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PROPOSED DEVELOPMENT AT THE CONCORDE INDUSTRIAL ESTATE, NAAS ROAD, WALKINSTOWN, DUBLIN 12

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CIVIL ENGINEERING INFRASTRUCTURE REPORT FOR PLANNING

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1.0 INTRODUCTION

1.1 GENERAL DESCRIPTION

Development Ocht Limited has commissioned Barrett Mahony Consulting Engineers (BMCE) to prepare a Civil Engineering Infrastructure Report for Planning for the mixed-use Concorde Residential Development at Concorde Industrial Estate, Naas Road, Walkinstown, Dublin 12. The proposed development will consist of 8no. above ground floor levels extending across most of the site along with a single level basement, 492 no. apartments, 3,327m^2 of commercial space, 238 No. car parking spaces and 516 No. bicycle parking spaces. The apartment will be a “Build-To-Rent” (BTR) scheme with management on site.

The apartment breakdown is as follows;

- Studio 104
- 1 Bedroom 136
- 2 Bedroom (4 person) 231
- 2 Bedroom (3 person) 21

The subject site is currently occupied by a number of automobile repair/sale small businesses, along with one unit being used as a gym. The building at the south-east corner of the site and the last unit to the west end of the building are currently unoccupied. The site is located to the west of Dublin City Centre, 220m south-west of the intersection of the Old Nass Road and the Nass Road.

The immediate vicinity of the site is shown in Figure 1 below. The site is bounded to the north by the Nass Road, to the east by an un-named public access road (cul de sac), to the west by an ESB high voltage mast and compound and to the south by a car yard and Drimnagh Castle playing fields. The main point of access to the site will be via the un-named road to the east which, in turn, is accessed from the Nass Road via a proposed new signalised junction. The overall site area is 1.88ha with the proposed building footprint area being 0.5825ha. The site surface is generally flat, at approximately +39.65m. The surface levels drop in the south-east corner by 0.5 m to 39.15m. There is a low retaining wall along the south boundary. There is also a low-level retaining wall (circa 0.75m in height) along the full northern (Nass Road) boundary.

Figure 1 – Location of Site

The site is located within a key development area, as identified in the Dublin City Council Naas Roads Lands Local Area Plan (LAP) 2013. Land Use Policy LUS1 is "To establish new and appropriate land uses that support a thriving employment and residential hub in recognition of the strategic nature of the plan area as a key development area, key district centre, Strategic Development and Regeneration Area, a gateway to the city and its location along the Naas Road/ Rail transport boundary innovation corridor".

The site area is 1.83ha and is currently occupied by 2 industrial buildings and a combination of concrete slab and bituminous surfacing over the remainder of the site.

1.2 Scope of this Report

This report describes the proposed civil engineering infrastructure for the development and how it connects to the public infrastructure serving the area.

In particular, foul and surface water drainage, water supply, flood risk and traffic engineering aspects are addressed. This report should be read in conjunction with the following drawings submitted with the planning application:

- 18.232-C1000 Proposed Foul & Surface Layout
- 18.232-C1001 Proposed Basement Drainage Layout
- 18.232-C1002 Proposed Roads & Surface Layout
- 18.232-C1003 Watermain Layout
- 18.232-C1004 Proposed Signalized Junction Layout
- 18.232-C1005 Proposed SuDS Layout

- 18.232-C1006 Proposed Basement Roads Layout
- 18.232-C1007 Proposed Sightlines Layout
- 18.232-C1009 Proposed Wayleave
- 18.232-C1050 Autoroute Refuse Vehicle Tracking
- 18.232-C1051 Autoroute Delivery Vehicle Tracking
- 18.232-C1052 Autoroute Fire Tender Tracking
- 18.232-C1100 Longitudinal Drainage Sections
- 18.232-C1103 Longitudinal Watermain Sections
- 18.232-C1200 Standard Drainage Details (Sheet 1 of 2)
- 18.232-C1201 Standard Drainage Details (Sheet 2 of 2)
- 18.232-C1210 Road Details
- 18.232-C1220 Standard Watermain Details (Sheet 1 of 2)
- 18.232-C1222 Standard Watermain Details (Sheet 2 of 2)
- 18.232-C1225 Standard SuDS Details

1.3 Pre-Planning Discussions

A pre-connection enquiry was submitted to Irish Water on 28th September 2018 to determine the feasibility of connecting to the public water and drainage infrastructure. A response to the Pre-connection enquiry has been received and Irish Water have confirmed a connection is feasible. Subsequently, Irish Water have reviewed the proposed design and issued a Letter of Design Acceptance. This correspondence is included in Appendix II.

A pre-planning meeting with Dublin City Council Drainage Engineer (Ms. Maria Treacy) took place on Friday 5th October 2018 to discuss the proposals for surface water drainage. The advice given at this meeting such as employing two stage treatment has been accounted for in the planning proposals in as much as is practicable.

2.0 SURFACE WATER DRAINAGE SYSTEM

2.1 EXISTING SURFACE WATER INFRASTRUCTURE

The nearest surface water sewer is a 450mm diameter concrete sewer on the south side of the Naas Road, parallel to the northern boundary of the site, flowing north-east. At approximately 25m north east of the development site boundary, the surface water sewer discharges to a manhole and subsequently, to the culverted River Camac.

There is also a 300mm diameter surface water sewer on the north side of the Naas Road flowing north-east, which also discharges to the culverted River Camac.

Refer to Appendix III for existing drainage records and drawing C1002 for additional information.

It is unclear how the existing site drains into the adjacent sewer network. There are currently no SuDS measures in place on the site.

2.2 PROPOSED SURFACE WATER DRAINAGE SYSTEM

The development will be served by a simple gravity drainage network, falling towards the public surface water manhole which is located at the centre of the northern boundary of the site with the Naas Road.

Two stage treatment is proposed for all rainwater falling on the site in the form of a podium Green Roof for rain falling on roof and podium areas, and Permeable Paving for rain falling on external paved areas (footpath, roads and car parking). This is explained in detail below.

Refers to drawings C1202 & C1200 and Appendix I for further information.

2.3 COMPLIANCE WITH THE PRINCIPLES OF SUSTAINABLE DRAINAGE SYSTEMS

The existing site layout is almost entirely hardstanding with unattenuated outflow to the public drainage network. The proposed development will be designed in accordance with the principles of Sustainable Drainage Systems (SuDS) as embodied in the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS) and will significantly reduce run-off rates and improve storm water quality discharging to the public storm water system. The GDSDS addresses the issue of sustainability by requiring designs to comply with a set of drainage criteria which aim to minimize the impact of urbanization by replicating the run-off characteristics of the greenfield site. The criteria provide a consistent approach to addressing the increase in both rate and volume of run-off, as well as ensuring the environment is protected from any pollution from roads and buildings. These drainage design criteria are as follows:

- Criterion 1 – River Water Quality Protection
- Criterion 2 – River Regime Protection
- Criterion 3 – Flood Risk Assessment
- Criterion 4 – River Flood Protection

The requirements of SuDS are typically addressed by provision of the following:

- Interception storage
- Treatment storage (not required if interception storage is provided)
- Attenuation storage

- Long term storage (not required if growth factors are not applied to Qbar when designing attenuation storage)

For the purposes of the SuDS calculations, relevant areas in m^2 are as follows:

Table 2.1: Summary of Drained Areas

Area Type	Area (m^2)
Total Roof	6,403
Podium Slab Over Basement	3,872
Total roof + Basement Podium slab	**10,275**
Permeable Paving (External Parking)	495
Impermeable Road	1,567
Impermeable Footpath	569
Total Drained Area	**12,906**

2.3.1 Criterion 1 GDSDS – River Water Quality Protection

Run-off from natural greenfield areas contributes very little pollution and sediment to rivers and for most rainfall events direct run-off from greenfield sites to rivers does not take place as rainfall percolates into the ground. By contrast, urban run-off, when drained by pipe systems, results in run-off from virtually every rainfall event with high levels of pollution, particularly in the first phase of run-off, with little rainfall percolating to the ground. To prevent this happening, Criterion 1 requires that interception storage and/or treatment storage is provided, thereby replicating the run-off characteristics of the pre-development greenfield site.

2.3.1.1 Interception Storage

Interception storage where provided, should ensure that, at a minimum, the first 5mm and preferably the first 10mm of rainfall is intercepted on site and does not find its way to the receiving water.

In the context of the subject site the total area discharging to the drainage system = 12,906m^2.

Providing a 10mm interception storage equates to a volume of 129.06m^3. Interception storage for the new development will be provided as follows:

- **Green Roof** over full extent of the ground floor podium slab surface area. A proprietary drainage underlay mat will be provided, a “Retention Spacer RSX 65” or similar, designed to retain 65mm of rainwater which is allowed to dissipate by evaporation.
- **Permeable Paving** over external parking bays.

The green roof has the effect of providing some initial storage of rainwater, while also reducing the rate at which rainwater from heavier rainfall events will discharge to the main attenuation tank. It can also help to filter the run-off, removing any pollutants and resulting in a higher quality of water discharging to the drainage system. A “Retention Spacer RSX 65” or similar, will be provided on the podium slab to intercept and retain 65 litres/m^2 (i.e. 65mm) as outlined below.

The proposed podium roof will be an intensive green roof incorporating a mixture of hard and soft landscaping for recreational use. (An extensive green roof on the other hand is a low maintenance lightweight roof, not intended for general access or leisure purposes). Rainwater falling on the roof will be collected and taken via rain water pipes to the podium where it will be dispersed into the 95% permeable 'Retention Spacer' using short lengths of slotted land drain pipe.

To model this in Microdrainage, an equivalent depth of storage over the entire area to be captured is modelled, as follows:

Podium Interception Storage Volume = $3{,}872m^2 \times 0.065 \times 0.95 = 239.10\ m^3$

Equivalent depth = $\frac{239.10m^3}{10{,}275m^2}$ = 0.023m over the entire area.

In the external area at the north of the site, car parking bays will be constructed using permeable paving. Adjoining impermeable areas finished in bituminous surfacing will be drained where possible towards the permeable paved parking bays. This will not be a tanked system but the design conservatively assumes no direct infiltration to the ground. (This is based on the BRE365 soakaway tests carried out in the area which indicate very low permeability overburden).

By providing a raised drainage outlet above the base of the coarse graded gravel bed it is possible to achieve interception storage. Raising the invert of the drainage pipe to 75mm above the gravel bed gives the following interception storage @ 40% voids in the gravel:

Volume of Interception storage = $495 \times 0.075 \times 0.4 = 14.85m^3$ storage

To model this in Microdrainage, an equivalent depth of storage over the entire area to be captured is modelled, as follows:

Equivalent depth = $\frac{14.85m^3}{2{,}631m^2}$ = 0.0056m over the entire area.

The proposed interception storage methods, green roof and permeable pavement, provide $239.10m^3$ and $14.85m^3$ of storage respectively. As outlined in the GDSDS Criterion 1, a new development should provide interception storage to retain the first 5mm to 10mm to fall over the new impermeable area of the site. In this case, the impermeable area of the site amounts to $13{,}053m^2$ requiring the storage of $64.53m^3$ to $129.06m^3$.

The cumulative interception storage provided therefore is as follows:

Table 2.2: Interception Storage: Required & Provided

Desirable Interception Storage (10mm criteria)	
Total Drained Area within Proposed Development Site (Refer to Table 2.1)	1.2906ha
Optimum level of interception storage as per GDSDS Table 6.3	10mm
∴ Minimum Required Interception Storage = $(0.010 \times 1.2906 \times 10^4) = 66.30m^3$	
Optimum Interception Storage	**$129.061m^3$**
Interception Storage Provided	
Intensive Green Roof on Podium Slab: Area = $3{,}872m^2$	
(e.g. "Retention Spacer RSX 65" to provide 65 litres/m^2 storage)	$239.10m^3$
Permeable area= $495m^2$	
(Drained gravel bed with raised outlet invert designed to achieve 30 litres/m^2 storage)	$14.85m^3$
Interception Storage Provided	**$253.95\ m^3$**

It is noted that the provided interception volume is above the optimum value, it is well in excess of the minimum requirement.

2.3.2 Criterion 3 GDSDS – Site Flooding

The GDSDS requires that no flooding should occur on site for storms up to and including the 1 in 30 year event. The pipe network and the attenuation storage volumes should, therefore, be checked for such storms to ensure that no site flooding occurs although partial surcharging of the system is allowed as long as it does not threaten to flood.

For the 1 in 100 year event, the pipe network can fully surcharge and cause site flooding, but the top water level due to any such flooding must be at least 500mm below any vulnerable internal floor levels, and the flood waters should be contained within the site. In addition, the top water level in any attenuation device during the 100 year storm must be at least 500mm below any vulnerable internal floor levels.

The pipe network is limited in extent due to the medium-rise nature of the proposed development. Therefore, the pipes have been oversized to ensure the following:

- The system does not surcharge for the 1 year event
- The system surcharges bus does not flood for the 30 year event.
- The system surcharges but does not flood for the 100 year event

The surcharging of the system is based on the system being allowed to fill as the attenuation tank fills, because the invert of the incoming pipes is below the top of the attenuation tank. This is not a function of the pipe size.

The basement car park is drained by a separate system that outfalls to a petrol interceptor followed by a pump sump buried below the basement slab. From there, the car park drainage is pumped to the nearest foul manhole, and is not at risk of any backflow from the surface water system during storm conditions. GDSDS Criterion 3 is therefore complied with.

2.3.3 Criterion 2 & 4 GDSDS – River Regime & Flood Protection

Regardless of the rainfall event, unchecked run-off from the developed site through traditional pipe networks will discharge into receiving waters at rates that are an order of magnitude greater than that prior to development. This can cause flash flow in the outfall river / stream that can cause scour and erosion. Attenuation storage is provided to prevent this occurring by limiting the rate of run-off to that which took place from the pre-development greenfield site. In practice, the rate of run-off needs to be appropriately low for the majority of rainfall events, and attenuation storage volumes should be provided for the 1 and 100 year storm event. The rate of outflow from such storage should be controlled so that it does not exceed the greenfield run-off rate of QBAR, which can be factored upwards by factors appropriate to the various return periods (given in the Flood Studies Report) if long term storage is provided. Notwithstanding that significant long-term storage will be provided in the form of interception storage, this does not equate to full long term storage volume provision and so growth factors will not be applied to QBAR when calculating the attenuation storage volume required.

Qbar for the site has been calculated in accordance with the IH124 method as 7.12l/s. Refer to Appendix I for HR Wallingford calculation outputs. A hydrobrake downstream of the attenuation tank will be limited to the max site discharge of Qbar for the site.

As the surface runoff flow rate generated on site does not exceed Qbar, there is no requirement for long-term storage to limit the impact on the receiving watercourse.

Criterion 4 is intended to prevent flooding of the receiving system / watercourse by either

a) limiting the volume of run-off to the pre-development greenfield volume using 'long-term storage' (Option 1) or by

b) limiting the rate of run-off for the 1 in 100 year storm to QBAR without applying growth factors using 'extended attenuation storage' (Option 2).

Significant long-term storage will be provided in the form of interception storage. This does not, however, equate to full long term storage volumes and it is not feasible to provide additional storage areas elsewhere on site to achieve the required volume.

Option 2 has therefore been used to comply with Criterion 4 and an attenuation volume will be provided in the proposed attenuation tank to limit the rate of discharge in the 1 in 100 year storm event to QBAR without growth factors applied.

2.3.4 Green Roof Details

The podium green roof will contain a mixture of paved and gravel paths, and grassed and planted areas. Details for each are given on the SuDS detail drawing C1225.

The proposed podium roof will accommodate all rainwater falling on the roof via rain water pipes down to the podium which disperse water into the 95% permeable 'Retention Spacer' using short lengths of slotted land drain pipe (See C1000 and C1225).

2.3.5 Attenuation Tank Design

As can be seen in the MicroDrainage computer output given in Appendix I the rate of outflow from the attenuation tank towards the receiving 450mm diameter stormwater sewer does not exceed QBAR during the 1 in 100 year storm event (i.e. no overflow volume is produced).

A tank volume of 500m^3 is required to provided adequate storage based on the calculations. Dimensions of 42.5m x 10m x 1.2m deep are proposed for the below ground floor attenuation tank. This level also allows for the network to fill in the critical storm event but manholes will not surcharge as the highest water level modelled is 40.0mOD, and all manholes, green roof outlets and permeable paving are above 40.5mOD.

2.3.6 Pipe Network Design

The pipe network has been designed using MicroDrainage software to determine the optimum pipe sizes that will prevent surcharging of the system during critical duration storm events. The network has been modelled with a main pipe for the water discharging from the green roof area and another line pipe for the permeable area discharging both into an attenuation tank. The output is given in Appendix III.

2.3.7 Tree Pits

It is not proposed to install tree pits in the planted verge on boundary with the Naas Road, despite this being requested by DCC at pre-planning stage. This is because they require a nominal level of direct infiltration to the ground to work effectively and the BRE365 soakaway tests carried out during preliminary site investigations show very low permeability in the overburden which consists of Boulder Clay at shallow depth.

2.3.8 Collector Drain

A collector land drain will also run along the Naas Road boundary, connecting permeable paving to the attenuation tank. This will also provide some additional storage volume within the French drain type arrangement. At this stage this volume has conservatively not been included in SUDS calculations.

3.0 SITE FLOOD RISK ASSESSMENT

3.1 INTRODUCTION

The flood risk assessment outlined below is carried out in accordance with the OPW publication "The Planning System and Flood Risk Assessment Guidelines for Planning Authorities".

The stages involved in the assessment of flood risk are listed in these publications as follows:

- Stage 1: Flood Risk Identification
- Stage 2: Initial Flood Risk Assessment
- Stage 3: Detailed Flood Risk Assessment

The OPW publication also outlines a Sequential Approach for determining whether a particular development is appropriate for a specified location in terms of flood risk. The categorization of the subject site in terms of the OPW's sequential approach is further outlined in section 2.2 below.

3.2 STAGE 1: FLOOD RISK IDENTIFICATION

Stage 1 identifies whether there are any flooding or surface water management issues related to the site, i.e. it identifies whether a flood risk assessment is required.

The coastline at Ringsend is approximately 8.2 kilometres to the East of the site and does not pose a risk. A culverted section of the Camac River, at its closest point, is just 80m the north east corner of the site and does pose a risk. An open channel section of the Camac River commences 340m to the north of the site and poses a risk. A second open channel section of the Camac River commences 207m east of the site and poses a risk.

The OPW Map (National Flood Hazard Mapping Service) presented in Appendix IV shows that no flood incidents have been recorded on the site or the adjacent area to the site. However, recurring flooding incidents have occurred at the culverted section of the Camac River adjacent the Old Naas Road, 440m west of the site.

All rain falling on the site will undergo two stage treatment, with outfall less than QBar. Therefore, the risk of pluvial flooding within the site is negligible. The PFRA map indicates pluvial flooding is possible in the open yards to the south east and south west of the site.

The GDSDS Phase 2 Existing Hydraulic Performance map for the area has also been consulted to determine if the sewer network around the site is at risk of flooding. This indicates that the surface water network which it is proposed to connect to does not surcharge for 1 or 2 year events and does not flood in the 30 year event. This is the best performance category in the system and is likely due to the proximity of the outfall to the River Camac downstream. The map is contained in Appendix V.

3.2.1 Flood Zones

The sequential approach defines the flood zones as detailed below:

- *Flood Zone A* – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);
- *Flood Zone B* – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and

- *Flood Zone C* – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

The Naas Road Lands Local Area Plan (January 2013), Appendix 1; Flood Risk Assessment indicates that the site is located in Zone C. This assessment was done in the absence of any river modelling, which followed in the OPW CFRAMS study in 2016. This also shows the site to be located in Flood Zone C, where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B. (See appendix VI for further information of flood zone).

3.2.1.1 Vulnerability Class

The sequential approach describes the vulnerability classes as follows:

- *Highly vulnerable development* – hospitals, schools, houses, student halls of residence etc.;
- *Less vulnerable development* – retail, commercial, industrial, agriculture etc.;

  and
- *Water compatible development* – docks, marinas, amenity open space etc.

The development is a residential development which is classed as 'highly vulnerable'.

3.2.1.2 Development Classification

The matrix of vulnerability as per "The Planning System and Flood Risk Management – Guidelines for Planning Authorities" is reproduced overleaf in Table 4.2.

Table 1: Matrix of Vulnerability

	Flood Zone A	**Flood Zone B**	**Flood Zone C**
Highly vulnerable development	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water compatible development	Appropriate	Appropriate	Appropriate

This development is therefore deemed appropriate.

3.3 STAGE 2: INITIAL FLOOD RISK ASSESSMENT

The initial flood risk assessment should ensure that all relevant flood risk issues are assessed in relation to the decisions to be made and potential conflicts between flood risk and development are addressed. It should assess the adequacy of existing information and any flood defences.

3.3.1 Examination of potential flooding sources that can affect the site

The possible sources of flood water are assessed in the table below using the "**Source – Pathway – Receptor Model"**.

Table 2: The possible sources of flood water

Source	Pathway	Receptor	Likelihood	Consequence	Risk	Notes
Tidal Note (Note 1)	Overtop Breach	People Property	Extremely Unlikely	High	Negligible	1
Fluvial Note	Overtop Breach	People Property	Unlikely	High	Negligible	
Pluvial Surface water	Overflow / Blockage	People Property	Possible	High	Moderate	
Groundwater	Rising groundwater levels	People Property	Unlikely	Medium	Low	

Note 1: The site development is 8.2 kilometres from the sea at Ringsend.

Note 2: The single level basement in the development will be waterproofed against groundwater ingress

3.3.2 Appraisal of the availability and adequacy of existing information and flood zone maps

3.3.2.1 Tidal/Fluvial: Current

Good data is available on possible flooding of the surrounding area to the site in the Eastern CFRAM Study by the OPW. The study is a requirement of the EU 'Floods' Directive (2007/60/EC). The PFRA map is also available and considers flood risk arising from any major source of flooding, including natural sources such as river, sea, groundwater and rainfall as well as infrastructural sources such as urban drainage systems, reservoirs, water supply systems ESB and Waterways Ireland Infrastructure.

The relevant maps are contained in Appendix II and show that the site is located outside of the Flood Risk Areas.

3.3.3 Determination of what technical studies are appropriate

Given the comprehensive nature of the existing information available regarding flooding, it is not considered necessary to carry out any further analysis of fluvial or tidal flooding or of the sewer network serving the area.

3.3.4 Description of what residual risks will be assessed and how they might be mitigated and potential impacts of development on flooding elsewhere

The proposed provision of an attenuation tank on site is given further consideration below.

3.4 STAGE 3: DETAILED FLOOD RISK ASSESSMENT

A detailed flood risk assessment involves the estimation of the level of flooding on the site and the performance of the development under these conditions so that a "fit for purpose" development can be delivered. Once the likely maximum flood level has been estimated, the design should develop so that the ground floor level is above this level. Residual flood risk may remain in other areas that for operational reasons have to be below the maximum flood level (street access, bin stores, etc.) and these areas will have to incorporate flood resilient design features and flood risk management procedures so that the risk is mitigated in so far as possible.

3.4.1 Maximum Flood Levels/Attenuation Tank

There are no significant flood risks to the site from pluvial, fluvial or tidal sources. A new attenuation tank beneath ground floor slab will be provided on site for rainwater runoff from permeable/non-permeable areas. The tank will be designed to deal with the 100-year +20% storm level. Discharge from the tank will be controlled by a hydrobrake flow control device installed downstream of the outfall manhole. Refers to Appendix I for further information about calculations.

3.4.2 Site Drainage System

These methods ensure that the runoff response to rainfall will not be increased with respect to the pre-development condition and ensure flood risk to the relevant catchment is not increased.

3.4.3 Basement Car Park

The top of the basement carpark ramp will be finished at 200mm above the adjacent road level.

Any potential flood risk to the basement from pluvial flow is mitigated by ensuring the ground levels at the ramp prevent overland flow into the basement.

The attenuation tank will be structurally separated from the basement by the basement wall. Notwithstanding the design of the tank for 100 year event + 20% climate change, any overtopping of the tank will run back into the green roof, or flood external manholes due to the sealed network. There won't be a route for this water to get into the basement.

The basement design will be tanked and the concrete structure will be designed to resist water pressure.

3.4.4 Ground Floor Levels

There are no significant flood risks to the site from pluvial, fluvial or tidal sources. The culverted River Camac which runs adjacent shown in the OPW Map (Appendix V) shows two areas of potential flooding of the river (nodes SO10327209 and 09CAMM00417J). The 1 in 1000 Annual Exceedance Probability (AEP) for both SO10327209 and 09CAMM00417J show that the maximum water levels lie below that of the proposed ground floor level. Node SO10327209 shows a maximum water level of +36.160mOD, this is 4.34m below Ground Floor level of the proposed development. Node 09CAMM00417J shows a maximum water level of +30.920mOD, this is 9.58m below Ground Floor level of the proposed development. The points shown before show no flood risk for the proposed development.

Ground floor levels will also be minimum 250mm above surrounding ground levels to prevent any pluvial flood waters on surrounding roads affecting the building.

3.5 CONCLUSION

The flood risk assessment has been carried out in accordance with the OPW publication "The Planning System and Flood Risk Assessment Guidelines for Planning Authorities".

There is a no risk of flooding affecting the site from fluvial sources, so it is possible to develop the site within Flood Zone C. Any flood events do not cause flooding of the proposed development, and the development does not affect the flood storage volume or increase flood risk elsewhere.

4.0 FOUL DRAINAGE SYSTEM

4.1 EXISTING FOUL SEWER INFRASTRUCTURE

There is a 1350mm Concrete Combined Sewer in Naas Road in the north of the development which runs west to east inside the site boundary parallel to the Naas Road. There is a 225mm foul sewer from the north east, crossing the Naas Road and running parallel to the 1350mm combined sewer along the eastern boundary of the site.

Refer to Appendix III for existing drainage records & drawings no. C1002 & C1200 for additional information.

4.2 PROPOSED FOUL SEWER SYSTEM

The new foul drainage system for the development will connect to the combined sewer at the East of this site. The foul effluent from the proposed dwellings is calculated as follows, assuming dry weather flow of 150 l/house/day. As outlined in the Irish Water Pre-Connection enquiry dated September 2018, the site consists of 492 apartments of which 104 are Studios. The table below shows the breakdown:

Mix	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Total Apartments	%	Total Beds
1 BED	12	16	18	18	18	18	18	18	136	27.64	136
2 BED	17	20	34	34	35	35	31	25	231	46.95	462
2 BED (3 Person)	1	1	2	4	4	4	4	1	21	4.27	42
STUDIO	11	12	15	15	15	15	11	10	104	21.14	104
TOTAL	41	49	69	71	72	72	64	54	492	100	744

Using the Irish Water assumed average occupancy of 2.7 persons/ unit and water usage of 150 l/person/day, the foul drainage for the proposed network is designed as shown below and the number of workers is calculated as: area in m² / area per FTE; as per Employment Densities Guide from OFFPAT.

<u>APARTMENTS</u>

<u>Daily Flow</u> = (Number of houses or Individuals) × (Dry Weather Flow)

Number of Apartments = 492

Number of Occupants = 492 x 2.7 = 1,328.4

1,328.4 domestic occupants x 150L/day/person x 1.1 = 219,186 l/day

$$\text{Average Flow} = \frac{\textit{Daily Flow}}{(\textit{Flow Duration})(3600)}$$

$$= \frac{219{,}186}{24 \times 60 \times 60}$$

= 2.537 l/s

Peak Flow = (Average Flow) × (6)

= 2.537 x 6

= 15.222 l/s

RESTAURANT Approximate Area= 287m²

a) Visitors:

- Number of restaurant seats: (60% dinning space) 287 x 0.6 = 172.2m²
- Number of visitors: (5m² per seat) 172.2 / 5 = 34.44
- Assuming 2 sitting per day : 34.44 x 2 = 68.88 visitors
- Daily flow visitors: 68.88 x 15 l/person/day x 1.1 = 1,136.52 l/day

b) Workers:

- 287m² / 18 = 15.94
- Daily flow workers: 15.94 x 45 l/person/day x 1.1 = 789.03 l/day

Total Daily Flow = 1,136.52 + 789.03 = 1,925.55 l/day

Average daily flow = 1,925.55 / (24x60x60) = 0.022 L/s

Peak daily flow = 0.022 x 6 = 0.132 L/s

COFFEE SHOP Approximate Area= 176m²

Number of Workers = 176 / 18 = 9.78

Daily flow workers : 9.78 x 45 l/person/day x 1.1 = 484.11 l / day

Assuming 20 visitors, daily flow visitors: 20 x 15 l/person/day x 1.1 = 330 l/day

Total Daily Flow = 484.11 + 330 = 814.11 l/day

Average daily flow = 814.11 / (24x60x60) = 0.009 L/s

Peak daily flow = 0.009 x 6 = 0.054 L/s

CONVENIENCE STORE Approximate Area= 439m²

Number of workers: 439 / 19 = 23.1

Daily flow workers: 23.1 x 45L/person/day x 1.1 = 1,143.45 l/day

Average daily flow = 1,143.45 / (24x60x60) = 0.013 l/s

Peak daily flow = 0.013 x 6 = 0.078 l/s

CRÉCHE Approximate Area= 347m²

Number of workers : 347 / 65 = 5.3

Daily flow workers = 5.3 x 45 l/person/day x 1.1 = 262.35 l/day

Assuming 20 children / day; daily flow children = 20 x 30 l/person/day x 1.1 = 660 l/day

Total daily flow = 262.35 + 660 = 922.35 l/day

Average daily flow = 922.35 / (24x60x60) = 0.0107 l/s

Peak daily flow = 0.0107 x 6 = 0.0642 l/s

PHARMACY Approximate Area= 144m²

Number of workers : 144 / 19 = 7.58

Daily flow : 7.58 workers x 45 l/person/day x 1.1 = 375.21 l/day

Average daily flow = 375.21 / (24x60x60) = 4.34x10^-3 l/s

Peak daily flow = 4.34x10^-3 x 6 = 0.026 l/s

MEDICAL CENTRE Approximate Area= 518m²

Number of workers: 518 / 65 = 7.97

Daily flow workers = 7.97 x 45 l/person/day x 1.1 = 394.515 l/day

Assuming 40 visitors/day; daily flow visitors = 40 x 30 l/person/day x 1.1 = 1,320 l/day

Total daily flow = 394.515 + 1,320 = 1,714.515 l/day

Average daily flow = 1,714.515 / (24x60x60) = 0.02 l/s

Peak daily flow = 0.02 x 6 = 0.12 l/s

CAR SHOW-ROOM Approximate Area= 364m²

Number of workers: 364/65 = 5.6

Daily flow workers = 5.6 x 45 l/person/day x 1.1 = 277.2 l/day

Assuming 10 visitors/day; daily flow visitors = 10 x 30 l/person/day x 1.1 = 330 l/day

Total daily flow = 277.2 + 330 = 607.2 l/day

Average daily flow = 607.2 / (24x60x60) = 0.007 L/s

Peak daily flow = 0.007 x 6 = 0.042 L/s

SHARED OFFICES Approximate Area = 723m²

Number of workers : 723 / 12 = 60.25

Daily flow = 60.25 x 45 l/person/day x 1.1 = 2,982.375 l/day

Average daily flow = 2,982.375 / (24x60x60) = 0.0345 l/s

Peak daily flow = 0.0345 x 6 = 0.207 l/s

REFUSE/GENERAL STORAGE Approximate Area = 71m²

Number of workers : 71 / 19 = 3.7

Daily flow = 3.7 x 45 l/person/day x 1.1 = 183.15 l/day

Average daily flow = 183.15 / (24x60x60) = 0.002 l/s

Peak daily flow = 0.002 x 6 = 0.012 l/s

COMMERCIAL Approximate Area = 260 m ²

Number of workers : 260 / 19 = 13.68

Daily flow = 13.68 x 30 l/person/day x 1.1 = 451.44 l/day

Average daily flow = 451.44 / (24x60x60) = 0.005 l/s

Peak daily flow = 0.005 x 6 = 0.03 l/s

TOTAL DOMESTIC:

Total Average flow : 2.537 l/s

Total Peak flow : 15.222 l/s

TOTAL COMMERCIAL:

Total Average flow : 0.127 l/s

Total Peak flow : 0.765 l/s

***Total Average:* 2.664 l/s**

***Total Peak:*15.987 l/s**

The peak foul flows are as submitted in the previous pre-connection enquiry. Please refer to Appendix V for more details on the submitted Pre-connection enquiry form and the Irish Water letter of confirmation of feasibility.

The proposed foul outfall pipe is 225mm diameter pipe at 1:100 minimum fall has a capacity = 47 l/s which is more than adequate. 100mm and 150mm diameter pipes with a capacity of at least 6 l/s and 17 l/s (at 1:100) respectively will be used for all other foul pipework within the site.

Refer to drawings no. C1000 & C1200 for further information relating to the foul drainage layout and details.

4.3 PROPOSED BASEMENT CAR PARK DRAINAGE SYSTEM

The basement car park will have a series of gullies and drainage channels cast into the floor slab which will cater for the limited amount of run-off that enters the basement through ramps, service openings and from vehicles. These channels will connect to a buried gravity pipe network that will fall to a petrol interceptor located at the east end of the basement. The outflow from the petrol interceptor will flow to a sump with duty and standby pumps and the effluent will be pumped from there through a rising main to the nearest foul manhole on the main gravity system.

Refer to drawing C1001 & C1200 for further information relating to the basement drainage layout and details.

5.0 WATER SUPPLY

5.1 EXISTING WATER SUPPLY INFRASTRUCTURE

There is an existing 9” watermain located in the Nass Road to the north of the site. There is 30” steel watermain running from the north east to the south west parallel to the site boundary. There is also an existing 110mm MOPVC within the site.

