	0	3	1	1	0	25	26.8
13:15	0	0	1	0	0	0	0	0	1	1	0	0	27	0	4	1	0	0	32	32.5
13:30	0	0	4	0	0	0	0	0	4	4	0	0	25	0	4	1	2	0	32	35.1
13:45	0	0	5	0	0	0	1	0	6	7.3	0	0	34	1	3	2	3	0	43	47.9
H/TOT	0	0	14	0	0	0	2	0	16	18.6	0	0	106	1	14	5	6	0	132	142.3
14:00	0	0	9	0	2	0	1	0	12	13.3	0	0	24	0	0	0	0	0	24	24
14:15	0	0	3	0	2	0	0	0	5	5	0	0	35	0	2	1	5	0	43	50
14:30	0	0	1	0	0	0	0	0	1	1	0	0	25	0	4	2	0	0	31	32
14:45	0	0	2	0	1	0	0	0	3	3	0	0	38	0	4	3	0	1	46	48.5
H/TOT	0	0	15	0	5	0	1	0	21	22.3	0	0	122	0	10	6	5	1	144	154.5
15:00	0	0	1	0	0	0	0	0	1	1	0	0	34	0	5	0	1	0	40	41.3
15:15	0	0	2	0	2	0	0	0	4	4	0	0	36	0	0	0	3	0	39	42.9
15:30	0	0	1	0	0	0	0	0	1	1	0	0	33	0	3	1	1	0	38	39.8
15:45	0	0	4	0	0	0	0	0	4	4	0	1	37	1	6	0	0	0	45	44.4
H/TOT	0	0	8	0	2	0	0	0	10	10	0	1	140	1	14	1	5	0	162	168.4
16:00	0	0	27	0	3	0	0	1	31	32	0	0	25	0	0	0	2	0	27	29.6
16:15	0	0	22	0	0	0	1	0	23	24.3	0	0	27	0	6	0	2	0	35	37.6
16:30	0	0	32	0	6	0	0	0	38	38	0	0	18	1	2	1	1	0	23	24.8
16:45	0	0	31	0	4	1	0	0	36	36.5	0	0	55	0	2	0	1	0	58	59.3
H/TOT	0	0	112	0	13	1	1	1	128	130.8	0	0	125	1	10	1	6	0	143	151.3
17:00	0	0	26	1	4	0	0	0	31	31	0	0	62	0	4	0	1	0	67	68.3
17:15	0	0	30	0	2	0	0	0	32	32	0	0	68	1	0	2	1	0	72	74.3
17:30	0	0	30	0	1	0	1	0	32	33.3	0	0	59	0	4	0	0	0	63	63
17:45	0	0	20	0	0	1	0	0	21	21.5	0	0	56	0	7	0	0	0	63	63
H/TOT	0	0	106	1	7	1	1	0	116	117.8	0	0	245	1	15	2	2	0	265	268.6
18:00	0	0	30	0	0	0	0	0	30	30	0	0	50	1	3	1	1	0	56	57.8
18:15	0	0	27	0	2	0	0	0	29	29	0	0	35	1	0	0	1	0	37	38.3
18:30	0	0	12	0	0	0	0	0	12	12	0	0	33	0	5	1	1	0	40	41.8
18:45	0	0	3	0	1	0	1	0	5	6.3	0	0	29	0	0	0	0	0	29	29
H/TOT	0	0	72	0	3	0	1	0	76	77.3	0	0	147	2	8	2	3	0	162	166.9
12 TOT	0	0	374	2	40	6	8	1	431	445.4	1	3	1776	18	158	28	61	3	2048	2141.7

	E => E									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
12 TOT	0	0	0	0	0	0	0	0	0	0

IDASO

Survey Name: 049 20078 Raheen-Limerick
Site: Site 2
Location: N69 / Slips N18
Date: Tue 03-Mar-2020

	A => A										A => B									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
12:30	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	2	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
13:00	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	1	0	0	0	0	1	2	3	0	0	0	0	0	0	0	0	0	0
14:00	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
14:15	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	2	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 TOT	0	0	7	0	0	0	0	1	8	9	0	0	0	0	0	0	0	0	0	0

	A => C										A => D									
TIME	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU
07:00	0	1	48	0	5	2	0	0	56	56.4	0	0	26	1	2	3	2	0	34	38.1
07:15	1	0	88	0	10	3	1	1	104	107	0	0	36	0	10	1	5	0	52	59
07:30	0	2	135	1	13	3	1	0	155	156.6	0	0	23	0	8	2	1	0	34	36.3
07:45	0	0	128	0	10	0	0	0	138	138	0	1	28	0	12	1	5	0	47	53.4
H/TOT	1	3	399	1	38	8	2	1	453	458	0	1	113	1	32	7	13	0	167	186.8
08:00	0	0	107	1	12	4	0	1	125	128	0	0	27	0	6	0	0	0	33	33
08:15	1	0	94	0	10	4	1	0	110	112.5	0	1	37	2	3	0	3	0	46	49.3
08:30	1	0	62	0	11	3	0	0	77	77.7	1	0	15	2	3	2	2	0	25	27.8
08:45	0	0	57	0	7	2	1	0	67	69.3	0	0	37	2	4	2	1	1	47	50.3
H/TOT	2	0	320	1	40	13	2	1	379	387.5	1	1	116	6	16	4	6	1	151	160.4
09:00	0	0	77	3	10	1	0	1	92	93.5	0	0	23	0	9	3	3	0	38	43.4
09:15	0	0	95	0	12	2	1	1	111	114.3	0	0	10	0	4	4	0	0	18	20
09:30	0	0	66	1	8	4	1	0	80	83.3	0	0	17	1	3	2	4	0	27	33.2
09:45	0	0	62	2	11	0	2	0	77	79.6	0	0	23	0	4	1	2	0	30	33.1
H/TOT	0	0	300	6	41	7	4	2	360	370.7	0	0	73	1	20	10	9	0	113	129.7
10:00	0	0	45	1	5	2	0	0	53	54	0	0	18	0	4	2	1	0	25	27.3
10:15	0	0	66	3	6	3	0	0	78	79.5	0	0	15	0	7	2	1	0	25	27.3
10:30	0	0	61	1	11	2	2	0	77	80.6	0	0	18	0	0	0	3	1	22	26.9
10:45	0	0	53	0	6	2	0	0	61	62	0	0	27	2	6	3	0	1	39	41.5
H/TOT	0	0	225	5	28	9	2	0	269	276.1	0	0	78	2	17	7	5	2	111	123
11:00	0	0	59	2	6	3	1	0	71	73.8	0	0	18	0	4	3	5	1	31	40
11:15	0	0	56	2	9	2	0	1	70	72	0	0	30	1	9	2	2	0	44	47.6
11:30	0	0	38	1	10	2	0	1	52	54	0	0	23	0	7	1	6	0	37	45.3
11:45	0	0	50	2	14	3	1	0	70	72.8	0	0	19	1	4	1	2	0	27	30.1
H/TOT	0	0	203	7	39	10	2	2	263	272.6	0	0	90	2	24	7	15	1	139	163
12:00	0	0	60	0	4	1	1	0	66	67.8	0	0	39	0	8	4	3	0	54	59.9
12:15	0	0	58	0	10	3	2	0	73	77.1	0	0	29	2	14	6	0	0	51	54
12:30	0	0	62	2	7	3	1	0	75	77.8	0	0	42	0	1	1	3	0	47	51.4
12:45	0	0	66	5	10	1	0	0	82	82.5	0	1	51	0	3	1	4	0	60	65.1
H/TOT	0	0	246	7	31	8	4	0	296	305.2	0	1	161	2	26	12	10	0	212	230.4
13:00	0	0	77	2	11	1	1	0	92	93.8	0	0	40	0	2	1	2	0	45	48.1
13:15	0	0	86	0	7	2	1	0	96	98.3	0	0	39	0	6	3	0	0	48	49.5
13:30	0	0	57	4	10	3	0	0	74	75.5	0	0	32	1	6	0	2	0	41	43.6
13:45	0	0	75	2	6	3	2	0	88	92.1	0	0	39	1	3	2	3	1	49	54.9
H/TOT	0	0	295	8	34	9	4	0	350	359.7	0	0	150	2	17	6	7	1	183	196.1
14:00	0	0	72	0	9	3	0	0	84	85.5	1	0	39	1	9	1	1	0	52	53
14:15	1	0	73	2	11	2	1	0	90	91.5	0	0	52	2	14	2	9	0	79	91.7
14:30	1	0	55	1	6	3	2	0	68	71.3	0	0	37	1	7	1	2	0	48	51.1
14:45	0	0	77	1	13	5	0	0	96	98.5	0	0	34	0	6	0	0	2	42	44
H/TOT	2	0	277	4	39	13	3	0	338	346.8	1	0	162	4	36	4	12	2	221	239.8
15:00	0	0	77	1	15	3	0	0	96	97.5	0	0	43	0	6	5	1	0	55	58.8
15:15	0	0	82	0	8	4	1	0	95	98.3	0	0	56	0	7	1	4	1	69	75.7
15:30	0	0	83	0	6	5	2	0	96	101.1	0	0	58	0	8	4	2	2	74	80.6
15:45	0	0	66	2	7	2	0	0	77	78	0	1	55	0	12	0	0	0	68	67.4
H/TOT	0	0	308	3	36	14	3	0	364	374.9	0	1	212	0	33	10	7	3	266	282.5
16:00	3	0	68	0	13	2	0	0	86	84.6	0	0	79	0	8	1	4	0	92	97.7
16:15	0	0	82	1	10	1	1	0	95	96.8	0	0	61	1	11	0	3	1	77	81.9
16:30	0	0	75	0	8	1	0	0	84	84.5	1	0	70	0	14	7	2	0	94	99.3
16:45	0	0	70	1	10	2	0	0	83	84	0	0	93	0	10	2	2	1	108	112.6
H/TOT	3	0	295	2	41	6	1	0	348	349.9	1	0	303	1	43	10	11	2	371	391.5
17:00	0	0	90	0	6	1	0	0	97	97.5	0	0	85	0	13	0	3	0	101	104.9
17:15	0	0	87	1	8	2	0	0	98	99	0	1	96	0	13	2	2	0	114	117
17:30	0	0	89	0	6	0	0	0	95	95	0	1	84	1	12	1	3	0	102	105.8
17:45	0	0	85	0	4	0	0	0	89	89	0	2	90	0	5	1	0	0	98	97.3
H/TOT	0	0	351	1	24	3	0	0	379	380.5	0	4	355	1	43	4	8	0	415	425
18:00	0	0	92	1	4	1	0	0	98	98.5	0	0	92	0	5	0	1	0	98	99.3
18:15	0	0	87	1	8	0	1	0	97	98.3	0	0	89	0	4	0	2	0	95	97.6
18:30	0	1	76	2	5	1	0	0	85	84.9	0	1	45	1	6	3	1	0	57	59.2

18:45	0	0	61	1	4	2	0	0	68	69	0	0	41	0	0	1	3	2	47	53.4
H/TOT	0	1	316	5	21	4	1	0	348	350.7	0	1	267	1	15	4	7	2	297	309.5
12 TOT	8	4	3535	50	412	104	28	6	4147	4232.6	3	9	2080	23	322	85	110	14	2646	2837.7

	A => E										A => F									
TIME	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU
07:00	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	2	2.5
07:15	0	0	2	0	0	0	0	0	2	2	0	0	3	0	0	0	0	0	3	3
07:30	0	0	7	0	1	0	0	0	8	8	0	0	2	0	4	1	1	0	8	9.8
07:45	0	0	6	0	1	0	0	0	7	7	0	0	8	0	5	2	1	0	16	18.3
H/TOT	0	0	16	0	2	0	0	0	18	18	0	0	14	0	9	4	2	0	29	33.6
08:00	0	0	2	0	0	0	0	0	2	2	0	0	9	0	3	0	0	0	12	12
08:15	0	0	0	0	0	0	0	0	0	0	0	0	9	0	4	0	1	0	14	15.3
08:30	0	0	1	0	0	0	0	0	1	1	0	0	18	0	0	0	4	1	23	29.2
08:45	0	0	0	0	1	0	0	0	1	1	1	0	5	1	4	0	0	0	11	10.2
H/TOT	0	0	3	0	1	0	0	0	4	4	1	0	41	1	11	0	5	1	60	66.7
09:00	0	0	0	0	1	1	1	0	3	4.8	0	0	3	0	0	0	1	1	5	7.3
09:15	0	0	0	0	0	0	1	0	1	2.3	0	0	4	1	2	0	0	0	7	7
09:30	0	0	0	0	1	0	0	0	1	1	0	0	2	0	2	0	0	0	4	4
09:45	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2	2.5
H/TOT	0	0	0	0	2	1	2	0	5	8.1	0	0	10	1	4	1	1	1	18	20.8
10:00	0	0	1	0	0	0	2	0	3	5.6	0	0	3	0	0	0	1	0	4	5.3
10:15	0	0	0	0	0	1	0	0	1	1.5	0	0	3	0	4	0	0	0	7	7
10:30	0	0	0	0	1	1	0	0	2	2.5	0	0	3	0	4	2	0	0	9	10
10:45	0	0	0	0	2	0	1	0	3	4.3	0	0	1	0	0	1	3	0	5	9.4
H/TOT	0	0	1	0	3	2	3	0	9	13.9	0	0	10	0	8	3	4	0	25	31.7
11:00	0	0	0	0	1	0	0	0	1	1	0	0	2	0	2	0	0	0	4	4
11:15	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	2	1	0	9	11.3
11:30	0	0	1	0	0	0	0	0	1	1	0	0	2	0	3	0	1	0	6	7.3
11:45	0	0	1	0	0	0	0	0	1	1	0	0	6	0	4	1	1	0	12	13.8
H/TOT	0	0	2	0	1	0	0	0	3	3	0	0	15	0	10	3	3	0	31	36.4
12:00	0	0	0	0	2	0	0	0	2	2	0	0	4	1	0	1	0	0	6	6.5
12:15	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0	6	6
12:30	0	0	0	0	0	0	0	0	0	0	0	0	2	0	5	1	1	0	9	10.8
12:45	0	0	1	0	0	0	1	0	2	3.3	0	0	7	0	1	0	1	0	9	10.3
H/TOT	0	0	1	0	2	0	1	0	4	5.3	0	0	18	1	7	2	2	0	30	33.6
13:00	0	0	0	0	0	0	0	0	0	0	0	0	8	1	0	0	0	0	9	9
13:15	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	3	4.3
13:30	0	0	0	0	0	0	1	0	1	2.3	0	0	5	0	0	0	2	0	7	9.6
13:45	0	0	0	0	0	0	1	0	1	2.3	0	0	7	0	1	1	1	0	10	11.8
H/TOT	0	0	0	0	0	0	2	0	2	4.6	0	0	22	1	1	1	4	0	29	34.7
14:00	0	0	1	0	1	0	0	0	2	2	0	0	7	1	0	0	0	0	8	8
14:15	0	0	0	0	1	0	0	0	1	1	0	0	1	0	0	1	1	0	3	4.8
14:30	0	0	0	0	0	0	0	0	0	0	0	0	6	0	1	0	0	0	7	7
14:45	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	6	6
H/TOT	0	0	1	0	2	0	0	0	3	3	0	0	19	2	1	1	1	0	24	25.8
15:00	0	0	0	0	0	0	1	0	1	2.3	0	0	6	0	0	0	0	1	7	8
15:15	0	0	1	0	0	0	0	0	1	1	0	0	4	0	1	0	0	0	5	5
15:30	0	0	0	0	1	0	0	0	1	1	0	0	2	1	0	0	0	0	3	3
15:45	0	0	1	0	0	0	0	0	1	1	0	0	9	0	1	0	1	0	11	12.3
H/TOT	0	0	2	0	1	0	1	0	4	5.3	0	0	21	1	2	0	1	1	26	28.3
16:00	0	0	0	0	0	0	1	0	1	2.3	0	0	2	0	0	0	0	0	2	2
16:15	0	0	0	0	1	0	1	0	2	3.3	1	0	6	0	0	3	0	0	10	10.7
16:30	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	0	2	0	8	10.6
16:45	0	0	0	0	0	0	0	0	0	0	0	0	7	1	0	0	1	0	9	10.3
H/TOT	0	0	0	0	1	0	2	0	3	5.6	1	0	17	2	3	3	3	0	29	33.6
17:00	0	0	0	0	0	0	1	0	1	2.3	0	0	4	1	0	1	0	0	6	6.5
17:15	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	6	6
17:30	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	8	8
17:45	0	0	0	0	0	0	0	0	0	0	0	0	14	1	2	2	1	0	20	22.3
H/TOT	0	0	0	0	0	0	1	0	1	2.3	0	0	32	2	2	3	1	0	40	42.8
18:00	0	0	0	0	1	1	0	0	2	2.5	0	0	12	0	1	0	0	0	13	13
18:15	0	0	1	0	1	0	0	0	2	2	0	0	4	1	0	1	0	0	6	6.5
18:30	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0	6	6

18:45	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	3.3
H/TOT	0	0	1	0	2	1	0	0	4	4.5	0	0	22	1	2	1	1	0	27	28.8
12 TOT	0	0	27	0	17	4	12	0	60	77.6	2	0	241	12	60	22	28	3	368	416.8

	B => A										B => B									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	1	30	1	7	1	1	0	41	42.2	0	0	0	0	0	0	0	0	0	0
07:15	0	0	32	0	20	6	7	3	68	83.1	0	0	0	0	0	0	0	0	0	0
07:30	0	0	49	0	10	5	9	0	73	87.2	0	0	0	0	0	0	0	0	0	0
07:45	0	0	107	0	17	3	8	0	135	146.9	0	0	0	0	0	0	0	0	0	0
H/TOT	0	1	218	1	54	15	25	3	317	359.4	0	0	0	0	0	0	0	0	0	0
08:00	0	0	84	0	18	4	4	1	111	119.2	0	0	0	0	0	0	0	0	0	0
08:15	0	0	82	1	6	2	8	0	99	110.4	0	0	0	0	0	0	0	0	0	0
08:30	0	0	115	0	12	3	5	2	137	147	0	0	0	0	0	0	0	0	0	0
08:45	0	0	93	0	13	5	5	0	116	125	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	374	1	49	14	22	3	463	501.6	0	0	0	0	0	0	0	0	0	0
09:00	0	0	91	2	16	4	4	2	119	128.2	0	0	0	0	0	0	0	0	0	0
09:15	0	0	71	0	14	2	4	1	92	99.2	0	0	0	0	0	0	0	0	0	0
09:30	0	0	77	0	9	2	9	2	99	113.7	0	0	0	0	0	0	0	0	0	0
09:45	0	0	38	0	15	9	1	2	65	72.8	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	277	2	54	17	18	7	375	413.9	0	0	0	0	0	0	0	0	0	0
10:00	0	0	32	0	13	4	1	0	50	53.3	0	0	0	0	0	0	0	0	0	0
10:15	0	0	36	0	10	5	7	1	59	71.6	0	0	0	0	0	0	0	0	0	0
10:30	0	0	44	1	7	11	3	1	67	77.4	0	0	0	0	0	0	0	0	0	0
10:45	0	0	28	0	4	5	7	1	45	57.6	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	140	1	34	25	18	3	221	259.9	0	0	0	0	0	0	0	0	0	0
11:00	0	0	39	0	11	5	0	0	55	57.5	0	0	0	0	0	0	0	0	0	0
11:15	0	0	30	0	18	5	8	1	62	75.9	0	0	0	0	0	0	0	0	0	0
11:30	0	0	32	1	14	2	9	0	58	70.7	0	0	0	0	0	0	0	0	0	0
11:45	0	0	48	0	7	5	5	0	65	74	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	149	1	50	17	22	1	240	278.1	0	0	0	0	0	0	0	0	0	0
12:00	0	0	18	0	14	3	4	1	40	47.7	0	0	0	0	0	0	0	0	0	0
12:15	0	0	34	0	11	3	6	1	55	65.3	0	0	0	0	0	0	0	0	0	0
12:30	0	0	33	1	13	6	10	0	63	79	0	0	0	0	0	0	0	0	0	0
12:45	0	0	25	2	10	4	6	0	47	56.8	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	110	3	48	16	26	2	205	248.8	0	0	0	0	0	0	0	0	0	0
13:00	0	0	27	0	12	2	8	0	49	60.4	0	0	0	0	0	0	0	0	0	0
13:15	0	0	31	1	9	5	3	1	50	57.4	0	0	0	0	0	0	0	0	0	0
13:30	0	0	44	0	12	1	5	0	62	69	0	0	0	0	0	0	0	0	0	0
13:45	0	0	42	0	17	5	4	0	68	75.7	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	144	1	50	13	20	1	229	262.5	0	0	0	0	0	0	0	0	0	0
14:00	1	0	45	0	12	3	6	1	68	77.5	0	0	0	0	0	0	0	0	0	0
14:15	0	0	49	0	7	3	4	1	64	71.7	0	0	0	0	0	0	0	0	0	0
14:30	0	0	38	0	12	6	7	0	63	75.1	0	0	0	0	0	0	0	0	0	0
14:45	0	0	49	1	13	10	7	0	80	94.1	0	0	0	0	0	0	0	0	0	0
H/TOT	1	0	181	1	44	22	24	2	275	318.4	0	0	0	0	0	0	0	0	0	0
15:00	0	0	45	0	10	7	8	3	73	89.9	0	0	0	0	0	0	0	0	0	0
15:15	0	0	51	0	14	8	5	2	80	92.5	0	0	0	0	0	0	0	0	0	0
15:30	0	0	40	0	14	9	2	1	66	74.1	0	0	0	0	0	0	0	0	0	0
15:45	0	0	51	0	13	7	7	0	78	90.6	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	187	0	51	31	22	6	297	347.1	0	0	0	0	0	0	0	0	0	0
16:00	0	0	39	2	9	4	8	2	64	78.4	0	0	0	0	0	0	0	0	0	0
16:15	0	0	49	0	14	4	11	0	78	94.3	0	0	0	0	0	0	0	0	0	0
16:30	0	0	34	0	13	8	5	1	61	72.5	0	0	0	0	0	0	0	0	0	0
16:45	0	0	47	0	9	8	5	1	70	81.5	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	169	2	45	24	29	4	273	326.7	0	0	0	0	0	0	0	0	0	0
17:00	0	0	9	0	5	0	4	1	19	25.2	0	0	0	0	0	0	0	0	0	0
17:15	0	0	8	0	1	3	5	2	19	29	0	0	0	0	0	0	0	0	0	0
17:30	0	0	5	1	10	1	5	0	22	29	0	0	0	0	0	0	0	0	0	0
17:45	0	0	5	1	6	2	3	0	17	21.9	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	27	2	22	6	17	3	77	105.1	0	0	0	0	0	0	0	0	0	0
18:00	0	0	27	1	6	1	2	1	38	42.1	0	0	0	0	0	0	0	0	0	0
18:15	0	0	13	0	8	0	3	1	25	29.9	0	0	0	0	0	0	0	0	0	0
18:30	0	0	30	0	3	3	1	0	37	39.8	0	0	0	0	0	0	0	0	0	0

18:45	0	0	20	1	7	0	1	0	29	30.3	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	90	2	24	4	7	2	129	142.1	0	0	0	0	0	0	0	0	0	0
12 TOT	1	1	2066	17	525	204	250	37	3101	3563.6	0	0	0	0	0	0	0	0	0	0

	B => C										B => D									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	15	0	1	0	0	0	16	16	0	0	45	0	7	0	9	0	61	72.7
07:15	0	0	17	0	3	0	0	0	20	20	0	0	36	0	6	1	2	0	45	48.1
07:30	0	0	24	0	4	0	0	0	28	28	0	0	35	0	5	2	5	0	47	54.5
07:45	0	1	44	0	4	0	0	0	49	48.4	0	0	27	1	13	0	4	0	45	50.2
H/TOT	0	1	100	0	12	0	0	0	113	112.4	0	0	143	1	31	3	20	0	198	225.5
08:00	0	0	28	0	7	0	0	0	35	35	0	0	59	0	6	1	4	0	70	75.7
08:15	0	0	24	0	4	0	0	0	28	28	0	1	56	1	5	1	5	0	69	75.4
08:30	0	0	24	0	3	1	0	0	28	28.5	0	0	64	0	13	2	3	0	82	86.9
08:45	0	0	15	0	2	2	0	0	19	20	0	0	22	0	7	1	4	1	35	41.7
H/TOT	0	0	91	0	16	3	0	0	110	111.5	0	1	201	1	31	5	16	1	256	279.7
09:00	0	0	28	0	1	0	0	0	29	29	0	0	17	0	3	0	5	0	25	31.5
09:15	0	0	18	0	3	1	0	0	22	22.5	0	0	11	0	4	2	5	0	22	29.5
09:30	0	0	17	0	4	2	0	0	23	24	0	0	14	1	5	2	1	1	24	27.3
09:45	0	0	19	0	4	0	0	0	23	23	0	0	17	1	6	2	5	0	31	38.5
H/TOT	0	0	82	0	12	3	0	0	97	98.5	0	0	59	2	18	6	16	1	102	126.8
10:00	0	0	14	0	5	0	0	0	19	19	0	0	13	0	6	0	3	0	22	25.9
10:15	0	0	14	0	4	1	0	0	19	19.5	0	0	12	0	5	1	2	0	20	23.1
10:30	0	0	20	1	1	0	0	0	22	22	0	0	18	0	3	3	1	1	26	29.8
10:45	0	0	23	0	4	0	0	0	27	27	0	0	11	2	1	1	7	0	22	31.6
H/TOT	0	0	71	1	14	1	0	0	87	87.5	0	0	54	2	15	5	13	1	90	110.4
11:00	0	0	16	0	1	2	0	0	19	20	0	0	16	0	1	2	1	0	20	22.3
11:15	0	0	17	1	1	0	0	0	19	19	0	0	19	1	2	3	6	0	31	40.3
11:30	0	0	17	0	0	1	0	0	18	18.5	0	0	21	0	4	0	4	0	29	34.2
11:45	0	0	30	0	1	0	0	0	31	31	0	0	21	0	5	2	2	0	30	33.6
H/TOT	0	0	80	1	3	3	0	0	87	88.5	0	0	77	1	12	7	13	0	110	130.4
12:00	0	0	20	1	4	1	0	0	26	26.5	0	0	15	1	2	1	3	0	22	26.4
12:15	0	0	17	1	5	1	0	0	24	24.5	0	0	20	1	5	3	3	1	33	39.4
12:30	0	0	19	0	2	1	0	0	22	22.5	0	0	23	0	5	2	5	0	35	42.5
12:45	0	0	21	0	2	1	0	0	24	24.5	0	0	21	0	6	2	0	0	29	30
H/TOT	0	0	77	2	13	4	0	0	96	98	0	0	79	2	18	8	11	1	119	138.3
13:00	0	0	30	0	2	0	0	2	34	36	0	0	35	1	4	1	1	0	42	43.8
13:15	0	0	16	0	1	0	0	0	17	17	0	0	23	0	7	2	4	0	36	42.2
13:30	0	0	29	0	1	0	1	0	31	32.3	0	0	28	1	1	1	2	0	33	36.1
13:45	0	0	25	0	3	0	0	0	28	28	0	0	35	1	3	2	7	0	48	58.1
H/TOT	0	0	100	0	7	0	1	2	110	113.3	0	0	121	3	15	6	14	0	159	180.2
14:00	0	0	30	0	5	1	1	0	37	38.8	0	0	32	0	2	1	2	0	37	40.1
14:15	0	0	27	1	1	0	0	0	29	29	0	1	30	0	6	0	0	0	37	36.4
14:30	0	0	15	1	2	1	1	0	20	21.8	0	0	26	0	2	1	9	0	38	50.2
14:45	0	0	29	0	3	1	0	0	33	33.5	0	0	32	1	5	3	7	0	48	58.6
H/TOT	0	0	101	2	11	3	2	0	119	123.1	0	1	120	1	15	5	18	0	160	185.3
15:00	0	0	27	0	2	0	1	0	30	31.3	0	0	39	1	3	3	3	1	50	56.4
15:15	0	0	22	0	1	0	0	0	23	23	0	0	41	0	5	1	2	0	49	52.1
15:30	0	0	17	0	4	0	0	0	21	21	0	0	23	0	8	1	3	0	35	39.4
15:45	0	0	28	0	4	1	0	0	33	33.5	0	0	47	0	6	0	2	0	55	57.6
H/TOT	0	0	94	0	11	1	1	0	107	108.8	0	0	150	1	22	5	10	1	189	205.5
16:00	0	0	26	0	4	0	0	0	30	30	0	0	46	1	10	0	3	0	60	63.9
16:15	0	0	36	1	3	0	0	0	40	40	1	0	68	0	11	2	0	1	83	84.2
16:30	0	0	31	0	2	0	0	0	33	33	0	0	70	0	11	1	1	1	84	86.8
16:45	0	0	52	0	2	0	0	0	54	54	0	0	58	1	12	2	1	1	75	78.3
H/TOT	0	0	145	1	11	0	0	0	157	157	1	0	242	2	44	5	5	3	302	313.2
17:00	0	0	42	0	6	0	0	0	48	48	0	0	55	0	13	2	6	0	76	84.8
17:15	0	0	49	0	7	1	0	0	57	57.5	0	0	78	0	14	1	7	0	100	109.6
17:30	0	0	38	1	7	0	0	0	46	46	0	1	67	0	9	0	1	0	78	78.7
17:45	0	0	51	0	0	0	0	0	51	51	0	0	64	0	8	0	5	2	79	87.5
H/TOT	0	0	180	1	20	1	0	0	202	202.5	0	1	264	0	44	3	19	2	333	360.6
18:00	0	1	52	1	5	2	0	0	61	61.4	0	0	63	2	8	0	1	0	74	75.3
18:15	0	0	37	0	4	0	0	0	41	41	0	0	49	0	7	1	4	0	61	66.7
18:30	0	1	36	0	5	0	0	0	42	41.4	0	0	39	0	9	0	1	0	49	50.3

18:45	0	0	30	0	2	0	0	0	32	32	0	0	33	1	7	0	0	0	41	41
H/TOT	0	2	155	1	16	2	0	0	176	175.8	0	0	184	3	31	1	6	0	225	233.3
12 TOT	0	3	1276	9	146	21	4	2	1461	1476.9	1	3	1694	19	296	59	161	10	2243	2489.2

	B => E										B => F									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	0	0	0	0	0
07:15	0	0	1	0	0	0	1	0	2	3.3	0	0	2	0	0	1	1	1	5	7.8
07:30	0	0	7	0	4	0	0	0	11	11	0	0	2	0	0	0	0	0	2	2
07:45	0	0	10	0	0	0	2	0	12	14.6	0	0	2	0	0	0	0	0	2	2
H/TOT	0	0	18	0	4	0	4	0	26	31.2	0	0	6	0	0	1	1	1	9	11.8
08:00	0	0	7	0	0	0	1	0	8	9.3	0	0	29	0	0	0	0	0	29	29
08:15	0	0	2	0	0	0	1	0	3	4.3	0	0	57	0	1	0	0	0	58	58
08:30	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	1	1	0	15	16.8
08:45	1	0	1	0	3	0	1	0	6	6.5	0	0	18	0	0	1	0	0	19	19.5
H/TOT	1	0	10	0	3	0	3	0	17	20.1	0	0	117	0	1	2	1	0	121	123.3
09:00	0	0	0	0	0	0	1	0	1	2.3	0	0	4	0	2	0	0	0	6	6
09:15	0	0	0	0	0	0	3	0	3	6.9	0	0	7	0	4	2	1	0	14	16.3
09:30	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	3	3.5
09:45	0	0	0	0	0	0	1	0	1	2.3	0	0	6	0	2	0	1	0	9	10.3
H/TOT	0	0	0	0	0	0	5	0	5	11.5	0	0	19	0	8	3	2	0	32	36.1
10:00	0	0	0	0	0	0	4	0	4	9.2	0	0	2	0	1	0	0	0	3	3
10:15	0	0	0	0	0	0	3	0	3	6.9	0	0	2	0	0	1	0	0	3	3.5
10:30	0	0	1	0	0	1	0	0	2	2.5	0	0	3	0	0	0	1	0	4	5.3
10:45	0	0	1	0	1	0	4	0	6	11.2	0	0	8	0	1	1	1	0	11	12.8
H/TOT	0	0	2	0	1	1	11	0	15	29.8	0	0	15	0	2	2	2	0	21	24.6
11:00	0	0	2	0	0	0	1	0	3	4.3	0	0	0	0	0	0	1	0	1	2.3
11:15	0	0	0	0	0	0	1	0	1	2.3	0	0	1	0	0	0	0	0	1	1
11:30	0	0	0	0	0	0	1	0	1	2.3	0	0	4	0	0	0	1	0	5	6.3
11:45	0	0	0	0	0	0	1	0	1	2.3	0	0	1	0	0	0	0	0	1	1
H/TOT	0	0	2	0	0	0	4	0	6	11.2	0	0	6	0	0	0	2	0	8	10.6
12:00	0	0	1	0	0	0	3	0	4	7.9	0	0	4	0	1	0	0	0	5	5
12:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
12:30	0	0	0	0	0	0	2	0	2	4.6	0	0	1	0	0	0	0	0	1	1
12:45	0	0	1	0	0	0	0	0	1	1	0	0	2	0	2	0	1	0	5	6.3
H/TOT	0	0	2	0	0	0	5	0	7	13.5	0	0	8	0	3	0	1	0	12	13.3
13:00	0	0	1	0	0	0	0	0	1	1	0	0	7	0	0	0	1	1	9	11.3
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	1	0	0	1	1.5
13:45	0	0	1	0	0	0	3	0	4	7.9	0	0	0	0	1	0	0	0	1	1
H/TOT	0	0	2	0	0	0	4	0	6	11.2	0	0	7	0	1	1	1	1	11	13.8
14:00	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	2	0	0	0	2	2	0	0	0	0	3	0	0	0	3	3
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	1	0	0	0	1	0	2	3.3	0	0	6	0	0	0	0	0	6	6
H/TOT	0	0	1	0	2	0	2	0	5	7.6	0	0	6	0	3	0	0	0	9	9
15:00	0	0	2	0	1	0	2	0	5	7.6	0	0	0	0	0	0	0	0	0	0
15:15	0	0	1	0	0	0	0	0	1	1	0	0	4	0	0	0	3	0	7	10.9
15:30	0	0	0	0	1	0	0	0	1	1	0	0	2	0	3	0	0	0	5	5
15:45	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
H/TOT	0	0	3	0	2	0	2	0	7	9.6	0	0	7	0	3	0	3	0	13	16.9
16:00	0	0	0	0	0	0	1	0	1	2.3	0	0	5	0	3	0	0	0	8	8
16:15	0	0	0	0	0	0	1	0	1	2.3	0	1	3	0	1	0	0	0	5	4.4
16:30	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	1	0	0	15	15.5
16:45	0	0	1	0	0	0	0	0	1	1	0	0	5	0	4	0	0	0	9	9
H/TOT	0	0	1	0	0	0	2	0	3	5.6	0	1	27	0	8	1	0	0	37	36.9
17:00	0	0	0	0	0	1	0	0	1	1.5	0	0	35	0	1	3	1	0	40	42.8
17:15	0	0	0	0	0	0	0	0	0	0	0	0	45	1	4	0	0	0	50	50
17:30	0	0	0	0	0	0	0	0	0	0	0	0	36	0	0	0	0	0	36	36
17:45	0	0	0	0	0	0	0	0	0	0	0	0	34	0	0	0	0	0	34	34
H/TOT	0	0	0	0	0	1	0	0	1	1.5	0	0	150	1	5	3	1	0	160	162.8
18:00	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	20	20
18:15	0	0	2	0	0	1	1	0	4	5.8	0	0	21	0	0	0	0	0	21	21
18:30	0	0	0	0	0	0	0	0	0	0	0	0	7	1	0	0	0	0	8	8

18:45	0	0	0	0	0	1	0	0	1	1.5	0	0	15	0	1	0	0	0	16	16
H/TOT	0	0	2	0	0	2	1	0	5	7.3	0	0	63	1	1	0	0	0	65	65
12 TOT	1	0	43	0	12	4	43	0	103	160.1	0	1	431	2	35	13	14	2	498	524.1

	C => A										C => B									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	32	0	7	1	0	0	40	40.5	0	0	0	0	0	0	0	0	0	0
07:15	0	0	32	1	5	2	0	0	40	41	0	0	0	0	0	0	0	0	0	0
07:30	0	0	54	0	7	2	0	0	63	64	0	0	0	0	0	0	0	0	0	0
07:45	0	1	86	0	16	1	1	0	105	106.2	0	0	0	0	0	0	0	0	0	0
H/TOT	0	1	204	1	35	6	1	0	248	251.7	0	0	0	0	0	0	0	0	0	0
08:00	0	0	122	0	9	0	0	0	131	131	0	0	0	0	0	0	0	0	0	0
08:15	0	0	130	1	4	1	0	0	136	136.5	0	0	0	0	0	0	0	0	0	0
08:30	0	1	83	0	1	2	0	0	87	87.4	0	0	0	0	0	0	0	0	0	0
08:45	0	0	64	1	1	1	0	0	67	67.5	0	0	0	0	0	0	0	0	0	0
H/TOT	0	1	399	2	15	4	0	0	421	422.4	0	0	0	0	0	0	0	0	0	0
09:00	1	0	45	1	10	4	0	0	61	62.2	0	0	0	0	0	0	0	0	0	0
09:15	0	0	59	1	10	3	1	1	75	78.8	0	0	0	0	0	0	0	0	0	0
09:30	0	0	43	1	7	2	2	0	55	58.6	0	0	0	0	0	0	0	0	0	0
09:45	0	1	46	0	10	7	1	0	65	69.2	0	0	0	0	0	0	0	0	0	0
H/TOT	1	1	193	3	37	16	4	1	256	268.8	0	0	0	0	0	0	0	0	0	0
10:00	0	0	40	3	11	4	0	0	58	60	0	0	0	0	0	0	0	0	0	0
10:15	0	0	58	2	9	4	0	0	73	75	0	0	0	0	0	0	0	0	0	0
10:30	0	0	58	0	6	3	0	0	67	68.5	0	0	0	0	0	0	0	0	0	0
10:45	0	1	49	1	6	1	1	1	60	62.2	0	0	0	0	0	0	0	0	0	0
H/TOT	0	1	205	6	32	12	1	1	258	265.7	0	0	0	0	0	0	0	0	0	0
11:00	0	0	43	2	9	1	1	0	56	57.8	0	0	0	0	0	0	0	0	0	0
11:15	0	0	41	0	5	3	1	0	50	52.8	0	0	0	0	0	0	0	0	0	0
11:30	0	0	46	0	8	3	0	0	57	58.5	0	0	0	0	0	0	0	0	0	0
11:45	0	0	49	0	5	2	1	0	57	59.3	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	179	2	27	9	3	0	220	228.4	0	0	0	0	0	0	0	0	0	0
12:00	0	0	42	1	9	2	1	2	57	61.3	0	0	0	0	0	0	0	0	0	0
12:15	0	0	48	0	8	3	1	0	60	62.8	0	0	0	0	0	0	0	0	0	0
12:30	0	0	55	1	14	1	1	0	72	73.8	0	0	0	0	0	0	0	0	0	0
12:45	0	0	59	2	8	4	0	0	73	75	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	204	4	39	10	3	2	262	272.9	0	0	0	0	0	0	0	0	0	0
13:00	0	0	52	3	8	0	0	0	63	63	0	0	0	0	0	0	0	0	0	0
13:15	1	0	51	1	5	0	1	1	60	61.5	0	0	0	0	0	0	0	0	0	0
13:30	0	0	52	0	6	1	0	1	60	61.5	0	0	0	0	0	0	0	0	0	0
13:45	0	0	64	0	13	1	0	0	78	78.5	0	0	0	0	0	0	0	0	0	0
H/TOT	1	0	219	4	32	2	1	2	261	264.5	0	0	0	0	0	0	0	0	0	0
14:00	0	0	64	0	12	2	0	0	78	79	0	0	0	0	0	0	0	0	0	0
14:15	0	0	54	0	8	2	0	0	64	65	0	0	0	0	0	0	0	0	0	0
14:30	3	1	62	0	4	2	0	0	72	70	0	0	0	0	0	0	0	0	0	0
14:45	0	0	61	1	8	0	0	0	70	70	0	0	0	0	0	0	0	0	0	0
H/TOT	3	1	241	1	32	6	0	0	284	284	0	0	0	0	0	0	0	0	0	0
15:00	0	0	83	2	8	0	1	0	94	95.3	0	0	0	0	0	0	0	0	0	0
15:15	0	0	66	1	6	3	1	0	77	79.8	0	0	0	0	0	0	0	0	0	0
15:30	0	0	59	1	11	6	0	0	77	80	0	0	0	0	0	0	0	0	0	0
15:45	0	0	67	0	10	3	3	0	83	88.4	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	275	4	35	12	5	0	331	343.5	0	0	0	0	0	0	0	0	0	0
16:00	0	1	97	0	8	2	0	1	109	110.4	0	0	0	0	0	0	0	0	0	0
16:15	0	0	76	1	9	2	0	0	88	89	0	0	0	0	0	0	0	0	0	0
16:30	0	0	73	2	12	0	0	0	87	87	0	0	0	0	0	0	0	0	0	0
16:45	0	0	90	2	15	0	1	0	108	109.3	0	0	0	0	0	0	0	0	0	0
H/TOT	0	1	336	5	44	4	1	1	392	395.7	0	0	0	0	0	0	0	0	0	0
17:00	0	0	104	1	17	3	1	0	126	128.8	0	0	0	0	0	0	0	0	0	0
17:15	0	0	106	0	7	1	0	0	114	114.5	0	0	0	0	0	0	0	0	0	0
17:30	0	0	120	0	6	0	0	0	126	126	0	0	0	0	0	0	0	0	0	0
17:45	0	0	110	1	12	0	0	0	123	123	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	440	2	42	4	1	0	489	492.3	0	0	0	0	0	0	0	0	0	0
18:00	0	0	100	0	6	0	0	0	106	106	0	0	0	0	0	0	0	0	0	0
18:15	0	1	78	2	6	0	0	0	87	86.4	0	0	0	0	0	0	0	0	0	0
18:30	0	0	68	2	2	0	0	0	72	72	0	0	0	0	0	0	0	0	0	0
18:45	1	0	72	0	5	0	0	0	78	77.2	0	0	0	0	0	0	0	0	0	0

H/TOT	1	1	318	4	19	0	0	0	343	341.6	0	0	0	0	0	0	0	0	0	0
12 TOT	6	7	3213	38	389	85	20	7	3765	3831.5	0	0	0	0	0	0	0	0	0	0

	C => C										C => D									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	1	0	0	0	0	0	1	1	0	0	2	0	0	0	0	0	2	2
07:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	2
07:30	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0	6	6
07:45	0	0	0	0	0	0	0	0	0	0	0	0	2	0	4	0	1	0	7	8.3
H/TOT	0	0	1	0	0	0	0	0	1	1	0	0	10	0	6	0	1	0	17	18.3
08:00	0	0	0	0	0	0	0	0	0	0	0	0	5	1	2	1	0	0	9	9.5
08:15	0	0	0	0	0	0	0	0	0	0	1	0	7	0	1	0	0	0	9	8.2
08:30	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	1	0	0	5	5.5
08:45	0	0	0	0	0	0	0	0	0	0	1	0	5	0	0	1	0	0	7	6.7
H/TOT	0	0	0	0	0	0	0	0	0	0	2	0	20	2	3	3	0	0	30	29.9
09:00	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0	6	6
09:15	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	6	6
09:30	0	0	0	0	0	0	0	0	0	0	0	0	4	1	4	0	0	0	9	9
09:45	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	1	10	11
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	24	1	5	0	0	1	31	32
10:00	0	0	0	0	0	0	0	0	0	0	0	0	5	0	4	0	0	0	9	9
10:15	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	1	0	6	7.3
10:30	0	0	0	0	0	0	0	0	0	0	0	0	10	0	2	1	0	1	14	15.5
10:45	0	0	0	0	0	0	0	0	0	0	0	0	5	0	2	0	0	0	7	7
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	24	1	8	1	1	1	36	38.8
11:00	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	2	0	0	5	6
11:15	0	0	0	0	0	0	0	0	0	0	0	0	6	0	3	1	0	0	10	10.5
11:30	0	0	0	0	0	0	0	0	0	0	0	0	3	1	1	1	0	0	6	6.5
11:45	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	1	0	10	11.3
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	20	1	5	4	1	0	31	34.3
12:00	0	0	0	0	0	0	0	0	0	0	0	0	7	0	1	0	0	0	8	8
12:15	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3	3
12:30	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	1	1	0	12	13.8
12:45	0	0	0	0	0	0	0	0	0	0	0	0	10	0	3	0	0	0	13	13
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	30	0	4	1	1	0	36	37.8
13:00	0	0	1	0	0	0	0	0	1	1	0	0	2	0	4	0	0	1	7	8
13:15	0	0	0	0	0	0	0	1	1	2	0	0	6	0	2	1	0	0	9	9.5
13:30	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	6	6
13:45	0	0	0	0	0	0	0	0	0	0	0	0	9	0	1	1	0	0	11	11.5
H/TOT	0	0	1	0	0	0	0	1	2	3	0	0	23	0	7	2	0	1	33	35
14:00	0	0	0	0	0	0	0	0	0	0	0	0	6	2	1	0	0	0	9	9
14:15	0	0	0	0	0	0	0	0	0	0	0	0	10	0	2	1	0	0	13	13.5
14:30	0	0	0	0	0	0	0	0	0	0	0	1	11	0	2	0	0	0	14	13.4
14:45	0	0	0	0	0	0	0	0	0	0	0	0	8	0	3	0	1	0	12	13.3
H/TOT	0	0	0	0	0	0	0	0	0	0	0	1	35	2	8	1	1	0	48	49.2
15:00	0	0	0	0	0	0	0	0	0	0	0	0	3	1	1	1	0	0	6	6.5
15:15	0	0	1	0	0	0	0	0	1	1	1	0	6	1	1	0	1	0	10	10.5
15:30	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	1	0	0	5	5.5
15:45	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0	6	6
H/TOT	0	0	1	0	0	0	0	0	1	1	1	0	17	3	3	2	1	0	27	28.5
16:00	0	0	0	0	0	0	0	0	0	0	0	0	4	1	2	2	0	1	10	12
16:15	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0	6	6
16:30	0	0	0	0	0	0	0	0	0	0	0	0	3	1	1	0	0	0	5	5
16:45	0	0	0	0	0	0	0	0	0	0	0	0	8	0	1	0	0	0	9	9
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	20	2	5	2	0	1	30	32
17:00	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3	3
17:15	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	4	4
17:30	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	1	0	0	5	5.5
17:45	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	4	4
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	1	0	0	16	16.5
18:00	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	4	4
18:15	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2
18:30	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1

18:45	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	3	3
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	7	0	3	0	0	0	10	10
12 TOT	0	0	3	0	0	0	0	1	4	5	3	1	245	12	57	17	6	4	345	362.3

	C => E										C => F									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	1	0	0	0	1	1	0	0	14	1	0	1	0	0	16	16.5
07:15	0	0	5	0	0	1	0	0	6	6.5	0	0	19	0	1	1	0	0	21	21.5
07:30	0	0	5	0	1	0	0	0	6	6	0	0	29	0	2	0	0	0	31	31
07:45	0	0	7	0	1	0	0	0	8	8	0	0	30	0	3	0	0	0	33	33
H/TOT	0	0	17	0	3	1	0	0	21	21.5	0	0	92	1	6	2	0	0	101	102
08:00	0	0	2	0	0	0	0	0	2	2	0	0	48	0	3	1	0	0	52	52.5
08:15	0	0	1	0	0	0	0	0	1	1	0	0	32	0	2	0	0	0	34	34
08:30	0	0	0	0	0	0	0	0	0	0	0	0	26	0	2	0	0	0	28	28
08:45	0	0	1	0	0	0	0	0	1	1	0	0	17	0	2	0	0	0	19	19
H/TOT	0	0	4	0	0	0	0	0	4	4	0	0	123	0	9	1	0	0	133	133.5
09:00	0	0	0	0	1	0	0	0	1	1	0	0	18	0	2	0	0	0	20	20
09:15	0	0	1	0	0	0	0	0	1	1	0	0	9	0	2	0	0	0	11	11
09:30	0	0	0	0	1	0	0	0	1	1	0	0	11	1	2	2	0	0	16	17
09:45	0	0	1	0	0	0	0	0	1	1	0	0	18	0	1	1	0	0	20	20.5
H/TOT	0	0	2	0	2	0	0	0	4	4	0	0	56	1	7	3	0	0	67	68.5
10:00	0	0	1	0	1	0	0	0	2	2	0	0	7	0	2	0	0	0	9	9
10:15	0	0	0	0	0	0	0	0	0	0	0	0	16	0	2	0	0	1	19	20
10:30	0	0	0	0	0	1	1	0	2	3.8	0	0	16	1	3	2	0	0	22	23
10:45	0	0	0	0	0	0	0	0	0	0	0	0	14	0	3	0	0	0	17	17
H/TOT	0	0	1	0	1	1	1	0	4	5.8	0	0	53	1	10	2	0	1	67	69
11:00	0	0	0	0	0	0	0	0	0	0	0	0	17	1	2	0	0	0	20	20
11:15	0	0	1	0	0	0	0	0	1	1	0	0	9	0	1	0	1	0	11	12.3
11:30	0	0	0	0	1	0	0	0	1	1	0	0	13	1	1	1	0	0	16	16.5
11:45	0	0	0	0	1	0	0	0	1	1	0	0	17	1	4	0	1	0	23	24.3
H/TOT	0	0	1	0	2	0	0	0	3	3	0	0	56	3	8	1	2	0	70	73.1
12:00	0	0	0	0	0	0	0	0	0	0	0	0	11	1	1	1	0	0	14	14.5
12:15	0	0	0	0	0	1	0	0	1	1.5	0	0	18	0	4	2	0	0	24	25
12:30	0	0	0	0	0	0	0	0	0	0	0	0	26	0	0	1	0	0	27	27.5
12:45	0	0	1	0	0	0	0	0	1	1	0	0	18	1	1	0	0	0	20	20
H/TOT	0	0	1	0	0	1	0	0	2	2.5	0	0	73	2	6	4	0	0	85	87
13:00	0	0	1	0	0	2	0	0	3	4	0	0	22	0	3	1	0	0	26	26.5
13:15	0	0	0	0	0	0	0	0	0	0	0	0	37	0	1	0	0	0	38	38
13:30	0	0	0	0	1	0	0	0	1	1	0	0	22	0	3	0	1	0	26	27.3
13:45	0	0	0	0	0	0	0	0	0	0	0	0	24	0	0	0	0	0	24	24
H/TOT	0	0	1	0	1	2	0	0	4	5	0	0	105	0	7	1	1	0	114	115.8
14:00	0	0	1	0	0	0	0	0	1	1	0	0	21	0	1	1	0	0	23	23.5
14:15	0	0	2	0	0	0	0	0	2	2	0	0	21	0	1	1	0	0	23	23.5
14:30	0	0	1	0	1	0	0	0	2	2	0	0	40	0	1	0	0	0	41	41
14:45	0	0	0	0	0	0	0	0	0	0	0	0	28	0	2	0	0	0	30	30
H/TOT	0	0	4	0	1	0	0	0	5	5	0	0	110	0	5	2	0	0	117	118
15:00	0	0	0	0	0	0	0	0	0	0	0	0	26	0	1	0	0	0	27	27
15:15	0	0	1	0	0	0	0	0	1	1	0	0	27	1	2	2	0	0	32	33
15:30	0	0	1	0	0	0	0	0	1	1	0	0	32	0	1	0	0	0	33	33
15:45	0	0	0	0	0	0	0	0	0	0	0	0	37	0	6	1	1	0	45	46.8
H/TOT	0	0	2	0	0	0	0	0	2	2	0	0	122	1	10	3	1	0	137	139.8
16:00	0	0	0	0	0	0	0	0	0	0	0	0	43	1	4	0	0	0	48	48
16:15	0	0	0	0	0	0	0	0	0	0	0	0	40	0	3	1	0	0	44	44.5
16:30	0	0	0	0	0	0	0	0	0	0	0	0	51	2	3	0	0	0	56	56
16:45	0	0	0	0	0	0	0	0	0	0	0	0	62	0	3	1	0	0	66	66.5
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	196	3	13	2	0	0	214	215
17:00	0	0	0	0	0	0	0	0	0	0	0	0	36	1	3	1	0	0	41	41.5
17:15	0	0	0	0	0	0	0	0	0	0	0	0	44	0	5	0	0	0	49	49
17:30	0	0	0	0	0	0	0	0	0	0	0	0	42	0	2	1	0	0	45	45.5
17:45	0	0	0	0	0	0	0	0	0	0	0	0	37	0	1	0	0	0	38	38
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	159	1	11	2	0	0	173	174
18:00	0	0	0	0	0	0	0	0	0	0	0	0	34	0	2	0	0	0	36	36
18:15	0	0	0	0	0	0	0	0	0	0	0	0	26	0	0	0	0	0	26	26
18:30	0	0	1	0	0	0	0	0	1	1	0	0	24	0	1	1	0	0	26	26.5

18:45	0	0	0	0	0	0	0	0	0	0	0	0	23	0	0	0	0	0	23	23
H/TOT	0	0	1	0	0	0	0	0	1	1	0	0	107	0	3	1	0	0	111	111.5
12 TOT	0	0	34	0	10	5	1	0	50	53.8	0	0	1252	13	95	24	4	1	1389	1407.2

	D => A										D => B									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	60	0	18	2	7	0	87	97.1	0	0	0	0	0	0	0	0	0	0
07:15	0	0	90	0	12	7	6	3	118	132.3	0	0	0	0	0	0	0	0	0	0
07:30	0	1	107	0	15	2	4	1	130	136.6	0	0	0	0	0	0	0	0	0	0
07:45	0	0	131	1	19	2	5	2	160	169.5	0	0	0	0	0	0	0	0	0	0
H/TOT	0	1	388	1	64	13	22	6	495	535.5	0	0	0	0	0	0	0	0	0	0
08:00	0	1	147	0	13	1	9	1	172	184.6	0	0	0	0	0	0	0	0	0	0
08:15	0	0	90	1	12	1	2	1	107	111.1	0	0	0	0	0	0	0	0	0	0
08:30	0	1	94	1	11	2	11	0	120	134.7	0	0	0	0	0	0	0	0	0	0
08:45	0	1	122	0	12	5	1	2	143	148.2	0	0	0	0	0	0	0	0	0	0
H/TOT	0	3	453	2	48	9	23	4	542	578.6	0	0	0	0	0	0	0	0	0	0
09:00	0	0	102	0	13	4	10	1	130	146	0	0	0	0	0	0	0	0	0	0
09:15	0	0	108	3	12	4	7	0	134	145.1	0	0	0	0	0	0	0	0	0	0
09:30	0	0	67	0	19	4	8	0	98	110.4	0	0	0	0	0	0	0	0	0	0
09:45	0	0	75	1	6	5	3	2	92	100.4	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	352	4	50	17	28	3	454	501.9	0	0	0	0	0	0	0	0	0	0
10:00	0	0	68	0	12	3	13	0	96	114.4	0	0	0	0	0	0	0	0	0	0
10:15	0	0	64	0	9	7	4	0	84	92.7	0	0	0	0	0	0	0	0	0	0
10:30	0	0	68	0	11	1	11	1	92	107.8	0	0	0	0	0	0	0	0	0	0
10:45	0	0	79	0	10	7	5	0	101	111	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	279	0	42	18	33	1	373	425.9	0	0	0	0	0	0	0	0	0	0
11:00	0	0	44	0	15	2	4	0	65	71.2	0	0	0	0	0	0	0	0	0	0
11:15	0	0	75	1	11	2	7	0	96	106.1	0	0	0	0	0	0	0	0	0	0
11:30	1	0	44	2	10	3	11	1	72	88	0	0	0	0	0	0	0	0	0	0
11:45	0	0	51	0	12	1	5	0	69	76	0	0	0	0	0	0	0	0	0	0
H/TOT	1	0	214	3	48	8	27	1	302	341.3	0	0	0	0	0	0	0	0	0	0
12:00	0	0	47	0	15	1	6	0	69	77.3	0	0	0	0	0	0	0	0	0	0
12:15	0	0	49	1	8	4	6	0	68	77.8	0	0	0	0	0	0	0	0	0	0
12:30	0	0	55	0	11	6	9	0	81	95.7	0	0	0	0	0	0	0	0	0	0
12:45	0	0	51	0	11	2	7	0	71	81.1	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	202	1	45	13	28	0	289	331.9	0	0	0	0	0	0	0	0	0	0
13:00	0	1	51	0	10	6	9	1	78	93.1	0	0	0	0	0	0	0	0	0	0
13:15	0	0	58	1	11	2	2	0	74	77.6	0	0	0	0	0	0	0	0	0	0
13:30	0	0	55	2	10	3	5	0	75	83	0	0	0	0	0	0	0	0	0	0
13:45	0	1	43	2	12	9	7	1	75	89	0	0	0	0	0	0	0	0	0	0
H/TOT	0	2	207	5	43	20	23	2	302	342.7	0	0	0	0	0	0	0	0	0	0
14:00	0	0	59	0	12	4	2	1	78	83.6	0	0	0	0	0	0	0	0	0	0
14:15	0	0	59	1	7	3	2	1	73	78.1	0	0	0	0	0	0	0	0	0	0
14:30	0	0	59	4	14	1	4	1	83	89.7	0	0	0	0	0	0	0	0	0	0
14:45	0	0	56	0	10	3	3	2	74	81.4	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	233	5	43	11	11	5	308	332.8	0	0	0	0	0	0	0	0	0	0
15:00	0	0	55	1	15	4	5	1	81	90.5	0	0	0	0	0	0	0	0	0	0
15:15	1	0	67	1	5	6	14	0	94	114.4	0	0	0	0	0	0	0	0	0	0
15:30	0	0	67	2	13	0	5	0	87	93.5	0	0	0	0	0	0	0	0	0	0
15:45	1	0	57	1	13	5	4	0	81	87.9	0	0	0	0	0	0	0	0	0	0
H/TOT	2	0	246	5	46	15	28	1	343	386.3	0	0	0	0	0	0	0	0	0	0
16:00	0	0	62	0	10	4	8	0	84	96.4	0	0	0	0	0	0	0	0	0	0
16:15	0	1	73	1	13	0	8	0	96	105.8	0	0	0	0	0	0	0	0	0	0
16:30	0	0	75	0	15	3	7	0	100	110.6	0	0	0	0	0	0	0	0	0	0
16:45	0	0	58	1	21	1	4	0	85	90.7	0	0	0	0	0	0	0	0	0	0
H/TOT	0	1	268	2	59	8	27	0	365	403.5	0	0	0	0	0	0	0	0	0	0
17:00	0	0	58	0	18	3	4	0	83	89.7	0	0	0	0	0	0	0	0	0	0
17:15	0	0	80	0	20	4	7	0	111	122.1	0	0	0	0	0	0	0	0	0	0
17:30	0	0	60	0	14	2	4	0	80	86.2	0	0	0	0	0	0	0	0	0	0
17:45	0	0	57	0	9	3	2	0	71	75.1	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	255	0	61	12	17	0	345	373.1	0	0	0	0	0	0	0	0	0	0
18:00	0	0	53	1	10	3	3	0	70	75.4	0	0	0	0	0	0	0	0	0	0
18:15	0	1	71	0	7	2	2	1	84	88	0	0	0	0	0	0	0	0	0	0
18:30	0	0	50	0	12	3	1	0	66	68.8	0	0	0	0	0	0	0	0	0	0

