

INFRASTRUCTURE

Project

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

Report Title

Site Specific Flood Risk Assessment

Client

Glenveagh



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Job Title: **Proposed Mixed Use Development at 1-4 East Road, East Wall, Dublin 3**

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Report Title: **SITE SPECIFIC FLOOD RISK ASSESSMENT,
PROPOSED MIXED USE DEVELOPMENT AT 1-4 EAST ROAD, EAST WALL, DUBLIN 3**

Report Reference: **170200-Rep-003**

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1.0 INTRODUCTION

1.1 Background

DBFL Consulting Engineers were commissioned by the applicant to prepare a Site Specific Flood Risk Assessment (SSFRA) for the proposed mixed use development on East Road, Dublin 3. This SSFRA was prepared to comply with current planning legislation and forms part of proposed planning application for the subject site.

1.2 Objectives

The objectives of this report are to inform the planning authority regarding flood risk for the potential development of the lands. The report will assess the site and development proposals in accordance the requirements of “*The Planning System and Flood Risk Management Guidelines for Planning Authorities*”.

The report will provide the following;

- The site’s flood zone category.
- Information to allow an informed decision of the planning application in the context of flood risk.
- Appropriate flood risk mitigation and management measures for any residual flood risk

1.3 Flood Risk Assessment Scope

This SSFRA relates only to the proposed development site in the vicinity of East Road and its immediate surroundings. This report uses information obtained from various sources, together with an assessment of flood risk for the existing land and proposed development. The report follows the requirements of ‘*The Planning System & Flood Risk Management – Guidelines for Planning Authorities*’, (referred to as the *Guidelines* for the remainder of this report).

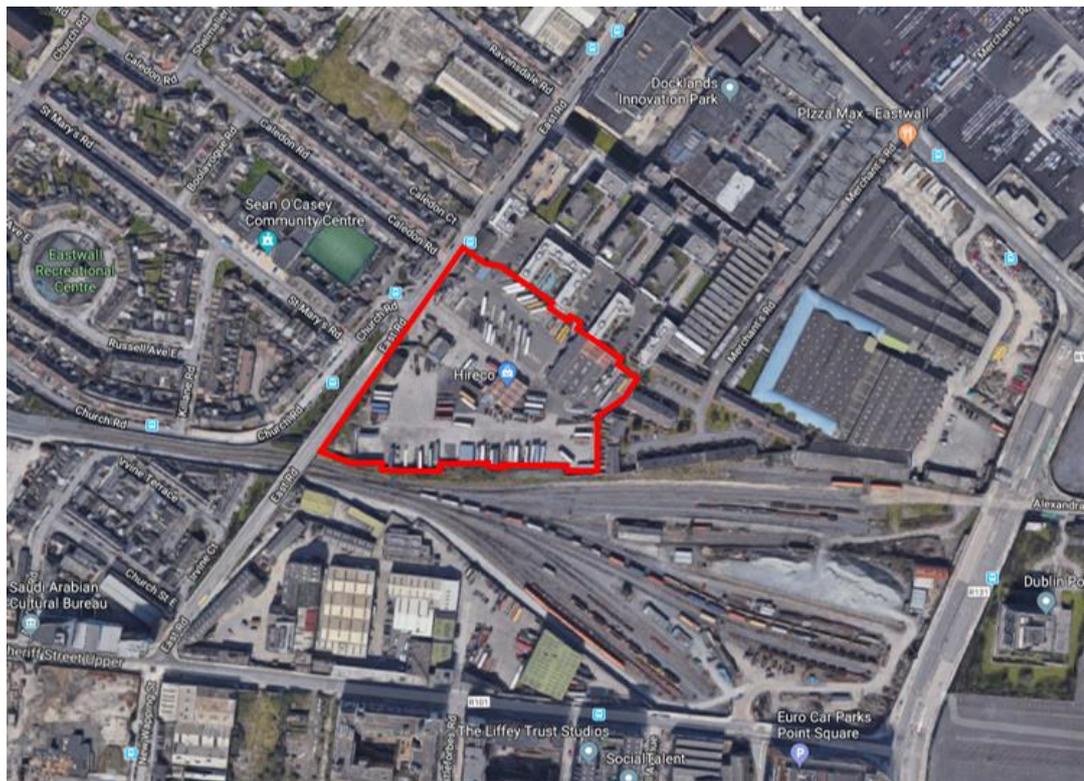
1.4 Existing Site

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 (O’Connell Street). The site is approximately 2.11Ha and is currently occupied by Hireco as a container/trailer park which comprises mostly hardstanding area together with five main buildings. There are also two existing red brick buildings at no. 4 East Road at the northern corner of the site.

The site is bound by East Road to the west, the Iarnrod Eireann railway to the south, Merchant’s Square residential development to the east and the Teeling Way residential apartments to the north site.

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.



— Site Boundary

Figure 1.1 Site Location (Site Boundary Indicative Only)

There are no watercourses in the immediate vicinity of the site and the site is located approximately 950m southwest of the Irish Sea at East Point. The nearest EPA designated watercourses are the River Liffey 625m to the south of the subject site and the River Tolka 630m to the north of the site as shown in figure 1.2.

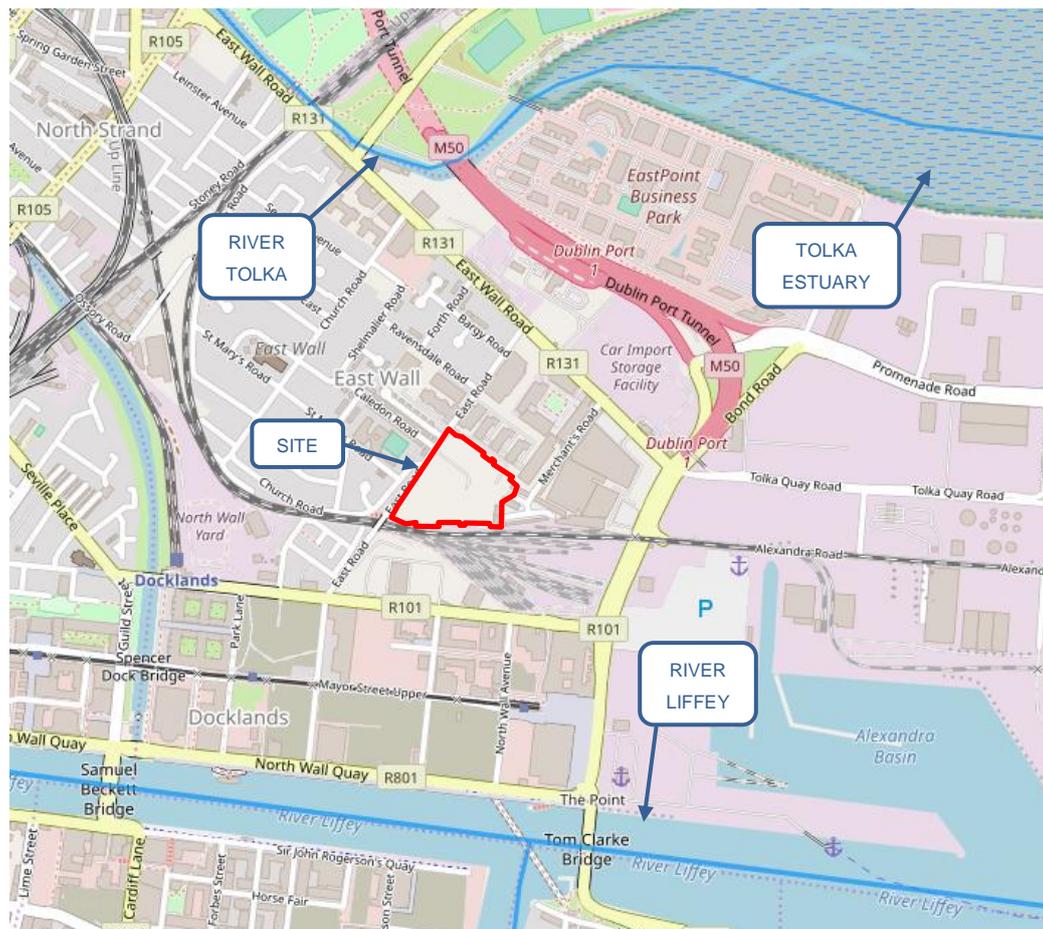


Figure 1.2 Extract from EPA online mapping

1.5 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, enterprise space, retail units, foodhub/café/exhibition space, residential amenity, crèche and men's shed. The site will accommodate car parking spaces, bicycle parking, storage, services and plant areas. Landscaping will include a new central public space and residential podium courtyards.

2.0 PLANNING GUIDELINES & FLOOD RISK ASSESSMENT

2.1 The Planning System and Flood Risk Management, Guidelines for Planning Authorities

The FRM Guidelines provide “mechanisms for the incorporation of flood risk identification, assessment and management into the planning process...”. They ensure a consistent approach throughout the country requiring identification of flood risk and flood risk assessment to be key considerations when preparing development plans, local area plans and planned development.

“The core objectives of The FRM Guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and
- Ensure the requirements of EU and national law in relation to the natural environment and nature conservation are complied with for flood risk management.”

The key principles of The FRM Guidelines are to apply the Sequential Approach to the planning process i.e.;

- “Avoid the risk, where possible,
- Substitute less vulnerable uses, where avoidance is not possible, and
- Mitigate and manage the risk, where avoidance and substitution are not possible.”

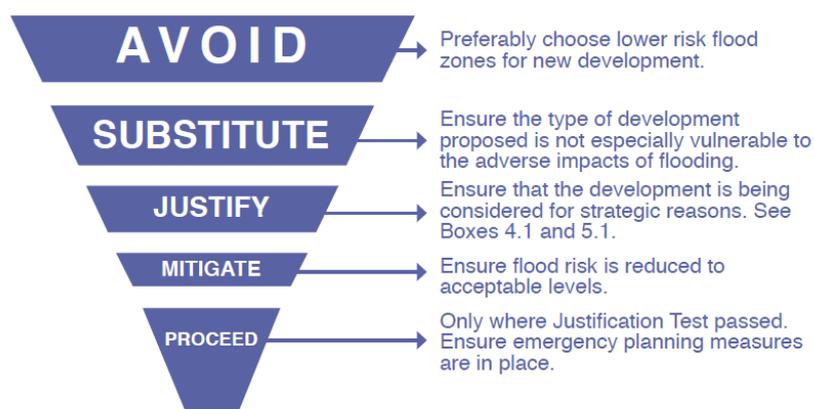


Figure 2.1 - Sequential Approach Principles in Flood Risk Management

Where the *Sequential Test's* **avoid** and **substitute** principals are not appropriate then the FRM Guidelines propose that a *Justification Test* be applied to assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk.