Refer to Appendix III for existing watermain records & drawing no. C1003 for further information.

5.2 PROPOSED WATER SUPPLY SYSTEM

It is proposed to connect to the existing line 30” line at the east of the site in accordance with the Irish Water response to the pre-connection enquiry (See Appendix II).

The water demand for the proposed development has been calculated bellow:

<u>APARTMENTS</u>

<u>Daily Flow</u> = (Number of houses or Individuals) × (Dry Weather Flow)

Number of Apartments = 492

Number of Occupants = 492 x 2.7 = 1,328.4

1,328.4 domestic occupants x 150L/day/person = 199,260 l/day

<u>Average Flow</u> $= \frac{\textit{Daily Flow}}{(\textit{Flow Duration})(3600)} \times 1.25$

$= \frac{199,260}{24 \times 60 \times 60} \times 1.25$

= 2.88 l/s

<u>Peak Flow</u> = (Average Flow) × (5)

= 2.88 x 5

= 14.4 l/s

<u>*RESTAURANT*</u> Approximate Area= 287m²

a) Visitors:

- Number of restaurant seats: (60% dinning space) 287 x 0.6 = 172.2m²

- Number of visitors: (5m² per seat) 172.2 / 5 = 34.44

- Assuming 2 sitting per day : 34.44 x 2 = 68.88 visitors

- Daily flow visitors: 68.88 x 15 l/person/day = 1,033.2 l/day

b) Workers:

- 287m² / 18 = 15.94

- Daily flow workers: 15.94 x 45 l/person/day = 717.3 l/day

Total Daily Flow = 1,033.2 + 717.3 = 1,750.5 l/day

Average daily flow = 1,750.5 / (24x60x60) x 1.25 = 0.025 L/s

Peak daily flow = 0.025 x 5 = 0.125 L/s

COFFEE SHOP Approximate Area= 176m²

Number of Workers = 176 / 18 = 9.78

Daily flow workers : 9.78 x 45 l/person/day = 440.1 l / day

Assuming 20 visitors, daily flow visitors: 20 x 15 l/person/day = 300 l/day

Total Daily Flow = 440.1 + 300 = 740.1 l/day

Average daily flow = 740.1 / (24x60x60) x 1.25 = 0.011 l/s

Peak daily flow = 0.011 x 5 = 0.055 l/s

CONVENIENCE STORE Approximate Area= 439m²

Number of workers: 439 / 19 = 23.1

Daily flow workers: 23.1 x 45L/person/day = 1,039.5 l/day

Average daily flow = 1,039.5 / (24x60x60) x 1.25 = 0.015 l/s

Peak daily flow = 0.015 x 5 = 0.075 l/s

CRÉCHE Approximate Area= 347m²

Number of workers : 347 / 65 = 5.3

Daily flow workers = 5.3 x 45 l/person/day = 238.5 l/day

Assuming 20 children / day; daily flow children = 20 x 30 l/person/day = 600 l/day

Total daily flow = 238.5 + 600 = 8385 l/day

Average daily flow = 838.5 / (24x60x60) x 1.25 = 0.012 l/s

Peak daily flow = 0.012 x 5 = 0.06 l/s

PHARMACY Approximate Area= 144m²

Number of workers : 144 / 19 = 7.58

Daily flow : 7.58 workers x 45 l/person/day = 341.1 l/day

Average daily flow = 341.1 / (24x60x60) x 1.25 = 4.93x10^-3 l/s

Peak daily flow = 4.93x10^-3 x 5 = 0.025 l/s

MEDICAL CENTRE Approximate Area= 518m²

Number of workers: 518 / 65 = 7.97

Daily flow workers = 7.97 x 45 l/person/day = 358.65 l/day

Assuming 40 visitors/day; daily flow visitors = 40 x 30 l/person/day = 1,200 l/day

Total daily flow = 358.65 + 1,200 = 1,558.65 l/day

Average daily flow = 1,558.65 / (24x60x60) x 1.25 = 0.022 l/s

Peak daily flow = 0.022 x 5 = 0.11 l/s

CAR SHOW-ROOM Approximate Area= 364m²

Number of workers: 364/65 = 5.6

Daily flow workers = 5.6 x 45 l/person/day = 252 l/day

Assuming 10 visitors/day; daily flow visitors = 10 x 30 l/person/day = 300 l/day

Total daily flow = 252 + 300 = 552 l/day

Average daily flow = 552 / (24x60x60) x 1.25 = 0.0036 L/s

Peak daily flow = 0.0036 x 5 = 0.018 L/s

SHARED OFFICES Approximate Area = 723m²

Number of workers : 723 / 12 = 60.25

Daily flow = 60.25 x 45 l/person/day = 2,711.25 l/day

Average daily flow = 2,711.25 / (24x60x60) x 1.25 = 0.039 l/s

Peak daily flow = 0.039 x 5 = 0.195 l/s

REFUSE/GENERAL STORAGE Approximate Area = 71m²

Number of workers : 71 / 19 = 3.7

Daily flow = 3.7 x 45 l/person/day = 166.5 l/day

Average daily flow = 166.5 / (24x60x60) x 1.25 = 0.0024 l/s

Peak daily flow = 0.0024 x 5 = 0.012 l/s

COMMERCIAL Approximate Area = 260 m ²

Number of workers : 260 / 19 = 13.68

Daily flow = 13.68 x 30 l/person/day = 410.4 l/day

Average daily flow = 410.4 / (24x60x60) x 1.25 = 0.0059 l/s

Peak daily flow = 0.0059 x 5 = 0.03 l/s

TOTAL DOMESTIC:

Total Average flow : 2.88 l/s

Total Peak flow : 14.40 l/s

TOTAL COMMERCIAL:

Total Average flow : 0.14 l/s

Total Peak flow : 0.705 l/s

Total Average: **3.02 l/s**

Total Peak:**15.105 l/s**

Twenty-four-hour storage will be provided to cater for possible shut-downs in the system.

Hydrants will be provided on the loop main in accordance with Part B of the Building Regulations and the Fire Safety Certificate's Requirements. Sluice valves will be provided at appropriate locations to facilitate isolation and purging of the system.

Refer to Drawing no. C1003 & C1220 for further information on the proposed watermain layout and the proposed connection to the existing network and details for the Watermain.

HR Wallingford
Working with water

Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	pilar rojo
Site name:	concorde
Site location:	concorde

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.32758° N
Longitude:	6.3372° W
Reference:	6448778
Date:	2018-10-15T10:04:43

Methodology	IH124

Site characteristics

Total site area (ha)	1.83

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	2	3
HOST class	---	---
SPR/SPRHOST	0.3	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm)	907	907
Hydrological region	12	12
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.13	2.13
Growth curve factor: 100 year	2.61	2.61

Notes:

(1) Is Q_{BAR} < 2.0 l/s/ha?

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consents are usually set at 5.0l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set in which case blockage work must be addressed by using appropriate drainage elements

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	4.52	7.12
1 in 1 year (l/s)	3.84	6.05
1 in 30 years (l/s)	9.62	15.16
1 in 100 years (l/s)	11.79	18.58

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.052	0.052	1.5	22.2	O K
30 min Summer	0.080	0.080	3.1	33.9	O K
60 min Summer	0.223	0.223	6.8	94.7	O K
120 min Summer	0.427	0.427	7.1	181.4	O K
180 min Summer	0.551	0.551	7.1	234.3	O K
240 min Summer	0.639	0.639	7.1	271.7	O K
360 min Summer	0.761	0.761	7.1	323.4	O K
480 min Summer	0.839	0.839	7.1	356.4	O K
600 min Summer	0.886	0.886	7.1	376.4	O K
720 min Summer	0.915	0.915	7.1	388.9	O K
960 min Summer	0.958	0.958	7.1	407.3	O K
1440 min Summer	1.009	1.009	7.1	428.9	O K
2160 min Summer	1.032	1.032	7.1	438.8	O K
2880 min Summer	1.019	1.019	7.1	433.2	O K
4320 min Summer	0.941	0.941	7.1	400.0	O K
5760 min Summer	0.827	0.827	7.1	351.6	O K
7200 min Summer	0.664	0.664	7.1	282.4	O K
8640 min Summer	0.529	0.529	7.1	224.7	O K
10080 min Summer	0.422	0.422	7.1	179.4	O K
15 min Winter	0.061	0.061	2.0	26.0	O K
30 min Winter	0.123	0.123	5.4	52.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	87.785	0.0	23.7	70
30 min Summer	60.484	0.0	39.8	71
60 min Summer	39.120	0.0	120.5	108
120 min Summer	24.614	0.0	216.8	152
180 min Summer	18.608	0.0	279.0	202
240 min Summer	15.235	0.0	326.9	256
360 min Summer	11.457	0.0	399.0	372
480 min Summer	9.347	0.0	453.9	486
600 min Summer	7.977	0.0	498.8	602
720 min Summer	7.006	0.0	536.9	688
960 min Summer	5.707	0.0	599.7	798
1440 min Summer	4.273	0.0	692.6	1052
2160 min Summer	3.197	0.0	801.0	1464
2880 min Summer	2.600	0.0	875.5	1876
4320 min Summer	1.941	0.0	980.2	2692
5760 min Summer	1.576	0.0	1055.6	3512
7200 min Summer	1.340	0.0	1109.2	4208
8640 min Summer	1.174	0.0	1149.7	4872
10080 min Summer	1.049	0.0	1180.3	5552
15 min Winter	87.785	0.0	28.9	67
30 min Winter	60.484	0.0	68.5	93

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.321	0.321	7.1	136.4	O K
120 min Winter	0.556	0.556	7.1	236.4	O K
180 min Winter	0.702	0.702	7.1	298.3	O K
240 min Winter	0.808	0.808	7.1	343.2	O K
360 min Winter	0.943	0.943	7.1	400.8	O K
480 min Winter	1.026	1.026	7.1	436.1	O K
600 min Winter	1.080	1.080	7.1	458.9	O K
720 min Winter	1.114	1.114	7.1	473.6	O K
960 min Winter	1.150	1.150	7.1	488.7	O K
1440 min Winter	1.188	1.188	7.1	504.7	O K
2160 min Winter	1.179	1.179	7.1	501.1	O K
2880 min Winter	1.127	1.127	7.1	479.1	O K
4320 min Winter	0.968	0.968	7.1	411.3	O K
5760 min Winter	0.740	0.740	7.1	314.3	O K
7200 min Winter	0.490	0.490	7.1	208.5	O K
8640 min Winter	0.328	0.328	7.1	139.5	O K
10080 min Winter	0.229	0.229	6.9	97.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	39.120	0.0	165.9	110
120 min Winter	24.614	0.0	273.8	156
180 min Winter	18.608	0.0	343.7	206
240 min Winter	15.235	0.0	397.5	258
360 min Winter	11.457	0.0	478.6	366
480 min Winter	9.347	0.0	540.6	478
600 min Winter	7.977	0.0	591.2	590
720 min Winter	7.006	0.0	634.3	698
960 min Winter	5.707	0.0	705.2	890
1440 min Winter	4.273	0.0	808.9	1116
2160 min Winter	3.197	0.0	935.7	1580
2880 min Winter	2.600	0.0	1021.6	2028
4320 min Winter	1.941	0.0	1144.0	2904
5760 min Winter	1.576	0.0	1234.0	3760
7200 min Winter	1.340	0.0	1299.4	4328
8640 min Winter	1.174	0.0	1350.3	4936
10080 min Winter	1.049	0.0	1390.6	5544

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.600	Shortest Storm (mins)	15
Ratio R	0.282	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Green Roof

Area (m³)	10275	Evaporation (mm/day)	3
Depression Storage (mm)	23	Decay Coefficient	0.050

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.186717	32	36	0.037698	64	68	0.007611	96	100	0.001537
4	8	0.152871	36	40	0.030864	68	72	0.006231	100	104	0.001258
8	12	0.125160	40	44	0.025269	72	76	0.005102	104	108	0.001030
12	16	0.102472	44	48	0.020689	76	80	0.004177	108	112	0.000843
16	20	0.083897	48	52	0.016939	80	84	0.003420	112	116	0.000690
20	24	0.068689	52	56	0.013868	84	88	0.002800	116	120	0.000565
24	28	0.056238	56	60	0.011354	88	92	0.002292			
28	32	0.046044	60	64	0.009296	92	96	0.001877			

Green Roof

Area (m³)	2631	Evaporation (mm/day)	3
Depression Storage (mm)	6	Decay Coefficient	0.050

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.047810	32	36	0.009653	64	68	0.001949	96	100	0.000393
4	8	0.039144	36	40	0.007903	68	72	0.001596	100	104	0.000322
8	12	0.032048	40	44	0.006470	72	76	0.001306	104	108	0.000264
12	16	0.026239	44	48	0.005298	76	80	0.001070	108	112	0.000216
16	20	0.021483	48	52	0.004337	80	84	0.000876	112	116	0.000177
20	24	0.017588	52	56	0.003551	84	88	0.000717	116	120	0.000145
24	28	0.014400	56	60	0.002907	88	92	0.000587			
28	32	0.011790	60	64	0.002380	92	96	0.000481			

Model Details

Storage is Online Cover Level (m) 2.650

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	425.0	1.201	0.0	2.501	0.0	4.200	0.0
0.200	425.0	1.600	0.0	3.000	0.0	4.400	0.0
0.400	425.0	1.800	0.0	3.200	0.0	4.600	0.0
0.600	425.0	1.801	0.0	3.400	0.0	4.800	0.0
0.800	425.0	2.001	0.0	3.600	0.0	5.000	0.0
1.000	425.0	2.300	0.0	3.800	0.0		
1.200	425.0	2.301	0.0	4.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0121-7100-1200-7100
Design Head (m)	1.200
Design Flow (l/s)	7.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	121
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	7.1
Flush-Flo™	0.354	7.1
Kick-Flo®	0.759	5.7
Mean Flow over Head Range	-	6.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.3	1.200	7.1	3.000	10.9	7.000	16.4
0.200	6.7	1.400	7.6	3.500	11.8	7.500	16.9
0.300	7.1	1.600	8.1	4.000	12.5	8.000	17.4
0.400	7.1	1.800	8.6	4.500	13.3	8.500	18.0
0.500	7.0	2.000	9.0	5.000	13.9	9.000	18.5
0.600	6.7	2.200	9.4	5.500	14.6	9.500	18.9
0.800	5.9	2.400	9.8	6.000	15.2		
1.000	6.5	2.600	10.2	6.500	15.8		

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	16.900	Add Flow / Climate Change (%)	20
Ratio R	0.290	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.782	4-8	0.515

Total Area Contributing (ha) = 1.297

Total Pipe Volume (m³) = 21.097

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	87.563	0.350	250.0	1.070	4.00	0.0	0.600	o	375	Pipe/Conduit	
1.001	0.800	0.003	250.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.000	90.000	0.600	150.0	0.148	4.00	0.0	0.600	o	300	Pipe/Conduit	
2.001	12.560	0.084	150.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.28	39.500	1.070	0.0	0.0	29.0	1.14	126.1«	173.9
1.001	50.00	5.29	39.000	1.070	0.0	0.0	29.0	1.14	126.1«	173.9
2.000	50.00	5.17	39.500	0.148	0.0	0.0	4.0	1.28	90.6	24.0
2.001	50.00	5.31	38.900	0.148	0.0	0.0	4.0	1.48	163.1	24.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.002	2.000	0.013	150.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	49.503	0.495	100.0	0.079	4.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	19.794	0.079	250.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.002	50.00	5.33	38.816	0.148	0.0	0.0	4.0	1.48	163.1	24.0
3.000	50.00	4.63	39.675	0.079	0.0	0.0	2.1	1.31	52.0	12.8
1.002	50.00	5.67	37.850	1.297	0.0	0.0	35.1	0.99	69.9«	210.8

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	40.500	1.000	Open Manhole	1350	1.000	39.500	375				
2	40.500	1.500	Open Manhole	1350	1.001	39.000	375	1.000	39.150	375	150
2	40.500	1.000	Open Manhole	1200	2.000	39.500	300				
2	40.500	1.600	Open Manhole	1350	2.001	38.900	375	2.000	38.900	300	
5	40.500	1.684	Open Manhole	1350	2.002	38.816	375	2.001	38.816	375	
3	40.500	0.825	Open Manhole	1200	3.000	39.675	225				
5	40.500	2.650	Open Manhole	1350	1.002	37.850	300	1.001	38.997	375	1222
								2.002	38.803	375	1028
								3.000	39.180	225	1255
	40.500	2.729	Open Manhole	0		OUTFALL		1.002	37.771	300	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	375	1	40.500	39.500	0.625	Open Manhole	1350
1.001	o	375	2	40.500	39.000	1.125	Open Manhole	1350
2.000	o	300	2	40.500	39.500	0.700	Open Manhole	1200
2.001	o	375	2	40.500	38.900	1.225	Open Manhole	1350
2.002	o	375	5	40.500	38.816	1.309	Open Manhole	1350
3.000	o	225	3	40.500	39.675	0.600	Open Manhole	1200
1.002	o	300	5	40.500	37.850	2.350	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	87.563	250.0	2	40.500	39.150	0.975	Open Manhole	1350
1.001	0.800	250.0	5	40.500	38.997	1.128	Open Manhole	1350
2.000	90.000	150.0	2	40.500	38.900	1.300	Open Manhole	1350
2.001	12.560	150.0	5	40.500	38.816	1.309	Open Manhole	1350
2.002	2.000	150.0	5	40.500	38.803	1.322	Open Manhole	1350
3.000	49.503	100.0	5	40.500	39.180	1.095	Open Manhole	1350
1.002	19.794	250.6		40.500	37.771	2.429	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	1.070	1.070	1.070
1.001	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.148	0.148	0.148
2.001	-	-	100	0.000	0.000	0.000
2.002	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.079	0.079	0.079
1.002	-	-	100	0.000	0.000	0.000
				Total 1.297	Total 1.297	Total 1.297

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
1.000	1	375	0.625	0.975	Unclassified	1350	0	0.625	Unclassified
1.001	2	375	1.125	1.128	Unclassified	1350	0	1.125	Unclassified
2.000	2	300	0.700	1.300	Unclassified	1200	0	0.700	Unclassified
2.001	2	375	1.225	1.309	Unclassified	1350	0	1.225	Unclassified
2.002	5	375	1.309	1.322	Unclassified	1350	0	1.309	Unclassified
3.000	3	225	0.600	1.095	Unclassified	1200	0	0.600	Unclassified
1.002	5	300	2.350	2.429	Unclassified	1350	0	2.350	Unclassified

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.002		40.500	37.771	39.150	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	1
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.900	Storm Duration (mins)	30
Ratio R	0.290		

Storage Structures for Storm

Tank or Pond Manhole: 5, DS/PN: 1.002

Invert Level (m) 37.850

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	425.0	1.200	425.0	1.201	0.0

Time Area Diagram for Green Roof at Pipe Number 1.000 (Storm)

Area (m³) 10275 Evaporation (mm/day) 3
Depression Storage (mm) 23 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.186717	32	36	0.037698	64	68	0.007611	96	100	0.001537
4	8	0.152871	36	40	0.030864	68	72	0.006231	100	104	0.001258
8	12	0.125160	40	44	0.025269	72	76	0.005102	104	108	0.001030
12	16	0.102472	44	48	0.020689	76	80	0.004177	108	112	0.000843
16	20	0.083897	48	52	0.016939	80	84	0.003420	112	116	0.000690
20	24	0.068689	52	56	0.013868	84	88	0.002800	116	120	0.000565
24	28	0.056238	56	60	0.011354	88	92	0.002292			
28	32	0.046044	60	64	0.009296	92	96	0.001877			

APPENDIX II

Irish Water Pre-Connection Application & Irish Water Letter of Consent

Pre-connection enquiry form

Large industrial and commercial developments, mixed use developments, housing developments, business developments.

This form is to be filled out by applicants enquiring about the feasibility of a water and/or wastewater connection to Irish Water infrastructure. If completing this form by hand, please use BLOCK CAPITALS and black ink.

Please refer to the **Guide to completing the pre-connection enquiry form** on page 12 of this document when completing the form.

Section A | Applicant details

1 WPRN number (where available):

2 Applicant details:

Registered company name (if applicable): BURLINTON REAL ES-TATE

Trading name (if applicable):

Company registration number (if applicable):

If you are not a registered company/business, please provide the applicant's name:

Contact name: BRIAN MURRAY

Postal address: 45 FITZWILLIAM PLACE
DUBLIN 2
CO. DUBLIN

Eircode: D02KP46

Telephone: 019058078

Mobile:

Email: BMURRAY@BURLREALESTATE.CO

3 Agent details (if applicable):

Contact name: Michael Shine

Company name (if applicable): BARRETT MAHONY

Postal address: 52-54 SANDWITH ST LOWER
DUBLIN 2

Eircode: D02WR26

Telephone: 016722129

Email: mshine@bmce.ie

4 **Please indicate whether it is the applicant or agent who should receive future correspondence in relation to the enquiry:**

Applicant ☐ Agent ☑

Section B | Site details

5 **Site address:** CONCORDE INDUSTRIAL ESTATE, DUBLIN 12, CO. DUBLIN

6 **Irish Grid co-ordinates of site:** E(X) 310761 N(Y) 232058

Eg. co-ordinates of GPO, O'Connell St., Dublin: E(X) 315,878 N(Y) 234,619

7 **Local Authority:**

Local Authority that granted planning permission (if applicable):

DUBLIN CITY COUNCIL

8 **Has full planning permission been granted?** Yes ☐ No ☑

If 'Yes', please provide the current or previous planning reference number:

9 **Previous use of this site (if applicable):** INDUSTIAL UNITS

10 **Date that previous development was last occupied (if applicable):** 0 / 0 / 0

CURRENTLY OCCUPIED

11 **Are there poor ground conditions on site?** Yes ☐ No ☑

If 'Yes', please include site investigation report and a detailed site-specific report on the approach being taken to deal with ground conditions specifically with regard to pipe support and trenching.

12 **Are there potential contaminated land issues?** Yes ☐ No ☑

If 'Yes', please include a detailed site-specific report on the approach being taken to deal with contaminated land and the measures being taken to mitigate the impact on infrastructure.

13 **Is the development compliant with the local area development plan?** Yes ☑ No ☐

Section C | Water connection and demand details

14	Is there an existing connection to public water mains at the site?	Yes ☑	No ☐
15	Is this enquiry for an additional connection to the one already installed?	Yes ☑	No ☐
16	Is this enquiry to increase the size of an existing water connection?	Yes ☑	No ☐
17	Is this enquiry for a new water connection?	Yes ☑	No ☐

18 Approximate date water connection is required: 1 / 1 / 2020

19 Please indicate pre-development water demand (if applicable):

Pre-development peak hour water demand	0.65	**l/s**
Pre-development average hour water demand		**l/s**

Pre-development refers to brownfield sites only. Please include calculations on the attached sheet provided.

20 Please indicate the domestic water demand (housing developments only):

Post-development peak hour water demand	14.35	**l/s**
Post-development average hour water demand	2.87	**l/s**

Please include calculations on the attached sheet provided.

21 Please indicate the business water demand (shops, offices, schools, hotels, restaurants, etc.):

Post-development peak hour water demand	0.523	**l/s**
Post-development average hour water demand	0.101	**l/s**

Please include calculations on the attached sheet provided. Where there will be a daily/weekly/seasonal variation in the water demand profile, please provide all such details.

22 Please indicate the industrial water demand (industry-specific water requirements):

Post-development peak hour water demand	N/A	**l/s**
Post-development average hour water demand	N/A	**l/s**

Please include calculations on the attached sheet provided. Where there will be a daily/weekly/seasonal variation in the water demand profile, please provide all such details.

23 What is the existing ground level at the property boundary at connection point (if known) above Malin Head Ordnance Datum?

40.24 m

24 What is the highest finished floor level of the proposed development above Malin Head Ordnance Datum?

63.64 m

25 **Is on-site water storage being provided?** Yes ☑ No ☐

Please include calculations on the attached sheet provided.

26 **Are there fire flow requirements?** Yes ☑ No ☐

Additional fire flow requirements over and above those identified in Q20, Q21 and Q22 above		**l/s**

Please include calculations on the attached sheet provided, and include confirmation of requirements from the Fire Authority.

27 **Do you propose to supplement your potable water supply from other sources?** Yes ☐ No ☑

If 'Yes', please indicate how you propose to supplement your potable water supply from other sources (see **Guide to completing the application form** on page 12 of this document for further details):

Section D | Wastewater connection and discharge details

28 **Is there an existing connection to a public sewer at the site?** Yes ☐ No ☑

29 **Is this enquiry for an additional connection to one already installed?** Yes ☐ No ☑

30 **Is this enquiry to increase the size of an existing connection?** Yes ☑ No ☐

31 **Is this enquiry for a new wastewater connection?** Yes ☑ No ☐

32 **Approximate date that wastewater connection is required:** 1 / 1 / 2020

33 **Please indicate pre-development wastewater discharge (if applicable):**

Pre-development peak discharge	0.66	**l/s**
Pre-development average discharge	0.11	**l/s**

Pre-development refers to brownfield sites only. Please include calculations on the attached sheet provided.

34 **Please indicate the domestic wastewater hydraulic load (housing developments only):**

Post-development peak discharge	15.06	**l/s**
Post-development average discharge	2.51	**l/s**

Please include calculations on the attached sheet provided.

35 **Please indicate the commercial wastewater hydraulic load (shops, offices, schools, hotels, restaurants, etc.):**

Post-development peak discharge	0.54	**l/s**
Post-development average discharge	0.9	**l/s**

Please include calculations on the attached sheet provided.

36 Please indicate the industrial wastewater hydraulic load (industry-specific discharge requirements):

Post-development peak discharge	N/A	l/s
Post-development average discharge	N/A	l/s

Please include calculations on the attached sheet provided.

37 Wastewater organic load:

Characteristic	Max concentration (mg/l)	Average concentration (mg/l)	Maximum daily load (kg/day)
Biochemical oxygen demand (BOD)	231	168	68
Chemical oxygen demand (COD)	544	389	160
Suspended solids (SS)	231	163	68
Total nitrogen (N)	50	40.6	14.7
Total phosphorus (P)	9.2	7.1	2.7
Other	N/A	N/A	N/A

Temperature range	N/A
pH range	N/A

38 Storm water run-off will only be accepted from brownfield sites that already have a storm/surface water connection to a combined sewer. In the case of such brownfield sites, please indicate if the development intends discharging surface water to the combined wastewater collection system:

Yes ☐ No ☑

If 'Yes', please give reason for discharge and comment on adequacy of SUDS/attenuation measures proposed.

ATTENUATION MEASURES INCLUDED
EXACT SIZE OF TANK TBC

39 Do you propose to pump the wastewater? Yes ☐ No ☑

If 'Yes', please include justification for your pumped solution with this application.

40 What is the existing ground level at the property boundary at connection point (if known) above Malin Head Ordnance Datum?

40.24 m

41 What is the lowest finished floor level on site above Malin Head Ordnance Datum? 36.74 m

Section E | Development details

42 Please outline the domestic and/or industry/business use proposed:

Property type	Total number of units for this application
Domestic	486
Office	0
Residential care home	0
Hotel	0
Factory	0
School	1 (CRÉCHE)
Institution	0
Retail unit	6
Industrial unit	0
Other (please specify)	2 (1x GYM, 1x MEDICAL CENTRE)

43 Approximate start date of proposed development: 1 / 1 / 2020

44 Is the development multi-phased? Yes ☐ No ☑

If 'Yes', application must include a master-plan identifying the development phases and the current phase number.

If 'Yes', please provide details of variations in water demand volumes and wastewater discharge loads due to phasing requirements.

Section F | Supporting documentation

Please provide the following additional information:

> Site location map: A site location map to a scale of 1:1000, which clearly identifies the land or structure to which the enquiry relates. The map shall include the following details:
>
> a) The scale shall be clearly indicated on the map.
>
> b) The boundaries shall be delineated in red.
>
> c) The site co-ordinates shall be marked on the site location map.

> Details of planning and development exemptions (if applicable).

> Calculations (calculation sheets provided below).

> Site layout map to a scale of 1:500 showing layout of proposed development, water network and wastewater network layouts, additional water/wastewater infrastructure if proposed, connection points to Irish Water infrastructure (if known).

> Any other information that might help Irish Water assess this pre-connection enquiry.

Section G | Declaration

I/We hereby make this application to Irish Water for a water and/or wastewater connection as detailed on this form.

I/We understand that any alterations made to this application must be declared to Irish Water.

The details that I/we have given with this application are accurate.

I/We have enclosed all the necessary supporting documentation.

Signature: Michael Shine Date: 26 / 09 / 2018

Your full name (in BLOCK CAPITALS):

Michael Shine

Irish Water will carry out a formal assessment based on the information provided on this form.
Any future connection offer made by Irish Water will be based on the information that has been provided here.

Please submit the completed form to **newconnections@water.ie** or alternatively, post to:

Irish Water
PO Box 860
South City Delivery Office
Cork City

For office use only:

Input customer number:

Calculations

Water demand

```
EXISTING PROPOSED:
RETAIL
200 workers x 45L/day per person(IW) = 9,000L/day
Average daily flow = 9000 x 1.25 / (24x60x60) = 0.13 L/s
Peak daily flow = 0.13 x 5 = 0.65 L/s

PROPOSED:
DOMESTIC
1,312 domestic occupants x 150L/day per person = 196,830 l/day
Average daily flow = 196,930 x 1.25 / (24x60x60) = 2.85 L/s
Peak daily flow = 2.85 x 5 = 14.25 L/s

RESTAURANT
(6 workers x 45L/day per person + 20 visitors x 30L/day per person(IW)) =
870L/day
Average daily flow = 870 x 1.25 / (24x60x60) = 0.013 L/s
Peak daily flow = 0.013 x 5 = 0.07 L/s

2x COFFEE SHOPS
2X(4 workers x 45L/day per person + 20 visitors x 30L/day per person(IW)) =
1,560L/day
Average daily flow = 1,560 x 1.25 / (24x60x60) = 0.0226 L/s
Peak daily flow = 0.0226 x 5 = 0.113 L/s

CONVENIENCE STORE
6 workers x 45L/day per person(IW) = 270L/day
Average daily flow = 270 x 1.25 / (24x60x60) = 3.9x10^-3 L/s
Peak daily flow = 3.9x10^-3 x 5 = 0.02 L/s

RETAIL SPACE
6 workers x 45L/day per person(IW) = 270L/day
Average daily flow = 270 x 1.25 / (24x60x60) = 3.9x10^-3 L/s
Peak daily flow = 3.9x10^-3 x 5 = 0.02 L/s

CRÉCHE
4 workers x 45L/day per person + 20 kids x 30L/day per person(IW) = 780L/day
Average daily flow = 780 x 1.25 / (24x60x60) = 0.0113 L/s
Peak daily flow = 0.0113 x 5 = 0.06 L/s

PHARMACY
6 workers x 45L/day per person(IW) = 270L/day
Average daily flow = 270 x 1.25 / (24x60x60) = 3.9x10^-3 L/s
Peak daily flow = 3.9x10^-3 x 5 = 0.02 L/s

GYM
6 workers x 45L/day per person + 40 visitors x 30L/day per person(IW) =
1,470L/day
Average daily flow = 1,470 x 1.25 / (24x60x60) = 0.021 L/s
Peak daily flow = 0.021 x 5 = 0.11 L/s

MEDICAL CENTRE
6 workers x 45L/day per person + 40 visitors x 30L/day per person(IW) =
1,470L/day
Average daily flow = 1,470 x 1.25 / (24x60x60) = 0.021 L/s
Peak daily flow = 0.021 x 5 = 0.11 L/s
```

On-site storage

Standard 24 hour water storage will be provided on site.

Fire flow requirements

Standard hydrants will be provided throughout the development

```
EXISTING PROPOSED:
RETAIL
200 workers x 45L/day per person(IW) = 9,000L/day
Average daily flow = 9000 x 1.1 / (24x60x60) = 0.11 L/s
Peak daily flow = 0.11 x 6 = 0.66 L/s

PROPOSED:
DOMESTIC
1,312 domestic occupants x 150L/day per person = 196,830 l/day
Average daily flow = 196,830 x 1.1 / (24x60x60) = 2.51 L/s
Peak daily flow = 2.51 x 6 = 15.06 L/s

RESTAURANT
(6 workers x 45L/day per person + 20 visitors x 30L/day per person(IW)) =
870L/day
Average daily flow = 870 x 1.1 / (24x60x60) = 0.011 L/s
Peak daily flow = 0.011 x 6 = 0.066 L/s

2x COFFEE SHOPS
2X(4 workers x 45L/day per person + 20 visitors x 30L/day per person(IW))
= 1,560L/day
Average daily flow = 1,560 x 1.1 / (24x60x60) = 0.02 L/s
Peak daily flow = 0.02 x 6 = 0.12 L/s

CONVENIENCE STORE
6 workers x 45L/day per person(IW) = 270L/day
Average daily flow = 270 x 1.1 / (24x60x60) = 3.44x10^-3 L/s
Peak daily flow = 3.44x10^-3 x 6 = 0.02 L/s

RETAIL SPACE
6 workers x 45L/day per person(IW) = 270L/day
Average daily flow = 270 x 1.1 / (24x60x60) = 3.44x10^-3 L/s
Peak daily flow = 3.44x10^-3 x 6 = 0.02 L/s

CRÉCHE
4 workers x 45L/day per person + 20 kids x 30L/day per person(IW) =
780L/day
Average daily flow = 780 x 1.1 / (24x60x60) = 0.01 L/s
Peak daily flow = 0.01 x 6 = 0.06 L/s

PHARMACY
6 workers x 45L/day per person(IW) = 270L/day
Average daily flow = 270 x 1.1 / (24x60x60) = 3.44x10^-3 L/s
Peak daily flow = 3.44x10^-3 x 6 = 0.02 L/s

GYM
6 workers x 45L/day per person + 40 visitors x 30L/day per person(IW) =
1,470L/day
Average daily flow = 1,470 x 1.1 / (24x60x60) = 0.019 L/s
Peak daily flow = 0.019 x 6 = 0.114 L/s

MEDICAL CENTRE
6 workers x 45L/day per person + 40 visitors x 30L/day per person(IW) =
1,470L/day
Average daily flow = 1,470 x 1.1 / (24x60x60) = 0.019 L/s
Peak daily flow = 0.019 x 6 = 0.114 L/s
```

Flow balancing and pumping

N/A

Guide to completing the pre-connection enquiry form

This form should be completed by applicants enquiring about the feasibility of a water and/or wastewater connection to Irish Water infrastructure.