18:45	0	0	69	0	3	1	1	0	74	75.8	0	0	0	0	0	0	0	0	0	0
H/TOT	0	1	243	1	32	9	7	1	294	308	0	0	0	0	0	0	0	0	0	0
12 TOT	3	8	3340	29	581	153	274	24	4412	4861.5	0	0	0	0	0	0	0	0	0	0

	D => C										D => D									
TIME	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU
07:00	0	0	2	1	0	0	0	0	3	3	0	0	0	0	0	0	3	0	3	6.9
07:15	0	0	4	0	0	0	0	0	4	4	0	0	0	0	0	0	3	0	3	6.9
07:30	0	0	3	0	1	0	0	0	4	4	0	0	0	0	0	0	3	0	3	6.9
07:45	0	0	2	0	1	2	1	0	6	8.3	0	0	0	0	0	0	3	0	3	6.9
H/TOT	0	0	11	1	2	2	1	0	17	19.3	0	0	0	0	0	0	12	0	12	27.6
08:00	0	0	3	0	1	0	1	0	5	6.3	0	0	0	0	0	0	3	0	3	6.9
08:15	0	0	2	1	0	0	0	0	3	3	0	0	0	0	0	0	3	0	3	6.9
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	6.9
08:45	0	0	3	1	1	1	0	0	6	6.5	0	0	0	0	0	0	3	0	3	6.9
H/TOT	0	0	8	2	2	1	1	0	14	15.8	0	0	0	0	0	0	12	0	12	27.6
09:00	0	0	2	0	0	0	0	0	2	2	0	0	0	0	0	0	3	0	3	6.9
09:15	0	0	7	0	2	0	0	0	9	9	0	0	0	0	0	0	3	0	3	6.9
09:30	0	0	2	1	0	0	0	0	3	3	0	0	0	0	0	0	3	0	3	6.9
09:45	0	0	3	0	0	0	0	0	3	3	0	0	0	0	0	0	3	0	3	6.9
H/TOT	0	0	14	1	2	0	0	0	17	17	0	0	0	0	0	0	12	0	12	27.6
10:00	0	0	1	0	1	2	0	0	4	5	0	0	0	0	0	0	3	0	3	6.9
10:15	0	0	4	0	3	0	1	0	8	9.3	0	0	0	0	0	0	3	0	3	6.9
10:30	0	0	6	0	1	0	1	1	9	11.3	0	0	0	0	0	0	3	0	3	6.9
10:45	0	0	10	0	0	0	0	0	10	10	0	0	0	0	0	0	3	0	3	6.9
H/TOT	0	0	21	0	5	2	2	1	31	35.6	0	0	0	0	0	0	12	0	12	27.6
11:00	0	0	5	0	4	1	1	1	12	14.8	0	0	1	0	0	0	4	0	5	10.2
11:15	0	0	4	0	3	0	0	0	7	7	0	0	0	0	0	0	3	0	3	6.9
11:30	0	0	2	0	1	0	0	0	3	3	0	0	0	0	0	0	3	0	3	6.9
11:45	0	0	6	1	1	0	0	0	8	8	0	0	0	0	0	0	3	0	3	6.9
H/TOT	0	0	17	1	9	1	1	1	30	32.8	0	0	1	0	0	0	13	0	14	30.9
12:00	0	0	4	0	1	0	1	0	6	7.3	0	0	1	0	0	0	3	0	4	7.9
12:15	0	0	4	1	1	0	0	0	6	6	0	0	0	0	0	1	4	0	5	10.7
12:30	0	0	5	0	2	0	0	0	7	7	0	0	0	0	0	0	3	0	3	6.9
12:45	0	0	5	0	0	0	1	0	6	7.3	0	0	0	0	0	0	3	0	3	6.9
H/TOT	0	0	18	1	4	0	2	0	25	27.6	0	0	1	0	0	1	13	0	15	32.4
13:00	0	0	2	0	1	2	0	0	5	6	0	0	0	0	0	0	3	0	3	6.9
13:15	0	0	2	0	0	0	0	0	2	2	0	0	0	0	0	0	3	0	3	6.9
13:30	0	0	6	0	2	0	0	0	8	8	0	0	0	0	0	0	3	0	3	6.9
13:45	0	0	2	0	3	0	0	0	5	5	0	0	0	0	0	0	3	0	3	6.9
H/TOT	0	0	12	0	6	2	0	0	20	21	0	0	0	0	0	0	12	0	12	27.6
14:00	0	0	9	0	0	0	0	0	9	9	0	0	0	0	0	0	3	0	3	6.9
14:15	0	0	9	0	3	0	0	0	12	12	0	0	0	0	0	0	3	0	3	6.9
14:30	0	0	2	0	3	2	0	0	7	8	0	0	0	0	0	0	3	0	3	6.9
14:45	0	0	9	2	1	0	0	0	12	12	0	0	0	0	0	0	4	0	4	9.2
H/TOT	0	0	29	2	7	2	0	0	40	41	0	0	0	0	0	0	13	0	13	29.9
15:00	0	0	3	1	0	0	0	0	4	4	0	0	0	0	0	0	3	0	3	6.9
15:15	0	0	4	1	0	1	1	0	7	8.8	0	0	0	0	0	0	3	0	3	6.9
15:30	0	0	5	0	1	0	0	0	6	6	0	0	0	0	0	0	3	0	3	6.9
15:45	0	0	3	0	0	0	0	0	3	3	0	0	0	0	0	0	3	0	3	6.9
H/TOT	0	0	15	2	1	1	1	0	20	21.8	0	0	0	0	0	0	12	0	12	27.6
16:00	0	0	2	0	0	0	0	0	2	2	0	0	0	0	0	0	3	0	3	6.9
16:15	0	0	6	0	0	0	0	0	6	6	0	0	0	0	0	0	3	0	3	6.9
16:30	0	0	6	0	0	1	0	0	7	7.5	0	0	0	0	0	0	3	0	3	6.9
16:45	0	0	4	0	1	0	1	0	6	7.3	0	0	0	0	0	0	3	0	3	6.9
H/TOT	0	0	18	0	1	1	1	0	21	22.8	0	0	0	0	0	0	12	0	12	27.6
17:00	0	1	4	2	0	0	0	0	7	6.4	0	0	0	0	0	0	3	0	3	6.9
17:15	1	0	2	0	0	0	0	0	3	2.2	0	0	0	0	0	0	3	0	3	6.9
17:30	0	0	5	1	2	0	0	0	8	8	0	0	0	0	0	0	3	0	3	6.9
17:45	0	0	10	1	0	0	0	0	11	11	0	0	0	0	0	0	3	0	3	6.9
H/TOT	1	1	21	4	2	0	0	0	29	27.6	0	0	0	0	0	0	12	0	12	27.6
18:00	0	0	2	0	0	0	0	0	2	2	0	0	0	0	0	0	3	0	3	6.9
18:15	1	0	3	0	2	0	0	0	6	5.2	0	0	0	0	0	0	3	0	3	6.9
18:30	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	3	0	3	6.9

18:45	0	0	1	0	0	1	0	0	2	2.5	0	0	0	0	0	0	4	0	4	9.2
H/TOT	1	0	7	0	2	1	0	0	11	10.7	0	0	0	0	0	0	13	0	13	29.9
12 TOT	2	1	191	14	43	13	9	2	275	293	0	0	2	0	0	1	148	0	151	343.9

	D => E										D => F									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	2	0	0	0	0	0	2	2	0	0	6	0	5	1	1	0	13	14.8
07:15	0	0	3	0	1	0	1	0	5	6.3	0	0	18	0	2	0	2	0	22	24.6
07:30	0	0	3	0	3	0	1	0	7	8.3	0	0	16	1	4	1	1	0	23	24.8
07:45	0	0	8	0	1	0	2	0	11	13.6	0	0	22	0	4	0	1	0	27	28.3
H/TOT	0	0	16	0	5	0	4	0	25	30.2	0	0	62	1	15	2	5	0	85	92.5
08:00	0	0	0	0	1	1	1	0	3	4.8	0	0	20	0	2	1	0	0	23	23.5
08:15	0	0	0	0	0	0	0	0	0	0	0	0	25	1	2	0	2	0	30	32.6
08:30	0	0	0	0	0	0	0	0	0	0	0	0	38	0	4	1	4	0	47	52.7
08:45	0	0	0	0	1	0	0	0	1	1	0	0	25	0	1	0	0	0	26	26
H/TOT	0	0	0	0	2	1	1	0	4	5.8	0	0	108	1	9	2	6	0	126	134.8
09:00	0	0	0	0	0	0	0	0	0	0	0	0	16	0	3	1	0	0	20	20.5
09:15	0	0	0	0	0	0	1	0	1	2.3	0	0	9	0	2	0	5	0	16	22.5
09:30	0	0	1	0	0	0	0	0	1	1	0	0	10	0	0	0	0	0	10	10
09:45	0	0	0	0	0	0	1	0	1	2.3	0	0	10	0	3	0	0	0	13	13
H/TOT	0	0	1	0	0	0	2	0	3	5.6	0	0	45	0	8	1	5	0	59	66
10:00	0	0	2	0	0	0	0	0	2	2	0	0	7	0	1	1	3	0	12	16.4
10:15	0	0	1	0	0	0	0	0	1	1	0	0	5	0	1	1	1	0	8	9.8
10:30	0	0	0	0	0	0	0	0	0	0	0	0	6	0	2	0	0	0	8	8
10:45	0	0	0	0	0	0	0	0	0	0	0	0	11	0	1	0	0	0	12	12
H/TOT	0	0	3	0	0	0	0	0	3	3	0	0	29	0	5	2	4	0	40	46.2
11:00	0	0	0	0	0	0	1	0	1	2.3	0	0	8	0	1	0	1	0	10	11.3
11:15	0	0	0	0	0	0	1	0	1	2.3	0	0	3	0	1	0	3	0	7	10.9
11:30	0	0	0	0	0	0	0	0	0	0	0	0	6	0	2	0	0	0	8	8
11:45	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	2	0	10	12.6
H/TOT	0	0	0	0	0	0	2	0	2	4.6	0	0	25	0	4	0	6	0	35	42.8
12:00	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	2	4	0	11	17.2
12:15	0	0	1	0	0	0	0	0	1	1	0	0	3	0	2	0	0	0	5	5
12:30	0	0	1	0	0	0	1	0	2	3.3	0	0	2	0	1	0	2	0	5	7.6
12:45	0	0	0	0	0	1	0	0	1	1.5	0	0	6	0	0	0	0	0	6	6
H/TOT	0	0	2	0	0	1	1	0	4	5.8	0	0	16	0	3	2	6	0	27	35.8
13:00	0	0	1	0	0	0	0	0	1	1	0	0	9	0	3	0	1	0	13	14.3
13:15	0	0	0	0	0	0	1	0	1	2.3	0	0	6	0	0	1	1	0	8	9.8
13:30	0	0	0	0	0	0	0	0	0	0	0	0	7	0	3	0	1	0	11	12.3
13:45	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4	0	8	13.2
H/TOT	0	0	1	0	0	0	1	0	2	3.3	0	0	26	0	6	1	7	0	40	49.6
14:00	0	0	0	0	0	0	0	0	0	0	0	0	11	0	1	0	3	0	15	18.9
14:15	0	0	0	0	0	1	0	0	1	1.5	0	0	7	0	0	0	1	0	8	9.3
14:30	0	0	0	0	0	0	1	0	1	2.3	0	0	10	0	4	0	3	0	17	20.9
14:45	0	0	0	0	0	0	2	0	2	4.6	0	1	11	0	2	0	3	0	17	20.3
H/TOT	0	0	0	0	0	1	3	0	4	8.4	0	1	39	0	7	0	10	0	57	69.4
15:00	0	0	0	0	0	0	1	0	1	2.3	0	0	14	0	1	1	2	0	18	21.1
15:15	0	0	0	0	0	0	1	0	1	2.3	0	0	10	1	1	1	2	0	15	18.1
15:30	0	0	0	0	0	0	1	0	1	2.3	0	0	10	0	1	1	0	0	12	12.5
15:45	0	0	0	0	2	0	3	0	5	8.9	0	0	10	0	3	0	3	0	16	19.9
H/TOT	0	0	0	0	2	0	6	0	8	15.8	0	0	44	1	6	3	7	0	61	71.6
16:00	0	0	0	0	0	0	1	0	1	2.3	0	0	11	0	4	0	1	0	16	17.3
16:15	0	0	0	0	0	0	0	0	0	0	0	0	23	0	1	1	1	0	26	27.8
16:30	0	0	0	0	0	0	1	0	1	2.3	0	0	15	0	3	0	0	0	18	18
16:45	0	0	0	0	1	0	0	0	1	1	0	0	17	0	3	0	0	0	20	20
H/TOT	0	0	0	0	1	0	2	0	3	5.6	0	0	66	0	11	1	2	0	80	83.1
17:00	0	0	0	0	0	0	0	0	0	0	0	0	21	0	4	0	1	0	26	27.3
17:15	0	0	0	0	0	0	0	0	0	0	0	0	33	0	5	1	1	0	40	41.8
17:30	0	0	0	0	0	0	0	0	0	0	0	0	19	0	1	0	1	0	21	22.3
17:45	0	0	1	0	0	0	0	0	1	1	0	0	21	0	1	0	0	0	22	22
H/TOT	0	0	1	0	0	0	0	0	1	1	0	0	94	0	11	1	3	0	109	113.4
18:00	0	0	0	0	0	0	0	0	0	0	0	0	15	0	1	0	0	0	16	16
18:15	0	0	1	0	0	0	0	0	1	1	0	0	5	0	2	0	0	0	7	7
18:30	0	0	0	0	0	1	0	0	1	1.5	0	0	4	0	0	0	0	0	4	4

18:45	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	1	0	0	5	5.5
H/TOT	0	0	1	0	0	1	0	0	2	2.5	0	0	28	0	3	1	0	0	32	32.5
12 TOT	0	0	25	0	10	4	22	0	61	91.6	0	1	582	3	88	16	61	0	751	837.7

	E => A										E => B									
TIME	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU
07:00	0	0	0	0	0	0	2	0	2	4.6	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	3	0	3	6.9	0	0	0	0	0	0	0	0	0	0
07:30	0	0	1	0	1	0	1	0	3	4.3	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	1	0	1	0	7	0	9	18.1	0	0	0	0	0	0	0	0	0	0
08:00	0	0	1	0	0	0	1	0	2	3.3	0	0	0	0	0	0	0	0	0	0
08:15	1	0	0	0	0	0	0	0	1	0.2	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	1	0	3	0	4	7.9	0	0	0	0	0	0	0	0	0	0
H/TOT	1	0	1	0	1	0	5	0	8	13.7	0	0	0	0	0	0	0	0	0	0
09:00	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	1	1	1	0	3	4.8	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	1	0	4	0	5	10.2	0	0	0	0	0	0	0	0	0	0
09:45	0	0	1	0	1	0	1	0	3	4.3	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	1	0	4	1	6	0	12	20.3	0	0	0	0	0	0	0	0	0	0
10:00	0	0	1	0	1	0	1	0	3	4.3	0	0	0	0	0	0	0	0	0	0
10:15	0	0	1	0	0	0	1	0	2	3.3	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	0	0	0	0	0
10:45	0	0	1	0	1	2	2	0	6	9.6	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	3	0	2	2	5	0	12	19.5	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	4	0	4	9.2	0	0	0	0	0	0	0	0	0	0
11:15	0	0	1	0	0	0	4	0	5	10.2	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	2	0	2	4.6	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	1	0	0	0	11	0	12	26.3	0	0	0	0	0	0	0	0	0	0
12:00	0	0	1	0	1	0	1	0	3	4.3	0	0	0	0	0	0	0	0	0	0
12:15	0	0	2	0	1	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0
12:30	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	4	0	2	0	2	0	8	10.6	0	0	0	0	0	0	0	0	0	0
13:00	0	0	2	0	0	0	1	0	3	4.3	0	0	0	0	0	0	0	0	0	0
13:15	0	0	2	0	0	0	1	0	3	4.3	0	0	0	0	0	0	0	0	0	0
13:30	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	5	1	0	0	2	0	8	10.6	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	4	0	4	9.2	0	0	0	0	0	0	0	0	0	0
14:30	0	0	2	0	1	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0
14:45	0	0	2	0	1	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	4	0	2	0	5	0	11	17.5	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	1	0	1	0	2	3.3	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0
15:45	0	0	2	0	1	0	1	0	4	5.3	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	2	0	2	0	2	2	8	12.6	0	0	0	0	0	0	0	0	0	0
16:00	0	0	5	0	2	0	1	0	8	9.3	0	0	0	0	0	0	0	0	0	0
16:15	0	0	4	0	2	0	2	0	8	10.6	0	0	0	0	0	0	0	0	0	0
16:30	0	0	12	0	3	0	3	0	18	21.9	0	0	0	0	0	0	0	0	0	0
16:45	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	22	0	7	0	6	0	35	42.8	0	0	0	0	0	0	0	0	0	0
17:00	0	0	2	0	2	0	1	0	5	6.3	0	0	0	0	0	0	0	0	0	0
17:15	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	2	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	5	0	2	0	1	0	8	9.3	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	2	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0

18:30	0	0	2	0	1	1	0	0	4	4.5	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	1	0	0	1	1.5	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	4	0	1	2	0	0	7	8	0	0	0	0	0	0	0	0	0	0
12 TOT	1	0	53	1	24	5	52	2	138	209.3	0	0	0	0	0	0	0	0	0	0

	E => C									E => D									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1.5
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	2.3
07:45	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	2	3.8
H/TOT	0	0	2	0	0	0	0	0	2	2	0	0	0	0	0	2	2	0	4	7.6
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
09:00	0	0	0	0	0	0	1	0	1	2.3	0	0	1	0	0	0	1	0	2	3.3
09:15	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	2	0	2	0	4	6.6	0	0	1	0	0	0	1	0	2	3.3
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
10:15	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	1	1
10:30	0	0	1	0	0	1	0	0	2	2.5	0	0	0	0	0	0	1	0	1	2.3
10:45	0	0	1	0	0	0	0	0	1	1	0	0	0	0	2	0	0	0	2	2
H/TOT	0	0	3	0	0	1	0	0	4	4.5	0	0	0	0	3	0	2	0	5	7.6
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
11:15	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	0	1	0	1	2.3
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
11:45	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	2.3
H/TOT	0	0	1	0	0	0	1	0	2	3.3	0	0	0	0	1	0	3	0	4	7.9
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
12:30	0	0	0	0	0	1	0	0	1	1.5	0	0	1	0	0	0	0	0	1	1
12:45	0	0	1	0	0	1	0	0	2	2.5	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	1	0	0	2	0	0	3	4	0	0	2	0	0	0	0	0	2	2
13:00	0	0	0	0	0	0	1	0	1	2.3	0	0	0	0	0	0	1	0	1	2.3
13:15	0	0	0	0	0	1	0	0	1	1.5	0	0	0	0	0	0	0	0	0	0
13:30	0	0	1	0	1	0	0	0	2	2	0	0	0	0	0	0	1	0	1	2.3
13:45	0	0	2	0	0	0	1	0	3	4.3	0	0	0	0	1	0	0	0	1	1
H/TOT	0	0	3	0	1	1	2	0	7	10.1	0	0	0	0	1	0	2	0	3	5.6
14:00	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	3	3.5
14:15	0	0	0	0	0	1	0	0	1	1.5	0	0	0	0	0	0	0	0	0	0
14:30	0	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	2	2
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	1	0	0	1	0	0	2	2.5	0	0	3	0	1	1	0	0	5	5.5
15:00	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	2
15:15	0	0	1	0	0	0	0	0	1	1	0	0	2	0	1	0	1	0	4	5.3
15:30	0	0	1	0	1	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	4.6
H/TOT	0	0	3	0	1	0	0	0	4	4	0	0	2	0	1	0	3	1	7	11.9
16:00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	3.3
16:15	0	0	1	0	0	0	0	0	1	1	0	0	2	0	2	0	0	0	4	4
16:30	0	0	2	0	1	0	0	0	3	3	0	0	2	0	3	0	0	0	5	5
16:45	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	2.3
H/TOT	0	0	4	0	1	0	0	0	5	5	0	0	5	0	5	0	2	0	12	14.6
17:00	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2
18:00	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	1	1
18:15	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
18:30	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0

18:45	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
H/TOT	0	0	3	0	0	0	0	0	3	3	0	0	2	0	0	0	0	0	2	2
12 TOT	0	0	21	0	5	5	5	0	36	45	0	0	17	0	12	3	16	1	49	72.3

	E => E										E => F									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	2
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	3.3
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2.3
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	4.6
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
16:45	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3	3
17:00	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3	3
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	3.3
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	1	0	5	6.3
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	3.3
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	3	4.3
12 TOT	0	0	0	0	0	0	0	0	0	0	0	0	12	0	2	0	7	1	22	32.1

	F => A										F => B									
TIME	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	F => C										F => D									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	F => E										F => F									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

IDASO

Survey Name: 049 20078 Raheen-Limerick
Site: Site 3
Location: R510 / Ard Aulin
Date: Tue 03-Mar-2020

	A => A										A => B									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0	0	1	60	2	6	2	0	0	71	71.4
07:15	0	0	0	0	0	0	0	0	0	0	1	0	107	0	12	3	1	1	125	128
07:30	0	0	0	0	0	0	0	0	0	0	0	2	153	1	16	3	1	0	176	177.6
07:45	0	0	1	0	0	0	0	0	1	1	0	1	169	0	15	1	1	0	187	188.2
H/TOT	0	0	1	0	0	0	0	0	1	1	1	4	489	3	49	9	3	1	559	565.2
08:00	0	0	1	0	0	0	0	0	1	1	0	0	130	1	19	5	1	1	157	161.8
08:15	0	0	0	0	0	0	0	0	0	0	1	0	125	0	13	3	1	0	143	145
08:30	0	0	0	0	0	0	0	0	0	0	0	0	89	0	14	5	0	0	108	110.5
08:45	0	0	2	0	0	1	0	0	3	3.5	1	0	67	0	8	3	1	0	80	82
H/TOT	0	0	3	0	0	1	0	0	4	4.5	2	0	411	1	54	16	3	1	488	499.3
09:00	0	0	0	0	0	0	0	0	0	0	0	0	106	0	8	2	1	1	118	121.3
09:15	0	0	0	0	0	0	0	0	0	0	0	0	112	0	18	3	1	1	135	138.8
09:30	0	0	0	0	0	0	0	0	0	0	0	0	86	0	12	6	2	0	106	111.6
09:45	0	0	1	0	0	0	0	0	1	1	0	0	87	1	17	0	2	0	107	109.6
H/TOT	0	0	1	0	0	0	0	0	1	1	0	0	391	1	55	11	6	2	466	481.3
10:00	0	0	1	0	0	0	0	0	1	1	0	0	60	1	12	2	1	0	76	78.3
10:15	0	0	0	0	0	0	0	0	0	0	0	0	84	1	9	5	0	0	99	101.5
10:30	0	0	0	0	0	0	0	0	0	0	0	0	88	1	13	4	2	1	109	114.6
10:45	0	0	0	0	0	0	0	0	0	0	0	0	82	1	11	1	1	0	96	97.8
H/TOT	0	0	1	0	0	0	0	0	1	1	0	0	314	4	45	12	4	1	380	392.2
11:00	0	0	0	0	0	0	0	0	0	0	0	0	78	1	11	6	1	1	98	103.3
11:15	0	0	2	0	0	0	1	0	3	4.3	0	0	85	0	13	2	1	1	102	105.3
11:30	0	0	0	0	0	0	0	0	0	0	0	0	59	0	10	3	0	1	73	75.5
11:45	0	0	0	0	0	0	0	0	0	0	0	0	86	0	15	3	0	0	104	105.5
H/TOT	0	0	2	0	0	0	1	0	3	4.3	0	0	308	1	49	14	2	3	377	389.6
12:00	0	0	0	0	0	0	0	0	0	0	0	0	86	1	6	2	3	0	98	102.9
12:15	0	0	0	0	0	0	0	0	0	0	0	0	77	2	13	4	2	0	98	102.6
12:30	0	0	0	0	0	0	0	0	0	0	0	0	85	1	11	5	1	0	103	106.8
12:45	0	0	0	0	0	0	0	0	0	0	0	0	98	3	11	3	1	0	116	118.8
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	346	7	41	14	7	0	415	431.1
13:00	0	0	0	0	0	0	0	0	0	0	0	0	102	3	12	3	2	2	124	130.1
13:15	0	0	0	0	0	0	0	0	0	0	0	0	101	1	11	2	0	1	116	118
13:30	0	0	0	0	0	0	0	0	0	0	0	0	89	1	11	4	2	0	107	111.6
13:45	0	0	0	0	0	0	0	0	0	0	0	0	107	1	11	3	3	0	125	130.4
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	399	6	45	12	7	3	472	490.1
14:00	0	0	0	0	0	0	0	0	0	0	0	0	108	0	16	4	1	0	129	132.3
14:15	0	0	0	0	0	0	0	0	0	0	1	0	109	2	13	2	1	0	128	129.5
14:30	0	0	0	0	0	0	0	0	0	0	1	0	75	1	8	6	2	0	93	97.8
14:45	0	0	0	0	0	0	0	0	0	0	0	0	113	0	19	7	1	0	140	144.8
H/TOT	0	0	0	0	0	0	0	0	0	0	2	0	405	3	56	19	5	0	490	504.4
15:00	0	0	0	0	0	0	0	0	0	0	0	0	107	1	16	3	1	0	128	130.8
15:15	0	0	0	0	0	0	0	0	0	0	0	0	104	0	8	5	2	0	119	124.1
15:30	0	0	1	0	0	0	0	0	1	1	0	0	110	0	10	5	1	0	126	129.8
15:45	0	0	0	0	1	0	0	0	1	1	0	0	98	0	10	3	1	0	112	114.8
H/TOT	0	0	1	0	1	0	0	0	2	2	0	0	419	1	44	16	5	0	485	499.5
16:00	0	0	0	0	0	0	0	0	0	0	4	0	102	0	11	2	0	0	119	116.8
16:15	0	0	1	0	0	0	0	0	1	1	0	0	120	2	13	1	0	0	136	136.5
16:30	0	0	0	0	0	0	0	0	0	0	0	0	116	0	9	2	0	0	127	128
16:45	0	0	0	0	0	0	0	0	0	0	0	0	123	1	12	2	1	0	139	141.3
H/TOT	0	0	1	0	0	0	0	0	1	1	4	0	461	3	45	7	1	0	521	522.6
17:00	0	0	0	0	0	0	0	0	0	0	0	1	131	1	10	0	0	0	143	142.4
17:15	0	0	1	0	1	1	0	0	3	3.5	1	0	127	0	16	3	0	0	147	147.7

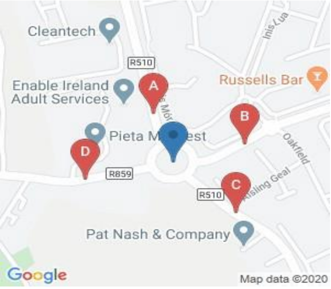
17:30	0	0	1	0	0	0	0	0	1	1	0	0	132	1	10	0	0	0	143	143
17:45	0	0	0	0	0	0	0	0	0	0	0	0	137	1	6	0	0	0	144	144
H/TOT	0	0	2	0	1	1	0	0	4	4.5	1	1	527	3	42	3	0	0	577	577.1
18:00	0	0	1	0	0	0	0	0	1	1	0	0	139	2	9	3	0	0	153	154.5
18:15	0	0	0	0	0	0	0	0	0	0	1	0	114	1	14	0	1	0	131	131.5
18:30	0	0	0	0	0	0	0	0	0	0	0	1	113	1	6	1	0	0	122	121.9
18:45	0	0	0	0	0	0	0	0	0	0	0	0	88	2	7	4	0	0	101	103
H/TOT	0	0	1	0	0	0	0	0	1	1	1	1	454	6	36	8	1	0	507	510.9
12 TOT	0	0	13	0	2	2	1	0	18	20.3	11	6	4924	39	561	141	44	11	5737	5863.3

	A => C										B => A									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	1	0	0	0	0	0	1	1	0	0	46	0	7	1	0	0	54	54.5
07:15	0	0	0	0	0	0	0	0	0	0	0	0	57	1	7	5	0	1	71	74.5
07:30	0	0	2	0	0	0	0	0	2	2	0	0	95	0	12	1	0	0	108	108.5
07:45	0	0	1	0	1	0	0	0	2	2	0	0	112	0	20	1	2	0	135	138.1
H/TOT	0	0	4	0	1	0	0	0	5	5	0	0	310	1	46	8	2	1	368	375.6
08:00	0	0	1	0	0	0	0	0	1	1	0	0	181	1	11	3	2	0	198	202.1
08:15	0	0	1	0	1	0	0	0	2	2	1	0	161	1	4	0	0	0	167	166.2
08:30	0	0	1	0	0	0	0	0	1	1	1	0	106	2	4	3	0	0	116	116.7
08:45	0	0	4	0	1	0	0	0	5	5	0	0	75	0	1	1	0	0	77	77.5
H/TOT	0	0	7	0	2	0	0	0	9	9	2	0	523	4	20	7	2	0	558	562.5
09:00	0	0	0	0	1	0	0	0	1	1	1	0	71	1	16	4	0	0	93	94.2
09:15	0	0	0	0	0	0	0	0	0	0	0	0	68	1	12	3	1	1	86	89.8
09:30	0	0	1	0	0	0	0	0	1	1	0	0	55	3	16	4	2	0	80	84.6
09:45	0	0	0	0	0	0	0	0	0	0	0	1	71	0	11	9	1	1	94	100.2
H/TOT	0	0	1	0	1	0	0	0	2	2	1	1	265	5	55	20	4	2	353	368.8
10:00	0	0	0	0	0	0	0	0	0	0	0	0	50	2	18	4	1	0	75	78.3
10:15	0	0	0	0	1	0	0	0	1	1	0	0	78	3	8	3	2	1	95	100.1
10:30	0	0	2	1	0	0	0	0	3	3	0	0	79	3	11	6	1	1	101	106.3
10:45	0	0	1	0	0	0	0	0	1	1	0	1	73	0	10	2	0	1	87	88.4
H/TOT	0	0	3	1	1	0	0	0	5	5	0	1	280	8	47	15	4	3	358	373.1
11:00	0	0	1	0	1	0	0	0	2	2	0	0	53	3	13	2	1	0	72	74.3
11:15	0	0	1	0	0	0	0	0	1	1	0	0	56	0	8	6	1	0	71	75.3
11:30	0	0	1	0	0	0	0	0	1	1	0	0	64	2	10	3	0	0	79	80.5
11:45	0	0	1	0	0	0	0	0	1	1	0	0	71	1	9	2	3	0	86	90.9
H/TOT	0	0	4	0	1	0	0	0	5	5	0	0	244	6	40	13	5	0	308	321
12:00	0	0	2	0	1	0	0	0	3	3	0	0	63	2	11	3	1	2	82	86.8
12:15	0	0	3	0	0	0	0	0	3	3	0	0	70	0	12	7	1	0	90	94.8
12:30	0	0	0	0	0	0	0	0	0	0	0	0	83	1	17	2	2	0	105	108.6
12:45	0	0	3	0	0	0	0	0	3	3	0	0	82	2	8	4	1	0	97	100.3
H/TOT	0	0	8	0	1	0	0	0	9	9	0	0	298	5	48	16	5	2	374	390.5
13:00	0	0	6	0	0	0	0	0	6	6	1	0	77	2	16	3	0	2	101	103.7
13:15	0	0	2	0	0	0	0	0	2	2	1	0	85	1	9	1	1	2	100	103
13:30	0	0	0	1	0	0	0	0	1	1	0	0	77	0	12	0	2	1	92	95.6
13:45	0	0	1	0	0	0	0	0	1	1	0	0	103	1	12	2	0	0	118	119
H/TOT	0	0	9	1	0	0	0	0	10	10	2	0	342	4	49	6	3	5	411	421.3
14:00	0	0	3	0	0	0	0	0	3	3	0	0	87	2	18	2	0	0	109	110
14:15	0	0	3	1	0	0	0	0	4	4	0	0	79	0	12	3	1	0	95	97.8
14:30	0	0	1	0	0	0	0	0	1	1	3	2	107	1	8	2	0	1	124	122.4
14:45	0	0	4	0	0	0	0	0	4	4	0	0	99	1	16	1	1	0	118	119.8
H/TOT	0	0	11	1	0	0	0	0	12	12	3	2	372	4	54	8	2	1	446	450
15:00	0	0	1	0	0	0	0	0	1	1	0	0	107	3	13	2	1	0	126	128.3
15:15	0	0	1	0	0	0	0	0	1	1	1	0	87	2	11	4	2	0	107	110.8
15:30	0	0	1	0	1	0	0	0	2	2	0	0	97	1	10	3	0	0	111	112.5
15:45	0	0	2	0	0	0	0	0	2	2	0	0	102	0	17	3	4	0	126	132.7
H/TOT	0	0	5	0	1	0	0	0	6	6	1	0	393	6	51	12	7	0	470	484.3
16:00	0	0	1	0	0	0	0	0	1	1	0	1	144	2	13	3	0	2	165	167.9
16:15	0	0	4	0	0	0	1	0	5	6.3	0	1	121	1	15	3	0	0	141	141.9
16:30	0	0	0	0	0	0	0	0	0	0	0	0	133	3	20	0	0	0	156	156
16:45	0	0	5	0	0	0	0	0	5	5	0	0	145	1	17	1	1	0	165	166.8
H/TOT	0	0	10	0	0	0	1	0	11	12.3	0	2	543	7	65	7	1	2	627	632.6
17:00	0	0	3	0	2	0	0	0	5	5	0	0	155	0	16	5	1	0	177	180.8
17:15	0	0	4	0	1	0	0	0	5	5	0	0	148	0	8	0	0	0	156	156
17:30	0	0	5	0	1	0	0	0	6	6	0	0	163	0	8	2	0	0	173	174
17:45	0	0	8	0	0	0	0	0	8	8	0	0	150	1	13	0	0	0	164	164
H/TOT	0	0	20	0	4	0	0	0	24	24	0	0	616	1	45	7	1	0	670	674.8
18:00	0	1	8	0	0	0	0	0	9	8.4	0	0	124	1	11	0	0	0	136	136
18:15	0	0	9	0	0	0	0	0	9	9	0	1	105	1	6	1	0	1	115	115.9
18:30	0	1	3	1	2	0	0	0	7	6.4	1	0	89	2	3	1	0	0	96	95.7
18:45	0	0	4	0	0	0	0	0	4	4	0	0	98	0	3	0	0	0	101	101
H/TOT	0	2	24	1	2	0	0	0	29	27.8	1	1	416	4	23	2	0	1	448	448.6
12 TOT	0	2	106	4	14	0	1	0	127	127.1	10	7	4602	55	543	121	36	17	5391	5503.1

	B => B										B => C									
TIME	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	1	1
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	1	1
08:00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
08:15	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	7	7
08:30	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	5	5
08:45	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	0	0	0	6	6
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	17	2	0	0	0	0	19	19
09:00	0	0	1	0	0	0	0	0	1	1	0	0	8	0	0	0	0	0	8	8
09:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	2
09:30	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2
09:45	0	0	0	0	0	0	0	0	0	0	0	0	3	1	1	0	0	0	5	5
H/TOT	0	0	1	0	0	0	0	0	1	1	0	0	14	1	2	0	0	0	17	17
10:00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	2
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	3	3
10:45	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	4	1	1	0	0	0	6	6
11:00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
11:15	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0	4	4.5
11:30	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2
11:45	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	2
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	7	0	1	1	0	0	9	9.5
12:00	0	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	4	3.2
12:15	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	4	4
12:30	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	6	6
12:45	0	0	0	0	0	0	0	0	0	0	0	0	4	0	1	0	0	0	5	5
H/TOT	0	0	0	0	0	0	0	0	0	0	1	0	15	1	2	0	0	0	19	18.2
13:00	0	0	1	0	0	0	0	0	1	1	0	0	4	0	0	0	0	0	4	4
13:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
13:30	0	0	0	0	0	0	0	0	0	0	0	0	4	0	2	0	0	0	6	6
13:45	0	0	0	0	0	1	0	0	1	1.5	0	0	7	0	0	0	0	0	7	7
H/TOT	0	0	1	0	0	1	0	0	2	2.5	0	0	16	0	2	0	0	0	18	18
14:00	0	0	0	0	1	0	0	0	1	1	0	0	3	0	0	0	0	0	3	3
14:15	0	0	1	0	0	0	0	0	1	1	0	0	4	0	0	0	0	0	4	4
14:30	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3	3
14:45	0	0	1	0	0	0	0	0	1	1	0	0	7	1	0	0	0	0	8	8
H/TOT	0	0	2	0	1	0	0	0	3	3	0	0	17	1	0	0	0	0	18	18
15:00	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	8	8
15:15	0	0	1	0	0	0	0	0	1	1	0	0	6	0	1	0	0	0	7	7
15:30	0	0	1	0	0	0	0	0	1	1	0	0	4	0	0	0	0	0	4	4
15:45	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0	4	4.5
H/TOT	0	0	2	0	0	0	0	0	2	2	0	0	21	0	1	1	0	0	23	23.5
16:00	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2
16:15	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	0	0	0	6	6
16:30	0	0	0	0	0	0	0	0	0	0	0	0	6	1	1	0	0	0	8	8
16:45	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	6	6
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	17	2	3	0	0	0	22	22
17:00	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	7	7
17:15	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	9	9
17:30	0	0	0	0	0	0	0	0	0	0	0	0	5	1	1	0	0	0	7	7
17:45	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	6	6
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	27	1	1	0	0	0	29	29
18:00	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	11	11
18:15	0	0	2	0	0	0	0	0	2	2	0	0	8	0	1	0	0	0	9	9
18:30	0	0	0	0	0	0	0	0	0	0	0	0	15	0	2	0	0	0	17	17
18:45	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	8	8
H/TOT	0	0	2	0	0	0	0	0	2	2	0	0	42	0	3	0	0	0	45	45
12 TOT	0	0	9	0	1	1	0	0	11	11.5	1	0	198	9	16	2	0	0	226	226.2

				C => A										C => B						
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	4	0	0	0	0	0	4	4	0	0	5	0	0	0	0	0	5	5
07:15	0	0	5	0	0	0	0	0	5	5	0	0	2	0	0	0	0	0	2	2
07:30	0	0	3	0	1	0	0	0	4	4	0	0	4	0	0	0	0	0	4	4
07:45	0	1	7	0	1	0	0	0	9	8.4	0	0	8	0	0	0	0	0	8	8
H/TOT	0	1	19	0	2	0	0	0	22	21.4	0	0	19	0	0	0	0	0	19	19
08:00	0	0	7	0	1	0	0	0	8	8	0	0	11	0	0	0	0	0	11	11
08:15	0	0	6	0	1	0	0	0	7	7	0	0	11	0	0	0	0	0	11	11
08:30	0	1	6	0	0	0	0	0	7	6.4	0	0	14	1	0	0	0	0	15	15
08:45	0	0	3	0	0	0	0	0	3	3	0	0	7	1	0	0	0	0	8	8
H/TOT	0	1	22	0	2	0	0	0	25	24.4	0	0	43	2	0	0	0	0	45	45
09:00	0	0	4	0	0	0	0	0	4	4	0	0	3	0	0	0	0	0	3	3
09:15	0	0	2	0	0	0	0	0	2	2	0	0	3	0	0	0	0	0	3	3
09:30	0	0	1	0	0	0	0	0	1	1	0	0	3	1	1	0	0	0	5	5
09:45	0	0	2	0	0	0	0	0	2	2	0	0	4	0	0	0	0	0	4	4
H/TOT	0	0	9	0	0	0	0	0	9	9	0	0	13	1	1	0	0	0	15	15
10:00	0	0	2	1	1	0	0	0	4	4	0	0	2	0	0	0	0	0	2	2
10:15	0	0	1	0	0	0	0	0	1	1	0	0	3	0	0	0	0	0	3	3
10:30	0	0	1	0	0	0	0	0	1	1	0	0	3	1	2	0	0	0	6	6
10:45	0	0	1	0	0	0	0	0	1	1	0	0	4	0	0	0	0	0	4	4
H/TOT	0	0	5	1	1	0	0	0	7	7	0	0	12	1	2	0	0	0	15	15
11:00	0	0	3	0	0	0	0	0	3	3	0	0	1	1	1	0	0	0	3	3
11:15	0	0	1	0	0	0	0	0	1	1	0	0	4	0	1	1	0	0	6	6.5
11:30	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
11:45	0	0	2	0	1	0	0	0	3	3	0	0	2	0	0	0	0	0	2	2
H/TOT	0	0	6	0	1	0	0	0	7	7	0	0	8	1	2	1	0	0	12	12.5
12:00	0	0	3	0	0	0	0	0	3	3	0	0	5	0	0	0	0	0	5	5
12:15	0	0	3	0	0	0	0	0	3	3	0	0	2	0	0	0	0	0	2	2
12:30	0	0	4	0	1	0	0	0	5	5	0	0	2	0	1	0	0	0	3	3
12:45	0	0	2	1	0	0	0	0	3	3	0	0	2	0	0	0	0	0	2	2
H/TOT	0	0	12	1	1	0	0	0	14	14	0	0	11	0	1	0	0	0	12	12
13:00	0	0	4	0	0	0	0	0	4	4	0	0	1	0	0	0	0	0	1	1
13:15	0	0	1	0	0	0	0	0	1	1	0	0	3	0	0	0	0	0	3	3
13:30	0	0	3	0	0	0	0	0	3	3	0	0	7	0	0	0	0	0	7	7
13:45	0	0	1	0	0	0	0	0	1	1	0	0	5	0	1	0	0	0	6	6
H/TOT	0	0	9	0	0	0	0	0	9	9	0	0	16	0	1	0	0	0	17	17
14:00	0	0	2	0	1	0	0	0	3	3	0	0	4	0	0	0	0	0	4	4
14:15	0	0	3	0	0	0	0	0	3	3	0	0	5	1	0	0	0	0	6	6
14:30	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	1	1
14:45	0	0	3	0	0	0	0	0	3	3	0	0	2	0	0	0	0	0	2	2
H/TOT	0	0	9	0	1	0	0	0	10	10	0	0	12	1	0	0	0	0	13	13
15:00	0	0	2	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
15:15	0	0	2	0	0	0	0	0	2	2	0	0	1	0	0	0	0	0	1	1
15:30	0	0	3	1	0	0	0	0	4	4	0	0	3	0	0	0	0	0	3	3
15:45	0	0	3	0	0	0	0	0	3	3	0	0	4	1	2	0	0	0	7	7
H/TOT	0	0	10	1	0	0	0	0	11	11	0	0	8	1	2	0	0	0	11	11
16:00	0	0	1	0	1	0	0	0	2	2	0	0	2	0	0	0	0	0	2	2
16:15	0	0	2	0	0	0	0	0	2	2	0	0	5	0	0	0	0	0	5	5
16:30	0	0	1	2	1	0	0	0	4	4	0	0	4	0	0	0	0	0	4	4
16:45	0	0	3	1	0	0	0	0	4	4	0	0	5	0	0	0	0	0	5	5
H/TOT	0	0	7	3	2	0	0	0	12	12	0	0	16	0	0	0	0	0	16	16
17:00	0	0	2	0	1	0	0	0	3	3	0	0	3	0	0	0	0	0	3	3
17:15	0	0	1	0	2	0	0	0	3	3	0	0	8	0	0	0	0	0	8	8
17:30	0	0	4	0	0	0	0	0	4	4	0	0	2	0	1	0	0	0	3	3
17:45	0	0	2	0	0	0	0	0	2	2	0	0	7	1	1	0	0	0	9	9
H/TOT	0	0	9	0	3	0	0	0	12	12	0	0	20	1	2	0	0	0	23	23
18:00	0	0	4	0	1	0	0	0	5	5	0	0	1	0	1	0	0	0	2	2
18:15	0	0	2	0	0	0	0	0	2	2	0	0	8	0	0	0	0	0	8	8
18:30	0	0	4	0	0	0	0	0	4	4	0	0	5	0	0	0	0	0	5	5
18:45	0	0	5	0	1	0	0	0	6	6	0	0	9	0	0	0	0	0	9	9
H/TOT	0	0	15	0	2	0	0	0	17	17	0	0	23	0	1	0	0	0	24	24
12 TOT	0	2	132	6	15	0	0	0	155	153.8	0	0	201	8	12	1	0	0	222	222.5

	C => C									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0
09:30	0	0	1	0	0	0	0	0	1	1
09:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	1	0	0	0	0	0	1	1
10:00	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0
12 TOT	0	0	1	0	0	0	0	0	1	1



IDASO

Survey Name: 049 20078 Raheen-Limerick
Site: Site 4
Location: R510 / Father Russell Rd / R859
Date: Tue 03-Mar-2020

	A => A										A => B									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0	0	0	12	0	1	0	0	0	13	13
07:15	0	0	0	0	0	0	0	0	0	0	0	0	14	0	2	0	0	0	16	16
07:30	0	0	0	0	0	0	0	0	0	0	0	0	18	0	4	0	0	0	22	22
07:45	0	0	0	0	0	0	0	0	0	0	0	0	26	0	4	0	0	0	30	30
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	70	0	11	0	0	0	81	81
08:00	0	0	0	0	0	1	0	0	1	1.5	0	0	21	0	3	0	0	0	24	24
08:15	0	0	0	0	0	0	0	0	0	0	1	0	23	1	3	0	0	0	28	27.2
08:30	0	0	0	0	0	0	0	0	0	0	0	0	15	0	3	1	0	0	19	19.5
08:45	0	0	0	0	0	0	0	0	0	0	0	0	22	0	3	0	0	0	25	25
H/TOT	0	0	0	0	0	1	0	0	1	1.5	1	0	81	1	12	1	0	0	96	95.7
09:00	0	0	0	0	0	0	0	0	0	0	0	0	26	0	3	2	0	0	31	32
09:15	0	0	0	0	0	0	0	0	0	0	0	0	25	0	1	0	0	0	26	26
09:30	0	0	0	0	0	0	0	0	0	0	0	0	19	1	1	1	0	0	22	22.5
09:45	0	0	0	0	0	0	0	0	0	0	0	0	20	0	4	0	0	0	24	24
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	90	1	9	3	0	0	103	104.5
10:00	0	0	0	0	0	0	0	0	0	0	0	0	17	1	2	0	0	0	20	20
10:15	0	0	0	0	0	0	0	0	0	0	0	0	32	1	3	0	0	0	36	36
10:30	0	0	0	0	0	0	0	0	0	0	0	0	25	1	4	0	0	0	30	30
10:45	0	0	0	0	0	0	0	0	0	0	0	0	16	1	4	0	0	0	21	21
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	90	4	13	0	0	0	107	107
11:00	0	0	0	0	0	0	0	0	0	0	0	0	23	2	0	0	0	0	25	25
11:15	0	0	0	0	0	0	0	0	0	0	0	0	25	0	1	1	0	0	27	27.5
11:30	0	0	0	0	0	0	0	0	0	0	0	0	16	0	2	0	0	0	18	18
11:45	0	0	0	0	0	0	0	0	0	0	0	0	21	1	2	0	0	0	24	24
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	85	3	5	1	0	0	94	94.5
12:00	0	0	0	0	0	0	0	0	0	0	0	0	27	0	1	0	0	0	28	28
12:15	0	0	0	0	0	0	0	0	0	0	0	0	30	2	3	0	0	0	35	35
12:30	0	0	0	0	0	0	0	0	0	0	0	0	30	0	4	0	0	0	34	34
12:45	0	0	0	0	0	0	0	0	0	0	0	0	29	2	3	1	0	0	35	35.5
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	116	4	11	1	0	0	132	132.5
13:00	0	0	0	0	0	0	0	0	0	0	0	0	32	0	1	0	0	0	33	33
13:15	0	0	0	0	0	0	0	0	0	0	0	0	29	0	2	0	0	0	31	31
13:30	0	0	0	0	0	0	0	0	0	0	0	0	29	0	2	1	0	0	32	32.5
13:45	0	0	0	0	0	0	0	0	0	0	0	0	25	0	4	0	0	0	29	29
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	115	0	9	1	0	0	125	125.5
14:00	0	0	0	0	0	0	0	0	0	0	0	0	31	0	3	2	1	0	37	39.3
14:15	0	0	0	0	0	0	0	0	0	0	0	0	32	0	3	0	0	0	35	35
14:30	0	0	0	0	0	0	0	0	0	0	0	0	30	0	3	1	0	0	34	34.5
14:45	0	0	0	0	0	0	0	0	0	0	0	0	38	2	1	1	0	0	42	42.5
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	131	2	10	4	1	0	148	151.3
15:00	0	0	0	0	0	0	0	0	0	0	0	0	29	2	2	0	0	0	33	33
15:15	0	0	0	0	0	0	0	0	0	0	0	0	28	0	1	0	0	0	29	29
15:30	0	0	0	0	0	0	0	0	0	0	0	0	31	0	5	0	0	0	36	36
15:45	0	0	0	0	0	0	0	0	0	0	0	0	25	0	3	2	0	0	30	31
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	113	2	11	2	0	0	128	129
16:00	0	0	0	0	0	0	0	0	0	0	0	0	28	1	4	0	0	0	33	33
16:15	0	0	0	0	0	0	0	0	0	0	0	0	35	1	3	0	0	0	39	39
16:30	0	0	0	0	0	0	0	0	0	0	0	0	26	0	4	0	0	0	30	30
16:45	0	0	0	0	0	0	0	0	0	0	0	0	47	0	1	0	0	0	48	48
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	136	2	12	0	0	0	150	150
17:00	0	0	0	0	0	0	0	0	0	0	0	0	47	0	4	0	0	0	51	51
17:15	0	0	0	0	0	0	0	0	0	0	1	0	54	0	6	0	0	0	61	60.2

17:30	0	0	0	0	0	0	0	0	0	0	0	0	44	1	7	0	0	0	52	52
17:45	0	0	0	0	0	0	0	0	0	0	0	0	48	1	2	0	0	0	51	51
H/TOT	0	0	0	0	0	0	0	0	0	0	1	0	193	2	19	0	0	0	215	214.2
18:00	0	0	0	0	0	0	0	0	0	0	0	0	43	1	3	0	0	0	47	47
18:15	0	0	0	0	0	0	0	0	0	0	0	0	41	1	4	0	0	0	46	46
18:30	0	0	0	0	0	0	0	0	0	0	0	0	33	0	4	1	0	0	38	38.5
18:45	0	0	0	0	0	0	0	0	0	0	0	0	39	0	4	1	0	0	44	44.5
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	156	2	15	2	0	0	175	176
12 TOT	0	0	0	0	0	1	0	0	1	1.5	2	0	1376	23	137	15	1	0	1554	1561.2