2.2 Flood Risk Assessment

The assessment of flood risk requires an understanding of where water comes from (the source), how and where it flows (the pathways) and the people and assets affected by it (the receptors).

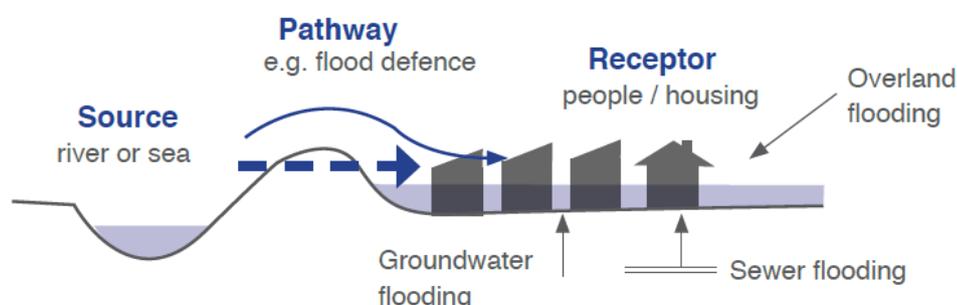


Figure 2.2 - Source-Pathway-Receptor Model

The principal sources are rainfall or higher than normal sea levels. The principal pathways are rivers, drains, sewers, overland flow and river and coastal floodplains and their defence assets. The receptors can include people, their property and the environment. All three elements are examined as part of the flood risk assessment including the vulnerability and exposure of receptors to determine potential consequences. Mitigation measures typically used in development management can reduce the impact of flooding on people and communities e.g. by blocking or impeding pathways. The planning process is primarily concerned with the location of receptors and potential sources and pathways that might put those receptors at risk.

Risks to people, property and the environment should be assessed over the full range of probabilities, including extreme events. Flood risk assessment should cover all sources of flooding, including effects of run-off from a development locally and beyond the development site.

2.2.1 Flood Risk Assessment Stages

The FRM Guidelines outline that a staged approach should be adopted when carrying out a flood risk appraisal or assessment. “These stages are:

- *Stage 1 Flood risk identification*
- *Stage 2 Initial flood risk assessment*
- *Stage 3 Detailed flood risk assessment*

The FRA Guidelines require a SSFRA be undertaken to assess flood risk for individual planning applications. This SSFRA comprises Stages 1, 2 and 3 involving both identification

and more detailed assessment of flood risks and surface water management related to the planned development site.

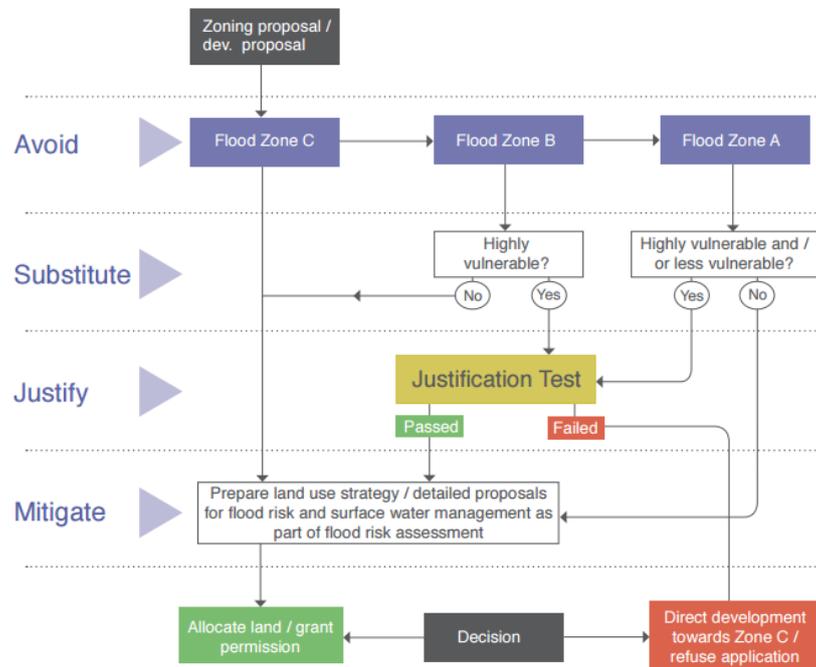
2.3 Flood Zones

The FRM Guidelines use flood zones to determine the likelihood of flooding and for flood risk management within the planning process. The three flood zones levels are:

- Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% AEP (Annual Exceedance Probability) or 1 in 100 for river flooding);
- Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% AEP or 1 in 1000 and 1% AEP or 1 in 100 for river flooding); and
- Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% AEP or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas outside zones A and B.

The FRM Guidelines categorises all types of development as either;

- Highly Vulnerable e.g. dwellings, hospitals, fire stations, essential infrastructure,
- Less Vulnerable e.g. retail, commercial or industrial buildings, local transport infrastructure.
- Water Compatible e.g. flood infrastructure, docks, amenity open space.



• **Figure 2.1: Sequential Approach mechanism in the Planning Process**

The Sequential Approach restricts development types to occur within the flood zone appropriate to their vulnerability class, see Table 2.1.

	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

Figure 2.2 – Table 3.2 from the FRA guidelines - Matrix of Vulnerability versus Flood Zone to illustrate appropriate development and that required to meet the Justification Test

2.4 Proposed Development's Vulnerability

The proposed type of development for this site is to be a mixed use of residential, enterprise and commercial. Enterprise and commercial are categorised by the Guidelines as **less vulnerable developments** and appropriate to be located within Flood Zone B and C. Residential developments are categorised as **highly vulnerable** and appropriate to be located just within Flood Zone C. To provide highly vulnerable and less vulnerable type development within Flood Zone A requires a **Justification Test** to be completed to justify development in this moderate flood risk area.

2.5 Site Specific Flood Risk Assessment for Development

The FRM Guidelines require a SSFRA to “gather relevant information sufficient to identify and assess all sources of flood risk and the impact of drainage from the proposal”. It should “quantify the risks and the effects of any necessary mitigation, together with the measures needed or proposed to manage residual risks”. It considers the nature of flood hazard, taking account of the presence of any flood risk management measures such as flood protection schemes and how development will reduce the flood risk to acceptable levels. A detailed assessment for a development application should conclude that core flood risk elements of the Justification Test are passed and that residual risks can be successfully managed with no unacceptable impacts on adjacent lands.

2.5.1 SSFRA Key Outputs

Key outputs of an SSFRA are:

- Plans showing the site and development proposals including its relationship with watercourses and structures which may influence local hydraulics;
- Surveys of site levels and comparison of development levels relative to sources of flooding and likely flood water levels;

- Assessments of;
 - Potential sources of flood risk;
 - Existing flood alleviation measures;
 - Potential impact of flooding on the site.
- How the layout and form of the development can reduce those impacts, including arrangements for safe access and egress.
- Proposals for surface water management and sustainable drainage.
- The effectiveness and impact of any mitigation measures.
- The residual risks to the site after the construction of any necessary measures and the means of managing those risks; and
- How flood risks are managed for occupants / employees of the site and its infrastructure.

3.0 STAGE 1 FLOOD RISK IDENTIFICATION

3.1 Available Flood Risk Information

The initial flood risk identification stage uses existing information to identify and confirm whether there may be flooding or surface water management issues for the lands in question that may warrant further investigation.

To initially identify potential flood risks for the existing Site and surrounding area a number of available data sources were consulted, these are listed in Table 3.1 below.

	Information Source	Coverage	Quality	Confidence	Identified Flood Risks	Flood Risk
Primary Data Source & Modelled Data	OPW ECFRAM - Fluvial	Regional	High	High	Flood maps indicates that the development site is in Flood Zone C (not at risk of fluvial flooding).	✓
	OPW ECFRAM - Tidal	Regional	High	High	Tidal Flooding Map identifies site to be outside of the indicated 0.5% AEP event coastal flood zone.	X
	ICPSS	Nationwide	High	High	ICPSS maps indicated that the subject site is within the tidal floodplain for the 0.5% AEP, although protected by defences.	✓
	DCC Development Plan SFRA	Local	High	High	Proposed development site within Flood Zone A and within the Defended Area.	✓
Secondary Data Source	Walkover Survey	Local	Varies	Varies	Container/trailer park covering most of the site area. No evidence of flooding. All drainage is underground. Levels within the site fall from north to south.	X
	OPW Historic Flood Records	Nationwide	Varies	Varies	No records of flooding on site.	X
	Historic OSI Maps	Nationwide	Moderate	Low	None.	X
	EPA Ex. Rivers	Nationwide	Moderate	Moderate	No designated River / Stream in site.	X
	Drainage Records	County	Moderate	Moderate	No Irish Water assets running through site.	X
	Geological Survey Ireland Maps	Nationwide	Moderate	Low	Made Ground on site cohesive deposits (CLAY and SAND). High groundwater table between 0.3m and 1.2m BGL.	X
	Topographic Survey	Local	High	High	Site relatively flat with slight fall from north to south. Levels range from 0.88m AOD to 0.11m AOD.	X

Table 3.1 – Review of Available Flood Risk Information

3.2 Identified Flood Risks/Flood Sources

3.2.1 OPW Predictive, Historic & Benefiting Lands Maps & Flood Hazard Information

From consultation of flood information from the OPW's floodmaps.ie website the site has not suffered from flooding in the past. A review of this report shows that there have been 28 flood events recorded within 2.5km of the site since 1905. However, there are no records of the site itself having been flooded. Nevertheless, there was a significant road flooding on Church Street on 1st February 2002 which had a recorded tide level of 2.95m AOD. The temporary and permanent flood works on the Royal Canal at Spencer Docks have prevented this happening since, the recorded higher tide of 3.014m AOD on the 3rd of January 2014 did not produce any significant flooding in the vicinity of the site.