The Irish Water Codes of Practice are available at **www.water.ie** for reference.

Section A | Applicant Details

Question 1: 'Water Point Reference Number (WPRN)' is a unique number assigned to every single water services connection in the country. The WPRN is prominently displayed on correspondence received from Irish Water, and can be found on water bills, previous connection offers, or previous enquiries in relation to the site. Existing customers and brownfield sites should have a WPRN. New customers are not required to answer this question.

Question 2: This question requires the applicant or company enquiring about the feasibility of a connection to identify themselves, their postal address, and to provide their contact details.

Question 3: If the applicant has employed a consulting engineer or an agent to manage the enquiry on their behalf, the agent's address and contact details should be recorded here.

Question 4: Please indicate whether it is the applicant or the agent who should receive future correspondence in relation to the enquiry.

Section B | Site details

Question 5: This is the address of the site requiring the water/wastewater service connection and for which this enquiry is being made.

Question 6: Please provide the Irish Grid co-ordinates of the proposed site. Irish grid positions on maps are expressed in two dimensions as Eastings (E or X) and Northings (N or Y) relative to an origin. You will find these coordinates on your Ordnance Survey map which is required to be submitted with an application.

Question 7: Please identify the Local Authority that is or will be dealing with your planning application, for example Cork City Council.

Question 8: Please indicate if planning permission has been granted for this application, and if so, please provide the planning permission reference number.

Question 9: Please specify the previous use of the site that is proposed to be developed, for example if greenfield, please state 'Agricultural'.

Question 10: Please specify the date that the development site was last occupied. Your answer will help us to determine the previous water usage/wastewater load of the development. If the site was previously greenfield, then this question does not need to be completed.

Question 11: Please provide details in relation to the ground conditions on the site if they are known to be poor, for example soil with a low bearing capacity, high water table, presence of peat, silt, etc. If a site investigation report is available, please include it with your enquiry.

Question 12: Please provide details in relation to contaminated land on your site (if any); this will determine what pipe material will be appropriate in the vicinity of the contaminated ground.

Question 13: Please indicate if the development is compliant with the local area development plan. You should contact your Local Authority in this regard and confirm same by ticking the appropriate box.

Section C | Water connection and demand details

Question 14: Please indicate if a water connection already exists for this site.

Question 15: Please indicate if this enquiry concerns an additional connection to one already installed on the site.

Question 16: Please indicate if you are proposing to upgrade the water connection to facilitate an increase in water demand. Irish Water will determine what impact this will have on our infrastructure.

Question 17: Please indicate if this enquiry concerns a new water connection for this site.

Question 18: Please indicate the approximate date that the proposed connection to the water infrastructure will be required.

Question 19: If the site was previously in use, please provide details of the pre-development peak hour and average hour water demand.

Question 20: Please provide calculations for domestic water demand and include your calculations on the calculation sheet provided. Demand rates (peak and average) are site specific. Average demand is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). For design purposes, please refer to the Irish Water Codes of Practice for Water Infrastructure.

Question 21: If this connection enquiry concerns a business premises, please provide calculations for the water demand and include your calculations on the calculation sheet provided. Business premises include shops, offices, hotels, schools, etc. Demand rates (peak and average) are site specific. Average demand is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). For design purposes, please refer to the Irish Water Codes of Practice for Water Infrastructure.

Question 22: If this connection enquiry is for an industrial premises, please calculate the water demand and include your calculations on the calculation sheet provided. Demand rates (peak and average) are site specific. Average demand is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). The peak demand for sizing of the pipe network will be as per the specific business production requirements. For design purposes, please refer to the Irish Water Codes of Practice for Water Infrastructure.

Question 23: Please specify the ground level at the location where connection to the public water mains will be made. This is required in order to determine if there is sufficient pressure in the existing water infrastructure to serve your proposed development. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 24: Please specify the highest finished floor level on site. This is required in order to determine if there is sufficient pressure in the existing water infrastructure to serve your proposed development. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 25: If storage is required, water storage capacity of 24-hour water demand must usually be provided at the proposed site. In some cases, 24-hour storage capacity may not be required, for example 24-hour storage for a domestic house would be provided in an attic storage tank. Please calculate the 24-hour water storage requirements and include your calculations on the attached sheet provided. Please also confirm that on-site storage is being provided by ticking the appropriate box.

Question 26: The water supply system shall be designed and constructed to reliably convey the water flows that are required of the development including fire flow requirements by the Fire Authority. The Fire Authority will provide the requirement for fire flow rates that the water supply system will have to carry. Please note that while flows in excess of your required demand may be achieved in the Irish Water network and could be utilised in the event of a fire, Irish Water cannot guarantee a flow rate to meet your fire flow requirement. To guarantee a flow to meet the Fire Authority requirements, you should provide adequate fire storage capacity within your development. Please include your calculations on the attached sheet provided, and further provide confirmation of the Fire Authority requirements.

Question 27: Please identify proposed additional water supply sources, that is, do you intend to connect to the public water mains or the public mains and supplement from other sources? If supplementing public water supply with a supply from another source, please provide details as to how the potable water supply is to be protected from cross contamination at the premises.

Section D | Wastewater connection and discharge details

Question 28: Please indicate if a wastewater connection to a public sewer already exists for this site.

Question 29: Please indicate if this enquiry relates to an additional wastewater connection to one already installed.

Question 30: Please indicate if you are proposing to upgrade the wastewater connection to facilitate an increased discharge. Irish Water will determine what impact this will have on our infrastructure.

Question 31: Please indicate if this enquiry relates to a new wastewater connection for this site.

Question 32: Please specify the approximate date that the proposed connection to the wastewater infrastructure will be required.

Question 33: If the site was previously in use, please provide details of the pre-development peak and average wastewater discharge.

Question 34: Please provide calculations for domestic wastewater discharge and include your calculations on the attached sheet provided. Discharge rates (peak and average) are site specific. Average discharge is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). For design purposes, please refer to the Irish Water Codes of Practice for Wastewater Infrastructure.

Question 35: If this enquiry relates to a business premises, please provide calculations for the wastewater discharge and include your calculations on the attached sheet provided. Business premises include shops, offices, hotels, schools, etc. Discharge rates (peak and average) are site specific. Average discharge is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). For design purposes, please refer to the Irish Water Codes of Practice for Wastewater Infrastructure.

Question 36: If this enquiry relates to an industrial premises, please provide calculations for the wastewater discharge and include your calculations on the calculation sheet provided. Discharge rates (peak and average) are site specific. Average discharge is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). The peak discharge for sizing of the pipe network will be as per the specific business production requirements. For design purposes, please refer to the Irish Water Codes of Practice for Wastewater Infrastructure.

Question 37: Please specify the maximum and average concentrations and the maximum daily load of each of the wastewater characteristics listed in the wastewater organic load table (if not domestic effluent), and also specify if any other significant concentrations are expected in the effluent. Please complete the table and provide additional supporting documentation if relevant. Note that the concentration shall be in mg/l and the load shall be in kg/day. Note that for business premises (shops, offices, schools, hotels, etc.) for which only domestic effluent will be discharged (excluding discharge from canteens/restaurants which would require a Trade Effluent Discharge licence), there is no need to complete this question.

Question 38: In exceptional circumstances, such as brownfield sites, where the only practical outlet for storm/surface water is to a combined sewer, Irish Water will consider permitting a restricted attenuated flow to the combined sewer. Storm/surface water will only be accepted from brownfield sites that already have a storm/surface water connection to a combined sewer and the applicant must demonstrate how the storm/surface water flow from the proposed site is minimised using sustainable urban drainage system (SUDS). This type of connection will only be considered on a case by case basis. Please advise if the proposed development intends discharging surface water to the combined wastewater collection system.

Question 39: Please specify if the development needs to pump its wastewater discharge to gain access to Irish Water infrastructure.

Question 40: Please specify the ground level at the location where connection to the public sewer will be made. This is required to determine if the development can be connected to the public sewer via gravity discharge. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 41: Please specify the lowest floor level of the proposed development. This is required in order to determine if the development can be connected to the public sewer via gravity discharge. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Section E | Development details

Question 42: Please specify the number of different property/premises types by filling in the table provided.

Question 43: Please indicate the approximate commencement date of works on the development.

Question 44: Please indicate if a phased building approach is to be adopted when developing the site. If so, please provide details of the phase master-plan and the proposed variation in water demand/wastewater discharge as a result of the phasing of the development.

Section F | Supporting documentation

Please provide additional information as listed.

Section G | Declaration

Please review the declaration, sign, and return the completed application form to Irish Water by email or by post using the contact details provided in Section G.

Notes

Notes

Burlinton Real Estate Brian Murphy C/o Michael Shine
52-54 Sandwith Street Lower Dublin 2

Uisce Éireann
Bosca OP 6000
Baile Átha Cliath 1
Éire

Irish Water
PO Box 6000
Dublin 1
Ireland

T: +353 1 89 25000
F: +353 1 89 25001
www.water.ie

18 December 2018

Dear Sir/Madam,

Re: Customer Reference No 692049107 pre-connection enquiry - Subject to contract | Contract denied
[Connection for 486 no. domestic units, a creche, a gym and a medical centre]

Irish Water has reviewed your pre-connection enquiry in relation to water and wastewater connections at Concorde industrial estate dublin 12 . Based upon the details that you have provided with your pre-connection enquiry and on the capacity currently available in the network(s), as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place, your proposed connection to the Irish Water network(s) can be facilitated.

In the case of wastewater connections this assessment does not confirm that a gravity connection is achievable. Therefore a suitably sized pumping station may be required to be installed on your site. All infrastructure should be designed and installed in accordance with the Irish Water Code of Practice.

Water:
Connection to the water network should be from the 30'' steel watermain on the opposite side of adjacent lane (please see attached layout map) and should include a full DMA outstation with telemetry system.
This Confirmation of Feasibility to connect to the Irish Water infrastructure also does not extend to your fire flow requirements. Please note that Irish Water can not guarantee a flow rate to meet fire flow requirements and in order to guarantee a flow to meet the Fire Authority requirements, you should provide adequate fire storage capacity within your development.
Wastewater:
The Development should be connected into the existing 1350mm concrete sewer adjacent to the site. Storm water from the Development should be connected separately into the existing storm water sewer. Note: the storm water drainage systems are the responsibility of the Dublin City County.

There are existing water and wastewater infrastructures (30'' steel watermain, 1350mm and 225mm sewers) running through the site.
Developer will be required to survey the site to determine the exact location of the infrastructure. Any trial investigations shall be carried out with the agreement and in the presence of Dublin City Council Inspector. You are advised that structures or works over or in close proximity to IW infrastructure that will inhibit access for maintenance or endanger structural or functional integrity of the infrastructure are not allowed.
Proposed diversion of 225mm dia. sewer will be subject to customer entering diversion agreement with Irish Water. You will also be required to furnish the Diversion Agreement with proposed designs, existing Infrastructure, condition reports and survey to prove feasibility. The connection to the existing premises must be maintained. For further information related to Diversion Enquiry please visit www.water.ie/connections/developer-services/diversions.

Irish Water notes that the scale of this development dictates that it is subject to the **Strategic Housing Development** planning process. Therefore in advance of submitting your full application to An Bord Pleanala for assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services. The design has to be in accordance with published Irish Water Code of Practice and Standard Details for water and wastewater.

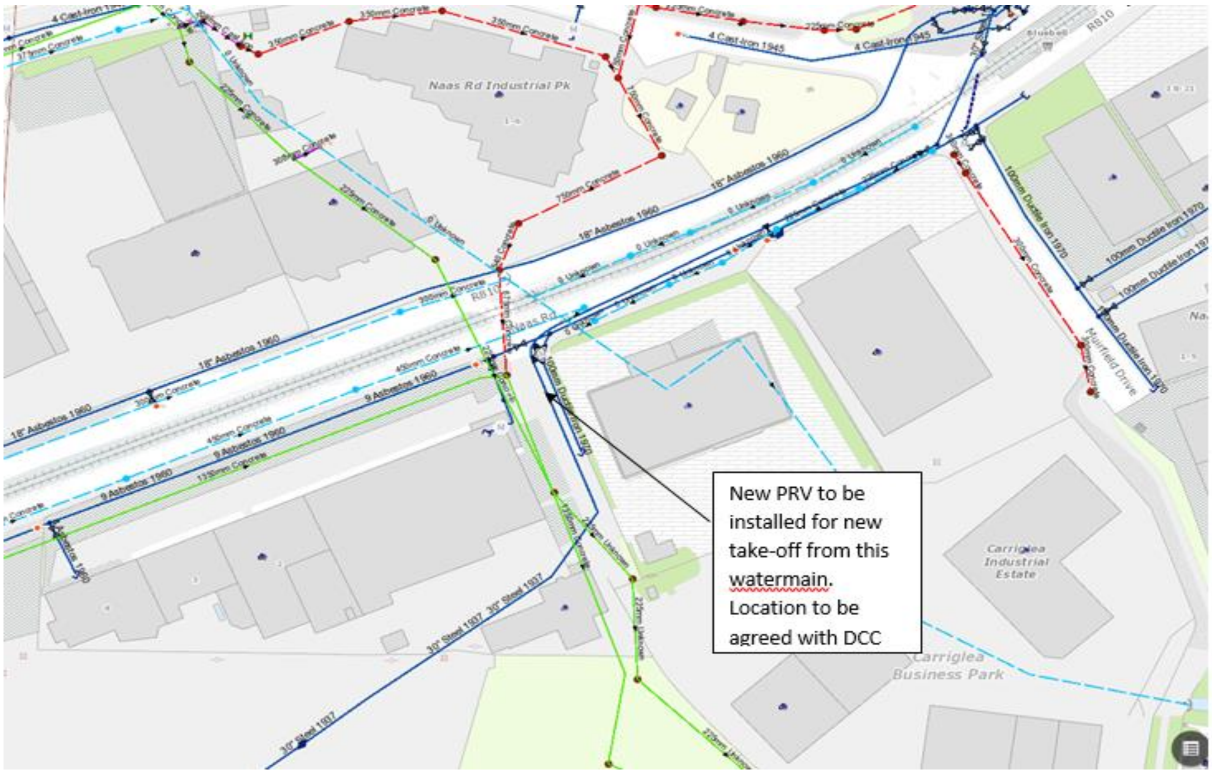
You are advised that this correspondence does not constitute an offer in whole or in part to provide a connection to any Irish Water infrastructure and is provided subject to a connection agreement being signed at a later date.

A connection agreement can be applied for by completing the connection application form available at **www.water.ie/connections**. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities.

If you have any further questions, please contact Marina Byrne from the design team on 018925991 or email mzbyrne@water.ie. For further information, visit **www.water.ie/connections**

Yours sincerely,

Maria O'Dwyer
Connections and Developer Services



UISCE ÉIREANN : IRISH WATER

Burlington Real Estate C/O Michael Shine
Barrett Mahony,
52-54 Sandwith St. Lower,
Dublin 2

20 March 2019

Uisce Éireann
Bosca OP 448
Oifig Sheachadta
na Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

Re: Design Submission for SHD Development at Concorde Industrial Estate, Dublin 12(the "Development") (the "Design Submission") / 692049107.

Dear Michael,

Many thanks for your recent Design Submission.

We have reviewed your proposal for the connection(s) at the Development. Based on the information provided, which included the documents outlined in Appendix A to this letter, Irish Water has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before you can connect to our network you must sign a connection agreement with Irish Water. This can be applied for by completing the connection application form at www.water.ie/connections. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities (CRU) (https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

You the Customer (including any designers/contractors or other related parties appointed by you) is entirely responsible for the design and construction of all water and/or wastewater infrastructure within the Development which is necessary to facilitate connection(s) from the boundary of the Development to Irish Water's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Irish Water does not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Irish Water Representative

Name: Marina Byrne
Phone: 018925991
Email: mzbyrne@water.ie

Yours sincerely,

M O'Dwyer

Maria O'Dwyer

Connections and Developer Services

Appendix A

Document Title & Revision

- CCRD-BMD-00-ZZ-DR-C-1000-PL5 Proposed Foul and Surface Layout
- CCRD-BMD-00-ZZ-DR-C-1003-PL4 Watermain Layout
- CCRD-BMD-00-ZZ-DR-C-1100-PL1 Longitudinal Drainage Sections
- CCRD-BMD-00-ZZ-DR-C-1103-PL1 Longitudinal Watermain Sections
- CCRD-BMD-00-ZZ-DR-C-1200-PL5 Standard Drainage Details Sheet 1 of 2
- CCRD-BMD-00-ZZ-DR-C-1201-PL1 Standard Drainage Details Sheet 2 of 2
- CCRD-BMD-00-ZZ-DR-C-1220-PL4 Standard Watermain Details Sheet 1 of 2
- CCRD-BMD-00-ZZ-DR-C-1222-PL4 Standard Watermain Details Sheet 2 of 2

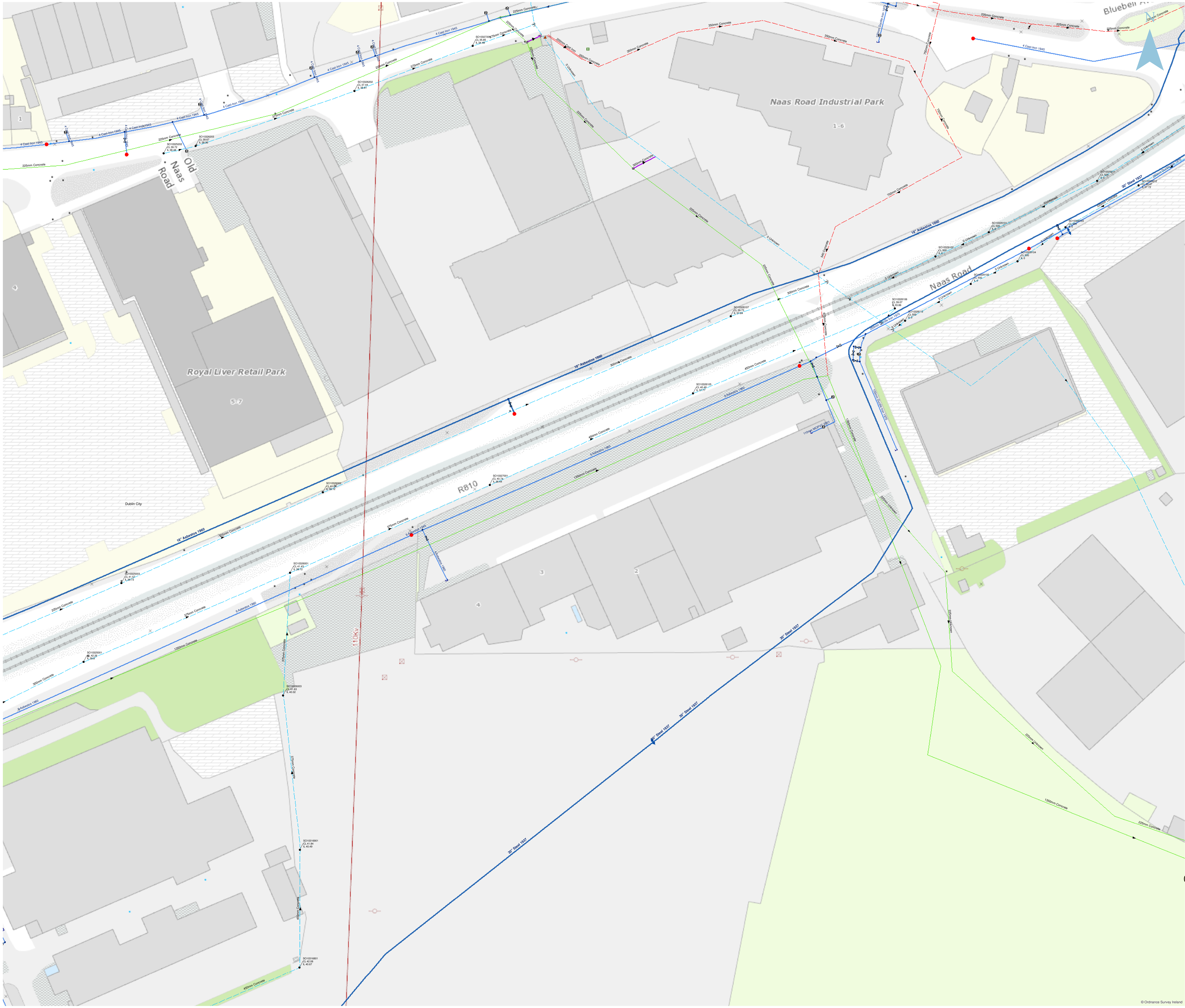
Standard Details/Code of Practice Exemption: N/A

For further information, visit ***www.water.ie/connections***

Notwithstanding any matters listed above, the Customer (including any appointed designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay Works. Acceptance of the Design Submission by Irish Water will not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

APPENDIX III

Irish Water Existing Services Maps



UISCE ÉIREANN : IRISH WATER

Legend

Unknown Meter ; Other Meter
Sluice Valve Open
Double Air Control Valve

Water Hydrants

Hydrant Function

- Fire Hydrant
- Telemetry Kiosk
- Cap
- Other Fittings

Water Distribution Mains

Owned By

- Distribution Water Main
- Trunk Water Main

Sewer Discharge Points

Discharge Type

- Other; Unknown
- Pump Station
- Gravity - Combined
- Gravity - Foul
- Gravity - Overflow
- Pumping - Foul

Storm Manholes

Manhole Type

- Standard

Storm Discharge Points

Discharge Type

- Outfall
- Surface Gravity Mains

1:500 at A0

Last edited: 12/06/2018

Metres

0 25 50 100

APPENDIX IV

OPW Flood Map for the Site

OPW *National Flood Hazard Mapping*

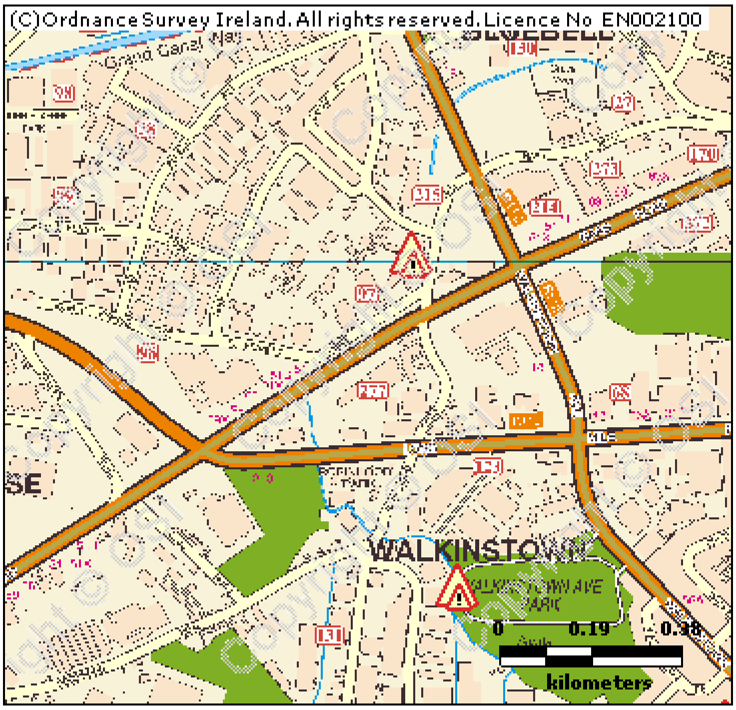
Summary Local Area Report

This Flood Report summarises all flood events within 2.5 kilometres of the map centre.

The map centre is in:

County: Dublin

NGR: O 101 318



Map Scale 1:15,532

Map Legend
Flood Points
Multiple / Recurring Flood Points
Areas Flooded
Hydrometric Stations
Rivers
Lakes
River Catchment Areas
Land Commission *
Drainage Districts *
Benefiting Lands *

* Important: These maps do not indicate flood hazard or flood extent. Thier purpose and scope is explained in the Glossary.

11 Results

1. Flooding at Diageo, Nangor Road, Dublin 12 on 24th Oct 2011 — Start Date: 24/Oct/2011
County: Dublin — Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information

2. Liffey Lower - Dec 1954 — Start Date: 08/Dec/1954
County: Kildare, Dublin — Flood Quality Code:2
Additional Information: Reports (4) Press Archive (2) More Mapped Information

3. Flooding at Walkinstown Crescent, Walkinstown, Dublin 12 on 24th Oct 2011 — Start Date: 24/Oct/2011
County: Dublin — Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information

4. Camac November 2000 — Start Date: 05/Nov/2000
County: Dublin — Flood Quality Code:4
Additional Information: Reports (1) More Mapped Information

5. Camac August 1986 — Start Date: 25/Aug/1986
County: Dublin — Flood Quality Code:2

Additional Information: Reports (3) More Mapped Information

6. Camac Goldenbridge Recurring | Start Date:
County: Dublin | Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

7. Flooding at Robinhood Industrial Estate, Clondalkin, Dublin 12 on 24th Oct 2011 | Start Date: 24/Oct/2011
County: Dublin | Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

8. Flooding at Yellow Meadow Apartments, Off Nangor/Yellow Meadows Road, Dublin 22 on 24th Oct 2011 | Start Date: 24/Oct/2011
County: Dublin | Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

9. Flooding at Riverview Business Centre, New Nangor Road, Dublin 12 on 24th Oct 2011 | Start Date: 24/Oct/2011
County: Dublin | Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

10. Robinhood Stream Walkinstown Recurring | Start Date:
County: Dublin | Flood Quality Code:3

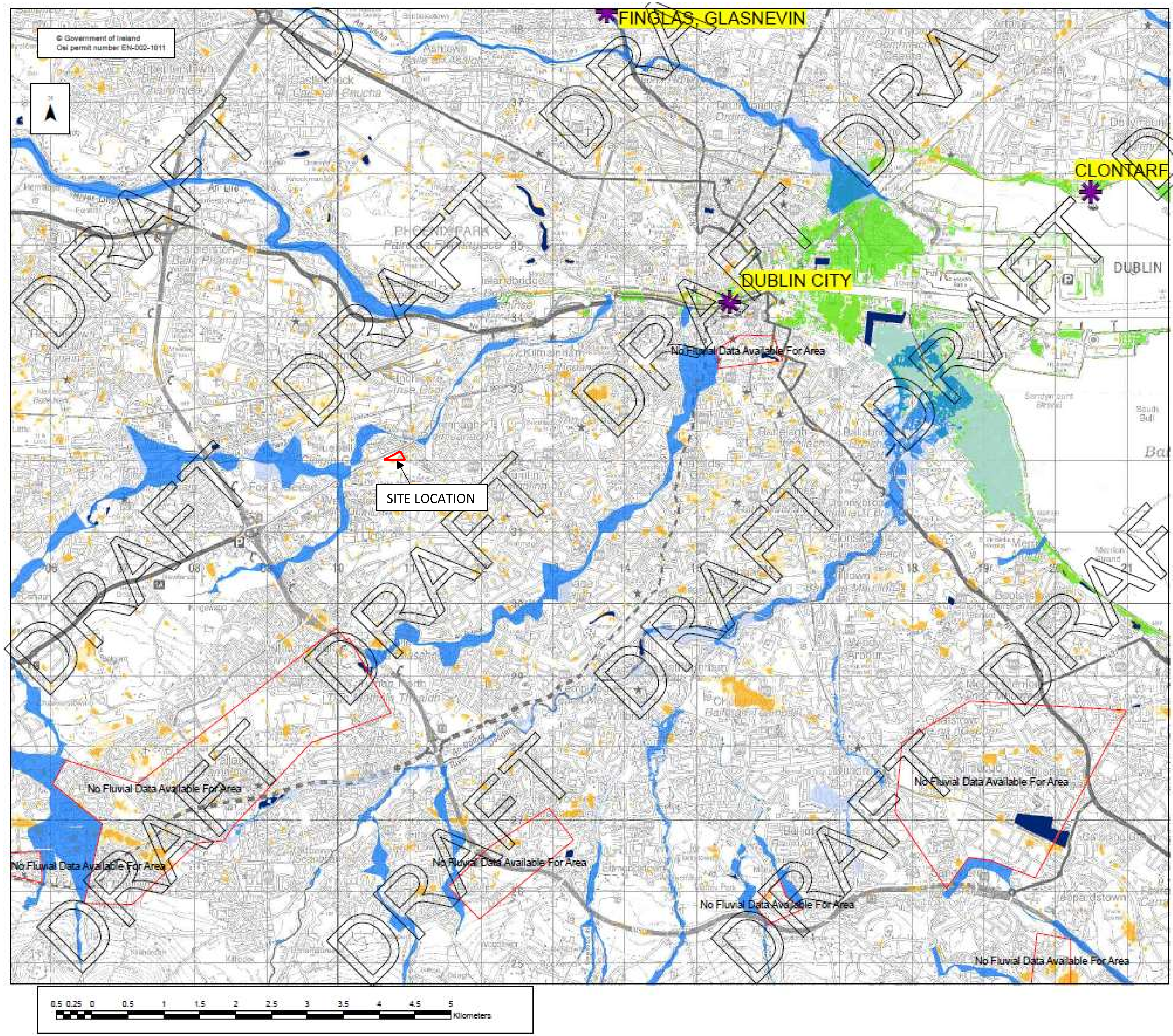
Additional Information: Reports (2) More Mapped Information

11. Camac Culvert Old Naas Road recurring | Start Date:
County: Dublin | Flood Quality Code:4

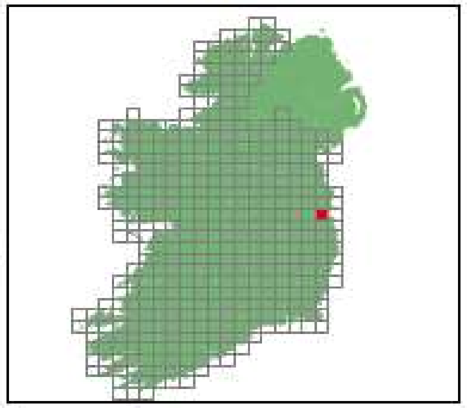
Additional Information: Reports (1) More Mapped Information

APPENDIX V

OPW PRFA Mapping



Location Plan :



Legend:

Flood Extents

- Fluvial - Indicative 1% AEP (100-yr) Event
- Fluvial - Extreme Event
- Coastal - Indicative 0.5% AEP (200-yr) Event
- Coastal - Extreme Event
- Pluvial - Indicative 1% AEP (100-yr) Event
- Pluvial - Extreme Event
- Groundwater Flood Extents
- Lakes / Turloughs

PFRA Outcomes

- Probable Area for Further Assesment
- Possible Area for Further Assesment

Important User Note:

The flood extents shown on these maps are based on broad-scale simple analysis and may not be accurate for a specific location. Information on the purpose, development and limitations of these maps is available in the relevant reports (see www.cfram.ie). Users should seek professional advice if they intend to rely on the maps in any way.

