Project

Mixed Use Development, 1-4 East Road, East Road, Dublin

Report Title

Infrastructure Design Report

Client

Glenveagh

INFRASTRUCTURE

DBFL CONSULTING ENGINEERS

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-	13/12/18	Pre-planning	IGR	NJF	DJR
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TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 Background

DBFL have been instructed to prepare an Infrastructure Design Report to accompany a planning application for the proposed mixed-use development on a site at 1-4 East Road, Dublin 3.

The proposed development is located off East Road, where the existing Hireco's container/trailer park currently is sited.

1.2 Location & Topography

The proposed site is located in East Wall, in the North Dock area of Dublin City, approximately 1.8km north-east of the City Centre. The site is approximately 2.11Ha and is currently occupied by Hireco as a container/trailer park which comprises mostly hardstanding area and five main buildings. There are also two existing red brick buildings at no. 4 East Road at the norther corner of the site.

The site is bound by East Road to the west, the Iarnrod Eireann railway to/from Dublin Port to the south, Merchant's Square residential development to the east and the Teeling Way residential apartments to the north and north-east.

As per Dublin City Councils development plan, the site has been zoned Z14, *to seek the social, economic and physical development and/or rejuvenation of an area with mixed use, of which residential and "Z6" would be the predominant uses.*

Generally, the site is relatively flat with a slight fall from north to south. The existing topography levels range from 0.88m AOD in the northern extent of the site to circa 0.11m AOD in the southern extents of the site.

The topographical survey has been included in appendix C.

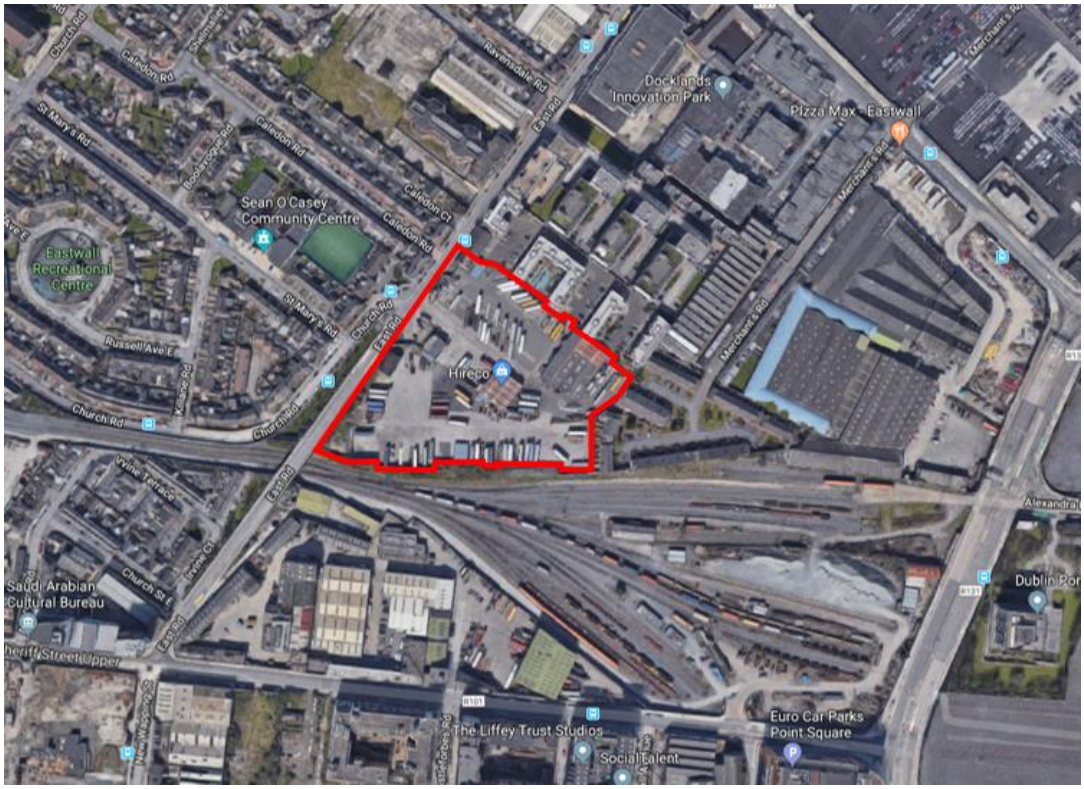


Figure 1.1 *Site Location (Site Boundary Indicative Only)*

1.3 Existing Ground Conditions

A ground investigation was undertaken by Ground Investigations Ireland and this revealed that the strata encountered consisted mainly of Surfacing on made ground to approximately 0.45m-1.5m BGL on Granular and Cohesive deposits of fine to medium or fine to coarse SAND and slightly sandy clayey SILT respectively above laminated cohesive deposits of sandy silty CLAY to 7.7m-15.6m BGL. Lower granular deposits were also encountered below the made ground deposits which were described as stiff cohesive glacial till deposits to approximately 15.4m-17.9m BGL extending to a maximum depth of 23.4m BGL in BH05A.

Rock was not encountered within the site investigation even though investigation went down to a depth of 30.9m BGL.

Groundwater was noted at depths between 0.33m and 1.2m BLG which indicates a high groundwater table.

1.4 Proposed Development

The development will consist of the construction of a mixed use development set out in 9 no. blocks, ranging in height from 3 to 15 storeys to accommodate 554 no. apartments, commercial/enterprise space, retail units, foodhub/café/exhibition space, residential amenity services, crèche and men's shed. The site will accommodate 241 no. car parking spaces, 810 bicycle parking, storage, services and plant areas. Landscaping will include a new central public plaza and residential podium courtyards.

2.0 Flood Risk

Based on a review of the Eastern Catchment Flood Risk Assessment and Management (CFRAM) study, the Irish Coastal Protection Strategy Study (ICPSS) and Dublin City Council's Strategic Flood Risk Assessment (SFRA), we note that the development lands are located within Flood Zone A, although the site is protected by flood defences.

The review concluded that the site is located within Flood Zone A, as indicated in the ICPSS indicating a flood level for the 0.5% AEP and 0.1% AEP as 3.07m and 3.28m respectively. As the proposed residential development will be classified as 'Highly vulnerable' within the 'Planning System and Flood Risk Management Guidelines for Planning Authorities' a flood level of 4.08m AOD, which includes climate change and freeboard as required by DCC, has been calculated as the minimum finished floor level for the elements of the development that have been classed as 'Highly vulnerable'.

All development below this level (i.e. ground floor) will be 'Less vulnerable development' consisting of car parking and commercial uses, and all development at this level will be of flood resilient design.

The above flood level information is supported from the North Lotts & Grand Canal SDZ Strategic Flood Risk Assessment and associated planning permissions in the region of the proposed development.

Flood risk has been assessed in a Site Specific Flood Risk Assessment (SSFRA). Please refer to DBFL report 170200-Rep-003 – SSFRA.

3.0 SITE ACCESS AND ROAD LAYOUT

3.1 Existing Access

The proposed development site has a single-entry point on East Road, opposite the existing East Road/Church Road priority junction, to the west of the subject site.

3.2 Proposed Access & East Road Signalised Junction

Access to the site for all users will be via East Road to the west of the proposed development site where the existing entrance is currently located.

The subject development proposals include the upgrading of the existing East Road/Church Road priority junctions to be signal controlled. The site access will be incorporated into these works, creating a four-arm signalised crossroads junction, refer to figure 3.1 and DBFL drawing 170200-2000.

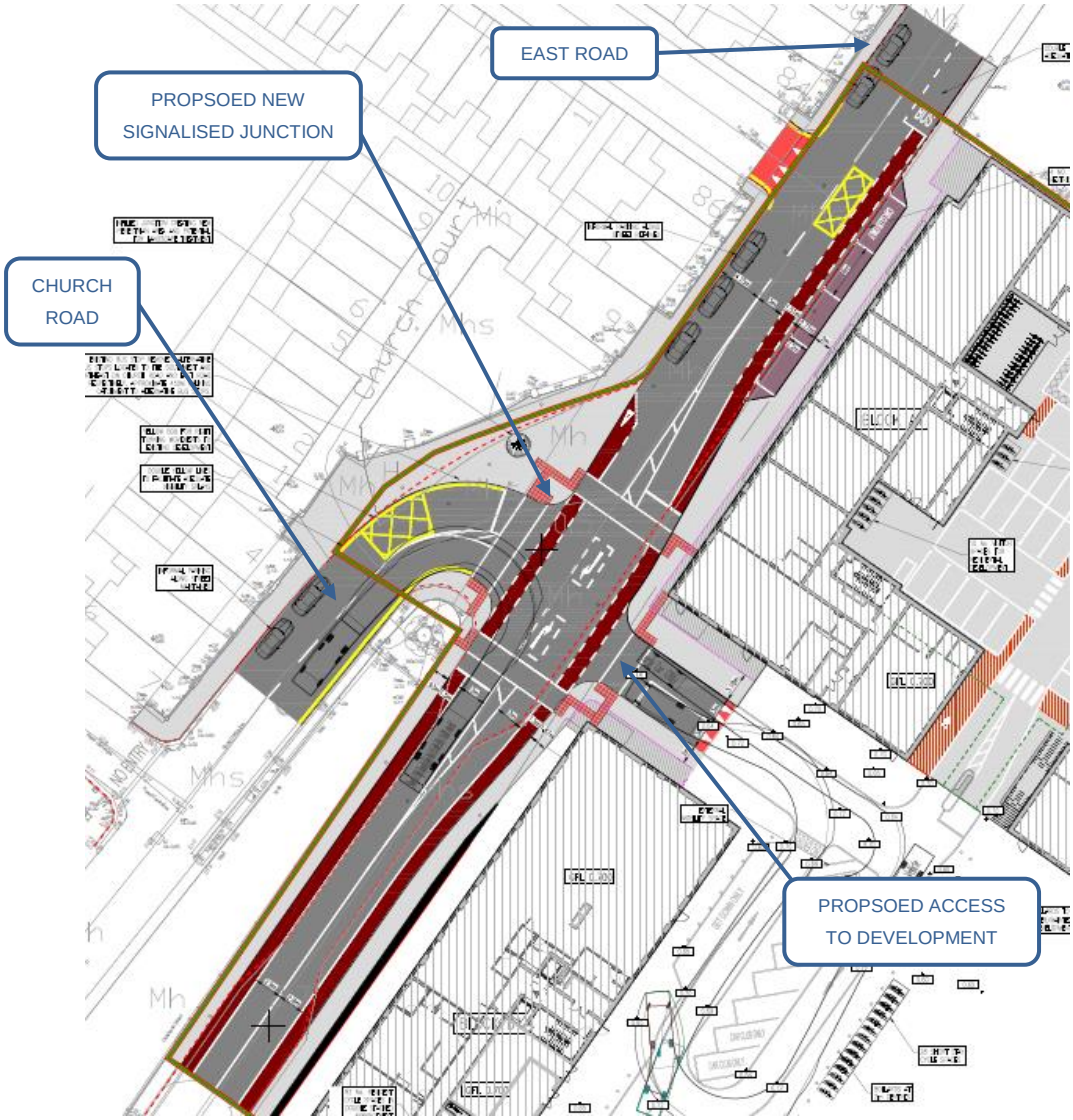


Figure 3.1 *Proposed Junction and Access for Development*

3.3 Proposed Parking

As part of the planning application, a separate report has been compiled to detail the parking strategy. This can be found in DBFL report 170200-Rep-005 – Car Parking strategy.

3.4 Vehicle Tracking and Servicing Strategy

As part of the servicing strategy the external vehicle area has been designed to accommodate all types of anticipated service vehicles. For the retail/commercial aspects of the development it is expected that deliveries will be the most frequent vehicles, and a set down layby has been provided (15.5m long by 2.7m wide) to accommodate these. The management company of the development will enforce restrictions for this set down area to ensure the area is available for the required servicing of the development.

The proposed road layout and hard landscaping areas have been tracked to demonstrate that the site's proposed corner radii and turning heads will accommodate everyday vehicles such as normal delivery and cars. Other vehicles such as refuse trucks and fire tender have been tracked to ensure they can turn and manoeuvre around the development (refer to DBFL Drawings 170200-2003).

As part of the refuse strategy detailed in the Operational Waste Management Strategy, the refuse collection point will be located adjacent to block D1 by the set down area. This will allow refuse vehicles to enter the development, turn in in the external vehicle area and use the set down layby to collect the refuse while keeping the entrance and exit routes clear.