	A => C										A => D									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	1	51	0	6	2	1	0	61	62.7	0	0	0	0	0	0	0	0	0	0
07:15	1	0	89	0	7	3	0	1	101	102.7	0	0	3	0	3	0	0	0	6	6
07:30	0	2	126	1	4	2	2	0	137	139.4	0	0	7	0	6	1	1	0	15	16.8
07:45	0	0	147	0	11	2	0	0	160	161	0	1	8	0	0	0	0	0	9	8.4
H/TOT	1	3	413	1	28	9	3	1	459	465.8	0	1	18	0	9	1	1	0	30	31.2
08:00	1	0	106	0	11	4	1	0	123	125.5	0	0	12	1	4	0	0	1	18	19
08:15	2	0	88	0	13	3	1	0	107	108.2	0	0	20	0	0	0	0	0	20	20
08:30	1	0	66	2	4	3	0	0	76	76.7	0	0	11	0	2	1	0	0	14	14.5
08:45	0	0	47	0	8	1	1	0	57	58.8	0	0	7	1	0	0	0	0	8	8
H/TOT	4	0	307	2	36	11	3	0	363	369.2	0	0	50	2	6	1	0	1	60	61.5
09:00	0	0	81	4	8	1	0	1	95	96.5	0	0	10	0	1	1	0	0	12	12.5
09:15	0	0	84	0	12	3	2	1	102	107.1	0	0	5	1	3	0	0	0	9	9
09:30	0	0	64	0	12	3	2	0	81	85.1	0	0	8	0	2	1	0	0	11	11.5
09:45	0	0	58	2	13	1	2	0	76	79.1	0	0	8	0	1	0	0	0	9	9
H/TOT	0	0	287	6	45	8	6	2	354	367.8	0	0	31	1	7	2	0	0	41	42
10:00	0	0	45	1	3	2	0	0	51	52	0	0	2	0	5	0	0	0	7	7
10:15	0	0	48	1	7	5	0	0	61	63.5	0	0	5	0	1	1	0	0	7	7.5
10:30	0	0	63	1	12	4	2	1	83	88.6	0	0	1	0	0	0	0	0	1	1
10:45	0	0	69	0	2	0	1	0	72	73.3	0	0	3	0	2	1	0	0	6	6.5
H/TOT	0	0	225	3	24	11	3	1	267	277.4	0	0	11	0	8	2	0	0	21	22
11:00	0	0	50	1	9	4	1	1	66	70.3	0	0	8	0	0	1	0	0	9	9.5
11:15	0	0	56	2	10	1	1	1	71	73.8	0	0	7	0	1	2	0	0	10	11
11:30	0	0	38	1	9	2	0	1	51	53	0	0	4	0	0	0	0	0	4	4
11:45	0	0	54	2	12	4	0	0	72	74	0	0	8	0	1	0	0	1	10	11
H/TOT	0	0	198	6	40	11	2	3	260	271.1	0	0	27	0	2	3	0	1	33	35.5
12:00	0	0	51	0	7	2	3	0	63	67.9	0	0	8	0	0	0	0	0	8	8
12:15	0	0	44	1	12	3	2	0	62	66.1	0	0	7	1	1	0	0	0	9	9
12:30	0	0	49	1	7	3	1	0	61	63.8	0	0	8	1	1	2	0	0	12	13
12:45	0	0	62	2	6	3	1	0	74	76.8	0	0	4	0	2	0	0	0	6	6
H/TOT	0	0	206	4	32	11	7	0	260	274.6	0	0	27	2	4	2	0	0	35	36
13:00	0	0	68	1	8	3	1	0	81	83.8	0	0	4	0	2	0	0	3	9	12
13:15	0	0	72	0	9	2	1	1	85	88.3	0	0	10	0	0	0	0	0	10	10
13:30	0	0	60	2	8	3	2	0	75	79.1	0	0	3	0	0	0	0	0	3	3
13:45	0	0	78	2	9	2	1	0	92	94.3	0	0	10	0	0	1	0	0	11	11.5
H/TOT	0	0	278	5	34	10	5	1	333	345.5	0	0	27	0	2	1	0	3	33	36.5
14:00	0	0	79	0	11	3	2	0	95	99.1	0	0	4	0	1	0	0	0	5	5
14:15	1	0	75	2	8	0	1	0	87	87.5	0	0	6	1	1	1	0	0	9	9.5
14:30	0	0	42	1	5	6	2	0	56	61.6	0	0	6	0	1	0	0	0	7	7
14:45	0	0	70	1	17	5	1	0	94	97.8	2	0	8	0	1	1	0	0	12	10.9
H/TOT	1	0	266	4	41	14	6	0	332	346	2	0	24	1	4	2	0	0	33	32.4
15:00	0	0	68	0	14	2	2	0	86	89.6	0	0	4	0	0	0	0	0	4	4
15:15	0	0	75	0	5	4	1	0	85	88.3	0	0	9	0	0	0	0	0	9	9
15:30	0	0	75	0	5	6	2	0	88	93.6	1	0	9	0	1	0	0	0	11	10.2
15:45	0	0	62	2	6	1	1	0	72	73.8	0	0	12	0	1	0	0	0	13	13
H/TOT	0	0	280	2	30	13	6	0	331	345.3	1	0	34	0	2	0	0	0	37	36.2
16:00	3	0	62	0	11	2	0	0	78	76.6	0	0	6	0	0	0	0	0	6	6
16:15	1	0	78	0	10	1	0	0	90	89.7	0	0	10	1	1	0	0	0	12	12
16:30	0	0	85	0	7	2	0	0	94	95	0	0	9	0	1	0	0	0	10	10
16:45	0	0	71	1	11	1	1	0	85	86.8	0	0	9	0	0	1	0	0	10	10.5
H/TOT	4	0	296	1	39	6	1	0	347	348.1	0	0	34	1	2	1	0	0	38	38.5
17:00	0	1	82	1	6	0	0	0	90	89.4	0	0	2	0	0	0	0	0	2	2
17:15	0	0	83	1	8	3	0	0	95	96.5	0	0	4	0	0	0	0	0	4	4
17:30	0	0	89	0	6	0	0	0	95	95	0	0	2	0	0	0	0	0	2	2
17:45	0	0	86	1	2	0	0	0	89	89	0	0	10	0	2	0	0	0	12	12
H/TOT	0	1	340	3	22	3	0	0	369	369.9	0	0	18	0	2	0	0	0	20	20
18:00	0	0	88	1	5	3	0	0	97	98.5	0	0	9	0	0	0	0	1	10	11
18:15	1	0	79	0	8	0	1	0	89	89.5	0	0	12	0	0	0	0	0	12	12
18:30	0	0	72	1	2	0	0	0	75	75	0	1	6	0	0	0	0	0	7	6.4
18:45	0	0	59	0	3	3	0	0	65	66.5	0	0	5	1	0	0	0	0	6	6
H/TOT	1	0	298	2	18	6	1	0	326	329.5	0	1	32	1	0	0	0	1	35	35.4
12 TOT	11	4	3394	39	389	113	43	8	4001	4110.2	3	2	333	8	48	15	1	6	416	427.2

	B => A										B => B									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	17	0	1	0	0	0	18	18	0	0	0	0	0	0	0	0	0	0
07:15	0	0	18	0	1	1	0	0	20	20.5	0	0	0	0	0	0	0	0	0	0
07:30	0	0	20	0	3	0	0	0	23	23	0	0	0	0	0	0	0	0	0	0
07:45	0	0	39	0	8	0	0	0	47	47	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	94	0	13	1	0	0	108	108.5	0	0	0	0	0	0	0	0	0	0
08:00	0	0	45	1	5	0	0	0	51	51	0	0	0	0	0	0	0	0	0	0
08:15	0	0	46	0	0	0	0	0	46	46	0	0	0	0	0	0	0	0	0	0
08:30	0	0	21	1	1	0	0	0	23	23	0	0	0	0	0	0	0	0	0	0
08:45	0	0	18	0	0	0	0	0	18	18	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	130	2	6	0	0	0	138	138	0	0	0	0	0	0	0	0	0	0
09:00	0	0	29	0	2	0	0	0	31	31	0	0	0	0	0	0	0	0	0	0
09:15	0	0	21	0	2	1	0	0	24	24.5	0	0	0	0	0	0	0	0	0	0
09:30	0	0	14	1	4	1	0	0	20	20.5	0	0	0	0	0	0	0	0	0	0
09:45	0	0	19	1	5	2	0	0	27	28	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	83	2	13	4	0	0	102	104	0	0	0	0	0	0	0	0	0	0
10:00	0	0	14	1	5	0	0	0	20	20	0	0	0	0	0	0	0	0	0	0
10:15	0	0	22	0	0	1	0	0	23	23.5	0	0	0	0	0	0	0	0	0	0
10:30	0	0	29	2	2	0	0	0	33	33	0	0	0	0	0	0	0	0	0	0
10:45	0	1	26	0	3	0	0	0	30	29.4	0	0	0	0	0	0	0	0	0	0
H/TOT	0	1	91	3	10	1	0	0	106	105.9	0	0	0	0	0	0	0	0	0	0
11:00	0	0	20	2	1	1	0	0	24	24.5	0	0	0	0	0	0	0	0	0	0
11:15	0	0	24	0	2	2	0	0	28	29	0	0	0	0	0	0	0	0	0	0
11:30	0	0	25	1	0	0	0	0	26	26	0	0	0	0	0	0	0	0	0	0
11:45	0	0	25	2	2	1	0	0	30	30.5	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	94	5	5	4	0	0	108	110	0	0	0	0	0	0	0	0	0	0
12:00	0	0	10	0	4	0	0	0	14	14	0	0	0	0	0	0	0	0	0	0
12:15	0	0	24	0	2	1	0	0	27	27.5	0	0	0	0	0	0	0	0	0	0
12:30	0	0	36	0	3	0	0	0	39	39	0	0	0	0	0	0	0	0	0	0
12:45	0	0	26	0	2	0	0	0	28	28	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	96	0	11	1	0	0	108	108.5	0	0	0	0	0	0	0	0	0	0
13:00	0	0	22	0	6	0	0	0	28	28	0	0	0	0	0	0	0	0	0	0
13:15	0	0	20	0	1	0	0	0	21	21	0	0	0	0	0	0	0	0	0	0
13:30	0	0	25	0	7	0	0	0	32	32	0	0	0	0	0	0	0	0	0	0
13:45	0	0	25	1	2	0	0	0	28	28	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	92	1	16	0	0	0	109	109	0	0	0	0	0	0	0	0	0	0
14:00	0	0	23	1	7	1	0	0	32	32.5	0	0	1	0	0	0	0	0	1	1
14:15	0	0	23	0	2	0	0	0	25	25	0	0	1	0	0	0	0	0	1	1
14:30	0	1	43	0	2	1	0	1	48	48.9	0	0	0	0	0	0	0	0	0	0
14:45	0	0	32	0	3	0	0	0	35	35	0	0	0	0	0	0	0	0	0	0
H/TOT	0	1	121	1	14	2	0	1	140	141.4	0	0	2	0	0	0	0	0	2	2
15:00	0	0	27	0	2	0	0	0	29	29	0	0	1	0	0	0	0	0	1	1
15:15	0	0	27	1	3	1	1	0	33	34.8	0	0	0	0	0	0	0	0	0	0
15:30	0	0	24	1	2	0	0	0	27	27	0	0	0	0	0	0	0	0	0	0
15:45	0	0	26	0	4	1	0	0	31	31.5	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	104	2	11	2	1	0	120	122.3	0	0	1	0	0	0	0	0	1	1
16:00	0	0	20	0	3	1	0	0	24	24.5	0	0	0	0	0	0	0	0	0	0
16:15	0	0	30	0	5	1	0	0	36	36.5	0	0	0	0	0	0	0	0	0	0
16:30	0	0	33	2	5	0	0	0	40	40	0	0	0	0	0	0	0	0	0	0
16:45	0	0	35	0	3	1	0	0	39	39.5	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	118	2	16	3	0	0	139	140.5	0	0	0	0	0	0	0	0	0	0
17:00	0	0	37	0	3	0	0	0	40	40	0	0	0	0	0	0	0	0	0	0
17:15	0	0	36	0	1	0	0	0	37	37	0	0	0	0	0	0	0	0	0	0
17:30	0	0	44	1	2	0	0	0	47	47	0	0	0	0	0	0	0	0	0	0
17:45	0	0	45	0	1	0	0	0	46	46	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	162	1	7	0	0	0	170	170	0	0	0	0	0	0	0	0	0	0
18:00	0	0	24	0	1	0	0	0	25	25	0	0	0	0	0	0	0	0	0	0
18:15	0	0	34	0	0	0	0	0	34	34	0	0	0	0	0	0	0	0	0	0
18:30	0	0	32	0	2	0	0	0	34	34	0	0	0	0	0	0	0	0	0	0
18:45	0	0	25	0	0	0	0	0	25	25	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	115	0	3	0	0	0	118	118	0	0	0	0	0	0	0	0	0	0
12 TOT	0	2	1300	19	125	18	1	1	1466	1476.1	0	0	3	0	0	0	0	0	3	3

				B => C										B => D						
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	1	0	8	0	1	0	0	0	10	9.2	0	0	10	1	3	0	0	0	14	14
07:15	0	0	11	1	2	1	0	1	16	17.5	0	0	12	0	0	0	0	0	12	12
07:30	0	0	34	1	3	0	0	0	38	38	0	0	19	0	0	0	0	1	20	21
07:45	0	0	39	2	6	0	0	1	48	49	0	0	23	0	3	0	0	1	27	28
H/TOT	1	0	92	4	12	1	0	2	112	113.7	0	0	64	1	6	0	0	2	73	75
08:00	0	0	31	0	3	0	0	0	34	34	1	0	69	0	2	0	0	3	75	77.2
08:15	0	0	46	0	3	0	0	0	49	49	4	0	50	0	0	0	0	0	54	50.8
08:30	0	0	34	0	2	1	0	2	39	41.5	7	0	57	1	2	1	0	0	68	62.9
08:45	0	0	30	1	1	0	0	1	33	34	1	0	27	0	0	0	0	0	28	27.2
H/TOT	0	0	141	1	9	1	0	3	155	158.5	13	0	203	1	4	1	0	3	225	218.1
09:00	0	0	21	0	0	0	0	0	21	21	0	0	15	0	1	0	0	1	17	18
09:15	1	0	25	0	1	0	0	1	28	28.2	0	0	21	0	2	1	0	0	24	24.5
09:30	0	0	17	0	3	0	0	0	20	20	0	0	10	0	2	1	0	0	13	13.5
09:45	0	0	9	0	2	1	0	1	13	14.5	0	0	11	0	0	0	0	0	11	11
H/TOT	1	0	72	0	6	1	0	2	82	83.7	0	0	57	0	5	2	0	1	65	67
10:00	0	0	15	0	3	0	0	0	18	18	0	0	12	1	0	0	0	0	13	13
10:15	0	0	16	1	2	0	0	1	20	21	0	0	17	1	1	0	0	0	19	19
10:30	0	0	25	0	1	0	0	0	26	26	0	0	22	0	5	0	0	0	27	27
10:45	0	0	17	0	1	0	0	1	19	20	0	0	22	0	0	0	0	0	22	22
H/TOT	0	0	73	1	7	0	0	2	83	85	0	0	73	2	6	0	0	0	81	81
11:00	0	0	12	0	2	0	0	0	14	14	0	0	28	1	0	0	0	0	29	29
11:15	0	0	19	0	0	1	0	1	21	22.5	0	0	19	1	1	0	0	0	21	21
11:30	0	0	14	0	1	1	0	0	16	16.5	0	0	26	0	5	0	0	0	31	31
11:45	0	0	15	0	0	0	0	1	16	17	0	0	46	0	0	0	0	0	46	46
H/TOT	0	0	60	0	3	2	0	2	67	70	0	0	119	2	6	0	0	0	127	127
12:00	0	0	28	0	2	0	0	0	30	30	1	0	28	1	1	0	0	0	31	30.2
12:15	0	0	14	1	1	0	0	1	17	18	0	0	32	1	2	1	0	0	36	36.5
12:30	0	0	21	1	1	1	0	0	24	24.5	0	0	40	0	4	0	0	0	44	44
12:45	0	0	25	0	2	1	0	1	29	30.5	0	0	41	0	4	0	0	0	45	45
H/TOT	0	0	88	2	6	2	0	2	100	103	1	0	141	2	11	1	0	0	156	155.7
13:00	0	2	21	2	0	1	0	0	26	25.3	1	0	38	0	3	0	0	0	42	41.2
13:15	0	0	33	0	1	2	0	1	37	39	0	0	39	1	2	2	0	0	44	45
13:30	0	0	36	2	6	1	0	0	45	45.5	0	0	49	0	4	0	0	0	53	53
13:45	0	0	25	0	1	0	0	1	27	28	0	0	63	1	2	0	0	0	66	66
H/TOT	0	2	115	4	8	4	0	2	135	137.8	1	0	189	2	11	2	0	0	205	205.2
14:00	0	0	22	1	2	0	0	0	25	25	0	0	50	0	0	0	0	0	50	50
14:15	0	0	24	2	3	0	0	0	29	29	0	0	50	0	2	0	0	0	52	52
14:30	0	0	31	0	1	0	0	1	33	34	0	0	38	1	1	0	0	0	40	40
14:45	0	0	24	0	2	0	0	1	27	28	0	0	38	0	3	0	0	0	41	41
H/TOT	0	0	101	3	8	0	0	2	114	116	0	0	176	1	6	0	0	0	183	183
15:00	0	0	21	1	0	0	0	0	22	22	0	0	43	0	1	0	0	1	45	46
15:15	0	0	26	0	1	0	0	1	28	29	0	0	38	1	4	1	0	0	44	44.5
15:30	0	0	17	2	2	0	0	0	21	21	0	0	47	2	4	0	0	1	54	55
15:45	0	0	23	2	0	0	0	0	25	25	0	0	58	2	0	0	0	0	60	60
H/TOT	0	0	87	5	3	0	0	1	96	97	0	0	186	5	9	1	0	2	203	205.5
16:00	1	0	30	1	0	0	0	1	33	33.2	0	0	45	1	1	0	0	0	47	47
16:15	1	0	33	0	1	0	0	1	36	36.2	0	0	50	1	4	1	0	0	56	56.5
16:30	0	0	46	2	2	0	0	2	52	54	0	0	39	1	3	2	0	0	45	46
16:45	0	0	43	2	0	0	0	0	45	45	1	0	52	0	3	0	0	0	56	55.2
H/TOT	2	0	152	5	3	0	0	4	166	168.4	1	0	186	3	11	3	0	0	204	204.7
17:00	0	0	33	0	2	0	0	1	36	37	0	0	60	1	2	1	0	0	64	64.5
17:15	0	0	40	0	4	0	0	0	44	44	3	0	62	0	4	0	0	0	69	66.6
17:30	0	0	28	1	4	0	0	1	34	35	1	0	38	2	1	0	0	0	42	41.2
17:45	0	0	44	0	2	0	0	0	46	46	0	0	62	0	3	0	0	1	66	67
H/TOT	0	0	145	1	12	0	0	2	160	162	4	0	222	3	10	1	0	1	241	239.3
18:00	0	0	32	0	1	0	0	1	34	35	0	0	53	0	2	0	0	0	55	55
18:15	0	0	35	0	3	0	0	0	38	38	0	0	25	0	3	0	0	0	28	28
18:30	0	0	35	0	2	0	0	1	38	39	0	0	38	0	1	0	0	0	39	39
18:45	0	0	30	1	3	0	0	1	35	36	0	0	19	0	3	0	0	0	22	22
H/TOT	0	0	132	1	9	0	0	3	145	148	0	0	135	0	9	0	0	0	144	144
12 TOT	4	2	1258	27	86	11	0	27	1415	1443.1	20	0	1751	22	94	11	0	9	1907	1905.5

	C => A										C => B									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	24	1	7	1	0	0	33	33.5	0	0	6	0	0	0	0	0	6	6
07:15	0	0	42	0	5	4	0	1	52	55	0	0	4	1	0	0	0	1	6	7
07:30	0	0	64	0	11	1	0	0	76	76.5	0	0	14	0	0	1	0	1	16	17.5
07:45	0	0	54	0	12	1	2	0	69	72.1	0	0	23	0	1	0	0	1	25	26
H/TOT	0	0	184	1	35	7	2	1	230	237.1	0	0	47	1	1	1	0	3	53	56.5
08:00	0	0	94	0	4	2	1	0	101	103.3	0	0	15	1	2	0	0	1	19	20
08:15	0	0	66	0	4	0	0	0	70	70	0	0	12	2	2	0	0	0	16	16
08:30	1	0	45	2	2	3	0	0	53	53.7	1	0	29	0	6	0	0	1	37	37.2
08:45	0	0	45	3	1	1	0	0	50	50.5	0	0	42	1	2	1	0	0	46	46.5
H/TOT	1	0	250	5	11	6	1	0	274	277.5	1	0	98	4	12	1	0	2	118	119.7
09:00	1	0	32	1	14	3	0	0	51	51.7	0	0	24	1	0	0	0	1	26	27
09:15	0	0	41	1	12	3	1	1	59	62.8	0	0	19	1	1	0	0	0	21	21
09:30	0	0	43	0	14	1	2	0	60	63.1	0	0	16	2	1	0	0	1	20	21
09:45	0	1	43	0	8	5	1	1	59	63.2	0	0	9	0	5	0	0	0	14	14
H/TOT	1	1	159	2	48	12	4	2	229	240.8	0	0	68	4	7	0	0	2	81	83
10:00	0	0	32	1	12	4	1	0	50	53.3	0	0	12	0	3	1	0	1	17	18.5
10:15	0	0	54	1	7	4	1	0	67	70.3	0	0	9	2	3	0	0	2	16	18
10:30	0	0	45	2	7	5	1	1	61	65.8	0	0	9	0	5	1	0	0	15	15.5
10:45	0	0	44	1	7	2	0	1	55	57	0	0	14	0	1	1	0	0	16	16.5
H/TOT	0	0	175	5	33	15	3	2	233	246.4	0	0	44	2	12	3	0	3	64	68.5
11:00	0	0	32	1	10	2	1	0	46	48.3	0	0	25	0	3	2	0	1	31	33
11:15	0	0	35	0	6	4	1	0	46	49.3	0	0	17	2	5	0	0	0	24	24
11:30	0	0	37	1	9	3	0	0	50	51.5	0	0	22	0	3	1	0	1	27	28.5
11:45	0	0	47	0	7	1	3	0	58	62.4	0	1	19	0	3	0	0	0	23	22.4
H/TOT	0	0	151	2	32	10	5	0	200	211.5	0	1	83	2	14	3	0	2	105	107.9
12:00	0	0	50	1	5	2	1	0	59	61.3	0	0	17	1	2	0	0	1	21	22
12:15	0	0	37	0	11	6	1	0	55	59.3	0	0	29	0	1	0	0	0	30	30
12:30	0	0	54	2	13	2	2	0	73	76.6	0	0	18	2	6	1	0	0	27	27.5
12:45	0	0	41	2	7	5	1	0	56	59.8	0	0	29	0	4	0	0	1	34	35
H/TOT	0	0	182	5	36	15	5	0	243	257	0	0	93	3	13	1	0	2	112	114.5
13:00	1	0	54	2	9	3	0	2	71	73.7	0	0	24	0	4	0	0	2	30	32
13:15	0	0	58	0	6	1	1	0	66	67.8	0	0	26	1	2	0	0	0	29	29
13:30	0	0	49	0	4	1	1	0	55	56.8	0	0	15	0	4	0	0	1	20	21
13:45	0	0	77	0	12	3	0	0	92	93.5	0	0	50	0	3	0	0	0	53	53
H/TOT	1	0	238	2	31	8	2	2	284	291.8	0	0	115	1	13	0	0	3	132	135
14:00	0	0	56	1	9	1	0	0	67	67.5	0	0	17	0	3	1	0	0	21	21.5
14:15	0	0	54	0	8	3	0	0	65	66.5	0	0	18	2	0	0	0	0	20	20
14:30	4	1	59	0	5	1	0	0	70	66.7	0	0	20	0	1	0	0	1	22	23
14:45	0	0	65	2	14	1	1	0	83	84.8	0	0	46	1	3	1	0	2	53	55.5
H/TOT	4	1	234	3	36	6	1	0	285	285.5	0	0	101	3	7	2	0	3	116	120
15:00	0	0	73	1	8	3	1	0	86	88.8	0	0	32	2	0	0	0	0	34	34
15:15	1	0	68	0	9	3	1	0	82	84	0	0	20	0	0	0	0	1	21	22
15:30	0	0	66	0	4	3	0	0	73	74.5	0	0	15	0	6	0	0	0	21	21
15:45	0	0	72	0	13	4	4	0	93	100.2	0	0	26	0	2	0	0	0	28	28
H/TOT	1	0	279	1	34	13	6	0	334	347.5	0	0	93	2	8	0	0	1	104	105
16:00	0	1	113	2	8	2	0	2	128	130.4	0	0	40	1	1	0	0	1	43	44
16:15	0	1	82	2	12	2	0	0	99	99.4	0	0	33	0	2	0	0	0	35	35
16:30	0	0	90	2	13	0	0	0	105	105	0	0	32	0	4	1	0	1	38	39.5
16:45	0	0	104	1	8	0	1	0	114	115.3	0	0	24	0	3	1	0	0	28	28.5
H/TOT	0	2	389	7	41	4	1	2	446	450.1	0	0	129	1	10	2	0	2	144	147
17:00	0	0	115	0	12	3	2	0	132	136.1	0	0	25	1	5	0	0	1	32	33
17:15	0	0	110	0	6	0	0	0	116	116	0	0	41	0	2	0	0	0	43	43
17:30	0	0	115	0	3	2	0	0	120	121	0	1	29	1	10	0	0	1	42	42.4
17:45	0	0	99	1	10	0	0	0	110	110	0	0	49	0	3	0	0	1	53	54
H/TOT	0	0	439	1	31	5	2	0	478	483.1	0	1	144	2	20	0	0	3	170	172.4
18:00	0	0	105	1	8	0	0	0	114	114	0	0	40	1	2	0	0	0	43	43
18:15	0	0	67	1	5	1	0	1	75	76.5	0	0	36	0	3	0	0	0	39	39
18:30	1	0	68	3	4	1	0	0	77	76.7	1	0	28	1	1	0	0	1	32	32.2
18:45	0	0	76	0	2	1	0	0	79	79.5	0	0	23	0	1	0	0	1	25	26
H/TOT	1	0	316	5	19	3	0	1	345	346.7	1	0	127	2	7	0	0	2	139	140.2
12 TOT	9	4	2996	39	387	104	32	10	3581	3675	2	2	1142	27	124	13	0	28	1338	1369.7

	C => C										C => D									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	0	0	0	0	0	0	0	0	0	0	7	0	2	0	0	0	9	9
07:15	0	0	0	0	0	0	0	0	0	0	0	0	10	0	3	0	0	0	13	13
07:30	0	0	0	0	0	0	0	0	0	0	0	0	22	1	3	0	0	0	26	26
07:45	0	0	0	0	0	0	0	0	0	0	0	0	34	0	6	0	0	3	43	46
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	73	1	14	0	0	3	91	94
08:00	0	0	1	0	0	0	0	0	1	1	0	1	91	1	4	0	0	0	97	96.4
08:15	0	0	0	0	0	0	0	0	0	0	0	0	97	0	2	0	0	0	99	99
08:30	0	0	0	0	0	0	0	1	1	2	0	0	81	3	2	1	0	1	88	89.5
08:45	0	0	0	0	0	0	0	0	0	0	0	0	31	0	3	1	0	0	35	35.5
H/TOT	0	0	1	0	0	0	0	1	2	3	0	1	300	4	11	2	0	1	319	320.4
09:00	0	0	0	0	0	0	0	0	0	0	0	0	20	0	1	0	0	0	21	21
09:15	0	0	0	0	0	0	0	0	0	0	0	0	23	0	2	0	0	0	25	25
09:30	0	0	0	0	0	0	1	0	1	2.3	0	0	13	1	2	0	0	0	16	16
09:45	0	0	0	0	0	0	0	0	0	0	0	0	17	1	3	0	0	0	21	21
H/TOT	0	0	0	0	0	0	1	0	1	2.3	0	0	73	2	8	0	0	0	83	83
10:00	0	0	0	0	0	0	0	0	0	0	0	0	27	0	1	0	0	0	28	28
10:15	0	0	0	0	0	0	0	0	0	0	0	0	24	0	2	0	0	0	26	26
10:30	0	0	0	0	0	0	0	0	0	0	0	0	27	0	2	0	0	1	30	31
10:45	0	0	0	0	0	0	0	0	0	0	0	0	23	0	1	0	0	0	24	24
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	101	0	6	0	0	1	108	109
11:00	0	0	1	0	0	0	0	0	1	1	0	0	22	0	5	0	0	0	27	27
11:15	0	0	0	0	0	0	0	0	0	0	0	0	19	0	1	0	0	0	20	20
11:30	0	0	1	0	0	0	1	0	2	3.3	0	0	24	0	5	1	0	0	30	30.5
11:45	0	0	0	0	0	0	0	0	0	0	0	0	27	0	2	1	0	1	31	32.5
H/TOT	0	0	2	0	0	0	1	0	3	4.3	0	0	92	0	13	2	0	1	108	110
12:00	0	0	0	0	0	0	0	0	0	0	0	0	31	0	4	1	0	0	36	36.5
12:15	0	0	0	0	0	0	1	0	1	2.3	0	0	35	0	3	0	0	0	38	38
12:30	0	0	0	0	0	0	0	0	0	0	0	0	33	2	5	1	0	0	41	41.5
12:45	0	0	0	0	0	0	0	0	0	0	0	0	54	0	2	0	0	0	56	56
H/TOT	0	0	0	0	0	0	1	0	1	2.3	0	0	153	2	14	2	0	0	171	172
13:00	0	0	0	0	0	0	0	0	0	0	1	0	30	2	0	0	1	0	34	34.5
13:15	0	0	0	0	0	0	0	0	0	0	0	0	29	0	1	0	0	0	30	30
13:30	0	0	0	0	0	0	0	0	0	0	0	0	35	1	2	1	0	0	39	39.5
13:45	0	0	0	0	0	0	1	0	1	2.3	0	0	54	0	4	0	0	1	59	60
H/TOT	0	0	0	0	0	0	1	0	1	2.3	1	0	148	3	7	1	1	1	162	164
14:00	0	0	0	0	0	0	1	0	1	2.3	0	0	42	0	2	0	0	1	45	46
14:15	0	0	2	0	0	0	0	0	2	2	0	0	42	0	6	0	0	0	48	48
14:30	0	0	0	0	0	0	0	0	0	0	1	0	27	2	4	0	0	0	34	33.2
14:45	0	0	0	0	0	0	0	0	0	0	0	0	39	0	2	1	0	1	43	44.5
H/TOT	0	0	2	0	0	0	1	0	3	4.3	1	0	150	2	14	1	0	2	170	171.7
15:00	0	0	0	0	0	0	0	0	0	0	0	0	35	0	1	0	0	0	36	36
15:15	0	0	1	0	0	0	0	0	1	1	0	0	42	1	3	0	0	0	46	46
15:30	0	0	0	0	0	0	0	0	0	0	0	0	55	0	1	0	0	0	56	56
15:45	0	0	0	0	0	0	0	0	0	0	0	0	48	4	4	0	0	0	56	56
H/TOT	0	0	1	0	0	0	0	0	1	1	0	0	180	5	9	0	0	0	194	194
16:00	0	0	1	0	0	0	0	0	1	1	0	0	66	0	3	0	0	0	69	69
16:15	0	0	0	0	1	0	1	0	2	3.3	0	0	37	1	3	1	0	0	42	42.5
16:30	0	0	1	0	0	0	0	0	1	1	0	0	48	1	1	0	0	0	50	50
16:45	0	0	0	0	0	0	0	0	0	0	2	0	47	0	5	0	0	1	55	54.4
H/TOT	0	0	2	0	1	0	1	0	4	5.3	2	0	198	2	12	1	0	1	216	215.9
17:00	0	0	0	0	0	0	0	0	0	0	0	0	53	1	3	0	0	0	57	57
17:15	0	0	0	0	0	0	0	0	0	0	0	0	54	0	0	2	1	0	57	59.3
17:30	0	0	0	0	0	0	0	0	0	0	0	0	45	0	0	0	0	0	45	45
17:45	0	0	0	0	0	0	1	0	1	2.3	0	0	54	0	3	0	1	0	58	59.3
H/TOT	0	0	0	0	0	0	1	0	1	2.3	0	0	206	1	6	2	2	0	217	220.6
18:00	0	0	0	0	0	0	0	0	0	0	0	0	68	0	1	0	0	0	69	69
18:15	0	0	0	0	0	0	0	0	0	0	0	0	26	0	1	1	1	0	29	30.8
18:30	0	0	1	0	0	0	0	0	1	1	0	0	25	0	1	0	0	0	26	26
18:45	0	0	0	0	0	0	0	0	0	0	0	0	38	0	2	0	0	0	40	40
H/TOT	0	0	1	0	0	0	0	0	1	1	0	0	157	0	5	1	1	0	164	165.8
12 TOT	0	0	9	0	1	0	7	1	18	28.1	4	1	1831	22	119	12	4	10	2003	2020.4

	D => A										D => B									
TIME	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**	**P/C**	**M/C**	**CAR**	**TAXI**	**LGV**	**OGV1**	**OGV2**	**PSV**	**TOT**	**PCU**
07:00	0	0	1	0	0	0	0	0	1	1	0	0	11	1	0	0	0	0	12	12
07:15	0	0	0	0	1	0	0	0	1	1	0	0	18	1	1	0	0	0	20	20
07:30	0	0	12	0	0	0	0	0	12	12	0	0	6	0	0	0	0	2	8	10
07:45	0	0	17	0	1	0	0	0	18	18	0	0	38	1	3	0	0	1	43	44
H/TOT	0	0	30	0	2	0	0	0	32	32	0	0	73	3	4	0	0	3	83	86
08:00	0	0	45	0	2	0	1	0	48	49.3	0	0	62	1	3	0	0	0	66	66
08:15	0	0	57	0	0	0	0	0	57	57	0	0	43	0	3	1	0	0	47	47.5
08:30	0	0	42	0	1	0	0	0	43	43	0	0	83	3	1	0	0	0	87	87
08:45	0	0	18	0	0	0	0	0	18	18	0	0	57	2	0	0	0	0	59	59
H/TOT	0	0	162	0	3	0	1	0	166	167.3	0	0	245	6	7	1	0	0	259	259.5
09:00	0	0	13	0	0	1	0	0	14	14.5	0	0	35	0	2	0	0	0	37	37
09:15	0	0	5	0	0	0	0	0	5	5	0	0	47	1	1	1	0	0	50	50.5
09:30	0	0	5	0	0	1	0	0	6	6.5	0	0	35	0	0	0	0	0	35	35
09:45	0	0	8	0	1	2	0	0	11	12	0	0	34	1	2	0	0	0	37	37
H/TOT	0	0	31	0	1	4	0	0	36	38	0	0	151	2	5	1	0	0	159	159.5
10:00	0	0	8	1	2	0	0	0	11	11	0	0	41	0	1	0	0	0	42	42
10:15	0	0	1	0	3	0	0	1	5	6	0	0	29	0	2	0	0	1	32	33
10:30	0	0	9	0	0	0	0	0	9	9	0	0	28	0	2	0	0	0	30	30
10:45	0	0	4	0	0	0	0	0	4	4	0	0	24	0	0	0	0	1	25	26
H/TOT	0	0	22	1	5	0	0	1	29	30	0	0	122	0	5	0	0	2	129	131
11:00	0	0	2	0	0	0	0	0	2	2	0	0	18	0	0	0	0	0	18	18
11:15	0	0	2	0	0	1	0	0	3	3.5	0	0	28	1	1	0	0	0	30	30
11:30	0	0	2	0	0	0	0	0	2	2	0	0	26	1	1	0	0	0	28	28
11:45	0	0	3	0	0	0	0	0	3	3	0	0	28	0	3	0	0	0	31	31
H/TOT	0	0	9	0	0	1	0	0	10	10.5	0	0	100	2	5	0	0	0	107	107
12:00	0	0	7	0	1	1	0	2	11	13.5	0	0	30	0	4	0	0	0	34	34
12:15	0	0	7	0	1	0	0	0	8	8	0	0	32	0	0	0	0	0	32	32
12:30	0	0	6	0	0	0	0	0	6	6	0	0	18	0	0	0	0	0	18	18
12:45	0	0	12	0	0	0	0	0	12	12	0	0	28	0	1	0	0	0	29	29
H/TOT	0	0	32	0	2	1	0	2	37	39.5	0	0	108	0	5	0	0	0	113	113
13:00	0	0	7	0	2	0	0	0	9	9	0	0	47	1	2	0	0	0	50	50
13:15	0	0	9	0	0	0	0	2	11	13	0	0	38	1	3	0	0	0	42	42
13:30	0	0	9	0	2	0	0	1	12	13	0	0	33	0	1	0	0	0	34	34
13:45	0	0	6	0	1	0	0	0	7	7	0	0	11	1	1	0	0	1	14	15
H/TOT	0	0	31	0	5	0	0	3	39	42	0	0	129	3	7	0	0	1	140	141
14:00	0	0	12	0	1	0	0	0	13	13	0	0	67	1	1	0	0	0	69	69
14:15	0	0	10	0	2	1	0	0	13	13.5	0	0	40	1	2	0	0	0	43	43
14:30	0	0	9	0	0	0	0	0	9	9	0	0	39	0	2	0	0	1	42	43
14:45	0	0	13	0	1	0	0	0	14	14	0	0	37	0	1	0	0	0	38	38
H/TOT	0	0	44	0	4	1	0	0	49	49.5	0	0	183	2	6	0	0	1	192	193
15:00	0	0	13	0	1	0	0	0	14	14	0	0	25	1	1	1	0	0	28	28.5
15:15	0	0	3	0	0	0	0	0	3	3	0	0	33	0	4	1	0	0	38	38.5
15:30	0	0	13	0	2	0	0	0	15	15	0	0	34	0	1	0	0	1	36	37
15:45	0	0	10	0	0	0	0	0	10	10	2	0	24	2	1	0	0	0	29	27.4
H/TOT	0	0	39	0	3	0	0	0	42	42	2	0	116	3	7	2	0	1	131	131.4
16:00	0	0	13	0	1	0	0	0	14	14	1	0	55	0	0	0	0	0	56	55.2
16:15	0	0	15	0	1	0	0	0	16	16	0	0	53	1	1	0	0	1	56	57
16:30	0	0	14	0	1	0	0	0	15	15	0	0	36	0	1	0	0	2	39	41
16:45	0	0	11	0	6	0	0	0	17	17	0	0	37	1	0	1	0	0	39	39.5
H/TOT	0	0	53	0	9	0	0	0	62	62	1	0	181	2	2	1	0	3	190	192.7
17:00	0	0	13	0	3	1	0	0	17	17.5	0	0	44	1	2	0	0	0	47	47
17:15	0	0	6	0	0	0	0	0	6	6	0	0	39	1	4	0	0	0	44	44
17:30	0	0	11	0	1	0	0	0	12	12	0	0	34	0	7	0	0	0	41	41
17:45	0	0	9	0	3	0	0	0	12	12	0	0	26	1	2	0	0	0	29	29
H/TOT	0	0	39	0	7	1	0	0	47	47.5	0	0	143	3	15	0	0	0	161	161
18:00	0	0	10	0	2	0	0	0	12	12	1	0	47	0	3	0	0	0	51	50.2
18:15	0	1	9	0	1	0	0	0	11	10.4	0	0	14	1	0	0	0	0	15	15
18:30	0	0	3	0	0	0	0	0	3	3	0	0	26	1	0	1	0	0	28	28.5
18:45	0	0	3	0	1	0	0	0	4	4	0	0	12	0	2	0	0	0	14	14
H/TOT	0	1	25	0	4	0	0	0	30	29.4	1	0	99	2	5	1	0	0	108	107.7
12 TOT	0	1	517	1	45	8	1	6	579	589.7	4	0	1650	28	73	6	0	11	1772	1782.8

	D => C										D => D									
TIME	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU
07:00	0	0	19	0	3	0	0	0	22	22	0	0	0	0	0	0	0	0	0	0
07:15	0	0	34	0	3	0	0	0	37	37	0	0	0	0	0	0	0	0	0	0
07:30	0	0	50	0	6	1	0	0	57	57.5	0	0	0	0	0	0	0	0	0	0
07:45	0	0	37	1	4	0	1	0	43	44.3	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	140	1	16	1	1	0	159	160.8	0	0	0	0	0	0	0	0	0	0
08:00	0	0	35	0	5	1	0	1	42	43.5	0	0	0	0	0	0	0	0	0	0
08:15	1	0	105	0	2	0	1	1	110	111.5	0	0	0	0	0	0	0	0	0	0
08:30	0	0	77	0	1	0	0	1	79	80	0	0	0	0	0	0	0	0	0	0
08:45	1	0	54	1	1	0	0	0	57	56.2	0	0	0	0	0	0	0	0	0	0
H/TOT	2	0	271	1	9	1	1	3	288	291.2	0	0	0	0	0	0	0	0	0	0
09:00	0	0	28	0	1	1	1	0	31	32.8	0	0	0	0	0	0	0	0	0	0
09:15	0	0	33	1	1	0	0	0	35	35	0	0	0	0	0	0	0	0	0	0
09:30	0	0	19	2	2	2	0	0	25	26	0	0	0	0	0	0	0	0	0	0
09:45	0	0	33	1	4	0	0	0	38	38	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	113	4	8	3	1	0	129	131.8	0	0	0	0	0	0	0	0	0	0
10:00	0	0	24	0	6	0	0	0	30	30	0	0	0	0	0	0	0	0	0	0
10:15	0	0	31	2	4	0	0	0	37	37	0	0	0	0	0	0	0	0	0	0
10:30	0	0	22	1	0	0	1	0	24	25.3	0	0	0	0	0	0	0	0	0	0
10:45	0	0	20	0	5	0	1	1	27	29.3	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	97	3	15	0	2	1	118	121.6	0	0	0	0	0	0	0	0	0	0
11:00	0	0	21	0	0	0	0	0	21	21	0	0	0	0	0	0	0	0	0	0
11:15	0	0	23	1	6	1	0	0	31	31.5	0	0	0	0	0	0	0	0	0	0
11:30	0	0	17	2	2	0	0	0	21	21	0	0	0	0	0	0	0	0	0	0
11:45	0	0	24	0	1	1	1	0	27	28.8	0	0	0	0	0	1	0	0	1	1.5
H/TOT	0	0	85	3	9	2	1	0	100	102.3	0	0	0	0	0	1	0	0	1	1.5
12:00	0	0	28	1	3	1	0	0	33	33.5	0	0	0	0	0	0	0	0	0	0
12:15	0	0	30	0	3	1	0	0	34	34.5	0	0	0	0	0	0	0	0	0	0
12:30	0	0	21	1	3	0	0	1	26	27	0	0	0	0	0	0	0	0	0	0
12:45	0	0	19	1	5	2	0	0	27	28	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	98	3	14	4	0	1	120	123	0	0	0	0	0	0	0	0	0	0
13:00	0	0	41	1	5	0	0	0	47	47	0	0	0	0	0	0	0	0	0	0
13:15	0	0	50	0	3	0	0	0	53	53	0	0	0	0	0	0	0	0	0	0
13:30	0	0	29	0	1	0	0	0	30	30	0	0	0	0	0	0	0	0	0	0
13:45	0	0	25	0	1	0	0	0	26	26	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	145	1	10	0	0	0	156	156	0	0	0	0	0	0	0	0	0	0
14:00	0	0	70	0	3	0	0	0	73	73	0	0	0	0	0	0	0	0	0	0
14:15	0	0	35	1	4	0	0	0	40	40	0	0	0	0	0	0	0	0	0	0
14:30	0	0	60	2	3	2	0	0	67	68	0	0	0	0	0	0	0	0	0	0
14:45	0	0	30	2	2	0	0	0	34	34	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	195	5	12	2	0	0	214	215	0	0	0	0	0	0	0	0	0	0
15:00	0	0	32	0	7	0	0	0	39	39	0	0	0	0	0	0	0	0	0	0
15:15	0	0	41	0	1	1	0	0	43	43.5	0	0	0	0	0	0	0	0	0	0
15:30	0	0	22	0	1	1	0	0	24	24.5	0	0	0	0	0	1	0	0	1	1.5
15:45	0	0	19	0	6	2	0	0	27	28	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	114	0	15	4	0	0	133	135	0	0	0	0	0	1	0	0	1	1.5
16:00	0	0	69	1	6	1	0	1	78	79.5	0	0	0	0	0	0	0	0	0	0
16:15	0	0	39	3	1	0	0	1	44	45	0	0	0	0	0	0	0	0	0	0
16:30	0	0	23	1	5	1	0	1	31	32.5	0	0	0	0	0	0	0	0	0	0
16:45	0	0	28	0	6	0	0	0	34	34	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	159	5	18	2	0	3	187	191	0	0	0	0	0	0	0	0	0	0
17:00	0	0	31	0	5	0	0	0	36	36	0	0	0	0	0	0	0	0	0	0
17:15	0	0	35	1	1	0	0	0	37	37	0	0	0	0	0	0	0	0	0	0
17:30	0	0	22	0	0	0	0	1	23	24	0	0	0	0	0	0	0	0	0	0
17:45	0	0	25	0	0	0	0	0	25	25	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	113	1	6	0	0	1	121	122	0	0	0	0	0	0	0	0	0	0
18:00	0	0	47	0	0	0	0	0	47	47	0	0	0	0	0	0	0	0	0	0
18:15	0	0	26	0	4	0	0	0	30	30	0	0	0	0	0	0	0	0	0	0
18:30	0	0	19	0	2	0	0	0	21	21	0	0	0	0	0	0	0	0	0	0
18:45	0	0	34	1	1	0	0	0	36	36	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	126	1	7	0	0	0	134	134	0	0	0	0	0	0	0	0	0	0
12 TOT	2	0	1656	28	139	19	6	9	1859	1883.7	0	0	0	0	0	2	0	0	2	3

APPENDIX 11.2 - Traffic Calculations Summary - TTRSA

Traffic Calculations – Summary
Existing R510/Ard Aulin/Site Access Roundabout (4-arm)

Arm A = R510 to/from North (N69)
Arm B = Site Access
Arm C = R510 to/from South
Arm D = Ard Aulin

Scenario	A-A	A-B	A-C	A-D	B-A	B-B	B-C	B-D	C-A	C-B	C-C	C-D	D-A	D-B	D-C	D-D
2020 AM Peak Hour (08:00-08:59)	5	0	499	9	0	0	0	0	563	0	0	19	24	0	45	0
2023 AM Peak Hour (Factor = 1.055)	5	0	527	9	0	0	0	0	593	0	0	20	26	0	47	0
2027 AM Peak Hour (Factor = 1.133)	**5**	**0**	**566**	**10**	**0**	**0**	**0**	**0**	**637**	**0**	**0**	**22**	**28**	**0**	**51**	**0**
2032 AM Peak Hour (Factor = 1.199)	**5**	**0**	**599**	**11**	**0**	**0**	**0**	**0**	**674**	**0**	**0**	**23**	**29**	**0**	**54**	**0**
2042 AM Peak Hour (Factor = 1.289)	**6**	**0**	**644**	**12**	**0**	**0**	**0**	**0**	**725**	**0**	**0**	**24**	**31**	**0**	**58**	**0**
Generated Trips AM	0	24	0	0	34	0	64	20	0	50	0	0	0	2	0	0
2027 AM Peak Hour With Proposed Development	**5**	**24**	**566**	**10**	**34**	**0**	**64**	**20**	**637**	**50**	**0**	**22**	**28**	**2**	**51**	**0**
2032 AM Peak Hour With Proposed Development	**5**	**24**	**599**	**11**	**34**	**0**	**64**	**20**	**674**	**50**	**0**	**23**	**29**	**2**	**54**	**0**
2042 AM Peak Hour With Proposed Development	**6**	**24**	**644**	**12**	**34**	**0**	**64**	**20**	**725**	**50**	**0**	**24**	**31**	**2**	**58**	**0**
2020 PM Peak Hour (17:00-17:59)	5	0	577	24	0	0	0	0	675	0	0	29	12	0	23	0
2023 PM Peak Hour (Factor = 1.055)	5	0	609	25	0	0	0	0	712	0	0	31	13	0	24	0
2027 PM Peak Hour (Factor = 1.133)	**5**	**0**	**654**	**27**	**0**	**0**	**0**	**0**	**765**	**0**	**0**	**33**	**14**	**0**	**26**	**0**
2032 PM Peak Hour (Factor = 1.199)	**5**	**0**	**692**	**29**	**0**	**0**	**0**	**0**	**809**	**0**	**0**	**35**	**14**	**0**	**28**	**0**
2042 PM Peak Hour (Factor = 1.289)	**6**	**0**	**744**	**31**	**0**	**0**	**0**	**0**	**870**	**0**	**0**	**37**	**15**	**0**	**30**	**0**
Generated Trips PM	0	29	0	0	21	0	40	13	0	35	0	0	0	1	0	0
2027 PM Peak Hour With Proposed Development	**5**	**29**	**654**	**27**	**21**	**0**	**40**	**13**	**765**	**35**	**0**	**33**	**14**	**1**	**26**	**0**
2032 PM Peak Hour With Proposed Development	**5**	**29**	**692**	**29**	**21**	**0**	**40**	**13**	**809**	**35**	**0**	**35**	**14**	**1**	**28**	**0**
2042 PM Peak Hour With Proposed Development	**6**	**29**	**744**	**31**	**21**	**0**	**40**	**13**	**870**	**35**	**0**	**37**	**15**	**1**	**30**	**0**

Data in PCUs rounded to the nearest whole number

Percentage impact of development in 2042 Peak Hours **10.3%**

Traffic Calculations – Summary
Existing R510/Mungret Road/Father Russell Road Roundabout (4-arm)

TTRSA
Traffic : Transport : Road Safety

Arm A = R510 to/from North
Arm B = Father Russell Road
Arm C = R510 to/from South
Arm D = Mungret Road

Scenario	**A-A**	**A-B**	**A-C**	**A-D**	**B-A**	**B-B**	**B-C**	**B-D**	**C-A**	**C-B**	**C-C**	**C-D**	**D-A**	**D-B**	**D-C**	**D-D**
2020 AM Peak Hour (08:00-08:59)	2	96	369	62	138	0	159	218	278	120	3	320	167	260	291	0
2023 AM Peak Hour (Factor = 1.055)	2	101	390	65	146	0	167	230	293	126	3	338	177	274	307	0
2027 AM Peak Hour (Factor = 1.133)	**2**	**108**	**418**	**70**	**156**	**0**	**180**	**247**	**314**	**136**	**3**	**363**	**190**	**294**	**330**	**0**
2032 AM Peak Hour (Factor = 1.199)	**2**	**115**	**443**	**74**	**165**	**0**	**190**	**262**	**333**	**144**	**4**	**384**	**201**	**311**	**349**	**0**
2042 AM Peak Hour (Factor = 1.289)	**2**	**123**	**476**	**79**	**178**	**0**	**204**	**281**	**358**	**154**	**4**	**413**	**216**	**334**	**375**	**0**
Generated Trips AM	0	12	45	7	12	0	0	0	24	0	0	0	14	0	0	0
2027 AM Peak Hour With Proposed Development	**2**	**120**	**463**	**77**	**168**	**0**	**180**	**247**	**338**	**136**	**3**	**363**	**204**	**294**	**330**	**0**
2032 AM Peak Hour With Proposed Development	**2**	**126**	**488**	**81**	**177**	**0**	**190**	**262**	**357**	**144**	**4**	**384**	**215**	**311**	**349**	**0**
2042 AM Peak Hour With Proposed Development	**2**	**135**	**521**	**87**	**190**	**0**	**204**	**281**	**382**	**154**	**4**	**413**	**230**	**334**	**375**	**0**
2020 PM Peak Hour (17:00-17:59)	0	214	370	20	170	0	160	239	483	172	2	221	48	161	122	0
2023 PM Peak Hour (Factor = 1.055)	0	226	390	21	179	0	169	252	510	182	2	233	50	170	129	0
2027 PM Peak Hour (Factor = 1.133)	**0**	**243**	**419**	**23**	**193**	**0**	**181**	**271**	**547**	**195**	**3**	**250**	**54**	**182**	**138**	**0**
2032 PM Peak Hour (Factor = 1.199)	**0**	**257**	**444**	**24**	**204**	**0**	**192**	**287**	**579**	**207**	**3**	**264**	**57**	**193**	**146**	**0**
2042 PM Peak Hour (Factor = 1.289)	**0**	**276**	**477**	**26**	**219**	**0**	**206**	**308**	**623**	**222**	**3**	**284**	**61**	**208**	**157**	**0**
Generated Trips PM	0	14	24	1	8	0	0	0	24	0	0	0	2	0	0	0
2027 PM Peak Hour With Proposed Development	**0**	**257**	**444**	**24**	**201**	**0**	**181**	**271**	**571**	**195**	**3**	**250**	**56**	**182**	**138**	**0**
2032 PM Peak Hour With Proposed Development	**0**	**271**	**468**	**25**	**212**	**0**	**192**	**287**	**603**	**207**	**3**	**264**	**59**	**193**	**146**	**0**
2042 PM Peak Hour With Proposed Development	**0**	**290**	**501**	**27**	**228**	**0**	**206**	**308**	**647**	**222**	**3**	**284**	**64**	**208**	**157**	**0**

Data in PCUs rounded to the nearest whole number

Percentage impact of development in 2042 Peak Hours **3.0%**

Traffic Calculations – Summary
Existing R510/N69/N18 Roundabout (6-arm)

Arm A = N69 Roundabout Connector to/from eastern Dock Road Roundabout
Arm B = N18 Northbound Off-slip (no traffic entering this arm)
Arm C = R510 to/from South
Arm D = N69 to/from West
Arm E = Irish Cement Access
Arm F = N18 Northbound On-slip (no traffic exiting this arm)

Scenario	A-A	A-C	A-D	A-E	A-F	B-A	B-C	B-D	B-E	B-F	C-A	C-C	C-D	C-E	C-F	D-A	D-C	D-D	D-E	D-F	E-A	E-C	E-D	E-E	E-F
2020 AM Peak Hour (08:00-08:59)	1	388	160	4	67	502	112	280	20	123	422	0	30	4	134	579	16	28	6	135	14	0	2	0	0
2023 AM Peak Hour (Factor = 1.055)	1	409	169	4	70	529	118	295	21	130	446	0	32	4	141	610	17	29	6	142	14	0	2	0	0
2027 AM Peak Hour (Factor = 1.133)	**1**	**439**	**182**	**5**	**76**	**568**	**126**	**317**	**23**	**140**	**479**	**0**	**34**	**5**	**151**	**656**	**18**	**31**	**7**	**153**	**16**	**0**	**3**	**0**	**0**
2032 AM Peak Hour (Factor = 1.199)	**1**	**465**	**192**	**5**	**80**	**601**	**134**	**335**	**24**	**148**	**506**	**0**	**36**	**5**	**160**	**694**	**19**	**33**	**7**	**162**	**16**	**0**	**3**	**0**	**0**
2042 AM Peak Hour (Factor = 1.289)	**1**	**499**	**207**	**5**	**86**	**647**	**144**	**361**	**26**	**159**	**544**	**0**	**39**	**5**	**172**	**746**	**20**	**36**	**7**	**174**	**18**	**0**	**3**	**0**	**0**
Generated Trips AM	0	18	0	0	0	0	5	0	0	0	24	0	2	0	8	0	1	0	0	0	0	0	0	0	0
2027 AM Peak Hour With Proposed Development	**1**	**457**	**182**	**5**	**76**	**568**	**132**	**317**	**23**	**140**	**503**	**0**	**36**	**5**	**159**	**656**	**19**	**31**	**7**	**153**	**16**	**0**	**3**	**0**	**0**
2032 AM Peak Hour With Proposed Development	**1**	**483**	**192**	**5**	**80**	**601**	**139**	**335**	**24**	**148**	**531**	**0**	**38**	**5**	**168**	**694**	**20**	**33**	**7**	**162**	**16**	**0**	**3**	**0**	**0**
2042 AM Peak Hour With Proposed Development	**1**	**518**	**207**	**5**	**86**	**647**	**149**	**361**	**26**	**159**	**569**	**0**	**40**	**5**	**180**	**746**	**21**	**36**	**7**	**174**	**18**	**0**	**3**	**0**	**0**
2020 PM Peak Hour (17:00-17:59)	0	381	425	2	43	105	203	361	2	163	489	0	17	0	174	373	28	28	1	113	9	0	2	0	6
2023 PM Peak Hour (Factor = 1.055)	0	401	448	2	45	111	214	380	2	172	516	0	17	0	184	394	29	29	1	120	10	0	2	0	7
2027 PM Peak Hour (Factor = 1.133)	**0**	**431**	**482**	**3**	**48**	**119**	**229**	**409**	**2**	**184**	**554**	**0**	**19**	**0**	**197**	**423**	**31**	**31**	**1**	**128**	**11**	**0**	**2**	**0**	**7**
2032 PM Peak Hour (Factor = 1.199)	**0**	**456**	**510**	**3**	**51**	**126**	**243**	**432**	**2**	**195**	**586**	**0**	**20**	**0**	**209**	**447**	**33**	**33**	**1**	**136**	**11**	**0**	**2**	**0**	**8**
2042 PM Peak Hour (Factor = 1.289)	**0**	**490**	**548**	**3**	**55**	**135**	**261**	**465**	**2**	**210**	**630**	**0**	**21**	**0**	**224**	**481**	**36**	**36**	**1**	**146**	**12**	**0**	**3**	**0**	**8**
Generated Trips PM	0	18	0	0	0	0	10	0	0	0	15	0	1	0	5	0	1	0	0	0	0	0	0	0	0
2027 PM Peak Hour With Proposed Development	**0**	**449**	**482**	**3**	**48**	**119**	**239**	**409**	**2**	**184**	**569**	**0**	**19**	**0**	**203**	**423**	**33**	**31**	**1**	**128**	**11**	**0**	**2**	**0**	**7**
2032 PM Peak Hour With Proposed Development	**0**	**474**	**510**	**3**	**51**	**126**	**252**	**432**	**2**	**195**	**601**	**0**	**20**	**0**	**214**	**447**	**34**	**33**	**1**	**136**	**11**	**0**	**2**	**0**	**8**
2042 PM Peak Hour With Proposed Development	**0**	**509**	**548**	**3**	**55**	**135**	**271**	**465**	**2**	**210**	**645**	**0**	**22**	**0**	**230**	**481**	**37**	**36**	**1**	**146**	**12**	**0**	**3**	**0**	**8**

Data in PCUs rounded to the nearest whole number

Percentage impact of development in 2042 Peak Hours **1.4%**

Traffic Calculations – Summary

Existing N69/N18/Dock Road Roundabout (5-arm)

Arm A = Limerick Main Drainage (Waterworks) Access
Arm B = Dock Road to/from East
Arm C = N18 Southbound On-slip (no traffic exiting this arm)
Arm D = N69 Roundabout Connector to/from western Roundabout
Arm E = N18 Southbound Off-slip (no traffic entering this arm)

Scenario	**A-A**	**A-B**	**A-C**	**A-D**	**B-A**	**B-B**	**B-C**	**B-D**	**B-E**	**D-A**	**D-B**	**D-C**	**D-D**	**E-A**	**E-B**	**E-C**	**E-D**
2020 AM Peak Hour (08:00-08:59)	0	1	10	4	8	30	438	361	0	7	1068	440	0	3	149	11	254
2023 AM Peak Hour (Factor = 1.055)	0	1	10	4	8	32	462	380	0	8	1127	464	0	3	157	12	268
2027 AM Peak Hour (Factor = 1.133)	**0**	**1**	**11**	**4**	**9**	**34**	**497**	**409**	**0**	**8**	**1210**	**499**	**0**	**3**	**169**	**13**	**288**
2032 AM Peak Hour (Factor = 1.199)	**0**	**1**	**12**	**5**	**9**	**36**	**526**	**432**	**0**	**9**	**1280**	**528**	**0**	**3**	**179**	**14**	**305**
2042 AM Peak Hour (Factor = 1.289)	**0**	**1**	**13**	**5**	**10**	**39**	**565**	**465**	**0**	**9**	**1376**	**567**	**0**	**3**	**192**	**15**	**328**
Generated Trips AM	0	0	0	0	0	0	0	10	0	0	17	7	0	0	0	0	7
2027 AM Peak Hour With Proposed Development	**0**	**1**	**11**	**4**	**9**	**34**	**497**	**419**	**0**	**8**	**1227**	**505**	**0**	**3**	**169**	**13**	**296**
2032 AM Peak Hour With Proposed Development	**0**	**1**	**12**	**5**	**9**	**36**	**526**	**443**	**0**	**9**	**1297**	**535**	**0**	**3**	**179**	**14**	**312**
2042 AM Peak Hour With Proposed Development	**0**	**1**	**13**	**5**	**10**	**39**	**565**	**475**	**0**	**10**	**1393**	**574**	**0**	**3**	**192**	**15**	**335**
2020 PM Peak Hour (17:00-17:59)	0	2	2	3	0	17	353	578	0	2	595	383	0	0	57	118	269
2023 PM Peak Hour (Factor = 1.055)	0	2	2	3	0	18	372	610	0	2	628	404	0	0	60	124	283
2027 PM Peak Hour (Factor = 1.133)	**0**	**2**	**2**	**4**	**0**	**19**	**400**	**655**	**0**	**2**	**674**	**434**	**0**	**0**	**64**	**133**	**304**
2032 PM Peak Hour (Factor = 1.199)	**0**	**2**	**2**	**4**	**0**	**20**	**423**	**693**	**0**	**2**	**714**	**459**	**0**	**0**	**68**	**141**	**322**
2042 PM Peak Hour (Factor = 1.289)	**0**	**3**	**3**	**4**	**0**	**22**	**455**	**745**	**0**	**2**	**767**	**494**	**0**	**0**	**73**	**152**	**346**
Generated Trips PM	0	0	0	0	0	0	0	12	0	0	9	6	0	0	0	0	6
2027 PM Peak Hour With Proposed Development	**0**	**2**	**2**	**4**	**0**	**19**	**400**	**667**	**0**	**2**	**683**	**440**	**0**	**0**	**64**	**133**	**310**
2032 PM Peak Hour With Proposed Development	**0**	**2**	**2**	**4**	**0**	**20**	**423**	**705**	**0**	**2**	**723**	**465**	**0**	**0**	**68**	**141**	**328**
2042 PM Peak Hour With Proposed Development	**0**	**3**	**3**	**4**	**0**	**22**	**455**	**757**	**0**	**2**	**776**	**500**	**0**	**0**	**73**	**152**	**352**

Data in PCUs rounded to the nearest whole number

Percentage impact of development in 2042 Peak Hours **1.1%**

APPENDIX 11.3 – Traffic Modelling - TTRSA

Junctions 9

ARCADY 9 - Roundabout Module

Version: 9.5.1.7462

For sales and distribution information, program advice and maintenance, contact TRL:
+44 (0)1344 379777 software@trl.co.uk www.trlsoftware.co.uk

Filename: site_access.j9
Path: D:\ttrsa\projects\T210607_Ballykeefe_Limerick_EIAR_Chapter_MMP\eiar_chapter\modelling
Report generation date: 07/03/2022 15:02:58

Summary of junction performance

	AM					PM				
	Set ID	Queue (PCU)	Delay (s)	RFC	LOS	Set ID	Queue (PCU)	Delay (s)	RFC	LOS
	2027 Without Development									
Arm A	D1	0.4	2.64	0.29	A	D7	0.5	2.81	0.34	A
Arm B		0.0	0.00	0.00	A		0.0	0.00	0.00	A
Arm C		0.7	3.57	0.39	A		0.9	4.17	0.47	A
Arm D		0.1	4.24	0.08	A		0.0	4.41	0.04	A
	2032 Without Development									
Arm A	D2	0.5	2.71	0.31	A	D8	0.6	2.90	0.36	A
Arm B		0.0	0.00	0.00	A		0.0	0.00	0.00	A
Arm C		0.7	3.71	0.41	A		1.0	4.40	0.50	A
Arm D		0.1	4.36	0.09	A		0.1	4.56	0.05	A
	2042 Without Development									
Arm A	D3	0.5	2.81	0.33	A	D9	0.7	3.04	0.39	A
Arm B		0.0	0.00	0.00	A		0.0	0.00	0.00	A
Arm C		0.8	3.92	0.44	A		1.2	4.76	0.54	A
Arm D		0.1	4.55	0.10	A		0.1	4.78	0.05	A
	2027 With Proposed Development									

Arm A	D4	0.5	2.76	0.31	A	D10	0.6	2.93	0.36	A
Arm B		0.2	5.92	0.16	A		0.1	5.90	0.10	A
Arm C		0.8	3.89	0.42	A		1.0	4.45	0.50	A
Arm D		0.1	4.49	0.09	A		0.1	4.59	0.05	A
	2032 With Proposed Development									
Arm A	D5	0.5	2.83	0.33	A	D11	0.6	3.03	0.38	A
Arm B		0.2	6.11	0.16	A		0.1	6.11	0.11	A
Arm C		0.8	4.05	0.45	A		1.1	4.72	0.52	A
Arm D		0.1	4.63	0.09	A		0.1	4.75	0.05	A
	2042 With Proposed Development									
Arm A	D6	0.6	2.94	0.35	A	D12	0.7	3.18	0.41	A
Arm B		0.2	6.38	0.17	A		0.1	6.42	0.11	A
Arm C		1.0	4.30	0.48	A		1.3	5.13	0.56	A
Arm D		0.1	4.85	0.11	A		0.1	4.99	0.06	A

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle.