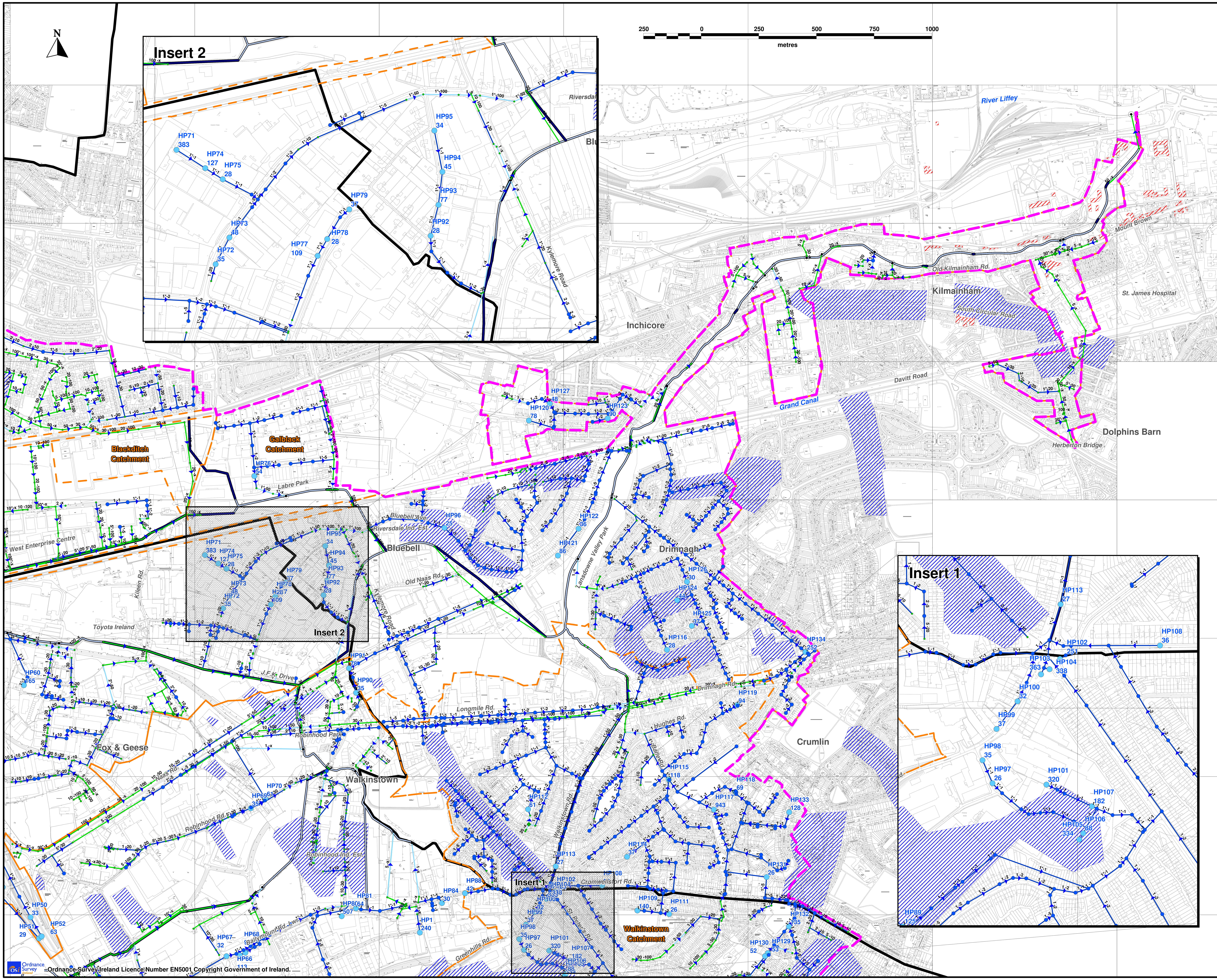
If you believe that the maps are inaccurate in some way please forward full details by contacting the OPW (refer to PFRA information leaflets or 'Have Your Say' on www.cfram.ie).

Office of Public Works
Jonathon Swift Street
Trim
Co Meath
Ireland

Project :
PRELIMINARY FLOOD RISK ASSESMENT (PFRA)

Map :
PFRA Indicative extents and outcomes
- Draft for Consultation

Figure By :	PJW	Date :	July2011
Checked By :	MA	Date :	July 2011
Figure No. :	2019 / MAP / 238 / A	Revision	0
Drawing Scale :	1:50,000	Plot Scale :	1:1 @ A3



Legend

- Wastewater Treatment Works
- County Council Boundary
- Catchment Boundary
- Sub-Catchment Boundary
- Rising Main (Coloured as sewer)
- Direction of Flow (on sewer line)
- River/Watercourse
- Culverted River/Watercourse
- 1:1000 OS Grid Line Boundaries
- 1:5000 OS Grid Line Boundaries
- Combined Sewer Overflow
- Foul/Combined Pumping Station
- Foul/Combined Bifurcation
- Foul/Combined Apex Manhole
- Foul/Combined Flow Management Chamber
- Storm Water Overflow to Foul/Combined
- Storm Water Pumping Station
- Storm Water Bifurcation
- Storm Water Apex Manhole
- Storm Water Flow Management Chamber
- Outfall
- Inlet

Flooding Performance Key

- Flooding greater than 25m3 Volume for 5yr Return Period Event (Volume m3)
- Flooding less than 25m3 Volume for 5yr Return Period Event
- Modelled Manhole does not flood for 5 year Return Period Event
- All Historically Reported Flooding Incidents caused by Hydraulic Overloading

Foul/Combined Hydraulic Performance Key

x-x Label for sewers showing (return period of surcharge (yrs) - return period of flooding (yrs))

Storm System Hydraulic Performance Key

- 2-10 Storm Sewer surcharges for 1 or 2 year return period events
- 5-20 Storm Sewer floods for 30 year return period or less.
- 10-50 Storm Sewer does not surcharge for 1or 2 year return period events and does not flood for a 30 year return period event or below. (eg 1,2,5,10,20)

Important Hydraulic Considerations

- Location of Known Basements
- Assumed Location of Basements

Structural Condition Assessment (Previously Reported/Graded Defects)

- Structural Condition - Grade 5
- Structural Condition - Grade 4

Catchment Deficiency Reference Key

HP 1	Hydraulic Deficiency Reference No.
SCD 1	Structural Deficiency Reference No.
CSO 1	CSO Deficiency Reference No. (Hydraulic or Environmental)
OP 1	Operational Deficiency Reference No.
GEN 1	General Deficiency Reference No.

Notes

1. Results are based on assessment of sewer system under 1, 2, 5, 10, 20, 30, 50 and 100 year return period rainfall events.
2. For colour coding, flooding takes priority over surcharging.
3. Where pipe is not predicted to surcharge or flood for the return periods analysed, the pipe has not been labeled.
4. Levels referenced in meters to Ordnance Survey Datum, which is Mean Sea Level at Malin Head, Co. Donegal (1970 Adjustment).
5. All dimensions given in metric units.

GREATER DUBLIN STRATEGIC DRAINAGE STUDY

Phase 2 - Existing Hydraulic Performance

CAMAC STORM LEVEL 1

GDSDS / S1004 / P2-005 / Tile 1

Dublin Drainage
A Strategic Study for Greater Dublin

Drawn	HS
Chk'd	EC
Approved	AC
Scale	1 : 7,500 at A1
Date	30.10. 2003
REVISION	D03

APPENDIX VI

Naas Road LAP part4 – Flood Risk Assessment

Chapter 6 – Implementation & Monitoring

6.1 Introduction

The Naas Road LAP outlines the vision for the lands and a physical framework for activating that vision. The LAP through its policies and objectives will thereby inform both the preparation and assessment of detailed planning applications and master plans.

The responsibility for the implementation of policies and objectives contained within the LAP will be dependant on a number of possible sources, including Government Departments, Infrastructure providers, Dublin City Council and the private sector.

The success of the plan will be measured with the degree of implementation that is achieved over the lifetime of the plan in the next six years. The objectives set out in the plan need to be realistic in terms of funding capabilities and implementation structures.

The funding of the plan falls within three sectors, 1) the national government, either directly or through the guise of public utilities, 2) the Council and 3) the private sector.

Dublin City Council will actively undertake a leadership role to progress and secure the implementation of the LAP. This will involve a collaborative approach with citizens, stakeholders, sectoral interests, city partners, and the adjoining authority, South Dublin County Council, to achieve collective support and successful implementation of the plan.

6.2 Masterplan Requirement

In the redevelopment of the key sites, all key stakeholders shall be required to produce a detailed site master plan accompanied by a clearly articulated design statement. This masterplan should be agreed with Dublin City Council in advance of any major planning application. Where a landholding immediately adjoins other lands within a key site, master planning should give due consideration to the anticipated roll-out of development on such land. Of particular importance in this plan is the KDC designation and the delivery of employment generating mixed uses including retailing. Delivery of new green links and improvements in public realm shall be given due consideration when masterplans are being considered and the Council shall have regard to community gain. Residential uses are particularly sensitive to impacts of surrounding construction, and this should be given full consideration in relation to master planning.

In situations where a key site is in multiple ownership, the Planning Authority shall have discretion in regard to determining the rollout of development in instances where some owners are more ready than others to progress development– i.e. the achievement of the objectives for the site as set out in this plan shall not be unnecessarily delayed.

Key Sites

Key Sites:

1: Royal Liver Retail Park
2: Motor Distributors Ltd
3: Nissan Site / Site Fronting onto Long Mile Road
4: Muirfield Drive / Naas Road

The masterplans shall address the following key issues:

- Site Layout
- Land Uses
- Building Density
- Building Height
- Urban Design
- Community & Social Infrastructure
- Education
- Open Space
- Public Realm
- Permeability
- Heritage/Conservation
- Car parking & Vehicular Access
- Natural Heritage
- Environmental Impact Assessment
- Construction Management
- Phasing & Implementations
- Monitoring
- Infrastructure
- Flood Risk
- Green Infrastructure
- SuDS
- Landscape Design

6.3 Possible Barriers to Development

The implementation of this Local Area Plan may be constrained by a number of elements, namely the current economic climate, allocated Local Authority funding, availability of funding from other sources, and other infrastructural constraints. The nature of statutory development plans is such that no budget is agreed in advance and therefore no funding of projects or implementation of all objectives within the plan is guaranteed in advance.

There are a number of high voltage cables running through the LAP lands, which consist of a double circuit 110kV line and a single circuit 38kV line, originating in the Inchicore 110kV substation. The 38KV and in particular the 110KV power lines impose restrictions with regards to development and visual amenity of the area. There is an 80 metre restriction corridor around the 110kV line, i.e 40m corridor each side. As part of implementation of the LAP and the phasing of development on the key sites, the undergrounding of the power lines must be taken on board in the masterplans for the sites. This will need co-operation between the individual land owners.

There is a large watermain running diagonally through three key sites, and this may have to be relocated to facilitate the development of these sites.

Development in the LAP lands is also dependent on capacity being available in the Ringsend Treatment Plant. Development will only be permitted in tandem with available water supply, waste water treatment and network capacity.

There are also a number of Seveso sites, although not within the LAP lands, these are located in close proximity in South Dublin County Council lands (see section 2.1.2) which would be within the consultation zone for these facilities. These must be taken into account for all new development.

Dublin City Council will take an interdepartmental approach to the implementation of this local area plan, and also will engage with the Department of the Environment, Community and Local Government, the NTA, Department of Eduction and Skills, the Offices of Pubic works, and other relevant agencies to coordinate the delivery of key infrastructure in this area.

6.4 Community Gain

It is important that the Local Area Plan delivers a balanced approach to the future development of the Naas Road Lands through the delivery of enhanced public realm, greater connectivity between the key sites for pedestrians and cyclists, new green routes, and improvements and delivery of key infrastructure.

New developments in the area will generate an appropriate financial return for the landowners, which will underpin investment and support the viability of community and social infrastructure. It is considered reasonable therefore that the identified key development sites shall each contribute to the provision of new community and cultural infrastructure to serve the local area and wider community. The delivery phasing, operation and the costs associated with the provision of new community and social infrastructure shall be the subject to detailed negotiations between the developer, the planning authority, statutory agencies and key stakeholders.

6.5 Public Realm

The public realm areas of the Naas Road Area are likely to be completed on a staggered timescale, when the key sites come up for redevelopment. It is important that the masterplans ensure a consistent high quality approach to the treatment of the public realm.

Street furniture should have a contemporary character, and will be simple, robust and elegant. It is important in the redevelopment of the key sites, that soft landscaping be introduced into the public realm proposals. All Landscape Design / Green Infrastructure proposals in the public realm areas would be subject to liaison with the Parks and Landscape Division in Dublin City Council, and should be consistent with any objectives set out in the Green Infrastructure chapter. Signage in the public realm areas will be restricted and shall be simple and legible, and consistent throughout the plan area.

6.6 Social and Affordable Housing

All residential and mixed use development will be required to comply with the Dublin City Housing Strategy as prepared under Part V of the Planning & Development Acts.

6.7 Contributions - Section 48 Levies

All development proposals within the local plan areas are subject to general financial contribution levies as set out under the Dublin City Council Development Contribution Scheme made under Section 48 of the Planning & Development Acts, towards expenditure by City Council for works including roads, water and drainage scheme, open spaces, cultural/ arts projects and other amenities which facilitate development.

6.8 Temporary Uses

Due to the current economic climate there is a possibility that a number or sections of the sites within the LAP area that are currently vacant or underutilised may remain so in the short/medium term. Dublin City Council will adopt a dual approach of 1) ensuring vacant sites are managed properly so that sites are kept clear of debris, buildings secured, and boundary treatments are attractive and maintained and 2) encouraging temporary uses on these sites to bring activity and vitality to the area.

Temporary uses on vacant sites may include:

- ‘Greening’ to create a temporary park/biodiversity space
- Landscape screening and attractive railing to reduce negative visual impacts of rear elevations/vacant sites/exposed boundary walls
- Use of space for local events, projects or festivals.
- Allotments or community gardens
- Start up business/innovation activities
- Temporary artistic ‘fake’ frontages.
- Limited surface parking until sites are redeveloped
- Visual arts projects which enliven the public realm

6.9 Construction Phase

Dublin City Council recognise the negative impacts albeit short term, that large scale construction projects can have on local businesses and community in terms of dust, noise and other nuisances. All major planning applications will be required to be accompanied by a construction management plan to mitigate against any adverse impacts on the local business and community.

6.10 Taking in Charge

Dublin City Council is committed to the taking in change of the public areas of developments, including where appropriate new community, social and recreational facilities. In this regard applicants should refer to guidelines for Open Space Development and Taking in Charge (Parks and Landscape Services vision 2009) and the overall approach to the taking in charge of completed developments of public spaces shall be agreed in accordance with the relevant stakeholders during the individual key site masterplan preparation process.

For residential schemes clarity at application stage needs to be provided regarding the extent and scale of management companies (if such are proposed) and the extent of areas to be taken in charge or not.

6.11 Phasing

With regard to phasing, it will be an objective of Dublin City Council to promote the implementation of the LAP in a rational and sequential approach that is in keeping with the proposed development strategy, and to ensure that essential facilities (such as road infrastructure, water, sewerage, undergrounding pylons) are secured and in place concurrent with the development of the key sites. As this LAP is not greenfield, but a regeneration area comprising of separate distinct sites, a large scale phasing plan is not appropriate. The sequence with which these schemes will be advanced determines the sequence and phasing of development in the key sites.

Having regard to the large land parcels that the key sites occupy, this plan does not demand the delivery of key site strategies in any specific order as this may preclude build-out of desirable development in association with improved market forces. Nonetheless, Dublin City Council recognises the functional interrelationship between key sites in regard to land uses, urban design and linkages - and it is critical that masterplanning addresses this.

It is an objective of the Planning Authority to ensure that essential facilities such as road infrastructure , water, and sewerage networks etc, are secured in tandem with the proposed development of the key sites and that later phases within each key site are appropriately managed, secured or landscaped until their future development.

Dublin City Council reserves the right to refuse development on the grounds of it being premature pending the provision of physical infrastructure or the provision of infrastructural capacities. The phasing of the various key sites will also be dependant on waste water treatment being available at the Ringsend Treatment Plant.

In setting out both masterplan and individual planning applications it is a requirement that key internal connections are delivered at an early stage in the phased development of each key site. The complete severance of routes by the non development of a large sections of the site on a medium or long term basis whilst awaiting development will not be accepted. Sites should be sub-divided with safe, attractive connections provided. Some of these connections can be temporary, providing connectivity until the final elements of the site are delivered. Provision of dead-ends or cul-de-sacs should be avoided. In delivering connectivity, a key element that must be provided in the early phases of the sites is the east west connecting boulevard for both the MDL site and the Nissan key site. For the Muirfield and Nissan sites, new development must provide for vehicular, pedestrian and cycle interconnectivity with adjoining lands (the detail of which must be agreed with Dublin City Council) to allow both residential areas fully integrate.

6.12 Monitoring and Review

The Naas Road Local Area Plan will have effect for a period of six years in accordance with the Planning and Development Acts 2000 – 2010. Thereafter the LAP will be reviewed or extended as appropriate by resolution of the members of Dublin City Council to reflect any changed planning policy or circumstance in addition to altered market conditions.

It is the role of Dublin City Council to put in place a structure for the continual monitoring and progress review of the LAP and its objectives.

In order to ensure that the development strategy outlined in this Local Area plan is being delivered, Dublin City Council through its development management functions will monitor the implementation and phasing of this Local Area Plan. A review will assist in assessing whether the objectives detailed in the plan are being met.

6.13 Transitional Arrangements

Once formally adopted this local area plan will apply to all planning applications lodged to the Planning Authority in the plan area. In the interim period, prior to the formal adoption of this local area plan, the Planning Authority can have regard to the contents of the plan in the assessment of planning applications.

Appendices

Appendix 1: Flood Risk Assessment

Introduction

This Flood Risk Assessment was prepared and informed by the DoEHLG Guidelines for Planning Authorities (DoEHLG & OPW, 2009) on 'The Planning System and Flood Risk Management' (and Technical Appendices). The Guidelines state that planning authorities are required to introduce flood risk assessment as an integral and leading element of their development plan functions. It sets out that development plans and local area plans, must establish the flood risk assessment requirements for their functional area.

A Strategic Flood Risk Assessment (SFRA) is an area wide assessment of the existing risks of flooding and the impact on those risks arising from proposed spatial planning decisions. The assessment will focus on Stage 1 primarily (Identification of Flood Risk) , where, in general the need for a more detailed flood risk assessment is flagged (Stage 2).

The guidelines require the planning system at national, regional and local levels to:

a) Avoid developments in areas at risk of flooding, particularly floodplains, unless there are proven wider sustainability grounds that justify appropriate development and where the flood risk can be reduced or managed to an acceptable level without increasing flood risk elsewhere.

b) Adopt a sequential approach to flood risk management when assessing the location for new development based on avoidance, reduction and mitigation of flood risk, and

c) Incorporate flood risk assessment into the process of making decisions on planning applications and planning appeals.

Stages in the Assessment of Flood Risk

Stage 1 – Flood Risk Identification - to identify whether there may be any flooding or surface water management issues related to the plan area. This stage mainly comprises a comprehensive desk study of available information to establish whether a flood risk issue is existing or whether one may exist in the future.

Stage 2 – Initial flood risk assessment – If a flood risk issue is deemed to exist arising from the Stage 1 Flood Risk Identification process, the assessment proceeds to Stage 2 which confirms the sources of flooding, appraises the adequacy of existing information and determines the extent of additional surveys and the degree of modelling that will be required. Stage 2 must be sufficiently detailed to allow the application of the sequential approach within the flood risk zone.

Stage 3- Detailed Risk Assessment – Where Stages 1 and 2 indicate that a proposed area of possible zoning or development may be subject to a significant flood risk, a Stage 3 Detailed Flood Risk Assessment must be undertaken.

The general approach is to avoid development in areas with a significant risk of flooding, and where development in floodplains cannot be avoided, to take a sequential approach to flood risk management based on avoidance, reduction and mitigation of risk.

As part of stage 2, a Flood Zone Map for the plan area must be prepared drawing on the most up to date available information. This map provides information on three zones of flood risk in the study area. Zone A where there is a high probability of flooding, Zone B where there is a moderate probability of flooding and Zone C where there is a low probability of flooding.

It is important to note that the above zonal approach and the flood extent maps only cover fluvial flood risk / flood plains etc. The flood extent maps should not be used to suggest that any areas are free from significant flood risk, since these maps do not include the effects of other forms of flooding such as groundwater, pluvial Flood Risk, infrastructural/sewer failure and overflows from dams, etc.

Existing Environment - Identification of Flood Hazards

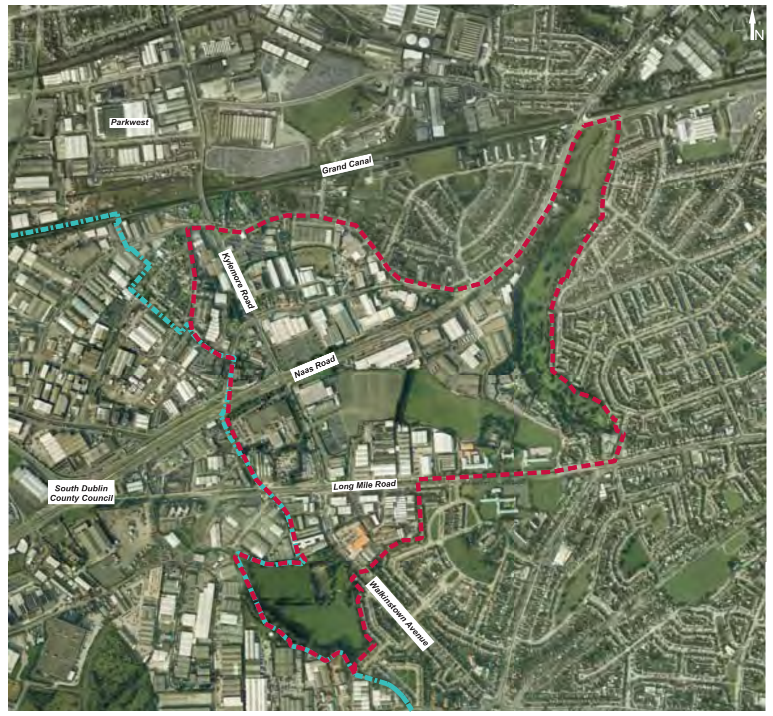
This section provides a description of spatial distribution of flood risk at appropriate scales for the Local Area Plan, based on available information.

The Grand Canal, which is a man made waterway runs in an east west direction to the north of the LAP area linking the river Liffey at Dublin with the Barrow at Athy and the Shannon, at Shannon Harbour. The river Camac enters into the functional area of Dublin City Council at the Old Naas Road and makes its way to the river Liffey at Heuston Station, Islandbridge via a series of natural open channels, mad-made channels and culverts. There are four stretches where the river channel is open and natural but these are so short and far apart that the river is essentially a heavily modified water body and has been designated as such in the River Basin Management Plan. The river passes through a number of industrial estates and residential areas as it flows into the city. The Robinhood stream, the Gallblack stream (including the Blackditch and Gallanstown streams) and the Walkinstown Stream all discharge to the river Camac. An extensive surface water drainage network discharges to the River Camac and a significant number of combined sewer overflows also discharge to the river and its tributaries.

Historically, flooding in the catchment has posed a problem within the heavily urbanised areas causing damage to adjacent river properties. However some flood alleviation measures have recently been undertaken on the main channel at Corkagh Park in Clondalkin, and along the Robinhood stream. The river drains large areas of residential and industrial lands and two major roads, the Western Parkway Motorway (M50) and the N7 Naas Road.

The drainage network in this area is a partially separate system in which foul sewage, together with some surface water is carried by an individual system of sewers to the Grand Canal Tunnel sewer and the balance of the surface water is collected in an independent system of surface water sewers ultimately discharging in to the River Camac. As the pipe network in the city centre catchment area is flowing at capacity, all new flows will be directed to the Grand Canal Tunnel through the 9B sewer serving the area. There are many misconnections of foul sewers to surface water infrastructure in the old industrial brownfield sites that make up much of this area, these are being addressed as far as is possible.

Naas Road LAP



Local Area Plan Boundary   Dublin City Council / South Dublin CC Boundary

In terms of the general performance of the pipe network in the Naas Road catchment, this varies from poor to reasonable. The Naas Road Local Area Plan area drains to two separate catchments. Most of the area is connected to the Grand Canal Tunnel catchment with a small area at the northern end connected to the city centre catchment. Both catchments ultimately discharge to the Regional Waste Water Treatment Plant at Ringsend. As of 2012, this facility is operating at its design capacity. Dublin City Council, is currently finalising proposals to increase capacity of the plant at Ringsend from 1.7 million PE (population equivalent) to 2.1 million PE, with a target completion date of 2015.

Although the River Camac runs through the eastern part of this LAP, there is a very limited surface water network connected to it. Most of the surface water pipes in the area discharge to combined sewers. It is not sustainable to allow storm water flows continue in the combined system as the cost of pumping and then treating 'clean' storm water is significant.

The storm water flow should be separated out using modern sustainable drainage systems. All new developments will be required to implement these principles by treating their storm water flows on site to ensure volumetric reduction and qualitative improvement of the storm flows. Examples of systems include soakaways and rainwater harvesting. Other systems can be viewed on www.irishsuds.ie.

Flood Zone Map

In preparing a flood zone map for the Naas Road Lands, the most suitable and most recent source of information is the Catchment Flood Risk Assessment and Management Studies (CFRAMS) which are being carried out by Dublin City Council and adjoining authorities in conjunction with the OPW.

In June of 2011 the Minister of State at the Department of the Finance with special responsibility of the Office of Public Works announced that RPS consulting engineers have been appointed to carry out a major study of flooding in the Eastern River Basin District catchment. This will identify in detail the causes of flooding throughout the catchment and produce an integrated plan of specific measures to address the significant flood risk factors in a proactive and comprehensive way. The Eastern River Basin District includes Co.Dublin and portions of Cavan, Kildare, Louth, Meath, Offaly, Westmeath, Wexford and Wicklow. The CFRAMS study is part of a programme being undertaken by the OPW in line with current national flood policy and the EU Directive on the Assessment and Management of Flood Risk which requires that such studies be completed for each catchment by 2015. The CFRAMS plans are due December 2015 with flood maps due December 2013.

In the absence of the CRAMS study, the main information to be used for the flood mapping comes form the Greater Dublin Strategic Drainage Study (GDSDS) which shows the computer modelled 1 in 100 year flood event extent; and also from a number of other sources below:

- Responses from statutory bodies during the consultation process were examined, with particular reference to concerns relating to flood risk.
- The nature and location of the area in the vicinity of the proposed development was described in terms of the existing hydrological environment.
- The existing site geology and hydrogeology was examined in terms of how they relate to the flooding history and the potential for drainage methods of the proposed scheme.
- All existing historical information on previous events, studies and surveys, was examined as made available from the Office of Public Works (OPW) flood hazard mapping website. www.floodmaps.ie.

The GDSDS was commissioned in 2001 to identify policies and works leading to the development of a sustainable drainage system for the Greater Dublin Area. As part of this study drainage models were produced for a number of foul and stormwater catchments including the Tolka River, the Camac River and Santry River. 100 year flood extent maps were prepared for each of the catchments as part of the studies. These maps were studied in the preparation of this flood risk assessment.

The main flood risks identified in the GDSDS for this area are flooding points 11 to 15 which refer to 100 year flooding of portions of Lansdowne Valley Business Park, Riversdale Industrial Estate, Bluebell Avenue, Sheldon Park Hotel (although some river widening has been carried out subsequently) and Kylemore Road.

The main risk to the Naas Road Area would be from both pluvial and fluvial flooding. All the areas identified above would be in Zone A when referring to the National Flooding Guidelines. The GDSDS did not carry out a 1,000 year flood extent map so Zones B and C cannot be accurately delineated until flood map outputs from the Eastern Region Catchment Flood Risk Assessment and Management Study are received around the end of 2013, however any development adjacent to Zone A must be considered to be in Zone B unless disproved by hydraulic analysis. A significant amount of road flooding is also indicated by the computer models in the 100 year event, especially on Bluebell Avenue and the Longmile Road.

For the purposes of this study an indicative 20m band outside the Flood Zone A has been identified which will act as a rough estimate for Flood Zone B.

As can be seen from the above, five specific areas have been identified in the GDSDS with potential conflicts between development and flood risk. These areas identified on the Flood Risk Map will be subject to a site specific flood risk assessment appropriate to the type and scale of the development being proposed. Mitigation measures will be incorporated to ensure that any development taking place will not exacerbate any flooding issues.

The five areas involved are largely confined to existing industrial estates and some existing residential area. These areas will be identified on a Flood Risk Map to accompany the plan and a policy will be included to state that any development proposal in these areas will be subject to a site specific Flood Risk Assessment appropriate to the type and scale of development being proposed. Mitigation measure will ensure that any development taking place will not exacerbate any flooding issue.

OPW Classification of Flood Zones

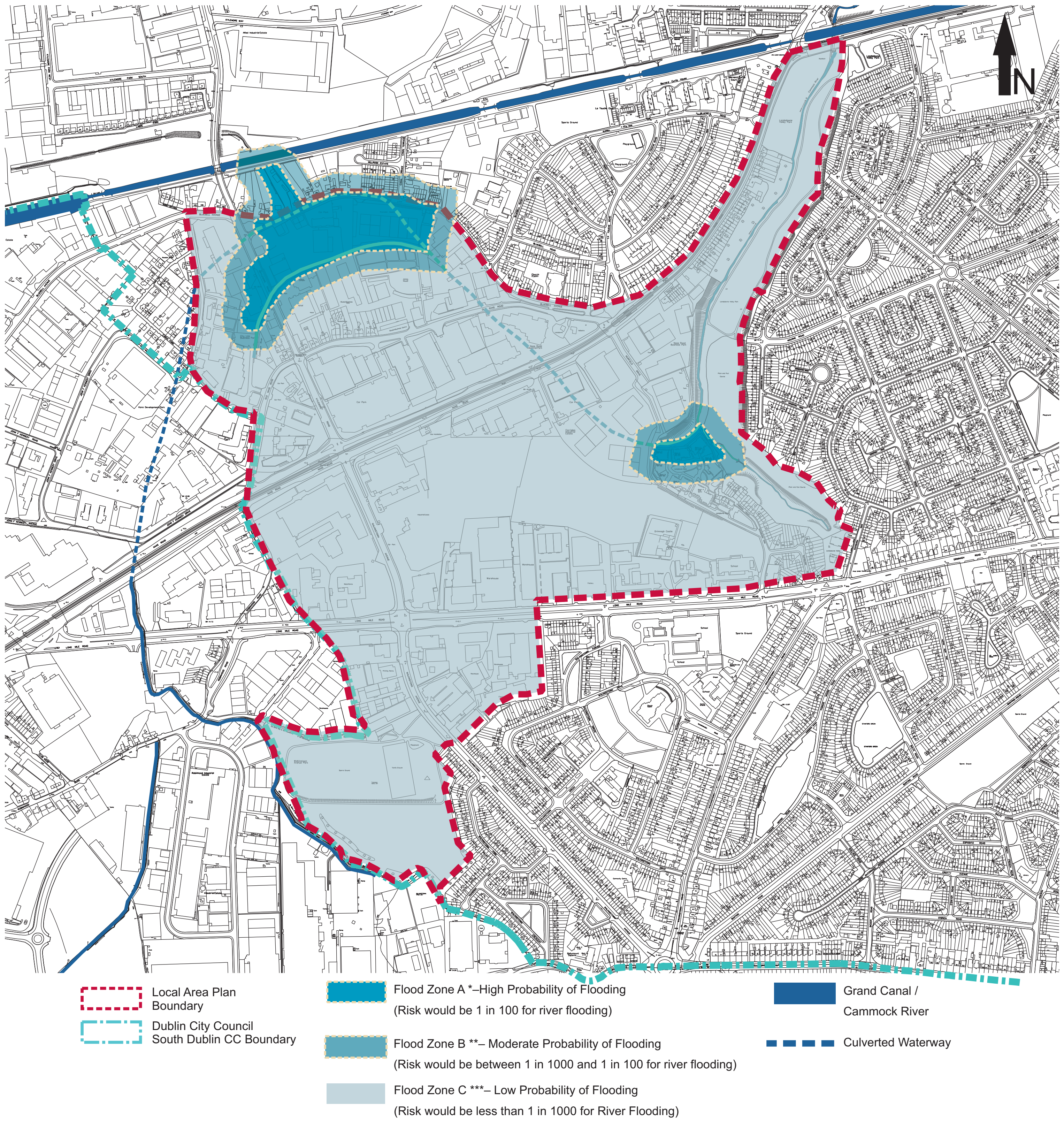
Flood Zones are geographical areas within which the likelihood of flooding is in a particular range and they are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning. There are three types or levels of flood zones defined in the DECLG and OPW Guidelines on Flood Risk Management:

- Zone A – High probability of flooding – Where the average probability of flooding from rivers and sea is highest (greater than 1% annually or more frequent than 1 in 100 years for river flooding or 0.5% annually or 1 in 200 years respectively for coastal flooding). Most forms of development are deemed to be inappropriate here, only water compatible development including essential infrastructure which cannot be located elsewhere, would normally be allowed

- Zone B – Moderate probability of flooding – (Risk between 0.1% annually or 1 in 1000 and 1 % annually or 1 in 100 years for river flooding, and between 0.1% or 1 in a 1000 years and 0.5% annually or 1 in 200 years for coastal flooding) highly vulnerable development including hospitals, residential care homes, Garda, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure would generally be considered inappropriate unless the requirements of the justification test is met. Less vulnerable development such as retail, commercial and industrial uses, short term let for caravans/camping, and secondary strategic transport and utilities infrastructure might be considered appropriate in this zone. Less vulnerable development should only be considered in this zone if adequate lands or sites are not available in Zone C and subject to a flood risk assessment to the appropriate level of detail to demonstrate that flood risk to and from the development can or will be adequately be managed.

- Zone C – Low probability of flooding – (Risk is less than 0.1% annually or 1 in 1000 years for both rivers and coastal flooding) Development is appropriate from a flood risk perspective (subject to flood hazard from sources other than rivers and coast meeting normal proper planning considerations).

Flood Zones



Mitigation Measures Proposed

The Greater Dublin Strategic Drainage Study made a number of recommendations to address the flooding issues in the most extreme scenario (2031). In their report, the areas which showed the most network deficiencies were in the older areas of the catchment. In Dublin City Council the following industrial areas such as Bluebell , Ballymount and Cookstown Industrial Estate , where solutions generally involve upsizing of pipes. In Walkinstown flooding in this area is unverified and it was recommended in the report that a detailed study be carried out, which included manhole and CCTV surveys. There were also a number of areas identified in the minor network of the catchment where non critical flooding was predicted. This is addressed in a single drainage development option which proposes upsizing of smaller pipes across the network. The following areas were found to be at risk of flooding during the option development in the catchment namely, a) Kilmainham b), Kylemore Road/Bluebell Avenue, c) Robinhood Industrial Estate, d) Nangor Road Industrial Area, and e) Clondalkin. In general, the primary solution at each deficiency was the upgrade of structures on the river to reduce afflux and backwater effect. Where this was not possible, or where the effects would be minimal, it was recommended that flood protection walls and embankments be constructed to the height of the peak predicted water level + 300mml freeboard. The solution for flooding upstream of culvert CAM-CU10 under Kileen Road included a recommendation for the addition of a further 200,000m3 of attenuation area in Corkagh Park. It was recommended in the GDSDS that a more detailed study of the Camac River catchment be done to confirm the ultimate feasibility of this option.