Fluvial Flood Risk

The OPW's Eastern CFRAM study produced flood risk maps and the assessment of fluvial flood plains over the eastern region of Ireland. As part of this study both the Liffey and the Tolka were assessed, the site falls between the two watercourses and is out of the fluvial flood extents of both these water courses, as can be seen in figure 3.1.

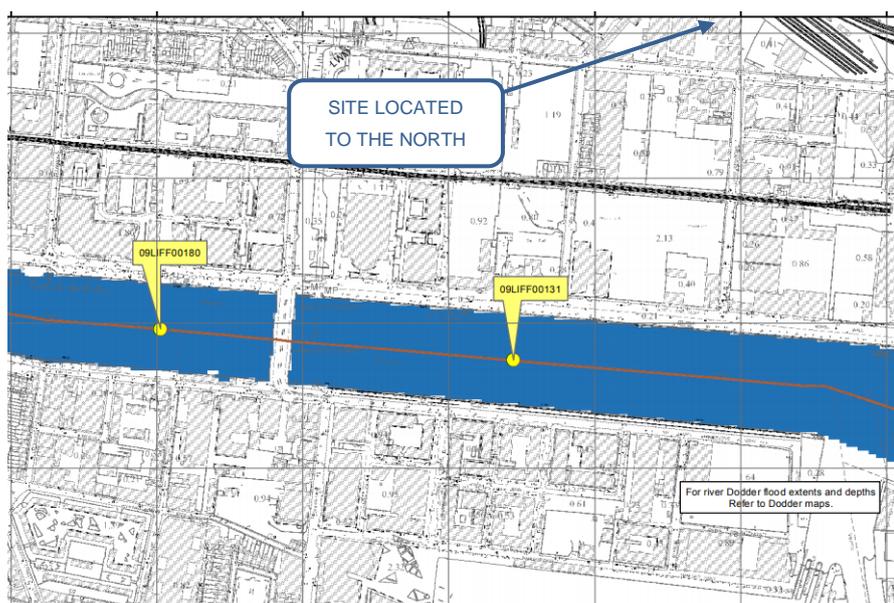


Figure 3.1 Extent of Fluvial Flood Risk (extract from CFRAMs Liffey Fluvial Flood Extents)

Tidal Flood Risk

The OPW ECFRAM coastal flood risk analysis for 0.5% and 0.1% AEP return periods show the site is outside the extents of the 0.5% AEP coastal flood event as seen in fig 3.2 and takes into the account the flood defence works completed in Spencer Dock in 2009. This is considered more detailed and up to date than the ICPSS map which indicates the site is located within the 0.5% AEP coastal flood event zone (see section 3.2.3).

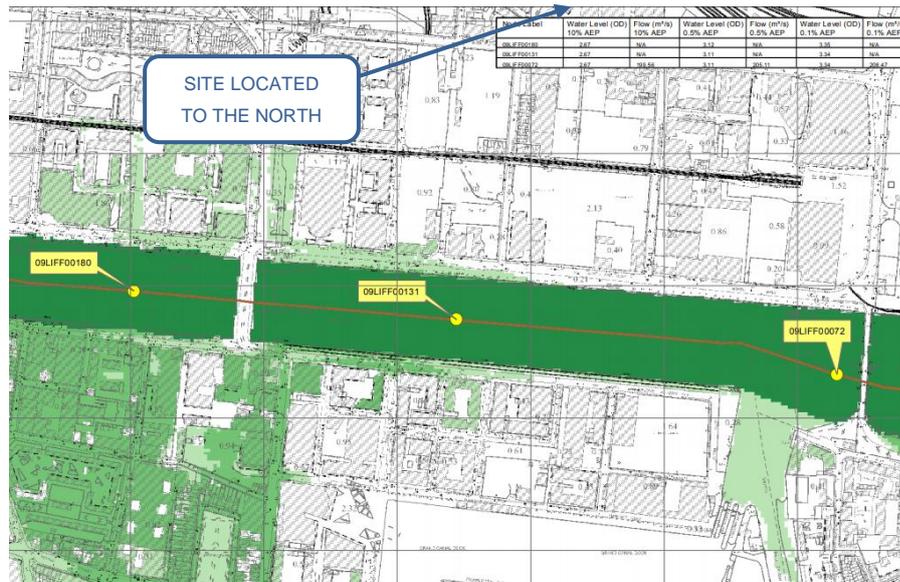


Figure 3.2 Extent of Tidal Flood Risk (extract from CFRAMs LiffeyTidal Flood Extents)

Pluvial Flood Risk

Furthermore, the OPW’s ECFRAM Study also assessed effects of pluvial flooding in the area. The Pluvial maps of Dublin City as part of the OPW Flood Resilient City Programme show the site has a moderate pluvial flood risk (refer to figure 3.1 below).

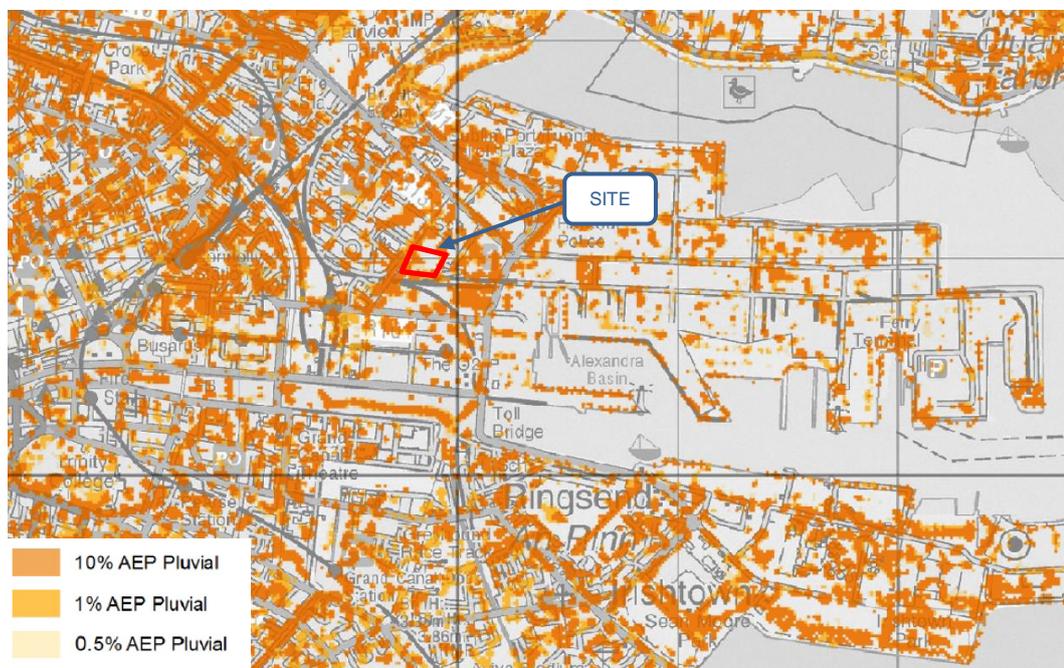


Figure 3.3 Extent of Pluvial Flood Risk (extract from Dublin City - Pluvial Flood Extents Map)

3.2.2 Dublin City Council Strategic Flood Risk Assessment

Appendix 7 of the Dublin City Development Plan 2016-2022 comprises the Strategic Flood Risk Assessment (SFRA) which uses the draft ECFRAM mapping as its basis for identifying areas at flood risk. The SFRA identifies the subject site as “Site: 3. Liffey: O’Connell Bridge to Tom Clarke Bridge” category, refer to figure 3.4 below for extents of flood risk identified by the SFRA.

Within same, it is noted that the proposed development site is located within the Flood Zone A, i.e. high probability of flooding. Although, the subject site is also located in an area protected by flood defences as shown in figure 3.4 & 3.5.

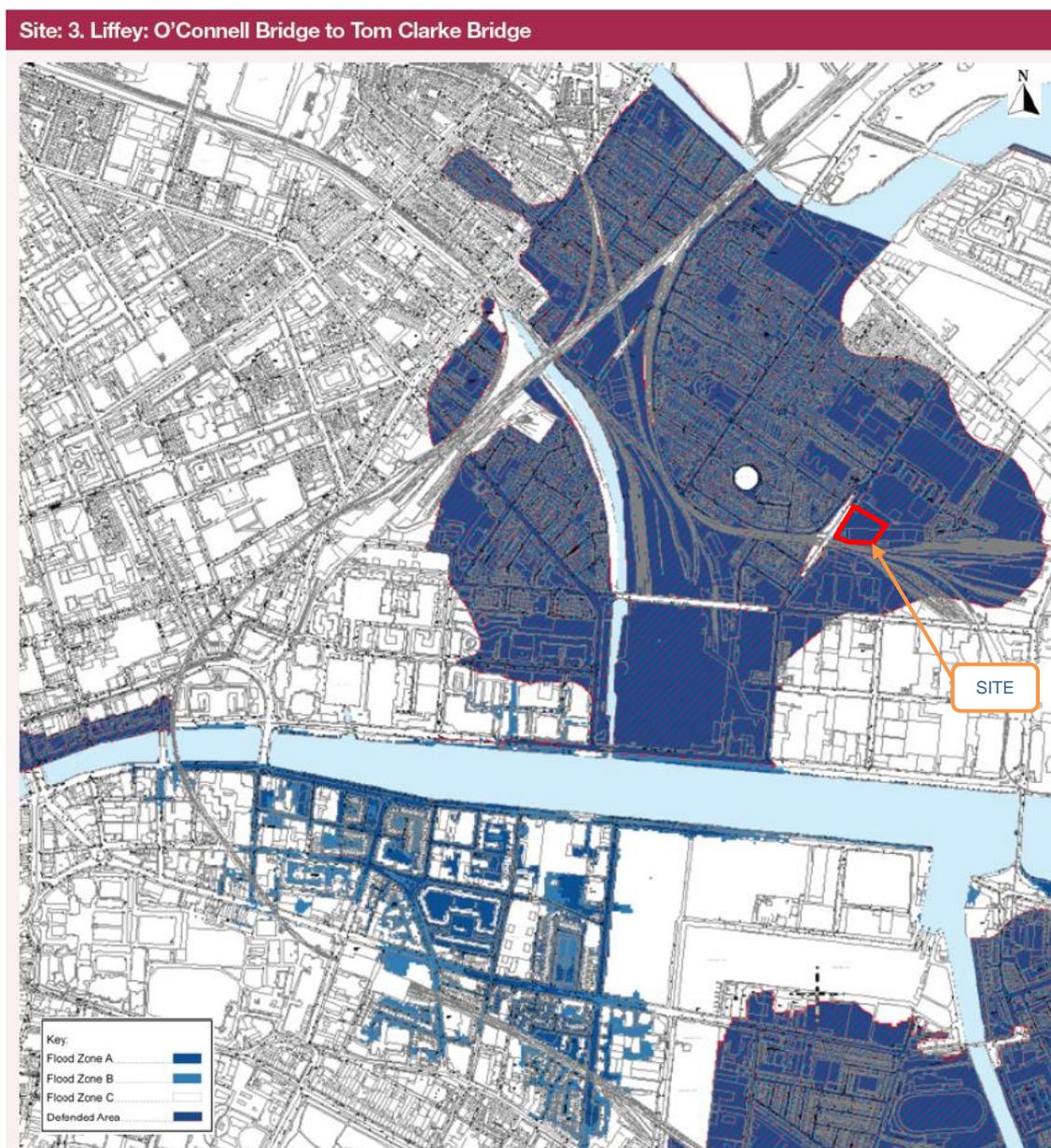


Figure 3.4 - Extract from DCC Strategic Flood Risk Assessment, Development Plan 2016-2022, Estimated Flood Extents