File summary

File Description

Title	Ballykeefe Site Access
Location	Existing R510 Roundabout
Site number	
Date	26/01/2022
Version	EIAR
Status	Final
Identifier	
Client	DW Raheen
Jobnumber	T210607
Enumerator	TTRSA
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin

Analysis Options

Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Calculate residual capacity	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
5.75				0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D1	2027 Without Development	AM	FLAT	07:45	09:15	90	15	☐
D2	2032 Without Development	AM	FLAT	07:45	09:15	90	15	☐
D3	2042 Without Development	AM	FLAT	07:45	09:15	90	15	☐
D4	2027 With Proposed Development	AM	FLAT	07:45	09:15	90	15	☐
D5	2032 With Proposed Development	AM	FLAT	07:45	09:15	90	15	☐
D6	2042 With Proposed Development	AM	FLAT	07:45	09:15	90	15	☐
D7	2027 Without Development	PM	FLAT	16:45	18:15	90	15	☐

D8	2032 Without Development	PM	FLAT	16:45	18:15	90	15	☐
D9	2042 Without Development	PM	FLAT	16:45	18:15	90	15	☐
D10	2027 With Proposed Development	PM	FLAT	16:45	18:15	90	15	☐
D11	2032 With Proposed Development	PM	FLAT	16:45	18:15	90	15	☐
D12	2042 With Proposed Development	PM	FLAT	16:45	18:15	90	15	☐

Analysis Set Details

ID	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	☐	100.000	100.000

2027 Without Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing R510/Ard Aulin/Site Access Roundabout	Standard Roundabout		A, B, C, D	3.20	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Arms

Arms

Arm	Name	Description
A	R510 to/from North	
B	Site Access	
C	R510 to/from South	
D	Ard Aulin	

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
A	5.60	7.40	14.0	30.0	40.0	41.0	
B	3.00	3.60	22.0	34.5	40.0	35.0	
C	3.70	6.30	30.0	25.0	40.0	36.0	
D	3.20	4.60	19.0	36.0	40.0	32.0	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Final slope	Final intercept (PCU/hr)
A	0.703	2038
B	0.519	1080
C	0.642	1719
D	0.573	1332

The slope and intercept shown above include any corrections and adjustments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D1	2027 Without Development	AM	FLAT	07:45	09:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	581	100.000
B		FLAT	☐	0	100.000
C		FLAT	☐	659	100.000
D		FLAT	☐	79	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	5	0	566	10
	B	0	0	0	0
	C	637	0	0	22
	D	28	0	51	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	**B**	**C**	**D**
From	**A**	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.29	2.64	0.4	A	581	872
B	0.00	0.00	0.0	A	0	0
C	0.39	3.57	0.7	A	659	989
D	0.08	4.24	0.1	A	79	119

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	581	145	51	2002	0.290	579	667	0.0	0.4	2.635	A
B	0	0	630	753	0.000	0	0	0.0	0.0	0.000	A
C	659	165	15	1709	0.386	656	615	0.0	0.7	3.557	A
D	79	20	639	966	0.082	79	32	0.0	0.1	4.229	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	581	145	51	2002	0.290	581	670	0.4	0.4	2.641	A
B	0	0	632	752	0.000	0	0	0.0	0.0	0.000	A
C	659	165	15	1709	0.386	659	617	0.7	0.7	3.574	A
D	79	20	642	964	0.082	79	32	0.1	0.1	4.239	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	581	145	51	2002	0.290	581	670	0.4	0.4	2.641	A
B	0	0	632	752	0.000	0	0	0.0	0.0	0.000	A
C	659	165	15	1709	0.386	659	617	0.7	0.7	3.574	A
D	79	20	642	964	0.082	79	32	0.1	0.1	4.239	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	581	145	51	2002	0.290	581	670	0.4	0.4	2.641	A
B	0	0	632	752	0.000	0	0	0.0	0.0	0.000	A
C	659	165	15	1709	0.386	659	617	0.7	0.7	3.574	A
D	79	20	642	964	0.082	79	32	0.1	0.1	4.239	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	581	145	51	2002	0.290	581	670	0.4	0.4	2.641	A
B	0	0	632	752	0.000	0	0	0.0	0.0	0.000	A
C	659	165	15	1709	0.386	659	617	0.7	0.7	3.574	A
D	79	20	642	964	0.082	79	32	0.1	0.1	4.239	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	581	145	51	2002	0.290	581	670	0.4	0.4	2.641	A
B	0	0	632	752	0.000	0	0	0.0	0.0	0.000	A
C	659	165	15	1709	0.386	659	617	0.7	0.7	3.574	A
D	79	20	642	964	0.082	79	32	0.1	0.1	4.239	A

2032 Without Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing R510/Ard Aulin/Site Access Roundabout	Standard Roundabout		A, B, C, D	3.31	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D2	2032 Without Development	AM	FLAT	07:45	09:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	615	100.000
B		FLAT	☐	0	100.000
C		FLAT	☐	697	100.000
D		FLAT	☐	83	100.000

Origin-Destination Data

Demand (PCU/hr)

	To				
		A	**B**	**C**	**D**
From	**A**	5	0	599	11
	B	0	0	0	0
	C	674	0	0	23
	D	29	0	54	0

Vehicle Mix

Heavy Vehicle Percentages

	To				
		A	**B**	**C**	**D**
From	**A**	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.31	2.71	0.5	A	615	923
B	0.00	0.00	0.0	A	0	0
C	0.41	3.71	0.7	A	697	1046
D	0.09	4.36	0.1	A	83	125

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	615	154	54	2000	0.308	613	705	0.0	0.5	2.704	A
B	0	0	667	734	0.000	0	0	0.0	0.0	0.000	A
C	697	174	16	1708	0.408	694	651	0.0	0.7	3.690	A
D	83	21	676	945	0.088	83	34	0.0	0.1	4.352	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	615	154	54	2000	0.308	615	708	0.5	0.5	2.710	A
B	0	0	669	732	0.000	0	0	0.0	0.0	0.000	A
C	697	174	16	1708	0.408	697	653	0.7	0.7	3.711	A
D	83	21	679	943	0.088	83	34	0.1	0.1	4.364	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	615	154	54	2000	0.308	615	708	0.5	0.5	2.710	A
B	0	0	669	732	0.000	0	0	0.0	0.0	0.000	A
C	697	174	16	1708	0.408	697	653	0.7	0.7	3.711	A
D	83	21	679	943	0.088	83	34	0.1	0.1	4.364	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	615	154	54	2000	0.308	615	708	0.5	0.5	2.710	A
B	0	0	669	732	0.000	0	0	0.0	0.0	0.000	A
C	697	174	16	1708	0.408	697	653	0.7	0.7	3.711	A
D	83	21	679	943	0.088	83	34	0.1	0.1	4.364	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	615	154	54	2000	0.308	615	708	0.5	0.5	2.710	A
B	0	0	669	732	0.000	0	0	0.0	0.0	0.000	A
C	697	174	16	1708	0.408	697	653	0.7	0.7	3.711	A
D	83	21	679	943	0.088	83	34	0.1	0.1	4.364	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	615	154	54	2000	0.308	615	708	0.5	0.5	2.710	A
B	0	0	669	732	0.000	0	0	0.0	0.0	0.000	A
C	697	174	16	1708	0.408	697	653	0.7	0.7	3.711	A
D	83	21	679	943	0.088	83	34	0.1	0.1	4.364	A

2042 Without Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing R510/Ard Aulin/Site Access Roundabout	Standard Roundabout		A, B, C, D	3.47	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D3	2042 Without Development	AM	FLAT	07:45	09:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	662	100.000
B		FLAT	☐	0	100.000
C		FLAT	☐	749	100.000
D		FLAT	☐	89	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	6	0	644	12
	B	0	0	0	0
	C	725	0	0	24
	D	31	0	58	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.33	2.81	0.5	A	662	993
B	0.00	0.00	0.0	A	0	0
C	0.44	3.92	0.8	A	749	1124
D	0.10	4.55	0.1	A	89	134

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	662	166	58	1997	0.331	660	759	0.0	0.5	2.804	A
B	0	0	718	707	0.000	0	0	0.0	0.0	0.000	A
C	749	187	18	1707	0.439	746	700	0.0	0.8	3.892	A
D	89	22	728	915	0.097	89	36	0.0	0.1	4.539	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	662	166	58	1997	0.332	662	762	0.5	0.5	2.811	A
B	0	0	720	706	0.000	0	0	0.0	0.0	0.000	A
C	749	187	18	1707	0.439	749	702	0.8	0.8	3.918	A
D	89	22	731	913	0.097	89	36	0.1	0.1	4.553	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	662	166	58	1997	0.332	662	762	0.5	0.5	2.811	A
B	0	0	720	706	0.000	0	0	0.0	0.0	0.000	A
C	749	187	18	1707	0.439	749	702	0.8	0.8	3.918	A
D	89	22	731	913	0.097	89	36	0.1	0.1	4.553	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service

A	662	166	58	1997	0.332	662	762	0.5	0.5	2.811	A
B	0	0	720	706	0.000	0	0	0.0	0.0	0.000	A
C	749	187	18	1707	0.439	749	702	0.8	0.8	3.918	A
D	89	22	731	913	0.097	89	36	0.1	0.1	4.553	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	662	166	58	1997	0.332	662	762	0.5	0.5	2.811	A
B	0	0	720	706	0.000	0	0	0.0	0.0	0.000	A
C	749	187	18	1707	0.439	749	702	0.8	0.8	3.918	A
D	89	22	731	913	0.097	89	36	0.1	0.1	4.553	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	662	166	58	1997	0.332	662	762	0.5	0.5	2.811	A
B	0	0	720	706	0.000	0	0	0.0	0.0	0.000	A
C	749	187	18	1707	0.439	749	702	0.8	0.8	3.918	A
D	89	22	731	913	0.097	89	36	0.1	0.1	4.553	A

2027 With Proposed Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing R510/Ard Aulin/Site Access Roundabout	Standard Roundabout		A, B, C, D	3.63	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D4	2027 With Proposed Development	AM	FLAT	07:45	09:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	605	100.000

B		FLAT	☐	118	100.000
C		FLAT	☐	709	100.000
D		FLAT	☐	81	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	5	24	566	10
	B	34	0	64	20
	C	637	50	0	22
	D	28	2	51	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	**B**	**C**	**D**
From	**A**	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.31	2.76	0.5	A	605	908
B	0.16	5.92	0.2	A	118	177
C	0.42	3.89	0.8	A	709	1064
D	0.09	4.49	0.1	A	81	122

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	605	151	103	1966	0.308	603	701	0.0	0.5	2.752	A
B	118	30	630	753	0.157	117	76	0.0	0.2	5.900	A
C	709	177	69	1675	0.423	706	679	0.0	0.8	3.865	A
D	81	20	723	918	0.088	81	52	0.0	0.1	4.480	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	605	151	103	1965	0.308	605	704	0.5	0.5	2.759	A
B	118	30	632	752	0.157	118	76	0.2	0.2	5.924	A

C	709	177	69	1674	0.423	709	681	0.8	0.8	3.888	A
D	81	20	726	916	0.088	81	52	0.1	0.1	4.494	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	605	151	103	1965	0.308	605	704	0.5	0.5	2.759	A
B	118	30	632	752	0.157	118	76	0.2	0.2	5.924	A
C	709	177	69	1674	0.423	709	681	0.8	0.8	3.888	A
D	81	20	726	916	0.088	81	52	0.1	0.1	4.494	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	605	151	103	1965	0.308	605	704	0.5	0.5	2.759	A
B	118	30	632	752	0.157	118	76	0.2	0.2	5.924	A
C	709	177	69	1674	0.423	709	681	0.8	0.8	3.888	A
D	81	20	726	916	0.088	81	52	0.1	0.1	4.494	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	605	151	103	1965	0.308	605	704	0.5	0.5	2.759	A
B	118	30	632	752	0.157	118	76	0.2	0.2	5.924	A
C	709	177	69	1674	0.423	709	681	0.8	0.8	3.888	A
D	81	20	726	916	0.088	81	52	0.1	0.1	4.494	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	605	151	103	1965	0.308	605	704	0.5	0.5	2.759	A
B	118	30	632	752	0.157	118	76	0.2	0.2	5.924	A
C	709	177	69	1674	0.423	709	681	0.8	0.8	3.888	A
D	81	20	726	916	0.088	81	52	0.1	0.1	4.494	A

2032 With Proposed Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing R510/Ard Aulin/Site Access Roundabout	Standard Roundabout		A, B, C, D	3.75	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D5	2032 With Proposed Development	AM	FLAT	07:45	09:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	639	100.000
B		FLAT	☐	118	100.000
C		FLAT	☐	747	100.000
D		FLAT	☐	85	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	5	24	599	11
	B	34	0	64	20
	C	674	50	0	23
	D	29	2	54	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	**B**	**C**	**D**
From	**A**	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.33	2.83	0.5	A	639	959
B	0.16	6.11	0.2	A	118	177
C	0.45	4.05	0.8	A	747	1121
D	0.09	4.63	0.1	A	85	128

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	639	160	105	1964	0.325	637	739	0.0	0.5	2.827	A
B	118	30	667	734	0.161	117	76	0.0	0.2	6.084	A
C	747	187	70	1674	0.446	744	714	0.0	0.8	4.021	A
D	85	21	760	897	0.095	85	54	0.0	0.1	4.619	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	639	160	106	1963	0.325	639	742	0.5	0.5	2.834	A
B	118	30	669	732	0.161	118	76	0.2	0.2	6.109	A
C	747	187	70	1674	0.446	747	717	0.8	0.8	4.051	A
D	85	21	763	895	0.095	85	54	0.1	0.1	4.634	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	639	160	106	1963	0.325	639	742	0.5	0.5	2.834	A
B	118	30	669	732	0.161	118	76	0.2	0.2	6.109	A
C	747	187	70	1674	0.446	747	717	0.8	0.8	4.051	A
D	85	21	763	895	0.095	85	54	0.1	0.1	4.634	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	639	160	106	1963	0.325	639	742	0.5	0.5	2.834	A
B	118	30	669	732	0.161	118	76	0.2	0.2	6.109	A
C	747	187	70	1674	0.446	747	717	0.8	0.8	4.051	A
D	85	21	763	895	0.095	85	54	0.1	0.1	4.634	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	639	160	106	1963	0.325	639	742	0.5	0.5	2.834	A
B	118	30	669	732	0.161	118	76	0.2	0.2	6.109	A
C	747	187	70	1674	0.446	747	717	0.8	0.8	4.051	A
D	85	21	763	895	0.095	85	54	0.1	0.1	4.634	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	639	160	106	1963	0.325	639	742	0.5	0.5	2.834	A
B	118	30	669	732	0.161	118	76	0.2	0.2	6.109	A
C	747	187	70	1674	0.446	747	717	0.8	0.8	4.051	A
D	85	21	763	895	0.095	85	54	0.1	0.1	4.634	A

2042 With Proposed Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing R510/Ard Aulin/Site Access Roundabout	Standard Roundabout		A, B, C, D	3.92	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D6	2042 With Proposed Development	AM	FLAT	07:45	09:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	686	100.000
B		FLAT	☐	118	100.000
C		FLAT	☐	799	100.000
D		FLAT	☐	91	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	6	24	644	12
	B	34	0	64	20
	C	725	50	0	24
	D	31	2	58	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	**B**	**C**	**D**
From	**A**	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.35	2.94	0.6	A	686	1029
B	0.17	6.38	0.2	A	118	177
C	0.48	4.30	1.0	A	799	1199
D	0.11	4.85	0.1	A	91	137

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	686	172	109	1961	0.350	684	792	0.0	0.6	2.935	A
B	118	30	718	707	0.167	117	76	0.0	0.2	6.353	A
C	799	200	72	1673	0.478	795	763	0.0	0.9	4.261	A
D	91	23	811	868	0.105	91	56	0.0	0.1	4.828	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	686	172	110	1960	0.350	686	796	0.6	0.6	2.945	A
B	118	30	720	706	0.167	118	76	0.2	0.2	6.384	A
C	799	200	72	1672	0.478	799	766	0.9	0.9	4.298	A
D	91	23	815	865	0.105	91	56	0.1	0.1	4.848	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	686	172	110	1960	0.350	686	796	0.6	0.6	2.945	A
B	118	30	720	706	0.167	118	76	0.2	0.2	6.384	A
C	799	200	72	1672	0.478	799	766	0.9	1.0	4.298	A
D	91	23	815	865	0.105	91	56	0.1	0.1	4.848	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	686	172	110	1960	0.350	686	796	0.6	0.6	2.945	A
B	118	30	720	706	0.167	118	76	0.2	0.2	6.384	A
C	799	200	72	1672	0.478	799	766	1.0	1.0	4.298	A
D	91	23	815	865	0.105	91	56	0.1	0.1	4.848	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	686	172	110	1960	0.350	686	796	0.6	0.6	2.945	A
B	118	30	720	706	0.167	118	76	0.2	0.2	6.384	A
C	799	200	72	1672	0.478	799	766	1.0	1.0	4.298	A
D	91	23	815	865	0.105	91	56	0.1	0.1	4.848	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	686	172	110	1960	0.350	686	796	0.6	0.6	2.945	A
B	118	30	720	706	0.167	118	76	0.2	0.2	6.384	A
C	799	200	72	1672	0.478	799	766	1.0	1.0	4.298	A
D	91	23	815	865	0.105	91	56	0.1	0.1	4.848	A

2027 Without Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing R510/Ard Aulin/Site Access Roundabout	Standard Roundabout		A, B, C, D	3.57	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D7	2027 Without Development	PM	FLAT	16:45	18:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	686	100.000
B		FLAT	☐	0	100.000
C		FLAT	☐	798	100.000
D		FLAT	☐	40	100.000

Origin-Destination Data

Demand (PCU/hr)

	To				
		A	**B**	**C**	**D**
From	**A**	5	0	654	27
	B	0	0	0	0
	C	765	0	0	33
	D	14	0	26	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.34	2.81	0.5	A	686	1029
B	0.00	0.00	0.0	A	0	0
C	0.47	4.17	0.9	A	798	1197
D	0.04	4.41	0.0	A	40	60

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	686	172	26	2019	0.340	684	780	0.0	0.5	2.806	A
B	0	0	710	711	0.000	0	0	0.0	0.0	0.000	A
C	798	200	32	1698	0.470	794	678	0.0	0.9	4.137	A
D	40	10	766	893	0.045	40	60	0.0	0.0	4.398	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	686	172	26	2019	0.340	686	784	0.5	0.5	2.815	A
B	0	0	712	710	0.000	0	0	0.0	0.0	0.000	A
C	798	200	32	1698	0.470	798	680	0.9	0.9	4.170	A
D	40	10	770	891	0.045	40	60	0.0	0.0	4.410	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	686	172	26	2019	0.340	686	784	0.5	0.5	2.815	A
B	0	0	712	710	0.000	0	0	0.0	0.0	0.000	A
C	798	200	32	1698	0.470	798	680	0.9	0.9	4.170	A
D	40	10	770	891	0.045	40	60	0.0	0.0	4.410	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service

A	686	172	26	2019	0.340	686	784	0.5	0.5	2.815	A
B	0	0	712	710	0.000	0	0	0.0	0.0	0.000	A
C	798	200	32	1698	0.470	798	680	0.9	0.9	4.170	A
D	40	10	770	891	0.045	40	60	0.0	0.0	4.410	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	686	172	26	2019	0.340	686	784	0.5	0.5	2.815	A
B	0	0	712	710	0.000	0	0	0.0	0.0	0.000	A
C	798	200	32	1698	0.470	798	680	0.9	0.9	4.170	A
D	40	10	770	891	0.045	40	60	0.0	0.0	4.410	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	686	172	26	2019	0.340	686	784	0.5	0.5	2.815	A
B	0	0	712	710	0.000	0	0	0.0	0.0	0.000	A
C	798	200	32	1698	0.470	798	680	0.9	0.9	4.170	A
D	40	10	770	891	0.045	40	60	0.0	0.0	4.410	A

2032 Without Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing R510/Ard Aulin/Site Access Roundabout	Standard Roundabout		A, B, C, D	3.73	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D8	2032 Without Development	PM	FLAT	16:45	18:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	726	100.000

B		FLAT	☐	0	100.000
C		FLAT	☐	844	100.000
D		FLAT	☐	42	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	5	0	692	29
	B	0	0	0	0
	C	809	0	0	35
	D	14	0	28	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	**B**	**C**	**D**
From	**A**	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.36	2.90	0.6	A	726	1089
B	0.00	0.00	0.0	A	0	0
C	0.50	4.40	1.0	A	844	1266
D	0.05	4.56	0.1	A	42	63

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	726	182	28	2018	0.360	724	824	0.0	0.6	2.896	A
B	0	0	752	690	0.000	0	0	0.0	0.0	0.000	A
C	844	211	34	1697	0.497	840	718	0.0	1.0	4.360	A
D	42	11	810	868	0.048	42	64	0.0	0.1	4.542	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	726	182	28	2018	0.360	726	828	0.6	0.6	2.905	A
B	0	0	754	688	0.000	0	0	0.0	0.0	0.000	A

C	844	211	34	1697	0.497	844	720	1.0	1.0	4.401	A
D	42	11	814	866	0.049	42	64	0.1	0.1	4.556	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	726	182	28	2018	0.360	726	828	0.6	0.6	2.905	A
B	0	0	754	688	0.000	0	0	0.0	0.0	0.000	A
C	844	211	34	1697	0.497	844	720	1.0	1.0	4.401	A
D	42	11	814	866	0.049	42	64	0.1	0.1	4.556	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	726	182	28	2018	0.360	726	828	0.6	0.6	2.905	A
B	0	0	754	688	0.000	0	0	0.0	0.0	0.000	A
C	844	211	34	1697	0.497	844	720	1.0	1.0	4.401	A
D	42	11	814	866	0.049	42	64	0.1	0.1	4.556	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	726	182	28	2018	0.360	726	828	0.6	0.6	2.905	A
B	0	0	754	688	0.000	0	0	0.0	0.0	0.000	A
C	844	211	34	1697	0.497	844	720	1.0	1.0	4.401	A
D	42	11	814	866	0.049	42	64	0.1	0.1	4.556	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	726	182	28	2018	0.360	726	828	0.6	0.6	2.905	A
B	0	0	754	688	0.000	0	0	0.0	0.0	0.000	A
C	844	211	34	1697	0.497	844	720	1.0	1.0	4.401	A
D	42	11	814	866	0.049	42	64	0.1	0.1	4.556	A

2042 Without Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing R510/Ard Aulin/Site Access Roundabout	Standard Roundabout		A, B, C, D	3.99	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D9	2042 Without Development	PM	FLAT	16:45	18:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	781	100.000
B		FLAT	☐	0	100.000
C		FLAT	☐	907	100.000
D		FLAT	☐	45	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	6	0	744	31
	B	0	0	0	0
	C	870	0	0	37
	D	15	0	30	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	**B**	**C**	**D**
From	**A**	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.39	3.04	0.7	A	781	1172
B	0.00	0.00	0.0	A	0	0
C	0.54	4.76	1.2	A	907	1361
D	0.05	4.78	0.1	A	45	68

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	781	195	30	2017	0.387	778	886	0.0	0.7	3.025	A
B	0	0	808	660	0.000	0	0	0.0	0.0	0.000	A
C	907	227	37	1695	0.535	902	771	0.0	1.2	4.708	A
D	45	11	871	833	0.054	45	68	0.0	0.1	4.762	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	781	195	30	2017	0.387	781	891	0.7	0.7	3.037	A
B	0	0	811	659	0.000	0	0	0.0	0.0	0.000	A
C	907	227	37	1695	0.535	907	774	1.2	1.2	4.764	A
D	45	11	876	830	0.054	45	68	0.1	0.1	4.779	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	781	195	30	2017	0.387	781	891	0.7	0.7	3.037	A
B	0	0	811	659	0.000	0	0	0.0	0.0	0.000	A
C	907	227	37	1695	0.535	907	774	1.2	1.2	4.764	A
D	45	11	876	830	0.054	45	68	0.1	0.1	4.780	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	781	195	30	2017	0.387	781	891	0.7	0.7	3.037	A
B	0	0	811	659	0.000	0	0	0.0	0.0	0.000	A
C	907	227	37	1695	0.535	907	774	1.2	1.2	4.764	A
D	45	11	876	830	0.054	45	68	0.1	0.1	4.780	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	781	195	30	2017	0.387	781	891	0.7	0.7	3.037	A
B	0	0	811	659	0.000	0	0	0.0	0.0	0.000	A
C	907	227	37	1695	0.535	907	774	1.2	1.2	4.764	A
D	45	11	876	830	0.054	45	68	0.1	0.1	4.780	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	781	195	30	2017	0.387	781	891	0.7	0.7	3.037	A
B	0	0	811	659	0.000	0	0	0.0	0.0	0.000	A
C	907	227	37	1695	0.535	907	774	1.2	1.2	4.764	A
D	45	11	876	830	0.054	45	68	0.1	0.1	4.780	A

2027 With Proposed Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing R510/Ard Aulin/Site Access Roundabout	Standard Roundabout		A, B, C, D	3.87	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D10	2027 With Proposed Development	PM	FLAT	16:45	18:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	715	100.000
B		FLAT	☐	74	100.000
C		FLAT	☐	833	100.000
D		FLAT	☐	41	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	5	29	654	27
	B	21	0	40	13
	C	765	35	0	33
	D	14	1	26	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	**B**	**C**	**D**
From	**A**	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.36	2.93	0.6	A	715	1073
B	0.10	5.90	0.1	A	74	111
C	0.50	4.45	1.0	A	833	1250
D	0.05	4.59	0.1	A	41	62

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	715	179	62	1994	0.359	713	801	0.0	0.6	2.924	A
B	74	19	710	711	0.104	74	65	0.0	0.1	5.883	A
C	833	208	66	1676	0.497	829	717	0.0	1.0	4.409	A
D	41	10	822	861	0.048	41	73	0.0	0.1	4.574	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	715	179	62	1994	0.359	715	805	0.6	0.6	2.934	A
B	74	19	712	710	0.104	74	65	0.1	0.1	5.901	A
C	833	208	66	1676	0.497	833	720	1.0	1.0	4.451	A
D	41	10	826	859	0.048	41	73	0.1	0.1	4.589	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	715	179	62	1994	0.359	715	805	0.6	0.6	2.934	A
B	74	19	712	710	0.104	74	65	0.1	0.1	5.901	A
C	833	208	66	1676	0.497	833	720	1.0	1.0	4.451	A
D	41	10	826	859	0.048	41	73	0.1	0.1	4.589	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	715	179	62	1994	0.359	715	805	0.6	0.6	2.934	A
B	74	19	712	710	0.104	74	65	0.1	0.1	5.901	A
C	833	208	66	1676	0.497	833	720	1.0	1.0	4.451	A
D	41	10	826	859	0.048	41	73	0.1	0.1	4.589	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	715	179	62	1994	0.359	715	805	0.6	0.6	2.934	A
B	74	19	712	710	0.104	74	65	0.1	0.1	5.901	A
C	833	208	66	1676	0.497	833	720	1.0	1.0	4.451	A
D	41	10	826	859	0.048	41	73	0.1	0.1	4.589	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	715	179	62	1994	0.359	715	805	0.6	0.6	2.934	A
B	74	19	712	710	0.104	74	65	0.1	0.1	5.901	A
C	833	208	66	1676	0.497	833	720	1.0	1.0	4.451	A
D	41	10	826	859	0.048	41	73	0.1	0.1	4.589	A

2032 With Proposed Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing R510/Ard Aulin/Site Access Roundabout	Standard Roundabout		A, B, C, D	4.05	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D11	2032 With Proposed Development	PM	FLAT	16:45	18:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	755	100.000
B		FLAT	☐	74	100.000
C		FLAT	☐	879	100.000
D		FLAT	☐	43	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	5	29	692	29
	B	21	0	40	13
	C	809	35	0	35
	D	14	1	28	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.38	3.03	0.6	A	755	1133
B	0.11	6.11	0.1	A	74	111
C	0.52	4.72	1.1	A	879	1319
D	0.05	4.75	0.1	A	43	65

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	755	189	64	1993	0.379	752	845	0.0	0.6	3.020	A
B	74	19	751	690	0.107	74	65	0.0	0.1	6.088	A
C	879	220	68	1675	0.525	874	757	0.0	1.1	4.663	A
D	43	11	865	836	0.051	43	77	0.0	0.1	4.729	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	755	189	64	1993	0.379	755	849	0.6	0.6	3.032	A
B	74	19	754	688	0.108	74	65	0.1	0.1	6.110	A
C	879	220	68	1675	0.525	879	760	1.1	1.1	4.716	A
D	43	11	870	834	0.052	43	77	0.1	0.1	4.747	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	755	189	64	1993	0.379	755	849	0.6	0.6	3.032	A
B	74	19	754	688	0.108	74	65	0.1	0.1	6.110	A
C	879	220	68	1675	0.525	879	760	1.1	1.1	4.716	A
D	43	11	870	834	0.052	43	77	0.1	0.1	4.747	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service

A	755	189	64	1993	0.379	755	849	0.6	0.6	3.032	A
B	74	19	754	688	0.108	74	65	0.1	0.1	6.110	A
C	879	220	68	1675	0.525	879	760	1.1	1.1	4.716	A
D	43	11	870	834	0.052	43	77	0.1	0.1	4.747	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	755	189	64	1993	0.379	755	849	0.6	0.6	3.032	A
B	74	19	754	688	0.108	74	65	0.1	0.1	6.110	A
C	879	220	68	1675	0.525	879	760	1.1	1.1	4.716	A
D	43	11	870	834	0.052	43	77	0.1	0.1	4.747	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	755	189	64	1993	0.379	755	849	0.6	0.6	3.032	A
B	74	19	754	688	0.108	74	65	0.1	0.1	6.110	A
C	879	220	68	1675	0.525	879	760	1.1	1.1	4.716	A
D	43	11	870	834	0.052	43	77	0.1	0.1	4.747	A

2042 With Proposed Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing R510/Ard Aulin/Site Access Roundabout	Standard Roundabout		A, B, C, D	4.33	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D12	2042 With Proposed Development	PM	FLAT	16:45	18:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)

A		FLAT	☐	810	100.000
B		FLAT	☐	74	100.000
C		FLAT	☐	942	100.000
D		FLAT	☐	46	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	6	29	744	31
	B	21	0	40	13
	C	870	35	0	37
	D	15	1	30	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	**B**	**C**	**D**
From	**A**	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.41	3.18	0.7	A	810	1215
B	0.11	6.42	0.1	A	74	111
C	0.56	5.13	1.3	A	942	1413
D	0.06	4.99	0.1	A	46	69

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	810	203	66	1992	0.407	807	907	0.0	0.7	3.161	A
B	74	19	808	660	0.112	73	65	0.0	0.1	6.393	A
C	942	236	71	1673	0.563	937	811	0.0	1.3	5.061	A
D	46	12	927	801	0.057	46	81	0.0	0.1	4.968	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	810	203	66	1991	0.407	810	912	0.7	0.7	3.177	A

B	74	19	811	659	0.112	74	65	0.1	0.1	6.420	A
C	942	236	71	1673	0.563	942	814	1.3	1.3	5.135	A
D	46	12	932	798	0.058	46	81	0.1	0.1	4.990	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	810	203	66	1991	0.407	810	912	0.7	0.7	3.177	A
B	74	19	811	659	0.112	74	65	0.1	0.1	6.420	A
C	942	236	71	1673	0.563	942	814	1.3	1.3	5.135	A
D	46	12	932	798	0.058	46	81	0.1	0.1	4.990	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	810	203	66	1991	0.407	810	912	0.7	0.7	3.177	A
B	74	19	811	659	0.112	74	65	0.1	0.1	6.420	A
C	942	236	71	1673	0.563	942	814	1.3	1.3	5.135	A
D	46	12	932	798	0.058	46	81	0.1	0.1	4.990	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	810	203	66	1991	0.407	810	912	0.7	0.7	3.177	A
B	74	19	811	659	0.112	74	65	0.1	0.1	6.420	A
C	942	236	71	1673	0.563	942	814	1.3	1.3	5.135	A
D	46	12	932	798	0.058	46	81	0.1	0.1	4.990	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	810	203	66	1991	0.407	810	912	0.7	0.7	3.177	A
B	74	19	811	659	0.112	74	65	0.1	0.1	6.420	A
C	942	236	71	1673	0.563	942	814	1.3	1.3	5.135	A
D	46	12	932	798	0.058	46	81	0.1	0.1	4.990	A

Junctions 9

ARCADY 9 - Roundabout Module

Version: 9.5.1.7462

For sales and distribution information, program advice and maintenance, contact TRL:
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Filename: quinns_cross.j9
Path: D:\ttrsa\projects\T210607_Ballykeefe_Limerick_EIAR_Chapter_MMP\eiar_chapter\modelling
Report generation date: 07/03/2022 17:26:19

Summary of junction performance

	AM					PM				
	Set ID	**Queue (PCU)**	**Delay (s)**	**RFC**	**LOS**	**Set ID**	**Queue (PCU)**	**Delay (s)**	**RFC**	**LOS**
	2027 Without Development									
Arm A	D1	0.6	3.88	0.38	A	D7	0.7	3.68	0.40	A
Arm B		0.8	4.93	0.43	A		0.8	4.53	0.44	A
Arm C		1.1	4.98	0.52	A		1.8	6.60	0.64	A
Arm D		1.4	6.29	0.58	A		0.4	4.33	0.30	A
	2032 Without Development									
Arm A	D2	0.7	4.14	0.41	A	D8	0.8	3.90	0.43	A
Arm B		0.9	5.35	0.47	A		0.9	4.86	0.47	A
Arm C		1.3	5.44	0.56	A		2.2	7.57	0.68	A
Arm D		1.7	7.08	0.62	A		0.5	4.60	0.33	A
	2042 Without Development									
Arm A	D3	0.9	4.54	0.45	A	D9	0.9	4.24	0.47	A
Arm B		1.1	6.04	0.52	A		1.1	5.38	0.51	A
Arm C		1.6	6.19	0.61	A		3.0	9.47	0.74	A
Arm D		2.2	8.50	0.68	A		0.6	5.02	0.36	A
	2027 With Proposed Development									
Arm A	D4	0.8	4.15	0.42	A	D10	0.8	3.83	0.42	A
Arm B		0.9	5.20	0.45	A		0.8	4.66	0.45	A
Arm C		1.2	5.21	0.54	A		2.0	6.95	0.65	A
Arm D		1.5	6.65	0.59	A		0.5	4.43	0.31	A
	2032 With Proposed Development									
Arm A	D5	0.9	4.45	0.45	A	D11	0.9	4.06	0.45	A

Arm B		1.0	5.67	0.49	A		1.0	5.00	0.48	A
Arm C		1.4	5.72	0.58	A		2.4	8.04	0.70	A
Arm D		1.8	7.54	0.64	A		0.5	4.71	0.33	A
	2042 With Proposed Development									
Arm A	D6	1.0	4.93	0.49	A	D12	1.7	7.53	0.62	A
Arm B		1.2	6.46	0.54	A		3.5	17.06	0.77	C
Arm C		1.7	6.57	0.63	A		19.5	63.56	0.96	F
Arm D		2.4	9.18	0.70	A		1.3	11.41	0.57	B

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle.

File summary

File Description

Title	Existing Quinns Cross Roundabout
Location	Ballykeefe Limerick
Site number	
Date	26/01/2022
Version	EIAR
Status	Final
Identifier	
Client	DW Raheen
Jobnumber	T210607
Enumerator	TTRSA
Description	Whilst the existing zebra pedestrian crossing have been included within the model, the pedestrian flows have been assigned a notional value as this data has not been collected and provided to TTRSA for inclusion within this model.

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin

Analysis Options

Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Calculate residual capacity	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
5.75				0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D1	2027 Without Development	AM	FLAT	07:45	09:15	90	15	☐
D2	2032 Without Development	AM	FLAT	07:45	09:15	90	15	☐
D3	2042 Without Development	AM	FLAT	07:45	09:15	90	15	☐
D4	2027 With Proposed Development	AM	FLAT	07:45	09:15	90	15	☐
D5	2032 With Proposed Development	AM	FLAT	07:45	09:15	90	15	☐
D6	2042 With Proposed Development	AM	FLAT	07:45	09:15	90	15	☐
D7	2027 Without Development	PM	FLAT	16:45	18:15	90	15	☐
D8	2032 Without Development	PM	FLAT	16:45	18:15	90	15	☐
D9	2042 Without Development	PM	FLAT	16:45	18:15	90	15	☐

D10	2027 With Proposed Development	PM	FLAT	16:45	18:15	90	15	☐
D11	2032 With Proposed Development	PM	FLAT	16:45	18:15	90	15	☐
D12	2042 With Proposed Development	PM	FLAT	16:45	18:15	90	15	☐

Analysis Set Details

ID	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	☐	100.000	100.000

2027 Without Development, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Pedestrian Crossing	Arm A - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm B - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm C - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm D - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing Quinns Cross Roundabout	Standard Roundabout		A, B, C, D	5.11	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Arms

Arms

Arm	Name	Description
A	R510 to/from North	
B	Father Russell Road	
C	R510 to/from South	
D	Mungret Road	

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
A	3.70	7.40	30.0	27.0	68.0	22.0	
B	3.30	6.80	26.0	13.5	68.0	16.0	
C	3.25	7.00	30.0	25.0	68.0	28.0	
D	3.20	7.10	22.0	25.0	68.0	32.0	

Zebra Crossings

Arm	Space between crossing and junction entry (Zebra) (PCU)	Vehicles queueing on exit (Zebra) (PCU)	Central Refuge	Crossing data type	Crossing length (entry side) (m)	Crossing time (entry side) (s)	Crossing length (exit side) (m)	Crossing time (exit side) (s)
A	2.00	1.00	☐	Distance	6.20	4.43	5.90	4.21
B	2.00	1.00	☐	Distance	5.80	4.14	5.50	3.93

C	2.00	1.00	☐	Distance	6.70	4.79	6.10	4.36
D	2.00	1.00	☐	Distance	5.60	4.00	6.60	4.71

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Final slope	Final intercept (PCU/hr)
A	0.573	2003
B	0.534	1785
C	0.539	1826
D	0.520	1728

The slope and intercept shown above include any corrections and adjustments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D1	2027 Without Development	AM	FLAT	07:45	09:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	598	100.000
B		FLAT	☐	583	100.000
C		FLAT	☐	816	100.000
D		FLAT	☐	814	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
A	[FLAT]	0.00
B	[FLAT]	0.00
C	[FLAT]	0.00
D	[FLAT]	0.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	2	108	418	70
	B	156	0	180	247
	C	314	136	3	363
	D	190	294	330	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.38	3.88	0.6	A	598	897
B	0.43	4.93	0.8	A	583	875
C	0.52	4.98	1.1	A	816	1224
D	0.58	6.29	1.4	A	814	1221

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	598	150	758	0.00	1568	0.381	595	658	0.0	0.6	3.848	A
B	583	146	819	0.00	1347	0.433	580	535	0.0	0.8	4.873	A
C	816	204	473	0.00	1572	0.519	812	926	0.0	1.1	4.911	A
D	814	204	608	0.00	1413	0.576	808	676	0.0	1.4	6.159	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	598	150	763	0.00	1566	0.382	598	662	0.6	0.6	3.879	A
B	583	146	823	0.00	1345	0.433	583	538	0.8	0.8	4.927	A
C	816	204	475	0.00	1570	0.520	816	931	1.1	1.1	4.976	A
D	814	204	611	0.00	1411	0.577	814	680	1.4	1.4	6.290	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	598	150	763	0.00	1566	0.382	598	662	0.6	0.6	3.879	A
B	583	146	823	0.00	1345	0.433	583	538	0.8	0.8	4.927	A
C	816	204	475	0.00	1570	0.520	816	931	1.1	1.1	4.976	A
D	814	204	611	0.00	1411	0.577	814	680	1.4	1.4	6.290	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service

A	598	150	763	0.00	1566	0.382	598	662	0.6	0.6	3.879	A
B	583	146	823	0.00	1345	0.433	583	538	0.8	0.8	4.927	A
C	816	204	475	0.00	1570	0.520	816	931	1.1	1.1	4.976	A
D	814	204	611	0.00	1411	0.577	814	680	1.4	1.4	6.290	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	598	150	763	0.00	1566	0.382	598	662	0.6	0.6	3.879	A
B	583	146	823	0.00	1345	0.433	583	538	0.8	0.8	4.927	A
C	816	204	475	0.00	1570	0.520	816	931	1.1	1.1	4.976	A
D	814	204	611	0.00	1411	0.577	814	680	1.4	1.4	6.290	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	598	150	763	0.00	1566	0.382	598	662	0.6	0.6	3.879	A
B	583	146	823	0.00	1345	0.433	583	538	0.8	0.8	4.927	A
C	816	204	475	0.00	1570	0.520	816	931	1.1	1.1	4.976	A
D	814	204	611	0.00	1411	0.577	814	680	1.4	1.4	6.290	A

2032 Without Development, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Pedestrian Crossing	Arm A - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm B - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm C - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm D - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing Quinns Cross Roundabout	Standard Roundabout		A, B, C, D	5.62	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D2	2032 Without Development	AM	FLAT	07:45	09:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	634	100.000
B		FLAT	☐	617	100.000
C		FLAT	☐	865	100.000
D		FLAT	☐	861	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
A	[FLAT]	0.00
B	[FLAT]	0.00
C	[FLAT]	0.00
D	[FLAT]	0.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	2	115	443	74
	B	165	0	190	262
	C	333	144	4	384
	D	201	311	349	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	**B**	**C**	**D**
From	**A**	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.41	4.14	0.7	A	634	951
B	0.47	5.35	0.9	A	617	926
C	0.56	5.44	1.3	A	865	1298
D	0.62	7.08	1.7	A	861	1292

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	634	159	802	0.00	1543	0.411	631	696	0.0	0.7	4.091	A
B	617	154	867	0.00	1321	0.467	613	566	0.0	0.9	5.277	A
C	865	216	500	0.00	1557	0.556	860	980	0.0	1.3	5.348	A
D	861	215	644	0.00	1394	0.618	854	716	0.0	1.7	6.884	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	634	159	808	0.00	1540	0.412	634	701	0.7	0.7	4.144	A
B	617	154	872	0.00	1319	0.468	617	570	0.9	0.9	5.349	A
C	865	216	503	0.00	1555	0.556	865	986	1.3	1.3	5.438	A
D	861	215	648	0.00	1392	0.619	861	720	1.7	1.7	7.072	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	634	159	808	0.00	1540	0.412	634	701	0.7	0.7	4.144	A
B	617	154	872	0.00	1319	0.468	617	570	0.9	0.9	5.349	A
C	865	216	503	0.00	1555	0.556	865	986	1.3	1.3	5.438	A
D	861	215	648	0.00	1392	0.619	861	720	1.7	1.7	7.075	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	634	159	808	0.00	1540	0.412	634	701	0.7	0.7	4.144	A
B	617	154	872	0.00	1319	0.468	617	570	0.9	0.9	5.349	A
C	865	216	503	0.00	1555	0.556	865	986	1.3	1.3	5.438	A
D	861	215	648	0.00	1392	0.619	861	720	1.7	1.7	7.075	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	634	159	808	0.00	1540	0.412	634	701	0.7	0.7	4.144	A
B	617	154	872	0.00	1319	0.468	617	570	0.9	0.9	5.349	A
C	865	216	503	0.00	1555	0.556	865	986	1.3	1.3	5.438	A
D	861	215	648	0.00	1392	0.619	861	720	1.7	1.7	7.075	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	634	159	808	0.00	1540	0.412	634	701	0.7	0.7	4.144	A
B	617	154	872	0.00	1319	0.468	617	570	0.9	0.9	5.349	A
C	865	216	503	0.00	1555	0.556	865	986	1.3	1.3	5.438	A
D	861	215	648	0.00	1392	0.619	861	720	1.7	1.7	7.075	A

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Pedestrian Crossing	Arm A - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm B - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm C - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm D - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing Quinns Cross Roundabout	Standard Roundabout		A, B, C, D	6.48	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D3	2042 Without Development	AM	FLAT	07:45	09:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	680	100.000
B		FLAT	☐	663	100.000
C		FLAT	☐	929	100.000
D		FLAT	☐	925	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
A	[FLAT]	0.00
B	[FLAT]	0.00
C	[FLAT]	0.00
D	[FLAT]	0.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	B	C	D
From	A	2	123	476	79
	B	178	0	204	281
	C	358	154	4	413
	D	216	334	375	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.45	4.54	0.9	A	680	1020
B	0.52	6.04	1.1	A	663	995
C	0.61	6.19	1.6	A	929	1394
D	0.68	8.50	2.2	A	925	1388

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	680	170	859	0.00	1510	0.450	677	748	0.0	0.8	4.486	A
B	663	166	930	0.00	1288	0.515	659	606	0.0	1.1	5.927	A
C	929	232	537	0.00	1537	0.604	923	1052	0.0	1.6	6.052	A
D	925	231	691	0.00	1369	0.676	917	768	0.0	2.1	8.153	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	680	170	867	0.00	1506	0.452	680	754	0.8	0.9	4.544	A
B	663	166	936	0.00	1285	0.516	663	611	1.1	1.1	6.039	A
C	929	232	540	0.00	1535	0.605	929	1059	1.6	1.6	6.188	A
D	925	231	696	0.00	1367	0.677	925	773	2.1	2.2	8.491	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	680	170	867	0.00	1506	0.452	680	754	0.9	0.9	4.544	A
B	663	166	936	0.00	1285	0.516	663	611	1.1	1.1	6.039	A
C	929	232	540	0.00	1535	0.605	929	1059	1.6	1.6	6.191	A
D	925	231	696	0.00	1367	0.677	925	773	2.2	2.2	8.498	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	680	170	867	0.00	1506	0.452	680	754	0.9	0.9	4.544	A
B	663	166	936	0.00	1285	0.516	663	611	1.1	1.1	6.039	A
C	929	232	540	0.00	1535	0.605	929	1059	1.6	1.6	6.191	A
D	925	231	696	0.00	1367	0.677	925	773	2.2	2.2	8.500	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	680	170	867	0.00	1506	0.452	680	754	0.9	0.9	4.544	A
B	663	166	936	0.00	1285	0.516	663	611	1.1	1.1	6.039	A
C	929	232	540	0.00	1535	0.605	929	1059	1.6	1.6	6.191	A
D	925	231	696	0.00	1367	0.677	925	773	2.2	2.2	8.500	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	680	170	867	0.00	1506	0.452	680	754	0.9	0.9	4.544	A
B	663	166	936	0.00	1285	0.516	663	611	1.1	1.1	6.039	A
C	929	232	540	0.00	1535	0.605	929	1059	1.6	1.6	6.191	A
D	925	231	696	0.00	1367	0.677	925	773	2.2	2.2	8.500	A

2027 With Proposed Development, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Pedestrian Crossing	Arm A - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm B - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm C - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm D - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing Quinns Cross Roundabout	Standard Roundabout		A, B, C, D	5.38	A

Junction Network Options

Driving side	Lighting

Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D4	2027 With Proposed Development	AM	FLAT	07:45	09:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	662	100.000
B		FLAT	☐	595	100.000
C		FLAT	☐	840	100.000
D		FLAT	☐	828	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
A	[FLAT]	0.00
B	[FLAT]	0.00
C	[FLAT]	0.00
D	[FLAT]	0.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	2	120	463	77
	B	168	0	180	247
	C	338	136	3	363
	D	204	294	330	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	**B**	**C**	**D**
From	**A**	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.42	4.15	0.8	A	662	993
B	0.45	5.20	0.9	A	595	893
C	0.54	5.21	1.2	A	840	1260
D	0.59	6.65	1.5	A	828	1242

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	662	166	758	0.00	1569	0.422	659	708	0.0	0.8	4.114	A
B	595	149	870	0.00	1320	0.451	592	547	0.0	0.8	5.133	A
C	840	210	491	0.00	1562	0.538	835	970	0.0	1.2	5.135	A
D	828	207	643	0.00	1394	0.594	822	683	0.0	1.5	6.498	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	662	166	763	0.00	1566	0.423	662	712	0.8	0.8	4.154	A
B	595	149	875	0.00	1317	0.452	595	550	0.8	0.9	5.198	A
C	840	210	494	0.00	1560	0.538	840	976	1.2	1.2	5.213	A
D	828	207	647	0.00	1392	0.595	828	687	1.5	1.5	6.652	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	662	166	763	0.00	1566	0.423	662	712	0.8	0.8	4.154	A
B	595	149	875	0.00	1317	0.452	595	550	0.9	0.9	5.198	A
C	840	210	494	0.00	1560	0.538	840	976	1.2	1.2	5.213	A
D	828	207	647	0.00	1392	0.595	828	687	1.5	1.5	6.655	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	662	166	763	0.00	1566	0.423	662	712	0.8	0.8	4.154	A
B	595	149	875	0.00	1317	0.452	595	550	0.9	0.9	5.198	A
C	840	210	494	0.00	1560	0.538	840	976	1.2	1.2	5.213	A
D	828	207	647	0.00	1392	0.595	828	687	1.5	1.5	6.655	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	662	166	763	0.00	1566	0.423	662	712	0.8	0.8	4.154	A
B	595	149	875	0.00	1317	0.452	595	550	0.9	0.9	5.198	A
C	840	210	494	0.00	1560	0.538	840	976	1.2	1.2	5.213	A
D	828	207	647	0.00	1392	0.595	828	687	1.5	1.5	6.655	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	662	166	763	0.00	1566	0.423	662	712	0.8	0.8	4.154	A
B	595	149	875	0.00	1317	0.452	595	550	0.9	0.9	5.198	A
C	840	210	494	0.00	1560	0.538	840	976	1.2	1.2	5.213	A
D	828	207	647	0.00	1392	0.595	828	687	1.5	1.5	6.655	A

2032 With Proposed Development, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Pedestrian Crossing	Arm A - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm B - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm C - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm D - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing Quinns Cross Roundabout	Standard Roundabout		A, B, C, D	5.94	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D5	2032 With Proposed Development	AM	FLAT	07:45	09:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	697	100.000
B		FLAT	☐	629	100.000
C		FLAT	☐	889	100.000
D		FLAT	☐	875	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
A	[FLAT]	0.00