As per the Operational Waste Management Strategy, it will be the development's management company that will ensure all refuse is moved from the waste storage areas to the refuse collection point. More details of the refuse strategy can be found in the Operation Management Strategy included with the planning application.

4.0 EXISTING SERVICES AND UTILITIES

4.1 General

A comprehensive topographical survey was carried out for the subject site and existing drainage and utility records in the vicinity of the site obtained and surveyed in detail. A summary of the existing main services is provided below, and the Irish Water records can be found in appendix D.

4.2 Surface Water Drainage

The proposed site is serviced by an existing surface water sewer located to the west of the site along East Road which runs in a southerly direction. This sewer in turn connects to the existing 920mm diameter brick combined sewer on Church Road and continues in a southerly direction passing under the railway, discharging to the existing Irish Water pumping station on East Road.

4.3 Foul Sewer

By reviewing records, the surrounding area predominately uses a combined drainage network. The subject site is serviced by an existing 600mm diameter combined sewer on East Road which runs from north to south towards the existing Irish Water pumping station to the south of the development.

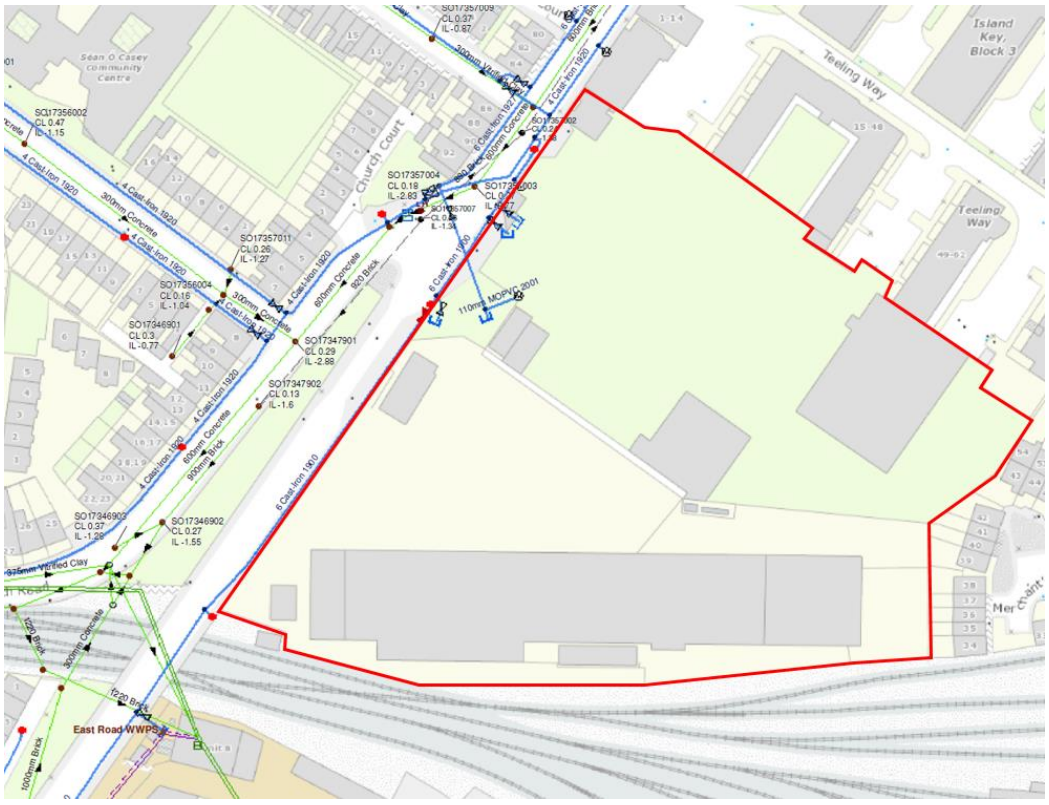


Figure 4.1 *Existing Watermain and Sewer Records*

4.4 Water Supply

The site is well served by a series of watermains in East Road and Church Road, with several spurs for connections, some of which may well be historical. The existing site is served by a 6 “Cast Iron watermain in East Road while also having a separate connection to a 6” Cast Iron watermain located on the junction of East Road and Church Road.

Existing fire hydrants are located along the site frontage in East Road.

5.0 PROPOSED SURFACE WATER DRAINAGE

5.1 Surface Water Policy

The management of surface water for the proposed development has been designed to comply with the policies and guidelines outlined in the Greater Dublin Strategic Drainage Study (GDSDS) and with the requirements of Dublin City Council. The guidelines require the following 4 main criteria to be provided by the design;

- Criterion 1: River Water Quality Protection – satisfied by providing interception storage and treatment within the green roof, bio-retention/filter drains and green courtyard and garden.
- Criterion 2: River Regime Protection – satisfied by attenuating to greenfield run-off rates.
- Criterion 3: Level of Service (flooding) for the site – satisfied by the development's surface water drainage design, planned flood routing, run-off contained within site, flood storage and building set greater than 0.5m above 100-year flood level.
- Criterion 4: River flood protection – attenuation volume and discharge limit designed to greenfield run-off rates (long term storage not provided).

5.2 Surface Water Strategy

To meet the requirements of the surface water policy above, the surface water strategy has been described in this section to give a clearer indication of how the design development has progressed to the submitted design. To give a clearer understanding of each SuDS element, and the different stages of the treatment train, the strategy has been broken down to different levels, which include roof, terraces, podium and ground. An overview of the different SuDS features incorporated within the development proposals can be seen on DBFL Drawing 170200-3000 and 3002.

Infiltration techniques such as Soakaways have been discounted as part of the development due to the groundwater table recorded during the site investigation and the potential presence of contaminated material within the site.

Roof & Terrace Level:

As the first part of the treatment train, the SuDS features have been designed to prioritise, interception and reduction of flow rates. The features that will be incorporated into the design are:

- Green roof - this will be a mixture of intensive and extensive type with 80mm minimum construction depth. All necessary safety requirements will be designed and constructed to ensure safe maintenance can occur. The green

roof will provide interception and reduction of flow rates at the beginning of the treatment train, providing source control for a large area of the development. Drawing 170200-3002 shows the extents of the Green Roof. After surface water has passed through the Green Roof, this will discharge to the surface water network.

- Planters will also be installed on the roof terraces locally acting to reduce run off and allowing an element of interception to occur.
- The hardstanding of the roof terraces will be constructed of permeable paving that allows the surface water to slowly percolate through the build-up before being discharged to the positive drainage system.
- Due to the rest of the roofs of the development being pitched, these will need to drain via a positive drainage system to the below surface water network.

Podium Level (1st Floor):

- At podium level the subject development will implement a permeable pavement and green landscaping (over Podium A and B). Refer to DBFL drawing 170200-3002 for extents.

  The green landscaped areas will constitute what is similar to an intensive Green Roof build-up, allowing surface water run-off to slowly percolate through the build-up medium, reducing the flows through the drainage network and also allowing vegetation to intercept run-off creating a reduction in run-off volumes.
- In areas of permeable paving a free draining aggregate sub-base will be used between the permeable paving and the podium slabs allowing a reduction in flows within the drainage network.
- Once the rainwater has filtered through the various build-up mediums, run-off will drain to gullies located at the structural slab level and then conveyed to the below ground system via slung drainage.
- In addition to the above, smaller SuDS elements will also be located on podium such as Bio-swales, raised planters and rain gardens (refer to fig 5.1). These will be specified in co-ordination with the landscape design to slow any areas of hardstanding that need to be drained and also provide additional treatment and subsequent improvement of discharge quality.

Figure 5.1 *Examples of Urban Swales/Bio-swales – Various Sources*

Ground Floor:

- Permeable paving will be located around the ground floor of the development to again treat and reduce run-off at source. Figure 5.2 shows the proposed main areas where permeable paving is proposed, and the full extents can be seen on DBFL drawing 170200-3002. Impermeable strips have been included in the design to allow other services to be easily constructed and maintained. These areas still predominately drain to either the permeable paving or the proposed landscape features such as rain gardens as seen in Fig 5.3 & 5.4.

Figure 5.2 *Main areas of Permeable Paving*

- Tree pits and vegetation planters will also be connected to the surface water drainage and allow run-off to pass through planters and tree pits allowing interception of this vegetation, further reducing volume and flow rates within the drainage system. The use of smaller sustainable conveyance techniques will also be implemented where possible.

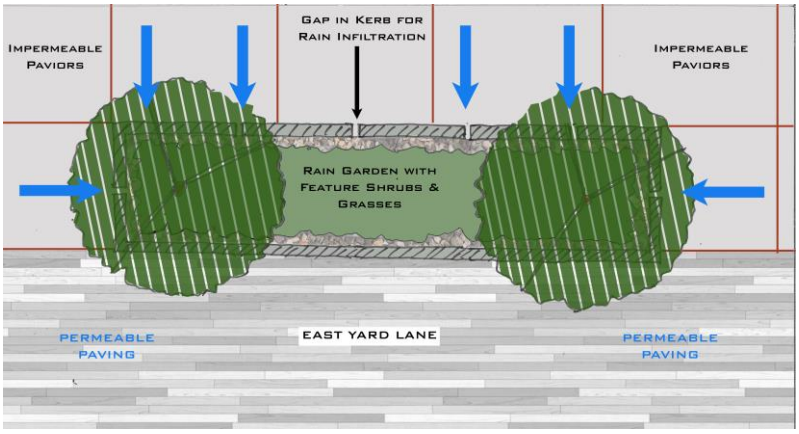


Figure 5.3 *Plan of East Yard Lane demonstrating integration of Landscape and Drainage design (from BSM Landscape Design Report)*

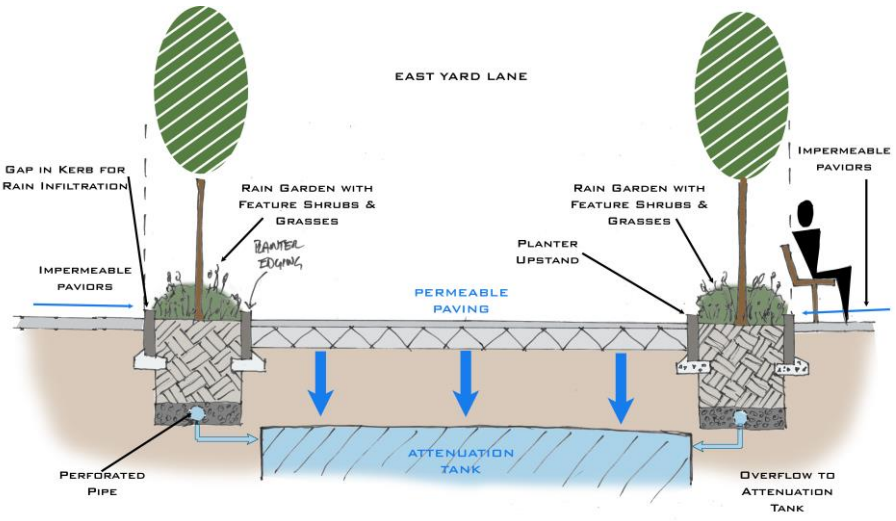


Figure 5.4 *Section of East Yard Lane demonstrating integration of Landscape and Drainage design (from BSM Landscape Design Report)*

- The above source control SuDS measures being included within the design have been co-ordinated into the landscape design to ensure the surface water strategy is integral to the Landscape. This has reduced the sites reliance on attenuation tanks to reduce peak run-off flow rates. Although due to the design storm event, and the need to incorporate climate change within the design a certain volume is still required within an attenuation tank.

- The site requires two attenuation tanks to provide the required volume to ensure the development does not flood in the 1 in 100 year storm event plus climate change. The main attenuation storage for the subject site will be located in the square of the development (East Square) with another attenuation system located under the pedestrianised street that runs through the spine of the development (East Yard Lane, as shown in Figure 5.4).

- SuDS elements as described previously on ground floor will be also be connected to these attenuation tanks, decreasing the reliance on attenuation systems and using a co-ordinated multi element SuDS network to service the site.

The incorporation of the above SUDS elements will provide a sustainable manner in which to disperse surface water from the site and provide treatment of run-off and subsequent improvement of discharge quality.

5.3 Attenuation

Attenuation volumes have been calculated based on an allowable outflow / green field runoff rate of 4l/sec ($QBAR_{RURAL}$ calculated in accordance with Institute of Hydrology Report 124, see Appendix A). Refer to Appendix A for calculations sheets.