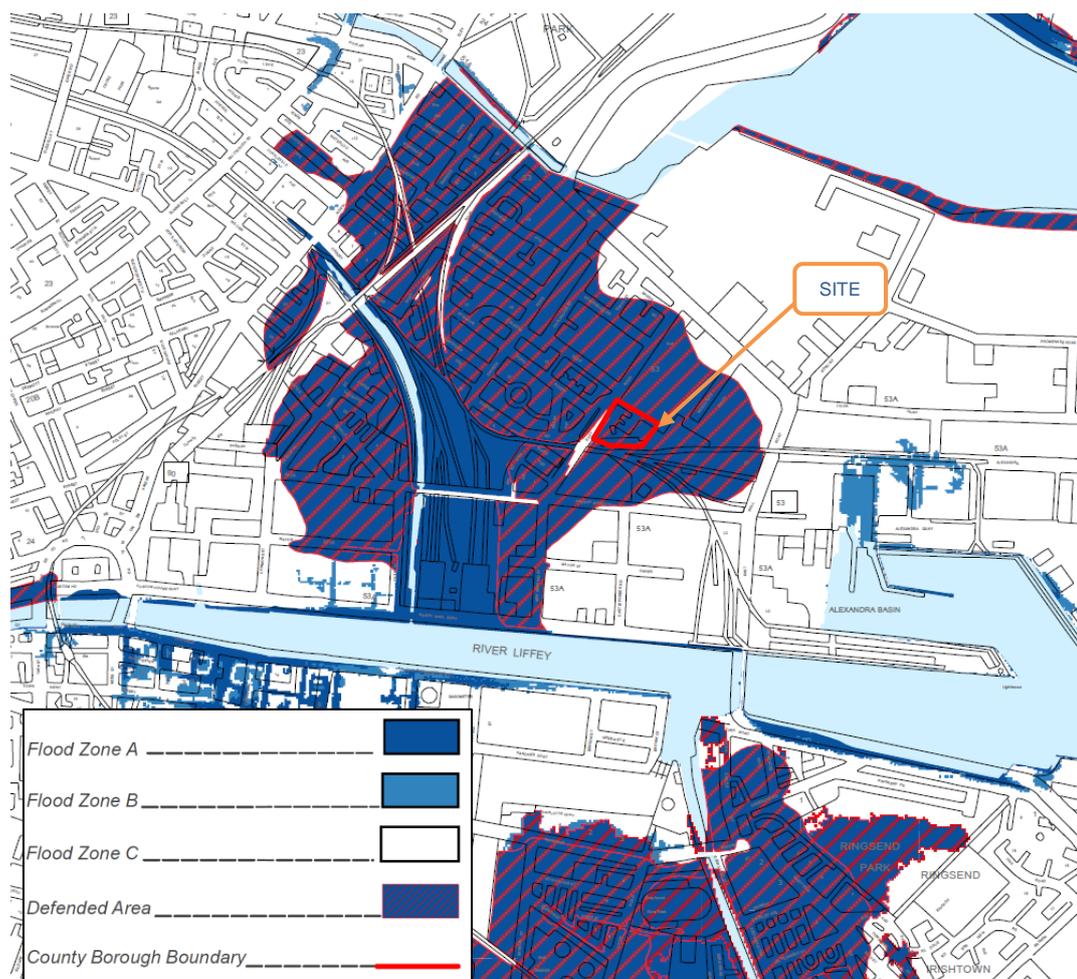


Figure 3.5 Extract from DCC Strategic Flood Risk Assessment indicating Defended Areas

3.2.3 Irish Coastal Protection Strategy Study (ICPSS)

After reviewing the ICPSS coastal flood extents maps, it can be seen that the subject site is within the modelled flood extent for the 0.5%AEP event, i.e. the subject site is within Flood Zone A as shown in Figure 3.6.

The maps included within the Irish Coastal Protection Strategy Study are 'predictive' flood maps, as they provide predicted flood extent and other information for a 'design' flood event that has an estimated probability of occurrence. The maps have been produced at a strategic level to provide an overview of coastal flood hazard and risk in Ireland, and minor or local features such as flood defence schemes which might affect a coastal flood, have not been included in their preparation.

It is important to note therefore that although the subject site is located within the coastal flood extent for the 0.5% AEP event, the ICPSS flood extent maps do not consider the existing flood defences which defend this area.

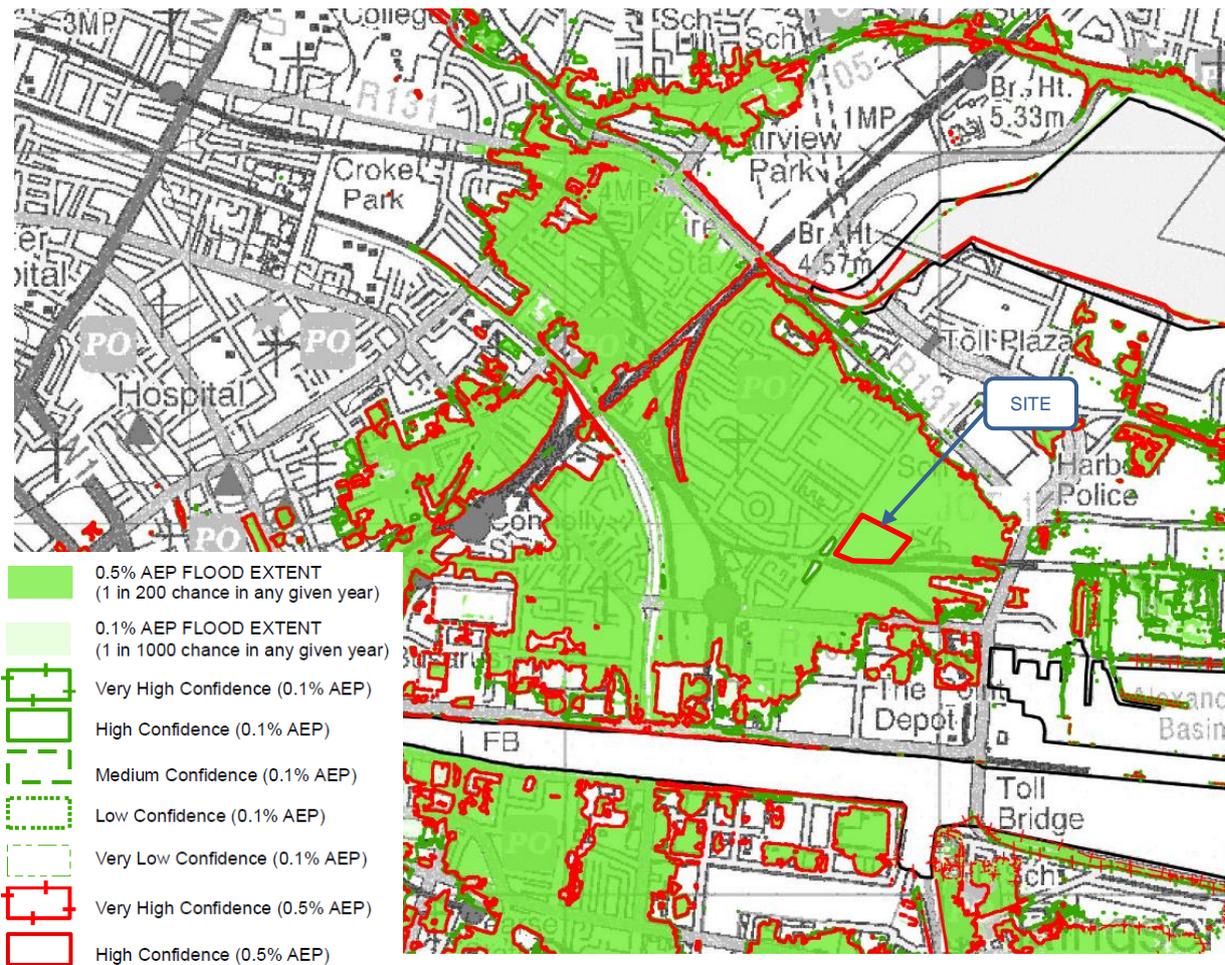


Figure 3.6 Extract from ICPSS 1 in 200-year tidal flood extent map

3.2.4 Topographical Survey

After reviewing the Topographical survey, the subject site is relatively level. The survey indicates existing highest ground levels of 0.88m AOD and 0.86m AOD in the northern and north-eastern areas of the site whereas the lowest levels of the site are in the south east corner at 0.11m AOD.

By reviewing the existing ground levels in the vicinity of the proposed development site, it can be seen that the levels on East Road at the existing access to the site range between 0.18m AOD and 0.11m AOD, East Road rises steeply to the south up to 6.15m AOD as it approaches the bridge that crosses over the existing railway.