B	[FLAT]	0.00
C	[FLAT]	0.00
D	[FLAT]	0.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	2	126	488	81
	B	177	0	190	262
	C	357	144	4	384
	D	215	311	349	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	**B**	**C**	**D**
From	**A**	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.45	4.45	0.9	A	697	1046
B	0.49	5.67	1.0	A	629	944
C	0.58	5.72	1.4	A	889	1334
D	0.64	7.54	1.8	A	875	1313

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	697	174	802	0.00	1543	0.452	694	746	0.0	0.9	4.400	A
B	629	157	918	0.00	1294	0.486	625	577	0.0	1.0	5.581	A
C	889	222	519	0.00	1547	0.575	883	1025	0.0	1.4	5.616	A
D	875	219	680	0.00	1375	0.636	868	723	0.0	1.8	7.304	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	697	174	808	0.00	1540	0.453	697	751	0.9	0.9	4.454	A
B	629	157	924	0.00	1291	0.487	629	581	1.0	1.0	5.670	A
C	889	222	522	0.00	1545	0.575	889	1031	1.4	1.4	5.722	A
D	875	219	684	0.00	1373	0.637	875	727	1.8	1.8	7.537	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	697	174	808	0.00	1540	0.453	697	751	0.9	0.9	4.454	A
B	629	157	924	0.00	1291	0.487	629	581	1.0	1.0	5.671	A
C	889	222	522	0.00	1545	0.575	889	1031	1.4	1.4	5.722	A
D	875	219	684	0.00	1373	0.637	875	727	1.8	1.8	7.540	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	697	174	808	0.00	1540	0.453	697	751	0.9	0.9	4.454	A
B	629	157	924	0.00	1291	0.487	629	581	1.0	1.0	5.671	A
C	889	222	522	0.00	1545	0.575	889	1031	1.4	1.4	5.722	A
D	875	219	684	0.00	1373	0.637	875	727	1.8	1.8	7.540	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	697	174	808	0.00	1540	0.453	697	751	0.9	0.9	4.454	A
B	629	157	924	0.00	1291	0.487	629	581	1.0	1.0	5.671	A
C	889	222	522	0.00	1545	0.575	889	1031	1.4	1.4	5.722	A
D	875	219	684	0.00	1373	0.637	875	727	1.8	1.8	7.540	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	697	174	808	0.00	1540	0.453	697	751	0.9	0.9	4.454	A
B	629	157	924	0.00	1291	0.487	629	581	1.0	1.0	5.671	A
C	889	222	522	0.00	1545	0.575	889	1031	1.4	1.4	5.722	A
D	875	219	684	0.00	1373	0.637	875	727	1.8	1.8	7.540	A

2042 With Proposed Development, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Pedestrian Crossing	Arm A - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm B - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm C - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm D - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing Quinns Cross Roundabout	Standard Roundabout		A, B, C, D	6.92	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D6	2042 With Proposed Development	AM	FLAT	07:45	09:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	745	100.000
B		FLAT	☐	675	100.000
C		FLAT	☐	953	100.000
D		FLAT	☐	939	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
A	[FLAT]	0.00
B	[FLAT]	0.00
C	[FLAT]	0.00
D	[FLAT]	0.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	B	C	D
From	A	2	135	521	87
	B	190	0	204	281
	C	382	154	4	413
	D	230	334	375	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.49	4.93	1.0	A	745	1118
B	0.54	6.46	1.2	A	675	1013
C	0.63	6.57	1.7	A	953	1430
D	0.70	9.18	2.4	A	939	1409

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	745	186	859	0.00	1511	0.493	741	798	0.0	1.0	4.853	A
B	675	169	982	0.00	1260	0.536	670	618	0.0	1.2	6.317	A
C	953	238	556	0.00	1527	0.624	946	1096	0.0	1.7	6.396	A
D	939	235	727	0.00	1351	0.695	930	776	0.0	2.3	8.742	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	745	186	867	0.00	1506	0.495	745	804	1.0	1.0	4.932	A
B	675	169	989	0.00	1256	0.537	675	623	1.2	1.2	6.458	A
C	953	238	560	0.00	1525	0.625	953	1104	1.7	1.7	6.565	A
D	939	235	732	0.00	1348	0.697	939	781	2.3	2.4	9.167	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	745	186	867	0.00	1506	0.495	745	804	1.0	1.0	4.932	A
B	675	169	989	0.00	1256	0.537	675	623	1.2	1.2	6.458	A
C	953	238	560	0.00	1525	0.625	953	1104	1.7	1.7	6.568	A
D	939	235	732	0.00	1348	0.697	939	781	2.4	2.4	9.172	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service

A	745	186	867	0.00	1506	0.495	745	804	1.0	1.0	4.933	A
B	675	169	989	0.00	1256	0.537	675	623	1.2	1.2	6.458	A
C	953	238	560	0.00	1525	0.625	953	1104	1.7	1.7	6.568	A
D	939	235	732	0.00	1348	0.697	939	781	2.4	2.4	9.178	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	745	186	867	0.00	1506	0.495	745	804	1.0	1.0	4.933	A
B	675	169	989	0.00	1256	0.537	675	623	1.2	1.2	6.458	A
C	953	238	560	0.00	1525	0.625	953	1104	1.7	1.7	6.568	A
D	939	235	732	0.00	1348	0.697	939	781	2.4	2.4	9.180	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	745	186	867	0.00	1506	0.495	745	804	1.0	1.0	4.933	A
B	675	169	989	0.00	1256	0.537	675	623	1.2	1.2	6.458	A
C	953	238	560	0.00	1525	0.625	953	1104	1.7	1.7	6.568	A
D	939	235	732	0.00	1348	0.697	939	781	2.4	2.4	9.180	A

2027 Without Development, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Pedestrian Crossing	Arm A - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm B - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm C - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm D - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing Quinns Cross Roundabout	Standard Roundabout		A, B, C, D	5.05	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D7	2027 Without Development	PM	FLAT	16:45	18:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	685	100.000
B		FLAT	☐	645	100.000
C		FLAT	☐	995	100.000
D		FLAT	☐	374	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
A	[FLAT]	0.00
B	[FLAT]	0.00
C	[FLAT]	0.00
D	[FLAT]	0.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	0	243	419	23
	B	193	0	181	271
	C	547	195	3	250
	D	54	182	138	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	**B**	**C**	**D**
From	**A**	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.40	3.68	0.7	A	685	1028
B	0.44	4.53	0.8	A	645	968
C	0.64	6.60	1.8	A	995	1493
D	0.30	4.33	0.4	A	374	561

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	685	171	515	0.00	1708	0.401	682	789	0.0	0.7	3.653	A
B	645	161	581	0.00	1474	0.437	642	617	0.0	0.8	4.492	A
C	995	249	485	0.00	1565	0.636	988	738	0.0	1.8	6.426	A
D	374	94	932	0.00	1244	0.301	372	541	0.0	0.4	4.298	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	685	171	518	0.00	1706	0.402	685	794	0.7	0.7	3.676	A
B	645	161	583	0.00	1473	0.438	645	620	0.8	0.8	4.533	A
C	995	249	487	0.00	1564	0.636	995	741	1.8	1.8	6.596	A
D	374	94	938	0.00	1241	0.301	374	544	0.4	0.4	4.331	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	685	171	518	0.00	1706	0.402	685	794	0.7	0.7	3.676	A
B	645	161	583	0.00	1473	0.438	645	620	0.8	0.8	4.533	A
C	995	249	487	0.00	1564	0.636	995	741	1.8	1.8	6.598	A
D	374	94	938	0.00	1241	0.301	374	544	0.4	0.4	4.331	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	685	171	518	0.00	1706	0.402	685	794	0.7	0.7	3.676	A
B	645	161	583	0.00	1473	0.438	645	620	0.8	0.8	4.533	A
C	995	249	487	0.00	1564	0.636	995	741	1.8	1.8	6.598	A
D	374	94	938	0.00	1241	0.301	374	544	0.4	0.4	4.331	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	685	171	518	0.00	1706	0.402	685	794	0.7	0.7	3.676	A
B	645	161	583	0.00	1473	0.438	645	620	0.8	0.8	4.533	A
C	995	249	487	0.00	1564	0.636	995	741	1.8	1.8	6.598	A
D	374	94	938	0.00	1241	0.301	374	544	0.4	0.4	4.331	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	685	171	518	0.00	1706	0.402	685	794	0.7	0.7	3.676	A
B	645	161	583	0.00	1473	0.438	645	620	0.8	0.8	4.533	A
C	995	249	487	0.00	1564	0.636	995	741	1.8	1.8	6.598	A
D	374	94	938	0.00	1241	0.301	374	544	0.4	0.4	4.331	A

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Pedestrian Crossing	Arm A - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm B - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm C - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm D - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing Quinns Cross Roundabout	Standard Roundabout		A, B, C, D	5.58	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D8	2032 Without Development	PM	FLAT	16:45	18:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	725	100.000
B		FLAT	☐	683	100.000
C		FLAT	☐	1053	100.000
D		FLAT	☐	396	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
A	[FLAT]	0.00
B	[FLAT]	0.00
C	[FLAT]	0.00
D	[FLAT]	0.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	B	C	D
From	A	0	257	444	24
	B	204	0	192	287
	C	579	207	3	264
	D	57	193	146	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.43	3.90	0.8	A	725	1088
B	0.47	4.86	0.9	A	683	1025
C	0.68	7.57	2.2	A	1053	1580
D	0.33	4.60	0.5	A	396	594

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	725	181	546	0.00	1690	0.429	722	834	0.0	0.8	3.865	A
B	683	171	614	0.00	1456	0.469	679	653	0.0	0.9	4.809	A
C	1053	263	512	0.00	1550	0.679	1044	781	0.0	2.2	7.304	A
D	396	99	985	0.00	1216	0.326	394	571	0.0	0.5	4.556	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	725	181	549	0.00	1688	0.429	725	840	0.8	0.8	3.897	A
B	683	171	617	0.00	1455	0.469	683	657	0.9	0.9	4.862	A
C	1053	263	515	0.00	1549	0.680	1053	785	2.2	2.2	7.565	A
D	396	99	993	0.00	1212	0.327	396	575	0.5	0.5	4.599	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	725	181	549	0.00	1688	0.429	725	840	0.8	0.8	3.897	A
B	683	171	617	0.00	1455	0.469	683	657	0.9	0.9	4.862	A
C	1053	263	515	0.00	1549	0.680	1053	785	2.2	2.2	7.568	A
D	396	99	993	0.00	1212	0.327	396	575	0.5	0.5	4.599	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	725	181	549	0.00	1688	0.429	725	840	0.8	0.8	3.897	A
B	683	171	617	0.00	1455	0.469	683	657	0.9	0.9	4.862	A
C	1053	263	515	0.00	1549	0.680	1053	785	2.2	2.2	7.571	A
D	396	99	993	0.00	1212	0.327	396	575	0.5	0.5	4.599	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	725	181	549	0.00	1688	0.429	725	840	0.8	0.8	3.897	A
B	683	171	617	0.00	1455	0.469	683	657	0.9	0.9	4.862	A
C	1053	263	515	0.00	1549	0.680	1053	785	2.2	2.2	7.571	A
D	396	99	993	0.00	1212	0.327	396	575	0.5	0.5	4.599	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	725	181	549	0.00	1688	0.429	725	840	0.8	0.8	3.897	A
B	683	171	617	0.00	1455	0.469	683	657	0.9	0.9	4.862	A
C	1053	263	515	0.00	1549	0.680	1053	785	2.2	2.2	7.571	A
D	396	99	993	0.00	1212	0.327	396	575	0.5	0.5	4.599	A

2042 Without Development, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Pedestrian Crossing	Arm A - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm B - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm C - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm D - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing Quinns Cross Roundabout	Standard Roundabout		A, B, C, D	6.55	A

Junction Network Options

Driving side	Lighting

Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D9	2042 Without Development	PM	FLAT	16:45	18:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	779	100.000
B		FLAT	☐	733	100.000
C		FLAT	☐	1132	100.000
D		FLAT	☐	426	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
A	[FLAT]	0.00
B	[FLAT]	0.00
C	[FLAT]	0.00
D	[FLAT]	0.00

Origin-Destination Data

Demand (PCU/hr)

	To				
		A	**B**	**C**	**D**
From	**A**	0	276	477	26
	B	219	0	206	308
	C	623	222	3	284
	D	61	208	157	0

Vehicle Mix

Heavy Vehicle Percentages

	To				
		A	**B**	**C**	**D**
From	**A**	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.47	4.24	0.9	A	779	1169
B	0.51	5.38	1.1	A	733	1100
C	0.74	9.47	3.0	A	1132	1698
D	0.36	5.02	0.6	A	426	639

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	779	195	586	0.00	1667	0.467	775	895	0.0	0.9	4.193	A
B	733	183	660	0.00	1432	0.512	729	701	0.0	1.1	5.306	A
C	1132	283	550	0.00	1530	0.740	1121	839	0.0	2.9	8.937	A
D	426	107	1057	0.00	1179	0.361	424	613	0.0	0.6	4.957	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	779	195	590	0.00	1665	0.468	779	903	0.9	0.9	4.238	A
B	733	183	663	0.00	1430	0.512	733	706	1.1	1.1	5.382	A
C	1132	283	553	0.00	1528	0.741	1132	843	2.9	2.9	9.452	A
D	426	107	1067	0.00	1174	0.363	426	618	0.6	0.6	5.020	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	779	195	590	0.00	1665	0.468	779	903	0.9	0.9	4.238	A
B	733	183	663	0.00	1430	0.512	733	706	1.1	1.1	5.382	A
C	1132	283	553	0.00	1528	0.741	1132	843	2.9	2.9	9.463	A
D	426	107	1067	0.00	1174	0.363	426	618	0.6	0.6	5.020	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	779	195	590	0.00	1665	0.468	779	903	0.9	0.9	4.238	A
B	733	183	663	0.00	1430	0.512	733	706	1.1	1.1	5.382	A
C	1132	283	553	0.00	1528	0.741	1132	843	2.9	2.9	9.467	A
D	426	107	1067	0.00	1174	0.363	426	618	0.6	0.6	5.020	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	779	195	590	0.00	1665	0.468	779	903	0.9	0.9	4.238	A
B	733	183	663	0.00	1430	0.512	733	706	1.1	1.1	5.382	A
C	1132	283	553	0.00	1528	0.741	1132	843	2.9	3.0	9.469	A
D	426	107	1067	0.00	1174	0.363	426	618	0.6	0.6	5.020	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	779	195	590	0.00	1665	0.468	779	903	0.9	0.9	4.238	A
B	733	183	663	0.00	1430	0.512	733	706	1.1	1.1	5.382	A
C	1132	283	553	0.00	1528	0.741	1132	843	3.0	3.0	9.469	A
D	426	107	1067	0.00	1174	0.363	426	618	0.6	0.6	5.020	A

2027 With Proposed Development, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Pedestrian Crossing	Arm A - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm B - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm C - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm D - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing Quinns Cross Roundabout	Standard Roundabout		A, B, C, D	5.25	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D10	2027 With Proposed Development	PM	FLAT	16:45	18:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	725	100.000
B		FLAT	☐	653	100.000
C		FLAT	☐	1019	100.000
D		FLAT	☐	376	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
A	[FLAT]	0.00

B	[FLAT]	0.00
C	[FLAT]	0.00
D	[FLAT]	0.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	0	257	444	24
	B	201	0	181	271
	C	571	195	3	250
	D	56	182	138	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	**B**	**C**	**D**
From	**A**	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.42	3.83	0.8	A	725	1088
B	0.45	4.66	0.8	A	653	980
C	0.65	6.95	2.0	A	1019	1529
D	0.31	4.43	0.5	A	376	564

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	725	181	515	0.00	1708	0.425	722	822	0.0	0.8	3.798	A
B	653	163	606	0.00	1461	0.447	650	631	0.0	0.8	4.611	A
C	1019	255	493	0.00	1560	0.653	1011	763	0.0	1.9	6.746	A
D	376	94	963	0.00	1228	0.306	374	542	0.0	0.5	4.390	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	725	181	518	0.00	1706	0.425	725	828	0.8	0.8	3.826	A
B	653	163	609	0.00	1459	0.447	653	634	0.8	0.8	4.656	A

C	1019	255	496	0.00	1559	0.654	1019	766	1.9	1.9	6.948	A
D	376	94	970	0.00	1224	0.307	376	545	0.5	0.5	4.426	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	725	181	518	0.00	1706	0.425	725	828	0.8	0.8	3.826	A
B	653	163	609	0.00	1459	0.447	653	634	0.8	0.8	4.656	A
C	1019	255	496	0.00	1559	0.654	1019	766	1.9	2.0	6.951	A
D	376	94	970	0.00	1224	0.307	376	545	0.5	0.5	4.426	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	725	181	518	0.00	1706	0.425	725	828	0.8	0.8	3.826	A
B	653	163	609	0.00	1459	0.447	653	634	0.8	0.8	4.656	A
C	1019	255	496	0.00	1559	0.654	1019	766	2.0	2.0	6.951	A
D	376	94	970	0.00	1224	0.307	376	545	0.5	0.5	4.426	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	725	181	518	0.00	1706	0.425	725	828	0.8	0.8	3.826	A
B	653	163	609	0.00	1459	0.447	653	634	0.8	0.8	4.656	A
C	1019	255	496	0.00	1559	0.654	1019	766	2.0	2.0	6.951	A
D	376	94	970	0.00	1224	0.307	376	545	0.5	0.5	4.426	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	725	181	518	0.00	1706	0.425	725	828	0.8	0.8	3.826	A
B	653	163	609	0.00	1459	0.447	653	634	0.8	0.8	4.656	A
C	1019	255	496	0.00	1559	0.654	1019	766	2.0	2.0	6.951	A
D	376	94	970	0.00	1224	0.307	376	545	0.5	0.5	4.426	A

2032 With Proposed Development, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Pedestrian Crossing	Arm A - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm B - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm C - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm D - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS

1	Existing Quinns Cross Roundabout	Standard Roundabout		A, B, C, D	5.83	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D11	2032 With Proposed Development	PM	FLAT	16:45	18:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	764	100.000
B		FLAT	☐	691	100.000
C		FLAT	☐	1077	100.000
D		FLAT	☐	398	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
A	[FLAT]	0.00
B	[FLAT]	0.00
C	[FLAT]	0.00
D	[FLAT]	0.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	**B**	**C**	**D**
From	**A**	0	271	468	25
	B	212	0	192	287
	C	603	207	3	264
	D	59	193	146	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	**B**	**C**	**D**
From	**A**	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.45	4.06	0.9	A	764	1146
B	0.48	5.00	1.0	A	691	1037
C	0.70	8.04	2.4	A	1077	1616
D	0.33	4.71	0.5	A	398	597

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	764	191	545	0.00	1690	0.452	761	867	0.0	0.9	4.024	A
B	691	173	639	0.00	1443	0.479	687	667	0.0	0.9	4.941	A
C	1077	269	521	0.00	1545	0.697	1068	805	0.0	2.3	7.716	A
D	398	100	1017	0.00	1200	0.332	396	572	0.0	0.5	4.660	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	764	191	549	0.00	1688	0.453	764	874	0.9	0.9	4.061	A
B	691	173	642	0.00	1442	0.479	691	671	0.9	1.0	5.001	A
C	1077	269	524	0.00	1544	0.698	1077	809	2.3	2.4	8.030	A
D	398	100	1025	0.00	1196	0.333	398	576	0.5	0.5	4.706	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	764	191	549	0.00	1688	0.453	764	874	0.9	0.9	4.062	A
B	691	173	642	0.00	1442	0.479	691	671	1.0	1.0	5.001	A
C	1077	269	524	0.00	1544	0.698	1077	809	2.4	2.4	8.035	A
D	398	100	1025	0.00	1196	0.333	398	576	0.5	0.5	4.707	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	764	191	549	0.00	1688	0.453	764	874	0.9	0.9	4.062	A
B	691	173	642	0.00	1442	0.479	691	671	1.0	1.0	5.001	A
C	1077	269	524	0.00	1544	0.698	1077	809	2.4	2.4	8.039	A
D	398	100	1025	0.00	1196	0.333	398	576	0.5	0.5	4.707	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	764	191	549	0.00	1688	0.453	764	874	0.9	0.9	4.062	A
B	691	173	642	0.00	1442	0.479	691	671	1.0	1.0	5.001	A

C	1077	269	524	0.00	1544	0.698	1077	809	2.4	2.4	8.038	A
D	398	100	1025	0.00	1196	0.333	398	576	0.5	0.5	4.707	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	764	191	549	0.00	1688	0.453	764	874	0.9	0.9	4.062	A
B	691	173	642	0.00	1442	0.479	691	671	1.0	1.0	5.001	A
C	1077	269	524	0.00	1544	0.698	1077	809	2.4	2.4	8.038	A
D	398	100	1025	0.00	1196	0.333	398	576	0.5	0.5	4.707	A

2042 With Proposed Development, PM

Data Errors and Warnings

Severity	Area	Item	Description
Last Run	Last Run	Arm A - Capacity	Pedestrian Crossing causes blocking on previous arm due to traffic queing to leave the junction in 6 timesegment(s).
Last Run	Last Run	Arm B - Capacity	Pedestrian Crossing causes blocking on previous arm due to traffic queing to leave the junction in 6 timesegment(s).
Last Run	Last Run	Arm C - Capacity	Pedestrian Crossing causes blocking on previous arm due to traffic queing to leave the junction in 6 timesegment(s).
Last Run	Last Run	Arm D - Capacity	Pedestrian Crossing causes blocking on previous arm due to traffic queing to leave the junction in 6 timesegment(s).

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing Quinns Cross Roundabout	Standard Roundabout		A, B, C, D	30.90	D

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D12	2042 With Proposed Development	PM	FLAT	16:45	18:15	90	15	☐

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	☐	818	100.000
B		FLAT	☐	742	100.000
C		FLAT	☐	1156	100.000
D		FLAT	☐	429	100.000

Demand overview (Pedestrians)

Arm	Profile type	Average pedestrian flow (Ped/hr)
A	[FLAT]	45.00
B	[FLAT]	45.00
C	[FLAT]	45.00
D	[FLAT]	45.00

Origin-Destination Data

Demand (PCU/hr)

	To				
		A	B	C	D
From	A	0	290	501	27
	B	228	0	206	308
	C	647	222	3	284
	D	64	208	157	0

Vehicle Mix

Heavy Vehicle Percentages

	To				
		A	B	C	D
From	A	3	3	3	3
	B	3	3	3	3
	C	3	3	3	3
	D	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.62	7.53	1.7	A	818	1227
B	0.77	17.06	3.5	C	742	1113
C	0.96	63.56	19.5	F	1156	1734
D	0.57	11.41	1.3	B	429	644

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	818	205	577	45.00	1332	0.614	811	910	0.0	1.6	7.126	A
B	742	186	682	45.00	972	0.764	729	707	0.0	3.1	14.824	B
C	1156	289	554	45.00	1219	0.948	1112	858	0.0	10.9	28.503	D
D	429	107	1063	45.00	788	0.544	424	603	0.0	1.2	10.182	B

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	818	205	587	45.00	1319	0.620	818	931	1.6	1.7	7.481	A
B	742	186	688	45.00	962	0.771	741	717	3.1	3.4	16.860	C
C	1156	289	562	45.00	1206	0.959	1142	866	10.9	14.3	46.968	E
D	429	107	1089	45.00	765	0.561	429	615	1.2	1.3	11.147	B

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	818	205	588	45.00	1318	0.621	818	934	1.7	1.7	7.509	A
B	742	186	688	45.00	962	0.772	742	718	3.4	3.4	16.998	C
C	1156	289	563	45.00	1204	0.960	1148	867	14.3	16.3	53.967	F
D	429	107	1094	45.00	761	0.564	429	617	1.3	1.3	11.296	B

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	818	205	589	45.00	1317	0.621	818	936	1.7	1.7	7.522	A
B	742	186	688	45.00	962	0.772	742	719	3.4	3.4	17.036	C
C	1156	289	563	45.00	1204	0.960	1151	867	16.3	17.7	58.271	F
D	429	107	1096	45.00	759	0.565	429	618	1.3	1.3	11.358	B

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	818	205	589	45.00	1317	0.621	818	937	1.7	1.7	7.528	A
B	742	186	688	45.00	962	0.772	742	719	3.4	3.5	17.053	C
C	1156	289	563	45.00	1203	0.961	1152	867	17.7	18.7	61.291	F
D	429	107	1097	45.00	758	0.566	429	618	1.3	1.3	11.392	B

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	818	205	589	45.00	1316	0.621	818	937	1.7	1.7	7.531	A
B	742	186	688	45.00	962	0.772	742	719	3.5	3.5	17.063	C
C	1156	289	563	45.00	1203	0.961	1153	867	18.7	19.5	63.557	F
D	429	107	1098	45.00	758	0.566	429	618	1.3	1.3	11.415	B

Junctions 9

ARCADY 9 - Roundabout Module

Version: 9.5.1.7462

Filename: N69_R510_N18.j9
Path: D:\ttrsa\projects\T210607_Ballykeefe_Limerick_EIAR_Chapter_MMP\eiar_chapter\modelling
Report generation date: 07/03/2022 17:31:20

Summary of junction performance

	AM					PM				
	Set ID	**Queue (PCU)**	**Delay (s)**	**RFC**	**LOS**	**Set ID**	**Queue (PCU)**	**Delay (s)**	**RFC**	**LOS**
	2027 Without Development									
Arm A	D1	0.4	1.93	0.27	A	D7	0.6	2.23	0.36	A
Arm B		1.0	3.13	0.49	A		0.8	2.97	0.43	A
Arm C		1.1	5.67	0.50	A		1.3	6.31	0.56	A
Arm D		1.4	6.03	0.58	A		0.6	3.54	0.37	A
Arm E		0.0	4.82	0.02	A		0.0	3.58	0.02	A
	2032 Without Development									
Arm A	D2	0.4	1.97	0.28	A	D8	0.7	2.31	0.39	A
Arm B		1.2	3.39	0.53	A		0.9	3.20	0.46	A
Arm C		1.3	6.42	0.55	A		1.7	7.33	0.61	A
Arm D		1.8	7.12	0.63	A		0.7	3.80	0.40	A
Arm E		0.0	5.25	0.03	A		0.0	3.76	0.02	A
	2042 Without Development									
Arm A	D3	0.4	2.03	0.30	A	D9	0.7	2.44	0.42	A
Arm B		1.4	3.85	0.58	A		1.0	3.55	0.50	A
Arm C		1.7	7.91	0.62	A		2.3	9.43	0.69	A
Arm D		2.6	9.46	0.71	A		0.8	4.22	0.44	A
Arm E		0.0	6.00	0.03	A		0.0	4.04	0.02	A
	2027 With Proposed Development									
Arm A	D4	0.4	1.95	0.27	A	D10	0.6	2.25	0.37	A

Arm B		1.0	3.17	0.50	A		0.8	3.00	0.43	A
Arm C		1.2	5.98	0.53	A		1.4	6.54	0.58	A
Arm D		1.5	6.22	0.59	A		0.6	3.55	0.36	A
Arm E		0.0	4.92	0.02	A		0.0	3.60	0.02	A
	2032 With Proposed Development									
Arm A	D5	0.4	1.99	0.29	A	D11	0.7	2.34	0.39	A
Arm B		1.2	3.45	0.53	A		0.9	3.25	0.47	A
Arm C		1.4	6.83	0.57	A		1.8	7.63	0.63	A
Arm D		1.9	7.38	0.64	A		0.7	3.85	0.40	A
Arm E		0.0	5.37	0.03	A		0.0	3.80	0.02	A
	2042 With Proposed Development									
Arm A	D6	0.5	2.05	0.31	A	D12	0.8	2.47	0.42	A
Arm B		1.5	3.92	0.58	A		1.1	3.66	0.51	A
Arm C		1.9	8.52	0.64	A		2.5	9.98	0.70	A
Arm D		2.7	9.93	0.72	A		0.8	4.28	0.44	A
Arm E		0.0	6.16	0.03	A		0.0	4.08	0.02	A

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle.

File summary

File Description

Title	Existing N69/N510/N18 Roundabout
Location	Limerick
Site number	
Date	26/01/2022
Version	EIAR
Status	Final
Identifier	
Client	DW Raheen
Jobnumber	T210607
Enumerator	TTRSA
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin

Analysis Options

Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Calculate residual capacity	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
5.75				0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D1	2027 Without Development	AM	FLAT	07:45	09:15	90	15	ü
D2	2032 Without Development	AM	FLAT	07:45	09:15	90	15	ü
D3	2042 Without Development	AM	FLAT	07:45	09:15	90	15	ü
D4	2027 With Proposed Development	AM	FLAT	07:45	09:15	90	15	ü

D5	2032 With Proposed Development	AM	FLAT	07:45	09:15	90	15	ü
D6	2042 With Proposed Development	AM	FLAT	07:45	09:15	90	15	ü
D7	2027 Without Development	PM	FLAT	16:45	18:15	90	15	ü
D8	2032 Without Development	PM	FLAT	16:45	18:15	90	15	ü
D9	2042 Without Development	PM	FLAT	16:45	18:15	90	15	ü
D10	2027 With Proposed Development	PM	FLAT	16:45	18:15	90	15	ü
D11	2032 With Proposed Development	PM	FLAT	16:45	18:15	90	15	ü
D12	2042 With Proposed Development	PM	FLAT	16:45	18:15	90	15	ü

Analysis Set Details

ID	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	ü	100.000	100.000

2027 Without Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/R510/N18 Roundabout	Standard Roundabout		A, B, C, D, E, F	4.12	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Arms

Arms

Arm	Name	Description
A	N69 Roundabout Connector to East	
B	N18 Northbound Off-Slip	
C	R510 to/from South	
D	N69 to/from West	
E	Irish Cement Access	
F	N18 Northbound On-Slip	

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
A	7.20	9.50	16.0	17.0	88.0	25.0	
B	6.00	11.30	30.0	25.0	100.0	34.0	
C	3.20	8.20	30.0	25.0	84.0	22.0	
D	4.00	9.80	30.0	18.0	84.0	31.0	
E	3.60	7.20	25.0	23.0	100.0	22.0	
F							ü

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Final slope	Final intercept (PCU/hr)
A	0.600	2682
B	0.607	2832
C	0.520	2031
D	0.546	2277
E	0.485	1900
F		

The slope and intercept shown above include any corrections and adjustments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D1	2027 Without Development	AM	FLAT	07:45	09:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	703	100.000
B		FLAT	ü	1174	100.000
C		FLAT	ü	669	100.000
D		FLAT	ü	865	100.000
E		FLAT	ü	19	100.000
F					

Origin-Destination Data

Demand (PCU/hr)

		To					
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	1	0	439	182	5	76
	B	568	0	126	317	23	140
	C	479	0	0	34	5	151
	D	656	0	18	31	7	153
	E	16	0	0	3	0	0
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Vehicle Mix

Heavy Vehicle Percentages

		To					
		A	B	C	D	E	F
From	A	3	3	3	3	3	3
	B	3	3	3	3	3	3
	C	3	3	3	3	3	3
	D	3	3	3	3	3	3
	E	3	3	3	3	3	3
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.27	1.93	0.4	A	703	1055
B	0.49	3.13	1.0	A	1174	1761
C	0.50	5.67	1.1	A	669	1004
D	0.58	6.03	1.4	A	865	1298
E	0.02	4.82	0.0	A	19	29
F						

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	703	176	52	2651	0.265	701	1711	0.0	0.4	1.925	A
B	1174	294	753	2375	0.494	1170	0	0.0	1.0	3.105	A
C	669	167	1342	1333	0.502	665	582	0.0	1.0	5.583	A
D	865	216	1441	1491	0.580	859	565	0.0	1.4	5.894	A
E	19	5	2261	804	0.024	19	40	0.0	0.0	4.782	A
F			1762				517				

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	703	176	52	2651	0.265	703	1720	0.4	0.4	1.927	A
B	1174	294	755	2374	0.495	1174	0	1.0	1.0	3.128	A
C	669	167	1346	1331	0.503	669	583	1.0	1.0	5.671	A
D	865	216	1448	1487	0.582	865	567	1.4	1.4	6.032	A
E	19	5	2273	798	0.024	19	40	0.0	0.0	4.818	A
F			1772				520				

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service

A	703	176	52	2651	0.265	703	1720	0.4	0.4	1.927	A
B	1174	294	755	2374	0.495	1174	0	1.0	1.0	3.128	A
C	669	167	1346	1331	0.503	669	583	1.0	1.0	5.671	A
D	865	216	1448	1487	0.582	865	567	1.4	1.4	6.032	A
E	19	5	2273	798	0.024	19	40	0.0	0.0	4.818	A
F			1772				520				

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	703	176	52	2651	0.265	703	1720	0.4	0.4	1.927	A
B	1174	294	755	2374	0.495	1174	0	1.0	1.0	3.128	A
C	669	167	1346	1331	0.503	669	583	1.0	1.1	5.671	A
D	865	216	1448	1487	0.582	865	567	1.4	1.4	6.032	A
E	19	5	2273	798	0.024	19	40	0.0	0.0	4.818	A
F			1772				520				

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	703	176	52	2651	0.265	703	1720	0.4	0.4	1.927	A
B	1174	294	755	2374	0.495	1174	0	1.0	1.0	3.128	A
C	669	167	1346	1331	0.503	669	583	1.1	1.1	5.671	A
D	865	216	1448	1487	0.582	865	567	1.4	1.4	6.032	A
E	19	5	2273	798	0.024	19	40	0.0	0.0	4.818	A
F			1772				520				

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	703	176	52	2651	0.265	703	1720	0.4	0.4	1.927	A
B	1174	294	755	2374	0.495	1174	0	1.0	1.0	3.128	A
C	669	167	1346	1331	0.503	669	583	1.1	1.1	5.671	A
D	865	216	1448	1487	0.582	865	567	1.4	1.4	6.032	A
E	19	5	2273	798	0.024	19	40	0.0	0.0	4.818	A
F			1772				520				

2032 Without Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/R510/N18 Roundabout	Standard Roundabout		A, B, C, D, E, F	4.64	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D2	2032 Without Development	AM	FLAT	07:45	09:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	743	100.000
B		FLAT	ü	1242	100.000
C		FLAT	ü	707	100.000
D		FLAT	ü	915	100.000
E		FLAT	ü	19	100.000
F					

Origin-Destination Data

Demand (PCU/hr)

		To					
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	1	0	465	192	5	80
	B	601	0	134	335	24	148
	C	506	0	0	36	5	160
	D	694	0	19	33	7	162
	E	16	0	0	3	0	0
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Vehicle Mix

Heavy Vehicle Percentages

		To					
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	3	3	3	3	3	3
	B	3	3	3	3	3	3
	C	3	3	3	3	3	3
	D	3	3	3	3	3	3
	E	3	3	3	3	3	3
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.28	1.97	0.4	A	743	1115
B	0.53	3.39	1.2	A	1242	1863

C	0.55	6.42	1.3	A	707	1061
D	0.63	7.12	1.8	A	915	1373
E	0.03	5.25	0.0	A	19	29
F						

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	743	186	55	2649	0.280	741	1807	0.0	0.4	1.966	A
B	1242	311	796	2349	0.529	1237	0	0.0	1.2	3.364	A
C	707	177	1417	1294	0.546	702	616	0.0	1.2	6.292	A
D	915	229	1522	1447	0.632	908	597	0.0	1.8	6.882	A
E	19	5	2389	742	0.026	19	41	0.0	0.0	5.194	A
F			1861				547				

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	743	186	55	2649	0.280	743	1818	0.4	0.4	1.969	A
B	1242	311	798	2348	0.529	1242	0	1.2	1.2	3.394	A
C	707	177	1422	1291	0.547	707	618	1.2	1.3	6.423	A
D	915	229	1530	1443	0.634	915	599	1.8	1.8	7.112	A
E	19	5	2404	735	0.026	19	41	0.0	0.0	5.245	A
F			1873				550				

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	743	186	55	2649	0.280	743	1818	0.4	0.4	1.969	A
B	1242	311	798	2348	0.529	1242	0	1.2	1.2	3.394	A
C	707	177	1422	1291	0.547	707	618	1.3	1.3	6.423	A
D	915	229	1530	1443	0.634	915	599	1.8	1.8	7.116	A
E	19	5	2404	735	0.026	19	41	0.0	0.0	5.246	A
F			1873				550				

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	743	186	55	2649	0.280	743	1818	0.4	0.4	1.969	A
B	1242	311	798	2348	0.529	1242	0	1.2	1.2	3.394	A
C	707	177	1422	1291	0.547	707	618	1.3	1.3	6.423	A
D	915	229	1530	1443	0.634	915	599	1.8	1.8	7.116	A
E	19	5	2404	735	0.026	19	41	0.0	0.0	5.246	A
F			1873				550				

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	743	186	55	2649	0.280	743	1818	0.4	0.4	1.969	A
B	1242	311	798	2348	0.529	1242	0	1.2	1.2	3.394	A
C	707	177	1422	1291	0.547	707	618	1.3	1.3	6.423	A
D	915	229	1530	1443	0.634	915	599	1.8	1.8	7.116	A
E	19	5	2404	735	0.026	19	41	0.0	0.0	5.246	A
F			1873				550				

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	743	186	55	2649	0.280	743	1818	0.4	0.4	1.969	A
B	1242	311	798	2348	0.529	1242	0	1.2	1.2	3.394	A
C	707	177	1422	1291	0.547	707	618	1.3	1.3	6.423	A
D	915	229	1530	1443	0.634	915	599	1.8	1.8	7.116	A
E	19	5	2404	735	0.026	19	41	0.0	0.0	5.246	A
F			1873				550				

2042 Without Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/R510/N18 Roundabout	Standard Roundabout		A, B, C, D, E, F	5.69	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D3	2042 Without Development	AM	FLAT	07:45	09:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	798	100.000
B		FLAT	ü	1337	100.000
C		FLAT	ü	760	100.000

D		FLAT	ü	983	100.000
E		FLAT	ü	21	100.000
F					

Origin-Destination Data

Demand (PCU/hr)

	To						
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	1	0	499	207	5	86
	B	647	0	144	361	26	159
	C	544	0	0	39	5	172
	D	746	0	20	36	7	174
	E	18	0	0	3	0	0
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Vehicle Mix

Heavy Vehicle Percentages

	To						
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	3	3	3	3	3	3
	B	3	3	3	3	3	3
	C	3	3	3	3	3	3
	D	3	3	3	3	3	3
	E	3	3	3	3	3	3
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.30	2.03	0.4	A	798	1197
B	0.58	3.85	1.4	A	1337	2006
C	0.62	7.91	1.7	A	760	1140
D	0.71	9.46	2.6	A	983	1475
E	0.03	6.00	0.0	A	21	32
F						

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	798	200	58	2647	0.301	796	1941	0.0	0.4	2.027	A
B	1337	334	855	2313	0.578	1331	0	0.0	1.4	3.801	A

C	760	190	1525	1238	0.614	754	661	0.0	1.6	7.653	A
D	983	246	1635	1385	0.710	973	643	0.0	2.5	8.905	A
E	21	5	2565	656	0.032	21	43	0.0	0.0	5.907	A
F			1999				587				

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	798	200	59	2647	0.302	798	1956	0.4	0.4	2.030	A
B	1337	334	857	2312	0.578	1337	0	1.4	1.4	3.850	A
C	760	190	1531	1235	0.616	760	663	1.6	1.6	7.903	A
D	983	246	1645	1380	0.712	983	646	2.5	2.5	9.439	A
E	21	5	2585	647	0.032	21	43	0.0	0.0	5.996	A
F			2015				591				

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	798	200	59	2647	0.302	798	1956	0.4	0.4	2.030	A
B	1337	334	857	2312	0.578	1337	0	1.4	1.4	3.850	A
C	760	190	1531	1235	0.616	760	663	1.6	1.7	7.907	A
D	983	246	1645	1380	0.712	983	646	2.5	2.5	9.451	A
E	21	5	2585	647	0.032	21	43	0.0	0.0	5.998	A
F			2015				591				

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	798	200	59	2647	0.302	798	1956	0.4	0.4	2.030	A
B	1337	334	857	2312	0.578	1337	0	1.4	1.4	3.850	A
C	760	190	1531	1235	0.616	760	663	1.7	1.7	7.907	A
D	983	246	1645	1380	0.712	983	646	2.5	2.6	9.455	A
E	21	5	2585	647	0.032	21	43	0.0	0.0	5.998	A
F			2015				591				

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	798	200	59	2647	0.302	798	1956	0.4	0.4	2.030	A
B	1337	334	857	2312	0.578	1337	0	1.4	1.4	3.850	A
C	760	190	1531	1235	0.616	760	663	1.7	1.7	7.908	A
D	983	246	1645	1380	0.712	983	646	2.6	2.6	9.457	A
E	21	5	2585	647	0.032	21	43	0.0	0.0	5.998	A
F			2015				591				

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	798	200	59	2647	0.302	798	1956	0.4	0.4	2.030	A
B	1337	334	857	2312	0.578	1337	0	1.4	1.4	3.850	A
C	760	190	1531	1235	0.616	760	663	1.7	1.7	7.908	A
D	983	246	1645	1380	0.712	983	646	2.6	2.6	9.459	A

E	21	5	2585	647	0.032	21	43	0.0	0.0	5.998	A
F			2015				591				

2027 With Proposed Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/R510/N18 Roundabout	Standard Roundabout		A, B, C, D, E, F	4.25	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D4	2027 With Proposed Development	AM	FLAT	07:45	09:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	721	100.000
B		FLAT	ü	1180	100.000
C		FLAT	ü	703	100.000
D		FLAT	ü	866	100.000
E		FLAT	ü	19	100.000
F					

Origin-Destination Data

Demand (PCU/hr)

		To					
		A	B	C	D	E	F
From	A	1	0	457	182	5	76
	B	568	0	132	317	23	140
	C	503	0	0	36	5	159
	D	656	0	19	31	7	153
	E	16	0	0	3	0	0
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Vehicle Mix

Heavy Vehicle Percentages

		To					
		A	B	C	D	E	F
From	A	3	3	3	3	3	3
	B	3	3	3	3	3	3
	C	3	3	3	3	3	3
	D	3	3	3	3	3	3
	E	3	3	3	3	3	3
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.27	1.95	0.4	A	721	1082
B	0.50	3.17	1.0	A	1180	1770
C	0.53	5.98	1.2	A	703	1055
D	0.59	6.22	1.5	A	866	1299
E	0.02	4.92	0.0	A	19	29
F						

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	721	180	53	2651	0.272	719	1734	0.0	0.4	1.942	A
B	1180	295	772	2363	0.499	1176	0	0.0	1.0	3.151	A
C	703	176	1342	1333	0.527	698	606	0.0	1.1	5.872	A
D	866	217	1473	1474	0.588	860	567	0.0	1.5	6.064	A
E	19	5	2293	788	0.024	19	40	0.0	0.0	4.880	A
F			1787				525				

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	721	180	53	2650	0.272	721	1744	0.4	0.4	1.945	A
B	1180	295	774	2362	0.500	1180	0	1.0	1.0	3.174	A
C	703	176	1346	1331	0.528	703	608	1.1	1.2	5.978	A
D	866	217	1480	1470	0.589	866	569	1.5	1.5	6.214	A
E	19	5	2306	782	0.024	19	40	0.0	0.0	4.919	A
F			1797				528				

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service

A	721	180	53	2650	0.272	721	1744	0.4	0.4	1.945	A
B	1180	295	774	2362	0.500	1180	0	1.0	1.0	3.174	A
C	703	176	1346	1331	0.528	703	608	1.2	1.2	5.978	A
D	866	217	1480	1470	0.589	866	569	1.5	1.5	6.217	A
E	19	5	2306	782	0.024	19	40	0.0	0.0	4.919	A
F			1797				528				

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	721	180	53	2650	0.272	721	1744	0.4	0.4	1.945	A
B	1180	295	774	2362	0.500	1180	0	1.0	1.0	3.174	A
C	703	176	1346	1331	0.528	703	608	1.2	1.2	5.978	A
D	866	217	1480	1470	0.589	866	569	1.5	1.5	6.217	A
E	19	5	2306	782	0.024	19	40	0.0	0.0	4.919	A
F			1797				528				

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	721	180	53	2650	0.272	721	1744	0.4	0.4	1.945	A
B	1180	295	774	2362	0.500	1180	0	1.0	1.0	3.174	A
C	703	176	1346	1331	0.528	703	608	1.2	1.2	5.978	A
D	866	217	1480	1470	0.589	866	569	1.5	1.5	6.217	A
E	19	5	2306	782	0.024	19	40	0.0	0.0	4.919	A
F			1797				528				

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	721	180	53	2650	0.272	721	1744	0.4	0.4	1.945	A
B	1180	295	774	2362	0.500	1180	0	1.0	1.0	3.174	A
C	703	176	1346	1331	0.528	703	608	1.2	1.2	5.978	A
D	866	217	1480	1470	0.589	866	569	1.5	1.5	6.217	A
E	19	5	2306	782	0.024	19	40	0.0	0.0	4.919	A
F			1797				528				

2032 With Proposed Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/R510/N18 Roundabout	Standard Roundabout		A, B, C, D, E, F	4.81	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D5	2032 With Proposed Development	AM	FLAT	07:45	09:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	761	100.000
B		FLAT	ü	1247	100.000
C		FLAT	ü	742	100.000
D		FLAT	ü	916	100.000
E		FLAT	ü	19	100.000
F					

Origin-Destination Data

Demand (PCU/hr)

		To					
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	1	0	483	192	5	80
	B	601	0	139	335	24	148
	C	531	0	0	38	5	168
	D	694	0	20	33	7	162
	E	16	0	0	3	0	0
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Vehicle Mix

Heavy Vehicle Percentages

		To					
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	3	3	3	3	3	3
	B	3	3	3	3	3	3
	C	3	3	3	3	3	3
	D	3	3	3	3	3	3
	E	3	3	3	3	3	3
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.29	1.99	0.4	A	761	1142
B	0.53	3.45	1.2	A	1247	1871

C	0.57	6.83	1.4	A	742	1113
D	0.64	7.38	1.9	A	916	1374
E	0.03	5.37	0.0	A	19	29
F						

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	761	190	56	2649	0.287	759	1831	0.0	0.4	1.985	A
B	1247	312	815	2338	0.533	1242	0	0.0	1.2	3.415	A
C	742	186	1417	1294	0.573	736	640	0.0	1.4	6.669	A
D	916	229	1555	1429	0.641	909	599	0.0	1.8	7.119	A
E	19	5	2423	726	0.026	19	41	0.0	0.0	5.313	A
F			1887				555				

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	761	190	56	2649	0.287	761	1843	0.4	0.4	1.988	A
B	1247	312	817	2336	0.534	1247	0	1.2	1.2	3.446	A
C	742	186	1422	1291	0.575	742	642	1.4	1.4	6.829	A
D	916	229	1563	1425	0.643	916	601	1.8	1.9	7.375	A
E	19	5	2438	718	0.026	19	41	0.0	0.0	5.369	A
F			1899				558				

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	761	190	56	2648	0.287	761	1843	0.4	0.4	1.988	A
B	1247	312	817	2336	0.534	1247	0	1.2	1.2	3.446	A
C	742	186	1422	1291	0.575	742	642	1.4	1.4	6.832	A
D	916	229	1563	1425	0.643	916	601	1.9	1.9	7.381	A
E	19	5	2438	718	0.026	19	41	0.0	0.0	5.369	A
F			1899				558				

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	761	190	56	2648	0.287	761	1843	0.4	0.4	1.988	A
B	1247	312	817	2336	0.534	1247	0	1.2	1.2	3.446	A
C	742	186	1422	1291	0.575	742	642	1.4	1.4	6.832	A
D	916	229	1563	1425	0.643	916	601	1.9	1.9	7.381	A
E	19	5	2438	718	0.026	19	41	0.0	0.0	5.369	A
F			1899				558				

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	761	190	56	2648	0.287	761	1843	0.4	0.4	1.988	A
B	1247	312	817	2336	0.534	1247	0	1.2	1.2	3.446	A
C	742	186	1422	1291	0.575	742	642	1.4	1.4	6.832	A
D	916	229	1563	1425	0.643	916	601	1.9	1.9	7.382	A
E	19	5	2438	718	0.026	19	41	0.0	0.0	5.369	A
F			1899				558				

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	761	190	56	2648	0.287	761	1843	0.4	0.4	1.988	A
B	1247	312	817	2336	0.534	1247	0	1.2	1.2	3.446	A
C	742	186	1422	1291	0.575	742	642	1.4	1.4	6.832	A
D	916	229	1563	1425	0.643	916	601	1.9	1.9	7.382	A
E	19	5	2438	718	0.026	19	41	0.0	0.0	5.369	A
F			1899				558				

2042 With Proposed Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/R510/N18 Roundabout	Standard Roundabout		A, B, C, D, E, F	5.96	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D6	2042 With Proposed Development	AM	FLAT	07:45	09:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	817	100.000
B		FLAT	ü	1342	100.000
C		FLAT	ü	794	100.000

D		FLAT	ü	984	100.000
E		FLAT	ü	21	100.000
F					

Origin-Destination Data

Demand (PCU/hr)

		To					
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	1	0	518	207	5	86
	B	647	0	149	361	26	159
	C	569	0	0	40	5	180
	D	746	0	21	36	7	174
	E	18	0	0	3	0	0
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Vehicle Mix

Heavy Vehicle Percentages

		To					
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	3	3	3	3	3	3
	B	3	3	3	3	3	3
	C	3	3	3	3	3	3
	D	3	3	3	3	3	3
	E	3	3	3	3	3	3
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.31	2.05	0.5	A	817	1226
B	0.58	3.92	1.5	A	1342	2013
C	0.64	8.52	1.9	A	794	1191
D	0.72	9.93	2.7	A	984	1476
E	0.03	6.16	0.0	A	21	32
F						

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	817	204	59	2646	0.309	815	1965	0.0	0.5	2.048	A
B	1342	336	875	2301	0.583	1336	0	0.0	1.4	3.867	A

C	794	199	1525	1238	0.641	787	686	0.0	1.8	8.195	A
D	984	246	1667	1368	0.720	974	644	0.0	2.6	9.304	A
E	21	5	2598	640	0.033	21	43	0.0	0.0	6.058	A
F			2024				595				

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	817	204	60	2646	0.309	817	1981	0.5	0.5	2.052	A
B	1342	336	877	2300	0.584	1342	0	1.4	1.5	3.919	A
C	794	199	1531	1235	0.643	794	688	1.8	1.9	8.510	A
D	984	246	1678	1362	0.723	984	647	2.6	2.7	9.910	A
E	21	5	2619	631	0.033	21	43	0.0	0.0	6.158	A
F			2041				599				

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	817	204	60	2646	0.309	817	1981	0.5	0.5	2.052	A
B	1342	336	877	2300	0.584	1342	0	1.5	1.5	3.919	A
C	794	199	1531	1235	0.643	794	688	1.9	1.9	8.515	A
D	984	246	1678	1362	0.723	984	647	2.7	2.7	9.925	A
E	21	5	2619	630	0.033	21	43	0.0	0.0	6.160	A
F			2041				599				

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	817	204	60	2646	0.309	817	1981	0.5	0.5	2.052	A
B	1342	336	877	2300	0.584	1342	0	1.5	1.5	3.919	A
C	794	199	1531	1235	0.643	794	688	1.9	1.9	8.517	A
D	984	246	1678	1362	0.723	984	647	2.7	2.7	9.931	A
E	21	5	2619	630	0.033	21	43	0.0	0.0	6.160	A
F			2041				599				

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	817	204	60	2646	0.309	817	1981	0.5	0.5	2.052	A
B	1342	336	877	2300	0.584	1342	0	1.5	1.5	3.919	A
C	794	199	1531	1235	0.643	794	688	1.9	1.9	8.517	A
D	984	246	1678	1362	0.723	984	647	2.7	2.7	9.933	A
E	21	5	2619	630	0.033	21	43	0.0	0.0	6.160	A
F			2041				599				

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	817	204	60	2646	0.309	817	1981	0.5	0.5	2.052	A
B	1342	336	877	2300	0.584	1342	0	1.5	1.5	3.919	A
C	794	199	1531	1235	0.643	794	688	1.9	1.9	8.518	A
D	984	246	1678	1362	0.723	984	647	2.7	2.7	9.933	A

E	21	5	2619	630	0.033	21	43	0.0	0.0	6.160	A
F			2041				599				

2027 Without Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/R510/N18 Roundabout	Standard Roundabout		A, B, C, D, E, F	3.64	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D7	2027 Without Development	PM	FLAT	16:45	18:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	964	100.000
B		FLAT	ü	943	100.000
C		FLAT	ü	770	100.000
D		FLAT	ü	614	100.000
E		FLAT	ü	20	100.000
F					

Origin-Destination Data

Demand (PCU/hr)

		To					
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	0	0	431	482	3	48
	B	119	0	229	409	2	184
	C	554	0	0	19	0	197
	D	423	0	31	31	1	128
	E	11	0	0	2	0	7
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Vehicle Mix

Heavy Vehicle Percentages

		To					
		A	B	C	D	E	F
From	A	3	3	3	3	3	3
	B	3	3	3	3	3	3
	C	3	3	3	3	3	3
	D	3	3	3	3	3	3
	E	3	3	3	3	3	3
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.36	2.23	0.6	A	964	1446
B	0.43	2.97	0.8	A	943	1415
C	0.56	6.31	1.3	A	770	1155
D	0.37	3.54	0.6	A	614	921
E	0.02	3.58	0.0	A	20	30
F						

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	964	241	64	2644	0.365	962	1101	0.0	0.6	2.229	A
B	943	236	1025	2210	0.427	940	0	0.0	0.8	2.949	A
C	770	193	1276	1367	0.563	765	689	0.0	1.3	6.179	A
D	614	154	1101	1677	0.366	612	940	0.0	0.6	3.518	A
E	20	5	1706	1073	0.019	20	6	0.0	0.0	3.565	A
F			1165				561				

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	964	241	64	2644	0.365	964	1107	0.6	0.6	2.234	A
B	943	236	1028	2208	0.427	943	0	0.8	0.8	2.967	A
C	770	193	1280	1365	0.564	770	691	1.3	1.3	6.306	A
D	614	154	1107	1673	0.367	614	943	0.6	0.6	3.543	A
E	20	5	1715	1069	0.019	20	6	0.0	0.0	3.579	A
F			1171				564				

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service

A	964	241	64	2644	0.365	964	1107	0.6	0.6	2.234	A
B	943	236	1028	2208	0.427	943	0	0.8	0.8	2.967	A
C	770	193	1280	1365	0.564	770	691	1.3	1.3	6.306	A
D	614	154	1107	1673	0.367	614	943	0.6	0.6	3.543	A
E	20	5	1715	1069	0.019	20	6	0.0	0.0	3.579	A
F			1171				564				

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	964	241	64	2644	0.365	964	1107	0.6	0.6	2.234	A
B	943	236	1028	2208	0.427	943	0	0.8	0.8	2.967	A
C	770	193	1280	1365	0.564	770	691	1.3	1.3	6.306	A
D	614	154	1107	1673	0.367	614	943	0.6	0.6	3.543	A
E	20	5	1715	1069	0.019	20	6	0.0	0.0	3.579	A
F			1171				564				

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	964	241	64	2644	0.365	964	1107	0.6	0.6	2.234	A
B	943	236	1028	2208	0.427	943	0	0.8	0.8	2.967	A
C	770	193	1280	1365	0.564	770	691	1.3	1.3	6.306	A
D	614	154	1107	1673	0.367	614	943	0.6	0.6	3.543	A
E	20	5	1715	1069	0.019	20	6	0.0	0.0	3.579	A
F			1171				564				

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	964	241	64	2644	0.365	964	1107	0.6	0.6	2.234	A
B	943	236	1028	2208	0.427	943	0	0.8	0.8	2.967	A
C	770	193	1280	1365	0.564	770	691	1.3	1.3	6.306	A
D	614	154	1107	1673	0.367	614	943	0.6	0.6	3.543	A
E	20	5	1715	1069	0.019	20	6	0.0	0.0	3.579	A
F			1171				564				

2032 Without Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/R510/N18 Roundabout	Standard Roundabout		A, B, C, D, E, F	4.02	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D8	2032 Without Development	PM	FLAT	16:45	18:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	1020	100.000
B		FLAT	ü	998	100.000
C		FLAT	ü	815	100.000
D		FLAT	ü	650	100.000
E		FLAT	ü	21	100.000
F					

Origin-Destination Data

Demand (PCU/hr)

	To						
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	0	0	456	510	3	51
	B	126	0	243	432	2	195
	C	586	0	0	20	0	209
	D	447	0	33	33	1	136
	E	11	0	0	2	0	8
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Vehicle Mix