The drainage design uses SOIL type 2 for the site's QBar greenfield run-off calculations. To derive the soil type, table 4.5 of the Flood Studies Report was used as recommended by the GDSDS. The following is a summary of the site characteristics used in the selection of the pre-development soil value.

Run-off from the new development will be attenuated and has been calculated using a maximum of 2l/s/ha in accordance with the requirements of Dublin City Council, using a 'hydrobrake optimum' or similar approved as a flow control device.

The impermeable areas contributing to the attenuation volume have had the following reduction factors applied:

Roof Level:

- Green roofs, the proposed build-up will be a mix of intensive and extensive type with 80mm minimum construction depth. The soil build-up will primarily absorb some of the initial run-off and once saturated will reduce the flow of run-off through the green roof medium. Therefore, a reduction of volume and flow rate will occur due to the presence of the green roof. Also, the green roof plant life will absorb a percentage of the run-off, further reducing volume that will drain to the surface water network. Therefore a 30% reduction factor has been applied.
- Flat impermeable roof and roads, a 5% reduction of the surface area is applied to take account of run-off not collected and stored within the micro and macro texture of the surfacing (various sources recommend different reduction coefficients e.g. IS EN752 recommends Runoff Coefficient (C for the Rational Method) of 0.9 to 1.0 for impermeable areas and steeply sloping roofs. For flat roofs it recommends 0.5 to 1.0 depending on area).

Podium Level & Ground Floor:

- Green areas over podium, a reduction factor of 50% has been applied. The deep soil build-up will primarily absorb a substantial amount of the initial run-off and once saturated will reduce the flow of run-off through the green roof medium.
- Permeable Paving on podium and ground will have a free draining material within the build-up and will reduce the flow rate from these areas. Rainfall will 'wet' the initial surface of the paving allowing water to be stored in the micro and macrotexture of the surfacing and will be lost to evapotranspiration, as the run-off drains through the free draining aggregate, this build-up will also 'wet' giving another volume reduction due to evapotranspiration and natural storage

within the SuDS feature. A reduction in velocity will also occur as the aggregate used will slow the run-off at source, changing the input hydrograph which will ultimately reduce the peak inflow for attenuation calculations. A reduction factor of 30% has been applied for these reasons.

- Areas draining to Filter Drains and Bioswales and/or Treepits, a conservative reduction factor of 20% has been applied for these areas not located over podium. Firstly, rainfall will 'wet' the initial surface of the paving, allowing water to be stored in the micro and macrotexture of the surfacing and will be lost to evapotranspiration, giving a reduction in volume. As run-off drains to these SuDS elements and through the build-up, the aggregate/soil surface area will also 'wet' giving another reduction of volume due to evapotranspiration and natural storage within the SuDS feature. There will also be a reduction of velocity as the aggregate/filter material used in the SuDS feature slows the run-off at source, changing the input hydrograph which will ultimately reduce the peak inflow for attenuation calculations. The SuDS Manual outlines that they "can help reduce flow rates from a site by providing some attenuation storage and can reduce storage volume requirements where infiltration occurs".
- Green areas over podium, a reduction factor of 50% has been applied. The deep soil build-up will primarily absorb a substantial amount of the initial run-off and once saturated will reduce the flow of run-off through the green roof medium.

Throughout the site, a geo-cellular storage system has been selected and designed to provide the required volume for the 100-year storm event (+20% climate change) using Micro Drainage source control software, refer to Appendix B for summary of results for various storm-water durations. Calculations indicate that 992m^3 of storage volume for the 100-year event (+20% climate change) is needed.

Micro-Drainage indicate the storage void required at the selected design head and a separate calculation sheet has been provided to demonstrate how the dimensions of the storage systems provide the necessary volume.

Surface water attenuation calculations can be found in Appendix B.

5.4 Design Standards

Storm-water drainage has been designed in accordance with the Greater Dublin Code of Practice for Drainage Works. The following design parameters are applicable to the design:

- Time of entry: 4 minutes
- Pipe Friction (Ks): 0.6 mm
- Minimum Velocity: 1.0 m/s
- Standard Average Annual Rainfall: 745mm
- M5-60: 17.1mm
- Ratio r (M5-60/M5-2D): 0.28
- Attenuation Tank Storm Return Event GDSDS Volume 2, p61, Criterion 3

  30 year no flooding on site.

  100 year check no internal property flooding. Flood routing plan. FFL freeboard above 100-year flood level. No flooding to adjacent areas.
- Climate Change 10% for rainfall intensities, as GDSDS

Surface water sewers have been designed in accordance with IS EN 752 and the recommendations of the 'Greater Dublin Strategic Drainage Study', (GDSDS).

The minimum pipe diameter for public surface water sewers is 225mm. Private drains comprise of diameters from 100mm.

5.5 Climate Change

Surface water calculations for the development made use of rainfall values for the East Wall area as provided by Met Eireann. Rainfall intensities were increased by a factor of 20% to take account of climate change, as required by the DCC for attenuation storage design.

5.6 Flooding Provision

In the case that that an exceedance storm event occurs, in excess of the 1% AEP. The development's layout is designed to ensure over-land flows are directed away from the buildings. In larger than the 100-year storm events, there will be additional volume within the surface water network which will be able to surcharge before flooding. When this tolerance has been exceeded the attenuation storage features will flood and overtop, with

overland flows expected to pass from the site onto East Road following the topography of the land (refer to figure 5.5).

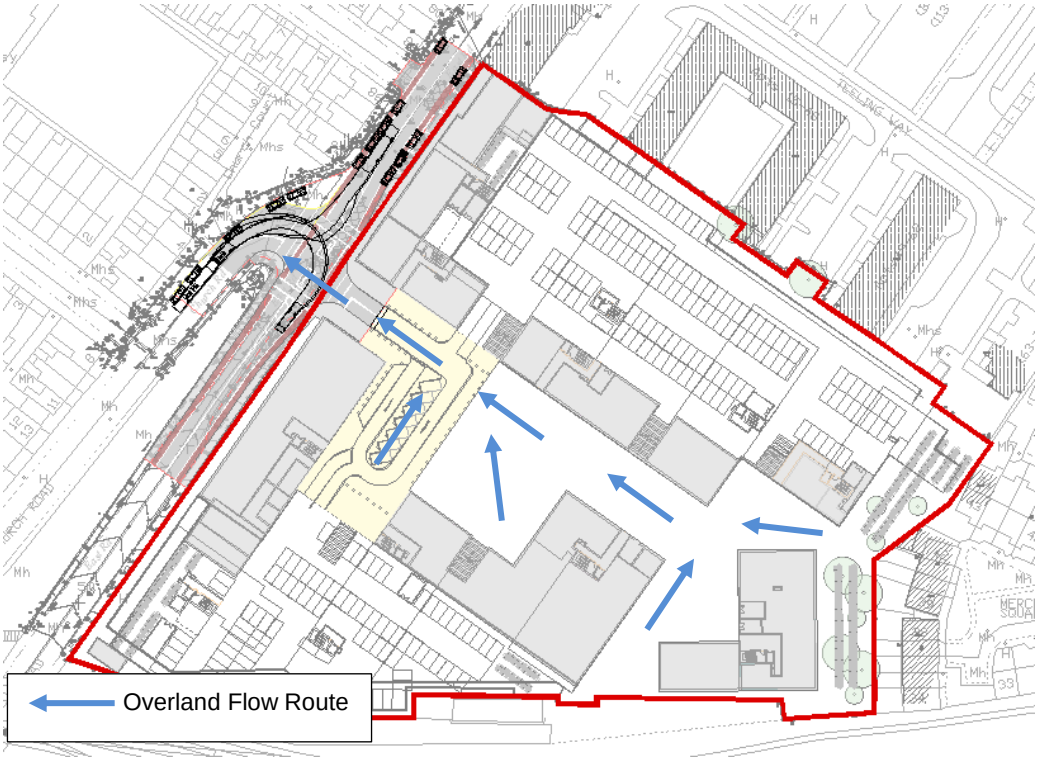


Figure 5.5 Overland Flow route in exceedance event

5.7 Surface Water Quality Impact

The type of development is low risk i.e. it does not present a high risk of run-off contamination. The development's design and layout further reduce the risk of contaminants entering the surface water network as the majority of the site coverage will either be roof area or green / pedestrianised podium areas with the majority of vehicle parking provided at ground level under podium. Run-off from roofs will have a first stage of treatment by draining through green-roof medium which in turn drain to the on-line attenuation storage systems. Soft and hard landscaped podiums will drain via their build-ups to a slung system which in turn also drain via the geo-cellular online attenuation storage systems which provide further secondary removal of pollutants due to the geotextiles and filter stone before final discharge to the sewer.

The highest risk of contaminated surface water run-off from the site would be from the access road and entrances to the car park which are relatively small areas.

All incidental drainage from the car park is discharged separately via a Class 1 oil separator to the surface water sewer. In this way it is considered that the development

provides treatment of collected run-off, provides a SUDS treatment train approach and is low risk of pollutants.

The proposed surface water system has therefore been designed to incorporate SuDS techniques which naturally reduce pollutants and improve water quality.

5.8 Interceptance

The GDSDS recommends that no run-off should pass directly to a river for rainfall depths of 5mm and up to 10mm if possible i.e. interception. The development's drainage design allows for collection of a majority of the site's run-off via SuDS features e.g. Greenroofs, filter drains and bio-swales, providing interception at source. In turn resulting runoff is conveyed to on-line attenuation storage systems which are combined with the developments landscape and connected to tree pits and planting which remove pollutants and provide a level of further interception. Calculations in accordance with the GDSDS recommendations can be found in appendix A and indicate a minimum of 58.5m^3 of interception volume should be provided. This interception will occur within elements such as Green-roof and green podium.

6.0 PROPOSED FOUL DRAINAGE

6.1 Proposed Foul Layout

The proposed foul drainage has been designed to drain via one outfall to the Irish Water combined sewer in East Road.

The foul drainage network can be found on DBFL drawing 170200-3001.

As part of the pre-planning stage, Irish Water have reviewed the designs and made their comments. The drawings have been updated and Irish Water has issued a Statement of Design Acceptance. Foul calculations can be found in appendix F.

6.2 Design Calculations

Minimum gradients and pipe diameters for gravity collector and main sewers are designed in accordance with the Building Regulations and Irish Water's Code of Practice for wastewater infrastructure and Standard Details for wastewater infrastructure.

The sewer network is designed in accordance with the principles and methods set out in Irish Water's Code of Practice for Wastewater Infrastructure, IS EN 752 (2008), IS EN12056: Part2 and Building Regulations Part H.

Foul sewer design criteria are as follows:

Pipe Roughness Coefficient	1.5 mm
Minimum Velocity	0.75 m/s (self-cleansing)
Maximum Velocity	3.0 m/s

Estimated peak foul loading generated by the proposed development is provided in Table 6.1 and 6.2 below:

RESIDENTIAL - PREDICTED DEVELOPMENT FOUL FLOWS						
Use Type	**No. of Units**	**Occupancy Rate**	**Population (P)**	**Loading (G) (l/day/person)***	**Daily Loading (PG) (l/day)**	**Daily Loading (l/s)**
Residential	554	2.7 people/dwelling	1496	150	224,400	2.60
					Daily Loading	**2.60**
					Growth factor	1.00
					Infiltration @ 10% (as CoP Appendix C - 1.2.4)	0.02
					Dry Weather Flow (l/s)	**2.62**
					Residential Peaking Factor (as CoP Appendix C - 1.2.5)	6.00
					Design Foul Flow (l/s)	**15.72**
					Surface Water allowance SW @ 1.5 (as CoP Appendix C - 1.2.10)	0.20
					Design Flow (l/s)	**15.74**
***Flow rates extracted from IW CoP for Wastewater Infrastructure - Appendix D**						

Table 6.1: Estimated Foul Loading for residential development

COMMERCIAL - PREDICTED DEVELOPMENT FOUL FLOWS						
Use Type	**Floor Space (m^2)**	**Occupancy Rate**	**Population (P)**	**Loading (G) (l/day/person)***	**Daily Loading (PG) (l/day)**	**Daily Loading (l/s)****
Café/Exhibition	680	1 per 60 m^2 (staff)	11	60	660	0.02
		1 per 3 m^2 (customers)	226	15	3,390	0.08
Crèche	539	1 per 6 m^2 (children)	90	50	4,500	0.10
		1 per 5 children (staff)	18	50	900	0.02
Enterprise	2444	1 per 10m^2	244	50	12,200	0.28
Tenant Amenity	362	1 per 5 m^2	72	50	3,600	0.08
Retail	344	1 per 20 m^2	17	50	850	0.02
					Daily Loading	**0.60**
					Growth factor	1.00
					Infiltration @ 10% (as CoP Appendix C - 1.2.4)	0.01
					Dry Weather Flow (l/s)	**0.61**
					Residential Peaking Factor (as CoP Appendix C - 1.2.7)	4.50
					Design Foul Flow (l/s)	**2.75**
					Surface Water allowance SW_E @ 1.5 (as CoP Appendix C - 1.2.11)	0.04
					Design Flow (l/s)	**2.79**
***Flow rates extracted from IW CoP for Wastewater Infrastructure - Appendix D** ****For commercial premises, a working day is assumed to be over 12 hours**						

Figure 6.1 Estimated Foul Loading for commercial development

Overall design flows from the development are calculated using IW CoP for Wastewater Infrastructure Appendix C, as outlined below.