Surface Water Management

Apart from recommendations made in the GDSDS, It is important that any new developments in the Naas Road LAP area deal with surface water at source, wherever feasible. The following principles should also be applied in the redevelopment of large brownfield sites, which will help reduce surface run off.

- Attenuating and filtering in the drainage layer of green roofs, podium gardens and tree planting pits at basement level.
- A porous approach to streets and hard landscape space, using permeable surface and storm water attenuating tree trenches.
- Preference for SuDS features with biodiversity and amenity benefits over inert/hard SuDS features e.g grass/planted swales, detention basins, infiltration basins, wetlands and storm water tree trenches in preference to attenuating in tanks, paving sub-base or cellular attenuation systems.
- In keeping with the Greater Dublin Strategic Drainage Study (2005), Sustainable Drainage Systems (SuDS) techniques will be incorporated into the development. The drainage strategy for the site will also take due cognisance of the objectives of the Flood Resilent City Project, which promotes an integrated approach to flood risk management, if it's results are available at the time of application. This project promotes 'Awareness, Avoidance, Alleviation and Assistance' when considering pluvial flood management. The OPW National Pluvial Study carried out by HR Wallingford should also be consulted.
- As part of the implementation of the local area plan, Dublin City Council will seek to remove the storm runoff from the combined system. In some cases, this will require new surface water pipes to be constructed. Any development in this area will be expected to manage surface water in accordance with modern sustainable principles to minimise peak flows in the system, for example, green roofs or rainwater harvesting.
- In the longer term Dublin City Council will explore more ambitious flood alleviation measures. After recent flood events in October 2011, which were the equivalent to a 1 in 100 year flood event, a large number of areas flooded due to large volumes of surface water entering the Camac, this led to substantial flooding downstream in the river. One future option to be considered is to introduce a flood relief scheme in Lansdowne Valley Park, which could include removal of the concrete channel from the north section of the river and reinstatement of natural riverbank vegetation or perhaps an area of wetland, which would be allowed to flood in times of increased volume in the river.

Settlement Strategy and Flood Risk

It is the strategy of Dublin City Council in accordance with the Guidelines to reduce the potential risk to people, property and the environment caused by flooding, through a hierarchy of avoidance, followed by substitution of lower vulnerability uses and, only if avoidance and substitution are not possible, reduction and management of the risks through a variety of techniques. Dublin City Council will continue its policy to steer new developments on Greenfield sites to areas with the lowest probability of flooding. Areas with moderate or high risk will require site specific Flood Risk Assessments in any new planning applications, and a subsequent Justification Test.

Conclusions and Recommendations

Until the CFRAMS Study is completed and the flood protection and management options are finalised, the flood maps should only be taken as indicative. All planning applications will be required to submit a site specific flood risk assessment addressing risks from all sources of flooding. All new development will be required to comply with the Greater Dublin Strategic Drainage Study for surface-water management, with possible provision for the High End Future Scenario. This will ensure that there is no increase in flood risk to properties downstream as a result of future development. In addition, in order to mitigate against the effects of flooding to new development, floor levels should be set to recommended levels. It is anticipated that specific recommendations for floor levels may issue from the CFRAMS Study. In the meantime, a precautionary approach should be taken of the 100 year fluvial flood level plus a minimum of 10% increase in rainfall intensity plus 300mm freeboard. An assessment of the effects of existing development within the LAP lands on flood risk to properties downstream will be undertaken, and where possible, recommendations made in relation to possible retrofitting of additional flood storage areas within LAP lands in order to bring existing development in line with current best practice flood management methods. This may result in the creation of areas of multi-functional recreational space within the LAP lands using principles of sustainable drainage design.

Policy Requirements for Naas Road Local Area Plan

The following policies and measures are applicable to all development within the Naas Road LAP.

FRA1 - All planning applications, for proposed development within the LAP area should include a site specific flood risk assessment (FRA)

FRA (a) - Risk to other development

- If the development does not result in increased discharge to foul or surface-water sewers, then it can be confirmed in the FRA that the development does not cause an increased flood risk to other areas. Note that since the publication of the GDSDS, it has been a requirement that surface-water discharge rates are limited to green-field rates for the development, so compliance with this requirement for all pluvial event results in compliance with flood risk management guidelines for surface-water discharge. This requirement is best achieved by properly incorporating SuDS techniques into the development.
- If the development does result in increased discharge rates to sewers, then the developer may be required either to confirm that there is adequate capacity in the local network to cater for the increased flows without surcharge of the system or to propose a flood management solution to cater for the additional flows.

FRA (b) - Risk to the development itself

- The FRA should address risks from all sources, including but not limited to coastal, fluvial and pluvial sources, possible flooding from sewer surcharging and flooding from groundwater.

  i) Incorporating storage within the development to cater for surface-water falling within the development for up to the 100-year pluvial (with climate change factor of a minimum of 10% applied as appropriate).

  ii) Designing floor levels. A precautionary approach should be taken of the 100 year fluvial flood level plus a minimum of 10% increase in rainfall intensity plus 300mm freeboard.

  iii) Designing basements and basement access to prevent ingress of water from groundwater sources or pluvial or fluvial flood events. Reference should be made to the DCC policy on basements as set out in the GDSDS Regional Drainage policy – Volume 6 – Basements.

Appendix 1

Sequential Approach & Justification Test

The key principles of the risk based sequential approach (see Figure 1 below) is managing flood risk in the preparation of plans as set out in Chapter 3 of the DEHLG Flood Guidelines and these principles should be followed in the Naas Road LAP .

This is the key tool in the decision making process of preparing plans to ensure that development is first and foremost directed towards land that is at low risk of flooding. See primary FRA maps at

www.cfram.ie/pfra/interactive-mapping

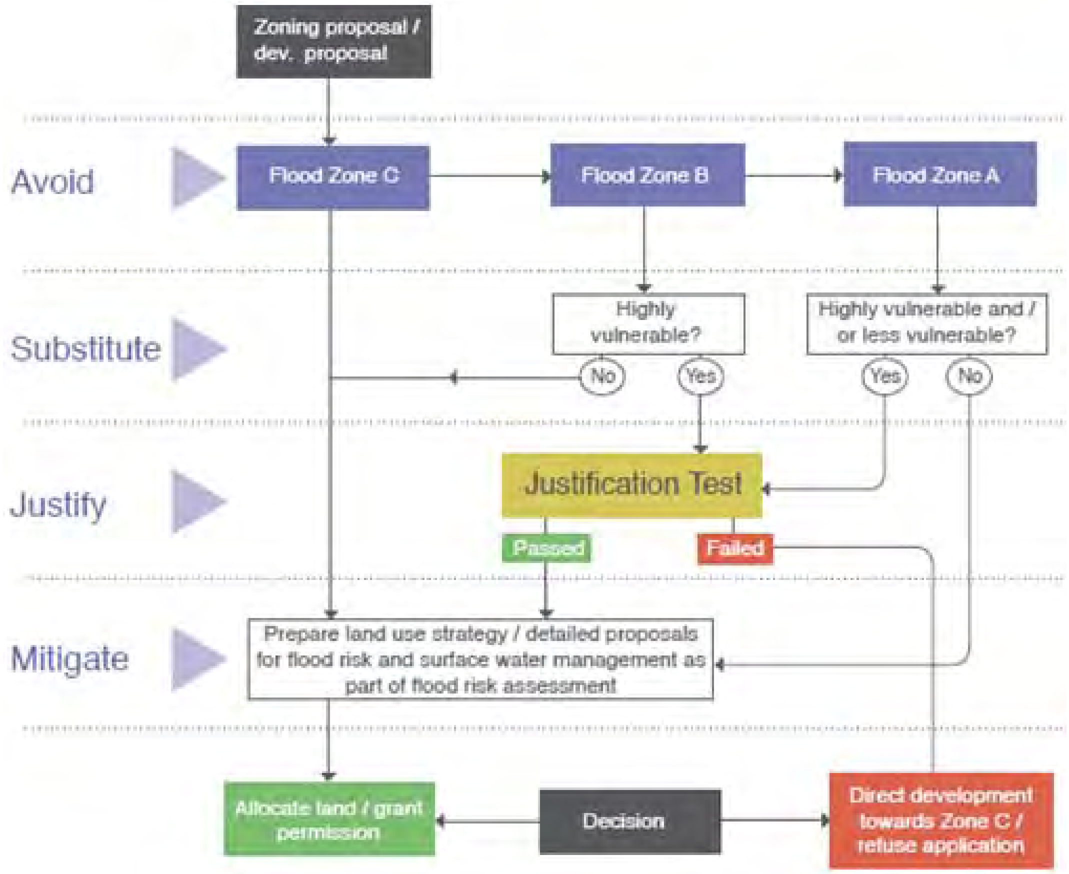
This approach makes use of existing flood risk assessments (FRA's) and of prior identification of flood zones for rivers, coastal flooding and pluvial flooding and classification of the vulnerability of flooding of different types of development.

The sequential approach in terms of flood risk is based on the following principles:

- The primary objective of the sequential approach is that development is primarily directed towards land that is at low risk of flooding (AVOID).
- The next stage is to ensure that the type of development proposed is not especially vulnerable to the adverse impacts of flooding (SUBSTITUTION).
- The Justification Test is designed to rigorously assess the appropriateness, or otherwise, of particular developments that, for various reasons, are being considered in areas of moderate or high flood risk (JUSTIFICATION).
- The test is comprised of two processes, namely The Plan-Making Justification Test and The Development Management Justification Test.

In summary, the planning implications for each of the flood zones are:

Zone A - High probability of flooding. Most types of development would be considered inappropriate in this zone. Development in this zone should be avoided and/or only considered in exceptional circumstances, such as in city and town centres, or in the case of essential infrastructure that cannot be located elsewhere, and where the Justification Test has been applied. Only water-compatible development, such as docks and marinas, dockside activities that require a waterside location, amenity open space, outdoor sports and recreation, would be considered appropriate in this zone.



Zone B - Moderate probability of flooding. Highly vulnerable development, such as hospitals, residential care homes, Garda, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in this zone, unless the requirements of the Justification Test can be met.

Less vulnerable development, such as retail, commercial and industrial uses, sites used for short-let for caravans and camping and secondary strategic transport and utilities infrastructure, and water compatible development might be considered appropriate in this zone.

In general however, less vulnerable development should only be considered in this zone if adequate lands or sites are not available in Zone C and subject to a flood risk assessment to the appropriate level of detail to demonstrate that flood risk to and from the development can or will adequately be managed.

Zone C - Low probability of flooding. Development in this zone is appropriate from a flood risk perspective (subject to assessment of flood hazard from sources other than rivers and the coast) but would need to meet the normal range of other proper planning and sustainable development considerations.

Table 1 classifies the vulnerability of different types of development while

Table 2 identifies the appropriateness of development belonging to each vulnerability class within each of the flood zones as well as identifying what instances in which the Justification Test should be undertaken.

Inappropriate development that does not meet the criteria of the Justification Test should not be considered at the plan-making stage or approved within the development management process

Table 1 Classification of vulnerability of different types of development

Vulnerability Class	Land Uses and Types of Development which include:
Highly Vulnerble Development Including essential infrastructure	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals;Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less Vulnerable Development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water Compatible Development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required in this category (subject to a specific warning and evacuation plan) by uses in this category (subject to a specific warning and evacuation plan).
	• Uses not listed here should be considered on their own merits.

Table 2 – matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test

	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable Development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less Vulnerable Development	Justification Test	Appropriate	Appropriate
Water Compatible Development	Appropriate	Appropriate	Appropriate

The Plan-Making Justification Test

Where, as part of the preparation and adoption of a development / local area plan, a planning authority is considering the future development of areas in an urban settlement that are at moderate or high risk of flooding, for uses or development vulnerable to flooding that would generally be inappropriate as set out in the Guidelines, all of the criteria listed below, as stated in the Guidelines, must be satisfied.

This is referred to as the Justification Test for Development Plans.

(I) The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act 2000, a amended.

(II) The zoning or designation of the lands for the particular use or development type is required to achieve the proper and sustainable planning of the urban settlement and in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement;

(ii) Comprises significant previously developed and/or under-utilised lands;

(iii) Is within or adjoining the core of an established or designated urban settlement;

(iv) Will be essential in achieving compact or sustainable urban growth;

(v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.

(III) A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the development plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.

MITIGATION is the process where the flood risk is reduced to acceptable levels by means of land use strategies or by means of detailed proposals for the management of flood risk and surface water, all as addressed in the Flood Risk Assessment.

The decision to PROCEED should only be taken after the Justification Test has been passed.

Development Management Justification Test

This is used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses vulnerable to flooding that would generally be inappropriate for that land. (as set out in Table 1),The Planning Authority must be satisfied that the development satisfies all the criteria of the Justification Test as it applies to development management .

When considering proposals for development which may be vulnerable to flooding, and that would generally be inappropriate (as set out in Table 2 above) , the following criteria must be satisfied:

1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.
2. The proposal has been subject to an appropriate flood risk assessment that demonstrates
   - (i) The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;
   - (ii) The development proposed includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;
   - (iii) The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design,implementation and funding of any future flood risk management measures and provisions for emergency services access, and
   - (iv) The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes,

The acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.

Note: See section 5.27 (The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009) in relation to major development on zoned lands where sequential approach has not been applied in the operative development plan.

Refer to section 5.26 (The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009) in relation to minor and infill developments.

Appendix 2: Taking in Charge Standards, Open Space Design Guidance and SuDS Guidance

Section 1: Guidelines for Open Space Development and Taking In Charge

How open space areas are managed and maintained after their provision is an important consideration at the design stage, particularly to ensure that public open space can be taken into charge by Dublin City Council successfully.

It is also important that topsoil is recognised as an important on site resource for biodiversity and landscaping. Considering the extent of lands still to be completed for development in the LAP area, a successful open space strategy is dependant on high quality soil being retained and appropriately stored on site for future landscaping purposes.

The Culture, Recreation and Amenity Department of Dublin City Council have produced a set of guidelines called "Guidelines for Open Space Development and Taking in Charge" which provide important information for landscape designers of new public open space.

Some of the important guidance provided, which will benefit open space provision in the LAP area, includes the following:

- Tree surveys should be carried out by a qualified Arboriculturist.
- Landscape works are to be completed before occupation of the development or initial phase of development.
- A detailed survey should be made of existing hedgerows, trees and other natural site characteristics to evaluate their potential for protection and augmentation within landscape proposals.
- Based on the survey information, works proposed to existing hedgerows and trees must be agreed with DCC. Vegetation supporting nests may only be altered between the period of 1st September to the 1ST February each year in the interest of protecting wildlife.
- A two stage consultation with the Parks and Landscape Devision is advised. The first should set out the existing site survey and analysis with the concept plan prior to an application being lodged. The second consultation should include the detailed design (at planning stage).
- For any public open space/streetscape to be taken in charge by the Dublin City Council, landscape submissions shall consider:
    - Landscape plan at an approved scale.
    - Location plan with areas intended to be taken in charge.
    - Sections / elevations.
    - Images
    - Specialist opinions.
    - Landscape maintenance specification.
- The principle of SuDS should be adopted in the treatment of surface water drainage.
- In general the developer will be responsible for the maintenance of the public open space for an 18 month period after the completion of works. At the end of the maintenance period Dublin City Council and landscape consultant will inspect the open space prior to taking in charge.
- As a general rule, areas designated for public open space purposes should be fenced off prior to the commencement of any development works on site and should not be used as site compounds etc.
- All development works should ideally be carried out during summer months under the supervision of the landscape consultant. In general all gradients in grassed areas shall not be greater than 1:4.
- Any excess top soil to be removed from the site is subject to agreement with the Dublin City Council. The developer shall store any top soil to be used in future public open space in accordance with the requirements of the Council. Existing topsoil is to be viewed as a resource to be valued and managed in accordance with Dublin City Council's Biodiversity Action Plan 2008 - 2012.
- Dublin City Council may require testing of material to be used as topsoil on any future public open spaces, at the cost to the developer, to ensure quality control. Any importation of topsoil will be subject to national legislation and Dublin City Council shall be informed of the source of any imported material.
- All areas to be grassed on public open space should be provided with an adequate layer of good quality top soil. A minimum depth of 150mm freely draining soil is required. The finished level of the topsoil shall remain 50mm above adjoining roads and footpaths to allow for settlement.
- All areas to be planted for trees and shrubs shall be provided with a minimum of 300mm depth of topsoil with a minimum depth of 300mm subsoil underneath.
- For street trees, a 600mm depth of topsoil, at a radius of 1m from the base of the tree, should be provided at all street tree planting positions. Street trees should not be planted under or within three metres of street lights.

Section 2: Private and Communal Open Space Design Guidance

Maximising the amenity value of homes and residential schemes is important for quality of life of the residents and in particular to encourage longer term residency. Attracting long term residents to develop the neighbourhood and a strong community, particularly in a new developing area such as the Naas Road Lands, was noted in the public observations as a target for this LAP. Providing good quality amenities for occupants is an important design consideration which will help to encourage a longer term resident base.

The Dublin City Development Plan 2011-2017 provides important guidance for the design of homes and Section 17.9 in particular sets out important quality standards which must be met. Of note for residential developments are the following:

For Apartments

- Where balconies are provided, they should be functional, screened, have a sunny aspect, be wheelchair accessible and allow table and chair seating. The primary balcony should be located adjacent to the main living area.
- Communal open space may include sheltered roof gardens and communal landscaped areas at ground or podium level accessible to all the units it serves.
- The design of communal open space should take into account good passive surveillance, children's play, wheelchair access, good sunlight penetration, appropriate maintenance and management arrangements (including factors of storage and water supply).
- Outside the city centre area , combined private and communal open space provision shall be 12-15 sq.m per bedspace at a minimum.

For Houses

- A standard of 15 sq.m private open space per bedspace will normally be applied.
- At the rear of dwellings, there should be adequate separation (traditionally 22 metres between two storey houses with first floor opposing windows). This distance can be shorter if the design is such that the privacy of adjacent occupiers is preserved.
- The provision of defensible space behind the public footpath by means of a planting strip is important for housing units that address a street with own door access and ground floor windows. In particular where on street parking is provided, a landscaped strip of 2 metres minimum depth should be provided.
- Rear gardens and private garden space should be screened from public areas, provide safe and secure play areas, be overlooked from a living or kitchen area, have robust boundaries and should not back onto roads or public open spaces.

Playgrounds and Children's Play Spaces

Incorporating opportunities for children's play and activity, inclusive of young children and teenagers, is an important consideration for open space design. In particular a network and sequence of different open space character areas can provide opportunities to provide amenities for different age groups. Providing safe routes between different character amenity areas can be very beneficial to encourage active use.

While all open space areas should have flexible design principles to encourage recreation for all ages, making sure that children and teenagers have access to recreational facilities is important for the development of the community, especially in a new developing community.

Section 17.16 of the Dublin City Development Plan 2011-2017 provides some valuable guidance on playgrounds and play spaces which will is valuable for designers creating open space within the LAP area.

Some guiding principles include:

- Play spaces for small children (under 5s) should be close to residential dwellings, safe from traffic, overlooked with housing and frequented streets and footpaths, have both sunny and shaded parts, and be equipped with both natural play elements and play equipment.
- Recreation facilities for older children and teenagers should take into account multi use game areas, teenage shelters, skate parks, meeting places (seating) etc. Such locations should be well positioned within the neighbourhood with good visual prominence and connections to the residential area.

Dublin City Council are creating a Play Plan and accompanying Play Checklist which will provide valuable guidance for designers.

Section 3.0 SuDS Design Guidance

The following general guidance is provided to guide future developments within the LAP area:

Domestic Designs

SuDS measures can have effective outcomes on management of surface water drainage if implemented as part of domestic design. The design of individual houses should take into consideration design features including:

- Roof drainage could incorporate green roofs or drain to a soakaway, permeable paving area or mini detention basin.
- Permeable materials (especially for driveways)
- Cost savings could be made if surface water is recycled for domestic use.

Commercial/Office/Apartment Blocks

Larger schemes will have optimal opportunities to incorporate SuDS measures, particularly where they can be incorporated as part of the site masterplan features. Using the scale of buildings, (roofscapes in particular) can provide good opportunities. Some design considerations would include:

- A 3 stage treatment train , or if there are space restrictions a 2 stage treatment train, would provide an optimal solution.
- Consider a green roof on all or part of the development.
- Consider rainwater harvesting as one stage in the process.

Large Scale Housing Development

The co-ordination of SuDS design measures into an overall integrated system at the masterplanning stage is important and an opportunity to benefit both the scheme and the environment. In particular, the planning and design of roads, open space areas and cumulative impact of roof drainage can be envisaged and co-ordinated.

Some design considerations will include:

- A 3 stage treatment train is optional.
- Roofs and roads could be drained by filter drains, soakaways, swales and detention basins.
- Use of green space and landscaping so that usable amenity space and a drainage function can co-exist.

Some images of SuDS incorporated into residential developments (examples from Finland)

APPENDIX VII

Traffic Impact Assessment

Proposed mixed use, commercial and residential development, Concorde Industrial Estate, Naas Road, Walkinstown, Dublin 12

Traffic Assessment

Client: Development Ocht Limited

Barrett Mahony Consulting Engineers

Dr Martin Rogers
Transport Planning Professional

December 2018

CONTENTS

FIGURES

APPENDIX 1 – TRICS Data

1 BACKGROUND TO PROJECT

It is proposed to construct a mixed use, commercial and residential development on lands within the Concorde Industrial Estate, Naas Road, Walkinstown, Dublin 12

Site location and site layout maps are contained within Figure 1.

Barrett Mahony Consulting Engineers have been appointed by Development Ocht Limited to assess the impact of traffic generated by the proposed development on the local road network.

The development is predominantly residential, and will comprise the construction of 492 No. apartment units.

For the purposes of this traffic assessment, the commercial / mixed use component of the proposed development will be assumed to consist of the following:

- 347 m^2 GFA crèche
- 723 m^2 GFA office space
- 1410 m^2 GFA retail space
- 518 m^2 medical practice

A total car parking provision of 200 No. spaces is planned for the residential element and 38 No. spaces for the commercial / mixed use component.

It is assumed that the development will be fully operational by 2021.

The traffic impact of the proposed development comprises the assessment of its impact on the four following major junctions in the vicinity:

- Naas Road Kylemore Road / Walkinstown Avenue signalised junction (Site No. 1);
- Naas Road / Concorde Industrial Estate signalised junction (Site No. 2);
- Walkinstown Road / Long Mile Road signalised junction (Site No. 3);
- Davitt Road / Tyrconnelll Road / Naas Road signalised junction (Site No. 4).

The location of these surveys are detailed within Figure 2.

Traffic surveys were carried out at the above 4 No. locations on Thursday 18th October 2018.

The traffic assessment within this report will analyse the existing flows on all major links and at the above 4 critical junctions, detail the existing level of operational efficiency at each location, and will also assess the impact that the flows predicted to be generated by the proposal will have on these operational efficiencies.

The analysis within this report is undertaken on the basis of zero growth in network traffic over the period 2018 to 2040 period, consistent with the 'low growth' assumption of 0% for Dublin city as detailed within the 2011 NRA document 'Project Appraisal Guidelines: Unit 5.5 Link-based traffic growth forecasting'.

Section 2 provides details of the receiving environment.

Section 3 details the traffic predicted to be generated by the proposed development. Traffic generated by the planned development in Muirfield Drive is also taken into consideration

Section 4 details the need for a traffic assessment based on the criteria within the 2014 Traffic and Transport Assessment Guidelines.

Section 5 provides an analysis of the post-development of major links and junctions in the vicinity of the proposed development.

Section 6 makes some concluding comments regarding the sustainability of the proposed project in traffic impact terms.

2 THE RECEIVING ENVIRONMENT

The site is located within an urban road network, with the links adjacent to the site carrying significant volumes of traffic into and out of the central business area within Dublin city.

A traffic survey was carried out on Thursday October 18th 2018 over a 12-hour period between 0700 and 1900 at the 4 No. stated junctions.

Junctions outside these 4 No. junctions are not considered of significant relevance as generated traffic will have significantly dissipated by the time it will have reached this wider network

The surveys, combined with the trip generation estimates, indicate that the weekday morning peak occurs between 0800 and 0900 with the evening peak occurring between 1600 and 1700 - these were observed to be the timeframes during which the major links in the vicinity of the subject site will be assumed to be most heavily loaded. The following analysis is based on these peak periods.

The morning and evening peak hour flows incident at the 4 No. junctions were as follows:

Naas Road Kylemore Road / Walkinstown Avenue signalised junction
AM peak hour - 3271 passenger car units
PM peak hour - 3200 passenger car units

Naas Road / Concorde Industrial Estate signalised junction
AM peak hour - 1833 passenger car units
PM peak hour - 1816 passenger car units

Walkinstown Road / Long Mile Road signalised junction
AM peak hour - 3407 passenger car units
PM peak hour - 3071 passenger car units

Davitt Road / Tyrconnelll Road / Naas Road signalised junction
AM peak hour - 2089 passenger car units
PM peak hour - 1997 passenger car units

The results of these surveys are detailed for the morning and evening peak hours in Figures 3 and 4 respectively.

It should be noted that, relative to the surveys completed in 2015 for the Muirfield Drive site, at the Naas Road and Concorde junctions, flows have increased marginally in the morning peak (+4%) and decreased by approximately the same quantity during the evening peak (-4%). At the Davitt Road junction, incident volumes were down by 7% in the morning peak hour and virtually identical within the evening peak hour. At the Long Mile Road junction, flows were down by an average of 5% over both peaks.

The Design Manual for Roads and Bridges document 'TA 79/99 – Traffic Capacity of Urban Roads' provides information on the capacity of urban roads based on classification and road width.

Based on this design standard, the following hourly capacities are assumed the major road links in the vicinity of the subject site:

- Davitt Road - 1020 vehicles/hour
- Naas Road - 1260 vehicles/hour
- Kylemore Road - 1550 vehicles/hour
- Walkinstown Avenue - 1620 vehicles/hour
- Long Mile Road - 1470 vehicles/hour

The above capacities are approximate, given the variability in road widths along their entire length and the difficulty in accurate classification in all cases.

Using both the above estimated capacities and the peak hour link flows for the above link roads, Tables 2-1 and 2-2 contains the existing ratio of flow to capacity for each of the above 5 No. links for the morning and evening peak hours respectively:

Link	Link capacity (vehicles/hr)	AM Peak flow (veh/hr)	Ratio of flow to capacity (RFC)
Davitt Road	1020	648	0.64
Naas Road	1260	1038	0.82
Kylemore Road	1550	727	0.47
Walkinstown Ave	1620	890	0.55
Long Mile Road	1470	1084	0.74

Table 2-1: Existing RFC's on major links in vicinity of proposed development for AM peak hour

Link	Link capacity (vehicles/hr)	PM Peak flow (veh/hr)	Ratio of flow to capacity (RFC)
Davitt Road	1020	687	0.67
Naas Road	1260	1109	0.88
Kylemore Road	1550	676	0.44
Walkinstown Ave	1620	874	0.54
Long Mile Road	1470	999	0.68

Table 2-2: Existing RFC's on major links in vicinity of proposed development for PM peak hour

As detailed above within Tables 2-1 and 2-2, the major links in the vicinity of the proposed development are operating at between 44% and 88% of their estimated capacity, with the Naas Road and Long Mile Road links the most heavily loaded.

3 TRIP GENERATION, DISTRIBUTION AND ASSIGNMENT ANALYSIS FOR PROPOSED DEVELOPMENT

3.1 INTRODUCTION

The traffic impact of the proposed development is derived by assessing the trips generated by the proposal and, taking the day of opening flows on the network, gauging the extent to which the superimposed flows from the proposed development will affect the efficiency of future network flows, particularly their impact on both link flows generally and on the operational efficiency of the 4 No. signalised junctions in its vicinity.

3.2 TRIPS GENERATED BY THE RESIDENTIAL COMPONENT OF THE PROPOSED DEVELOPMENT

It is proposed to construct 492 No apartment units.

TRICS typically gives the following weekday morning and evening peak trip rates for apartments using Irish sites only:

		Weekday AM		Weekday PM	
		IN	OUT	IN	OUT
Apartments	Trips/Unit	0.044	0.186	0.157	0.062

Table 3-1: Peak hour trip rates for apartments within development site

The above TRICS trip rates give rise to the following weekday morning and evening peak trip rates for apartments:

		Weekday AM		Weekday PM	
	Units (No.)	IN	OUT	IN	OUT
Apartments	492	22	92	77	31

Table 3-2: Peak hour flows generated by proposed apartments within development site

3.3 TRIPS GENERATED BY THE COMMERCIAL / MIXED USE COMPONENT OF THE PROPOSED DEVELOPMENT

As stated above, for the purposes of trip generation analysis, the commercial / mixed use component of the proposed development will be assumed to consist of the following:

- 347 m^2 GFA crèche
- 723 m^2 GFA office space
- 1410 m^2 GFA retail space
- 518 m^2 medical practice

TRICS typically gives the following weekday morning and evening peak trip rates for the crèche component:

		Weekday AM		Weekday PM	
		IN	OUT	IN	OUT
Crèche	Trips/100m^2 GFA	3.5	3.3	1.57	1.49

Table 3-3: Peak hour trip rates for crèche component within development site

The above TRICS trip rates give rise to the following weekday morning and evening peak trip rates for the crèche component:

		Weekday AM		Weekday PM	
	GFA (m^2)	IN	OUT	IN	OUT

Crèche	347	12	11	5	5

Table 3-4: Peak hour flows generated for crèche component within development site

TRICS typically gives the following weekday morning and weekday evening peak trip rates for community centre / healthcare developments:

		Weekday AM		Weekday PM	
		IN	OUT	IN	OUT
Office	Trips/100 m^2 GFA	1.1	0.26	0.35	1.14

Table 3-5: Typical peak hour trip rates for car showroom component within development site

The above TRICS trip rates give rise to the following weekday morning and evening peak trip rates for the car showroom component:

		Weekday AM		Weekday PM	
	GFA m^2	IN	OUT	IN	OUT
Office	723	8	2	3	8

Table 3-6: Peak hour flows generated by car showroom component within development site

TRICS typically gives the following weekday morning and weekday evening peak trip rates for local shop developments:

		Weekday AM		Weekday PM	
		IN	OUT	IN	OUT
Retail space	Trips/100 m^2 GFA	3.3	2.9	4.1	4.6

Table 3-7: Typical peak hour trip rates for pharmacy component within development site

The above TRICS trip rates give rise to the following weekday morning and evening peak trip rates for the pharmacy component:

		Weekday AM		Weekday PM	
	GFA m^2	IN	OUT	IN	OUT
Retail space	1410	47	41	58	65

Table 3-8: Peak hour flows generated by car showroom component within development site

TRICS typically gives the following weekday morning and weekday evening peak trip rates for medical centre developments:

		Weekday AM		Weekday PM	
		IN	OUT	IN	OUT
Medical centre / GP	Trips/100 m^2 GFA	2.77	1.19	1.36	2.1

Table 3-9: Typical peak hour trip rates for medical centre component within development site

The above TRICS trip rates give rise to the following weekday morning and evening peak trip rates for the medical centre component:

		Weekday AM		Weekday PM	
	GFA m^2	IN	OUT	IN	OUT
Medical centre / GP	518	14	6	7	11

Table 3-10: Peak hour flows generated by car showroom component within development site

The following are the combined flows generated by the commercial / mixed use component within the subject site for the morning and evening peak:

	Weekday AM		Weekday PM	
	IN	OUT	IN	OUT
Crèche	12	11	5	5
Office	8	2	3	8
Shop space	47	41	58	65
Medical practice	14	6	7	11
Total generated flows	81	60	73	89

Table 3-11: Total flows generated by the commercial / mixed use component of the proposed development

It would be reasonable to assume that a significant proportion of the above trips will be generated by the occupants of the proposed residential component.

This report will assume that up to 25% of the trips detailed within Table 3-11 are generated by the residential component as detailed within Table 3-2, with a further 20%, on average, applied to take account of trips already present on the network (pass-by / diverted trips) and thus not new, additional trips.

Thus, Table 3-12 below details the total flows predicted to be generated by the total proposed development:

	Weekday AM		Weekday PM	
	IN	OUT	IN	OUT
Residential component	22	92	77	31
Commercial / mixed use component	40	35	45	45
Total generated flows	62	127	122	76

Table 3-12: Total flows generated by the commercial / mixed use component of the proposed development

In summary, the proposed development will generate 2 outgoing and 1 incoming trips per minute during the morning peak, with the reverse applying during the evening peak.

In reality, this analysis is overly conservative. In terms of the residential component, the low parking provision will result in generated volumes significantly lower than those predicted within this report. For the commercial / mixed use component, in reality, the vast majority of the generated trips, in all probability greater than the 20% allowed for within this report, are not new trips but will result from vehicles already on the network, i.e. pass-by / diverted trips.

In reality, the generated trips could be significantly less than 50% of the volumes indicated within Table 3-12.

3.4 TRIPS GENERATED BY ADJACENT PERMITTED DEVELOPMENT ON MUIRFIELD DRIVE

The 2015 traffic assessment for the proposed Muirfield Drive development estimated the following generated traffic for the proposed mixed use development:

AM Peak hour:

11 No. vehicles entering, 74 No. vehicles departing

PM peak hour:

39 No. vehicles entering, 14 No. vehicles exiting

These volumes will be added to the development flows estimated for the proposed development at the Concorde site.