Heavy Vehicle Percentages

	To						
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	3	3	3	3	3	3
	B	3	3	3	3	3	3
	C	3	3	3	3	3	3
	D	3	3	3	3	3	3
	E	3	3	3	3	3	3
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.39	2.31	0.7	A	1020	1530
B	0.46	3.20	0.9	A	998	1497

C	0.61	7.33	1.7	A	815	1223
D	0.40	3.80	0.7	A	650	975
E	0.02	3.76	0.0	A	21	32
F						

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1020	255	68	2641	0.386	1017	1163	0.0	0.7	2.307	A
B	998	250	1085	2173	0.459	994	0	0.0	0.9	3.175	A
C	815	204	1350	1329	0.613	809	730	0.0	1.6	7.129	A
D	650	163	1164	1642	0.396	647	994	0.0	0.7	3.766	A
E	21	5	1806	1025	0.020	21	6	0.0	0.0	3.739	A
F			1231				596				

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1020	255	68	2641	0.386	1020	1170	0.7	0.7	2.315	A
B	998	250	1088	2172	0.460	998	0	0.9	0.9	3.198	A
C	815	204	1354	1327	0.614	815	732	1.6	1.6	7.332	A
D	650	163	1172	1638	0.397	650	997	0.7	0.7	3.799	A
E	21	5	1816	1020	0.021	21	6	0.0	0.0	3.758	A
F			1238				599				

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1020	255	68	2641	0.386	1020	1170	0.7	0.7	2.315	A
B	998	250	1088	2172	0.460	998	0	0.9	0.9	3.198	A
C	815	204	1354	1327	0.614	815	732	1.6	1.6	7.335	A
D	650	163	1172	1638	0.397	650	997	0.7	0.7	3.799	A
E	21	5	1816	1020	0.021	21	6	0.0	0.0	3.758	A
F			1238				599				

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1020	255	68	2641	0.386	1020	1170	0.7	0.7	2.315	A
B	998	250	1088	2172	0.460	998	0	0.9	0.9	3.198	A
C	815	204	1354	1327	0.614	815	732	1.6	1.7	7.335	A
D	650	163	1172	1638	0.397	650	997	0.7	0.7	3.799	A
E	21	5	1816	1020	0.021	21	6	0.0	0.0	3.758	A
F			1238				599				

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1020	255	68	2641	0.386	1020	1170	0.7	0.7	2.315	A
B	998	250	1088	2172	0.460	998	0	0.9	0.9	3.198	A
C	815	204	1354	1327	0.614	815	732	1.7	1.7	7.335	A
D	650	163	1172	1638	0.397	650	997	0.7	0.7	3.799	A
E	21	5	1816	1020	0.021	21	6	0.0	0.0	3.758	A
F			1238				599				

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1020	255	68	2641	0.386	1020	1170	0.7	0.7	2.315	A
B	998	250	1088	2172	0.460	998	0	0.9	0.9	3.198	A
C	815	204	1354	1327	0.614	815	732	1.7	1.7	7.335	A
D	650	163	1172	1638	0.397	650	997	0.7	0.7	3.799	A
E	21	5	1816	1020	0.021	21	6	0.0	0.0	3.758	A
F			1238				599				

2042 Without Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/R510/N18 Roundabout	Standard Roundabout		A, B, C, D, E, F	4.72	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D9	2042 Without Development	PM	FLAT	16:45	18:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	1096	100.000
B		FLAT	ü	1063	100.000
C		FLAT	ü	875	100.000

D		FLAT	ü	700	100.000
E		FLAT	ü	23	100.000
F					

Origin-Destination Data

Demand (PCU/hr)

	To						
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	0	0	490	548	3	55
	B	135	0	251	465	2	210
	C	630	0	0	21	0	224
	D	481	0	36	36	1	146
	E	12	0	0	3	0	8
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Vehicle Mix

Heavy Vehicle Percentages

	To						
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	3	3	3	3	3	3
	B	3	3	3	3	3	3
	C	3	3	3	3	3	3
	D	3	3	3	3	3	3
	E	3	3	3	3	3	3
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.42	2.44	0.7	A	1096	1644
B	0.50	3.55	1.0	A	1063	1595
C	0.69	9.43	2.3	A	875	1313
D	0.44	4.22	0.8	A	700	1050
E	0.02	4.04	0.0	A	23	35
F						

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1096	274	75	2637	0.416	1093	1249	0.0	0.7	2.427	A
B	1063	266	1168	2123	0.501	1059	0	0.0	1.0	3.515	A

C	875	219	1452	1276	0.686	866	775	0.0	2.2	8.984	A
D	700	175	1249	1596	0.439	697	1069	0.0	0.8	4.160	A
E	23	6	1940	960	0.024	23	6	0.0	0.0	4.007	A
F			1324				639				

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1096	274	75	2637	0.416	1096	1258	0.7	0.7	2.435	A
B	1063	266	1171	2121	0.501	1063	0	1.0	1.0	3.546	A
C	875	219	1457	1273	0.687	875	777	2.2	2.3	9.413	A
D	700	175	1259	1590	0.440	700	1073	0.8	0.8	4.215	A
E	23	6	1953	953	0.024	23	6	0.0	0.0	4.035	A
F			1333				643				

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1096	274	75	2637	0.416	1096	1258	0.7	0.7	2.435	A
B	1063	266	1171	2121	0.501	1063	0	1.0	1.0	3.546	A
C	875	219	1457	1273	0.687	875	777	2.3	2.3	9.422	A
D	700	175	1259	1590	0.440	700	1073	0.8	0.8	4.216	A
E	23	6	1953	953	0.024	23	6	0.0	0.0	4.035	A
F			1333				643				

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1096	274	75	2637	0.416	1096	1258	0.7	0.7	2.435	A
B	1063	266	1171	2121	0.501	1063	0	1.0	1.0	3.546	A
C	875	219	1457	1273	0.687	875	777	2.3	2.3	9.424	A
D	700	175	1259	1590	0.440	700	1073	0.8	0.8	4.216	A
E	23	6	1953	953	0.024	23	6	0.0	0.0	4.035	A
F			1333				643				

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1096	274	75	2637	0.416	1096	1258	0.7	0.7	2.435	A
B	1063	266	1171	2121	0.501	1063	0	1.0	1.0	3.546	A
C	875	219	1457	1273	0.687	875	777	2.3	2.3	9.426	A
D	700	175	1259	1590	0.440	700	1073	0.8	0.8	4.216	A
E	23	6	1953	953	0.024	23	6	0.0	0.0	4.035	A
F			1333				643				

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1096	274	75	2637	0.416	1096	1258	0.7	0.7	2.435	A
B	1063	266	1171	2121	0.501	1063	0	1.0	1.0	3.546	A
C	875	219	1457	1273	0.687	875	777	2.3	2.3	9.426	A
D	700	175	1259	1590	0.440	700	1073	0.8	0.8	4.216	A

E	23	6	1953	953	0.024	23	6	0.0	0.0	4.035	A
F			1333				643				

2027 With Proposed Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/R510/N18 Roundabout	Standard Roundabout		A, B, C, D, E, F	3.72	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D10	2027 With Proposed Development	PM	FLAT	16:45	18:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	982	100.000
B		FLAT	ü	953	100.000
C		FLAT	ü	791	100.000
D		FLAT	ü	605	100.000
E		FLAT	ü	20	100.000
F					

Origin-Destination Data

Demand (PCU/hr)

		To					
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	0	0	449	482	3	48
	B	119	0	239	409	2	184
	C	569	0	0	19	0	203
	D	423	0	22	31	1	128
	E	11	0	0	2	0	7
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Vehicle Mix

Heavy Vehicle Percentages

		To					
		A	B	C	D	E	F
From	A	3	3	3	3	3	3
	B	3	3	3	3	3	3
	C	3	3	3	3	3	3
	D	3	3	3	3	3	3
	E	3	3	3	3	3	3
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.37	2.25	0.6	A	982	1473
B	0.43	3.00	0.8	A	953	1430
C	0.58	6.54	1.4	A	791	1187
D	0.36	3.55	0.6	A	605	908
E	0.02	3.60	0.0	A	20	30
F						

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	982	246	55	2649	0.371	980	1116	0.0	0.6	2.246	A
B	953	238	1034	2204	0.432	950	0	0.0	0.8	2.985	A
C	791	198	1276	1367	0.579	785	708	0.0	1.4	6.392	A
D	605	151	1121	1665	0.363	603	940	0.0	0.6	3.525	A
E	20	5	1718	1067	0.019	20	6	0.0	0.0	3.584	A
F			1171				567				

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	982	246	55	2649	0.371	982	1122	0.6	0.6	2.251	A
B	953	238	1037	2203	0.433	953	0	0.8	0.8	3.003	A
C	791	198	1280	1365	0.579	791	710	1.4	1.4	6.536	A
D	605	151	1128	1662	0.364	605	943	0.6	0.6	3.551	A
E	20	5	1727	1063	0.019	20	6	0.0	0.0	3.599	A
F			1177				570				

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service

A	982	246	55	2649	0.371	982	1122	0.6	0.6	2.251	A
B	953	238	1037	2203	0.433	953	0	0.8	0.8	3.003	A
C	791	198	1280	1365	0.579	791	710	1.4	1.4	6.536	A
D	605	151	1128	1662	0.364	605	943	0.6	0.6	3.551	A
E	20	5	1727	1063	0.019	20	6	0.0	0.0	3.599	A
F			1177				570				

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	982	246	55	2649	0.371	982	1122	0.6	0.6	2.251	A
B	953	238	1037	2203	0.433	953	0	0.8	0.8	3.003	A
C	791	198	1280	1365	0.579	791	710	1.4	1.4	6.536	A
D	605	151	1128	1662	0.364	605	943	0.6	0.6	3.551	A
E	20	5	1727	1063	0.019	20	6	0.0	0.0	3.599	A
F			1177				570				

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	982	246	55	2649	0.371	982	1122	0.6	0.6	2.251	A
B	953	238	1037	2203	0.433	953	0	0.8	0.8	3.003	A
C	791	198	1280	1365	0.579	791	710	1.4	1.4	6.536	A
D	605	151	1128	1662	0.364	605	943	0.6	0.6	3.551	A
E	20	5	1727	1063	0.019	20	6	0.0	0.0	3.599	A
F			1177				570				

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	982	246	55	2649	0.371	982	1122	0.6	0.6	2.251	A
B	953	238	1037	2203	0.433	953	0	0.8	0.8	3.003	A
C	791	198	1280	1365	0.579	791	710	1.4	1.4	6.536	A
D	605	151	1128	1662	0.364	605	943	0.6	0.6	3.551	A
E	20	5	1727	1063	0.019	20	6	0.0	0.0	3.599	A
F			1177				570				

2032 With Proposed Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/R510/N18 Roundabout	Standard Roundabout		A, B, C, D, E, F	4.13	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D11	2032 With Proposed Development	PM	FLAT	16:45	18:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	1038	100.000
B		FLAT	ü	1007	100.000
C		FLAT	ü	835	100.000
D		FLAT	ü	651	100.000
E		FLAT	ü	21	100.000
F					

Origin-Destination Data

Demand (PCU/hr)

		To					
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	0	0	474	510	3	51
	B	126	0	252	432	2	195
	C	601	0	0	20	0	214
	D	447	0	34	33	1	136
	E	11	0	0	2	0	8
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Vehicle Mix

Heavy Vehicle Percentages

		To					
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	3	3	3	3	3	3
	B	3	3	3	3	3	3
	C	3	3	3	3	3	3
	D	3	3	3	3	3	3
	E	3	3	3	3	3	3
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.39	2.34	0.7	A	1038	1557
B	0.47	3.25	0.9	A	1007	1511

C	0.63	7.63	1.8	A	835	1253
D	0.40	3.85	0.7	A	651	977
E	0.02	3.80	0.0	A	21	32
F						

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1038	260	69	2641	0.393	1035	1178	0.0	0.7	2.334	A
B	1007	252	1104	2162	0.466	1003	0	0.0	0.9	3.232	A
C	835	209	1350	1329	0.628	828	758	0.0	1.7	7.396	A
D	651	163	1184	1631	0.399	648	994	0.0	0.7	3.807	A
E	21	5	1826	1015	0.021	21	6	0.0	0.0	3.777	A
F			1246				601				

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1038	260	69	2641	0.393	1038	1185	0.7	0.7	2.342	A
B	1007	252	1107	2160	0.466	1007	0	0.9	0.9	3.255	A
C	835	209	1354	1327	0.629	835	760	1.7	1.7	7.630	A
D	651	163	1192	1627	0.400	651	997	0.7	0.7	3.846	A
E	21	5	1837	1010	0.021	21	6	0.0	0.0	3.796	A
F			1254				604				

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1038	260	69	2641	0.393	1038	1185	0.7	0.7	2.342	A
B	1007	252	1107	2160	0.466	1007	0	0.9	0.9	3.255	A
C	835	209	1354	1327	0.629	835	760	1.7	1.8	7.633	A
D	651	163	1192	1627	0.400	651	997	0.7	0.7	3.846	A
E	21	5	1837	1010	0.021	21	6	0.0	0.0	3.797	A
F			1254				604				

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1038	260	69	2641	0.393	1038	1185	0.7	0.7	2.342	A
B	1007	252	1107	2160	0.466	1007	0	0.9	0.9	3.255	A
C	835	209	1354	1327	0.629	835	760	1.8	1.8	7.633	A
D	651	163	1192	1627	0.400	651	997	0.7	0.7	3.846	A
E	21	5	1837	1010	0.021	21	6	0.0	0.0	3.797	A
F			1254				604				

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1038	260	69	2641	0.393	1038	1185	0.7	0.7	2.342	A
B	1007	252	1107	2160	0.466	1007	0	0.9	0.9	3.255	A
C	835	209	1354	1327	0.629	835	760	1.8	1.8	7.633	A
D	651	163	1192	1627	0.400	651	997	0.7	0.7	3.846	A
E	21	5	1837	1010	0.021	21	6	0.0	0.0	3.797	A
F			1254				604				

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1038	260	69	2641	0.393	1038	1185	0.7	0.7	2.342	A
B	1007	252	1107	2160	0.466	1007	0	0.9	0.9	3.255	A
C	835	209	1354	1327	0.629	835	760	1.8	1.8	7.633	A
D	651	163	1192	1627	0.400	651	997	0.7	0.7	3.846	A
E	21	5	1837	1010	0.021	21	6	0.0	0.0	3.797	A
F			1254				604				

2042 With Proposed Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/R510/N18 Roundabout	Standard Roundabout		A, B, C, D, E, F	4.91	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D12	2042 With Proposed Development	PM	FLAT	16:45	18:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	1115	100.000
B		FLAT	ü	1083	100.000
C		FLAT	ü	897	100.000

D		FLAT	ü	701	100.000
E		FLAT	ü	23	100.000
F					

Origin-Destination Data

Demand (PCU/hr)

		To					
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	0	0	509	548	3	55
	B	135	0	271	465	2	210
	C	645	0	0	22	0	230
	D	481	0	37	36	1	146
	E	12	0	0	3	0	8
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Vehicle Mix

Heavy Vehicle Percentages

		To					
		A	**B**	**C**	**D**	**E**	**F**
From	**A**	3	3	3	3	3	3
	B	3	3	3	3	3	3
	C	3	3	3	3	3	3
	D	3	3	3	3	3	3
	E	3	3	3	3	3	3
	F	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.42	2.47	0.8	A	1115	1673
B	0.51	3.66	1.1	A	1083	1625
C	0.70	9.98	2.5	A	897	1346
D	0.44	4.28	0.8	A	701	1052
E	0.02	4.08	0.0	A	23	35
F						

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1115	279	76	2637	0.423	1112	1263	0.0	0.8	2.457	A
B	1083	271	1188	2111	0.513	1079	0	0.0	1.1	3.621	A

C	897	224	1452	1276	0.703	887	814	0.0	2.4	9.450	A
D	701	175	1269	1585	0.442	698	1070	0.0	0.8	4.217	A
E	23	6	1961	949	0.024	23	6	0.0	0.0	4.052	A
F			1339				645				

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1115	279	76	2636	0.423	1115	1273	0.8	0.8	2.467	A
B	1083	271	1191	2109	0.513	1083	0	1.1	1.1	3.657	A
C	897	224	1457	1273	0.705	897	817	2.4	2.4	9.959	A
D	701	175	1280	1579	0.444	701	1074	0.8	0.8	4.275	A
E	23	6	1975	943	0.024	23	6	0.0	0.0	4.081	A
F			1349				649				

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1115	279	76	2636	0.423	1115	1273	0.8	0.8	2.467	A
B	1083	271	1191	2109	0.513	1083	0	1.1	1.1	3.657	A
C	897	224	1457	1273	0.705	897	817	2.4	2.5	9.971	A
D	701	175	1280	1579	0.444	701	1074	0.8	0.8	4.275	A
E	23	6	1975	943	0.024	23	6	0.0	0.0	4.082	A
F			1349				649				

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1115	279	76	2636	0.423	1115	1273	0.8	0.8	2.467	A
B	1083	271	1191	2109	0.513	1083	0	1.1	1.1	3.657	A
C	897	224	1457	1273	0.705	897	817	2.5	2.5	9.973	A
D	701	175	1280	1579	0.444	701	1074	0.8	0.8	4.276	A
E	23	6	1975	943	0.024	23	6	0.0	0.0	4.082	A
F			1349				649				

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1115	279	76	2636	0.423	1115	1273	0.8	0.8	2.467	A
B	1083	271	1191	2109	0.513	1083	0	1.1	1.1	3.657	A
C	897	224	1457	1273	0.705	897	817	2.5	2.5	9.975	A
D	701	175	1280	1579	0.444	701	1074	0.8	0.8	4.276	A
E	23	6	1975	943	0.024	23	6	0.0	0.0	4.082	A
F			1349				649				

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	1115	279	76	2636	0.423	1115	1273	0.8	0.8	2.467	A
B	1083	271	1191	2109	0.513	1083	0	1.1	1.1	3.657	A
C	897	224	1457	1273	0.705	897	817	2.5	2.5	9.977	A
D	701	175	1280	1579	0.444	701	1074	0.8	0.8	4.276	A

E	23	6	1975	943	0.024	23	6	0.0	0.0	4.082	A
F			1349				649				

Junctions 9
ARCADY 9 - Roundabout Module
Version: 9.5.1.7462 © Copyright TRL Limited, 2019
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Filename: dock_rd_rbt.j9
Path: D:\ttrsa\projects\T210607_Ballykeefe_Limerick_EIAR_Chapter_MMP\eiar_chapter\modelling
Report generation date: 07/03/2022 17:38:28

Summary of junction performance

	AM					PM				
	Set ID	Queue (PCU)	Delay (s)	RFC	LOS	Set ID	Queue (PCU)	Delay (s)	RFC	LOS
	2027 Without Development									
Arm A	D1	0.0	4.18	0.02	A	D7	0.0	3.09	0.01	A
Arm B		0.8	2.85	0.42	A		1.0	3.26	0.48	A
Arm D		1.4	2.88	0.57	A		0.6	1.95	0.37	A
Arm E		0.6	4.28	0.35	A		0.4	3.10	0.29	A
	2032 Without Development									
Arm A	D2	0.0	4.54	0.02	A	D8	0.0	3.22	0.01	A
Arm B		0.8	3.05	0.45	A		1.1	3.55	0.52	A
Arm D		1.6	3.12	0.60	A		0.7	2.01	0.39	A
Arm E		0.7	4.74	0.39	A		0.5	3.29	0.32	A
	2042 Without Development									
Arm A	D3	0.0	5.11	0.03	A	D9	0.0	3.43	0.01	A
Arm B		1.1	3.45	0.50	A		1.4	4.06	0.57	A
Arm D		1.9	3.58	0.65	A		0.7	2.12	0.42	A
Arm E		0.8	5.56	0.44	A		0.6	3.57	0.35	A
	2027 With Proposed Development									
Arm A	D4	0.0	4.26	0.02	A	D10	0.0	3.12	0.01	A
Arm B		0.8	2.89	0.42	A		1.0	3.32	0.49	A
Arm D		1.4	2.93	0.58	A		0.6	1.96	0.37	A
Arm E		0.6	4.38	0.36	A		0.4	3.14	0.30	A

	2032 With Proposed Development									
Arm A	D5	0.0	4.63	0.02	A	D11	0.0	3.26	0.01	A
Arm B		0.9	3.10	0.46	A		1.2	3.62	0.53	A
Arm D		1.6	3.18	0.61	A		0.7	2.03	0.39	A
Arm E		0.7	4.87	0.40	A		0.5	3.33	0.32	A
	2042 With Proposed Development									
Arm A	D6	0.0	5.16	0.01	A	D12	0.0	3.47	0.01	A
Arm B		1.0	3.41	0.50	A		1.4	4.15	0.58	A
Arm D		2.0	3.61	0.66	A		0.8	2.13	0.42	A
Arm E		0.9	5.74	0.45	A		0.6	3.62	0.36	A

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle.

File summary

File Description

Title	Existing N69/N18/Dock Road Roundabout
Location	Limerick
Site number	
Date	26/01/2022
Version	EIAR
Status	Final
Identifier	
Client	DW Raheen
Jobnumber	T210607
Enumerator	TTRSA
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin

Analysis Options

Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Calculate residual capacity	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
5.75				0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D1	2027 Without Development	AM	FLAT	07:45	09:15	90	15	ü
D2	2032 Without Development	AM	FLAT	07:45	09:15	90	15	ü
D3	2042 Without Development	AM	FLAT	07:45	09:15	90	15	ü
D4	2027 With Proposed Development	AM	FLAT	07:45	09:15	90	15	ü
D5	2032 With Proposed Development	AM	FLAT	07:45	09:15	90	15	ü
D6	2042 With Proposed Development	AM	FLAT	07:45	09:15	90	15	ü
D7	2027 Without Development	PM	FLAT	16:45	18:15	90	15	ü
D8	2032 Without Development	PM	FLAT	16:45	18:15	90	15	ü
D9	2042 Without Development	PM	FLAT	16:45	18:15	90	15	ü
D10	2027 With Proposed Development	PM	FLAT	16:45	18:15	90	15	ü
D11	2032 With Proposed Development	PM	FLAT	16:45	18:15	90	15	ü

D12	2042 With Proposed Development	PM	FLAT	16:45	18:15	90	15	ü

Analysis Set Details

ID	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	ü	100.000	100.000

2027 Without Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/N18/Dock Road Roundabout	Standard Roundabout		A, B, C, D, E	3.08	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Arms

Arms

Arm	Name	Description
A	Limerick Main Drainage Access	
B	Dock Road to/from East	
C	N18 Southbound On-Slip	
D	N69 Roundabout Connector	
E	N18 Southbound Off-Slip	

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
A	4.00	9.60	19.0	12.0	80.0	21.0	
B	5.20	10.30	30.0	25.0	80.0	8.0	
C							ü
D	7.60	11.00	15.0	40.0	80.0	22.0	
E	4.25	9.70	30.0	25.0	80.0	30.0	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Final slope	Final intercept (PCU/hr)
A	0.528	2082
B	0.653	2798
C		
D	0.682	3051
E	0.571	2355

The slope and intercept shown above include any corrections and adjustments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D1	2027 Without Development	AM	FLAT	07:45	09:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	16	100.000
B		FLAT	ü	949	100.000
C					
D		FLAT	ü	1717	100.000
E		FLAT	ü	473	100.000

Origin-Destination Data

Demand (PCU/hr)

		To				
		A	**B**	**C**	**D**	**E**
From	**A**	0	1	11	4	0
	B	9	34	497	409	0
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	8	1210	499	0	0
	E	3	169	13	288	0

Vehicle Mix

Heavy Vehicle Percentages

		To				
		A	**B**	**C**	**D**	**E**
From	**A**	3	3	3	3	3
	B	3	3	3	3	3
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	3	3	3	3	3
	E	3	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.02	4.18	0.0	A	16	24
B	0.42	2.85	0.8	A	949	1424
C						
D	0.57	2.88	1.4	A	1717	2576
E	0.35	4.28	0.6	A	473	710

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	16	4	2205	918	0.017	16	20	0.0	0.0	4.162	A
B	949	237	812	2268	0.418	946	1409	0.0	0.7	2.833	A
C			741				1017				
D	1717	429	43	3022	0.568	1712	698	0.0	1.4	2.853	A
E	473	118	1754	1354	0.349	471	0	0.0	0.6	4.242	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	16	4	2213	914	0.018	16	20	0.0	0.0	4.181	A
B	949	237	815	2266	0.419	949	1414	0.7	0.7	2.849	A
C			744				1020				
D	1717	429	43	3022	0.568	1717	701	1.4	1.4	2.876	A
E	473	118	1760	1351	0.350	473	0	0.6	0.6	4.277	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	16	4	2213	914	0.018	16	20	0.0	0.0	4.181	A
B	949	237	815	2266	0.419	949	1414	0.7	0.7	2.849	A
C			744				1020				
D	1717	429	43	3022	0.568	1717	701	1.4	1.4	2.876	A
E	473	118	1760	1351	0.350	473	0	0.6	0.6	4.277	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	16	4	2213	914	0.018	16	20	0.0	0.0	4.181	A
B	949	237	815	2266	0.419	949	1414	0.7	0.8	2.849	A
C			744				1020				
D	1717	429	43	3022	0.568	1717	701	1.4	1.4	2.876	A
E	473	118	1760	1351	0.350	473	0	0.6	0.6	4.277	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	16	4	2213	914	0.018	16	20	0.0	0.0	4.181	A
B	949	237	815	2266	0.419	949	1414	0.8	0.8	2.849	A
C			744				1020				
D	1717	429	43	3022	0.568	1717	701	1.4	1.4	2.876	A
E	473	118	1760	1351	0.350	473	0	0.6	0.6	4.277	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	16	4	2213	914	0.018	16	20	0.0	0.0	4.181	A
B	949	237	815	2266	0.419	949	1414	0.8	0.8	2.849	A
C			744				1020				
D	1717	429	43	3022	0.568	1717	701	1.4	1.4	2.876	A
E	473	118	1760	1351	0.350	473	0	0.6	0.6	4.277	A

2032 Without Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/N18/Dock Road Roundabout	Standard Roundabout		A, B, C, D, E	3.35	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D2	2032 Without Development	AM	FLAT	07:45	09:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	18	100.000
B		FLAT	ü	1003	100.000
C					
D		FLAT	ü	1817	100.000
E		FLAT	ü	501	100.000

Origin-Destination Data

Demand (PCU/hr)

		To				
		A	B	C	D	E
From	A	0	1	12	5	0
	B	9	36	526	432	0
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	9	1280	528	0	0
	E	3	179	14	305	0

Vehicle Mix

Heavy Vehicle Percentages

		To				
		A	B	C	D	E
From	A	3	3	3	3	3
	B	3	3	3	3	3
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	3	3	3	3	3
	E	3	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.02	4.54	0.0	A	18	27
B	0.45	3.05	0.8	A	1003	1505
C						
D	0.60	3.12	1.6	A	1817	2726
E	0.39	4.74	0.7	A	501	752

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	18	5	2333	850	0.021	18	21	0.0	0.0	4.510	A
B	1003	251	860	2237	0.448	1000	1491	0.0	0.8	3.028	A
C			784				1076				
D	1817	454	45	3021	0.602	1811	739	0.0	1.6	3.086	A
E	501	125	1856	1296	0.387	498	0	0.0	0.7	4.692	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	18	5	2342	846	0.021	18	21	0.0	0.0	4.535	A
B	1003	251	864	2234	0.449	1003	1496	0.8	0.8	3.048	A
C			787				1080				

D	1817	454	45	3021	0.602	1817	742	1.6	1.6	3.118	A
E	501	125	1862	1292	0.388	501	0	0.7	0.7	4.743	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	18	5	2342	846	0.021	18	21	0.0	0.0	4.535	A
B	1003	251	864	2234	0.449	1003	1496	0.8	0.8	3.048	A
C			787				1080				
D	1817	454	45	3021	0.602	1817	742	1.6	1.6	3.118	A
E	501	125	1862	1292	0.388	501	0	0.7	0.7	4.743	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	18	5	2342	846	0.021	18	21	0.0	0.0	4.535	A
B	1003	251	864	2234	0.449	1003	1496	0.8	0.8	3.048	A
C			787				1080				
D	1817	454	45	3021	0.602	1817	742	1.6	1.6	3.118	A
E	501	125	1862	1292	0.388	501	0	0.7	0.7	4.743	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	18	5	2342	846	0.021	18	21	0.0	0.0	4.535	A
B	1003	251	864	2234	0.449	1003	1496	0.8	0.8	3.048	A
C			787				1080				
D	1817	454	45	3021	0.602	1817	742	1.6	1.6	3.118	A
E	501	125	1862	1292	0.388	501	0	0.7	0.7	4.743	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	18	5	2342	846	0.021	18	21	0.0	0.0	4.535	A
B	1003	251	864	2234	0.449	1003	1496	0.8	0.8	3.048	A
C			787				1080				
D	1817	454	45	3021	0.602	1817	742	1.6	1.6	3.118	A
E	501	125	1862	1292	0.388	501	0	0.7	0.7	4.743	A

2042 Without Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/N18/Dock Road Roundabout	Standard Roundabout		A, B, C, D, E	3.84	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D3	2042 Without Development	AM	FLAT	07:45	09:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	19	100.000
B		FLAT	ü	1105	100.000
C					
D		FLAT	ü	1952	100.000
E		FLAT	ü	538	100.000

Origin-Destination Data

Demand (PCU/hr)

		To				
		A	B	C	D	E
From	A	0	1	13	5	0
	B	10	39	565	465	26
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	9	1376	567	0	0
	E	3	192	15	328	0

Vehicle Mix

Heavy Vehicle Percentages

		To				
		A	B	C	D	E
From	A	3	3	3	3	3
	B	3	3	3	3	3
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	3	3	3	3	3
	E	3	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.03	5.11	0.0	A	19	29
B	0.50	3.45	1.1	A	1105	1658

C						
D	0.65	3.58	1.9	A	1952	2928
E	0.44	5.56	0.8	A	538	807

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	19	5	2506	759	0.025	19	22	0.0	0.0	5.072	A
B	1105	276	924	2196	0.503	1101	1601	0.0	1.0	3.417	A
C			869				1155				
D	1952	488	75	3000	0.651	1944	794	0.0	1.9	3.530	A
E	538	135	1993	1218	0.442	535	26	0.0	0.8	5.471	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	19	5	2517	753	0.025	19	22	0.0	0.0	5.112	A
B	1105	276	928	2193	0.504	1105	1608	1.0	1.1	3.451	A
C			873				1160				
D	1952	488	75	3000	0.651	1952	798	1.9	1.9	3.581	A
E	538	135	2001	1213	0.443	538	26	0.8	0.8	5.560	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	19	5	2517	753	0.025	19	22	0.0	0.0	5.112	A
B	1105	276	928	2193	0.504	1105	1608	1.1	1.1	3.451	A
C			873				1160				
D	1952	488	75	3000	0.651	1952	798	1.9	1.9	3.581	A
E	538	135	2001	1213	0.443	538	26	0.8	0.8	5.560	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	19	5	2517	753	0.025	19	22	0.0	0.0	5.112	A
B	1105	276	928	2193	0.504	1105	1608	1.1	1.1	3.451	A
C			873				1160				
D	1952	488	75	3000	0.651	1952	798	1.9	1.9	3.581	A
E	538	135	2001	1213	0.443	538	26	0.8	0.8	5.560	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	19	5	2517	753	0.025	19	22	0.0	0.0	5.112	A
B	1105	276	928	2193	0.504	1105	1608	1.1	1.1	3.451	A
C			873				1160				

D	1952	488	75	3000	0.651	1952	798	1.9	1.9	3.581	A
E	538	135	2001	1213	0.443	538	26	0.8	0.8	5.560	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	19	5	2517	753	0.025	19	22	0.0	0.0	5.112	A
B	1105	276	928	2193	0.504	1105	1608	1.1	1.1	3.451	A
C			873				1160				
D	1952	488	75	3000	0.651	1952	798	1.9	1.9	3.581	A
E	538	135	2001	1213	0.443	538	26	0.8	0.8	5.560	A

2027 With Proposed Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/N18/Dock Road Roundabout	Standard Roundabout		A, B, C, D, E	3.14	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D4	2027 With Proposed Development	AM	FLAT	07:45	09:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	16	100.000
B		FLAT	ü	959	100.000
C					
D		FLAT	ü	1740	100.000
E		FLAT	ü	481	100.000

Origin-Destination Data

Demand (PCU/hr)

		To				
		A	B	C	D	E
From	A	0	1	11	4	0
	B	9	34	497	419	0
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	8	1227	505	0	0
	E	3	169	13	296	0

Vehicle Mix

Heavy Vehicle Percentages

		To				
		A	B	C	D	E
From	A	3	3	3	3	3
	B	3	3	3	3	3
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	3	3	3	3	3
	E	3	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.02	4.26	0.0	A	16	24
B	0.42	2.89	0.8	A	959	1439
C						
D	0.58	2.93	1.4	A	1740	2610
E	0.36	4.38	0.6	A	481	722

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	16	4	2236	902	0.018	16	20	0.0	0.0	4.239	A
B	959	240	826	2259	0.424	956	1426	0.0	0.8	2.875	A
C			759				1023				
D	1740	435	43	3022	0.576	1734	716	0.0	1.4	2.902	A
E	481	120	1777	1341	0.359	479	0	0.0	0.6	4.344	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	16	4	2244	897	0.018	16	20	0.0	0.0	4.259	A
B	959	240	829	2257	0.425	959	1431	0.8	0.8	2.891	A
C			762				1026				

D	1740	435	43	3022	0.576	1740	719	1.4	1.4	2.928	A
E	481	120	1783	1338	0.360	481	0	0.6	0.6	4.382	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	16	4	2244	897	0.018	16	20	0.0	0.0	4.259	A
B	959	240	829	2257	0.425	959	1431	0.8	0.8	2.891	A
C			762				1026				
D	1740	435	43	3022	0.576	1740	719	1.4	1.4	2.928	A
E	481	120	1783	1338	0.360	481	0	0.6	0.6	4.382	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	16	4	2244	897	0.018	16	20	0.0	0.0	4.259	A
B	959	240	829	2257	0.425	959	1431	0.8	0.8	2.891	A
C			762				1026				
D	1740	435	43	3022	0.576	1740	719	1.4	1.4	2.928	A
E	481	120	1783	1338	0.360	481	0	0.6	0.6	4.382	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	16	4	2244	897	0.018	16	20	0.0	0.0	4.259	A
B	959	240	829	2257	0.425	959	1431	0.8	0.8	2.891	A
C			762				1026				
D	1740	435	43	3022	0.576	1740	719	1.4	1.4	2.928	A
E	481	120	1783	1338	0.360	481	0	0.6	0.6	4.382	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	16	4	2244	897	0.018	16	20	0.0	0.0	4.259	A
B	959	240	829	2257	0.425	959	1431	0.8	0.8	2.891	A
C			762				1026				
D	1740	435	43	3022	0.576	1740	719	1.4	1.4	2.928	A
E	481	120	1783	1338	0.360	481	0	0.6	0.6	4.382	A

2032 With Proposed Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/N18/Dock Road Roundabout	Standard Roundabout		A, B, C, D, E	3.42	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D5	2032 With Proposed Development	AM	FLAT	07:45	09:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	18	100.000
B		FLAT	ü	1014	100.000
C					
D		FLAT	ü	1841	100.000
E		FLAT	ü	508	100.000

Origin-Destination Data

Demand (PCU/hr)

		To				
		A	B	C	D	E
From	A	0	1	12	5	0
	B	9	36	526	443	0
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	9	1297	535	0	0
	E	3	179	14	312	0

Vehicle Mix

Heavy Vehicle Percentages

		To				
		A	B	C	D	E
From	A	3	3	3	3	3
	B	3	3	3	3	3
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	3	3	3	3	3
	E	3	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.02	4.63	0.0	A	18	27
B	0.46	3.10	0.9	A	1014	1521

C						
D	0.61	3.18	1.6	A	1841	2762
E	0.40	4.87	0.7	A	508	762

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	18	5	2364	834	0.022	18	21	0.0	0.0	4.599	A
B	1014	254	874	2228	0.455	1011	1507	0.0	0.9	3.075	A
C			802				1083				
D	1841	460	45	3021	0.609	1835	757	0.0	1.6	3.149	A
E	508	127	1879	1283	0.396	505	0	0.0	0.7	4.814	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	18	5	2373	829	0.022	18	21	0.0	0.0	4.627	A
B	1014	254	878	2225	0.456	1014	1513	0.9	0.9	3.098	A
C			805				1087				
D	1841	460	45	3021	0.609	1841	760	1.6	1.6	3.182	A
E	508	127	1886	1279	0.397	508	0	0.7	0.7	4.870	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	18	5	2373	829	0.022	18	21	0.0	0.0	4.627	A
B	1014	254	878	2225	0.456	1014	1513	0.9	0.9	3.098	A
C			805				1087				
D	1841	460	45	3021	0.609	1841	760	1.6	1.6	3.182	A
E	508	127	1886	1279	0.397	508	0	0.7	0.7	4.870	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	18	5	2373	829	0.022	18	21	0.0	0.0	4.627	A
B	1014	254	878	2225	0.456	1014	1513	0.9	0.9	3.098	A
C			805				1087				
D	1841	460	45	3021	0.609	1841	760	1.6	1.6	3.182	A
E	508	127	1886	1279	0.397	508	0	0.7	0.7	4.870	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	18	5	2373	829	0.022	18	21	0.0	0.0	4.627	A
B	1014	254	878	2225	0.456	1014	1513	0.9	0.9	3.098	A
C			805				1087				

D	1841	460	45	3021	0.609	1841	760	1.6	1.6	3.182	A
E	508	127	1886	1279	0.397	508	0	0.7	0.7	4.870	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	18	5	2373	829	0.022	18	21	0.0	0.0	4.627	A
B	1014	254	878	2225	0.456	1014	1513	0.9	0.9	3.098	A
C			805				1087				
D	1841	460	45	3021	0.609	1841	760	1.6	1.6	3.182	A
E	508	127	1886	1279	0.397	508	0	0.7	0.7	4.870	A

2042 With Proposed Development, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/N18/Dock Road Roundabout	Standard Roundabout		A, B, C, D, E	3.87	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D6	2042 With Proposed Development	AM	FLAT	07:45	09:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	9	100.000
B		FLAT	ü	1089	100.000
C					
D		FLAT	ü	1977	100.000
E		FLAT	ü	545	100.000

Origin-Destination Data

Demand (PCU/hr)

		To				
		A	B	C	D	E
From	A	0	1	3	5	0
	B	10	39	565	475	0
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	10	1393	574	0	0
	E	3	192	15	335	0

Vehicle Mix

Heavy Vehicle Percentages

		To				
		A	B	C	D	E
From	A	3	3	3	3	3
	B	3	3	3	3	3
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	3	3	3	3	3
	E	3	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.01	5.16	0.0	A	9	14
B	0.50	3.41	1.0	A	1089	1634
C						
D	0.66	3.61	2.0	A	1977	2966
E	0.45	5.74	0.9	A	545	818

Main Results for each time segment

07:45 - 08:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	9	2	2537	743	0.012	9	23	0.0	0.0	5.115	A
B	1089	272	927	2193	0.497	1085	1618	0.0	1.0	3.376	A
C			860				1152				
D	1977	494	49	3018	0.655	1969	811	0.0	2.0	3.554	A
E	545	136	2018	1203	0.453	542	0	0.0	0.9	5.646	A

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	9	2	2548	737	0.012	9	23	0.0	0.0	5.157	A
B	1089	272	932	2190	0.497	1089	1625	1.0	1.0	3.409	A
C			864				1157				

D	1977	494	49	3018	0.655	1977	815	2.0	2.0	3.606	A
E	545	136	2026	1199	0.455	545	0	0.9	0.9	5.740	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	9	2	2548	737	0.012	9	23	0.0	0.0	5.157	A
B	1089	272	932	2190	0.497	1089	1625	1.0	1.0	3.409	A
C			864				1157				
D	1977	494	49	3018	0.655	1977	815	2.0	2.0	3.606	A
E	545	136	2026	1199	0.455	545	0	0.9	0.9	5.741	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	9	2	2548	737	0.012	9	23	0.0	0.0	5.157	A
B	1089	272	932	2190	0.497	1089	1625	1.0	1.0	3.409	A
C			864				1157				
D	1977	494	49	3018	0.655	1977	815	2.0	2.0	3.606	A
E	545	136	2026	1199	0.455	545	0	0.9	0.9	5.741	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	9	2	2548	737	0.012	9	23	0.0	0.0	5.157	A
B	1089	272	932	2190	0.497	1089	1625	1.0	1.0	3.409	A
C			864				1157				
D	1977	494	49	3018	0.655	1977	815	2.0	2.0	3.606	A
E	545	136	2026	1199	0.455	545	0	0.9	0.9	5.741	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	9	2	2548	737	0.012	9	23	0.0	0.0	5.157	A
B	1089	272	932	2190	0.497	1089	1625	1.0	1.0	3.409	A
C			864				1157				
D	1977	494	49	3018	0.655	1977	815	2.0	2.0	3.606	A
E	545	136	2026	1199	0.455	545	0	0.9	0.9	5.741	A

2027 Without Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/N18/Dock Road Roundabout	Standard Roundabout		A, B, C, D, E	2.69	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D7	2027 Without Development	PM	FLAT	16:45	18:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	8	100.000
B		FLAT	ü	1074	100.000
C					
D		FLAT	ü	1110	100.000
E		FLAT	ü	501	100.000

Origin-Destination Data

Demand (PCU/hr)

		To				
		A	B	C	D	E
From	A	0	2	2	4	0
	B	0	19	400	655	0
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	2	674	434	0	0
	E	0	64	133	304	0

Vehicle Mix

Heavy Vehicle Percentages

		To				
		A	B	C	D	E
From	A	3	3	3	3	3
	B	3	3	3	3	3
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	3	3	3	3	3
	E	3	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.01	3.09	0.0	A	8	12
B	0.48	3.26	1.0	A	1074	1611

C						
D	0.37	1.95	0.6	A	1110	1665
E	0.29	3.10	0.4	A	501	752

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1624	1225	0.007	8	2	0.0	0.0	3.084	A
B	1074	269	875	2228	0.482	1070	757	0.0	1.0	3.233	A
C			979				966				
D	1110	278	19	3038	0.365	1108	960	0.0	0.6	1.942	A
E	501	125	1127	1712	0.293	499	0	0.0	0.4	3.092	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1628	1223	0.007	8	2	0.0	0.0	3.090	A
B	1074	269	877	2226	0.483	1074	759	1.0	1.0	3.258	A
C			982				969				
D	1110	278	19	3038	0.365	1110	963	0.6	0.6	1.946	A
E	501	125	1129	1711	0.293	501	0	0.4	0.4	3.102	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1628	1223	0.007	8	2	0.0	0.0	3.090	A
B	1074	269	877	2226	0.483	1074	759	1.0	1.0	3.258	A
C			982				969				
D	1110	278	19	3038	0.365	1110	963	0.6	0.6	1.946	A
E	501	125	1129	1711	0.293	501	0	0.4	0.4	3.102	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1628	1223	0.007	8	2	0.0	0.0	3.090	A
B	1074	269	877	2226	0.483	1074	759	1.0	1.0	3.258	A
C			982				969				
D	1110	278	19	3038	0.365	1110	963	0.6	0.6	1.946	A
E	501	125	1129	1711	0.293	501	0	0.4	0.4	3.102	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1628	1223	0.007	8	2	0.0	0.0	3.090	A
B	1074	269	877	2226	0.483	1074	759	1.0	1.0	3.258	A
C			982				969				

D	1110	278	19	3038	0.365	1110	963	0.6	0.6	1.946	A
E	501	125	1129	1711	0.293	501	0	0.4	0.4	3.102	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1628	1223	0.007	8	2	0.0	0.0	3.090	A
B	1074	269	877	2226	0.483	1074	759	1.0	1.0	3.258	A
C			982				969				
D	1110	278	19	3038	0.365	1110	963	0.6	0.6	1.946	A
E	501	125	1129	1711	0.293	501	0	0.4	0.4	3.102	A

2032 Without Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/N18/Dock Road Roundabout	Standard Roundabout		A, B, C, D, E	2.87	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D8	2032 Without Development	PM	FLAT	16:45	18:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	8	100.000
B		FLAT	ü	1136	100.000
C					
D		FLAT	ü	1175	100.000
E		FLAT	ü	531	100.000

Origin-Destination Data

Demand (PCU/hr)

		To				
		A	**B**	**C**	**D**	**E**
From	**A**	0	2	2	4	0
	B	0	20	423	693	0
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	2	714	459	0	0
	E	0	68	141	322	0

Vehicle Mix

Heavy Vehicle Percentages

		To				
		A	**B**	**C**	**D**	**E**
From	**A**	3	3	3	3	3
	B	3	3	3	3	3
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	3	3	3	3	3
	E	3	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.01	3.22	0.0	A	8	12
B	0.52	3.55	1.1	A	1136	1704
C						
D	0.39	2.01	0.7	A	1175	1763
E	0.32	3.29	0.5	A	531	797

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1719	1174	0.007	8	2	0.0	0.0	3.218	A
B	1136	284	925	2194	0.518	1132	802	0.0	1.1	3.518	A
C			1035				1022				
D	1175	294	20	3038	0.387	1172	1015	0.0	0.7	2.010	A
E	531	133	1192	1675	0.317	529	0	0.0	0.5	3.272	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1724	1172	0.007	8	2	0.0	0.0	3.224	A
B	1136	284	928	2193	0.518	1136	804	1.1	1.1	3.552	A
C			1039				1025				

D	1175	294	20	3038	0.387	1175	1019	0.7	0.7	2.015	A
E	531	133	1195	1673	0.317	531	0	0.5	0.5	3.286	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1724	1172	0.007	8	2	0.0	0.0	3.224	A
B	1136	284	928	2193	0.518	1136	804	1.1	1.1	3.552	A
C			1039				1025				
D	1175	294	20	3038	0.387	1175	1019	0.7	0.7	2.015	A
E	531	133	1195	1673	0.317	531	0	0.5	0.5	3.286	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1724	1172	0.007	8	2	0.0	0.0	3.224	A
B	1136	284	928	2193	0.518	1136	804	1.1	1.1	3.552	A
C			1039				1025				
D	1175	294	20	3038	0.387	1175	1019	0.7	0.7	2.015	A
E	531	133	1195	1673	0.317	531	0	0.5	0.5	3.286	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1724	1172	0.007	8	2	0.0	0.0	3.224	A
B	1136	284	928	2193	0.518	1136	804	1.1	1.1	3.552	A
C			1039				1025				
D	1175	294	20	3038	0.387	1175	1019	0.7	0.7	2.015	A
E	531	133	1195	1673	0.317	531	0	0.5	0.5	3.286	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1724	1172	0.007	8	2	0.0	0.0	3.224	A
B	1136	284	928	2193	0.518	1136	804	1.1	1.1	3.552	A
C			1039				1025				
D	1175	294	20	3038	0.387	1175	1019	0.7	0.7	2.015	A
E	531	133	1195	1673	0.317	531	0	0.5	0.5	3.286	A

2042 Without Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/N18/Dock Road Roundabout	Standard Roundabout		A, B, C, D, E	3.17	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D9	2042 Without Development	PM	FLAT	16:45	18:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	10	100.000
B		FLAT	ü	1222	100.000
C					
D		FLAT	ü	1263	100.000
E		FLAT	ü	571	100.000

Origin-Destination Data

Demand (PCU/hr)

		To				
		A	B	C	D	E
From	A	0	3	3	4	0
	B	0	22	455	745	0
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	2	767	494	0	0
	E	0	73	152	346	0

Vehicle Mix

Heavy Vehicle Percentages

		To				
		A	B	C	D	E
From	A	3	3	3	3	3
	B	3	3	3	3	3
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	3	3	3	3	3
	E	3	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.01	3.43	0.0	A	10	15
B	0.57	4.06	1.4	A	1222	1833

C						
D	0.42	2.12	0.7	A	1263	1895
E	0.35	3.57	0.6	A	571	857

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	10	3	1849	1106	0.009	10	2	0.0	0.0	3.424	A
B	1222	306	996	2148	0.569	1217	863	0.0	1.4	4.006	A
C			1112				1100				
D	1263	316	22	3036	0.416	1260	1090	0.0	0.7	2.110	A
E	571	143	1282	1623	0.352	569	0	0.0	0.6	3.552	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	10	3	1854	1103	0.009	10	2	0.0	0.0	3.433	A
B	1222	306	999	2146	0.569	1222	865	1.4	1.4	4.061	A
C			1117				1104				
D	1263	316	22	3036	0.416	1263	1095	0.7	0.7	2.116	A
E	571	143	1285	1622	0.352	571	0	0.6	0.6	3.572	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	10	3	1854	1103	0.009	10	2	0.0	0.0	3.433	A
B	1222	306	999	2146	0.569	1222	865	1.4	1.4	4.061	A
C			1117				1104				
D	1263	316	22	3036	0.416	1263	1095	0.7	0.7	2.116	A
E	571	143	1285	1622	0.352	571	0	0.6	0.6	3.572	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	10	3	1854	1103	0.009	10	2	0.0	0.0	3.433	A
B	1222	306	999	2146	0.569	1222	865	1.4	1.4	4.061	A
C			1117				1104				
D	1263	316	22	3036	0.416	1263	1095	0.7	0.7	2.116	A
E	571	143	1285	1622	0.352	571	0	0.6	0.6	3.572	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	10	3	1854	1103	0.009	10	2	0.0	0.0	3.433	A
B	1222	306	999	2146	0.569	1222	865	1.4	1.4	4.061	A
C			1117				1104				

D	1263	316	22	3036	0.416	1263	1095	0.7	0.7	2.116	A
E	571	143	1285	1622	0.352	571	0	0.6	0.6	3.572	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	10	3	1854	1103	0.009	10	2	0.0	0.0	3.433	A
B	1222	306	999	2146	0.569	1222	865	1.4	1.4	4.061	A
C			1117				1104				
D	1263	316	22	3036	0.416	1263	1095	0.7	0.7	2.116	A
E	571	143	1285	1622	0.352	571	0	0.6	0.6	3.572	A

2027 With Proposed Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/N18/Dock Road Roundabout	Standard Roundabout		A, B, C, D, E	2.72	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D10	2027 With Proposed Development	PM	FLAT	16:45	18:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	8	100.000
B		FLAT	ü	1086	100.000
C					
D		FLAT	ü	1125	100.000
E		FLAT	ü	507	100.000

Origin-Destination Data

Demand (PCU/hr)

		To				
		A	B	C	D	E
From	A	0	2	2	4	0
	B	0	19	400	667	0
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	2	683	440	0	0
	E	0	64	133	310	0

Vehicle Mix

Heavy Vehicle Percentages

		To				
		A	B	C	D	E
From	A	3	3	3	3	3
	B	3	3	3	3	3
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	3	3	3	3	3
	E	3	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.01	3.12	0.0	A	8	12
B	0.49	3.32	1.0	A	1086	1629
C						
D	0.37	1.96	0.6	A	1125	1688
E	0.30	3.14	0.4	A	507	761

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1645	1214	0.007	8	2	0.0	0.0	3.112	A
B	1086	272	886	2220	0.489	1082	766	0.0	1.0	3.290	A
C			996				972				
D	1125	281	19	3038	0.370	1123	977	0.0	0.6	1.957	A
E	507	127	1141	1704	0.298	505	0	0.0	0.4	3.129	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1649	1212	0.007	8	2	0.0	0.0	3.118	A
B	1086	272	889	2218	0.490	1086	768	1.0	1.0	3.315	A
C			1000				975				

D	1125	281	19	3038	0.370	1125	981	0.6	0.6	1.961	A
E	507	127	1144	1702	0.298	507	0	0.4	0.4	3.140	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1649	1212	0.007	8	2	0.0	0.0	3.118	A
B	1086	272	889	2218	0.490	1086	768	1.0	1.0	3.315	A
C			1000				975				
D	1125	281	19	3038	0.370	1125	981	0.6	0.6	1.961	A
E	507	127	1144	1702	0.298	507	0	0.4	0.4	3.140	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1649	1212	0.007	8	2	0.0	0.0	3.118	A
B	1086	272	889	2218	0.490	1086	768	1.0	1.0	3.315	A
C			1000				975				
D	1125	281	19	3038	0.370	1125	981	0.6	0.6	1.961	A
E	507	127	1144	1702	0.298	507	0	0.4	0.4	3.140	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1649	1212	0.007	8	2	0.0	0.0	3.118	A
B	1086	272	889	2218	0.490	1086	768	1.0	1.0	3.315	A
C			1000				975				
D	1125	281	19	3038	0.370	1125	981	0.6	0.6	1.961	A
E	507	127	1144	1702	0.298	507	0	0.4	0.4	3.140	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1649	1212	0.007	8	2	0.0	0.0	3.118	A
B	1086	272	889	2218	0.490	1086	768	1.0	1.0	3.315	A
C			1000				975				
D	1125	281	19	3038	0.370	1125	981	0.6	0.6	1.961	A
E	507	127	1144	1702	0.298	507	0	0.4	0.4	3.140	A

2032 With Proposed Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/N18/Dock Road Roundabout	Standard Roundabout		A, B, C, D, E	2.91	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D11	2032 With Proposed Development	PM	FLAT	16:45	18:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	8	100.000
B		FLAT	ü	1148	100.000
C					
D		FLAT	ü	1190	100.000
E		FLAT	ü	537	100.000

Origin-Destination Data

Demand (PCU/hr)

		To				
		A	**B**	**C**	**D**	**E**
From	**A**	0	2	2	4	0
	B	0	20	423	705	0
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	2	723	465	0	0
	E	0	68	141	328	0

Vehicle Mix

Heavy Vehicle Percentages

		To				
		A	**B**	**C**	**D**	**E**
From	**A**	3	3	3	3	3
	B	3	3	3	3	3
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	3	3	3	3	3
	E	3	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.01	3.26	0.0	A	8	12

B	0.53	3.62	1.2	A	1148	1722
C						
D	0.39	2.03	0.7	A	1190	1785
E	0.32	3.33	0.5	A	537	806

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1740	1163	0.007	8	2	0.0	0.0	3.248	A
B	1148	287	937	2187	0.525	1143	811	0.0	1.1	3.582	A
C			1053				1028				
D	1190	298	20	3038	0.392	1187	1033	0.0	0.7	2.026	A
E	537	134	1207	1666	0.322	535	0	0.0	0.5	3.314	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1745	1161	0.007	8	2	0.0	0.0	3.255	A
B	1148	287	940	2185	0.525	1148	813	1.1	1.1	3.620	A
C			1057				1031				
D	1190	298	20	3038	0.392	1190	1037	0.7	0.7	2.031	A
E	537	134	1210	1664	0.323	537	0	0.5	0.5	3.329	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1745	1161	0.007	8	2	0.0	0.0	3.255	A
B	1148	287	940	2185	0.525	1148	813	1.1	1.2	3.620	A
C			1057				1031				
D	1190	298	20	3038	0.392	1190	1037	0.7	0.7	2.031	A
E	537	134	1210	1664	0.323	537	0	0.5	0.5	3.329	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1745	1161	0.007	8	2	0.0	0.0	3.255	A
B	1148	287	940	2185	0.525	1148	813	1.2	1.2	3.620	A
C			1057				1031				
D	1190	298	20	3038	0.392	1190	1037	0.7	0.7	2.031	A
E	537	134	1210	1664	0.323	537	0	0.5	0.5	3.329	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1745	1161	0.007	8	2	0.0	0.0	3.255	A
B	1148	287	940	2185	0.525	1148	813	1.2	1.2	3.620	A

C			1057				1031				
D	1190	298	20	3038	0.392	1190	1037	0.7	0.7	2.031	A
E	537	134	1210	1664	0.323	537	0	0.5	0.5	3.329	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	8	2	1745	1161	0.007	8	2	0.0	0.0	3.255	A
B	1148	287	940	2185	0.525	1148	813	1.2	1.2	3.620	A
C			1057				1031				
D	1190	298	20	3038	0.392	1190	1037	0.7	0.7	2.031	A
E	537	134	1210	1664	0.323	537	0	0.5	0.5	3.329	A

2042 With Proposed Development, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	Existing N69/N18/Dock Road Roundabout	Standard Roundabout		A, B, C, D, E	3.22	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D12	2042 With Proposed Development	PM	FLAT	16:45	18:15	90	15	ü

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.30

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		FLAT	ü	10	100.000
B		FLAT	ü	1234	100.000
C					
D		FLAT	ü	1278	100.000
E		FLAT	ü	577	100.000

Origin-Destination Data

Demand (PCU/hr)

		To				
		A	B	C	D	E
From	A	0	3	3	4	0
	B	0	22	455	757	0
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	2	776	500	0	0
	E	0	73	152	352	0

Vehicle Mix

Heavy Vehicle Percentages

		To				
		A	B	C	D	E
From	A	3	3	3	3	3
	B	3	3	3	3	3
	C	Exit-only	Exit-only	Exit-only	Exit-only	Exit-only
	D	3	3	3	3	3
	E	3	3	3	3	3

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
A	0.01	3.47	0.0	A	10	15
B	0.58	4.15	1.4	A	1234	1851
C						
D	0.42	2.13	0.8	A	1278	1917
E	0.36	3.62	0.6	A	577	866

Main Results for each time segment

16:45 - 17:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	10	3	1870	1095	0.009	10	2	0.0	0.0	3.459	A
B	1234	309	1008	2141	0.576	1228	872	0.0	1.4	4.090	A
C			1130				1106				
D	1278	320	22	3036	0.421	1275	1108	0.0	0.8	2.128	A
E	577	144	1297	1615	0.357	575	0	0.0	0.6	3.602	A

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	10	3	1875	1092	0.009	10	2	0.0	0.0	3.468	A
B	1234	309	1011	2138	0.577	1234	874	1.4	1.4	4.150	A
C			1135				1110				

D	1278	320	22	3036	0.421	1278	1113	0.8	0.8	2.134	A
E	577	144	1300	1613	0.358	577	0	0.6	0.6	3.622	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	10	3	1875	1092	0.009	10	2	0.0	0.0	3.468	A
B	1234	309	1011	2138	0.577	1234	874	1.4	1.4	4.150	A
C			1135				1110				
D	1278	320	22	3036	0.421	1278	1113	0.8	0.8	2.134	A
E	577	144	1300	1613	0.358	577	0	0.6	0.6	3.622	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	10	3	1875	1092	0.009	10	2	0.0	0.0	3.468	A
B	1234	309	1011	2138	0.577	1234	874	1.4	1.4	4.150	A
C			1135				1110				
D	1278	320	22	3036	0.421	1278	1113	0.8	0.8	2.134	A
E	577	144	1300	1613	0.358	577	0	0.6	0.6	3.622	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	10	3	1875	1092	0.009	10	2	0.0	0.0	3.468	A
B	1234	309	1011	2138	0.577	1234	874	1.4	1.4	4.150	A
C			1135				1110				
D	1278	320	22	3036	0.421	1278	1113	0.8	0.8	2.134	A
E	577	144	1300	1613	0.358	577	0	0.6	0.6	3.622	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Throughput (exit side) (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
A	10	3	1875	1092	0.009	10	2	0.0	0.0	3.468	A
B	1234	309	1011	2138	0.577	1234	874	1.4	1.4	4.150	A
C			1135				1110				
D	1278	320	22	3036	0.421	1278	1113	0.8	0.8	2.134	A
E	577	144	1300	1613	0.358	577	0	0.6	0.6	3.622	A

APPENDIX 11.4 – Mobility Management Plan - TTRSA

Proposed Residential Development

Ballykeefe, Raheen, Limerick

Mobility Management Plan

DW Raheen Developments Ltd.