Dry Weather Flow = PG + I + E

Design Foul Flow = $[Pf_{Dom} \times PG] + [Pf_{Dom, Ind} \times P_E G_E] + I + [Pf_{Trade} \times E]$ (Eqn1)

Design Flow = Eqn 1 + $[SW + SW_E]$

The type of proposed use is commercial comprising offices i.e. trade use, so that no industrial flow has been assumed.

For commercial premises a working day is assumed to be over 12 hours when flows will be contributing to the public sewer network.

Growth rates are not assumed as the proposed application is for a fixed quantum of development (G = 1).

Dry Weather Flow = 0.61l/s.

Design Foul Flow = 2.75l/s

Design Flow = 2.79l/s

7.0 WATER SUPPLY AND DISTRIBUTION

7.1 Proposed Water main and Supply

As part of the development proposals the existing water main on site will be removed and a new connection to the existing 6" diameter watermain in East Road will be made (refer to DBFL Drawings 170200- 3002). This will feed a cold-water storage tank located at undercroft level.

7.2 Water main Standards and Details

The water main layout and details including valves, hydrants, metering etc. will be in accordance with Irish Water's Code of Practice and Standard Details for water infrastructure.

7.3 Hydrants

As stated previously, Existing fire hydrants are located along the site frontage in East Road. These will be maintained to cater for any fire at the proposed development.

Hydrants shall comply with the requirements of BS 750:2012 and shall be installed in accordance with Irish Water's Code of Practice and Standard Details.

7.4 Design Calculations

The water demand is designed in accordance with the principles and methods set out in Irish Water's Code of Practice for Water Infrastructure Connections and Developer Services Design & Construction Requirements for Self-Lay Developments December 2017:

Overall water demand is calculated using IW CoP for Water Infrastructure section 3.7.2, as outlined below:

Per-capita consumption	150l/person/day
Average day/week demand factor	1.25
Peak demand factor	5.0

Average daily domestic demand = Total occupancy * Per-capita consumption

Average day/peak week demand = Average daily domestic demand * Average day/week demand factor

Peak hour water demand = Average day/peak week demand * Peak demand factor

Estimated water demand for the proposed development is provided in Table 7.1:

RESIDENTIAL WATER DEMAND							
Use Type	**No. of Units**	**Occupancy Rate**	**Population (P)**	**Average daily domestic demand (l/day)**	**Average daily domestic demand (l/s)**	**Average day/peak week demand (l/s)**	**Peak hour water demand (l/s)**
Residential	554	2.7 persons/dwelling	1496	224,400	2.60	3.25	16.25
						Peak hour water demand (l/s)	**16.25**

Table 7.1 Estimated Water Demand for Residential Development

COMMERCIAL WATER DEMAND							
Use Type	**Floor Space (m^2)**	**Occupancy Rate**	**Population (P)**	**Average daily domestic demand (l/day)**	**Average daily domestic demand (l/s)***	**Average day/peak week demand (l/s)**	**Peak hour water demand (l/s)**
Café	680	1 per 60 m^2	11	660	0.02	0.03	0.15
		1 per 3 m^2	226	3,390	0.08	0.1	0.50
Crèche	539	1 per 6 m^2 (children)	90	4,500	0.10	0.13	0.65
		1 per 5 children (staff)	18	900	0.02	0.03	0.15
Enterprise	2444	1 per 10 m2	244	12,200	0.28	0.35	1.75
Tenant Amenity	362	1 per 5 m^2	72	3,600	0.08	0.10	0.5
Retail	344	1 per 20 m^2	17	850	0.02	0.03	0.15
						Peak hour water demand (l/s)	**3.85**
For commercial premises, a working day is assumed to be over 12 hours							

Table 7.2 Estimated Water Demand for Commercial Development

Appendix A

PERMISSIBLE OUTFLOW CALCULATIONS

PROJECT			JOB REF.
Mixed Use Development at 1-3 East Road, East Wall, Dublin 3			p170200
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Permissible Site Discharge (Impermeable Area draining to Attenuation Tank)			1
Drawing ref.	**Calculations by**	**Checked by**	**Date**
170200-3001	IGR	NJF	13-Dec-18

PERMISSIBLE SURFACE WATER DISCHARGE CALCULATIONS

Site Area

What is the overall site area? **2.11** Hectares (ha) Site is Less than 50 Hectares

Pre-Development Catchment Soil Characteristics

Are there different soil types present on the pre-developed site? No

Catchment (This refers to the entire site area)	2.11	
Area	2.10	Hectares (ha)
Drainage Group	1	Class
Depth to Impermeable Layers	1	Class
Permeability Group above Impermeable Layers	3	Class
Slope (o)	1	Class
SOIL Type	2	
[1]SOIL Index	0.30	

SOIL	SOIL Value	SPR
1	0.15	0.10
2	0.30	0.30
3	0.40	0.37
4	0.45	0.47
5	0.50	0.53

Site SOIL Index Value **0.30**

Site SPR Value **0.30**

Post-Development Catchment Characteristics

Is the development divided into sub-catchments? No

What is the overall site area for catchment? 2.11 Hectares (ha)

Catchment 1	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Roofs (Draining to gullies)	5134.000	0.95	4877.300
Green Roofs	4120.000	0.70	2884.000
Roads and Footpaths - Type 1 (Draining to Gullies)	0.000	0.95	0.000
Road and Footpaths - Type 2 (Draining to SuDS Features)	0.000	0.80	0.000
Paved Areas (Draining to SuDS Features)	1683.000	0.80	1346.400
Paved Areas (Draining to gullies)	520.000	0.90	468.000
Permeable Paving	1853.000	0.70	1297.100
Green Podium	2965.000	0.50	1482.500
Podium draining to SuDS Features	2458.000	0.80	1966.400
Podium draining to gullies		0.80	0.000
Grassed Areas	2301.000	0.00	0.000
Public Open Space	0.000	0.00	0.000

Include Public Open Space in Effective Catchment Area? No

Effective Catchment Area **14321.700** m^2

Effective Catchment Runoff Coefficient **0.68**

Long-Term Storage

Is long-term Storage provided? No

Permissible Site Discharge

What is the Standard Average Annual Rainfall (SAAR)? 693.0 mm From Met Eireann, Co-ordinates N235000, E318000

Is the overall site area less than 50 hectares? Yes

[5]$QBAR_{Rural}$ calculated for 50 ha and linearly interpolated for area of site 3.90 Litres/sec

[7]Site Discharge = **3.90** Litres/sec

Notes and Formulae

1. SOIL index value calculated from Flood Studies Report - The Classification of Soils from Winter Rainfall Acceptance Rate (Table 4.5).
2. SPR value calculated from GDSDS - Table 6.7.
3. Rainfall depth for 100 year return period, 6 hour duration with additional 10% for climate change.
4. Long-term storage Vol_{xs} (m^3) = Rainfall.Area.10.[(PIMP/100)(0.8.α)+(1-PIMP/100)(β.SPR)-SPR]. (GDSDS Section 6.7.3).
   Where long-term storage cannot be provided on-site due to ground conditions, Total Permissible Outflow is to be kept to $QBAR_{(Rural)}$.
5. Total Permissible Outflow - $QBAR_{(Rural)}$ calculated in accordance with GDSDS - Regional Drainage Policies
   (Volume 2 - Chapter 6), i.e. $QBAR(m3/s)=0.00108x(Area)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ - For catchments greater than 50 hectares in area. Flow rates are linearly interpolated for areas samller than 50hectares.
6. Where Total Permissible Outflow is less than 2.0l/s and not achievable, use 2.0 l/s or closest value possible.
7. QBAR multiplied by growth factors of 0.85 for 1 year, 2.1 for 30 year and 2.6 for 100 year return period events, from GDSDS Figure C2.

PROJECT			JOB REF.
Mixed Use Development at 1-3 East Road, East Wall, Dublin 3			p170200
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Infiltration Volume			2
Drawing ref.	**Calculations by**	**Checked by**	**Date**
170200-3001	IGR	NJF	13-Dec-18

SURFACE WATER CALCULATIONS

Site Area

Total Site Area =	2.11	Hectares (ha)

Infiltration Volume (Post-Development)

Impermeable Area =	1.46	Hectares (ha)
Rainfall Depth =	5	mm
[1]**Infiltration Volume =**	58.5	m^3

Notes

1. Infiltration Volume (m^3) = Impermeable Area (ha) x 5mm x 10 (GDSDS Section 6.3.1.2.1). For sites where a pond is applicable.

80% runoff from impermeable areas assumed.

Appendix B

ATTENUATION CALCULATIONS

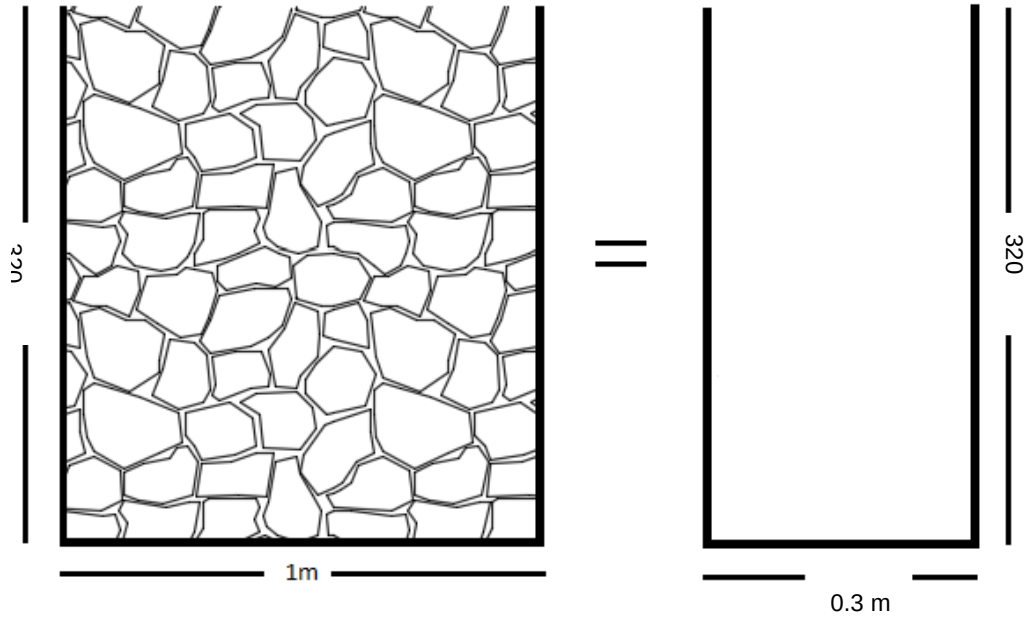
Calculation of attenuation tank dimensions:

In this surface water management design, the porosity of the storage beneath permeable paving and geo-cellular attenuation tank will vary. Micro Drainage source control does not enable the user to create calculations with different porosity values, therefore the attenuation tank was modelled assuming a porosity of 100%, effectively modelling the volume of storage required at the correct head. The volumes were then multiplied by the porosity of the proposed material for each element without altering the depth; 30% for free draining aggregate sub-base and 95% for the geo-cellular attenuation tank.