3.5 ESIMATION OF TOTAL GENERATED FLOWS ALLOWED FOR WITHIN THE TRAFFIC ASSESSMENT

By combining the estimated traffic generation flows for the proposed development with the flows estimated to be generated by the adjacent Muirfield Drive site, the following morning and evening peak hour trips are derived:

	Weekday AM		Weekday PM	
	IN	OUT	IN	OUT
Concorde site	62	127	122	76
Muirfield site	11	74	39	14
Total volumes	73	201	161	90

Table 3-13: Total flows generated by the commercial / mixed use component of the proposed development

3.6 TRIP DISTRIBUTION

In relation to the distribution of the flows into and out of the proposed roundabout junction at the development entrance, based on existing flows within the general network, the following is assumed:

<u>Morning peak hour</u>

Arrivals

50% of generated flows will arrive from the Naas Road signalised intersection (73 × 0.5 = 36 pcu), with 50% arriving from the Davit Road / Tyrconnell Road junction, (73 × 0.5 = 36 pcu).

The traffic arriving from Davitt Road / Tyrconnell Road is split 50:50 (36 × 0.5 = 18 pcu)

The traffic arriving from Naas Road will be predominantly via Naas Road west (90% = 36 × 0.9 = 32 pcu), with 10% arriving via the Long Mile Road junction (10% = 36 × 0.1 = 4 pcu).

Departures

50% of generated flows will depart towards the Naas Road signalised intersection (201 × 0.5 = 100 pcu), with 50% departing to the Davit Road / Tyrconnell Road junction, (201 × 0.5 = 100 pcu).

The traffic departing to Davitt Road / Tyrconnell Road is split 50:50 (100 × 0.5 = 50 pcu)

The traffic departing to Naas Road will predominantly exit via Naas Road west (90% = 100 × 0.9 = 90 pcu), with 10% exiting via the Long Mile Road junction (10% = 100 × 0.1 = 10 pcu).

<u>Evening peak hour</u>

Arrivals

60% of generated flows will arrive from the Naas Road signalised intersection (161 × 0.6 = 96 pcu), with 40% arriving from the Davit Road / Tyrconnell Road junction, (161 × 0.4 = 64 pcu).

The traffic arriving from Davitt Road / Tyrconnell Road is split 50:50 (64 × 0.5 = 32 pcu)

The traffic arriving from Naas Road will be predominantly via Naas Road west (90% = 96 × 0.9 = 86 pcu), with 10% arriving via the Long Mile Road junction (10% = 96 × 0.1 = 10 pcu).

Departures
50% of generated flows will depart towards the Naas Road signalised intersection (90 × 0.5 = 45 pcu), with 50% departing to the Davit Road / Tyrconnell Road junction, (90 × 0.5 = 45 pcu).

The traffic departing to Davitt Road / Tyrconnell Road is split 50:50 (45 × 0.5 = 22 pcu)

The traffic departing to Naas Road will predominantly exit via Naas Road west (90% = 45 × 0.9 = 40 pcu), with 10% exiting via the Long Mile Road junction (10% = 45 × 0.1 = 5 pcu).

These generated flows and their distribution are detailed for the morning and evening peak hours in Figures 5 and 6 respectively.

3.7 TRIP ASSIGNMENT

The Do-Something scenario for the year of opening is obtained by combining Figures 3 and 5 for the morning peak hour, and Figures 4 and 6 for the evening peak hour.

4 REQUIREMENT FOR A TRAFFIC ASSESSMENT

The 2014 Traffic and Transport Assessment Guidelines requires the impact of the additional traffic volumes on the critical nearby junctions to be assessed in detail if:

- Development flows exceed 10% of existing turning movements at the two relevant junctions;
- Development flows exceed 5% of turning movements if the location has the potential to become congested.

It can be seen from the October 2018 traffic surveys undertaken at 4 No. major junctions in the vicinity of the subject site for the morning and evening peak hours respectively that the incident development flows (including those for the proposed Muirfield Drive project) on each junction as a percentage of total incident flows are as follows:

AM Peak
<u>Naas Road Kylemore Road / Walkinstown Avenue signalised junction</u>
AM peak hour 2-way flow on network - 3271 pcu
AM peak hour 2-way incident generated flows – 136 pcu = 4% increase in network flow

Naas Road / Concorde Industrial Estate signalised junction
AM peak hour 2-way flow on network - 1833 pcu
AM peak hour 2-way incident generated flows - 230 pcu = 12% increase in network flow

Walkinstown Road / Long Mile Road signalised junction
AM peak hour 2-way flow on network - 3407 pcu
AM peak hour 2-way incident generated flows - 14 pcu = 0.4% increase in network flow

Davitt Road / Tyrconnelll Road / Naas Road signalised junction
AM peak hour 2-way flow on network - 2089 pcu
AM peak hour 2-way incident generated flows - 136 pcu = 6% increase in network flow

PM Peak

Naas Road Kylemore Road / Walkinstown Avenue signalised junction
PM peak hour 2-way flow on network - 3200 pcu
PM peak hour 2-way incident generated flows – 141 pcu = 4% increase in network flow

Naas Road / Concorde Industrial Estate signalised junction
PM peak hour 2-way flow on network - 1816 pcu
PM peak hour 2-way incident generated flows - 228 pcu = 12% increase in network flow

Walkinstown Road / Long Mile Road signalised junction
PM peak hour 2-way flow on network - 3071 pcu
PM peak hour 2-way incident generated flows - 15 pcu = 0.5% increase in network flow

Davitt Road / Tyrconnelll Road / Naas Road signalised junction
PM peak hour 2-way flow on network - 1997 pcu
PM peak hour 2-way incident generated flows - 108 pcu = 5% increase in network flow

Given that all three junctions are significantly congested at peak times, and as a result assuming that the 5% threshold applies, then the 2014 Guidelines would require analysis of the traffic impact of the proposal at the development entrance (site No. 2) where increase are in the order of 12%. At the two other junctions on the Naas Road (Site Nos. 1 and 4), the need for an assessment is marginal, as increases are in the 4% to 6% range. Given flow patterns within the network, with generated traffic predicted to enter and exit in a predominantly east-west direction, the impact of the proposal on the Long Mile Road junction (Site No. 3) is very low level.

Furthermore, it must be noted that the trip generation forecasts within this report are very robust and conservative. If trip generation rates for the residential component were reduced to reflect the low parking provision at the subject site, and if trip generation rates for the commercial / mixed use component were reduced to reflect the fact that a significant proportion of these trips, greater than the 15% allowed for within this analysis, are already on the network (pass-by / diverted trips), then Site Nos 1 and 4 would not meet the 5% threshold.

5 TRAFFIC IMPACT ASSESSMENT OF PROPOSED DEVELOPMENT ON LOCAL ROAD NETWORK

5.1 INTRODUCTION

This section analyses the impact of the proposed development on link capacities of Davitt Road, Naas Road, Kylemore Road, Walkinstown Avenue and Long Mile Road.

This section also assesses the impact of the proposed development on the following 4 No. junctions:

- Naas Road Kylemore Road / Walkinstown Avenue signalised junction
- Naas Road / Concorde Industrial Estate signalised junction
- Walkinstown Road / Long Mile Road signalised junction
- Davitt Road / Tyrconnelll Road / Naas Road signalised junction

For the junction analysis, 4 No. scenarios are evaluated:

- Existing flows (AM and PM peak)
- 2021 flows with development in place (AM and PM peak)

The OSCADY programme was used to model the incident peak-hour lows at the signalised junctions.

5.2 LINK CAPACITIES WITH PROPOSED DEVELOPMENT IN PLACE

Using the hourly capacities assumed for the major road links within section 2 of this report for the vicinity of the subject site:

- Davitt Road - 1020 vehicles/hour
- Naas Road - 1260 vehicles/hour
- Kylemore Road - 1550 vehicles/hour
- Walkinstown Avenue - 1620 vehicles/hour
- Long Mile Road - 1470 vehicles/hour

And combining the network flows detailed within section 2 with the development flows as estimated within section 3, Tables 4-1 and 4-2 contain the post development ratios of flow to capacity for each of the above 5 No. links for the morning and evening peak hours respectively:

Link	Link capacity (vehicles/hr)	AM Peak flow (veh/hr)	Ratio of flow to capacity (RFC)
Davitt Road	1020	666	0.65
Naas Road	1260	1106	0.88
Kylemore Road	1550	727	0.47
Walkinstown Ave	1620	894	0.55
Long Mile Road	1470	1084	0.74

Table 5-1: Post development RFC's on major links in0 vicinity of proposed development for AM peak hour

Link	Link capacity (vehicles/hr)	PM Peak flow (veh/hr)	Ratio of flow to capacity (RFC)
Davitt Road	1020	719	0.70
Naas Road	1260	1165	0.92
Kylemore Road	1550	676	0.44
Walkinstown Ave	1620	884	0.55
Long Mile Road	1470	999	0.68

Table 5-2: Post development RFC's on major links in vicinity of proposed development for PM peak hour

As detailed above within Tables 5-1 and 4-2, the major links in the vicinity of the proposed development will operate at between 44% and 92% of their estimated capacity with all accounted for developments in place.

The maximum RFC has thus increased by a maximum of 4% on the existing levels, emphasising the low impact of the proposed development on the local road network. RFC's along Davitt Road are increased by 2% on average over both peak, Naas Road by an average of 5% over both peaks and Walkinstown Avenue by, on average over both peaks, less than 1%.

The proposed development is predicted to have no perceptible impact on the Kylemore Road and Long Mile Road links.

5.3 ANALYSIS OF NAAS ROAD/ KYLEMORE ROAD / WALKINSTOWN AVENUE SIGNALISED JUNCTION

5.3.1 Geometric parameters

For the junction in question, the following geometric characteristics apply:

Kylemore Road (Arm A)
3 No. lanes, inside lane for left-turning traffic only, outside lane and inner lane for straight-ahead only, all assumed to be 3.0 metres wide.

Naas Road East (Arm B)
4 No. lanes, inside lane for left-turning traffic only, outside lane for right-turning, and two inner lanes for straight-ahead only, all assumed to be 3.0 metres wide.

Walkinstown Avenue (Arm C)
2 No. lanes, outside lane for right-turning and straight-ahead traffic, inside lane for straight-ahead and left-turning, both assumed to be 3.0 metres wide.

Naas Road West (Arm D)
3 No. lanes, inside lane for left-turning traffic only, outside lane for right-turning, and inner lane for straight-ahead only, all assumed to be 3.0 metres wide.

5.3.2 Signal timings and phasing

A basic 3-phase signal cycle is in place at the junction, as observed within the October 2018 survey, configured as follows:

Phase 1
All northbound and southbound traffic (Arms A and C) from Kylemore Road and Walkinstown Avenue approaches have priority. All other traffic is stopped

Phase 2
All eastbound and westbound straight-ahead and left-turning traffic (Arms B and D) from Naas Road (east and west) approaches have priority. All other traffic is stopped.

Phase 3
All eastbound and westbound right-turning traffic (Arms B and D) from Naas Road (east and west) approaches have priority. All other traffic is stopped.

Times allocated to each phase will vary. However, in general, based on the observations during the traffic survey in October 2018, the following timings have been used for the morning and evening peaks within this analysis:

Morning Peak
Phase 1: 30 seconds
Phase 2: 80 seconds
Phase 3: 15 seconds

Total cycle time = 140 seconds, including an Intergreen Period set at 5 seconds for each of the 3 phases – total intergreen = 15 seconds)

Evening Peak
Phase 1: 45 seconds
Phase 2: 27 seconds
Phase 3: 15 seconds
Total cycle time = 102 seconds, including an Intergreen Period set at 5 seconds for each of the 3 phases – total intergreen = 15 seconds)

While this set of timings would appear upon inspection not to be optimised, the above timings have been used within this report to mirror the existing reality as closely as possible.

5.3.3 Analysis of existing AM and PM peak hour flows

Tables 5-3 and 5-4 immediately below detail the flows, capacities, RFC's and queue lengths for the existing morning and evening peaks:

	Morning peak hour 2018 (existing flows)			
0800-0815	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Kylemore Rd left-turning	0.64	5.52	0.12	2
Kylemore Rd straight	10.09	15.41	0.66	10
Naas Rd (E) left-turning	2.43	14.29	0.17	3
Naas Rd (E) straight	14.21	39.88	0.36	7
Naas Rd (E) right-turning	0.69	3.11	0.22	2
Walkinstown Av left-str-right	10.60	10.41	1.01	15
Naas Rd (W) left-turning	3.05	14.29	0.21	3
Naas Rd (W) straight	13.16	19.94	0.66	14
Naas Rd (W) right-turning	2.86	3.11	0.92	9
0815-0830	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Kylemore Rd left-turning	0.28	5.52	0.06	1
Kylemore Rd straight	9.05	15.41	0.67	9
Naas Rd (E) left-turning	1.83	14.29	0.26	2
Naas Rd (E) straight	13.78	39.88	0.37	7
Naas Rd (E) right-turning	1.00	3.11	0.12	2
Walkinstown Av left-str-right	10.60	9.78	1.00	21
Naas Rd (W) left-turning	2.38	14.29	0.16	3
Naas Rd (W) straight	10.47	19.94	0.56	11
Naas Rd (W) right-turning	3.01	3.11	0.94	11
0830-0845	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Kylemore Rd left-turning	0.32	5.52	0.06	1
Kylemore Rd straight	10.28	15.41	0.67	10
Naas Rd (E) left-turning	3.76	14.29	0.26	4
Naas Rd (E) straight	14.66	39.88	0.37	8
Naas Rd (E) right-turning	0.38	3.11	0.12	1
Walkinstown Av left-str-right	10.40	10.34	1.00	23
Naas Rd (W) left-turning	2.28	14.29	0.16	3
Naas Rd (W) straight	11.06	19.94	0.56	12
Naas Rd (W) right-turning	2.93	3.11	0.94	12
0845-0900	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Kylemore Rd left-turning	0.61	5.52	0.11	2
Kylemore Rd straight	8.12	15.41	0.53	8
Naas Rd (E) left-turning	1.97	14.29	0.14	2
Naas Rd (E) straight	12.79	39.88	0.32	7
Naas Rd (E) right-turning	1.64	3.11	0.53	4
Walkinstown Av left-str-right	10.40	9.98	1.04	26
Naas Rd (W) left-turning	1.95	14.29	0.14	2
Naas Rd (W) straight	10.74	19.94	0.54	11
Naas Rd (W) right-turning	3.58	3.11	1.15	20

Table 5-3: Ratios of flow to capacity and queue lengths for each 15-minute interval during the weekday morning peak hour for existing 2018 flows

	Evening peak hour 2018 (existing flows)			
1600-1615	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Kylemore Rd left-turning	0.48	11.19	0.04	1
Kylemore Rd straight	11.46	31.23	0.37	6
Naas Rd (E) left-turning	1.06	6.86	0.16	2
Naas Rd (E) straight	15.96	19.14	0.83	11
Naas Rd (E) right-turning	0.71	4.26	0.17	1
Walkinstown Av left-str-right	10.53	21.28	0.50	5
Naas Rd (W) left-turning	1.99	6.86	0.29	3
Naas Rd (W) straight	9.29	9.57	0.97	19
Naas Rd (W) right-turning	1.99	4.26	0.47	4
1615-1630	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Kylemore Rd left-turning	0.36	11.19	0.03	1
Kylemore Rd straight	11.70	31.23	0.38	6
Naas Rd (E) left-turning	1.77	6.86	0.26	3
Naas Rd (E) straight	17.70	19.14	0.93	14
Naas Rd (E) right-turning	0.20	4.26	0.05	1
Walkinstown Av left-str-right	8.73	21.17	0.41	5
Naas Rd (W) left-turning	2.62	6.86	0.38	4
Naas Rd (W) straight	11.32	9.57	1.18	46
Naas Rd (W) right-turning	2.46	4.26	0.58	4
1630-1645	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Kylemore Rd left-turning	0.63	11.19	0.06	1
Kylemore Rd straight	12.03	31.23	0.39	6
Naas Rd (E) left-turning	1.47	6.86	0.22	2
Naas Rd (E) straight	16.38	19.14	0.86	12
Naas Rd (E) right-turning	0.55	4.26	0.13	1
Walkinstown Av left-str-right	10.13	20.53	0.49	5
Naas Rd (W) left-turning	1.63	6.86	0.24	2
Naas Rd (W) straight	8.65	9.57	0.90	35
Naas Rd (W) right-turning	2.26	4.26	0.53	4
1645-1700	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Kylemore Rd left-turning	0.48	11.19	0.04	1
Kylemore Rd straight	11.58	31.23	0.37	6
Naas Rd (E) left-turning	1.45	6.86	0.21	2
Naas Rd (E) straight	15.96	19.14	0.83	12
Naas Rd (E) right-turning	0.73	4.26	0.17	2
Walkinstown Av left-str-right	8.67	22.02	0.39	5
Naas Rd (W) left-turning	1.83	6.86	0.27	3
Naas Rd (W) straight	9.85	9.57	1.03	40
Naas Rd (W) right-turning	2.39	4.26	0.56	4

Table 5-4: Ratios of flow to capacity and queue lengths for each 15-minute interval during the weekday evening peak hour for existing 2018 flows

It can be seen that the junction is quite heavily loaded within both the morning and evening peaks, with the Naas Road (West) link most heavily loaded during both peaks.

Queuing is significant on all approaches, most significantly on the Naas Road (West) approach)

5.3.4 Analysis of 2021 AM and PM peak hour flows with development in place (Do-something scenarios)

Tables 5-5 and 5-6 immediately below detail the flows, capacities, RFC's and queue lengths for the 2021 morning and evening peaks with the development in place (year of opening with development in place):

	Morning peak hour 2021 (development in place)			
0800-0815	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Kylemore Rd left-turning	0.64	5.52	0.12	2
Kylemore Rd straight	10.09	15.41	0.66	10
Naas Rd (E) left-turning	2.53	14.29	0.18	3
Naas Rd (E) straight	14.81	39.88	0.37	8
Naas Rd (E) right-turning	0.72	3.11	0.23	2
Walkinstown Av left-str-right	10.73	10.10	1.06	17
Naas Rd (W) left-turning	2.87	14.29	0.20	3
Naas Rd (W) straight	14.53	19.94	0.73	16
Naas Rd (W) right-turning	3.07	3.11	0.99	11
0815-0830	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Kylemore Rd left-turning	0.28	5.52	0.05	1
Kylemore Rd straight	9.05	15.41	0.59	9
Naas Rd (E) left-turning	1.91	14.29	0.13	2
Naas Rd (E) straight	14.39	39.88	0.36	8
Naas Rd (E) right-turning	1.04	3.11	0.34	3
Walkinstown Av left-str-right	10.73	9.51	1.12	26
Naas Rd (W) left-turning	2.42	14.29	0.17	3
Naas Rd (W) straight	11.91	19.94	0.60	13
Naas Rd (W) right-turning	2.94	3.11	0.95	12
0830-0845	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Kylemore Rd left-turning	0.32	5.52	0.06	1
Kylemore Rd straight	10.28	15.41	0.67	10
Naas Rd (E) left-turning	3.71	14.29	0.26	4
Naas Rd (E) straight	15.24	39.88	0.38	8
Naas Rd (E) right-turning	0.59	3.11	0.19	2
Walkinstown Av left-str-right	10.40	10.03	1.04	30
Naas Rd (W) left-turning	2.44	14.29	0.17	3
Naas Rd (W) straight	13.30	19.94	0.67	14
Naas Rd (W) right-turning	3.00	3.11	0.96	13
0845-0900	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Kylemore Rd left-turning	0.61	5.52	0.11	2
Kylemore Rd straight	8.12	15.41	0.53	8
Naas Rd (E) left-turning	2.06	14.29	0.14	2
Naas Rd (E) straight	13.54	39.88	0.34	7
Naas Rd (E) right-turning	1.54	3.11	0.50	4
Walkinstown Av left-str-right	10.53	9.76	1.08	35
Naas Rd (W) left-turning	1.95	14.29	0.14	2
Naas Rd (W) straight	12.06	19.94	0.61	13
Naas Rd (W) right-turning	3.72	3.11	1.20	23

Table 5-5: Ratios of flow to capacity and queue lengths for each 15-minute interval during the weekday morning peak hour for 2021 flows with development in place

	Evening peak hour 2021 (development in place)			
1600-1615	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Kylemore Rd left-turning	0.84	11.19	0.08	1
Kylemore Rd straight	11.10	31.23	0.36	6
Naas Rd (E) left-turning	1.16	6.86	0.17	2
Naas Rd (E) straight	17.46	19.14	0.91	13
Naas Rd (E) right-turning	0.78	4.26	0.18	2
Walkinstown Av left-str-right	10.60	21.53	0.49	5
Naas Rd (W) left-turning	2.07	6.86	0.30	3
Naas Rd (W) straight	9.94	9.57	1.04	24
Naas Rd (W) right-turning	1.79	4.26	0.42	3
1615-1630	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Kylemore Rd left-turning	0.36	11.19	0.03	1
Kylemore Rd straight	11.70	31.23	0.38	6
Naas Rd (E) left-turning	1.92	6.86	0.28	3
Naas Rd (E) straight	19.20	19.14	1.00	19
Naas Rd (E) right-turning	0.21	4.26	0.05	1
Walkinstown Av left-str-right	8.80	20.88	0.42	5
Naas Rd (W) left-turning	2.71	6.86	0.40	4
Naas Rd (W) straight	11.68	9.57	1.22	56
Naas Rd (W) right-turning	2.54	4.26	0.60	5
1630-1645	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Kylemore Rd left-turning	0.63	11.19	0.06	1
Kylemore Rd straight	12.03	31.23	0.39	6
Naas Rd (E) left-turning	1.61	6.86	0.23	2
Naas Rd (E) straight	17.86	19.14	0.93	17
Naas Rd (E) right-turning	0.60	4.26	0.14	1
Walkinstown Av left-str-right	10.20	20.24	0.50	5
Naas Rd (W) left-turning	1.57	6.86	0.23	2
Naas Rd (W) straight	9.15	9.57	0.96	51
Naas Rd (W) right-turning	2.35	4.26	0.55	4
1645-1700	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Kylemore Rd left-turning	0.48	11.19	0.04	1
Kylemore Rd straight	11.58	31.23	0.37	6
Naas Rd (E) left-turning	1.58	6.86	0.23	2
Naas Rd (E) straight	17.42	19.14	0.91	14
Naas Rd (E) right-turning	0.79	4.26	0.19	2
Walkinstown Av left-str-right	8.73	22.02	0.40	5
Naas Rd (W) left-turning	1.75	6.86	0.26	3
Naas Rd (W) straight	10.37	9.57	1.08	64
Naas Rd (W) right-turning	2.48	4.26	0.58	4

Table 5-6: Ratios of flow to capacity and queue lengths for each 15-minute interval during the weekday evening peak hour for 2021 flows with development in place

It can be seen that, with the development in place, the junction remains quite heavily loaded within both the morning and evening peaks, with the Naas Road (West) link remaining the most heavily loaded during both peaks.

Queuing remains significant on all approaches, most significantly on the Naas Road (West) approach) where queuing has increased most.

5.4 ANALYSIS OF NAAS ROAD / CONCORDE INDUSTRIAL ESTATE SIGNALISED JUNCTION

5.4.1 Geometric parameters

For the junction in question, the following geometric characteristics apply:

Naas Road (East) (Arm A)
3 No. lanes, inside lane for left-turning traffic only, outside lane for right-turning only, and inner lane for straight-ahead only, all assumed to be 3.0 metres wide.

Concorde Industrial Estate (Arm B)
2 No. lanes, inside lane for left-turning traffic only, outside lane for right-turning, both assumed to be 2.25 metres wide.

Naas Road (West) (Arm C)
2 No. lanes, outside lane for right-turning only, inside lane for straight-ahead only, both assumed to be 3.0 metres wide.

5.4.2 Signal timings and phasing

A basic 3-phase signal cycle is in place at the junction, as observed within the October 2018 survey, configured as follows:

Phase 1
All eastbound and westbound straight-ahead and left-turning traffic movements (Arms A and C) from Naas Road (E) and (W) have priority. All other traffic is stopped.

Phase 2
Eastbound straight-ahead and right-turning traffic (Arm C) from Naas Road (W) approach have priority. All other traffic is stopped.

Phase 3
All outbound exiting movements from Concorde Industrial estate have priority (Arm B). All other traffic is stopped.

A vehicle actuated intersection has been assumed, with a maximum cycle time of 120 seconds

5.4.3 Analysis of existing AM and PM peak hour flows

Tables 5-7 and 5-8 immediately below detail the flows, capacities, RFC's and queue lengths for the existing morning and evening peaks:

	Morning peak hour 2018 (existing flows)			
0800-0815	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Naas Rd (E) left-turning	0.00	19.23	0.00	0
Naas Rd (E) straight	17.33	53.75	0.32	4
Concorde left + right-turning	0.07	1.40	0.05	1
Naas Rd (W) straight	14.47	27.59	0.52	4
Naas Rd (W) right-turning	0.00	1.39	0.00	0
0815-0830	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Naas Rd (E) left-turning	0.00	19.23	0.00	0
Naas Rd (E) straight	16.40	53.75	0.31	4
Concorde left + right-turning	0.33	1.40	0.24	1
Naas Rd (W) straight	11.96	27.59	0.43	3
Naas Rd (W) right-turning	0.37	1.39	0.27	1
0830-0845	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Naas Rd (E) left-turning	0.00	19.23	0.00	0
Naas Rd (E) straight	18.80	53.75	0.35	4
Concorde left + right-turning	0.07	1.40	0.05	1
Naas Rd (W) straight	12.42	27.59	0.45	3
Naas Rd (W) right-turning	0.52	1.39	0.37	2
0845-0900	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Naas Rd (E) left-turning	0.33	17.59	0.02	1
Naas Rd (E) straight	16.33	49.17	0.33	4
Concorde left + right-turning	0.20	1.76	0.11	1
Naas Rd (W) straight	11.65	26.69	0.44	3
Naas Rd (W) right-turning	1.01	2.22	0.46	2

Table 5-7: Ratios of flow to capacity and queue lengths for each 15-minute interval during the weekday morning peak hour for existing 2018 flows

	Evening peak hour 2018 (existing flows)			
1600-1615	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Naas Rd (E) left-turning	0.36	19.23	0.02	1
Naas Rd (E) straight	17.51	53.75	0.33	4
Concorde left + right-turning	0.2	1.27	0.16	1
Naas Rd (W) straight	11.48	27.59	0.42	3
Naas Rd (W) right-turning	0.12	1.39	0.08	1
1615-1630	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Naas Rd (E) left-turning	0.20	19.23	0.01	1
Naas Rd (E) straight	19.47	53.75	0.36	4
Concorde left + right-turning	0.27	1.27	0.21	1
Naas Rd (W) straight	12.41	27.59	0.45	3
Naas Rd (W) right-turning	0.25	1.39	0.18	1
1630-1645	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Naas Rd (E) left-turning	0.00	7.96	0.00	1
Naas Rd (E) straight	18.20	53.75	0.34	4
Concorde left + right-turning	0.20	1.27	0.16	1
Naas Rd (W) straight	10.78	27.59	0.39	3
Naas Rd (W) right-turning	0.22	1.39	0.16	1
1645-1600	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Naas Rd (E) left-turning	0.00	18.24	0.00	0
Naas Rd (E) straight	17.53	50.99	0.34	4
Concorde left + right-turning	0.60	1.54	0.39	2
Naas Rd (W) straight	10.88	26.85	0.41	3
Naas Rd (W) right-turning	0.45	1.69	0.27	1

Table 5-8: Ratios of flow to capacity and queue lengths for each 15-minute interval during the weekday evening peak hour for existing 2018 flows

It can be seen that the junction is not heavily loaded within both the morning and evening peaks, as traffic exiting the industrial estate is very at very low levels.

Queuing is low on all approaches.

5.4.4 Analysis of 2021 AM and PM peak hour flows with development in place (Do-something scenarios)

Tables 5-9 and 5-10 immediately below detail the flows, capacities, RFC's and queue lengths for the 2021 morning and evening peaks with the development in place (year of opening with development in place):

	Morning peak hour 2021 (development in place)			
0800-0815	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Naas Rd (E) left-turning	0.55	15.31	0.04	1
Naas Rd (E) straight	17.91	43.33	0.41	4
Concorde left-turning	1.14	2.34	0.49	2
Concorde right-turning	1.06	2.52	0.42	2
Naas Rd (W) straight	14.46	24.66	0.59	4
Naas Rd (W) right-turning	0.60	2.56	0.24	1
0815-0830	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Naas Rd (E) left-turning	0.53	14.53	0.04	0
Naas Rd (E) straight	17.01	41.13	0.41	4
Concorde left-turning	1.34	2.57	0.52	2
Concorde right-turning	1.06	2.76	0.38	2
Naas Rd (W) straight	12.55	24.07	0.52	4
Naas Rd (W) right-turning	0.39	2.78	0.14	1
0830-0845	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Naas Rd (E) left-turning	0.60	14.74	0.04	1
Naas Rd (E) straight	19.34	41.73	0.46	4
Concorde left-turning	1.14	2.49	0.46	2
Concorde right-turning	1.06	2.68	0.39	2
Naas Rd (W) straight	12.45	24.24	0.51	4
Naas Rd (W) right-turning	1.08	2.73	0.40	2
0845-0900	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Naas Rd (E) left-turning	0.89	13.41	0.07	1
Naas Rd (E) straight	16.91	37.96	0.45	4
Concorde left-turning	1.14	2.86	0.40	2
Concorde right-turning	1.19	3.08	0.39	2
Naas Rd (W) straight	11.81	23.24	0.51	3
Naas Rd (W) right-turning	1.46	3.12	0.47	2

Table 5-9: Ratios of flow to capacity and queue lengths for each 15-minute interval during the weekday morning peak hour for 2021 with development in place

	Evening peak hour 2021 (development in place)			
1600-1615	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Naas Rd (E) left-turning	1.13	14.96	0.08	1
Naas Rd (E) straight	17.67	41.83	0.42	4
Concorde left-turning	0.84	2.43	0.34	1
Concorde right-turning	0.63	2.62	0.24	1
Naas Rd (W) straight	11.88	24.40	0.49	3
Naas Rd (W) right-turning	1.32	2.66	0.50	2
1615-1630	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Naas Rd (E) left-turning	1.03	15.12	0.07	1
Naas Rd (E) straight	19.57	42.26	0.46	4
Concorde left-turning	0.90	2.36	0.38	1
Concorde right-turning	0.63	2.55	0.25	1
Naas Rd (W) straight	12.84	24.59	0.52	4
Naas Rd (W) right-turning	1.43	2.69	0.53	2
1630-1645	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Naas Rd (E) left-turning	0.77	14.85	0.05	0
Naas Rd (E) straight	18.37	41.50	0.44	4
Concorde left-turning	0.84	2.47	0.34	1
Concorde right-turning	0.63	2.65	0.24	1
Naas Rd (W) straight	11.21	24.32	0.46	3
Naas Rd (W) right-turning	1.39	2.70	0.51	2
1645-1600	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Naas Rd (E) left-turning	0.74	13.46	0.06	1
Naas Rd (E) straight	17.73	37.63	0.47	4
Concorde left-turning	1.23	2.83	0.44	2
Concorde right-turning	0.63	3.05	0.21	1
Naas Rd (W) straight	11.21	23.32	0.48	3
Naas Rd (W) right-turning	1.39	3.15	0.53	2

Table 5-10: Ratios of flow to capacity and queue lengths for each 15-minute interval during the weekday evening peak hour for 2021 with development in place

It can be seen that the junction remains lightly loaded within both the morning and evening peaks, with the generated traffic increasing queues marginally.

The junction is predicted to operate efficiently at all times with the development in place.

5.5 ANALYSIS OF WALKINSTOWN ROAD / LONG MILE ROAD SIGNALISED JUNCTION

5.5.1 Geometric parameters

For the junction in question, the following geometric characteristics apply:

Walkinstown Avenue North (Arm A)
3 No. lanes, inside lane for left-turning traffic only, outside lane for right-turn only and inner lane for straight-ahead only, all assumed to be 3.0 metres wide.

Long Mile Road East (Arm B)
3 No. lanes, inside lane for left-turning traffic only, outside lane for right-turning, and inner lane for straight-ahead only, all assumed to be 3.0 metres wide.

Walkinstown Avenue South (Arm C)
2 No. lanes, outside lane for right-turning and straight-ahead traffic, inside lane for straight-ahead and left-turning, both assumed to be 3.0 metres wide.

Long Mile Road West (Arm D)
3 No. lanes, inside lane for left-turning traffic only, outside lane for right-turning only, and inner lane for straight-ahead only, all assumed to be 3.0 metres wide.

5.5.2 Signal timings and phasing

A basic 4-phase signal cycle is in place at the junction, as observed within the October 2018 survey, configured as follows:

Phase 1
All southbound traffic (Arm A) from Walkinstown Avenue (N) has priority. All other traffic is stopped
Phase 2
All unopposed straight-ahead and left-turning northbound and southbound traffic (Arms A and C) along Walkinstown Avenue (north and south) approaches have priority. All other traffic is stopped

Phase 3
All eastbound and westbound straight-ahead and left-turning traffic (Arms B and D) from Long Mile Road (east and west) approaches have priority. All other traffic is stopped.

Phase 3
All eastbound and westbound right-turning traffic (Arms B and D) from the Long Mile Road (east and west) approaches have priority. All other traffic is stopped.