7 March 2022

TTRSA
Traffic : Transport : Road Safety

Document Control Sheet

Project Title	Proposed Residential Development Ballykeefe, Raheen, Limerick
Report Title	Mobility Management Plan
TTRSA Ref:	210607
Revision	1
Status	Final
Control Date	7th March 2022

Record of Issue

Issue	Status	Date
1/1	Draft	25/01//2022
1/2	Final	07/03/2022

Distribution

Organisation	Copies
DW Raheen Developments Ltd.	1 Electronic

1.0 Introduction

1.1 Proposed Development

1.1.1 The nature of the development

The proposed residential development at Ballykeefe, Raheen, Limerick, by RW Raheen Developments Ltd. comprises 384 residential units (202 houses and 182 apartments, and a crèche. The development will be accessed via the eastern arm of an existing roundabout junction on the R510 regional road, the western arm of the roundabout currently serving the Ard Aulin residential estate. It is intended that the proposed development will open in phases between 2023 and 2027. The proposed development covers approximately ten hectares bounded by the R510 regional road to the west and existing residential areas including the Inis Mor residential estate and Whitethorn residential estate to the south (Figure 1.1).

Extract from Gleeson McSweeney 'Phasing Layout' Ref:1704-10-SLP-Ph – based on topographical survey

The design process for the development has been structured to incorporate mobility management measures from conception, through design, construction and opening of the development, and this Mobility Management Plan has been prepared as part of the planning application for the development.

1.2 The Background to Mobility Management Plans

1.2.1 What is a MMP?

A MMP is a package of measures resulting from a collaborative process in which organisations and individuals can work together to reduce the negative impact which their travel and transportation related activities have on the environment. This is achieved by promoting the use of the most appropriate mode of transport for each journey. MMPs are not 'anti-car', but typically result in reduced car-dependency. The concept originated in the USA during the 1980s and has become established business practice. Put simply a MMP is the start of a new and better way of living and working.

1.2.2 What policies inform the development of a Mobility Management Plan?

This MMP is being developed as part of a planning application. Local policies related to MMPs are contained within the Limerick City Development Plan 2010-2016 (as Extended), which is in turn directed by national guidance such as the National Transport Authority (NTA) document 'Achieving Effective Workplace Travel Plans: Guidance for Local Authorities', which seeks to implement the overarching policy 'smarter travel >>> A Sustainable Transport Future: A New Transport Policy for Ireland 2009-2020'. This MMP has also been developed to provide consistency with the Draft Limerick Shannon Metropolitan Area Transport Strategy 2040[27].

1.2.3 Who has developed the Mobility Management Plan?

This MMP has been developed by Traffic Transport and Road Safety Associates Ltd. (TTRSA), a specialist traffic and transport consultancy. To develop the MMP, TTRSA has worked in collaboration with the developer, DW Raheen Developments Ltd, and the wider architectural, engineering and planning team for the proposed development. As the end users (residents) within the development are not yet determined, the MMP has been prepared as a strategic framework document, intended to be developed further based on the outcome of travel surveys once the development opens.

1.2.4 What are the main benefits resulting from a MMP?

For a development of this type, the main benefits resulting from the implementation of the MMP will typically include:

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[27] https://www.nationaltransport.ie/wp-content/uploads/2020/09/Draft_LSMATS_Report.pdf

- Helping to minimise potential parking and accessibility related issues;
- Reducing car use on the local highway network, for example, improving air quality; and
- Promoting active access, for example by walking and cycling which helps people establish and maintain a healthy lifestyle.

1.3 This Mobility Management Plan

It is intended that this MMP will cover all aspects of the development on this site, including: those living and working within the proposed development.

1.3.1 The Structure of this MMP

This MMP provides the basis for the preparation of a detailed MMP to be completed once the site is opened. This MMP is intended to detail the obligations on the developer and end users in relation to the management and provision of travel related to the site.

This MMP is comprised of a number of sections:

- Section 2 outlines the roles and responsibilities for the management and implementation of the MMP;
- Section 3 sets out the objectives of the MMP, with targets and indicators to guide the successful implementation of the MMP;
- Section 4 outlines existing sustainable transport provision in the vicinity of the site;
- Section 5 details the initial range of MMP (Action Plan) measures that it is intended to implement; and,
- Section 6 provides a framework for monitoring and evaluation of the MMP.

2 Roles and Responsibilities

2.1 Responsibility and Commitment to Delivery

The organisation with overall responsibility for delivery of this MMP will be the estate management company for this residential development, who will work collaboratively with residents and the management of the crèche facility to deliver this MMP through a MMP Working Group consisting of the following team:

- An identified MMP Co-ordinator (within the estate management company);
- A representative of the crèche;
- Representatives of the residents on site;
- A representative of the proposed Bicycle User Group; and,
- A representative of Limerick City and County Council.

2.2 The Role of the Mobility Management Plan Co-ordinator

The estate management company will nominate an identified MMP Co-ordinator[28]. For a development of this scale, this role is not full-time, but the MMP Coordinator should receive appropriate training, support and resources to enable successful delivery of this MMP.

The MMP Co-ordinator role will include the following:

- Day-to-day management of the MMP;
- Taking responsibility for implementation of the MMP measures, including regular dissemination of travel related information;
- Ensuring that traffic and transportation implications are considered within decision making related to the operation, maintenance and management of the development;
- Acting as the focal point for the MMP Working Group; and,
- Coordinating MMP monitoring and evaluation (with third party support as necessary), including undertaking related traffic and travel surveys.

2.3 The Role of the MMP Working Group

The MMP Working Group, comprising those listed in Section 2.1, will be established within three months of the completion of Phase 1 of the development. DW Raheen Developments

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[28] Prior to the development being opened, DW Raheen Developments Ltd. will provide the contact details of the MMP Co-ordinator to Limerick City and County Council.

Ltd. and the estate management company will work with the MMP Working Group to define its remit and operating procedures. The MMP Working Group should meet as often as required, but not less than once every six months.

3 Objectives, Targets and Indicators

3.1 Objectives

The main objective of this MMP is to '*Implement all necessary measures to provide and promote active and sustainable travel options, and reduce car dependency for those living in and working at the development".*

The secondary objective of this MMP is focused on ensuring that individuals make informed travel choices by *"Promoting walking, cycling and public transport as the primary modes of travel to the development".*

3.2 Outcome Based Indicators & Targets

3.2.1 Being SMART

The difficulty in setting relevant indicators and targets has been recognised for decades. However, it is generally accepted that if indicators meet certain criteria then they are more effective at guiding a team or organisation towards their ultimate goal. The criteria are given the acronym 'SMART', which can have several interpretations. For the purposes of setting the indicators and targets within this Mobility Management Plan, the traditional interpretation developed by Doran[29] has been applied.

- **Specific** – target a specific area for improvement.
- **Measurable** – quantify or at least suggest an indicator of progress.
- **Assignable** – specify who will do it.
- **Realistic** – state what results can realistically be achieved, given available resources.

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[29] Doran, G. T. (1981). "There's a S.M.A.R.T. way to write management's goals and objectives". Management Review (AMA FORUM) 70 (11): 35–36

- **Time-related** – specify when the result(s) can be achieved.

3.2.2 Being focused on outcomes

Being SMART is not enough. In the past, targets related to SMART indicators were often written in the form, for example, '*to install one hundred bicycle stands within the development prior to the completion of construction*'. Whilst this meets the requirements of being SMART, the provision of a certain number of bicycle stands by a certain date or point in time, this does not necessarily result in an increase in the number of people living within the development cycling regularly, or the number of cycling journeys being made to and from the development. The starting point for selecting outcome-based indicators and targets is understanding the desired outcome itself. For example: a more sustainable mix of travel modes being used to access the development; an increased level of active travel by those living and working within the development; or, an overall reduction in the number of car parking spaces required within the development, allowing space to be reallocated to other uses.

3.3 Existing Travel Patterns in Limerick

In the 2016 Census, the development (site) was located in the Ballycummin Electoral Division (ED), where average car ownership reported within the Census was 1.45 cars per household. The ED is home to 18,388 people of which 7,879 travel to work and 4,067 travel to school or college.

Tables 3.1 and 3.2 show the 2016 Census modal split for journeys to work and school for Limerick City as a whole, and for the Ballycummin ED. The main notable difference between the two tables is the higher levels of car dependency for journeys to work and school for those already living within the vicinity of the development.

Table 3.1: 2016 Census Modal Split for Journeys to Work and School in Limerick City

Journey	**Walk**	**Bicycle**	**Bus**	**Car Driver**	**Car Passenger**	**Other**
To Work	22%	3%	6%	57%	7%	5%

Journey	Walk	Bicycle	Bus	Car Driver	Car Passenger	Other
To School	42%	3%	11%	6%	37%	1%

Data rounded to whole percentages

Table 3.2: 2016 Census Ballycummin ED Modal Split for Journeys to Work and School

Journey	Walk	Bicycle	Bus	Car Driver	Car Passenger	Other
To Work	9%	2%	4%	78%	5%	1%
To School	14%	1%	21%	8%	56%	0%

Data rounded to whole percentages

3.4 Primary Indicator & Targets

3.4.1 Modal split

The primary outcome-based indicator in terms of the effective delivery of this Mobility Management Plan will be the modal split of all access to the development. This will be expressed as a target percentage by main mode of travel. Table 3.4 shows indicative modal split targets for access to the site based on similar mixes of land use in the 2016 Census, in an opening year (full occupancy) of 2027; and, a future target years of 2029 and 2031, the latter being consistent with the medium term actions within the Draft Limerick Shannon Metropolitan Area Transport Strategy 2040. The targets focus on increased cycle use, which is consistent with the facilities provided on site, cycle route improvements in the local area by Limerick City and County Council and journey distances to key facilities. The 2031 targets exceed the targets set by ‘smarter travel >>> A Sustainable Transport Future: A New Transport Policy for Ireland 2009-2020’.

The primary drivers towards meeting the modal split targets will be encouraging use of the most appropriate mode of transport for residents’ journeys and through supporting Mobility as a Service (MaaS) initiatives to reduce the need to travel. The targets include an increase in cycling and public transport as facilities are improved in line with the Limerick Metropolitan Cycle Network Study[30], and for example funding allocations through Active Travel Investment Grants. It should also be noted that the distances of many trips from the site are more conducive to cycling than walking, whilst there is potential to increase walking for local trips such as journeys to school.

The modal split targets will be developed further as additional information becomes available through the monitoring and evaluation process outlined in Section 6.

Table 3.4: Indicative Modal Split Targets for All Access to the Site

Year	**Walk**	**Bicycle**	**Bus**	**Car (alone)**	**Car share**	**Other***
2016 Census^	10%	2%	7%	65%	15%	1%
2027	10%	4%	8%	61%	15%	2%
2029	11%	8%	9%	55%	15%	2%
2031	12%	10%	10%	50%	15%	3%

*Data rounded to whole percentages: * includes motorcycle and taxi: ^ taking into account the likely number of school age children*

3.5 Secondary Indicators

Secondary indicators are useful in assessing trajectories towards the primary indicator where additional data can be collected without incurring significant time or cost penalties that could impact on delivery of the MMP. Some suggested indicators are listed below. These can be developed further by the MMP Co-ordinator and the MMP Working Group once baseline information is available.

- The number of cars entering the site – with an aim of reducing the number over time;
- The occupancy of cars entering the site – with an aim of increasing the number over time;

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[30] https://www.limerick.ie/sites/default/files/media/documents/2019-04/Limerick-Metropolitan-Cycle-Network-Study.pdf

- The number of cars owned by those living on the site – with an aim of reducing the number over time;
- The number of pedestrians and cyclists using the peripheral pedestrian and cycle tracks; and,
- The usage of car-club vehicles based at the site.

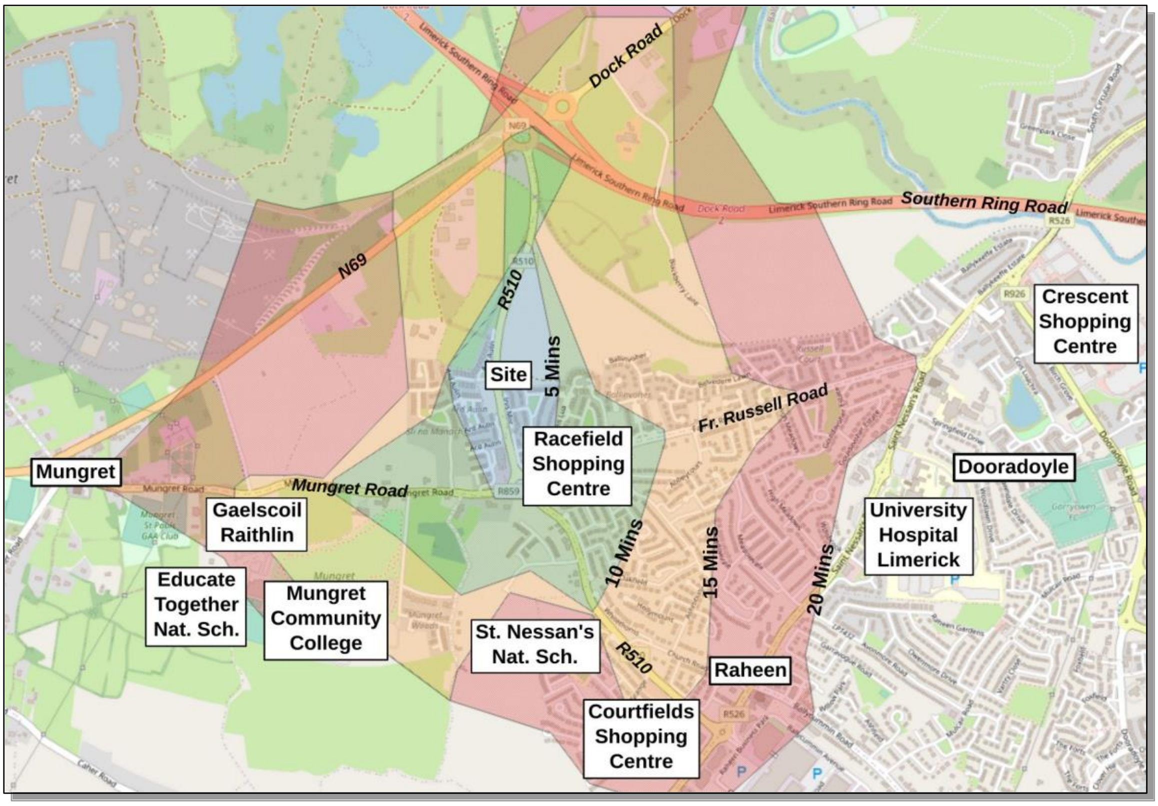
It is likely that the construction of the development will impact on the Small Area(s) statistics within future censuses. This may facilitate the creation of additional indicators and targets based on publicly available census output.

4 Existing Sustainable Transport Provision

4.1 Walking

There is a well developed walking network in the vicinity of the proposed development (site), providing access to a wide range of everyday services including education, and those available within the Racefield and Courtfields Shopping Centres (local neighbourhood centres). Figure 4.1 shows the areas within five, ten, fifteen and twenty minutes walking time respectively.

Figure 4.1 – Walking Accessibility Map – Walking Time Isochrones



Base-mapping © OpenStreetMap contributors

4.2 Cycling

The proposed development site is well served by existing cycle facilities, including the off-road tracks adjacent to the R510 (Plate 4.1) and facilities on Mungret Road providing access to the Gaelscoil, Educate Together School, and Mungret Community College. As part of the 2021 Active Travel Investment Grants settlement[31], funding has also been made available for the Father Russell Road Cycle Scheme. Continued investment in the cycle route network and associated facilities, resulting from both the Limerick Metropolitan Cycle Network Study and the Draft Limerick Shannon Metropolitan Area Transport Strategy 2040, increase the potential for significant increases in cycling within, to, and from the Raheen area of the city.

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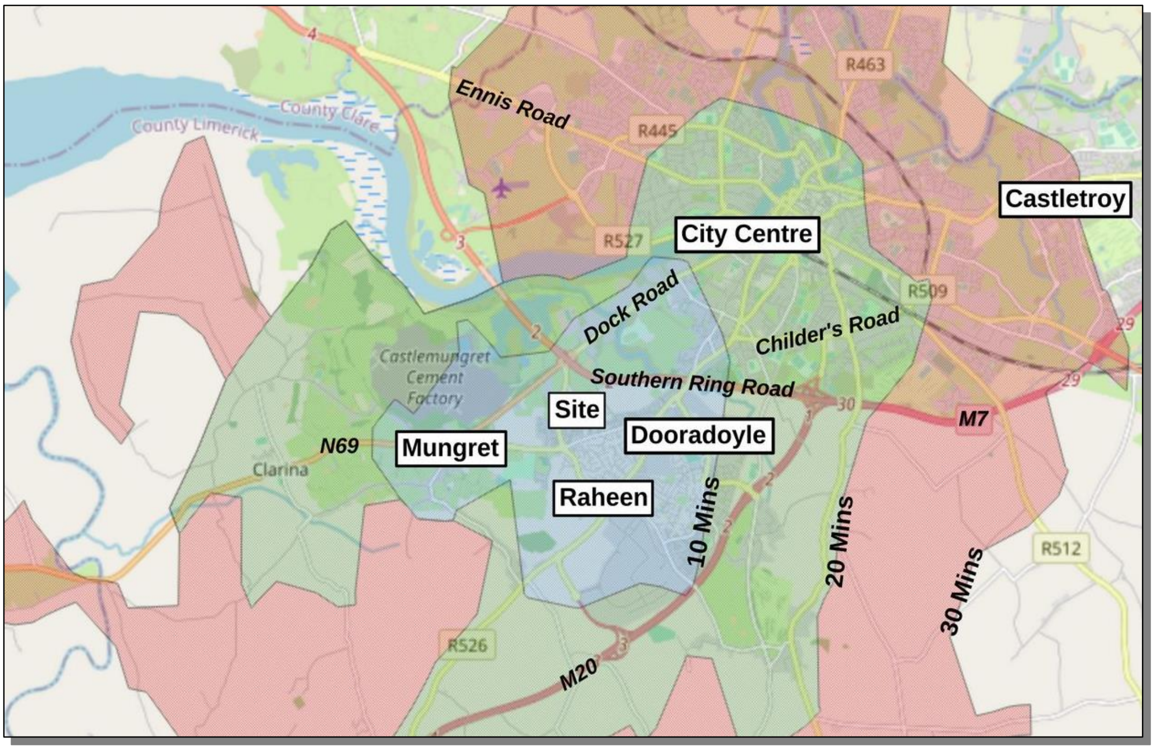
[31] https://www.nationaltransport.ie/wp-content/uploads/2022/01/2022-Active-Travel-Investment-Allocations.pdf

Plate 4.1 – Off-road cycling facilities adjacent to the R510

Figure 4.2 shows the areas within ten, twenty and thirty minutes cycling time of the development (site). The City Centre and many of the major employment areas within the city, including University Hospital Limerick and the Raheen Business Park/Industrial Estate, are located within distances typically considered to be conducive to cycling trips.

Figure 4.2 – Cycling Accessibility Map – Cycling Time Isochrones



Base-mapping © OpenStreetMap contributors

4.3 Public Transport

4.3.1 Bus routes and services

The proposed development is served by bus route 301 operated by Bus Éireann, which is accessed from bus stops located on Father Russell Road. Route 301 links the development to: the Raheen Business Park; the Mid-Western Regional Hospital; the Crescent Shopping Centre; Limerick City Centre including Colbert Station and Henry Street, operating on a 7-day 30 minute frequency. The journey time by bus from the city centre to and from the development (site) is approximately 35 minutes including walking to and from bus stops. The adult single trip bus fare between Father Russell Road and the City Centre is currently €1.68 if using a Leap Card. Leap Card weekly tickets are available for €21.00 for adults, €16.60 for students and €9.80 for children. From May 2021, users of the route 301 bus service have also been able to make payment using the TFI Go App[32].

Both Father Russell Road to the south of the proposed development and the R510 to west of the proposed development are shown as being including within the '*2040 Core Bus Network*' within the Draft Limerick Shannon Metropolitan Area Transport Strategy.

4.3.2 Taxis

There are numerous taxi operators serving Limerick and its suburbs.

5 Actions and Measures

5.1 The Action Plan

The actions and measures included in this MMP have been developed as an integrated package (Action Plan) to specifically deliver the overall objective of the MMP (stated in Section 3.1). Many of the measures contained within this MMP are designed to promote rather than force behavioural change. The measures contained within this Section of the MMP are illustrated diagrammatically, with timescales for implementation, in Figure 5.1.

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[32] https://www.transportforireland.ie/tfi-go-app/

Figure 5.1 Outline Action Plan

Action / Mode	Measure	Infrastructure	Management	Promotion	Individual / Organisation(s)	Before opening	2023	2027-2031	2031 onwards
Overarching Coordination	Appoint the Travel Plan Coordinator (Site Manager)		🟨		DW Raheen Developments Ltd.	🟨			
	Establish the MMP Working Group and define its remit and operating procedures		🟨		MMP Coordinator / DW Raheen Developments Ltd.		🟨		
Walking	Develop and maintain on-site accessible pedestrian routes	🟩	🟩		DW Raheen Developments Ltd. / LCCC	🟩	🟩	🟩	🟩
	Promote walking through walking activities such as organised lunchtime walks and participation in events			🟩	MMP Coordinator		🟩	🟩	🟩
	Establish walking buses between the site and local national schools			🟩	MMP Coordinator / Parents / Local Schools		🟩	🟩	🟩
Cycling	Provide and maintain secure cycle parking facilities on-site	🟦	🟦		DW Raheen Developments Ltd.	🟦	🟦	🟦	🟦
	Provide and maintain cycle tracks within the site	🟦	🟦		DW Raheen Developments Ltd. / LCCC	🟦	🟦	🟦	🟦
	Establish a Bicycle User Group (BUG)			🟦	MMP Coordinator		🟦		
	Provide cycle maintenance and cycle awareness training for those living and working on site			🟦	MMP Coordinator		🟦	🟦	🟦
	Develop a programme of regular cycle promotion events, including in national 'Bike to Work' week			🟦	BUG / MMP Coordinator		🟦	🟦	🟦
	Produce a cycle map for inclusion in residential welcome packs and employees induction packs, and also for display on-site			🟦	BUG / MMP Coordinator / Limerick City and County Council		🟦	🟦	🟦
Public Transport	Provide those living and working on the site with public transport information, including taxi information, and promote the NTA "Real Time Ireland" app			🟪	MMP Coordinator		🟪	🟪	🟪
Reducing Car Dependency	Limit car parking for private vehicles	🟥	🟥	🟥	MMP Coordinator / DW Raheen Developments Ltd.	🟥	🟥	🟥	🟥
	Establish a car club base on site (e.g. GoCar) to faciltate access to vehicles without the need for vehicle ownership	🟥	🟥	🟥	DW Raheen Developments Ltd.	🟥			
	Facilitate car sharing by facilitating meetings and diseminating information			🟥	MMP Coordinator	🟥	🟥	🟥	🟥
	Investigate provision of on-site community 'Click and Collect' facility	🟥	🟥		DW Raheen Developments Ltd.	🟥			
Communication	Regular communication with all those living and working on site to promote, and ensure the implementation of this MMP and Action Plan			🟦	MMP Coordinator / MMP Working Group	🟦	🟦	🟦	🟦

5.1.1 The role of the action plan

The main roles of the Action Plan are: to provide focus to the delivery of the MMP for the development to achieve the objectives detailed in Section 3.1; to ensure that maximum benefit is derived from the investment in MMP related measures; and, to ensure that the end-users of the development are provided with travel choices including the optimal modes for their individual journeys, for example, facilitating journeys on foot, by bicycle and by public transport within the city.

5.1.2 Amendments to the action plan

As the MMPhas been prepared in advance of the development, it is intended that the Action Plan will be further developed and updated by the MMP Working Group based on the initial travel surveys conducted following the opening of the development. Thereafter, the MMP will continue be a ‘live’ document which is updated annually. Inability to deliver a specific measure to the timescale indicated, should not in itself be considered to be a failure of this Action Plan or the travel planning process as a whole, particularly if progress is still being made towards the targets set within Sections 3.4 and 3.5. Conversely if measures are not being delivered as intended and targets are likely to be missed, the priorities and timescales within this Action Plan should be altered by the MMP Working Group as part of the monitoring and evaluation process detailed in Section 6.

5.1.3 The role of communication in delivery of the action plan

Communication and openness is critical to the successful implementation of this Action Plan. The measures containing within the Action Plan may challenge the pre-conceptions of those living and working on the site in relation to their travel choices and entitlements. Due to the nature of the development, communication will need to be managed through a number of channels including direct communication through paper-based and electronic newsletters, and interactive social media, the latter being harnessed for more regular two-way communications and marketing.

5.2 Walking

5.2.1 On-site walking routes

Through the design process for the residential development, a network of accessible walking routes has been provided within the site, including: a circular pedestrian route around the perimeter of the residential development; the potential for connectivity to any future greenway on the railway alignment which formerly served Castlemungret; and, multiple pedestrian accesses, including to the existing neighbouring Inis Mor and Ballinvoher residential estates. This approach is consistent with the Draft Limerick Shannon Metropolitan Area Transport Strategy 2040 objective which seeks all new development areas to '*be fully permeable for pedestrians and cyclists*' whilst applying '*the principle of filtered permeability, whereby through private car traffic is discouraged*'.

Figure 5.2 – Pedestrian access to, and routes within, the proposed development site

Source: Gleeson McSweeney (Extract of Site Layout Plan Technical (Dwg No. 1704-10-SLP-T; Dated September 2021)

5.2.2 Promotion of walking

The location of the residential development site, proximity of local services and wider connections, makes the locality ideal for promoting walking as a mode of transport, and the developer has indicated a willingness to consider the promotion of walking activities such as organised lunchtime (group) walks and participation of residents in events such as the Irish Heart Foundation's Step Challenge. To reduce the impact of the residential development on the local road network at each end of the school day, walking buses should be established between the site and local schools.

5.3 Cycling

5.3.1 Secure cycle parking and on-site cycle tracks

Secure cycle parking spaces will be provided at numerous locations throughout the residential development in agreement with Limerick City and County Council. A segregated cycle track is proposed on the western boundary of the development, with a shared-use pedestrian and cycle track being proposed as a peripheral route to the east and north of the residential development.

5.3.2 Cycle training

Depending on the level of demand identified through travel surveys, the MMP co-ordinator will arrange courses annually in safe cycling (Cycle Right[33]), and bicycle maintenance, for those living and working within the residential development.

5.3.3 Cycle promotion

Following completion of the residential development, the MMP Coordinator will establish a bicycle user group (BUG) for those living and working on the site who already cycle or have an interest in taking up cycling. The MMP Coordinator will work with the BUG to hold promotional

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[33] http://www.cycleright.ie/

events on a regular basis. Additional promotional activities will also be arranged during National Bike to Work week, held in June each year. The nature of these activities should be determined by the BUG with the assistance of the MMP Coordinator, with input from the MMP Working Group as required.

As part of the residential development, it is intended to produce a map of the local area, including: formal cycling facilities; routes which Limerick Cycling consider to be suitable for most cyclists; also the cycling journey times across the local area and to specific destinations based on the analysis contained within Figure 4.3. This map will be: displayed within the site on the public notice boards detailed in Section 5.2.2; distributed to all new residents as part of their welcome pack; and, provided to employees at the crèche as part of their induction.

5.4 Public Transport

The R510, Mungret Road and Father Russell Road are including within the Draft Limerick Shannon Metropolitan Area Transport Strategy 2040as part of the city's bus network with both the R510 and Father Russell Road also being identified for the provision of bus priority measures. The strategy suggests that such measures may include '*the reallocation of road space from the private car, Advance Bus Signalisation, bus gates and acquisition of land to accommodate bus lanes here required*'. This increase in modal share associated with such provision is reflected in the targets set out in Table 3.4 for 2031, consistent with the timescale proposed for implementing medium term measures within the Draft Limerick Shannon Metropolitan Area Transport Strategy 2040.

As part of the residential development, it is intended to provide public notice boards including information such as: bus stops and routes; details of the Limerick Leap Card; and, links to the National Transport Authority (NTA) "Real Time Ireland" public transport information app[34]. This information will also be provided to all new residents as part of their welcome pack, and to employees of the crèche as part of their induction.

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[34] https://www.transportforireland.ie/real-time/real-time-ireland/

5.5 Measures to Reduce Car-dependency

5.5.1 Car parking and parking management

The main measure to reduce car dependence within the residential development will be limiting parking for private vehicles. This approach is generally consistent with the Project Ireland 2040 National Planning Framework[35]and supported by the Draft Limerick Shannon Metropolitan Area Transport Strategy 2040. Electric vehicle charging facilities will be provided.

5.5.2 Car club

To facilitate access to vehicles when needed, without the need to own a personal vehicle, the developer has indicated that car parking spaces within the residential development site could be made available for use by a car club such as GoCar which is already established in Limerick. GoCar offer pay-as-you-go driving with hourly rates on a return to base scheme. The closest GoCar parking location (base) is currently located on Childers Road approximately 3km to the north-east of the development.

The Draft Limerick Shannon Metropolitan Area Transport Strategy 2040 highlights research which indicates that over ten private cars can be removed for each car club vehicle as users' dispose of their cars, and a further 22 private cars are not purchased for each car club vehicle as members would not buy a car as a result of their need for a car being satisfied by car club membership.

5.5.3 Car sharing

To facilitate car sharing for those living within the residential development, the MMP Coordinator will facilitate meetings of potential car sharers to let them find out what's involved, and allow them to meet with potential car sharing partners.

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[35] https://npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf

5.5.4 Community ‘Click and Collect’ facility

The Draft Limerick Shannon Metropolitan Area Transport Strategy 2040 supports the placement of local ‘Click and Collect’ facilities in new residential developments to reduce the amount of individual personal deliveries to homes where the recipient is often absent. The developer has agreed to investigate the potential for providing such a facility, for example an An Post Parcel Locker[36] or a Parcel Motel[37] within the residential development.

6 Monitoring and Evaluation

6.1 Monitoring

Monitoring of the implementation of this MMP will be a key role of the MMP Coordinator.

The primary form of monitoring will be travel surveys of those living and working within the development. These travel surveys will be carried out annually during the same month each year, and will be focused on travel behaviour and the monitoring of action plan related measures. The surveys will also be used to monitor the uptake of MMP measures.

An annual monitoring report, including current trajectories towards established targets will be prepared and submitted to Limerick City and County Council, within three months of completion of the surveys.

6.2 Evaluation

This MMP Plan will be reviewed annually by the aforementioned MMP Working Group, taking full account of the results of the travel surveys and the trajectories toward established targets.

The review of the MMP may involve:

- Changing priorities within the implementation of the Action Plan based on progress and experience to ensure that the MMP modal split targets are achieved;

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[36] https://www.anpost.com/Post-Parcels/Receiving/Parcel-Lockers

[37] https://parcelmotel.com

- The setting of increasingly challenging targets if the proposed targets are achieved ahead of schedule; and,
- The introduction of additional activities and/or measures to the Action Plan through the following of national best practice or local innovation.

If the trajectories towards established targets suggest that the targets will not be met, the MMP Working Group should, as appropriate, recommend the level of annual budget increase required to meet the targets in the following year, for example to fund the implementation of additional Action Plan measures.

The findings of this MMP review will be disseminated to those living and working within the development, and Limerick City and County Council, within three months of completion of the review.

APPENDIX 12.1 – Construction and Demolition Resource Waste Management Plan – AWN Consulting

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CONSTRUCTION & DEMOLITION RESOURCE WASTE MANAGEMENT PLAN FOR

A PROPOSED DEVELOPMENT

BALLYKEEFFE, RAHEEN, CO. LIMERICK.

Report Prepared For

DW Raheen Developments Ltd.

Report Prepared By

Chonaill Bradley, Principal Environmental Consultant

Our Reference

CB/21/12529WMR01

Date of Issue

18 January 2022

Document History

Document Reference		Original Issue Date	
CB/21/12529WMR01		18 January 2022	
Revision Level	Revision Date	Description	Sections Affected

Record of Approval

Details	Written by	Approved by
Signature		
Name	Chonaill Bradley	Fergal Callaghan
Title	Principal Environmental Consultant	Director
Date	18 January 2022	18 January 2022

Contents **Page**

1.0 INTRODUCTION

AWN Consulting Ltd. (AWN) has prepared this Construction & Demolition Resource Waste Management Plan (C&D RWMP) on behalf of DW Raheen. The development will principally consist of a mixed-use development of apartments, houses, incorporating common areas and a childcare facility at a site located at site located in Ballykeeffe, Raheen, Co. Limerick.

This plan will provide information necessary to ensure that the management of C&D waste at the site is undertaken in accordance with the current legal and industry standards including the *Waste Management Acts 1996 - 2011* and associated Regulations [1], *Protection of the Environment Act 2003* as amended [2], *Litter Pollution Act 1997* as amended [3] and the *Southern Region Waste Management Plan 2015 – 2021* [4]. In particular, this Plan aims to ensure maximum recycling, reuse and recovery of waste with diversion from landfill, wherever possible. It also seeks to provide guidance on the appropriate collection and transport of waste from the site to prevent issues associated with litter or more serious environmental pollution (e.g. contamination of soil and/or water).

This C&D RWMP includes information on the legal and policy framework for C&D waste management in Ireland, estimates of the type and quantity of waste to be generated by the proposed development and makes recommendations for management of different waste streams. The C&D RWMP should be viewed as a live document that will be update by the site construction contractor as and when changing site conditions require it to do so.

2.0 CONSTRUCTION & DEMOLITION WASTE MANAGEMENT IN IRELAND

2.1 National Level

The Irish Government issued a policy statement in September 1998*, Changing Our Ways*[5], which identified objectives for the prevention, minimisation, reuse, recycling, recovery and disposal of waste in Ireland. The target for C&D waste in this report was to recycle at least 50% of C&D waste within a five year period (by 2003), with a progressive increase to at least 85% over fifteen years (i.e. 2013).

In response to the *Changing Our Ways* report, a task force (Task Force B4) representing the waste sector of the already established Forum for the Construction Industry, released a report entitled '*Recycling of Construction and Demolition Waste'* [6] concerning the development and implementation of a voluntary construction industry programme to meet the Government's objectives for the recovery of C&D waste.

In September 2020, the Irish Government published a new policy document outlining a new action plan for Ireland to cover the period of 2020-2025. This plan *'A Waste Action Plan for a Circular Economy'* [7] (WAPCE), was prepared in response to the 'European Green Deal' which sets a roadmap for a transition to a new economy, where climate and environmental challenges are turned into opportunities, replacing the previous national waste management plan *"A Resource Opportunity"* (2012).

The WAPCE sets the direction for waste planning and management in Ireland up to 2025. This reorientates policy from a focus on managing waste to a much greater focus on creating circular patterns of production and consumption. Other policy statements of a number of public bodies already acknowledge the circular economy as a national policy priority.

The policy document contains over 200 measures across various waste areas including circular economy, municipal waste, consumer protection and citizen engagement, plastics and packaging, construction and demolition, textiles, green public procurement and waste enforcement.

One of the first actions to be taken was the development of the Whole of Government Circular Economy Strategy 2022-2023 'Living More, using Less' (2021) [8] to set a course for Ireland to transition across all sectors and at all levels of Government toward circularity and was issued in December 2021. It is anticipated that the Strategy will be updated in full every 18 months to 2 years.

The Environmental Protection Agency (EPA) of Ireland issued guildines the '*Best Practice Guidelines for the Preparation of Resource & Waste Management Plans for Construction & Demolition Projects' in November 2021* [9]*.* These guidelines replace the previous 2006 guidelines issued by The National Construction and Demolition Waste Council (NCDWC)and the Department of the Environment, Heritage and Local Government (DoEHLG) in 2006 [10]. The guidelines provide a practical and informed approach which is informed by best practice in the prevention and management of C&D wastes and resources from design to construction of a project, including consideration of the deconstruction of a project. These guidelines have been followed in the preparation of this document and include the following elements:

Predicted C&D wastes and procedures to prevent, minimise, recycle and reuse wastes;
Design teams roles and approach;
Relevant EU, national and local waste policy, legislation and guidelines;
Waste disposal/recycling of C&D wastes at the site;
Provision of training for resource manager and site crew;
Details of proposed record keeping system;
Details of waste audit procedures and plan; and

Details of consultation with relevant bodies i.e. waste recycling companies, Local Authority, etc.

Section 3 of the Guidelines identifies thresholds above which there is a requirement for the preparation of a C&D Waste Management Plan for developments. The new guidance Classifies developments on a two Tiers based system. Below the following thresholds may be classed as Tier 1 development and above a Tier 2:

- New residential development of less than 10 dwellings.
- Retrofit of 20 dwellings or less.
- New commercial, industrial, infrastructural, institutional, educational, health and other developments with an aggregate floor area less than 1,250m^2.
- Retrofit of commercial, industrial, infrastructural, institutional, educational, health and other developments with an aggregate floor area less than 2,000m^2; and
- Demolition projects generating in total less than 100m^3 in volume of C&D waste.

Developments above these thresholds are classed as Tier-2 projects

This development requires a C&D WMP as a Tier 2 development as they are above following criterion:

- New residential development of less than 10 dwellings.

Other guidelines followed in the preparation of this report include *'Construction and Demolition Waste Management – a handbook for Contractors and Site Managers'* [9] , published by FÁS and the Construction Industry Federation in 2002 and the previous guildines 'Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects' (2006).

These guidance documents are considered to define best practice for C&D projects in Ireland and describe how C&D projects are to be undertaken such that environmental impacts and risks are minimised and maximum levels of waste recycling are achieved.

2.2 Regional Level

The proposed development is located in the Local Authority area of Limerick City and County Council (LCCC).

The *Southern Region Waste Management Plan 2015 – 2021* is the regional waste management plan for the LCCC area published in 2014.

The Regional Plan sets out the strategic targets for waste management in the region and sets a specific target for C&D waste of *"70% preparing for reuse, recycling and other recovery of construction and demolition waste"* (excluding natural soils and stones and hazardous wastes) to be achieved by 2020.

Municipal landfill charges in Ireland are based on the weight of waste disposed. In the Munster Region, charges are approximately €130 - €150 per tonne of waste which includes a €75 per tonne landfill levy introduced under the *Waste Management (Landfill Levy) (Amendment) Regulations 2012.*

Limerick County Development Plan 2010-2016 (as Extended) [12] sets out a number of objectives for the Limerick City and County area, in line with the objectives of the regional waste management plan. The plan identifies the Council's commitment to the promotion of the Waste Hierarchy. Waste objectives with a particular relevance to the proposed development are:

<u>Objectives:</u>

- **IN 043: Education and Awareness** To promote education and awareness on all issues associated with waste management, both at industry and community level. This will include the promotion of waste reduction by encouraging the minimisation, re-use, recycling and recovery of waste within the county.
- **IN 044: Polluter pays principle** To ensure the provision of quality cost effective waste infrastructure and services, which reflect and meet the needs of the community and to ensure that the 'polluter pays' principle is adhered to in all waste management activities.
- **IN O46:** Proposed waste disposal It is the objective of the Council in assessing planning applications to have regard to the waste produced by proposed developments including the nature and amount produced and proposed method of disposal. Developments should ensure that production/disposal methods do not give rise to environmental pollution, result in undue loss of amenity or be detrimental to public health.

The Draft Limerick Development Plan 2022-2028 [13] sets out a number of objectives for the Limerick City and County area, in line with the objectives of the regional waste management plan and the Circular Economy Policy. Waste objectives with a particular relevance to the proposed development are:

Objective IN O15 *Waste Management and the Circular Economy It is an objective of the Council to:*

- Support innovative, smart solutions and processes, based on the principles of the circular economy to implement the Regional Waste Management Plan for the Southern Region 2015 – 2021 and any subsequent plan, including any targets contained therein.
- Collaborate with the Regional Waste Management Office and other agencies to implement the EU Action Plan for the Circular Economy – Closing the Loop, 2015, its successor the Circular Economy Action Plan: A New Circular

Economy Action Plan for a Cleaner More Competitive Europe, 2020 and the Resource Opportunity-Waste Management Policy, DECLG, 2012 and any subsequent plans.

- Promote sustainable patterns of consumption and production in the areas of product design, production processes and waste management.
- Implement the provisions of the Waste Action Plan for a Circular Economy – Ireland's National Waste Policy 2020 - 2025, DECC, 2020 in the assessment of planning applications.
- Protect existing civic amenity sites and bring sites throughout Limerick and support the development of additional sites in accordance with the Southern Regional Waste Management Plan 2015 – 2021 and any subsequent plans.

2.3 Legislative Requirements

The primary legislative instruments that govern waste management in Ireland and applicable to the development are:

- Waste Management Act 1996 as amended. Sub-ordinate legislation includes:
    - European Communities (Waste Directive) Regulations 2011 (SI 126 of 2011) as amended
    - Waste Management (Collection Permit) Regulations (S.I No. 820 of 2007) as amended
    - Waste Management (Facility Permit and Registration) Regulations 2007, (S.I No. 821 of 2007) as amended
    - Waste Management (Licensing) Regulations 2004 (S.I. No. 395 of 2004) as amended
    - Waste Management (Packaging) Regulations 2014 (S.I. 282 of 2014) as amended
    - Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997)
    - Waste Management (Landfill Levy) Regulations 2015 (S.I. No. 189 of 2015)
    - European Union (Waste Electrical and Electronic Equipment) Regulations 2014 (S.I. No. 149 of 2014)
    - European Union (Batteries and Accumulators) Regulations 2014 (S.I. No. 283 of 2014) as amended
    - Waste Management (Food Waste) Regulations 2009 (S.I. 508 of 2009), as amended
    - European Union (Household Food Waste and Bio-waste) Regulation 2015 (S.I. No. 191 of 2015)
    - Waste Management (Hazardous Waste) Regulations, 1998 (S.I. No. 163 of 1998) as amended
    - Waste Management (Shipments of Waste) Regulations, 2007 (S.I. No. 419 of 2007) as amended

    - Waste Management (Hazardous Waste) Regulations 1998 (S.I. No. 163 of 1998) as amended;
    - European Communities (Transfrontier Shipment of Waste) Regulations 1994 (SI 121 of 1994)
    - European Union (Properties of Waste which Render it Hazardous) Regulations 2015 (S.I. No. 233 of 2015) as amended

- Environmental Protection Act 1992 as amended.
- Litter Pollution Act 1997 as amended.
- Planning and Development Act 2000 as amended [14.]

One of the guiding principles of European waste legislation, which has in turn been incorporated into the *Waste Management Act 1996 - 2001* and subsequent Irish legislation, is the principle of *"Duty of Care"*. This implies that the waste producer is responsible for waste from the time it is generated through until its legal recycling, recovery or disposal (including its method of disposal). As it is not practical in most cases for the waste producer to physically transfer all waste from where it is produced to the final destination, waste contractors will be employed to physically transport waste to the final destination. Following on from this is the concept of *"Polluter Pays"* whereby the waste producer is liable to be prosecuted for pollution incidents, which may arise from the incorrect management of waste produced, including the actions of any contractors engaged (e.g. for transportation and disposal/recovery/recycling of waste).

It is therefore imperative that the Developer ensures that the waste contractors engaged by construction contractors are legally compliant with respect to waste transportation, recycling, recovery and disposal. This includes the requirement that a contractor handle, transport and recycle/recover/dispose of waste in a manner that ensures that no adverse environmental impacts occur as a result of any of these activities.

A collection permit to transport waste must be held by each waste contractor which is issued by the National Waste Collection Permit Office (NWCPO). Waste receiving facilities must also be appropriately permitted or licensed. Operators of such facilities cannot receive any waste, unless in possession of a Certificate of Registration (COR) or waste permit granted by the relevant Local Authority under the *Waste Management (Facility Permit & Registration) Regulations 2007 and Amendments* or a Waste or Industrial Emissions Licence granted by the EPA. The COR / permit / licence held will specify the type and quantity of waste able to be received, stored, sorted, recycled, recovered and/or disposed of at the specified site.

3.0 DESCRIPTION OF THE DEVELOPMENT

3.1 Location, Size and Scale of the Development

DW Raheen are seeking permission for a strategic housing development consisting of the provision of 384 residential house and apartment units on a ca. 10.44 hectare site located in Ballykeeffe, Raheen, Co. Limerick.

The site is greenfield land that is enclosed by existing residential development to the south, east and west and open land to the north. Access to the site is provided by an existing entrance off a roundabout on the R510 regional road.

The proposed development will provide as follows:

- 202 no. housing units, comprising a variety of forms to include bungalows, detached, semi-detached and terraced houses. A mix of house sizes are proposed to include 20 no. two bedroom houses, 156 no. three bedroom houses and 26 no. four bedroom houses.
- 182 no. apartment and duplex units across 25 small scale blocks, 2 to 4 storeys in heights throughout the development. The apartments and duplexes provide a mix of one, two, three and four bed units, comprising of 10 no. four bedroom duplex units, 10 no. three bedroom duplex units, 6 no. two bedroom duplex units, 18 no. three bedroom apartments, 92 no. two bedroom apartments, and 46 no. one bedroom apartments.

The proposed development also includes;

- A childcare facility measuring 761.75m2, providing 79 childcare places (55 full time and 24 after school places), located at the south-western edge of the development.
- The provision of 377 no. car parking spaces and 311 secured bicycle parking spaces.
- The provision of 3 no. ESB sub-stations, ancillary services and infrastructure works including foul and surface water drainage, attenuation areas, landscaped public open spaces (approximately 29,500m2, or 28.2% of the total site area), landscaping, lighting, internal roads, cycle paths, and footpaths.

A Natura Impact Statement (NIS) and Environmental Impact Assessment Report (EIAR) have been prepared in respect of the proposed development.

3.2 Details of the Non-Hazardous Wastes to be Produced

There will be soil, stones and clay excavated to facilitate construction of new foundations and underground services. The development Engineers, Hutch O'Malley Consulting Engineers have estimated that 126,000m^3 of material will need to be excavated to do so. It is currently envisaged that the soil will be able to be retained and reused onsite for landscaping and fill, and a negligible amount will need to be removed offsite due to the limited opportunities for reuse on site. Any soil to be removed from the site will be taken for appropriate offsite reuse, recovery, recycling and / or disposal.

During the construction phase there may be a surplus of building materials, such as timber off-cuts, broken concrete blocks, cladding, plastics, metals and tiles generated. There may also be excess concrete during construction which will need to be disposed of. Plastic and cardboard waste from packaging and supply of materials will also be generated. The contractor will be required to ensure that oversupply of materials is kept to a minimum and opportunities for reuse of suitable materials is maximised.

Waste will also be generated from construction workers e.g. organic / food waste, dry mixed recyclables (waste paper, newspaper, plastic bottles, packaging, aluminium cans, tins and Tetra Pak cartons), mixed non-recyclables and potentially sewage sludge from temporary welfare facilities provided on site during the construction phase. Waste printer / toner cartridges, waste electrical and electronic equipment (WEEE) and waste batteries may also be generated infrequently from site offices.

3.3 Potential Hazardous Wastes Arising

3.3.1 Contaminated Soil

Site investigations were undertaken at this site by Priority Geotechnical (PGL) in July 2021. A total of 11 samples were sent for Waste Acceptance Criteria (WAC) analysis. The results from the WAC analysis can be found in chapter 6 (Lands, Soils and Geology) of the EIAR or in the site investigation report submitted under a separate cover.

If any potentially contaminated material is encountered, it will need to be segregated from clean / inert material, tested and classified as either non-hazardous or hazardous in accordance with the EPA publication entitled *'Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous'* [15] using the *HazWasteOnline* application (or similar approved classification method). The material will then need to be classified as clean, inert, non-hazardous or hazardous in accordance with the *EC Council Decision 2003/33/EC* [16], which establishes the criteria for the acceptance of waste at landfills.

In the event that Asbestos Containing Materials (ACMs) are found within the excavated material, the removal will only be carried out by a suitably permitted waste contractor, in accordance with *S.I. No. 386 of 2006 Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010.* All asbestos will be taken to a suitably licensed or permitted facility.

In the event that hazardous soil, or historically deposited waste is encountered during the construction phase, the contractor will notify LCCC and provide a Hazardous / Contaminated Soil Management Plan, to include estimated tonnages, description of location, any relevant mitigation, destination for disposal / treatment, in addition to information on the authorised waste collector(s).

3.3.2 Fuel/Oils

Fuels and oils are classed as hazardous materials; any on-site storage of fuel / oil, and all storage tanks and all draw-off points will be bunded and located in a dedicated, secure area of the site. Provided that these requirements are adhered to and the site crew are trained in the appropriate refuelling techniques, it is not expected that there will be any fuel / oil waste generated at the site.

3.3.3 Invasive Plant Species

A baseline ecological survey was undertaken by SLR Environmental Consulting part of this survey was designated to identify the presence and location of any invasive species (listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2015)). The presence of such species was not found at or adjacent to the site and was not found in any areas where excavation may be required. If during the process of construction any schedule 3 invasive species are located on site an invasive species management plan will be prepared for the site to prevent the introduction or spread of any invasive species within the footprint of the works. An invasive species management plan, if required, will set out best practice control methods.

3.3.4 Other Known Hazardous Substances

Paints, glues, adhesives and other known hazardous substances will be stored in designated areas. They will generally be present in small volumes only and associated waste volumes generated will be kept to a minimum. Wastes will be stored in appropriate receptacles pending collection by an authorised waste contractor.

In addition, WEEE (containing hazardous components), printer toner / cartridges, batteries (Lead, Ni-Cd or Mercury) and / or fluorescent tubes and other mercury containing waste may be generated from during C&D activities or temporary site offices. These wastes, if generated, will be stored in appropriate receptacles in designated areas of the site pending collection by an authorised waste contractor.

3.4 Main Construction and Demolition Waste Categories

The main non-hazardous and hazardous waste streams that could be generated by the construction activities at a typical site are shown in Table 6.1. The List of Waste (LoW) code (applicable as of 1 June 2015) (also referred to as the European Waste Code (EWC)) for each waste stream is also shown.

Table 6.1 *Typical waste types generated and LoW codes (individual waste types may contain hazardous substances)*

Waste Material	LoW/EWC Code
Concrete, bricks, tiles, ceramics	17 01 01-03 & 07
Wood, glass and plastic	17 02 01-03
Treated wood, glass, plastic, containing hazardous substances	17-02-04*
Bituminous mixtures, coal tar and tarred products	17 03 01*, 02 & 03*
Metals (including their alloys) and cable	17 04 01-11
Soil and stones	17 05 03* & 04
Gypsum-based construction material	17 08 01* & 02
Paper and cardboard	20 01 01
Mixed C&D waste	17 09 04
Green waste	20 02 01
Electrical and electronic components	20 01 35 & 36
Batteries and accumulators	20 01 33 & 34
Liquid fuels	13 07 01-10
Chemicals (solvents, pesticides, paints, adhesives, detergents etc.)	20 01 13, 19, 27-30
Insulation materials	17 06 04
Organic (food) waste	20 01 08
Mixed Municipal Waste	20 03 01

* *Individual waste type may contain hazardous substances*

4.0 RESOURCE AND WASTE MANAGEMENT

4.1 Demolition Waste Generation

The site is a greenfield site and there will be no demolition associated with this proposed development.

4.2 Construction Waste Generation

Table 4.1 shows the breakdown of C&D waste types produced on a typical site based on data from the EPA *National Waste Reports* [17] *and the joint EPA & GMIT study* [18].

Table 6.1: *Waste materials generated on a typical Irish construction site*

Waste Types	**%**
Mixed C&D	33
Timber	28
Plasterboard	10
Metals	8
Concrete	6
Other	15
Total	**100**

Table 4.2, below, shows the estimated construction waste generation for the proposed Project based on the gross floor area of construction and other information available to date, along with indicative targets for management of the waste streams. The estimated amounts for the main waste types (with the exception of soils and stones) are based on an average large-scale development waste generation rate per m^2, using the waste breakdown rates shown in Table 4.1. These have been calculated from the schedule of development areas provided by the architect.

***Table 6.2**: Predicted on and off-site reuse, recycle and disposal rates for construction waste*

Waste Type	**Tonnes**	**Reuse**		**Recycle / Recovery**		**Disposal**	
		%	**Tonnes**	**%**	**Tonnes**	**%**	**Tonnes**
Mixed C&D	805.7	10	80.6	80	644.5	10	80.6
Timber	683.6	40	273.4	55	376.0	5	34.2
Plasterboard	244.1	30	73.2	60	146.5	10	24.4
Metals	195.3	5	9.8	90	175.8	5	9.8
Concrete	146.5	30	43.9	65	95.2	5	7.3
Other	366.2	20	73.2	60	219.7	20	73.2
Total	**2441.5**		**554.2**		**1657.8**		**229.5**

In addition to the waste streams in Table 4.3, there will be c. 126,000 m^3 of soil, stones and clay excavated to facilitate construction of new foundations and underground services. Any suitable excavated material will be temporarily stockpiled for reuse as fill, where possible. It is envisaged that the majority of this material will be reused on-site with negligible soil being removed from the site.

It should be noted that until final materials and detailed construction methodologies have been confirmed, it is difficult to predict with a high level of accuracy the construction waste that will be generated from the proposed works as the exact materials and quantities may be subject to some degree of change and variation during the construction process.