The free draining aggregate sub-base will be constructed in an area of 1,404m^2 at a depth of 0.32m and the geo-cellular storage will be placed in an area of 1022m^2 at a depth of 0.9m. This together with the porosity of each attenuation storage type results in *Table 1*.

Attenuation type	Calculated Volume from Micro Drainage (m^3)	Fixed Depth (m)	Porosity (void ratio)	Attenuation area (m^2)	Relative area (m^2)	Attenuation volume provided (m^3)
Geo-cellular Attenuation Tank	892.80	0.90	0.95	1,022.00	970.90	873.81
Free Draining Sub-base	88.24	0.32	0.30	1,404.00	421.20	134.78
TOTAL	**981.04**					**1,008.59**

Table 3 Storage provided



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

Half Drain Time : 2225 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	-0.570	0.230	0.0	3.7	3.7	223.3	O K
30 min Summer	-0.483	0.317	0.0	3.8	3.8	308.2	O K
60 min Summer	-0.390	0.410	0.0	3.8	3.8	398.1	O K
120 min Summer	-0.289	0.511	0.0	3.8	3.8	495.8	O K
180 min Summer	-0.227	0.573	0.0	3.8	3.8	556.3	O K
240 min Summer	-0.181	0.619	0.0	3.8	3.8	600.8	O K
360 min Summer	-0.116	0.684	0.0	3.8	3.8	664.4	O K
480 min Summer	-0.069	0.731	0.0	3.8	3.8	709.8	O K
600 min Summer	-0.033	0.767	0.0	3.8	3.8	744.8	O K
720 min Summer	-0.005	0.795	0.0	3.8	3.8	771.8	O K
960 min Summer	0.034	0.834	0.0	3.8	3.8	809.8	O K
1440 min Summer	0.075	0.875	0.0	3.8	3.8	849.4	O K
2160 min Summer	0.090	0.890	0.0	3.8	3.8	864.3	O K
2880 min Summer	0.089	0.889	0.0	3.8	3.8	863.6	O K
4320 min Summer	0.072	0.872	0.0	3.8	3.8	846.9	O K
5760 min Summer	0.046	0.846	0.0	3.8	3.8	821.3	O K
7200 min Summer	0.015	0.815	0.0	3.8	3.8	791.0	O K
8640 min Summer	-0.020	0.780	0.0	3.8	3.8	757.3	O K
10080 min Summer	-0.061	0.739	0.0	3.8	3.8	717.4	O K
15 min Winter	-0.542	0.258	0.0	3.7	3.7	250.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	85.194	0.0	195.8	38
30 min Summer	58.879	0.0	263.5	52
60 min Summer	38.241	0.0	390.3	82
120 min Summer	24.118	0.0	488.5	140
180 min Summer	18.261	0.0	546.8	198
240 min Summer	14.961	0.0	583.4	258
360 min Summer	11.264	0.0	606.1	376
480 min Summer	9.197	0.0	599.7	494
600 min Summer	7.854	0.0	585.7	614
720 min Summer	6.901	0.0	571.9	732
960 min Summer	5.625	0.0	549.2	970
1440 min Summer	4.216	0.0	517.0	1444
2160 min Summer	3.158	0.0	1109.7	2052
2880 min Summer	2.570	0.0	1079.3	2392
4320 min Summer	1.920	0.0	987.9	3168
5760 min Summer	1.560	0.0	1596.8	3992
7200 min Summer	1.328	0.0	1695.1	4840
8640 min Summer	1.164	0.0	1775.4	5712
10080 min Summer	1.041	0.0	1833.7	6472
15 min Winter	85.194	0.0	218.7	38

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	-0.444	0.356	0.0	3.8	346.0	O K
60 min Winter	-0.339	0.461	0.0	3.8	447.1	O K
120 min Winter	-0.226	0.574	0.0	3.8	557.8	O K
180 min Winter	-0.154	0.646	0.0	3.8	626.8	O K
240 min Winter	-0.102	0.698	0.0	3.8	678.1	O K
360 min Winter	-0.025	0.775	0.0	3.8	752.8	O K
480 min Winter	0.030	0.830	0.0	3.8	805.6	O K
600 min Winter	0.071	0.871	0.0	3.8	845.2	O K
720 min Winter	0.105	0.905	0.0	3.8	876.3	O K
960 min Winter	0.211	1.011	0.0	3.8	920.9	O K
1440 min Winter	0.326	1.126	0.0	3.8	969.4	O K
2160 min Winter	0.382	1.182	0.0	3.8	992.8	O K
2880 min Winter	0.371	1.171	0.0	3.8	988.2	O K
4320 min Winter	0.321	1.121	0.0	3.8	967.3	O K
5760 min Winter	0.236	1.036	0.0	3.8	931.2	O K
7200 min Winter	0.131	0.931	0.0	3.8	887.0	O K
8640 min Winter	0.061	0.861	0.0	3.8	836.0	O K
10080 min Winter	0.003	0.803	0.0	3.8	779.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	58.879	0.0	286.2	52
60 min Winter	38.241	0.0	436.3	80
120 min Winter	24.118	0.0	541.2	138
180 min Winter	18.261	0.0	593.7	196
240 min Winter	14.961	0.0	610.2	254
360 min Winter	11.264	0.0	599.4	370
480 min Winter	9.197	0.0	582.7	486
600 min Winter	7.854	0.0	568.9	602
720 min Winter	6.901	0.0	557.8	718
960 min Winter	5.625	0.0	542.9	950
1440 min Winter	4.216	0.0	530.9	1404
2160 min Winter	3.158	0.0	1139.9	2056
2880 min Winter	2.570	0.0	1107.6	2632
4320 min Winter	1.920	0.0	1034.9	3304
5760 min Winter	1.560	0.0	1786.9	4272
7200 min Winter	1.328	0.0	1893.4	5208
8640 min Winter	1.164	0.0	1966.6	6152
10080 min Winter	1.041	0.0	1951.4	7072

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)	16.200	Shortest Storm (mins)	15
Ratio R	0.279	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 1.430

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.250	8	12	0.250	16	20	0.230
4	8	0.250	12	16	0.250	20	24	0.200

Model Details

Storage is Online Cover Level (m) 0.700

Cellular Storage Structure

Invert Level (m) -0.800 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	970.9	1000.0	1.200	421.2	1000.0
0.100	970.9	1000.0	1.220	421.2	1000.0
0.200	970.9	1000.0	1.221	0.0	1000.0
0.300	970.9	1000.0	1.300	0.0	1000.0
0.400	970.9	1000.0	1.400	0.0	1000.0
0.500	970.9	1000.0	1.500	0.0	1000.0
0.600	970.9	1000.0	1.600	0.0	1000.0
0.700	970.9	1000.0	1.700	0.0	1000.0
0.800	970.9	1000.0	1.800	0.0	1000.0
0.900	970.9	1000.0	1.900	0.0	1000.0
0.901	421.2	1000.0	2.000	0.0	1000.0
1.000	421.2	1000.0	2.100	0.0	1000.0
1.100	421.2	1000.0	2.200	0.0	1000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0089-3800-1220-3800
Design Head (m)	1.220
Design Flow (l/s)	3.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	89
Invert Level (m)	-0.800
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.220	3.8
Flush-Flo™	0.369	3.8
Kick-Flo®	0.755	3.0
Mean Flow over Head Range	-	3.3

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

Hydro-Brake® Optimum Outflow Control

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.8	1.200	3.8	3.000	5.8	7.000	8.6
0.200	3.6	1.400	4.0	3.500	6.2	7.500	8.9
0.300	3.8	1.600	4.3	4.000	6.6	8.000	9.2
0.400	3.8	1.800	4.5	4.500	7.0	8.500	9.4
0.500	3.7	2.000	4.8	5.000	7.3	9.000	9.7
0.600	3.6	2.200	5.0	5.500	7.7	9.500	10.0
0.800	3.1	2.400	5.2	6.000	8.0		
1.000	3.5	2.600	5.4	6.500	8.3		

Appendix C

TOPOGRAPHICAL SURVEY

East Rd

Church Rd

NO ENTRY

STOP

STAFF ONLY

DISABLED PARKING

ZONE 1

ZONE 1

STN
tsmn4
E 717730.605
N 735070.342
H 0.566

STN
tsmn3
E 717715.706
N 735050.424
H 0.237

STN
bm2
E 717675.391
N 735036.801
H 0.661

STN
tsmn10
E 717716.706
N 735004.578
H 0.221

STN
tsmn5
E 717791.542
N 735021.247
H 0.692

STN
tsmn6
E 717773.596
N 734993.661
H 0.610

717650 717675 717700 717725 717750 717775 717800

735100 735075 735050 735025 735000 734975

LEGEND

Street furniture & Services

- Over Head Wires (LUAS) - Pylon ESB
- Flowerbed
- Pipe
- Lift
- Barrier
- Pump
- Trial Pit
- Bus/Tram Shelter
- Postbox
- Valve - General
- Water Valve
- Gas Valve
- Sluice Valve
- Air Valve
- Stop Cock
- C P Post
- Marker Post
- Traffic light
- Parking Meter
- Plane Aerial Mark
- Smart Card Validator
- Unknown Valve
- Bus Stop
- Bollard
- Beacon
- Coalhole Cover
- Bore Hole
- Electricity Pole
- Telegraph pole
- OCS Pole
- CCTV Camera Pole
- Lamp Post
- Foul Manhole
- Surface Water MH
- Manholes
- Air Conditioning Vents
- Services Inspection Cover
- Traffic Inspection Cover
- Cable TV Inspection Cover
- ESAT Inspection Cover
- NTL Inspection Cover
- Eircom Inspection Cover
- Rodding Eye
- Road Sign
- Bench Seat
- Kiosk
- Gully
- Waste Bin
- Hydrant
- Fire Hydrant
- ESB Box
- ESB Inspection Cover
- Traffic Control Box
- LUAS Technical Cubicle
- Ticket Vending Machine
- Water Meter Cover
- Telecom Inspection Cover
- Monument / Toilets
- Tank Storage
- Basement: MH. Cover & Pipe
- Dished Aerial Mark
- Stay for pole
- Pipe Protection
- Washout
- Phone Box
- Duct
- Gas Cover
- C P Box
- Waste Bin
- Fire Hydrant
- ESB Box
- Traffic Control Box
- Water Meter Cover
- Pipe Protection
- Washout

Natural Features

- Surface Change
- Land Drain
- Bottom of Slope
- Top of Slope
- Ditch
- Water Edge / Lake / Pond
- Hedge / Trees Drip Line / Vegetation
- Tree Coniferous
- Tree Deciduous
- Water Level
- Crown Level
- Invert level
- Bed Level
- Spotheight

Golf

- Fair Way
- Green
- Tee Box

Other

- Survey Station
- Photo point
- Top of Tree

Built Features

Roads & Road Markings

- Building
- Edge of Road
- Kerb Bottom
- Kerb Top
- Bridge Abutment
- Bridge Deck
- Bridge Parapet
- Building Façade
- Footpath / Platform Train & Tram
- Damp Proof Course / Verge
- Bridge Pier / Wall & Gate Pillar / LUAS Trackbed
- Cycleway / Private Landing Area
- Fence
- Gate
- Road Centreline
- Top of Wall
- Hoarding
- Property Line
- Road Scar
- Top of Fence
- Floor Level
- Apex Height
- Eaves Height
- Parapet Height
- Soffit Elevation
- Step Level
- Concrete Pad
- Track
- Wall / Retaining Wall
- Railway / Tram Rail / Grating / Ramp
- Building Canopy / Roof / Overhang

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The Company shall not be liable for any inaccuracy of the data provided beyond the specified scale or accuracy, or for any matters resulting from their use for purposes other than that stated in the Contract. No liability shall attach to the Surveyor in respect of any consequential loss or damages suffered by the Client.

The Client must promptly notify the Company of any errors in mapping of which it becomes aware. If misleading, inaccurate or otherwise inappropriate information is brought to the Company's attention or the Company itself identifies any such imprecision or error in a survey, it shall use its reasonable endeavours to fix or remove it and if necessary in certain instances, the Company being on notice of any such misleading, inaccurate or otherwise inappropriate information, it will re-conduct the survey and reproduce the data to within the specified scale or accuracy.