3.2.5 Walkover Survey

From a walkover of the site it is clear that the subject site which is currently used as a container/trailer park, is relatively flat and no evidence of flooding or flow paths are evident on site. Levels on East Road are higher than the subject site at the railway bridge and fall steeply from south to north towards the subject site. The walkover survey confirmed the proposed development site is as expected and ties in with the topographical survey.

3.2.6 Other Sources

Other information sources were consulted to determine if there was any additional flood risk to the subject site, these included;

- Soil data from GSI – The entire site consists of made ground soils on gravels on clay.
- Site Investigation – High groundwater table was recorded on site, ranging between 0.33m and 1.2m BGL.
- Groundwater information from GSI – There are no records of any karst features in the locality and there is no record of evidence of groundwater flooding for the proposed site.
- Groundwater information from OPW's Draft Preliminary Flood Risk Assessment – The flood risk map indicates no groundwater flood risk to the site or to the surrounding area.
- Existing Local Authority Drainage Records – The surrounding area predominately uses a combined drainage network. To the west of the development an existing 600mm diameter combined sewer services the site which runs along East Road from north to south towards the existing Irish Water pumping station to the south of the development.

The proposed site is also serviced by an existing surface water sewer located to the west of the site along East Road which also runs in a southerly direction. This sewer connects to the existing 900mm diameter combined sewer on Church Road (900mm diameter) and continues in a southerly direction passing under the railway and ending in the aforementioned Irish Water pumping station.

No other Local Authority drainage infrastructure appears to exist in the vicinity of the site.

- Historic Maps – no evidence of flooding or marsh areas within the site.

3.3 Source-Pathway-Receptor Model

A Source-Pathway-Receptor model was produced to summarise the possible sources of floodwater, the people and assets (receptors) that could be affected by potential flooding (with specific reference to the proposals), see Table 3.1. It provides the probability and magnitude of the sources, the performance and response of pathways and the consequences to the receptors in the context of the mixed-use development proposal. These sources, pathways and receptors will be assessed further in the initial flood risk assessment stage.

Source	Pathway	Receptor	Likelihood	Impact	Risk
Tidal	Subject site within the defended flood extents for the 0.5% AEP if a breach or overtopping of flood defences occurs.	Future Development	Very remote	High	Medium
Fluvial	Proposed development site within Flood Zone C (low risk of fluvial flooding).	-	Remote	-	-
Surface Water Drainage (Pluvial)	Flooding from the surcharging of the development's drainage systems.	Future development	Possible	Low	Low
Groundwater flooding	Rising GWL on the site	Future development	Possible	Low	Low
Infrastructural - Human or Mechanical Error	Blockage of new drainage network.	Areas of development draining to the surface water network	Possible	Low	Low

Table 3.1 - Source-Pathway-Receptor Analysis

The following paragraph provides a summary of the results of this Source-Pathway-Receptor flooding model for the subject site.

3.4 Source-Pathway-Receptor Model Results

As it can be seen in the above flooding analysis, the proposed development site is not at risk from fluvial flooding.

However, there is a risk of groundwater flooding. This type of flooding occurs when water levels in the ground rise above surface levels. Prolonged storm events together with medium and/or high tides may increase the existing groundwater level on site. Considering the geology and topography of the subject site, and the proposed development will be raising the low points of the site, the possibility of groundwater rising above ground levels is considered low.

There is also a low risk of pluvial flooding due to the potential surcharging and blockage of the new drainage network.

Lastly there is a medium risk associated with Tidal flooding, due to the site being identified in Flood Zone A within both the DCC SFRA and ICPSS, although it must be noted that the Dublin City Council's SFRA also identifies that site benefits being in a defended zone and therefore flood risk is considerably lowered.

Consequently, an initial flood risk assessment will follow to provide further detail on the causes, effects and possible mitigation measures for the sources of flood risk identified above.

4.0 STAGE 2 INITIAL FLOOD RISK ASSESSMENT STAGE

The main sources of flood risk identified from Stage 1 are;

- A low pluvial flood risk associated with the proposed developments proposed drainage network.
- A low groundwater flood risk associated with the groundwater levels encountered in the site investigation.
- A moderate risk of Tidal flooding associated with an extreme sea level rise.

4.1 Initial Tidal Flood Risk Assessment

As stated above, the 1 in 200-year (0.5% AEP) tidal flood extent map estimated as part of the Irish Coastal Protection Strategy Study (ICPSS) for the area around the subject site indicates that the proposed development site is within the modelled flood extent. This indicates that the site of the proposed development is within Flood Zone A for tidal flooding, in accordance with the Planning System and Flood Risk Management Guidelines for Planning Authorities.

The ICPSS mapping indicates the 200-year design tidal water level in the vicinity of the subject site as 3.07m AOD as shown in table 4.1 below:

Annual Exceedance Probability (AEP)	10%	0.5%	0.1%
Return Period	10 years	200 years	1000 years
Point 22	2.67m AOD	3.07m AOD	3.28m AOD

Table 4.1 Tidal Flood Levels (Extract from North East Coast Flood Extent Map)

It is important to note that The Planning System and Flood Risk Management Guidelines for Planning Authorities ignore the presence of flood defences when defining flood zones. As outlined above, the proposed development site is located in an area protected from tidal by flood defence works on the Royal Canal at Spencer Dock and along the Tolka.

As a result of climate change, the sea level is expected to gradually rise in the future. As the proposed development is a mixed-use development, it is proposed that all highly vulnerable development (i.e. residential and creche) are located above the 1 in 200 coastal flood level including an allowance for climate change, with an appropriate freeboard in accordance with the DCC SFRA.

Yearly high tides are approximately 2.5m AOD and the highest recorded tide was 3.014m AOD on 3rd January 2014.

It is important to note that The Planning System and Flood Risk Management Guidelines for Planning Authorities ignore the presence of flood defences when defining flood zones. As outlined above, the proposed development site is located in an area protected from tidal by flood defence works on the Royal Canal at Spencer Dock and along the Tolka.

4.2 Initial Pluvial Flood Risk Assessment

The Source-Pathway-Receptor model identified that there could be potential for pluvial flood risk within the development site related to the future drainage networks serving the proposed development.

These have potential to cause local flooding unless they are designed in accordance with the regulations e.g. GSDSDS and to take account of flood exceedance e.g. for storms return periods over 1% AEP. However, this is not an issue for the subject development as the proposed drainage system has been designed in accordance with current requirements of the GSDSDS (i.e. 2-year, 30 year no flooding on site & check at 100 year for surcharging, storage, flood routing & freeboard to FFLs).

Pluvial flood risk associated with the proposed development has been addressed in detail within DBFL Infrastructure Design Report 170200-Rep-002. The pluvial risk has been mitigated for the proposed via:

- New drainage collection system incorporating SUDS features.
- Surface water network capacity to be designed in accordance with GSDSDS recommendations and DCC requirements and incorporate 20% climate change.
- Existing runoff rates will be reduced by the provision of a co-ordinated surface water network incorporating SuDS elements at different stages with attenuated outlet (“hydrobrake optimum” or similar approved as a flow control device). This is designed to restrict discharges to 2l/s per hectare of contributing catchment.
- An adequately sized attenuation facility to cater for retained flood volumes. This is designed for the 1 in 100-year storm plus 20% allowance for climate change.

Proper operation and maintenance of the drainage system should also be implemented in accordance with the CIRIA 753, The SuDS Manual, to reduce the risk of human or mechanical error causing pluvial flood risk from blockages, etc.

4.3 Initial Groundwater Flood Risk Assessment

The Source-Pathway-Receptor model identified that there could be potential for groundwater flood risk on the proposed site due to the encountered water during the site investigation works. Water was encountered 0.33-1.2m in various locations around the boundary of the site, although groundwater was consistently found along the southern boundary where the existing ground levels are lowest.

Further to this, no known groundwater flooding has occurred in the vicinity of the site and as part of the development proposals the lower areas of the site will be raised, also as the development does not include for basements, the surrounding groundwater level will be unaffected. Therefore, flood risk associated with Groundwater will not be increased due to the development proposals and can be deemed as low.

4.4 Flood Zone Category

Following the assessment of the flood risk to the site and the available information it is considered that the proposed development site is located within a defended portion of the 0.5% AEP coastal flood zone event, i.e. Flood Zone A, as defined by the Guidelines and indicated by the Irish Coastal Protection Strategy Study and Dublin City Councils' Strategic Flood Risk Assessment.

Both Pluvial and groundwater have been assessed as being low and no further assessment is deemed necessary.

As the proposed development has a moderate tidal flood risk on site, this document will therefore further assess the viability and vulnerability of the proposed development in regards to this source of flooding.

5.0 STAGE 3 DETAILED FLOOD RISK ASSESSMENT

The detailed Flood Risk assessment stage will look more closely how the proposed development will mitigate flood risk from the identified source.

In regards to the moderate tidal flood risk, the detailed flood risk assessment stage will assess this in relation to the following;

- Proposed development plans (FFLs, site vulnerability, building extents).
- Impact of proposed development on adjacent properties.
- In relation to the objectives set out in the DCC SFRA justification test.
- Any residual risks
- Flood exceedance.

5.1 Detailed Tidal Flood Risk Assessment

As stated in section 1.5, the proposed development is to construct a mixed-use development arranged in nine 3 to 15-storey buildings with associated courtyard and landscaping.

The initial flood risk assessment assessed the risk associated with the 1 in 200-year tidal flood event as the principle source of the flooding on the site.

As the development for the site is proposing a mixed use of residential, enterprise and commercial, it should be noted that enterprise and commercial development types are categorised by the Guidelines as 'less vulnerable' development and appropriate to be located within Flood Zone A if the justification test is passed (refer to section 5.2). Residential developments are categorised as 'highly vulnerable' development and appropriate to be located above the appropriate flood level (plus freeboard and climate change) in accordance with Dublin City Councils' Strategic Flood Risk Assessment.

The ICPSS mapping indicated that the 200-year design tidal water level in the vicinity of the subject site as 3.07m AOD. Existing topography levels along East Road at the access to the site vary between 0.11m AOD and 0.21m AOD as shown in figure 5.1.