Times allocated to each phase will vary. However, in general, based on the observations during the traffic survey in October 2018, the following timings have been used for the morning and evening peaks within this analysis:

Morning and Evening Peaks
Phase 1: 15 seconds
Phase 2: 35 seconds
Phase 3: 45 seconds

Phase 4: 20 seconds

Total cycle time = 135 seconds, including an Intergreen Period set at 5 seconds for each of the 4 phases – total intergreen = 20 seconds)

While this set of timings would appear upon inspection not to be optimised, the above timings have been used within this report to mirror the existing reality as closely as possible.

5.5.3 Analysis of existing AM and PM peak hour flows

Tables 5-11 and 5-12 immediately below detail the flows, capacities, RFC's and queue lengths for the existing morning and evening peaks:

	Morning peak hour 2018 (existing flows)			
0800-0815	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Walkinstown Ave (N) left-turning	4.65	10.28	0.45	7
Walkinstown Ave (N) straight	6.69	14.33	0.47	9
Walkinstown Ave (N) left-turning	3.20	3.22	0.99	11
Long Mile Rd (E) left-turning	1.06	8.46	0.13	2
Long Mile Rd (E) straight	10.74	11.80	0.91	20
Long Mile Rd (E) right-turning	3.33	4.20	0.79	8
Walkinstown Ave (S) left-str-right	10.93	14.19	0.77	10
Long Mile Rd (W) left-turning	1.85	8.46	0.22	3
Long Mile Rd (W) straight	8.58	11.80	0.81	17
Long Mile Rd (W) right-turning	5.38	4.20	1.28	28
0815-0830	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Walkinstown Ave (N) left-turning	4.99	10.28	0.49	7
Walkinstown Ave (N) straight	5.36	14.33	0.37	8
Walkinstown Ave (N) left-turning	2.12	3.22	0.66	5
Long Mile Rd (E) left-turning	0.48	8.46	0.06	1
Long Mile Rd (E) straight	13.22	11.80	1.12	45
Long Mile Rd (E) right-turning	2.23	4.20	0.53	5
Walkinstown Ave (S) left-str-right	9.87	14.20	0.70	9
Long Mile Rd (W) left-turning	1.75	8.46	0.21	3
Long Mile Rd (W) straight	11.57	11.80	0.98	26
Long Mile Rd (W) right-turning	4.21	4.20	1.00	29
0830-0845	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Walkinstown Ave (N) left-turning	5.97	10.28	0.58	8
Walkinstown Ave (N) straight	6.45	14.33	0.45	9
Walkinstown Ave (N) left-turning	3.71	3.22	1.15	17
Long Mile Rd (E) left-turning	0.86	8.46	0.10	2
Long Mile Rd (E) straight	10.84	11.80	0.92	35
Long Mile Rd (E) right-turning	2.57	4.20	0.61	6
Walkinstown Ave (S) left-str-right	10.73	12.40	0.87	11
Long Mile Rd (W) left-turning	1.79	8.46	0.21	3
Long Mile Rd (W) straight	11.43	11.80	0.97	27
Long Mile Rd (W) right-turning	4.65	4.20	1.11	36
0845-0900	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Walkinstown Ave (N) left-turning	4.68	10.28	0.46	7
Walkinstown Ave (N) straight	5.20	14.33	0.36	7
Walkinstown Ave (N) left-turning	3.12	3.22	0.97	17
Long Mile Rd (E) left-turning	0.79	8.46	0.09	2
Long Mile Rd (E) straight	11.85	11.80	1.00	38
Long Mile Rd (E) right-turning	3.16	4.20	0.75	8
Walkinstown Ave (S) left-str-right	10.13	13.92	0.73	9
Long Mile Rd (W) left-turning	3.84	8.46	0.45	6
Long Mile Rd (W) straight	8.64	11.80	0.73	14
Long Mile Rd (W) right-turning	3.52	4.20	0.84	27

Table 5-11: Ratios of flow to capacity and queue lengths for each 15-minute interval during the weekday morning peak hour for existing 2018 flows

	Evening peak hour 2018 (existing flows)			
1600-1615	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Walkinstown Ave (N) left-turning	2.42	10.28	0.24	4
Walkinstown Ave (N) straight	5.65	14.33	0.39	8
Walkinstown Ave (N) left-turning	3.46	3.22	1.08	14
Long Mile Rd (E) left-turning	1.55	8.46	0.18	3
Long Mile Rd (E) straight	11.74	11.80	0.99	27
Long Mile Rd (E) right-turning	3.97	4.20	0.95	12
Walkinstown Ave (S) left-str-right	8.33	12.74	0.65	8
Long Mile Rd (W) left-turning	2.90	8.46	0.34	5
Long Mile Rd (W) straight	8.70	11.80	0.74	14
Long Mile Rd (W) right-turning	3.66	4.20	0.87	10
1615-1630	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Walkinstown Ave (N) left-turning	4.38	10.28	0.43	6
Walkinstown Ave (N) straight	6.28	14.33	0.44	9
Walkinstown Ave (N) left-turning	3.94	3.22	1.22	25
Long Mile Rd (E) left-turning	1.43	8.46	0.17	3
Long Mile Rd (E) straight	9.62	11.80	0.82	17
Long Mile Rd (E) right-turning	1.95	4.20	0.47	4
Walkinstown Ave (S) left-str-right	8.80	11.94	0.74	8
Long Mile Rd (W) left-turning	2.17	8.46	0.26	4
Long Mile Rd (W) straight	10.17	11.80	0.86	18
Long Mile Rd (W) right-turning	4.33	4.20	1.03	16
1630-1645	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Walkinstown Ave (N) left-turning	2.73	10.28	0.27	4
Walkinstown Ave (N) straight	7.02	14.33	0.49	10
Walkinstown Ave (N) left-turning	3.25	3.22	1.01	26
Long Mile Rd (E) left-turning	1.40	8.46	0.17	3
Long Mile Rd (E) straight	5.70	11.80	0.49	9
Long Mile Rd (E) right-turning	2.90	4.20	0.69	7
Walkinstown Ave (S) left-str-right	7.27	12.80	0.57	7
Long Mile Rd (W) left-turning	3.49	8.46	0.41	6
Long Mile Rd (W) straight	9.08	11.80	0.77	15
Long Mile Rd (W) right-turning	4.89	4.20	1.17	27
1645-1700	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Walkinstown Ave (N) left-turning	3.71	10.28	0.36	5
Walkinstown Ave (N) straight	7.70	14.33	0.54	11
Walkinstown Ave (N) left-turning	2.85	3.22	0.89	22
Long Mile Rd (E) left-turning	1.91	8.46	0.23	3
Long Mile Rd (E) straight	5.19	11.80	0.44	8
Long Mile Rd (E) right-turning	3.50	4.20	0.84	9
Walkinstown Ave (S) left-str-right	9.53	11.46	0.83	9
Long Mile Rd (W) left-turning	2.75	8.46	0.33	5
Long Mile Rd (W) straight	10.84	11.80	0.92	21
Long Mile Rd (W) right-turning	3.61	4.20	0.86	20

Table 5-12: Ratios of flow to capacity and queue lengths for each 15-minute interval during the weekday evening peak hour for existing 2018 flows

It can be seen that the junction is heavily loaded within both the morning and evening peaks.

Queuing is significant on all approaches.

5.5.4 Analysis of 2021 AM and PM peak hour flows with development in place (Do-something scenarios)

Tables 5-13 and 5-14 immediately below detail the flows, capacities, RFC's and queue lengths for the 2021 morning and evening peaks with the development in place (year of opening with development in place):

	Morning peak hour 2021 (development in place)			
0800-0815	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Walkinstown Ave (N) left-turning	4.71	10.28	0.46	7
Walkinstown Ave (N) straight	6.78	14.33	0.47	10
Walkinstown Ave (N) left-turning	3.24	3.22	1.00	12
Long Mile Rd (E) left-turning	1.06	8.46	0.13	2
Long Mile Rd (E) straight	10.74	11.80	0.91	20
Long Mile Rd (E) right-turning	3.33	4.20	0.79	8
Walkinstown Ave (S) left-str-right	11.00	14.19	0.78	10
Long Mile Rd (W) left-turning	1.85	8.46	0.22	3
Long Mile Rd (W) straight	9.58	11.80	0.81	17
Long Mile Rd (W) right-turning	5.38	4.20	1.28	28
0815-0830	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Walkinstown Ave (N) left-turning	5.07	10.28	0.49	7
Walkinstown Ave (N) straight	5.45	14.33	0.38	8
Walkinstown Ave (N) left-turning	2.15	3.22	0.67	6
Long Mile Rd (E) left-turning	0.48	8.46	0.06	1
Long Mile Rd (E) straight	13.22	11.80	1.12	45
Long Mile Rd (E) right-turning	2.23	4.20	0.53	5
Walkinstown Ave (S) left-str-right	9.93	14.20	0.70	9
Long Mile Rd (W) left-turning	1.75	8.46	0.21	3
Long Mile Rd (W) straight	11.57	11.80	0.98	26
Long Mile Rd (W) right-turning	4.21	4.20	1.00	29
0830-0845	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Walkinstown Ave (N) left-turning	6.02	10.28	0.59	9
Walkinstown Ave (N) straight	6.51	14.33	0.45	9
Walkinstown Ave (N) left-turning	3.74	3.22	1.16	17
Long Mile Rd (E) left-turning	0.86	8.46	0.10	2
Long Mile Rd (E) straight	10.84	11.80	0.92	35
Long Mile Rd (E) right-turning	2.57	4.20	0.61	6
Walkinstown Ave (S) left-str-right	10.80	12.40	0.87	11
Long Mile Rd (W) left-turning	1.79	8.46	0.21	3
Long Mile Rd (W) straight	11.43	11.80	0.97	27
Long Mile Rd (W) right-turning	4.65	4.20	1.11	36
0845-0900	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Walkinstown Ave (N) left-turning	4.73	10.28	0.46	7
Walkinstown Ave (N) straight	5.25	14.33	0.37	7
Walkinstown Ave (N) left-turning	3.15	3.22	0.98	18
Long Mile Rd (E) left-turning	0.79	8.46	0.09	2
Long Mile Rd (E) straight	11.85	11.80	1.00	38
Long Mile Rd (E) right-turning	3.16	4.20	0.75	8
Walkinstown Ave (S) left-str-right	10.20	13.92	0.73	9
Long Mile Rd (W) left-turning	3.84	8.46	0.45	6
Long Mile Rd (W) straight	8.64	11.80	0.73	14
Long Mile Rd (W) right-turning	3.52	4.20	0.84	27

Table 5-13: Ratios of flow to capacity and queue lengths for each 15-minute interval during the weekday morning peak hour for 2021 flows with development in place

	Evening peak hour 2021 (development in place)			
1600-1615	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Walkinstown Ave (N) left-turning	2.45	10.28	0.24	4
Walkinstown Ave (N) straight	5.72	14.33	0.40	8
Walkinstown Ave (N) left-turning	3.50	3.22	1.09	14
Long Mile Rd (E) left-turning	1.55	8.46	0.18	3
Long Mile Rd (E) straight	11.74	11.80	0.99	27
Long Mile Rd (E) right-turning	3.97	4.20	0.95	12
Walkinstown Ave (S) left-str-right	8.53	12.74	0.67	8
Long Mile Rd (W) left-turning	2.90	8.46	0.34	5
Long Mile Rd (W) straight	8.70	11.80	0.74	14
Long Mile Rd (W) right-turning	3.66	4.20	0.87	10
1615-1630	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Walkinstown Ave (N) left-turning	4.40	10.28	0.43	6
Walkinstown Ave (N) straight	6.31	14.33	0.44	9
Walkinstown Ave (N) left-turning	3.96	3.22	1.23	26
Long Mile Rd (E) left-turning	1.43	8.46	0.17	3
Long Mile Rd (E) straight	9.62	11.80	0.82	17
Long Mile Rd (E) right-turning	1.95	4.20	0.47	4
Walkinstown Ave (S) left-str-right	9.00	11.94	0.76	9
Long Mile Rd (W) left-turning	2.17	8.46	0.26	4
Long Mile Rd (W) straight	10.17	11.80	0.86	18
Long Mile Rd (W) right-turning	4.33	4.20	1.03	16
1630-1645	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Walkinstown Ave (N) left-turning	2.74	10.28	0.27	4
Walkinstown Ave (N) straight	7.06	14.33	0.49	10
Walkinstown Ave (N) left-turning	3.27	3.22	1.01	27
Long Mile Rd (E) left-turning	1.40	8.46	0.17	3
Long Mile Rd (E) straight	5.70	11.80	0.49	9
Long Mile Rd (E) right-turning	2.90	4.20	0.69	7
Walkinstown Ave (S) left-str-right	7.47	12.80	0.58	7
Long Mile Rd (W) left-turning	3.49	8.46	0.41	6
Long Mile Rd (W) straight	9.08	11.80	0.77	15
Long Mile Rd (W) right-turning	4.89	4.20	1.17	27
1645-1700	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Walkinstown Ave (N) left-turning	3.73	10.28	0.36	5
Walkinstown Ave (N) straight	7.74	14.33	0.54	11
Walkinstown Ave (N) left-turning	2.87	3.22	0.89	23
Long Mile Rd (E) left-turning	1.91	8.46	0.23	3
Long Mile Rd (E) straight	5.19	11.80	0.44	8
Long Mile Rd (E) right-turning	3.50	4.20	0.83	9
Walkinstown Ave (S) left-str-right	9.67	11.46	0.85	10
Long Mile Rd (W) left-turning	2.75	8.46	0.33	5
Long Mile Rd (W) straight	10.84	11.80	0.92	21
Long Mile Rd (W) right-turning	3.61	4.20	0.86	20

Table 5-14: Ratios of flow to capacity and queue lengths for each 15-minute interval during the weekday evening peak hour for 2021 flows with development in place

It can be seen that, with the development in place, the junction remains heavily loaded within both the morning and evening peaks, however, the increases in RFC's and queuing is imperceptible given the very small increases in incident flow due to development volumes.

Queuing, however, remains significant on all approaches.

5.6 ANALYSIS OF DAVITT ROAD / TYRCONNELLL ROAD / NAAS ROAD SIGNALISED JUNCTION

5.6.1 Geometric parameters

For the junction in question, the following geometric characteristics apply:

Tyrconnell Road (Arm A)
2 No. lanes, inside lane for left-turning traffic only, outside lane for right-turning only, and inner lane for straight-ahead only, all assumed to be 3.0 metres wide.

Davitt Road (Arm B)
2 No. lanes, inside lane for left-turning traffic only, outside lane for right-turning, both assumed to be 2.25 metres wide.

Naas Road (Arm C)
2 No. lanes, outside lane for right-turning only, inside lane for straight-ahead only, both assumed to be 3.0 metres wide.

5.6.2 Signal timings and phasing

The sequencing at this junction is quite erratic. There is a basic 3-phase cycle, but it is interspersed by a combination on three other phases which, at peak times, would appear to occur quite randomly.

In order to allow the junction to be modelled, the basic 3-phase sequence was used in combination with a fourth phase which caters only for LUAS movement, during which, effectively, very little vehicular movement takes place.

The results for the existing situation using this 4-phase cycle provided queue lengths reasonably similar to those observed during the site survey.

The basic 4-phase signal cycle assumed for the junction is thus as follows:

Phase 1

All traffic movements exiting Davitt Road (Arm B) onto Naas Road / Tyrconnell Road have priority. All other traffic is stopped.

Phase 2

All left-turning movements exiting Davitt Road (Arm A) and all right-turning movements exiting Naas Road (Arm C) have priority. All other movements are stopped.

Phase 3

All traffic movements exiting Tyrconnell Road (Arm A) onto Naas Road / Davitt Road have priority, along with straight-ahead traffic exiting Naas Road (Arm C) onto Tyrconnell Road. All other traffic is stopped.

Phase 4

No traffic movement takes place

The following timings have been used for the morning and evening peaks within this analysis:

Morning Peak

Phase 1: 15 seconds
Phase 2: 35 seconds
Phase 3: 35 seconds
Phase 4: 20 seconds

Total cycle time = 125 seconds, including an Intergreen Period set at 5 seconds for each of the 4 phases – total intergreen = 20 seconds)

Evening Peak

Phase 1: 15 seconds
Phase 2: 35 seconds
Phase 3: 30 seconds
Phase 4: 20 seconds

Total cycle time = 120 seconds, including an Intergreen Period set at 5 seconds for each of the 4 phases – total intergreen = 20 seconds)

5.6.3 Analysis of existing AM and PM peak hour flows

Tables 5-15 and 5-16 immediately below detail the flows, capacities, RFC's and queue lengths for the existing morning and evening peaks:

	Morning peak hour 2018 (existing flows)			
0800-0815	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Tyrconnell Rd (E) left-turning	1.25	6.69	0.19	2
Tyrconnell Rd (E) straight	10.15	9.36	1.08	31
Davitt Rd left -turning	8.37	10.52	0.80	12
Davitt Rd right -turning	1.36	3.08	0.44	3
Naas Rd straight	9.33	8.70	1.07	28
Naas Rd right-turning	4.81	7.20	0.67	8
0815-0830	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Tyrconnell Rd (E) left-turning	2.13	6.69	0.32	4
Tyrconnell Rd (E) straight	8.53	9.36	0.91	23
Davitt Rd left -turning	8.55	10.52	0.81	12
Davitt Rd right -turning	2.85	3.08	0.93	9
Naas Rd straight	7.85	8.70	0.90	20
Naas Rd right-turning	4.42	7.20	0.61	8
0830-0845	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Tyrconnell Rd (E) left-turning	1.37	6.69	0.21	3
Tyrconnell Rd (E) straight	7.76	9.36	0.83	15
Davitt Rd left -turning	8.71	10.52	0.83	13
Davitt Rd right -turning	2.75	3.08	0.89	9
Naas Rd straight	8.30	8.70	0.95	21
Naas Rd right-turning	5.30	7.20	0.74	10
0845-0900	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Tyrconnell Rd (E) left-turning	1.94	6.69	0.29	3
Tyrconnell Rd (E) straight	8.26	9.36	0.88	16
Davitt Rd left -turning	8.80	10.52	0.84	13
Davitt Rd right -turning	1.80	3.08	0.58	4
Naas Rd straight	9.26	8.70	1.06	32
Naas Rd right-turning	5.67	7.20	0.79	11

Table 5-15: Ratios of flow to capacity and queue lengths for each 15-minute interval during the weekday morning peak hour for existing 2018 flows

	Evening peak hour 2018 (existing flows)			
1600-1615	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Tyrconnell Rd (E) left-turning	0.91	6.28	0.14	2
Tyrconnell Rd (E) straight	9.16	8.77	1.04	25
Davitt Rd left -turning	9.24	11.26	0.82	12
Davitt Rd right -turning	1.89	3.53	0.54	4
Naas Rd straight	7.82	8.16	0.96	18
Naas Rd right-turning	3.85	7.82	0.49	6
1615-1630	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Tyrconnell Rd (E) left-turning	1.35	6.28	0.22	2
Tyrconnell Rd (E) straight	9.05	8.77	1.03	31
Davitt Rd left -turning	8.60	11.26	0.76	11
Davitt Rd right -turning	1.40	3.53	0.40	3
Naas Rd straight	8.75	8.16	1.07	29
Naas Rd right-turning	4.31	7.82	0.55	7
1630-1645	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Tyrconnell Rd (E) left-turning	1.53	6.28	0.24	3
Tyrconnell Rd (E) straight	10.21	8.77	1.16	53
Davitt Rd left -turning	8.75	11.26	0.78	11
Davitt Rd right -turning	1.92	3.53	0.54	4
Naas Rd straight	5.80	8.16	0.71	12
Naas Rd right-turning	3.26	7.82	0.42	5
1645-1700	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Tyrconnell Rd (E) left-turning	1.50	6.28	0.24	3
Tyrconnell Rd (E) straight	6.83	8.77	0.78	26
Davitt Rd left –turning	11.25	11.26	1.00	22
Davitt Rd right –turning	2.81	3.53	0.80	7
Naas Rd straight	8.36	8.16	1.03	22
Naas Rd right-turning	4.70	7.82	0.60	8

Table 5-16: Ratios of flow to capacity and queue lengths for each 15-minute interval during the weekday evening peak hour for existing 2018 flows

At present, all approaches operate at close to capacity if not in excess of it during both peak hours.

Queuing is significant during both peak periods.

5.6.4 Analysis of 2021 AM and PM peak hour flows with development in place (Do-something scenarios)

Tables 5-17 and 5-18 immediately below detail the flows, capacities, RFC's and queue lengths for the 2021 morning and evening peaks with the development in place (year of opening with development in place):

	Morning peak hour 2021 (development in place)			
0800-0815	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Tyrconnell Rd (E) left-turning	1.75	6.69	0.26	3
Tyrconnell Rd (E) straight	10.78	9.36	1.15	39
Davitt Rd left -turning	9.37	10.52	0.89	15
Davitt Rd right -turning	2.49	3.08	0.81	7
Naas Rd straight	9.43	8.70	1.08	29
Naas Rd right-turning	5.30	7.20	0.74	10
0815-0830	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Tyrconnell Rd (E) left-turning	2.71	6.69	0.41	5
Tyrconnell Rd (E) straight	9.09	9.36	0.97	39
Davitt Rd left -turning	9.61	10.52	0.91	16
Davitt Rd right -turning	3.92	3.08	1.27	21
Naas Rd straight	7.98	8.70	0.92	22
Naas Rd right-turning	4.89	7.20	0.68	9
0830-0845	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Tyrconnell Rd (E) left-turning	1.85	6.69	0.28	3
Tyrconnell Rd (E) straight	8.42	9.36	0.90	28
Davitt Rd left -turning	9.74	10.52	0.93	17
Davitt Rd right -turning	3.79	3.08	1.23	32
Naas Rd straight	8.38	8.70	0.96	23
Naas Rd right-turning	5.82	7.20	0.81	11
0845-0900	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** (-)	**Max queue** (veh/lane)
Tyrconnell Rd (E) left-turning	2.49	6.69	0.37	4
Tyrconnell Rd (E) straight	8.84	9.36	0.95	27
Davitt Rd left -turning	9.75	10.52	0.93	18
Davitt Rd right -turning	2.91	3.08	0.94	31
Naas Rd straight	9.32	8.70	1.07	34
Naas Rd right-turning	6.21	7.20	0.86	12

Table 5-17: Ratios of flow to capacity and queue lengths for each 15-minute interval during the weekday morning peak hour for 2021 flows with the development in place

	Evening peak hour 2021 (development in place)			
1600-1615	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Tyrconnell Rd (E) left-turning	1.76	6.28	0.28	3
Tyrconnell Rd (E) straight	9.24	8.77	1.05	26
Davitt Rd left -turning	9.80	11.26	0.87	14
Davitt Rd right -turning	2.60	3.53	0.74	6
Naas Rd straight	6.90	8.16	0.85	13
Naas Rd right-turning	6.37	7.82	0.81	11
1615-1630	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Tyrconnell Rd (E) left-turning	2.27	6.28	0.36	4
Tyrconnell Rd (E) straight	9.07	8.77	1.03	32
Davitt Rd left -turning	9.24	11.26	0.82	13
Davitt Rd right -turning	2.03	3.53	0.57	4
Naas Rd straight	9.24	8.16	1.13	33
Naas Rd right-turning	5.43	7.82	0.69	9
1630-1645	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Tyrconnell Rd (E) left-turning	2.28	6.28	0.36	4
Tyrconnell Rd (E) straight	10.39	8.77	1.18	57
Davitt Rd left -turning	9.43	11.26	0.84	13
Davitt Rd right -turning	2.51	3.53	0.71	6
Naas Rd straight	6.19	8.16	0.76	13
Naas Rd right-turning	4.48	7.82	0.57	7
1645-1700	**Flow** (veh/min)	**Cap.** (veh/min)	**RFC** **(-)**	**Max queue** (veh/lane)
Tyrconnell Rd (E) left-turning	2.32	6.28	0.37	4
Tyrconnell Rd (E) straight	6.95	8.77	0.79	31
Davitt Rd left –turning	11.81	11.26	1.05	28
Davitt Rd right –turning	3.53	3.53	1.00	12
Naas Rd straight	8.80	8.16	1.08	27
Naas Rd right-turning	5.87	7.82	0.75	10

Table 5-18: Ratios of flow to capacity and queue lengths for each 15-minute interval during the weekday evening peak hour for 2021 flows with the development in place

On the day of opening of the proposed development in 2021, all approaches will continue to operate at close to capacity if not in excess of it during both peak hours.

While queuing remains significant during both peak periods, the increases resulting from the predicted development flows are not significant (the predicted development flows amount to a 2-way flow of approximately 2 vehicles per minute during both peaks).

6 OVERALL CONCLUSIONS REGARDING SUSTAINABILITY OF PROPOSED MIXED USE, COMMERCIAL AND RESIDENTIAL DEVELOPMENT IN TRANSPORTATION TERMS

This report demonstrates that the existing road network in the vicinity of the proposed development is busy and congested at peak times.

It is demonstrated that the volume of trips predicted to be generated by the proposal will be at low levels, and will not have a significant impact on major road junctions adjacent to the subject site.

The congested nature of the network, and the proximity of the LUAS Red line are significant arguments for a low provision of car parking at the subject site for the residential component of the proposed development. Technical support for these arguments are contained within other submitted documents.

In relation to the mixed use and commercial component of the proposed development, as stated earlier within this report, it is highly likely that trips attracted to these facilities are not new trips but already exist on the network. Entering and exiting trips in this case will thus be pass-by trips by commuters availing of these facilities before they complete their onward journey. The actual proportion of pass-by trips is probably far greater than assumed within this report.

In relation to the residential component of the proposed development, the low parking provision will result in high public transport and soft mode usage by residents at peak times on the network. Mobility measures outlined within the accompanying Parking and Mobility Report will help ensure the promotion of more sustainable modes of transport for residents at the subject site.

In overall terms, therefore, based on the analysis within this report, and given the mitigating facts listed immediately above, it is predicted that the proposal will have limited impact in transportation terms, and will constitute a wholly sustainable development.

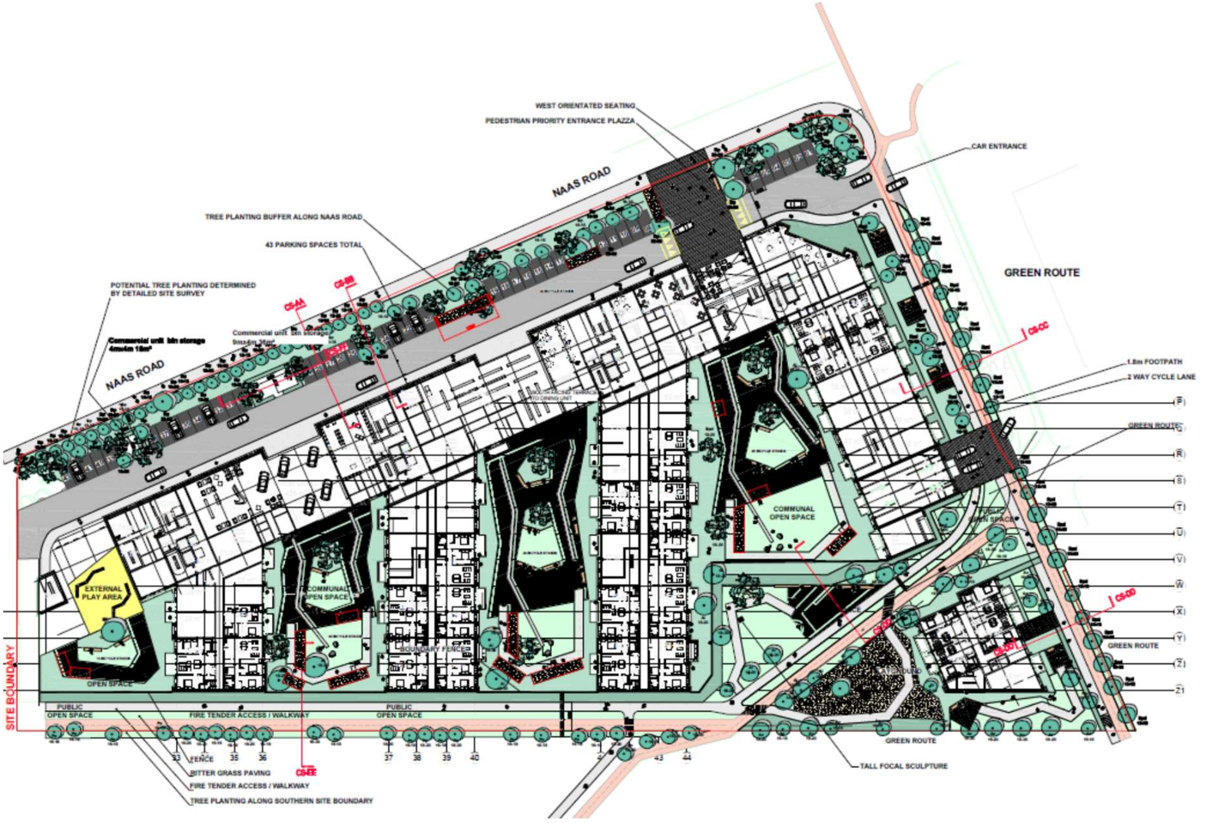


Figure 1: Site location and site layout for proposed development

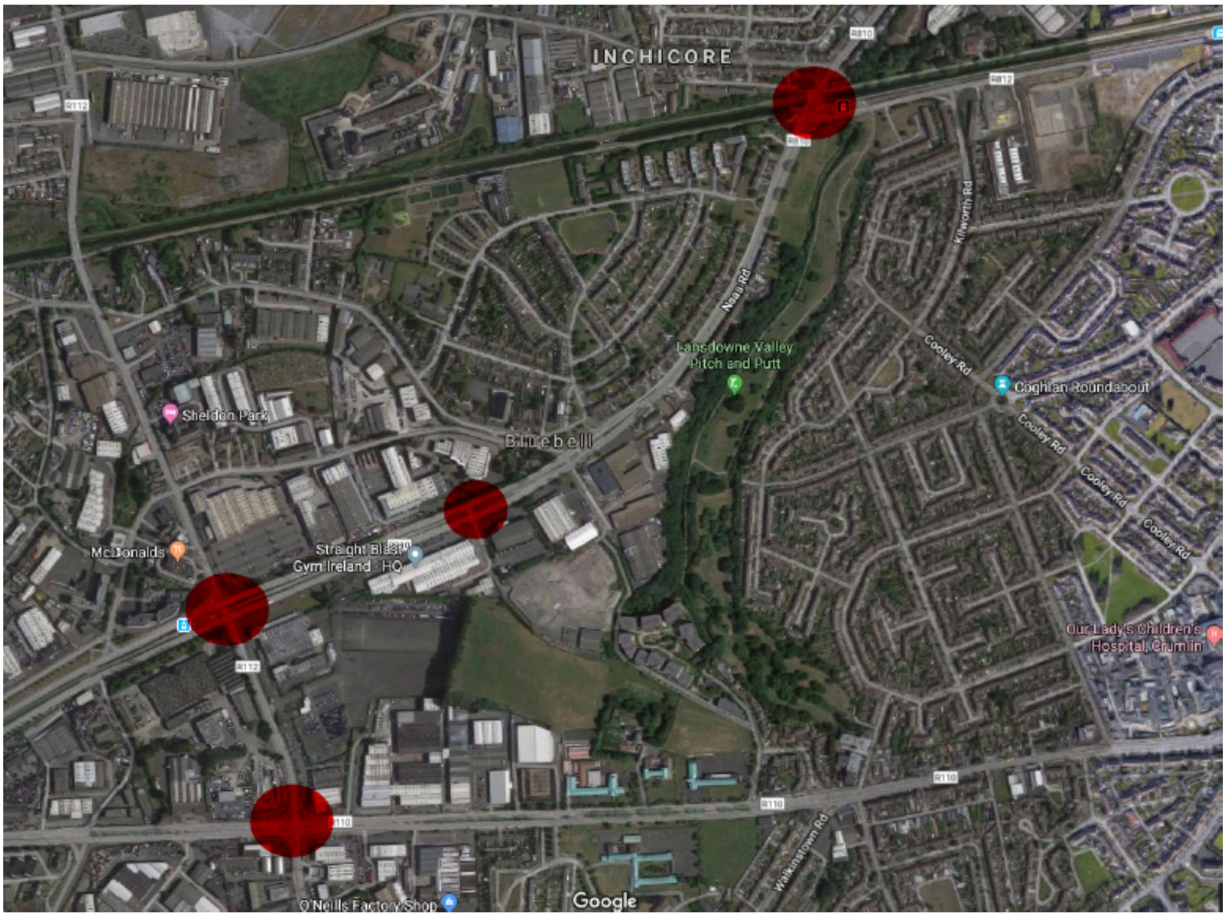


Figure 2: Location of traffic surveys

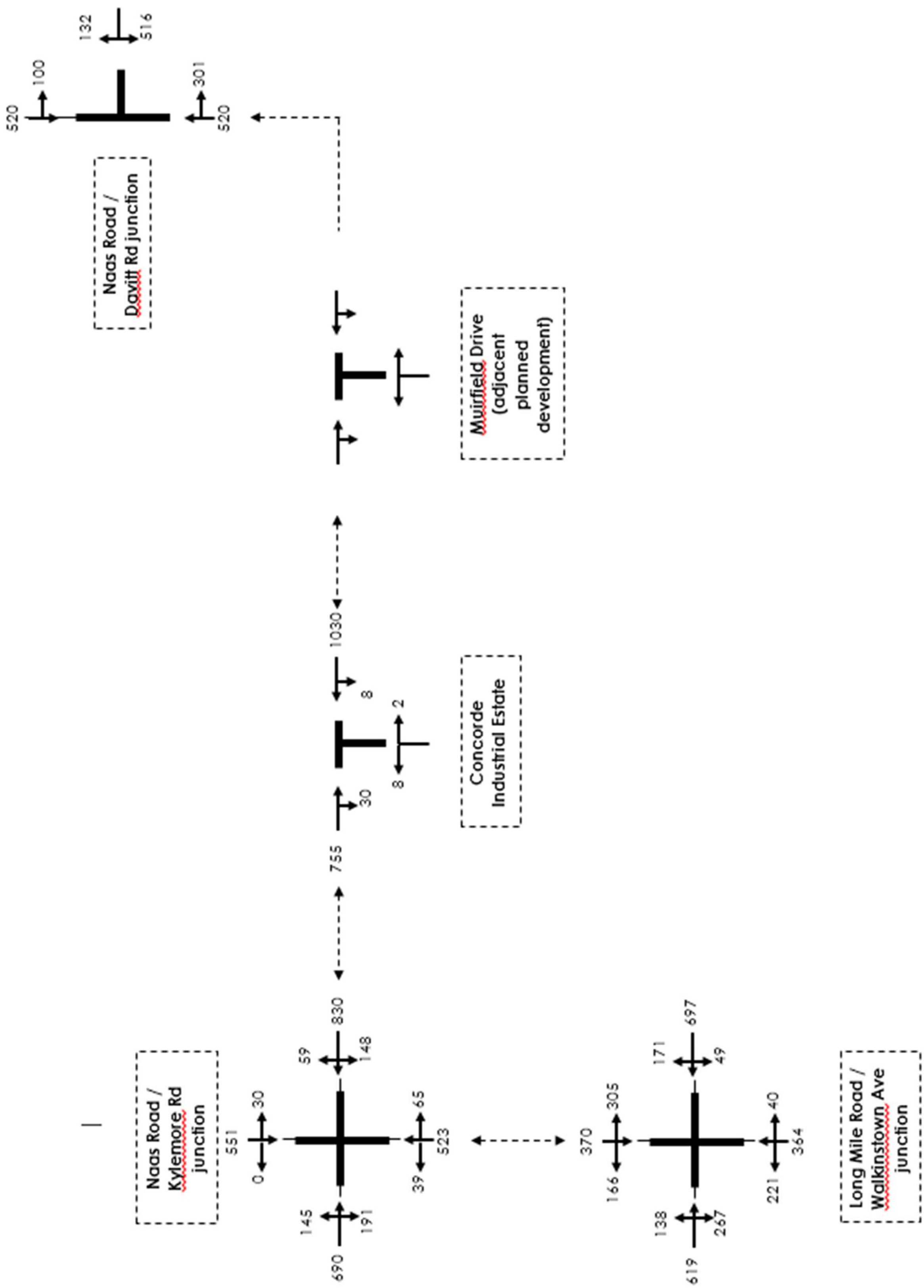


Figure 3: Existing AM Peak Flows (also assumed as 2021 opening day flows without development in place)