North

Site Location

Map Sheet Layout

01

Surveyed by : MN	Date: February 2018	Datum	Main Head
Drawn by : AR	Date: 15.02.2018	Grid System:	
Checked by : PK	Date: 16.02.2018	Irish National Grid ☐ ITM(15) ☐	

Revisions

No.	Date	Description
0	16.02.2018	First Drawing

SOCIETY OF CHARTERED SURVEYORS IRELAND

THE SURVEY ASSOCIATION FULL MEMBER

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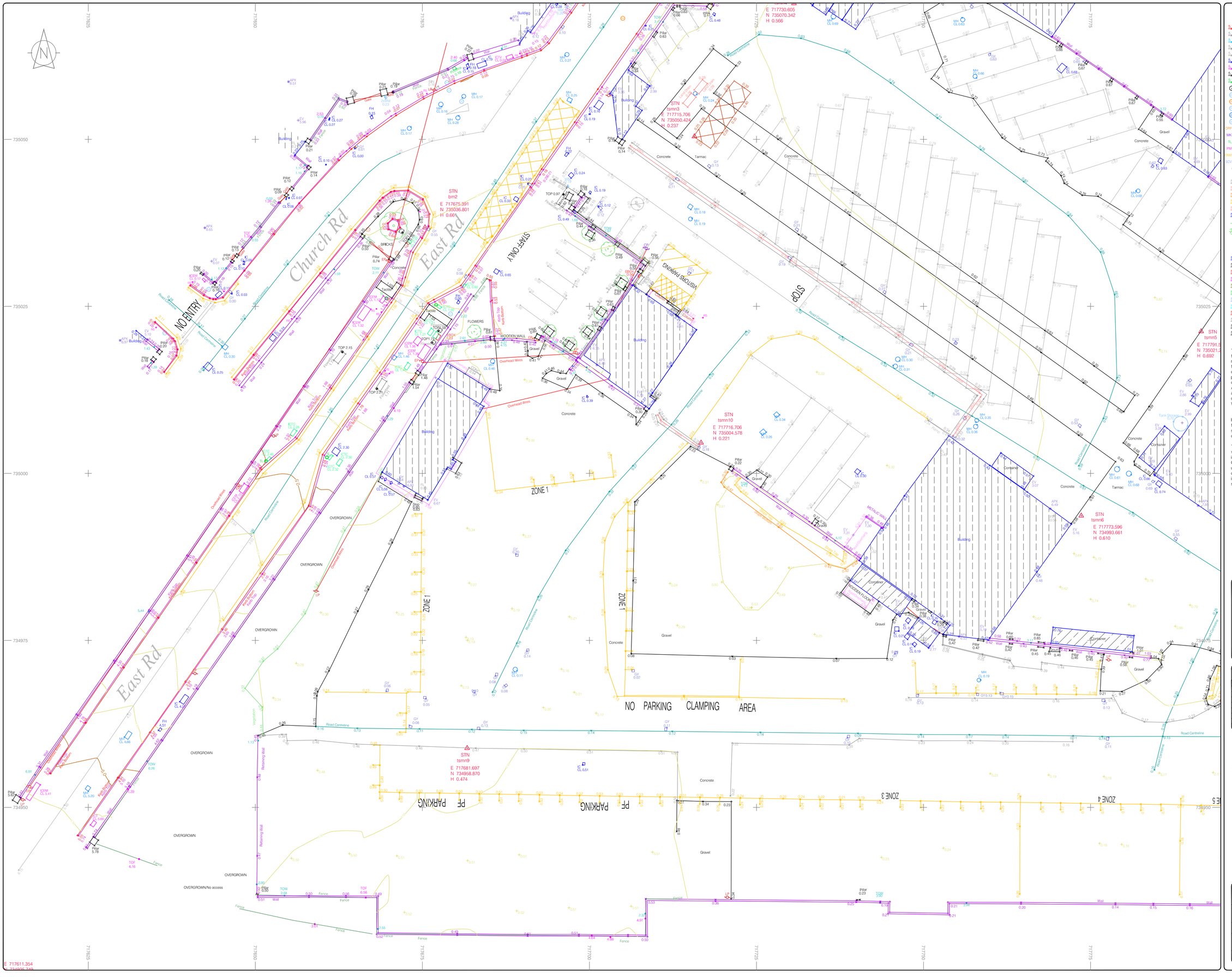
Client :	Glenveagh Living
Project :	Survey 3 East Road
Date : 16.02.2018	**Scale :** 1:250@A1
Description :	Topographical survey
Drawing Number :	MSL24281-T-Rev0-01



LEGEND

Street furniture & Services

Over Head Wires (LUAS) - Pylon ESB · Flowerbed · Pipe · Lift · Barrier · Pump · Trial Pit · Bus/Tram Shelter · Postbox · Valve - General · Water Valve · Gas Valve · Sluice Valve · Air Valve · Stop Cock · C P Post · Marker Post · Traffic light · Parking Meter · Plane Aerial Mark · Smart Card Validator · Unknown Valve

Road Sign · Bench Seat · Bus Stop · Duct · Bollard · Kiosk · Beacon · Gully · Coalhole Cover · Bore Hole · Waste Bin · Electricity Pole · Hydrant · Telegraph pole · Fire Hydrant · OCS Pole · ESB Box · CCTV Camera Pole · ESB Inspection Cover · Lamp Post · Traffic Control Box · Foul Manhole · LUAS Technical Cubicle · Surface Water MH · Ticket Vending Machine · Manholes · Water Meter Cover · Air Conditioning Vents · Telecom Inspection Cover · Services Inspection Cover · Monument / Toilets · Traffic Inspection Cover · Tank Storage · Cable TV Inspection Cover · Basement: MH, Cover & Pipe · ESAT Inspection Cover · Disched Aerial Mark · NTL Inspection Cover · Stay for pole · Eircom Inspection Cover · Pipe Protection · Rodding Eye · Washout

Natural Features

Surface Change · Land Drain · Bottom of Slope · Top of Slope · Ditch · Water Edge / Lake / Pond · Hedge / Trees Drip Line / Vegetation · Tree Coniferous · Tree Deciduous

Water Level · Crown Level · Invert level · Bed Level · Spotheight

Golf

Fair Way · Green · Tee Box

Other

Survey Station · Photo point · Top of Tree

Built Features

Roads & Road Markings

Building · Edge of Road · Kerb Bottom · Kerb Top · Bridge Abutment · Bridge Deck · Bridge Parapet · Building Façade · Footpath / Platform Train & Tram · Damp Proof Course / Verge · Bridge Pier / Wall & Gate Pillar / LUAS Trackbed · Cycleway / Private Landing Area

Fence · Gate · Road Centreline · Top of Wall · Hoarding · Property Line · Road Scar · Top of Fence

Floor Level · Apex Height · Eaves Height · Parapet Height · Soffit Elevation · Step Level · Concrete Pad · Track

Wall / Retaining Wall · Railway / Tram Rail / Grating / Ramp · Building Canopy / Roof / Overhang

North

Site Location

Map Sheet Layout:

02

Surveyed by : MN	Date: February 2018	Datum : Malin Head
Drawn by : AR	Date: 15.02.2018	Grid System:
Checked by : PK	Date: 16.02.2018	Irish National Grid ☐ ITM(15) ☐

Revisions

No	Date	Description
0	16.02.2018	First Drawing

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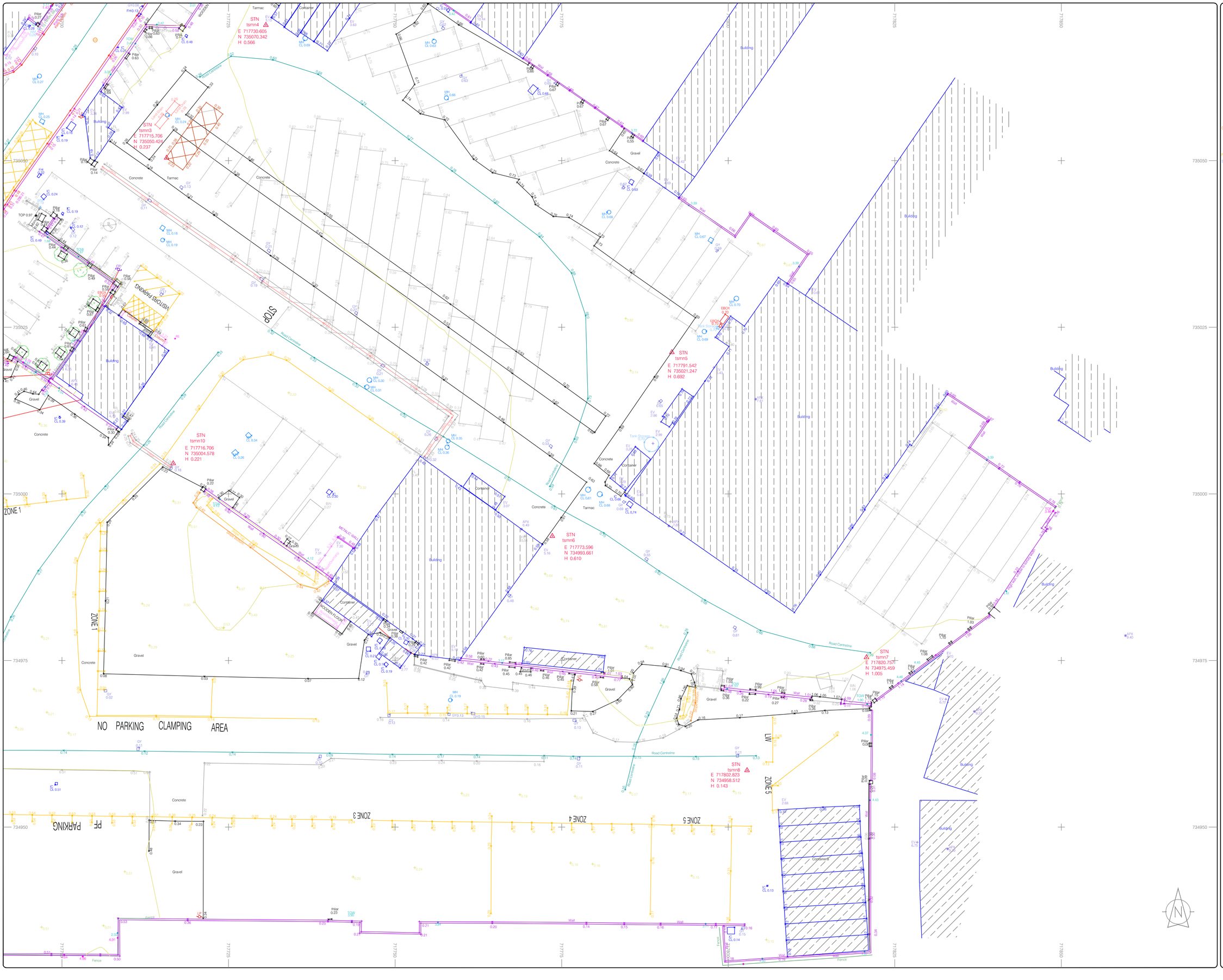
The Client must promptly notify the Company of any errors in mapping of which it becomes aware. If misleading, inaccurate or otherwise inappropriate information is brought to the Company's attention or the Company itself identifies any such imprecision or error in a survey, it shall use its reasonable endeavours to fix or remove it and if necessary in certain instances, the Company being on notice of any such misleading, inaccurate or otherwise inappropriate information, it will re-conduct the survey and reproduce the data to within the specified scale or accuracy.