Figure 5.1 Existing road levels in the vicinity of the proposed development site

According to the DCC SFRA, the minimum finished floor level for a 'highly vulnerable' development should be the 1 in 200-year tidal flood level, with a suitable allowance for climate change and a suitable freeboard. The freeboard should be at least 300mm but in tidal risk areas could be higher, particularly where wave action or combined fluvial/tidal events are present. In this case, as there isn't a combined fluvial/tidal event and that wave action would not be present as source of flooding is not coastal tidal, the freeboard has been maintained at 300mm.

The proposed ground floor level is 0.70m AOD so as to tie in with the existing levels in the northern part of the site and to raise the lower areas of the site for consistency over the proposed development. Since this level is below both the 0.5% and 0.1% AEP levels, only 'less vulnerable' enterprise and retail units/café will be set at ground level. As such flood resilient building techniques and materials will be employed in these areas.

To take a conservative approach and to be consistent with the adjacent North Lotts and Grand Canal Dock SDZ, the 0.1% AEP flood level and a 300mm freeboard have been used to calculate the minimum level for 'Highly vulnerable' development throughout the proposed site as can be seen in table 5.1.

0.1% AEP Flood Level	Climate Change Allowance	Freeboard	Minimum FFL of 'Highly Vulnerable' Development
3.28m AOD	+0.5m	+0.3m	4.08m AOD

Table 5.1 Minimum FFL for Highly Vulnerable development

Due to other development requirements, all proposed residential development will be set at a minimum of 4.68m AOD which is in exceedance again of the above calculated.

5.2 Justification Test

As part of the Dublin City Development Plan Strategic Flood Risk Assessment, a number of sites were identified as being within Flood Zones A and B and Justification Tests for development plans undertaken for those not zoned for a water compatible land use to confirm their specific zoning objectives. The proposed development is located within one of these sites (Site 3. Liffey: O'Connell Bridge to Tom Clarke Bridge (see Appendix D) and the Justification test for Development Plans was undertaken.

As part of the requirements of the Justification Test and the Planning System and Flood Risk Management Guidelines, the proposed development must satisfy the Justification Test for development management as follows;

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.*

As stated previously, the site has been zoned Z14 within the DCC Development Plan 2016-2022, to seek the social, economic and physical development and/or rejuvenation of an area with mixed use, of which residential and "Z6" – to provide for the creation and protection of enterprise and facilitate opportunities for employment creation – would be predominant uses.

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;*

Yes, the development proposals include for a sustainable approach in surface water management, including the use of various SuDS features detailed in the development's Infrastructure Design Report,

reducing the peak flow rate of surface water to calculated Greenfield Run-off Rates. This will reduce flows and increase capacity in the Public drainage network and have a net benefit for the surrounding area.

- (ii) *The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;*

Yes, the development ensures all 'highly vulnerable' development is located at a minimum floor level of 4.08m, which includes for a climate change allowance and freeboard. The lower 'less vulnerable' development will include measures to minimise flood risk such as the use of demountable flood barriers, for enterprise and café accesses.

- (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*

Yes, the nature of the proposed development will mean the development will be managed and that staff that will ensure, that, in the highly unlikely event that the flood defences were breached then residents and workers could be alerted and the emergency plan be implemented, if required.

- (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.*

Yes, the proposed development is in accordance with the planning objectives and also in accordance with the Planning System and Flood Risk Management Guidelines.

All of the above points have been addressed throughout this flood risk assessment and within the design of the development. The following sections of this SSFRA, will go through, the key points, mitigation measures and residual risks associated with the development to demonstrate that flood risk has been reduced to an acceptable level and how the justification requirements have been met.

5.3 Residual Risks

Remaining residual flood risk, following the initial assessment include the following;

- Pluvial flooding from the drainage system related to blockage.
- Pluvial flooding from the development's drainage system for the 0.5% AEP tidal event.
- Defence failure (overtopping or breach of the flood defences by a flood that exceeds the design level of the defence).

5.4 Mitigation Measures

Proposed mitigation measures to address residual flood risk are summarised below;

- All proposed residential development will be set above the 1 in 1000-year tidal flood level including an allowance for climate change and an appropriate freeboard:
 $3.28\text{m AOD (for the 1 in 1000year tidal flood level in the vicinity of the subject site)} + 0.3 \text{ (freeboard)} + 0.5 \text{ (climate change)} = 4.08\text{m AOD.}$
- Any development below this level will be designed to be flood resilient in accordance with the Dublin City council's Code of Practice for Flood Resilience and Adaptation Measures to minimise damage. Some techniques used include:
 - Structural walls and columns designed for short-term immersion;
 - As much as possible, the location of the main electrical circuitry and other utilities should be located above the 0.1% AEP design level and that sockets and electrical connections are located 1m above floor level to give a level of protection.
 - Materials, details and finishes are selected and designed for durability and ease of maintenance and be considered flood resilient.
- Advanced warning systems such as alarms or notifications will be implemented where possible for residents and workers to be alerted of any imminent flood warnings. Depending on the level of warning, advice on appropriate action will be given to those residents with car parking spaces in the undercroft. This will aid in the reduction of damage by allowing residents to move vehicles out of the development.
- The proposed drainage system to be maintained on a regular basis to reduce the risk of a blockage.
- In the event of storms exceeding the 100-year design capacity of the drainage system, then possible flood routing for overland flows towards East Road should not be blocked.

5.4.1 Effectiveness of Mitigation Measures

It is considered that the flood risk mitigation measures once fully implemented are sufficient to provide a suitable level of protection to the proposed development.

The proposed development will not increase the run-off rates when compared with the existing site and satisfies the requirement of the SFRA to reduce flooding and improve water quality.

5.5 **Flood Warning and Evacuation**

To facilitate an emergency warning and evacuation plan which will allow site users to leave the premises of the property in the event of a flood, the flood warning and evacuation plan should be prepared in liaison with the Local Authority and the Emergency Services.

The Triton and Tidewatch early warning systems are based in Dublin Bay providing continuous information on sea-level changes and sending alarm messages to relevant personal in the Local Authority. The Local Authority is responsible for monitoring flood events and for issuing warnings to people in properties and businesses at risk of flooding. The site users will not be able to evacuate the development once a flood has occurred. The site will therefore be registered with the Local Authority's Warning Service as well as having a copy of the Warning and Evacuation plan on site.

A comprehensive and effective Flood Warning and Emergency Response Plan shall be produced with recommendations for required site procedures that should be taken in response to forecasted flooding and for any scenario where flooding starts to occur without prior warning. If flooding does occur without prior warning, the site users will not be able to leave the site safely, however the podium development will be raised above the flood level and will act as a "safe haven". Site users should therefore remain indoors and wait for the emergency services.

The Warning and Evacuation Plan can be found in Appendix C.

5.6 **Flood Exceedance**

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 5.2).

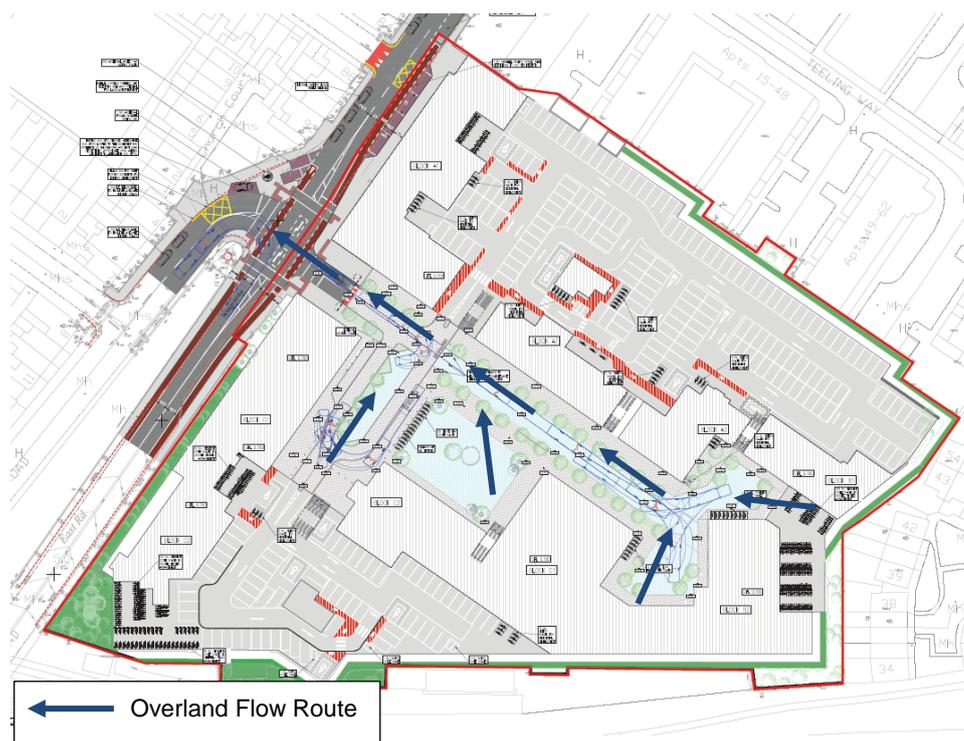


Figure 5.2 Overland Flow route in exceedance event

As part of the Pre-application submission, Dublin City Council Drainage department requested that the Flood Risk Assessment clarified the flood risk in an exceedance case that the 1% AEP rainfall event coincided with the yearly high tide.

At this point 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 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 duration (for the 0.1%AEP event + 20% Climate change) with no discharge leaving site.

6.0 CONCLUSION

The SSFRA concludes the following;

- This Site Specific Flood Risk Assessment for the proposed mixed-use development at East Road was undertaken in accordance with the requirements of the “Planning System and Flood Risk Management Guidelines for Planning Authorities”, November 2009.
- The proposed type of development for this site is to be mixed use residential, enterprise and commercial. Enterprise and commercial are categorised by the Guidelines as **less vulnerable development** and appropriate to be located within Flood Zone A if the requirements of the Justification Test are met. Residential units and creche are categorised as **highly vulnerable development**
- The development passes the Justification Test in accordance with Box 5.1 of the Guidelines and the proposed development is deemed appropriate to be located within Flood Zone A on the basis that the mitigation measures stipulated within the justification are met.
- The proposed development site is within Flood Zone A for tidal flooding, however it is the site is located in an area that benefits from flood defence measures, therefore the SSFRA has assessed the residual risks associated with breach of these defences.
- As part of the mitigation measures to reduce the associated Flood risk for site users was by ensuring all ‘highly vulnerable’ finished floor levels are located above the 0.1% AEP flood level, in addition to a climate change allowance and a conservative freeboard, giving a minimum FFL for this type of development of 4.08m.
- As part of the development proposals, a Warning and Evacuation Plan has been created to ensure the site users are aware of the potential risks of flooding.
- A possible source of flood risk from the surcharging or blockage of the development’s drainage system has been identified. This risk is mitigated by suitable design of the drainage network (as detailed in DBFL Infrastructure Design Report 170200-Rep-002), regular maintenance and inspection of the network and establishment of exceedance overland flow routes.
- The development’s drainage design includes for a 20% climate change allowance.
- The proposed development will not increase run-off rate when compared with the existing site and satisfies the requirement of the SFRA to reduce flooding and improve water quality.