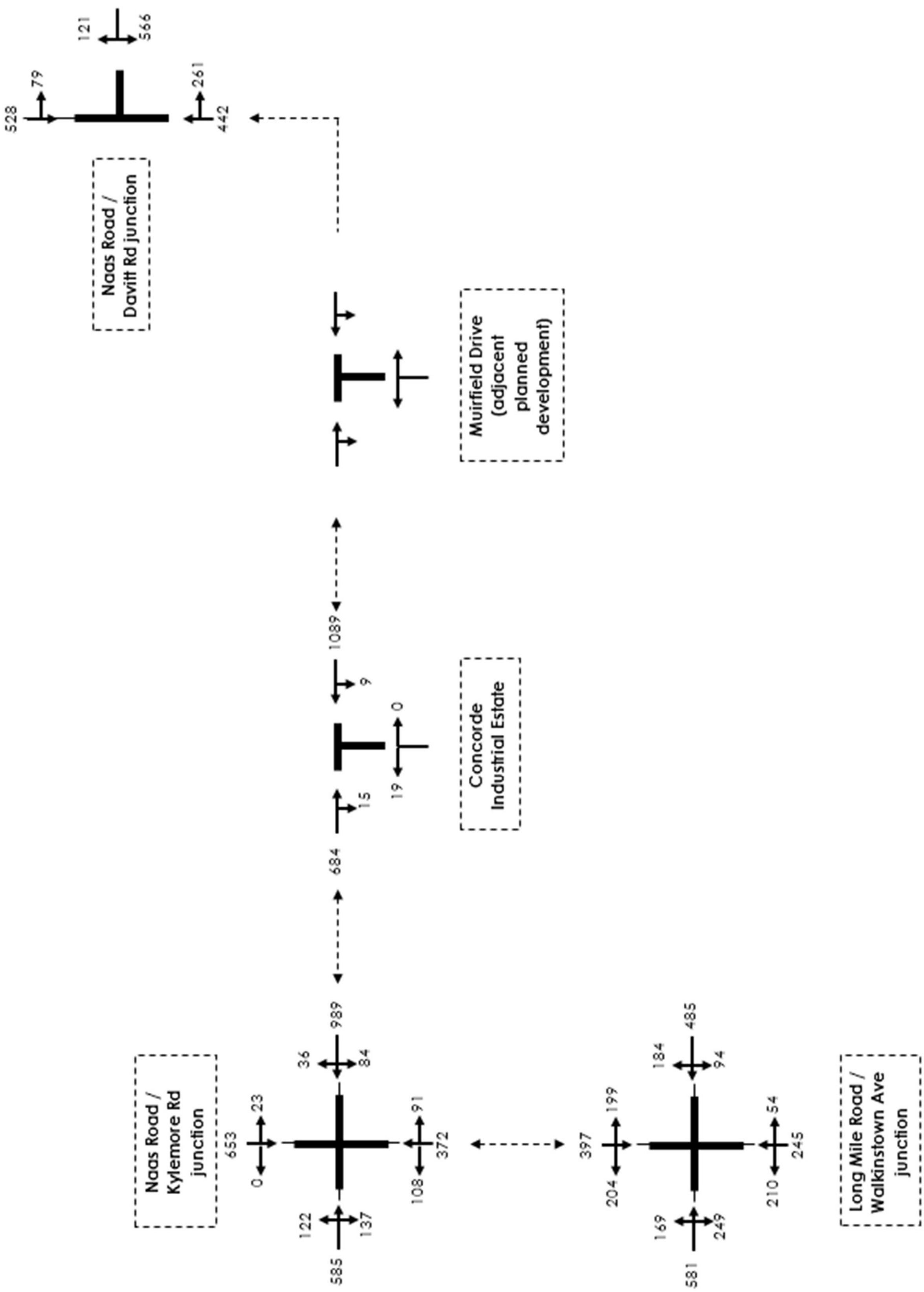


Figure 4: Existing PM Peak Flows (also assumed as 2021 opening day flows without development in place)

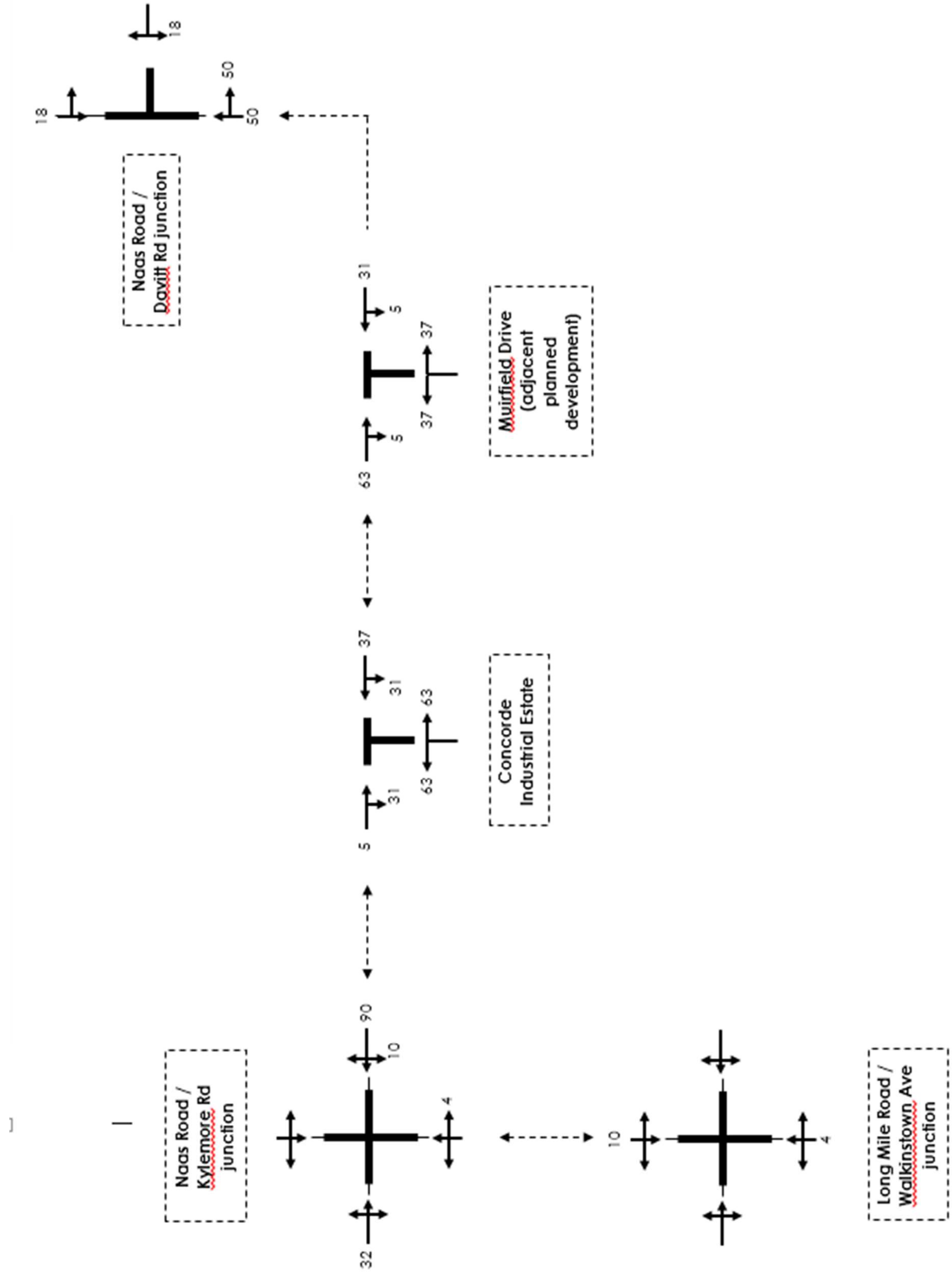


Figure 5: AM peak generated flows from Concorde site plus adjacent Muirfield Drive site

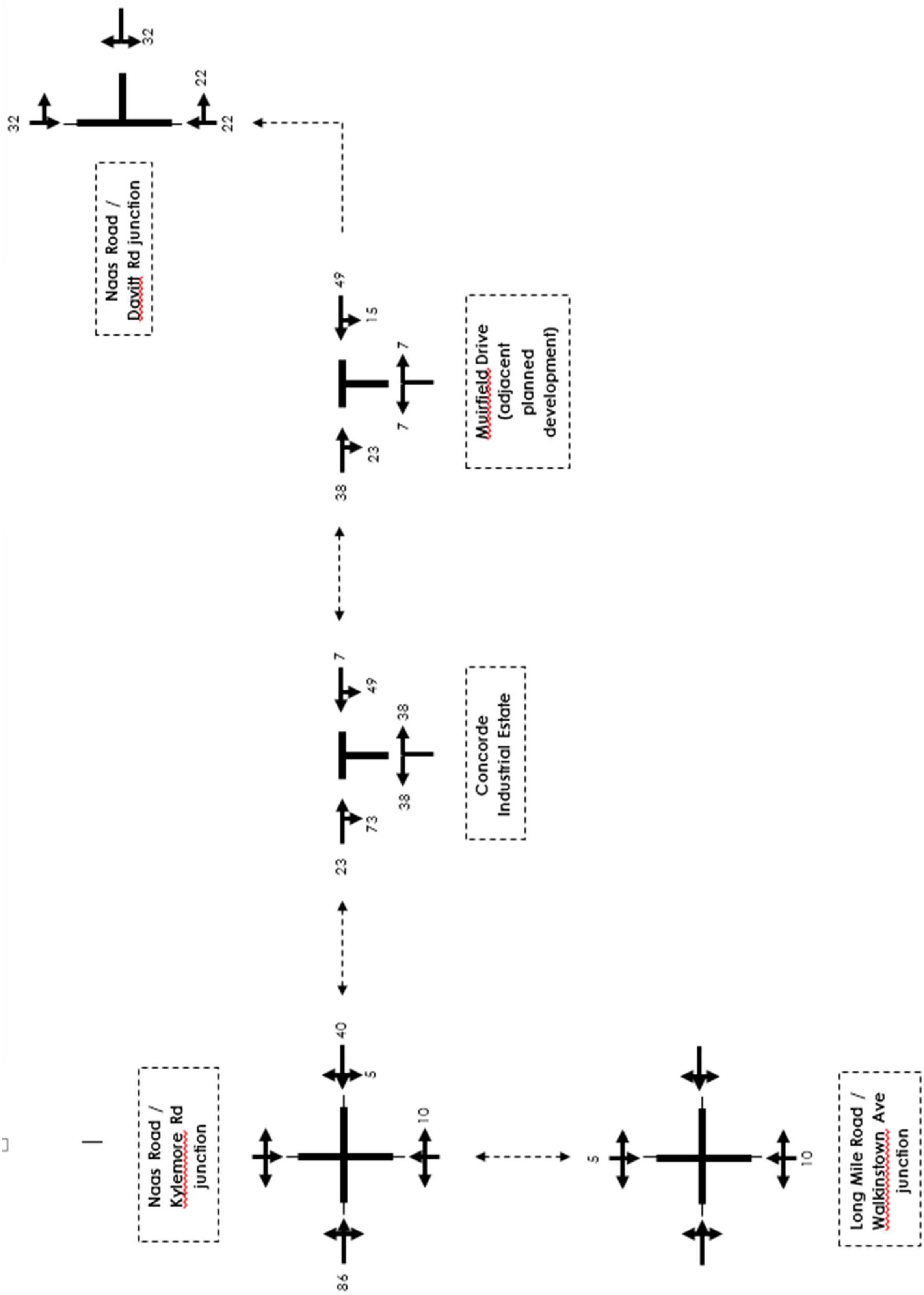


Figure 6: PM peak generated flows from Concorde site plus adjacent Muirfield Drive site

APPENDIX 1

TRICS Data

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 03 - RESIDENTIAL
Category : C - FLATS PRIVATELY OWNED
VEHICLES

Selected regions and areas:

02	**SOUTH EAST**		
	ES	EAST SUSSEX	1 days
	EX	ESSEX	1 days
	HC	HAMPSHIRE	1 days
04	**EAST ANGLIA**		
	CA	CAMBRIDGESHIRE	1 days
	NF	NORFOLK	1 days
	SF	SUFFOLK	1 days
05	**EAST MIDLANDS**		
	NT	NOTTINGHAMSHIRE	1 days
06	**WEST MIDLANDS**		
	WM	WEST MIDLANDS	1 days
08	**NORTH WEST**		
	GM	GREATER MANCHESTER	1 days
09	**NORTH**		
	TV	TEES VALLEY	1 days
11	**SCOTLAND**		
	SR	STIRLING	1 days
13	**MUNSTER**		
	WA	WATERFORD	1 days
14	**LEINSTER**		
	LU	LOUTH	1 days
15	**GREATER DUBLIN**		
	DL	DUBLIN	4 days

TRIP RATE for Land Use 03 - RESIDENTIAL/C - FLATS PRIVATELY OWNED
VEHICLES
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	17	120	0.032	17	120	0.135	17	120	0.167
08:00 - 09:00	17	120	0.044	**17**	**120**	**0.186**	**17**	**120**	**0.230**
09:00 - 10:00	17	120	0.055	17	120	0.081	17	120	0.136
10:00 - 11:00	17	120	0.044	17	120	0.059	17	120	0.103
11:00 - 12:00	17	120	0.055	17	120	0.059	17	120	0.114
12:00 - 13:00	17	120	0.068	17	120	0.065	17	120	0.133
13:00 - 14:00	17	120	0.066	17	120	0.071	17	120	0.137
14:00 - 15:00	17	120	0.064	17	120	0.061	17	120	0.125
15:00 - 16:00	17	120	0.075	17	120	0.053	17	120	0.128
16:00 - 17:00	17	120	0.100	17	120	0.058	17	120	0.158
17:00 - 18:00	**17**	**120**	**0.157**	17	120	0.062	17	120	0.219
18:00 - 19:00	17	120	0.133	17	120	0.076	17	120	0.209
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.893			0.966			1.859

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 02 - EMPLOYMENT
Category : B - BUSINESS PARK
VEHICLES

Selected regions and areas:

01	**GREATER LONDON**		
	BK	BARKING	1 days
	HO	HOUNSLOW	1 days
	WF	WALTHAM FOREST	1 days
03	**SOUTH WEST**		
	DV	DEVON	1 days
07	**YORKSHIRE & NORTH LINCOLNSHIRE**		
	WY	WEST YORKSHIRE	1 days
08	**NORTH WEST**		
	CH	CHESHIRE	1 days
12	**CONNAUGHT**		
	CS	SLIGO	1 days
15	**GREATER DUBLIN**		
	DL	DUBLIN	1 days
17	**ULSTER (NORTHERN IRELAND)**		
	AN	ANTRIM	1 days

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate
00:00 - 00:30									
00:30 - 01:00									
01:00 - 01:30									
01:30 - 02:00									
02:00 - 02:30									
02:30 - 03:00									
03:00 - 03:30									
03:30 - 04:00									
04:00 - 04:30									
04:30 - 05:00									
05:00 - 05:30									
05:30 - 06:00									
06:00 - 06:30									
06:30 - 07:00									
07:00 - 07:30	9	1910	0.227	9	1910	0.058	9	1910	0.285
07:30 - 08:00	9	1910	0.279	9	1910	0.047	9	1910	0.326
08:00 - 08:30	9	1910	0.337	9	1910	0.076	9	1910	0.413
08:30 - 09:00	9	1910	0.535	9	1910	0.105	9	1910	0.640
09:00 - 09:30	**9**	**1910**	**0.634**	9	1910	0.157	9	1910	0.791
09:30 - 10:00	9	1910	0.459	9	1910	0.221	9	1910	0.680
10:00 - 10:30	9	1910	0.343	9	1910	0.221	9	1910	0.564
10:30 - 11:00	9	1910	0.250	9	1910	0.204	9	1910	0.454
11:00 - 11:30	9	1910	0.233	9	1910	0.198	9	1910	0.431
11:30 - 12:00	9	1910	0.268	9	1910	0.209	9	1910	0.477
12:00 - 12:30	9	1910	0.169	9	1910	0.326	9	1910	0.495
12:30 - 13:00	9	1910	0.273	9	1910	0.273	9	1910	0.546
13:00 - 13:30	9	1910	0.268	9	1910	0.308	9	1910	0.576
13:30 - 14:00	9	1910	0.308	9	1910	0.244	9	1910	0.552
14:00 - 14:30	9	1910	0.297	9	1910	0.285	9	1910	0.582
14:30 - 15:00	9	1910	0.250	9	1910	0.326	9	1910	0.576
15:00 - 15:30	9	1910	0.198	9	1910	0.238	9	1910	0.436
15:30 - 16:00	9	1910	0.279	9	1910	0.297	9	1910	0.576
16:00 - 16:30	9	1910	0.221	9	1910	0.459	9	1910	0.680
16:30 - 17:00	9	1910	0.204	9	1910	0.384	9	1910	0.588
17:00 - 17:30	9	1910	0.151	**9**	**1910**	**0.762**	**9**	**1910**	**0.913**
17:30 - 18:00	9	1910	0.134	9	1910	0.529	9	1910	0.663
18:00 - 18:30	9	1910	0.111	9	1910	0.209	9	1910	0.320
18:30 - 19:00	9	1910	0.064	9	1910	0.238	9	1910	0.302
19:00 - 19:30									
19:30 - 20:00									
20:00 - 20:30									
20:30 - 21:00									
21:00 - 21:30									
21:30 - 22:00									
22:00 - 22:30									
22:30 - 23:00									
23:00 - 23:30									
23:30 - 24:00									
Total Rates:			6.492			6.374			12.866

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 02 - EMPLOYMENT
Category : B - BUSINESS PARK
VEHICLES

Selected regions and areas:

01	**GREATER LONDON**		
	BK	BARKING	1 days
	HO	HOUNSLOW	1 days
	WF	WALTHAM FOREST	1 days
03	**SOUTH WEST**		
	DV	DEVON	1 days
07	**YORKSHIRE & NORTH LINCOLNSHIRE**		
	WY	WEST YORKSHIRE	1 days
08	**NORTH WEST**		
	CH	CHESHIRE	1 days
12	**CONNAUGHT**		
	CS	SLIGO	1 days
15	**GREATER DUBLIN**		
	DL	DUBLIN	1 days
17	**ULSTER (NORTHERN IRELAND)**		
	AN	ANTRIM	1 days

TRIP RATE for Land Use 14 - CAR SHOW ROOMS/A - CAR SHOW ROOMS
VEHICLES
Calculation factor: 100 sqm
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00	2	985	0.000	2	985	0.000	2	985	0.000
07:00 - 08:00	16	1166	0.279	16	1166	0.043	16	1166	0.322
08:00 - 09:00	**22**	**1069**	**1.093**	22	1069	0.327	22	1069	1.420
09:00 - 10:00	22	1069	0.868	22	1069	0.770	22	1069	1.638
10:00 - 11:00	22	1069	0.927	22	1069	0.766	22	1069	1.693
11:00 - 12:00	22	1069	0.923	22	1069	0.855	22	1069	1.778
12:00 - 13:00	22	1069	0.778	22	1069	0.791	22	1069	1.569
13:00 - 14:00	22	1069	0.808	22	1069	0.778	22	1069	1.586
14:00 - 15:00	22	1069	0.868	22	1069	0.936	22	1069	1.804
15:00 - 16:00	22	1069	0.761	22	1069	0.876	22	1069	1.637
16:00 - 17:00	22	1069	0.817	**22**	**1069**	**1.072**	**22**	**1069**	**1.889**
17:00 - 18:00	22	1069	0.417	22	1069	0.889	22	1069	1.306
18:00 - 19:00	20	1124	0.111	20	1124	0.436	20	1124	0.547
19:00 - 20:00	3	831	0.000	3	831	0.361	3	831	0.361
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			8.650			8.900			17.550

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 01 - RETAIL
Category : O - CONVENIENCE STORE
VEHICLES

Selected regions and areas:

01	**GREATER LONDON**		
	BT	BRENT	1 days
	EG	EALING	1 days
	EN	ENFIELD	2 days
	KN	KENSINGTON AND CHELSEA	1 days
	WE	WESTMINSTER	1 days
04	**EAST ANGLIA**		
	CA	CAMBRIDGESHIRE	2 days
07	**YORKSHIRE & NORTH LINCOLNSHIRE**		
	NY	NORTH YORKSHIRE	1 days
	SY	SOUTH YORKSHIRE	1 days
	WY	WEST YORKSHIRE	1 days
09	**NORTH**		
	DH	DURHAM	1 days
	TW	TYNE & WEAR	1 days
10	**WALES**		
	CF	CARDIFF	2 days
11	**SCOTLAND**		
	AD	ABERDEEN CITY	1 days
	EB	CITY OF EDINBURGH	2 days
	GC	GLASGOW CITY	1 days
13	**MUNSTER**		
	TI	TIPPERARY	1 days
15	**GREATER DUBLIN**		
	DL	DUBLIN	1 days

TRIP RATE for Land Use 01 - RETAIL/O - CONVENIENCE STORE
VEHICLES
Calculation factor: 100 sqm
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate
00:00 - 01:00	1	370	0.000	1	370	1.081	1	370	1.081
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00	2	385	0.649	2	385	0.130	2	385	0.779
06:00 - 07:00	7	438	2.804	7	438	2.119	7	438	4.923
07:00 - 08:00	21	556	3.124	21	556	2.816	21	556	5.940
08:00 - 09:00	21	556	3.304	21	556	2.979	21	556	6.283
09:00 - 10:00	21	556	3.235	21	556	2.953	21	556	6.188
10:00 - 11:00	21	556	3.390	21	556	3.064	21	556	6.454
11:00 - 12:00	21	556	3.441	21	556	3.338	21	556	6.779
12:00 - 13:00	21	556	3.954	21	556	4.031	21	556	7.985
13:00 - 14:00	21	556	3.732	21	556	3.467	21	556	7.199
14:00 - 15:00	21	556	3.766	21	556	3.843	21	556	7.609
15:00 - 16:00	21	556	3.877	21	556	3.595	21	556	7.472
16:00 - 17:00	21	556	3.749	21	556	3.749	21	556	7.498
17:00 - 18:00	**21**	**556**	**4.168**	**21**	**556**	**4.699**	**21**	**556**	**8.867**
18:00 - 19:00	21	556	3.980	21	556	4.656	21	556	8.636
19:00 - 20:00	21	556	2.876	21	556	3.081	21	556	5.957
20:00 - 21:00	20	565	2.202	20	565	2.450	20	565	4.652
21:00 - 22:00	20	565	1.273	20	565	1.486	20	565	2.759
22:00 - 23:00	5	468	1.836	5	468	2.220	5	468	4.056
23:00 - 24:00	3	499	1.602	3	499	1.469	3	499	3.071
Total Rates:			56.962			57.226			114.188

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 06 - HOTEL, FOOD & DRINK
Category : C - PUB/RESTAURANT
VEHICLES

Selected regions and areas:

01	**GREATER LONDON**		
	CI	CITY OF LONDON	1 days
	HG	HARINGEY	1 days
	IS	ISLINGTON	2 days
	LB	LAMBETH	1 days
	WH	WANDSWORTH	1 days
02	**SOUTH EAST**		
	BF	BRACKNELL FOREST	1 days
03	**SOUTH WEST**		
	BR	BRISTOL CITY	1 days
04	**EAST ANGLIA**		
	SF	SUFFOLK	1 days
06	**WEST MIDLANDS**		
	WK	WARWICKSHIRE	1 days
	WO	WORCESTERSHIRE	1 days
08	**NORTH WEST**		
	CH	CHESHIRE	1 days
	LC	LANCASHIRE	2 days
10	**WALES**		
	SW	SWANSEA	1 days
11	**SCOTLAND**		
	AG	ANGUS	1 days
13	**MUNSTER**		
	TI	TIPPERARY	1 days
15	**GREATER DUBLIN**		
	DL	DUBLIN	1 days

TRIP RATE for Land Use 06 - HOTEL, FOOD & DRINK/C - PUB/RESTAURANT
VEHICLES
Calculation factor: 100 sqm
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	1	600	0.000	1	600	0.000	1	600	0.000
08:00 - 09:00	1	600	0.000	1	600	0.000	1	600	0.000
09:00 - 10:00	1	600	0.000	1	600	0.000	1	600	0.000
10:00 - 11:00	16	559	0.369	16	559	0.224	16	559	0.593
11:00 - 12:00	16	559	0.660	16	559	0.369	16	559	1.029
12:00 - 13:00	**18**	**559**	**1.590**	18	559	0.676	18	559	2.266
13:00 - 14:00	18	559	1.352	18	559	1.083	18	559	2.435
14:00 - 15:00	18	559	0.785	18	559	0.775	18	559	1.560
15:00 - 16:00	18	559	0.855	18	559	0.775	18	559	1.630
16:00 - 17:00	18	559	0.646	18	559	0.656	18	559	1.302
17:00 - 18:00	18	559	0.984	18	559	0.567	18	559	1.551
18:00 - 19:00	18	559	1.531	18	559	1.541	18	559	3.072
19:00 - 20:00	18	559	1.481	**18**	**559**	**1.759**	**18**	**559**	**3.240**
20:00 - 21:00	18	559	1.282	18	559	1.560	18	559	2.842
21:00 - 22:00	18	559	0.726	18	559	1.133	18	559	1.859
22:00 - 23:00	18	559	0.567	18	559	1.173	18	559	1.740
23:00 - 24:00	17	545	0.389	17	545	0.972	17	545	1.361
Total Rates:			13.217			13.263			26.480

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 07 - LEISURE
Category : K - FITNESS CLUB (PRIVATE)
VEHICLES

Selected regions and areas:

01	**GREATER LONDON**		
	BT	BRENT	1 days
	EN	ENFIELD	1 days
	HG	HARINGEY	1 days
	HK	HACKNEY	1 days
	IS	ISLINGTON	1 days
02	**SOUTH EAST**		
	ES	EAST SUSSEX	1 days
05	**EAST MIDLANDS**		
	NR	NORTHAMPTONSHIRE	1 days
07	**YORKSHIRE & NORTH LINCOLNSHIRE**		
	NY	NORTH YORKSHIRE	1 days
	WY	WEST YORKSHIRE	1 days
09	**NORTH**		
	CB	CUMBRIA	1 days
	TW	TYNE & WEAR	1 days
10	**WALES**		
	PS	POWYS	1 days

TRIP RATE for Land Use 07 - LEISURE/K - FITNESS CLUB (PRIVATE)
VEHICLES
Calculation factor: 100 sqm
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00	1	1570	0.000	1	1570	0.000	1	1570	0.000
06:00 - 07:00	12	1224	0.831	12	1224	0.191	12	1224	1.022
07:00 - 08:00	12	1224	0.511	12	1224	0.586	12	1224	1.097
08:00 - 09:00	12	1224	0.463	12	1224	0.504	12	1224	0.967
09:00 - 10:00	12	1224	0.960	12	1224	0.470	12	1224	1.430
10:00 - 11:00	12	1224	0.722	12	1224	0.647	12	1224	1.369
11:00 - 12:00	12	1224	0.518	12	1224	0.661	12	1224	1.179
12:00 - 13:00	12	1224	0.681	12	1224	0.681	12	1224	1.362
13:00 - 14:00	12	1224	0.538	12	1224	0.647	12	1224	1.185
14:00 - 15:00	12	1224	0.647	12	1224	0.538	12	1224	1.185
15:00 - 16:00	12	1224	0.620	12	1224	0.654	12	1224	1.274
16:00 - 17:00	12	1224	0.960	12	1224	0.811	12	1224	1.771
17:00 - 18:00	**12**	**1224**	**1.389**	12	1224	0.845	12	1224	2.234
18:00 - 19:00	12	1224	1.219	**12**	**1224**	**1.396**	**12**	**1224**	**2.615**
19:00 - 20:00	12	1224	0.994	12	1224	1.383	12	1224	2.377
20:00 - 21:00	12	1224	0.484	12	1224	1.137	12	1224	1.621
21:00 - 22:00	12	1224	0.129	12	1224	0.463	12	1224	0.592
22:00 - 23:00	3	851	0.078	3	851	0.274	3	851	0.352
23:00 - 24:00									
Total Rates:			11.744			11.888			23.632

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 05 - HEALTH
Category : G - GP SURGERIES
VEHICLES

Selected regions and areas:

01	**GREATER LONDON**		
	WH	WANDSWORTH	1 days
02	**SOUTH EAST**		
	BU	BUCKINGHAMSHIRE	1 days
	SC	SURREY	1 days
03	**SOUTH WEST**		
	GS	GLOUCESTERSHIRE	1 days
	SM	SOMERSET	1 days
04	**EAST ANGLIA**		
	NF	NORFOLK	1 days
05	**EAST MIDLANDS**		
	LN	LINCOLNSHIRE	1 days
	NT	NOTTINGHAMSHIRE	1 days
06	**WEST MIDLANDS**		
	WK	WARWICKSHIRE	1 days
07	**YORKSHIRE & NORTH LINCOLNSHIRE**		
	NY	NORTH YORKSHIRE	2 days
	WY	WEST YORKSHIRE	1 days
08	**NORTH WEST**		
	CH	CHESHIRE	1 days
09	**NORTH**		
	TW	TYNE & WEAR	1 days
10	**WALES**		
	CF	CARDIFF	3 days
11	**SCOTLAND**		
	DU	DUNDEE CITY	1 days
12	**CONNAUGHT**		
	RO	ROSCOMMON	1 days
14	**LEINSTER**		
	CC	CARLOW	1 days
	WC	WICKLOW	1 days
15	**GREATER DUBLIN**		
	DL	DUBLIN	1 days
17	**ULSTER (NORTHERN IRELAND)**		
	AN	ANTRIM	1 days
	DE	DERRY	1 days

TRIP RATE for Land Use 05 - HEALTH/G - GP SURGERIES
VEHICLES
Calculation factor: 100 sqm
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	22	848	0.649	22	848	0.129	22	848	0.778
08:00 - 09:00	24	813	2.771	24	813	1.199	24	813	3.970
09:00 - 10:00	**24**	**813**	**3.243**	24	813	2.684	24	813	5.927
10:00 - 11:00	24	813	3.222	**24**	**813**	**3.320**	**24**	**813**	**6.542**
11:00 - 12:00	24	813	2.720	24	813	3.028	24	813	5.748
12:00 - 13:00	24	813	2.228	24	813	2.684	24	813	4.912
13:00 - 14:00	24	813	1.445	24	813	1.511	24	813	2.956
14:00 - 15:00	24	813	2.828	24	813	2.500	24	813	5.328
15:00 - 16:00	24	813	2.725	24	813	2.741	24	813	5.466
16:00 - 17:00	24	813	2.285	24	813	2.684	24	813	4.969
17:00 - 18:00	24	813	1.363	24	813	2.111	24	813	3.474
18:00 - 19:00	23	831	0.241	23	831	0.963	23	831	1.204
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			25.720			25.554			51.274

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