Client :	Glenveagh Living
Project :	Survey 3 East Road
Date : 16.02.2018	**Scale :** 1:250@A1
Description :	Topographical survey
Drawing Number :	**MSL24281-T-Rev0-02**

E 717611.354
N 734935.749



LEGEND

Street furniture & Services

- Over Head Wires (LUAS) - Pylon ESB
- Flowerbed
- Pipe
- Lift
- Barrier
- Pump
- Trial Pit
- Bus/Tram Shelter
- Postbox
- Valve - General
- Water Valve
- Gas Valve
- Sluice Valve
- Air Valve
- Stop Cock
- C P Post
- Marker Post
- Traffic light
- Parking Meter
- Plane Aerial Mark
- Smart Card Validator
- Unknown Valve
- Road Sign
- Bus Stop
- Bollard
- Beacon
- Coalhole Cover
- Bore Hole
- Electricity Pole
- Telegraph pole
- OCS Pole
- CCTV Camera Pole
- Lamp Post
- Foul Manhole
- Surface Water MH
- Manholes
- Air Conditioning Vents
- Services Inspection Cover
- Traffic Inspection Cover
- Cable TV Inspection Cover
- ESAT Inspection Cover
- NTL Inspection Cover
- Eircom Inspection Cover
- Rodding Eye
- Phone Box
- Bench Seat
- Kiosk
- Gully
- LUAS Car Park Vent
- Waste Bin
- Hydrant
- Fire Hydrant
- ESB Box
- ESB Inspection Cover
- Traffic Control Box
- LUAS Technical Cubicle
- Ticket Vending Machine
- Water Meter Cover
- Telecom Inspection Cover
- Monument / Toilets
- Tank Storage
- Basement: MH, Cover & Pipe
- Dished Aerial Mark
- Stay for pole
- Pipe Protection
- Washout

Natural Features

- Surface Change
- Land Drain
- Bottom of Slope
- Top of Slope
- Ditch
- Water Edge / Lake / Pond
- Hedge / Trees Drip Line / Vegetation
- Tree Coniferous
- Tree Deciduous
- Water Level
- Crown Level
- Invert level
- Bed Level
- Spotheight

Golf

- Fair Way
- Green
- Tee Box

Other

- Survey Station
- Photo point
- Top of Tree

Built Features
Roads & Road Markings

- Building
- Edge of Road
- Kerb Bottom
- Kerb Top
- Bridge Abutment
- Bridge Deck
- Bridge Parapet
- Building Façade
- Footpath / Platform Train & Tram
- Damp Proof Course / Verge
- Bridge Pier / Wall & Gate Pillar / LUAS Trackbed
- Cycleway / Private Landing Area
- Fence
- Gate
- Road Centreline
- Top of Wall
- Hoarding
- Property Line
- Road Scar
- Top of Fence
- Floor Level
- Apex Height
- Eaves Height
- Parapet Height
- Soffit Elevation
- Step Level
- Concrete Pad
- Track
- Wall / Retaining Wall
- Railway / Tram Rail / Grating / Ramp
- Building Canopy / Roof / Overhang

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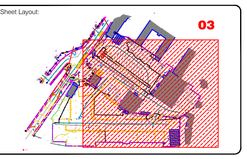
North

Site Location

Map Sheet Layout:



Surveyed by:	MN	Date:	February 2018
Drawn by :	AR	Date:	15.02.2018
Checked by :	PK	Date:	16.02.2018

Datum: Malin Head
Grid System:
Irish National Grid ☐ ITM (15) ☐

Revisions

No	Date	Description
0	16.02.2018	First Drawing

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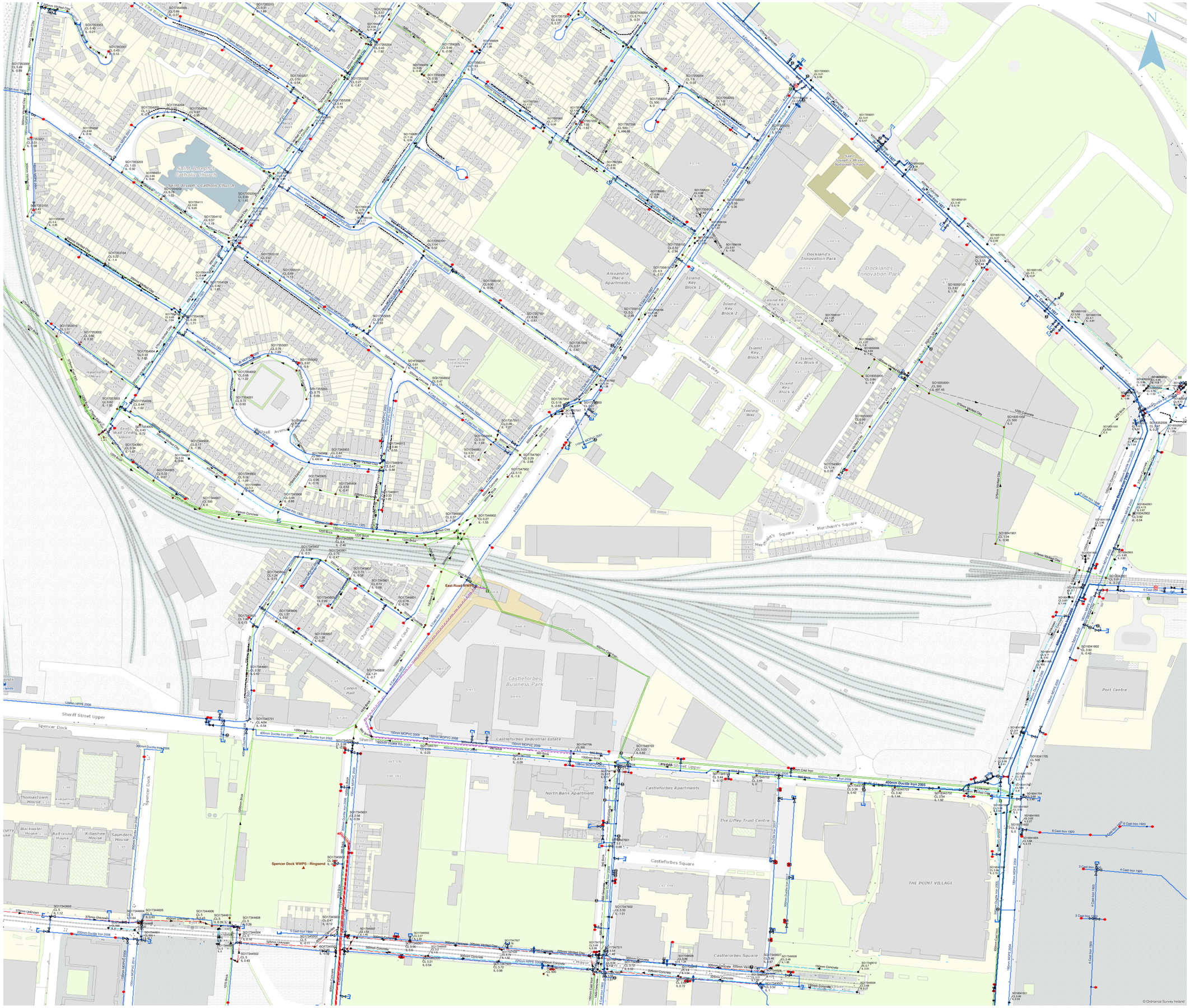
Client :	Glenveagh Living
Project :	Survey 3 East Road
Date : 16.02.2018	**Scale :** 1:250@A1
Description :	Topographical survey
Drawing Number :	**MSL24281-T-Rev0-03**

Appendix D

IRISH WATER RECORDS



UISCE ÉIREANN : IRISH WATER

Legend

- Boundary Meter
- Check Meter
- Unknown Meter ; Other Meter
- PRV
- Sluice Valve Open
- Sluice Valve Closed
- Butterfly Valve Open
- Sluice Valve Closed
- Scour Valves
- Double Air Control Valve

Water Hydrants

Hydrant Function

- Fire Hydrant
- Telemetry Kiosk
- Cap
- Other Fittings

Water Distribution Mains

Owned By

- Irish Water
- Irish Water
- Water Abandoned Lines

Sewer Manholes

Manhole Type

- Standard
- Hatchbox
- Lamphole

Sewer Discharge Points

Discharge Type

- Other; Unknown
- Pump Station

Sewer Inlets

Inlet Type

- Catchpit
- Gravity - Combined
- Gravity - Foul
- Gravity - Overflow
- Pumping - Combined
- Pumping - Foul
- Syphon - Overflow

Storm Manholes

Manhole Type

- Standard
- Surface Gravity Mains
- Surface Gravity Mains Private

Surface Fittings

Fitting Type

- Other; Unknown

1:1,000 at A0

Last edited: 13/04/2018

Metres

0 25 50 100

Appendix E

IRISH WATER CONFIRMATION OF FEASBILITY & STATEMENT OF DESIGN ACCEPTANCE

Nick Fenner
Ormond House
Upper Ormond Quay
Dublin 7

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

11 September 2018

Dear Sir/Madam,

Re: Customer Reference No 0356794551 pre-connection enquiry - Subject to contract | Contract denied
[Connection for 520 domestic units]

Irish Water has reviewed your pre-connection enquiry in relation to
water and wastewater connections at 1-3 East Road, East Wall, Dublin
Based upon the details you have provided with your pre-connection enquiry and on the capacity currently available 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 can be facilitated.

Water:
In order to accommodate the proposed connection at the Premises, upgrade works are required to provide a connection from the 24" trunk watermain on East Wall Road into the adjacent 12" distribution watermain. This connection will require a PRV to be installed. An existing 150mm connection to the 24" trunk watermain exists at the junction of East Wall Road and the entrance to the Port Tunnel that could possibly be used. Further investigation of the viability of this existing connection will be required at connection stage. Further testing of the network will be required following the installation of the above arrangement to ensure sufficient water supply to the development and to determine if further upgrades are necessary. Irish Water does not currently have any plans to carry out the works required to provide the necessary upgrade and capacity. Should you wish to have such upgrade works progressed, please contact Irish Water to discuss this further.
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:
In order to accommodate the proposed connection at the Premises the network requires reconfiguration works in the vicinity of the East Road Pumping station. Currently Irish Water is doing a survey of the network and details of the required reconfiguration will be known by the end of 2018 after the survey. Currently the works are not on Irish Water Capital Investment Plan.
There is a combined wastewater system in the area. The development has to incorporate Sustainable Drainage Systems/ Attenuation in the management of stormwater and to reduce surface water inflow into the combine sewers. Full details of these have to be agreed with Dublin City Council Drainage Division.

Strategic Housing Development
Irish Water notes that the scale of this development dictates that it is subject to the Strategic Housing Development planning process. Therefore:
A. 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.
B. 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 and appropriate connection fee paid at a later date.
C. In advance of submitting this development to An Bord Pleanala for full assessment, the Developer is required to have entered into a Project Works Services Agreement to deliver infrastructure upgrades to facilitate the connection of the development to Irish Water infrastructure.

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 Utility Regulation.

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

Nick Fenner,
DBFL,
Ormond House,
Upper Ormond Quay,
Dublin 7

3 April 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 1-3 East Road, East Wall, Dublin(the "Development") (the "Design Submission") / 0356794551.

Dear Nick,

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,

Maria O'Dwyer

Connections and Developer Services

Appendix A

Document Title & Revision

- 170200-3000 Revision C Site Services Layout
- 170200-3001 Revision B Watermain Layout

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 F

FOUL CALCULATIONS

FOUL SEWERAGE DESIGN

Design Criteria for Foul

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Calculation Method	EN 752	Maximum Backdrop Height (m)	1.500
Frequency Factor	0.50	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	25.816	0.156	165.5	0.000	238.0	0.0	0.600	o	150	Pipe/Conduit	
F1.001	21.220	0.236	89.9	0.000	0.0	0.0	0.600	o	150	Pipe/Conduit	
F2.000	23.776	0.392	60.7	0.000	224.0	0.0	0.600	o	150	Pipe/Conduit	
F1.002	74.842	0.377	198.5	0.000	0.0	0.0	0.600	o	225	Pipe/Conduit	
F1.003	14.409	0.106	135.9	0.000	2730.0	0.0	0.600	o	225	Pipe/Conduit	
F3.000	42.233	0.226	186.9	0.000	672.0	0.0	0.600	o	225	Pipe/Conduit	
F3.001	23.036	0.095	242.5	0.000	210.0	0.0	0.600	o	225	Pipe/Conduit	
F3.002	18.173	0.324	56.1	0.000	0.0	0.0	0.600	o	225	Pipe/Conduit	
F4.000	16.766	0.140	119.8	0.000	224.0	0.0	0.600	o	150	Pipe/Conduit	
F4.001	6.875	0.057	120.6	0.000	0.0	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	-0.050	0.000	0.0	238.0	0.0	80	0.80	0.78	13.8	7.7
F1.001	-0.206	0.000	0.0	238.0	0.0	67	1.01	1.06	18.7	7.7
F2.000	-0.050	0.000	0.0	224.0	0.0	59	1.16	1.29	22.9	7.5
F1.002	-0.517	0.000	0.0	462.0	0.0	83	0.80	0.92	36.8	10.7
F1.003	-0.894	0.000	0.0	3192.0	0.0	130	1.18	1.12	44.5	28.2
F3.000	-0.355	0.000	0.0	672.0	0.0	91	0.87	0.95	37.9	13.0
F3.001	-0.581	0.000	0.0	882.0	0.0	105	0.81	0.84	33.2	14.8
F3.002	-0.676	0.000	0.0	882.0	0.0	70	1.40	1.75	69.6	14.8
F4.000	-0.050	0.000	0.0	224.0	0.0	72	0.90	0.92	16.2	7.5
F4.001	-0.190	0.000	0.0	224.0	0.0	72	0.90	0.91	16.1	7.5