Appendix A

OPW Flood Hazard Report

Summary Local Area Report

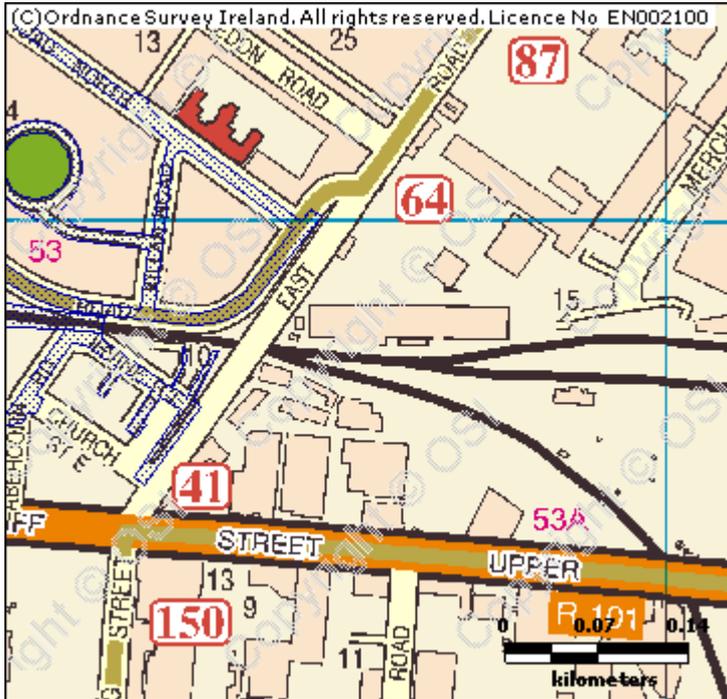
This Flood Report summarises all flood events within 2.5 kilometres of the map centre.

The map centre is in:

County: Dublin

NGR: O 177 348

This Flood Report has been downloaded from the Web site www.floodmaps.ie. The users should take account of the restrictions and limitations relating to the content and use of this Web site that are explained in the Disclaimer box when entering the site. It is a condition of use of the Web site that you accept the User Declaration and the Disclaimer.



Map Scale 1:5,849

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. Their purpose and scope is explained in the Glossary.

28 Results

	1. Flooding at Bessborough Avenue, North Strand, Dublin 3 on 24th Oct 2011 County: Dublin	Start Date: 24/Oct/2011 Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information		
	2. Tolka December 1954 County: Dublin	Start Date: 08/Dec/1954 Flood Quality Code:1
Additional Information: Photos (2) Reports (13) Press Archive (9) More Mapped Information		
	3. Tolka November 2002 County: Meath, Dublin	Start Date: 13/Nov/2002 Flood Quality Code:1
Additional Information: Photos (126) Reports (9) Videos (3) Press Archive (13) More Mapped Information		
	4. Dublin City Tidal Feb 2002 County: Dublin	Start Date: 01/Feb/2002 Flood Quality Code:1
Additional Information: Photos (32) Reports (10) Press Archive (27) More Mapped Information		
	5. Tolka Richmond Road Drumcondra Nov 2000 County: Dublin	Start Date: 05/Nov/2000 Flood Quality Code:3

Additional Information: Reports (5) Press Archive (5) More Mapped Information



6. Tolka Richmond Road August 1986

County: Dublin

Start Date: 25/Aug/1986

Flood Quality Code:1

Additional Information: Reports (4) More Mapped Information



7. Tolka Nov 1965

County: Dublin

Start Date: 25/Nov/1965

Flood Quality Code:3

Additional Information: Photos (2) Reports (6) Press Archive (2) More Mapped Information



8. Tolka September 1946

County: Dublin

Start Date: 20/Sep/1946

Flood Quality Code:3

Additional Information: Reports (10) More Mapped Information



9. Tolka September 1931

County: Dublin

Start Date: 03/Sep/1931

Flood Quality Code:3

Additional Information: Reports (10) Press Archive (1) More Mapped Information



10. Tolka November 1915

County: Dublin

Start Date: 12/Nov/1915

Flood Quality Code:3

Additional Information: Reports (10) More Mapped Information



11. Tolka November 1901

County: Dublin

Start Date: 12/Nov/1901

Flood Quality Code:3

Additional Information: Reports (9) More Mapped Information



12. Tolka November 1898

County: Dublin

Start Date: 23/Nov/1898

Flood Quality Code:3

Additional Information: Reports (9) More Mapped Information



13. Tolka October 1880

County: Dublin

Start Date: 28/Oct/1880

Flood Quality Code:3

Additional Information: Reports (7) More Mapped Information



14. Fenian Street June 1963

County: Dublin

Start Date: 11/Jun/1963

Flood Quality Code:3

Additional Information: Reports (3) Press Archive (2) More Mapped Information



15. Ringsend June 1963

County: Dublin

Start Date: 11/Jun/1963

Flood Quality Code:3

Additional Information: Reports (3) Press Archive (2) More Mapped Information



16. Grafton Street June 1963

County: Dublin

Start Date: 11/Jun/1963

Flood Quality Code:3

Additional Information: Reports (3) Press Archive (2) More Mapped Information



17. North Strand Road June 1963

County: Dublin

Start Date: 11/Jun/1963

Flood Quality Code:3

Additional Information: Reports (3) Press Archive (2) More Mapped Information



18. Flooding at Herbert Cottages, Ballsbridge, Dublin 4 on 24th
Oct 2011
County: Dublin

Start Date: 24/Oct/2011

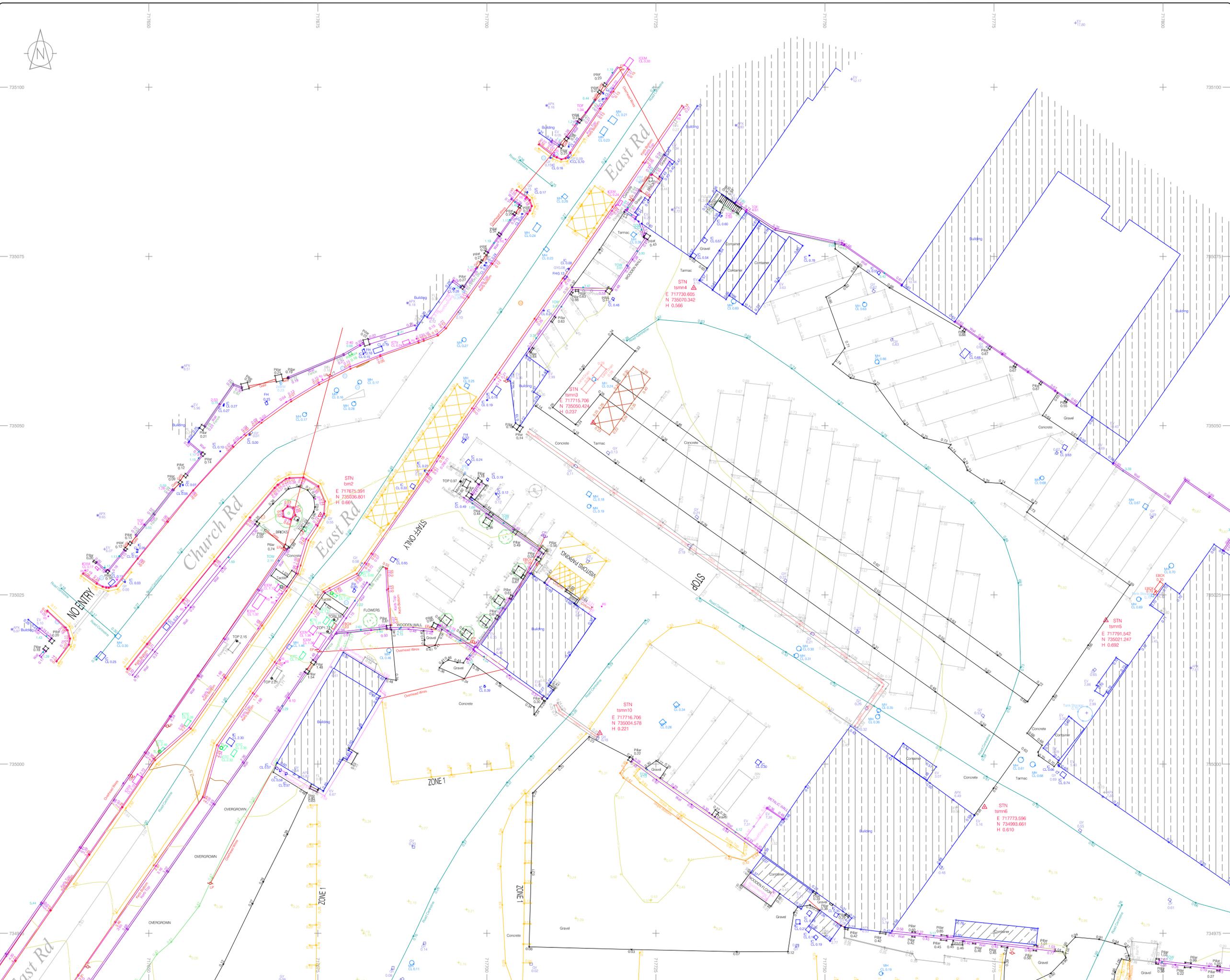
Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