4.3 Proposed Resource and Waste Management Options

Waste materials generated will be segregated on- site, where it is practical. Where the on- site segregation of certain wastes types is not practical, off- site segregation will be carried out. There will be skips and receptacles provided to facilitate segregation at source, where feasible. All waste receptacles leaving site will be covered or enclosed. The appointed waste contractor will collect and transfer the wastes as receptacles are filled. There are numerous waste contractors in the Dublin region that provide this service.

All waste arisings will be handled by an approved waste contractor holding a current waste collection permit. All waste arisings requiring disposal off- site will be reused, recycled, recovered or disposed of at a facility holding the appropriate registration, permit or licence, as required.

During construction, some of the sub-contractors on site will generate waste in relatively low quantities. The transportation of non-hazardous waste by persons who are not directly involved with the waste business, at weights less than or equal to 2 tonnes, and in vehicles not designed for the carriage of waste, are exempt from the requirement to have a waste collection permit (per Article 30 (1) (b) of the Waste Collection Permit Regulations 2007, as amended). Any sub-contractors engaged that do not generate more than 2 tonnes of waste at any one time can transport this waste off- site in their work vehicles (which are not designed for the carriage of waste). However, they are required to ensure that the receiving facility has the appropriate COR / permit / licence.

Written records will be maintained by the contractor(s), detailing the waste arising throughout the C&D phases, the classification of each waste type, waste collection permits for all waste contactors who collect waste from the site and COR / permit / licence for the receiving waste facility for all waste removed off- site for appropriate reuse, recycling, recovery and / or disposal

Dedicated bunded storage containers will be provided for hazardous wastes which may arise, such as batteries, paints, oils, chemicals, if required.

The anticipated management of the main waste streams is outlined as follows:

Soil, Stone, Gravel, Clay

The waste hierarchy states that the preferred option for waste management is prevention and minimisation of waste, followed by preparing for reuse and recycling / recovery, energy recovery (i.e. incineration) and, least favoured of all, disposal. The excavations are required to facilitate construction works so the preferred option (prevention and minimisation) cannot be accommodated for the excavation phase.

When material is removed off- site it could be reused as a by-product (and not as a waste). If this is done, it will be done in accordance with Article 27 of the *European Communities (Waste Directive) Regulations 2011*, which requires that certain conditions are met and that by-product notifications are made to the EPA via their online notification form. Excavated material should not be removed from site until approval from the EPA has been received. Article 27 will be investigated to see if the material can be exported off this site for beneficial reuse instead of disposal.

The next option (beneficial reuse) may be appropriate for the excavated material, pending environmental testing to classify the material as hazardous or non-hazardous in accordance with the EPA *Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous* publication. Clean inert material may be used as fill material in other construction projects or engineering fill for waste licensed sites. Beneficial reuse of surplus excavation material as engineering fill may be subject to further testing to determine if materials meet the specific engineering standards for their proposed end use.

Any nearby sites requiring clean fill/capping material will be contacted to investigate reuse opportunities for clean and inert material. If any of the material is to be reused on another site as a by-product (and not as a waste), this will be done in accordance with Article 27. Similarly, if any soils/stones are imported onto the site from another construction site as a by-product, this will also be done in accordance with Article 27. Article 27 will be investigated to see if the material can be imported onto this site for beneficial reuse instead of using virgin materials.

If the material is deemed to be a waste, then removal and reuse / recovery / disposal of the material will be carried out in accordance with the *Waste Management Acts 1996 – 2011* as amended, the *Waste Management (Collection Permit) Regulations 2007* as amended and the *Waste Management (Facility Permit & Registration) Regulations 2007* as amended. Once all available beneficial reuse options have been exhausted, the options of recycling and recovery at waste permitted and licensed sites will be considered.

In the event that contaminated material is encountered and subsequently classified as hazardous, this material will be stored separately to any non-hazardous material. It will require off-site treatment at a suitable facility or disposal abroad via Transfrontier Shipment of Wastes (TFS).

Bedrock

While it is not envisaged that bedrock will be encountered, if bedrock is encountered, it is anticipated that it will not be crushed on site. Any excavated rock is expected to be removed off- site for appropriate reuse, recovery and / or disposal. If bedrock is to be crushed on- site, the appropriate mobile waste facility permit will be obtained from LCCC.

Silt & Sludge

During the construction phase, silt and petrochemical interception will be carried out on run-off and pumped water from site works, where required. Sludge and silt will then be collected by a suitably licensed contractor and removed off- site.

Concrete Blocks, Bricks, Tiles & Ceramics

The majority of concrete blocks, bricks, tiles and ceramics generated as part of the construction works are expected to be clean, inert material and should be recycled, where possible. If concrete is to be crushed on- site, the appropriate mobile waste facility permit will be obtained from LCCC.

Hard Plastic

As hard plastic is a highly recyclable material, much of the plastic generated will be primarily from material off-cuts. All recyclable plastic will be segregated and recycled, where possible.

Timber

Timber that is uncontaminated, i.e. free from paints, preservatives, glues, etc., will be disposed of in a separate skip and recycled off- site.

Metal

Metals will be segregated, where practical, and stored in skips. Metal is highly recyclable and there are numerous companies that will accept these materials.

Plasterboard

There are currently a number of recycling services for plasterboard in Ireland. Plasterboard from the construction phases will be stored in a separate skip, pending collection for recycling. The site Manager will ensure that oversupply of new plasterboard is carefully monitored to minimise waste.

Glass

Glass materials will be segregated for recycling, where possible.

Waste Electrical & Electronic Equipment (WEEE)

Any WEEE will be stored in dedicated covered cages / receptacles / pallets pending collection for recycling.

Other Recyclables

Where any other recyclable wastes, such as cardboard and soft plastic, are generated, these will be segregated at source into dedicated skips and removed off- site.

Non-Recyclable Waste

C&D waste which is not suitable for reuse or recovery, such as polystyrene, some plastics and some cardboards, will be placed in separate skips or other receptacles. Prior to removal from site, the non-recyclable waste skip / receptacle will be examined by a member of the waste team (see Section 6.0) to determine if recyclable materials have been placed in there by mistake. If this is the case, efforts will be made to determine the cause of the waste not being segregated correctly and recyclable waste will be removed and placed into the appropriate receptacle.

Other Hazardous Wastes

On-site storage of any hazardous wastes produced (i.e. contaminated soil if encountered and / or waste fuels) will be kept to a minimum, with removal off-site organised on a regular basis. Storage of all hazardous wastes on-site will be undertaken so as to minimise exposure to on-site personnel and the public and to also minimise potential for environmental impacts. Hazardous wastes will be recovered, wherever possible, and failing this, disposed of appropriately.

On-Site Crushing

It is currently not envisaged that the crushing of waste materials will occur on- site. However, if the crushing of material is to be undertaken, a waste facility permit will first be obtained from LCCC and the destination of the accepting waste facility will be supplied to the LCCC waste unit.

4.4 Tracking and Documentation Procedures for Off-Site Waste

All waste will be documented prior to leaving the site. Waste will be weighed by the contractor, either by a weighing mechanism on the truck or at the receiving facility. These waste records will be maintained on site by the nominated project Waste Manager (see Section 6.0).

All movement of waste and the use of waste contractors will be undertaken in accordance with the *Waste Management Acts 1996 - 2011*, *Waste Management*

(Collection Permit) Regulations 2007 as amended and *Waste Management (Facility Permit & Registration) Regulations 2007* and amended. This includes the requirement for all waste contractors to have a waste collection permit issued by the NWCPO. The nominated project Waste Manager (see Section 6.0) will maintain a copy of all waste collection permits on-Site.

If the waste is being transported to another site, a copy of the Local Authority waste COR / permit or EPA Waste / Industrial Emissions Licence for that site will be provided to the nominated project Waste Manager (see Section 6.0). If the waste is being shipped abroad, a copy of the Transfrontier Shipping (TFS) notification document will be obtained from DCC (as the relevant authority on behalf of all Local Authorities in Ireland) and kept on-Site along with details of the final destination (COR, permits, licences, etc.). A receipt from the final destination of the material will be kept as part of the on-Site waste management records.

All information will be entered in a waste management recording system to be maintained on-Site.

5.0 ESTIMATED COST OF WASTE MANAGEMENT

An outline of the costs associated with different aspects of waste management is outlined below. The total cost of C&D waste management will be measured and will take into account handling costs, storage costs, transportation costs, revenue from rebates and disposal costs.

5.1 Reuse

By reusing materials on site, there will be a reduction in the transport and recycle / recovery / disposal costs associated with the requirement for a waste contractor to take the material off-Site. Clean and inert soils, gravel, stones, etc., which cannot be reused on-Site may be used as access roads or capping material for landfill sites, etc. This material is often taken free of charge or at a reduced fee for such purposes, reducing final waste disposal costs.

5.2 Recycling

Salvageable metals will earn a rebate, which can be offset against the costs of collection and transportation of the skips.

Clean, uncontaminated cardboard and certain hard plastics can also be recycled. Waste contractors will charge considerably less to take segregated wastes, such as recyclable waste, from a site than mixed waste.

Timber can be recycled as chipboard. Again, waste contractors will charge considerably less to take segregated wastes, such as timber, from a site than mixed waste.

5.3 Disposal

Landfill charges are currently at around €130 - €150 per tonne which includes a €75 per tonne landfill levy specified in the *Waste Management (Landfill Levy) Regulations 2015*. In addition to disposal costs, waste contractors will also charge a collection fee for skips.

Collection of segregated C&D waste usually costs less than municipal waste. Specific C&D waste contractors take the waste off-site to a licensed or permitted facility and, where possible, remove salvageable items from the waste stream before disposing of the remainder to landfill. Clean soil, rubble, etc., is also used as fill / capping material, wherever possible.

6.0 TRAINING PROVISIONS

A member of the construction team will be appointed as the Waste Manager to ensure commitment, operational efficiency and accountability in relation to waste management during the C&D phases of the development.

6.1 Waste Manager Training and Responsibilities

The nominated Waste Manager will be given responsibility and authority to select a waste team if required, i.e. members of the site crew that will aid them in the organisation, operation and recording of the waste management system implemented on site.

The Waste Manager will have overall responsibility to oversee, record and provide feedback to the client on everyday waste management at the site. Authority will be given to the Waste Manager to delegate responsibility to sub-contractors, where necessary, and to coordinate with suppliers, service providers and sub-contractors to prioritise waste prevention and material salvage.

The Waste Manager will be trained in how to set up and maintain a record keeping system, how to perform an audit and how to establish targets for waste management on site. The Waste Manager will also be trained in the best methods for segregation and storage of recyclable materials, have information on the materials that can be reused on site and be knowledgeable in how to implement this C&D RWMP.

6.2 Site Crew Training

Training of site crew in relation to waste is the responsibility of the Waste Manager and, as such, a waste training program should be organised. A basic awareness course will be held for all site crew to outline the C&D RWMP and to detail the segregation of waste materials at source. This may be incorporated with other site training needs such as general site induction, health and safety awareness and manual handling.

This basic course will describe the materials to be segregated, the storage methods and the location of the Waste Storage Areas (WSAs). A sub-section on hazardous wastes will be incorporated into the training program and the particular dangers of each hazardous waste will be explained.

7.0 RECORD KEEPING

Records should be kept for all waste material which leaves the site, either for reuse on another site, recycling or disposal. A recording system will be put in place to record the waste arisings on Site.

A waste tracking log should be used to track each waste movement from the site. On exit from the site, the waste collection vehicle driver should stop at the site office and sign out as a visitor and provide the security personnel or Waste Manager with a waste docket (or Waste Transfer Form (WTF) for hazardous waste) for the waste load collected. At this time, the security personnel should complete and sign the Waste Tracking Register with the following information:

- Date
- Time
- Waste Contractor
- Company waste contractor appointed by, e.g. Contractor or subcontractor name
- Collection Permit No.
- Vehicle Reg.
- Driver Name
- Docket No.
- Waste Type
- EWC / LoW

The waste vehicle will be checked by security personal or the Waste Manager to ensure it has the waste collection permit no. displayed and a copy of the waste collection permit in the vehicle before they are allowed to remove the waste from the site.

The waste transfer dockets will be transferred to the Waste Manager on a weekly basis and can be placed in the Waste Tracking Log file. This information will be forwarded onto the LCCC Waste Regulation Unit when requested.

Alternatively, each subcontractor that has engaged their own waste contractor will be required to maintain a similar waste tracking log with the waste dockets / WTF maintained on file and available for inspection on site by the main contractor as required.

Waste receipts from the receiving waste facility will also be obtained by the site contractor(s) and retained. A copy of the Waste Collection Permits, CORs, Waste Facility Permits and Waste Licences will be maintained on site at all times. Subcontractors who have engaged their own waste contractors, should provide the main contractor with a copy of the waste collection permits and COR / permit / licence for the receiving waste facilities and maintain a copy on file, available for inspection on site as required.

8.0 OUTLINE WASTE AUDIT PROCEDURE

8.1 Responsibility for Waste Audit

The appointed Waste Manager will be responsible for conducting a waste audit at the site during the C&D phase of the proposed Project. Contact details for the nominated Waste Manager will be provided to the LCCC Waste Regulation Unit after the main contractor is appointed and prior to any material being removed from site.

8.2 Review of Records and Identification of Corrective Actions

A review of all waste management costs and the records for the waste generated and transported off-site should be undertaken mid-way through the construction phase of the proposed Project.

If waste movements are not accounted for, the reasons for this should be established in order to see if and why the record keeping system has not been maintained. The waste records will be compared with the established recovery / reuse / recycling targets for the site. Each material type will be examined, in order to see where the largest percentage waste generation is occurring. The waste management methods for each material type will be reviewed in order to highlight how the targets can be achieved.

Upon completion of the C&D phase, a final report will be prepared, summarising the outcomes of waste management processes adopted and the total recycling / reuse / recovery figures for the development.

9.0 CONSULTATION WITH RELEVANT BODIES

9.1 Local Authority

Once construction contractors have been appointed and have appointed waste contractors, and prior to removal of any C&D waste materials off-site, details of the proposed destination of each waste stream will be provided to the LCCC Waste Regulation Unit.

LCCC will also be consulted, as required, throughout the excavation and construction phases in order to ensure that all available waste reduction, reuse and recycling opportunities are identified and utilised and that compliant waste management practices are carried out.

9.2 Recycling / Salvage Companies

The appointed waste contractor for the main waste streams managed by the construction contractor will be audited in order to ensure that relevant and up-to-date waste collection permits and facility registrations / permits / licences are held. In addition, information will be obtained regarding the feasibility of recycling each material, the costs of recycling / reclamation, the means by which the wastes will be collected and transported off- site, and the recycling / reclamation process each material will undergo off- site.

10.0 REFERENCES

1. Waste Management Act 1996 (No. 10 of 1996) as amended. Sub-ordinate and associated legislation includes:
    - European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011) as amended.
    - Waste Management (Collection Permit) Regulations 2007 (S.I. No. 820 of 2007) as amended.
    - Waste Management (Facility Permit and Registration) Regulations 2007 (S.I No. 821 of 2007) as amended.
    - Waste Management (Licensing) Regulations 2000 (S.I No. 185 of 2000) as amended.
    - European Union (Packaging) Regulations 2014 (S.I. No. 282 of 2014) as amended.
    - Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997) as amended.
    - Waste Management (Landfill Levy) Regulations 2015 (S.I. No. 189 of 2015)
    - European Union (Waste Electrical and Electronic Equipment) Regulations 2014 (S.I. No. 149 of 2014)
    - European Union (Batteries and Accumulators) Regulations 2014 (S.I. No. 283 of 2014) as amended.
    - Waste Management (Food Waste) Regulations 2009 (S.I. No. 508 of 2009) as amended.
    - European Union (Household Food Waste and Bio-waste) Regulations 2015 (S.I. No. 430 of 2015)
    - Waste Management (Hazardous Waste) Regulations 1998 (S.I. No. 163 of 1998) as amended.
    - Waste Management (Shipments of Waste) Regulations 2007 (S.I. No. 419 of 2007) as amended.
    - European Communities (Shipments of Hazardous Waste exclusively within Ireland) Regulations 2011 (S.I. No. 324 of 2011)
    - European Union (Properties of Waste which Render it Hazardous) Regulations 2015 (S.I. No. 233 of 2015) as amended
2. Protection of the Environment Act 2003, (No. 27 of 2003) as amended.
3. Litter Pollution Act 1997 (S.I. No. 12 of 1997) as amended
4. Southern Region Waste Management Plan 2015 – 2021 (2015).
5. Department of Environment and Local Government (DoELG) *Waste Management – Changing Our Ways, A Policy Statement* (1998).
6. Forum for the Construction Industry – *Recycling of Construction and Demolition Waste.*

7. Department of Communications, Climate Action and Environment (DCCAE), *Waste Action Plan for the Circular Economy - Ireland's National Waste Policy 2020-2025* (Sept 2020).

8. Environmental Protection Agency (EPA) *'Best Practice Guidelines for the Preparation of Resource Management Plans for Construction & Demolition Projects' (2021)*

9. DCCAE, *Whole of Government Circular Economy Strategy 2022-2023 'Living More, Using Less*' (2021)

10. Department of Environment, Heritage and Local Government, *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects* (2006).

11. FÁS and the Construction Industry Federation (CIF), *Construction and Demolition Waste Management – a handbook for Contractors and* site *Managers* (2002).

12. Limerick City & County Council (LCCC), *Limerick County Development Plan 2010-2016 (as Extended)* (2010)

13. LCCC, Draft Limerick Development Plan 2022 -2028 (2021)

14. Planning and Development Act 2000 (S.I. No. 30 of 2000) as amended

15. EPA, *Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous* (2015)

16. Council Decision 2003/33/EC, establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC.

17. Environmental Protection Agency (EPA), *National Waste Database Reports 1998 – 2012*.

18. EPA and Galway-Mayo Institute of Technology (GMIT), *EPA Research Report 146 – A Review of Design and Construction Waste Management Practices in Selected Case Studies – Lessons Learned* (2015).

APPENDIX 12.2 – Operational Waste Management Plan – AWN Consulting

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OPERATIONAL WASTE MANAGEMENT PLAN FOR A PROPOSED DEVELOPMENT

BALLYKEEFFE, RAHEEN, CO. LIMERICK.

Report Prepared For

DW Raheen Developments Ltd.

Report Prepared By

Chonaill Bradley, Principal Environmental Consultant

Our Reference

CB/21/12529WMR02

Date of Issue

18 January 2022

Document History

Document Reference		Original Issue Date	
CB/21/12529WMR01		18 January 2022	
Revision Level	Revision Date	Description	Sections Affected

Record of Approval

Details	Written by	Approved by
Signature		
Name	Chonaill Bradley	Fergal Callaghan
Title	Principal Environmental Consultant	Director
Date	18 January 2022	18 January 2022

CONTENTS

1.0 INTRODUCTION

AWN Consulting Ltd. (AWN) has prepared this Operational Waste Management Plan (OWMP) on behalf of DW Raheen Developments Ltd.. The development will principally consist of a mixed-use development of apartments, houses, incorporating common areas and a childcare facility at a site located at site located in Ballykeeffe, Raheen, Co. Limerick.

This OWMP has been prepared to ensure that the management of waste during the operational phase of the proposed Development is undertaken in accordance with the current legal and industry standards including, the Waste Management Act 1996 – 2011 as amended and associated Regulations [1], *Protection of the Environment Act 2003* as amended [2], *Litter Pollution Act 2003* as amended [3], the *'Southern Region Waste Management Plan 2015 – 2021'* [4] and the LCCC *"City and County of Limerick (Segregation, Storage and Presentation of Household and Commercial Waste) Bye-Laws (2019)"* [5]. In particular, this OWMP aims to provide a robust strategy for the storage, handling, collection and transport of the wastes generated at Site.

This OWMP aims to ensure maximum recycling, reuse and recovery of waste with diversion from landfill, wherever possible. The OWMP also seeks to provide guidance on the appropriate collection and transport of waste to prevent issues associated with litter or more serious environmental pollution (e.g. contamination of soil or water resources). The plan estimates the type and quantity of waste to be generated from the proposed Development during the operational phase and provides a strategy for managing the different waste streams.

At present, there are no specific guidelines in Ireland for the preparation of OWMPs. Therefore, in preparing this document, consideration has been given to the requirements of national and regional waste policy, legislation and other guidelines.

2.0 OVERVIEW OF WASTE MANAGEMENT IN IRELAND

2.1 National Level

The Government issued a policy statement in September 1998 entitled *'Changing Our Ways'* [6], which identified objectives for the prevention, minimisation, reuse, recycling, recovery and disposal of waste in Ireland. A heavy emphasis was placed on reducing reliance on landfill and finding alternative methods for managing waste. Amongst other things, *Changing Our Ways* stated a target of at least 35% recycling of municipal (i.e. household, commercial and non-process industrial) waste.

A further policy document, *'Preventing and Recycling Waste – Delivering Change'* was published in 2002 [7]. This document proposed a number of programmes to increase recycling of waste and allow diversion from landfill. The need for waste minimisation at source was considered a priority.

This view was also supported by a review of sustainable development policy in Ireland and achievements to date, which was conducted in 2002, entitled *'Making Irelands Development Sustainable – Review, Assessment and Future Action'* [8]. This document also stressed the need to decouple economic growth and waste generation, again through waste minimisation and reuse of discarded material.

In order to establish the progress of the Government policy document *Changing Our Ways*, a review document was published in April 2004 entitled *'Taking Stock and Moving Forward'* [9]. Covering the period 1998 – 2003, the aim of this document was to assess progress to date with regard to waste management in Ireland, to consider developments since the policy framework and the local authority waste management plans were put in place, and to identify measures that could be undertaken to further support progress towards the objectives outlined in *Changing Our Ways*.

In particular, *Taking Stock and Moving Forward* noted a significant increase in the amount of waste being brought to local authority landfills. The report noted that one of the significant challenges in the coming years was the extension of the dry recyclable collection services.

In September 2020, the Irish Government published a new policy document outlining a new action plan for Ireland to cover the period of 2020-2025. This plan *'A Waste Action Plan for a Circular Economy'* [10] (WAPCE), was prepared in response to the 'European Green Deal' which sets a roadmap for a transition to a new economy, where climate and environmental challenges are turned into opportunities, replacing the previous national waste management plan *"A Resource Opportunity"* (2012).

The WAPCE sets the direction for waste planning and management in Ireland up to 2025. This reorientates policy from a focus on managing waste to a much greater focus on creating circular patterns of production and consumption. Other policy statements of a number of public bodies already acknowledge the circular economy as a national policy priority.

The policy document contains over 200 measures across various waste areas including circular economy, municipal waste, consumer protection and citizen engagement, plastics and packaging, construction and demolition, textiles, green public procurement and waste enforcement.

One of the first actions to be taken was the development of the Whole of Government Circular Economy Strategy 2022-2023 'Living More, using Less' (2021) [11] to set a course for Ireland to transition across all sectors and at all levels of Government toward circularity and was issued in December 2021. It is anticipated that the Strategy will be updated in full every 18 months to 2 years.

Since 1998, the Environmental Protection Agency (EPA) has produced periodic *'National Waste (Database) Reports'* [12] detailing, among other things, estimates for household and commercial (municipal) waste generation in Ireland and the level of recycling, recovery and disposal of these materials. The *2019 National Waste Statistics*, which is the most recent study published, along with the national waste statistics web resource (November 2021) reported the following key statistics for 2019:

- **Generated –** Ireland produced 3,085,652 t of municipal waste in 2019. This is almost a 6% increase since 2018. This means that the average person living in Ireland generated 628 kg of municipal waste in 2019.
- **Managed –** Waste collected and treated by the waste industry. In 2019, a total of 3,036,991 t of municipal waste was managed and treated.
- **Unmanaged –**Waste that is not collected or brought to a waste facility and is, therefore, likely to cause pollution in the environment because it is burned, buried or dumped. The EPA estimates that 48,660 t was unmanaged in 2019.

- **Recovered –** The amount of waste recycled, used as a fuel in incinerators, or used to cover landfilled waste. In 2019, around 83% of municipal waste was recovered – a decrease from 84% in 2018.
- **Recycled –** The waste broken down and used to make new items. Recycling also includes the breakdown of food and garden waste to make compost. The recycling rate in 2019 was 37%, which is down from 38% in 2018.
- **Disposed –** Less than a sixth (15%) of municipal waste was landfilled in 2019. This is an increase from 14% in 2018.

2.2 Regional Level

The proposed development is located in the Local Authority area of Limerick City and County Council (LCCC).

The *Southern Region Waste Management Plan 2015 – 2021* is the regional waste management plan for the LCCC area published in 2014.

The Regional Plan sets out the strategic targets for waste management in the region and sets a specific target for C&D waste of *"70% preparing for reuse, recycling and other recovery of construction and demolition waste"* (excluding natural soils and stones and hazardous wastes) to be achieved by 2020.

Municipal landfill charges in Ireland are based on the weight of waste disposed. In the Munster Region, charges are approximately €130 - €150 per tonne of waste which includes a €75 per tonne landfill levy introduced under the *Waste Management (Landfill Levy) (Amendment) Regulations 2012.*

Limerick County Development Plan 2010-2016 (as Extended) [13] sets out a number of objectives for the Limerick City and County area, in line with the objectives of the regional waste management plan. The plan identifies the Council's commitment to the promotion of the Waste Hierarchy. Waste objectives with a particular relevance to the proposed development are:

Objectives:

- **IN 043: Education and Awareness** To promote education and awareness on all issues associated with waste management, both at industry and community level. This will include the promotion of waste reduction by encouraging the minimisation, re-use, recycling and recovery of waste within the county.
- **IN 044: Polluter pays principle** To ensure the provision of quality cost effective waste infrastructure and services, which reflect and meet the needs of the community and to ensure that the 'polluter pays' principle is adhered to in all waste management activities.
- **IN O46:** Proposed waste disposal It is the objective of the Council in assessing planning applications to have regard to the waste produced by proposed developments including the nature and amount produced and proposed method of disposal. Developments should ensure that production/disposal methods do not give rise to environmental pollution, result in undue loss of amenity or be detrimental to public health.

The Draft Limerick Development Plan 2022-2028 [14] sets out a number of objectives for the Limerick City and County area, in line with the objectives of the regional waste management plan and the Circular Economy Policy. Waste objectives with a particular relevance to the proposed development are:

Objective IN O15 *Waste Management and the Circular Economy It is an objective of the Council to:*

- Support innovative, smart solutions and processes, based on the principles of the circular economy to implement the Regional Waste Management Plan for the Southern Region 2015 – 2021 and any subsequent plan, including any targets contained therein.
- Collaborate with the Regional Waste Management Office and other agencies to implement the EU Action Plan for the Circular Economy – Closing the Loop, 2015, its successor the Circular Economy Action Plan: A New Circular Economy Action Plan for a Cleaner More Competitive Europe, 2020 and the Resource Opportunity-Waste Management Policy, DECLG, 2012 and any subsequent plans.
- Promote sustainable patterns of consumption and production in the areas of product design, production processes and waste management.
- Implement the provisions of the Waste Action Plan for a Circular Economy – Ireland's National Waste Policy 2020 - 2025, DECC, 2020 in the assessment of planning applications.
- Protect existing civic amenity sites and bring sites throughout Limerick and support the development of additional sites in accordance with the Southern Regional Waste Management Plan 2015 – 2021 and any subsequent plans.

2.3 Legislative Requirements

The primary legislative instruments that govern waste management in Ireland and applicable to the proposed Development are:

- Waste Management Act 1996 as amended. Sub-ordinate and associated legislation includes:
  - European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011) as amended
  - Waste Management (Collection Permit) Regulations 2007 (S.I. No. 820 of 2007) as amended
  - Waste Management (Facility Permit and Registration) Regulation 2007 (S.I No. 821 of 2007) as amended
  - Waste Management (Licensing) Regulations 2000 (S.I No. 185 of 2000) as amended
  - European Union (Packaging) Regulations 2014 (S.I. No. 282 of 2014) as amended.
  - Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997) as amended
  - Waste Management (Landfill Levy) Regulations 2015 (S.I. No. 189 of 2015)
  - European Communities (Waste Electrical and Electronic Equipment) Regulations 2014 (S.I. No. 149 of 2014)
  - Waste Management (Batteries and Accumulators) Regulations 2014 (S.I. No. 283 of 2014) as amended
  - Waste Management (Food Waste) Regulations 2009 (S.I. No. 508 of 2009) as amended

  - European Union (Household Food Waste and Bio-waste) Regulations 2015 (S.I. No. 191 of 2015)
  - Waste Management (Hazardous Waste) Regulations 1998 (S.I. No. 163 of 1998) as amended
  - Waste Management (Shipments of Waste) Regulations 2007 (S.I. No. 419 of 2007) as amended
  - *European Communities (Transfrontier Shipment of Waste) Regulations 1994 (SI 121 of 1994)*
  - European Union (Properties of Waste Which Render it Hazardous) Regulations 2015 (S.I. No. 233 of 2015) as amended
- Environmental Protection Act 1992 as amended;
- Litter Pollution Act 1997 as amended and
- Planning and Development Act 2000 as amended [15]

These Acts and subordinate Regulations transpose the relevant European Union Policy and Directives into Irish law.

One of the guiding principles of European waste legislation, which has in turn been incorporated into the Waste Management Act 1996 - 2011 and subsequent Irish legislation, is the principle of "Duty of Care". This implies that the waste producer is responsible for waste from the time it is generated through until its legal disposal (including its method of disposal.) As it is not practical in most cases for the waste producer to physically transfer all waste from where it is produced to the final disposal area, waste contractors will be employed to physically transport waste to the final waste disposal site.

It is, therefore, imperative that the residents, tenants and the proposed facilities management company undertake on-Site management of waste in accordance with all legal requirements and that the facilities management company employ suitably permitted / licenced contractors to undertake off-Site management of their waste in accordance with all legal requirements. This includes the requirement that a waste contactor handle, transport and reuse / recover / recycle / dispose of waste in a manner that ensures that no adverse environmental impacts occur as a result of any of these activities.

A collection permit to transport waste must be held by each waste contractor which is issued by the National Waste Collection Permit Office (NWCPO). Waste receiving facilities must also be appropriately permitted or licensed. Operators of such facilities cannot receive any waste, unless in possession of a Certificate of Registration (COR) or waste permit granted by the relevant Local Authority under the Waste Management (Facility Permit & Registration) Regulations 2007, as amended, or a Waste or Industrial Emissions (IE) Licence granted by the EPA. The COR / permit / licence held will specify the type and quantity of waste able to be received, stored, sorted, recycled, recovered and / or disposed of at the specified site.

2.3.1 Limerick City and County Council Waste Bye-Laws

The LCCC "City and County of Limerick (Segregation, Storage and Presentation of Household and Commercial Waste) Bye-Laws (2019)" came into use in March 2019. The Bye-Laws set a number of enforceable requirements on waste holders with regard to storage, separation and presentation of waste within the LCCC functional area. Key requirements under these Bye-Laws of relevance to the proposed development include the following

- Kerbside waste presented for collection shall not be presented for collection earlier than 6.00 pm on the day immediately preceding the designated waste collection day; while the Metropolitan District of Limerick area shall not be presented for collection earlier than 8.00 pm on the day immediately preceding the designated waste collection day.
- All containers used for the presentation of kerbside waste and any uncollected waste shall be removed from any roadway, footway, footpath or any other public place no later than 9.00pm the day of collection; while the Metropolitan District of Limerick area shall removed their bins no later than 9.30am on the designated waste collection day.
- Documentation, including receipts, is obtained and retained for a period of no less than one year to provide proof that any waste removed from the premises has been managed in a manner that conforms to these bye-laws, to the Waste Management Act and, where such legislation is applicable to that person, to the European Union (Household Food Waste and Bio-Waste) Regulations 2015; and
- Adequate access and egress onto and from the premises by waste collection vehicles is maintained.

The full text of the Waste Bye-Laws is available from the LCCC website.

2.4 Regional Waste Management Service Providers and Facilities

Various contractors offer waste collection services for the residential sector in the LCCC region. Details of waste collection permits (granted, pending and withdrawn) for the region are available from the NWCPO.

There are a number of licensed and permitted facilities in operation in the region including waste transfer stations, hazardous waste facilities and integrated waste management facilities. There is a proposed thermal treatment facility in Ringaskiddy, Co. Cork which was approved by An Bord Pleanála in 2018. However, a legal challenge in the high court has overturned this decision and the project is now in limbo.

There is a Recycling Centre (Fronting Recycling Centre) located 1.9k to the southwest of the development at Mungret which can be utilised by the residents of the proposed Development for other household waste streams while a bring bank can also be found at the same location.

A copy of all CORs and waste permits issued by the Local Authorities are available from the NWCPO website and all Waste / Industrial Emissions Licenses issued are available from the EPA.

3.0 DESCRIPTION OF THE DEVELOPMENT

3.1 Location, Size and Scale of the Development

DW Raheen Developments Ltd. are seeking permission for a strategic housing development consisting of the provision of 384 residential house and apartment units on a ca. 10.44 hectare site located in Ballykeeffe, Raheen, Co. Limerick.

The site is greenfield land that is enclosed by existing residential development to the south, east and west and open land to the north. Access to the site is provided by an existing entrance off a roundabout on the R510 regional road.

The proposed development will provide as follows:

- 202 no. housing units, comprising a variety of forms to include bungalows, detached, semi-detached and terraced houses. A mix of house sizes are proposed to include 20 no. two bedroom houses, 156 no. three bedroom houses and 26 no. four bedroom houses.

- 182 apartment and duplex units across 25 small scale blocks, 2 to 4 storeys in heights, throughout the development. The apartments and duplexes provide a mix of one, two, three and four bed units, comprising of 10 no. four bedroom duplex units, 10 no. three bedroom duplex units, 6 no. two bedroom duplex units, 18 no. three bedroom apartments, 92 no. two bedroom apartments and 46 no. one bedroom apartments.

The proposed development also includes;

- A childcare facility measuring 761.75m^2, providing 79 childcare places (55 full time and 24 after school places), located at the south-western edge of the development.

- The provision of 377 no. car parking spaces and 311 secured bicycle parking spaces.

- The provision of 3 no. ESB sub-stations, ancillary services and infrastructure works including foul and surface water drainage, attenuation areas, landscaped public open spaces (approximately 29,500m^2, or 28.2% of the total site area), landscaping, lighting, internal roads, cycle paths, and footpaths.

A Natura Impact Statement (NIS) and Environmental Impact Assessment Report (EIAR) have been prepared in respect of the proposed development.

3.2 Typical Waste Categories

The typical non-hazardous and hazardous wastes that will be generated at the proposed Development will include the following:

- Dry Mixed Recyclables (DMR) - includes waste paper (including newspapers, magazines, brochures, catalogues, leaflets), cardboard and plastic packaging, metal cans, plastic bottles, aluminium cans, tins and Tetra Pak cartons;
- Organic waste – food waste and green waste generated from internal plants / flowers;
- Glass; and
- Mixed Non-Recyclable (MNR)/General Waste.

In addition to the typical waste materials that will be generated at the development on a daily basis, there will be some additional waste types generated less frequently / in smaller quantities which will need to be managed separately including:

- Green / garden waste may be generated from external landscaping;
- Batteries (both hazardous and non-hazardous);
- Waste electrical and electronic equipment (WEEE) (both hazardous and non-hazardous);
- Printer cartridges / toners;
- Chemicals (paints, adhesives, resins, detergents, etc.);
- Light bulbs;
- Textiles;
- Waste cooking oil (if any generated by the residents and Childcare tenant);
- Furniture (and, from time to time, other bulky wastes); and
- Abandoned bicycles.

Wastes should be segregated into the above waste types to ensure compliance with waste legislation and guidance while maximising the re-use, recycling and recovery of waste with diversion from landfill wherever possible.

3.3 European Waste Codes

In 1994, the *European Waste Catalogue* [14] and *Hazardous Waste List* [15] were published by the European Commission. In 2002, the EPA published a document titled the *European Waste Catalogue and Hazardous Waste List* [16], which was a condensed version of the original two documents and their subsequent amendments. This document has recently been replaced by the EPA '*Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous*' [17], applicable since the 1st June 2015. This waste classification system applies across the EU and is the basis for all national and international waste reporting, such as those associated with waste collection permits, CORs, permits and licences and the EPA National Waste Database.

Under the classification system, different types of wastes are fully defined by a code. The List of Waste (LoW) code (also referred to as European Waste Code (EWC)) for typical waste materials expected to be generated during the operation of the proposed development are provided in Table 3.1, below.

Table 3.1 Typical Waste Types Generated and LoW Codes

Waste Material	LoW/EWC Code
Paper and Cardboard	20 01 01
Plastics	20 01 39
Metals	20 01 40
Mixed Non-Recyclable Waste	20 03 01
Glass	20 01 02
Biodegradable Kitchen Waste	20 01 08
Oils and Fats	20 01 25
Textiles	20 01 11
Batteries and Accumulators*	20 01 33* - 34
Printer Toner/Cartridges*	20 01 27* - 28
Green Waste	20 02 01
WEEE*	20 01 35*-36
Chemicals (solvents, pesticides, paints & adhesives, detergents, etc.) *	20 01 13*/19*/27*/28/29*30

Fluorescent tubes and other mercury containing waste*	20 01 21*
Bulky Wastes	20 03 07

** Individual waste type may contain hazardous materials*

4.0 ESTIMATED WASTE ARISINGS

A waste generation model (WGM) developed by AWN has been used to predict waste types, weights and volumes expected to arise from operations within the proposed Development. The WGM incorporates building area and use and combines these with other data, including Irish and US EPA waste generation rates.

The estimated quantum / volume of waste that will be generated from the residential has been determined based on the predicted occupancy of the units. While the floor area usage (m^2) has been used to estimate the waste arising from the childcare facility unit. Waste generated in residential common areas have been considered and are included within residential waste figures.

The estimated waste generation for the proposed Development for the main waste types is presented in Tables 4.1 – 4.3.

Table 4.2 *Estimated Waste Generation for Residential House and Apartment Block Type A*

Waste Type	**Waste Volume (m^3 / week)**			
	2 Bedroom House (Individual)	**3 Bedroom House (Individual)**	**4 Bedroom House (Individual)**	**Apartments Block Type A (Combined)**
Organic Waste	0.02	0.02	0.02	0.59
Dry Mixed Recyclables	0.11	0.13	0.18	4.17
Glass	>0.00	>0.00	>0.00	0.11
Mixed Non-Recyclables	0.07	0.08	0.09	2.19
Total	**0.20**	**0.23**	**0.29**	**7.06**

Table 4.2 *Estimated Waste Generation for Residential Apartment Blocks Type B-E*

Waste Type	**Waste Volume (m^3 / week)**			
	Apartments Block Type B (Combined) 5 no. Blocks	**Apartments Block Type C (Combined)**	**Apartments Block Type D (Combined)**	**Apartments Block Type E (Combined) 2 no. Blocks**
Organic Waste	0.11	0.10	0.64	0.46
Dry Mixed Recyclables	0.72	0.69	4.50	3.24
Glass	0.02	0.02	0.12	0.09
Mixed Non-Recyclables	0.42	0.40	2.37	1.71
Total	**1.27**	**1.21**	**7.63**	**5.50**

Table 4.3 *Estimated Waste Generation for Commercial unit / Childcare Facility*

Waste Type	**Waste Volume (m^3 / week)**
	Childcare Facility (Individual)
Organic Waste	0.05
Dry Mixed Recyclables	1.91
Glass	0.01
Mixed Non-Recyclables	1.04
Total	**3.01**

BS5906:2005 Waste Management in Buildings – Code of Practice[18] has been considered in the calculations of waste estimates. AWN's modelling methodology is based on recently published data and data from numerous other similar developments in Ireland and is based on AWN's experience, it provides a more representative estimate of the likely waste arisings from the proposed Development.

5.0 WASTE STORAGE AND COLLECTION

This section provides information on how waste generated within the Site will be stored and collected. This has been prepared with due consideration of the proposed Site layout as well as best practice standards, local and national waste management requirements, including those of LCCC. In particular, consideration has been given to the following documents:

- *BS 5906:2005 Waste Management in Buildings – Code of Practice,*
- *SR Waste Management Plan 2015 – 2021;*
- *Dublin City Council Development Plan 2016 – 2022 (Appendix 10);*
- LCCC City and County of Limerick (Segregation, Storage and Presentation of Household and Commercial Waste) Bye-Laws (2019) and
- *DoHLGH, Sustainable Urban Housing: Design Standards for New Apartments, Guidelines for Planning Authorities* (2020) [19].

Waste Storage Areas

Locations of all Waste Storage Areas (WSAs) can be viewed on the drawings submitted with the planning application under separate cover.

Individual Houses

Residents in houses will have individual waste stores allocated at the rear of their property where external access to the rear yard is possible. When rear is storage is not possible a shielded bin store will be allocated at the front of the unit.

Residential Blocks A (A1 & A2)

1 (2 no. in total) shared communal WSAs, have been allocated within the development design for the residential apartment blocks. These have been strategically located on the ground floor level, in an external location in the enclosed courtyard between the unit blocks.

Residential Blocks B

1 (5 no. in total) shared communal WSAs, have been allocated within the development design for the residential apartment blocks. These have been strategically located on the ground floor level, in an external location directly beside each block.

Residential Blocks C

1 (3 no. in total) shared communal WSAs, have been allocated within the development design for the residential apartment blocks. These have been strategically located on the ground floor level, in an external location in the shared communal space at the rear of the unit.

Residential Blocks D

1 (1 no. in total) shared communal WSA, has been allocated within the development design for the residential apartment block. This has been strategically located on the ground floor level, in an internal location, in close proximity to the cores.

Residential Blocks E

1 (2 no. in total) shared communal WSAs, have been allocated within the development design for the residential apartment blocks. These have been strategically located on the ground floor level, in an internal location, in close proximity to the cores.

Childcare Facility

1 (1 no. in total) WSAs has been allocated within the development design for the Childcare Facility unit. This WSA had been strategically located at ground floor level, in an external location within the outdoor area of the creche property.

The waste receptacles from the shared WSAc will be collected by facilities management, immediately prior to collection and brought through to the nearest internal road to where the bins will be staged prior to collection. The staging areas are such that they will not obstruct traffic or pedestrians (allowing a footway path of at least 1.8m, the space needed for two wheelchairs to pass each other) as is recommended in the *Design Manual for Urban Roads and Streets* (2019) [20].

Using the estimated waste generation volumes in Tables 4.1 – 4.3, above, the waste receptacle requirements for MNR, DMR, organic waste and glass have been established for the WSA. It is envisaged that MNR, DMR and organic waste and glass will be collected on a weekly basis.

Waste Storage Requirements

Estimated waste storage requirements for the operational phase of the proposed Development are detailed in Table 5.1, below.

Table 6.3 *Waste storage requirements for the proposed development*

Area/Use	**Bins Required**			
	MNR[1]	**DMR[2]**	**Glass**	**Organic**
House (Individual)	1 no. 240 L	1 no. 240 L	Bottle Bank	1 no. 120 L

Area/Use	Bins Required			
	MNR[1]	DMR[2]	Glass	Organic
Block A Residential (Combined)	2 no. 1100 L	4 no. 1100 L	1 no. 240 L	3 no. 240 L
Block B Residential (Per Block)	2 no. 240 L	1 no. 1100 L	1 no. 120 L	1 no. 120 L
Block C Residential (Per Block)	2 no. 240 L	1 no. 1100 L	1 no. 120 L	1 no. 120 L
Block D Residential (Combined)	2 no. 1100 L 1 no. 240L	4 no. 1100 L 1 no. 240L	1 no. 120 L	3 no. 240 L
Block E Residential (Per Block)	2 no. 1100 L	3 no. 1100 L	1 no. 120 L	2 no. 240 L
Childcare Facility Unit (Individual)	2 no. 240 L	1 no. 1100 L	1 no. 120 L	1 no. 120 L

Note: 1 = Mixed Non-Recyclables
2 = Dry Mixed Recyclables

The waste receptacle requirements have been established from distribution of the total weekly waste generation estimate into the holding capacity of each receptacle type. Waste storage receptacles as per Table 5.1, above, (or similar appropriate approved containers) will be provided by the facilities management company company in the residential WSA.

The types of bins used will vary in size, design and colour dependent on the appointed waste contractor. However, examples of typical receptacles to be provided in the WSAs are shown in Figure 5.1. All waste receptacles used will comply with the IS EN 840 2012 standard for performance requirements of mobile waste containers, where appropriate.

Figure 6.1 *Typical waste receptacles of varying size (240 L and 1100 L)*

5.1 Waste Storage – Residential Units

Residents will be required to segregate waste into the following main waste streams:

- DMR;
- MNR;
- Glass; and
- Organic waste.

Residents will be required to take their segregated waste materials to their designated WSA and deposit their segregated waste into the appropriate bins. The location of the WSAs are illustrated in the drawings submitted with the planning application under separate cover.

Space will be provided in the residential units to accommodate 3 no. bin types to facilitate waste segregation at source.

Each bin / container in the WSAs will be clearly labelled and colour coded to avoid cross contamination of the different waste streams. Signage will be posted above or on the bins to show exactly which waste types can be placed in each bin.

Access to the apartment block WSAs will be restricted to authorised residents, facilities management and waste contractors by means of a key or electronic fob access.

Other waste materials such as textiles, batteries, printer toner / cartridges, light bulbs and WEEE may be generated infrequently by the residents. Residents will be required to identify suitable temporary storage areas for these waste items within their own units and dispose of them appropriately. Further details on additional waste types can be found in Section 5.4.

5.2 Waste Storage – Childcare Facility

Staff at the Childcare Facility will be required to segregate their waste into the following waste categories within their own units:

- DMR;
- MNR;
- Organic waste; and
- Glass.

As required, the staff will need to take segregated DMR, MNR, glass and organic waste to their allocated WSA.

Each bin / container in the WSA will be clearly labelled and colour coded to avoid cross contamination of the different waste streams. Signage will be posted above or on the bins to show exactly which waste types can be placed in each bin.

Other waste materials such as textiles, batteries, WEEE, lightbulbs, cooking oil and printer toner / cartridges may be generated infrequently by the tenants. Tenants will be required to identify suitable temporary storage areas for these waste items within the Childcare Facility and dispose of them appropriately. Further details on additional waste types can be found in Section 5.4.

5.3 Waste Collection

There are numerous private contractors that provide waste collection services in the LCCC area. All waste contractors servicing the proposed development must hold a valid waste collection permit for the specific waste types collected. All waste collected must be transported to registered / permitted / licensed facilities only.

Bins from the development will be brought to collection / staging points by the waste contractor or facilities management, immediately prior to collection. All locations for collection can be viewed on the drawings submitted with the planning application under separate cover.

Residents in houses with their own individual bins will be responsible for convey their bins to and from the curtilage for collection.

A trolley / tug or suitable vehicle may be required to convey the bins to and from the collection area. The facilities management or waste contractor will ensure that empty bins are promptly returned to the WSAs after collection / emptying.

Suitable access and egress has been provided to enable the bins to be moved easily from the WSA to the waste collection vehicles on the appropriate days. Waste will be collected at agreed days and times by the nominated waste contractors.

All waste receptacles should be clearly identified as required by waste legislation and the requirements of the LCCC *Waste Bye-Laws*. Waste will be presented for collection in a manner that will not endanger health, create a risk to traffic, harm the environment or create a nuisance through odours or litter.

It is recommended that bin collection times are staggered to reduce the number of bins required to be emptied at once and the time the waste vehicle is on-Site. This will be determined during the process of appointment of a waste contractor.

5.4 Additional Waste Materials

In addition to the typical waste materials that are generated on a daily basis, there will be some additional waste types generated from time to time that will need to be managed separately. A non-exhaustive list is presented below.

<u>Green Waste</u>
Green waste may be generated from gardens, external landscaping and internal plants / flowers. Green waste generated from landscaping of external areas will be removed by external landscape contractors. Green waste generated from gardens internal plants / flowers can be placed in the organic waste bins.

<u>Batteries</u>
A take-back service for waste batteries and accumulators (e.g. rechargeable batteries) is in place in order to comply with the S.I. No. 283/2014 - European Union (Batteries and Accumulators) Regulations 2014, as amended. In accordance with these regulations, consumers are able to bring their waste batteries to their local civic amenity centre or can return them free of charge to retailers which supply the equivalent type of battery, regardless of whether or not the batteries were purchased at the retail outlet and regardless of whether or not the person depositing the waste battery purchases any product or products from the retail outlet.

The commercial tenants cannot use the civic amenity centre. They must segregate their waste batteries and either avail of the take-back service provided by retailers or arrange for recycling / recovery of their waste batteries by a suitably permited / licenced contractor. Facilties management may arrange collection, depending on the agreement.

Waste Electrical and Electronic Equipment (WEEE)

The WEEE Directive (Directive 2002/96/EC) and associated Waste Management (WEEE) Regulations have been enacted to ensure a high level of recycling of electronic and electrical equipment. In accordance with the regulations, consumers can bring their waste electrical and electronic equipment to their local recycling centre. In addition, consumers can bring back WEEE within 15 days to retailers when they purchase new equipment on a like for like basis. Retailers are also obliged to collect WEEE within 15 days of delivery of a new item, provided the item is disconnected from all mains, does not pose a health and safety risk and is readily available for collection.

As noted above, the commercial tenants cannot use the civic amenity centre. They must segregate their WEEE and either avail of the take-back / collection service provided by retailers or arrange for recycling / recovery of their WEEE by a suitably permited / licenced contractor. Facilties management may arrange collection, depending on the agreement.

Printer Cartridge / Toners

It is recommended that a printer cartridge / toner bin is provided in the commercial unit, where appropriate. The commercial tenant will be required to store this waste within their unit and arrange for return to retailers or collection by an authorised waste contractor, as required.

Waste printer cartridge / toners generated by residents can usually be returned to the supplier free of charge or can be brought to a civic amenity centre.

Chemicals

Chemicals (such as solvents, paints, adhesives, resins, detergents, etc) are largely generated from building maintenance works. Such works are usually completed by external contractors who are responsible for the off-site removal and appropriate recovery / recycling / disposal of any waste materials generated.

Any waste cleaning products or waste packaging from cleaning products generated in the commercial units that is classed as hazardous (if they arise) will be appropriately stored within the tenants' own space. Facilties management may arrange collection, depending on the agreement.

Any waste cleaning products or waste packaging from cleaning products that are classed as hazardous (if they arise) generated by the residents should be brought to a civic amenity centre.

Light Bulbs

Waste light bulbs (fluorescent, incandescent and LED) may be generated by lighting at the commercial units. It is anticipated that commercial tenants will be responsible for the off-site removal and appropriate recovery / disposal of these wastes. Facilties management may arrange collection, depending on the agreement.

Light bulbs generated by residents should be taken to the nearest civic amenity centre for appropriate storage and recovery / disposal.

Textiles

Where possible, waste textiles should be recycled or donated to a charity organisation for reuse. Commercial and residential tenants will be responsible for disposing of waste textiles appropriately.

Waste Cooking Oil

If the commerial tenants use cooking oil, waste cooking oil will need to be stored within the unit on a bunded area or spill pallet and regular collections by a dedicated waste contractor will need to be organised as required. Under sink grease traps will be installed in any cooking space.

If the residents generate waste cooking oil, this can be brought to a civic amenity centre.

Furniture & Other Bulky Waste Items

Furniture and other bulky waste items (such as carpet, etc.) may occasionally be generated by the commercial tenant. The collection of bulky waste will be arranged, as required by the tenant. If residents wish to dispose of furniture, this can be brought a civic amenity centre.

Abandoned Bicycles

Bicycle parking areas are planned for the development. As happens in other developments, residents sometimes abandon faulty or unused bicycles, and it can be difficult to determine their ownership. Abandoned bicycles should be donated to charity if they arise or Facilties management willmay arrange collection by a licensed waste contractor.

Covid-19 Waste

Any waste generated by residential and commercial tenants that have tested positive for Covid-19 should be manged in accordance with the current Covid-19 HSE Guidelines at the time that that waste arises. At the time this report was prepared, the HSE Guidelines require the following procedure for any waste from a person that tests positive for Covid-19:

- Put all waste (gloves, tissues, wipes, masks) from that person in a bin bag and tie when almost full;
- Put this bin bag into a second bin bag and tie a knot;
- Store this bag safely for 3 days, then put the bag into the non-recyclable waste / general waste wheelie bin for collection / emptying.

Please note that this guidance is likely to be updated by the time the proposed Development is open and occupied and the relevant guidance at the time will need to be reviewed.

5.5 Waste Storage Area Design

The shared WSAs should be designed and fitted-out to meet the requirements of relevant design Standards, including:

- Be fitted with a non-slip floor surface;

- Provide ventilation to reduce the potential for generation of odours with a recommended 6-10 air changes per hour for a mechanical system for internal WSAs;
- Provide suitable lighting – a minimum Lux rating of 220 is recommended;
- Be easily accessible for people with limited mobility;
- Be restricted to access by nominated personnel only;
- Be supplied with hot or cold water for disinfection and washing of bins;
- Be fitted with suitable power supply for power washers;
- Have a sloped floor to a central foul drain for bins washing run-off;
- Have appropriate signage placed above and on bins indicating correct use;
- Have access for potential control of vermin, if required; and
- Be fitted with CCTV for monitoring.

The facilities management company, tenants and residents will be required to maintain the resident bins and storage areas in good condition as required by the LCCC Waste Bye-Laws.

6.0 CONCLUSIONS

In summary, this OWMP presents a waste strategy that addresses all legal requirements, waste policies and best practice guidelines and demonstrates that the required storage areas have been incorporated into the design of the proposed Development.

Implementation of this OWMP will ensure a high level of recycling, reuse and recovery at the development. All recyclable materials will be segregated at source to reduce waste contractor costs and ensure maximum diversion of materials from landfill, thus contributing to the targets set out in the *SR Waste Management Plan 2015 – 2021*.

Adherence to this plan will also ensure that waste management at the development is carried out in accordance with the requirements of the *LCCC Waste Bye-Laws.*

The waste strategy presented in this document will provide sufficient storage capacity for the estimated quantity of segregated waste. The designated areas for waste storage will provide sufficient room for the required receptacles in accordance with the details of this strategy.

7.0 REFERENCES

1. Waste Management Act 1996 as amended. Sub-ordinate and associated legislation includes:
    - European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011) as amended
    - Waste Management (Collection Permit) Regulations 2007 (S.I. No. 820 of 2007) as amended
    - Waste Management (Facility Permit and Registration) Regulations 2007 (S.I No. 821 of 2007) as amended
    - Waste Management (Licensing) Regulations 2000 (S.I No. 185 of 2000) as amended
    - European Union (Packaging) Regulations 2014 (S.I. No. 282 of 2014)
    - Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997)
    - Waste Management (Landfill Levy) Regulations 2015 (S.I. No. 189 of 2015)
    - European Communities (Waste Electrical and Electronic Equipment) Regulations 2014 (S.I. No. 149 of 2014)
    - Waste Management (Batteries and Accumulators) Regulations 2014 (S.I. No. 283 of 2014) as amended
    - Waste Management (Food Waste) Regulations 2009 (S.I. No. 508 of 2009) as amended 2015 (S.I. No. 190 of 2015)
    - European Union (Household Food Waste and Bio-waste) Regulations 2015 (S.I. No. 191 of 2015)
    - Waste Management (Hazardous Waste) Regulations 1998 (S.I. No. 163 of 1998) as amended 2000 (S.I. No. 73 of 2000)
    - Waste Management (Shipments of Waste) Regulations 2007 (S.I. No. 419 of 2007) as amended
    - *European Communities (Transfrontier Shipment of Waste) Regulations 1994 (SI 121 of 1994)*
    - European Union (Properties of Waste which Render it Hazardous) Regulations 2015 (S.I. No. 233 of 2015) as amended
2. Environmental Protection Act 1992 as amended;
3. Litter Pollution Act 1997 as amended;
4. Southern Waste Region, *Southern (SR) Waste Management Plan 2015 – 2021* (2015)
5. Limerick City and County Council (LCCC) *City and County of Limerick (Segregation, Storage and Presentation of Household and Commercial Waste) Bye-Laws (2019)*
6. Department of Environment and Local Government (DoELG) *Waste Management – Changing Our Ways, A Policy Statement* (1998)
7. Department of Environment, Heritage and Local Government (DoEHLG) *Preventing and Recycling Waste - Delivering Change* (2002)
8. DoELG, *Making Ireland's Development Sustainable – Review, Assessment and Future Action (World Summit on Sustainable Development)* (2002)
9. DoEHLG, *Taking Stock and Moving Forward* (2004)
10. Department of Communications, Climate Action and Environment (DCCAE), *Waste Action Plan for the Circular Economy - Ireland's National Waste Policy 2020-2025* (2020).
11. DCCAE, *Whole of Government Circular Economy Strategy 2022-2023 'Living More, Using Less*' (2021)
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