Network Design Table for Foul

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F4.002	29.010	0.244	118.9	0.000	0.0	0.0	0.600	o	150	Pipe/Conduit	
F4.003	15.554	0.139	111.9	0.000	1190.0	0.0	0.600	o	225	Pipe/Conduit	
F4.004	14.752	0.077	191.6	0.000	2352.0	0.0	0.600	o	225	Pipe/Conduit	
F4.005	26.901	0.219	122.8	0.000	0.0	0.0	0.600	o	225	Pipe/Conduit	
F1.004	30.578	0.141	216.9	0.000	0.0	0.0	0.600	o	300	Pipe/Conduit	
F1.005	24.677	0.124	199.0	0.000	0.0	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F4.002	-0.247	0.000	0.0	224.0	0.0	71	0.90	0.92	16.3	7.5
F4.003	-0.566	0.000	0.0	1414.0	0.0	96	1.16	1.24	49.1	18.8
F4.004	-0.704	0.000	0.0	3766.0	0.0	155	1.05	0.94	37.4	30.7
F4.005	-0.781	0.000	0.0	3766.0	0.0	133	1.25	1.18	46.9	30.7
F1.004	-1.075	0.000	0.0	7840.0	0.0	166	1.11	1.06	75.2	44.3
F1.005	-1.216	0.000	0.0	7840.0	0.0	161	1.14	1.11	78.5	44.3

Manhole Schedules for Foul

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
F6	0.700	0.750	Open Manhole	1200	F1.000	-0.050	150				
F5	0.700	0.906	Open Manhole	1200	F1.001	-0.206	150	F1.000	-0.206	150	
FB4	0.700	0.750	Open Manhole	1200	F2.000	-0.050	150				
F4	0.620	1.137	Open Manhole	1200	F1.002	-0.517	225	F1.001	-0.442	150	
								F2.000	-0.442	150	
F3	0.640	1.534	Open Manhole	1200	F1.003	-0.894	225	F1.002	-0.894	225	
F2-3	0.620	0.975	Open Manhole	1200	F3.000	-0.355	225				
F2-2	0.600	1.181	Open Manhole	1200	F3.001	-0.581	225	F3.000	-0.581	225	
F2-1	0.650	1.326	Open Manhole	1200	F3.002	-0.676	225	F3.001	-0.676	225	
FB8	0.700	0.750	Open Manhole	1200	F4.000	-0.050	150				
FB7	0.700	0.890	Open Manhole	1200	F4.001	-0.190	150	F4.000	-0.190	150	
FB6	0.700	0.947	Open Manhole	1200	F4.002	-0.247	150	F4.001	-0.247	150	
FB5	0.700	1.266	Open Manhole	1200	F4.003	-0.566	225	F4.002	-0.491	150	
F1-2	0.650	1.355	Open Manhole	1200	F4.004	-0.704	225	F4.003	-0.705	225	
F1-1	0.650	1.431	Open Manhole	1200	F4.005	-0.781	225	F4.004	-0.781	225	
F1	0.640	1.715	Open Manhole	1200	F1.004	-1.075	300	F1.003	-1.000	225	
								F3.002	-1.000	225	
								F4.005	-1.000	225	
F0-01	0.330	1.546	Open Manhole	1200	F1.005	-1.216	300	F1.004	-1.216	300	
F0	0.270	1.610	Open Manhole	1200		OUTFALL		F1.005	-1.340	300	

PIPELINE SCHEDULES for Foul

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)
F1.000	o	150	F6	0.700	-0.050	0.600	Open Manhole	1200
F1.001	o	150	F5	0.700	-0.206	0.756	Open Manhole	1200
F2.000	o	150	FB4	0.700	-0.050	0.600	Open Manhole	1200
F1.002	o	225	F4	0.620	-0.517	0.912	Open Manhole	1200
F1.003	o	225	F3	0.640	-0.894	1.309	Open Manhole	1200
F3.000	o	225	F2-3	0.620	-0.355	0.750	Open Manhole	1200
F3.001	o	225	F2-2	0.600	-0.581	0.956	Open Manhole	1200
F3.002	o	225	F2-1	0.650	-0.676	1.101	Open Manhole	1200
F4.000	o	150	FB8	0.700	-0.050	0.600	Open Manhole	1200
F4.001	o	150	FB7	0.700	-0.190	0.740	Open Manhole	1200
F4.002	o	150	FB6	0.700	-0.247	0.797	Open Manhole	1200
F4.003	o	225	FB5	0.700	-0.566	1.041	Open Manhole	1200
F4.004	o	225	F1-2	0.650	-0.704	1.129	Open Manhole	1200
F4.005	o	225	F1-1	0.650	-0.781	1.206	Open Manhole	1200
F1.004	o	300	F1	0.640	-1.075	1.415	Open Manhole	1200
F1.005	o	300	F0-01	0.330	-1.216	1.246	Open Manhole	1200

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)
F1.000	25.816	165.5	F5	0.700	-0.206	0.756	Open Manhole	1200
F1.001	21.220	89.9	F4	0.620	-0.442	0.912	Open Manhole	1200
F2.000	23.776	60.7	F4	0.620	-0.442	0.912	Open Manhole	1200
F1.002	74.842	198.5	F3	0.640	-0.894	1.309	Open Manhole	1200
F1.003	14.409	135.9	F1	0.640	-1.000	1.415	Open Manhole	1200
F3.000	42.233	186.9	F2-2	0.600	-0.581	0.956	Open Manhole	1200
F3.001	23.036	242.5	F2-1	0.650	-0.676	1.101	Open Manhole	1200
F3.002	18.173	56.1	F1	0.640	-1.000	1.415	Open Manhole	1200
F4.000	16.766	119.8	FB7	0.700	-0.190	0.740	Open Manhole	1200
F4.001	6.875	120.6	FB6	0.700	-0.247	0.797	Open Manhole	1200
F4.002	29.010	118.9	FB5	0.700	-0.491	1.041	Open Manhole	1200
F4.003	15.554	111.9	F1-2	0.650	-0.705	1.130	Open Manhole	1200
F4.004	14.752	191.6	F1-1	0.650	-0.781	1.206	Open Manhole	1200
F4.005	26.901	122.8	F1	0.640	-1.000	1.415	Open Manhole	1200
F1.004	30.578	216.9	F0-01	0.330	-1.216	1.246	Open Manhole	1200
F1.005	24.677	199.0	F0	0.270	-1.340	1.310	Open Manhole	1200

Area Summary for Foul

Pipe Number	Gross Area (ha)	Pipe Total (ha)
1.000	0.000	0.000
1.001	0.000	0.000
2.000	0.000	0.000
1.002	0.000	0.000
1.003	0.000	0.000
3.000	0.000	0.000
3.001	0.000	0.000
3.002	0.000	0.000
4.000	0.000	0.000
4.001	0.000	0.000
4.002	0.000	0.000
4.003	0.000	0.000
4.004	0.000	0.000
4.005	0.000	0.000
1.004	0.000	0.000
1.005	0.000	0.000
	Total	Total
	0.000	0.000

Free Flowing Outfall Details for Foul

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.005	F0	0.270	-1.340	0.000	1200	0

Appendix G

DCC PRE-APP COMMENT RESPONSES

This document has been created to demonstrate how Dublin City Councils comments have been addressed from the original pre-planning application. The original DCC comments can be found in the left column while the response and explanation of how the design has been amended is shown on the right.

	DCC Comment	**Application Response**
	ROADS DEPARTMENT	
1	The proposed 3no. on street car parking spaces, 2no. on the west side of East Road and the 3rd on Church Road should be removed as part of the proposal.	Noted, these 3 spaces have been removed and can be seen on updated DBFL drawing 170200-2000.
2	The applicant is requested to provide details on the proposed servicing arrangements, this should ensure that refuse collection does not conflict with normal vehicular movements at the access points to the undercroft. The types of service vehicle should also be clearly legible on the submitted drawings.	As part of the servicing strategy the external vehicle area has been designed to accommodate all types of anticipated service vehicles. For the retail/commercial aspects of the development it is expected that deliveries will be the most frequent vehicles, and a set down layby has been provided (15.5m long by 2.7m wide) to accommodate these. The management company of the development will enforce restrictions for this set down area to ensure the area is available for the required servicing of the development. The proposed road layout and hard landscaping areas have been tracked to demonstrate that the site's proposed corner radii and turning heads will accommodate everyday vehicles such as normal delivery and cars. Other vehicles such as refuse trucks and fire tender have been tracked to ensure they can turn and manoeuvre around the development (refer to DBFL Drawings 170200-2003). The types of service vehicle have been clearly annotated on the updated drawings. As part of the refuse strategy detailed in the Operational Waste Management Strategy, the refuse collection point will be located adjacent to block D1 by the set down area. This will allow refuse vehicles to enter the development, turn in in the external vehicle area and use the set down layby to collect the refuse while keeping the entrance and exit routes clear. As per the Operational Waste Management Strategy, it will be the development's management company that will ensure all refuse is moved from the waste storage areas to the refuse collection point. More details of the refuse strategy can be found in the Operation Management Strategy included with the planning application.

3	The applicant shall identify the areas to be Taken in Charge by Dublin City Council.	A drawing has been created to clearly identify the areas to be Taken in Charge. This consists of 3 defining areas as follows: • Private frontage to commercial developments on East Road • Taken in charge area (covering area that is currently owned by the applicant) • Works in DCC lands for Junction upgrade Please refer to drawing 170200 – 2002.
4	The applicant shall submit confirmation from a Car Club provider confirming commitment of a car share scheme for the development. The location of the car club parking spaces shall be clearly indicated on the associated drawings	A letter from GoCar has been included in appendices of the Infrastructure Design Report and the Traffic and Transportation Assessment. This indicates GoCar would like to include 3 car club spaces for the development. The location of Car club spaces have been labelled on drawing 170200-2001
5	A detailed Car Parking Management Plan shall be submitted which includes details as to how car parking spaces will be allocated and managed on an on-going basis.	A Development Management Plan by Aramark has been lodged as part of the application which will detail how car parking spaces are allocated and managed as part of the development.
6	A cycle parking management plan, indicating how bicycle parking shall be kept secure and accessible, shall be submitted. A key/fob access is required to bicycle compounds and cycle parking shall allow both wheel and frame be locked to the parking stand.	A Development Management Plan by Aramark has been lodged as part of the application which will detail how cycle parking is secure and accessible.

	DCC Comment	Application Response
	DRAINAGE DEPARTMENT	
7	Revised surface water storage calculations shall be submitted to account for 20% climate change as per the "Dublin City Development Plan 2016-2020 Strategic Flood Risk Assessment".	All surface water calculations have been revised to account for 20% climate change allowance and the drawings have been updated to reflect the change in required volume within the system.
8	The developer shall carry our further flood risk assessment for the proposed development: • Assuming a one year high tide event during 100 year rainfall event • The impact of 20% Climate Change as outlined in the "Dublin City Development Plan 2016-2020 Strategic Flood Risk Assessment".	A section in the SSFRA has been added under exceedance events to clarify this, and the further assessment has been summarised below. It must be noted the surface water runoff for the area drains to a combined system and flows to the East Road Pumping station south of the development. As the combined drainage is pumped at this point, the site's drainage network is not tidally influenced and the drainage infrastructure around the development should flow freely in the case of a high tide. To further analyse this scenario, in the unlikely case the infrastructure does become tidal locked. There would be sufficient storage within the development's attenuation system to ensure flooding would not occur in the 1% AEP rainfall event. Reviewing the drainage calculations, the development requires 992m3 of storage for the 2160min duration 1% AEP event which includes for 20% climate change. Taking a worst-case scenario that the drainage infrastructure could be tide locked for 8 hours, it can be noted that the total discharge volume from shorter storm durations of the 1% AEP event are smaller than the attenuation volume required for the 2160min duration storm event. It is evident the developments drainage system is capable of storing up to a 10hour storm (for the 0.1%AEP event + 20% Climate change) with no discharge leaving site.