	19. Flooding at ESB Sportsco, Ringsend, Dublin 4 on 24th Oct 2011 County: Dublin	Start Date: 24/Oct/2011 Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information		
	20. Flooding at Bath Avenue, Sandymount, Dublin 4 on 24th Oct 2011 County: Dublin	Start Date: 24/Oct/2011 Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information		
	21. Flooding at Railway Cottages, Ballsbridge, Dublin 4 on 24th Oct 2011 County: Dublin	Start Date: 24/Oct/2011 Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information		
	22. Flooding at Havelock Square, Sandymount, Dublin 4 on 24th Oct 2011 County: Dublin	Start Date: 24/Oct/2011 Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information		
	23. Clontarf Rd Seaview Avenue August 2004 County: Dublin	Start Date: 23/Aug/2004 Flood Quality Code:3
Additional Information: Reports (3) More Mapped Information		
	24. Clontarf Oulton road area August 2004 County: Dublin	Start Date: 23/Aug/2004 Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information		
	25. Clontarf Kincora Park August 2004 County: Dublin	Start Date: 23/Aug/2004 Flood Quality Code:3
Additional Information: Reports (2) More Mapped Information		
	26. Dodder Oct 1987 County: Dublin	Start Date: 21/Oct/1987 Flood Quality Code:4
Additional Information: Photos (3) More Mapped Information		
	27. Bath Avenue June 1963 County: Dublin	Start Date: 11/Jun/1963 Flood Quality Code:2
Additional Information: Photos (1) Reports (2) More Mapped Information		
	28. Tolka April 1909 County: Dublin	Start Date: 03/Apr/1909 Flood Quality Code:4
Additional Information: Reports (4) More Mapped Information		

Appendix B

Topographical Survey



LEGEND

Street furniture & Services

Over Head Wires (LUAS) - Pylon ESB	Street Sign	Phone Box
Flowerbed	Beach Seat	Duct
Pipe	Beacon	Kiosk
Light	Coalhole Cover	USG W
Barrier	Bole Hole	Waste Bin
Pump	Electricity Pole	Hydrant
Trail Pit	Telegraph pole	File Hydrant
Postbox	OCS Pole	ESB Box
Valve - General	OCTV Camera Pole	ESB Inspection Cover
Water Valve	Lamp Post	Trucks Control Box
Gas Valve	Four Manhole	LUAS Technical Cabinet
Sluice Valve	Surface Water MH	Ticket Vending Machine
Air Valve	Manholes	Water Meter Cover
Stop Cock	Air Conditioning Vents	Telecom Inspection Cover
C/P Post	Services Inspection Cover	Monument / Toilets
Marker Post	Traffic Inspection Cover	Tank Storage
Trailing Light	Cable TV Inspection Cover	Basement, MH, Cover & Pipe
Tracing Meter	ESB Inspection Cover	Dispersed Annel Mark
Flow Annel Mark	MH Inspection Cover	Stop for pole
Small Canal Valves	Excres Inspection Cover	Stop Protection
Unknown Valve	Rodding Eye	PP
		Washout

Natural Features

Surface Change	Water Level	Golf
Land Drain	Down Level	Fair Way
Bottom of Slope	Invert level	Green
Top of Slope	Bed Level	Tea Box
Ditch	Spotheight	Other
Water Edge / Lake / Pond		Survey Station
Hedge / Trees / Vegetation		Photo point
Tree Contourous	Tree Deciduous	Top of Tree

Built Features

Roads & Road Markings

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

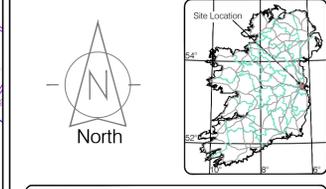
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Site Location



No	Date	Description	Revisions
1	16.02.2018	First Drawing	

Drawn by: MN	Date: February 2018	Drawn: Main Head
Checked by: PK	Date: 16.02.2018	Grid System: Irish National Grid (ITM11)

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Client: Glenveagh Living

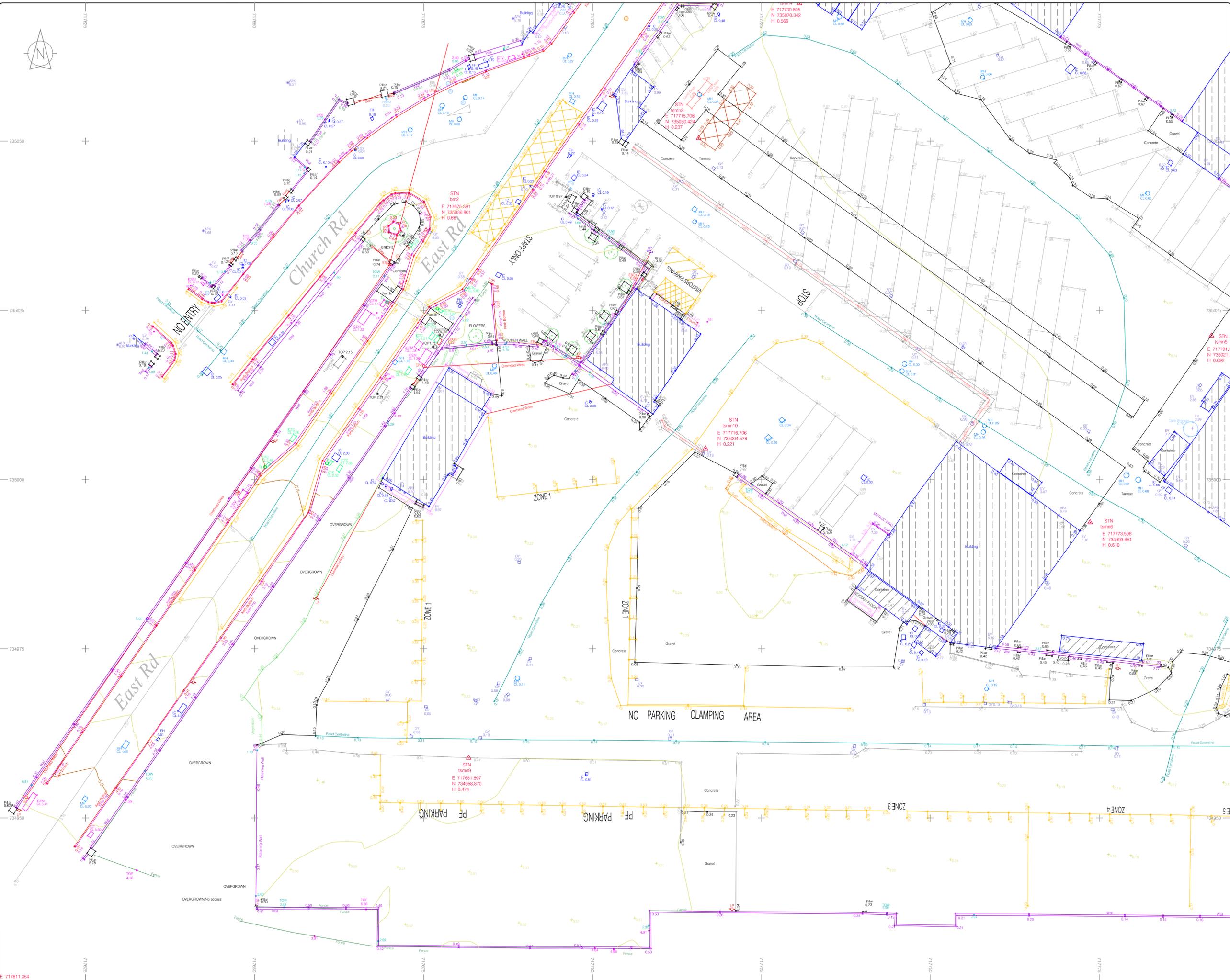
Project: Survey 3 East Road

Date: 16.02.2018 **Scale:** 1:250@A1

Description: Topographical survey

Drawing Number: MSL24281-T-Rev0-01

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LEGEND

Street furniture & Services

Over Head Wires (LUAS) - Pylon ESB	Street Sign	Phone Box
Flowerbed	Ballast	Beach Seat
Pipe	Beacon	Keok
Light	Coalhole Cover	Gas Cover
Barrier	Bole Hole	US Car Park VMS
Pump	Electricity Pole	Waste Bin
Manhole	Telegraph pole	Hydrant
Postbox	OCIS Pole	Fire Hydrant
Water - General	CCTV Camera Pole	ESB Box
Water Valve	Lamp Post	ESB Inspection Cover
Gas Valve	Four Manhole	Trucks Covered Box
Sluice Valve	Surface Water MH	LUAS Technical Cabinet
Air Valve	Manholes	Water Meter Cover
Stop Cock	Air Conditioning Vents	Water Meter Cover
C/P Post	Services Inspection Cover	Telecom Inspection Cover
Marker Post	Traffic Inspection Cover	Monument / Toilets
Traffic Light	Cable TV Inspection Cover	Tank Storage
Parking Meter	Garage Inspection Cover	Basement, MH, Cover & Pipe
Play Area Mark	Manhole Inspection Cover	Basement, MH, Cover & Pipe
Small Cart Validator	Excres Inspection Cover	Spot for pole
Unknown Valve	Rodding Eye	Washout

Natural Features

Surface Change	Water Level	Golf
Land Drain	Ground Level	Fair Way
Bottom of Slope	Invert level	Green
Top of Slope	Bed Level	Tea Box
Ditch	Spotlight	Other
Water Edge / Lake / Pond	Survey Station	Photo point
Hedge / Trees / Drop Lines / Vegetation	Tree Deciduous	Top of Tree

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Kerb Bottom	Road Centreline	Eaves Height
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Bridge Deck	Property Line	Step Level
Bridge Pier	Road Bar	Concrete Pad
Building Facade	Top of Fence	Track
Footpath / Platform / Train / Tram	Wall / Retaining Wall	
Damp Proof Course / Vene	Railway / Tram Rail / Gosing / Ramp	
Bridge Pier / Wall & Gate Pillar / LUAS Trackbed	Building Canopy / Roof / Overhang	
Cycleway / Private Landing Area		

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North

Site Location

Map Sheet Layout

02

Drawn by: MN	Date: February 2018	Datum: Mean Head
Checked by: PK	Date: 16.02.2018	Grid System: Irish National Grid
	Date: 16.02.2018	ITM (E): 0

No	Date	Description	Revisions
1	16.02.2018	First Drawing	

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Client: Glenveagh Living

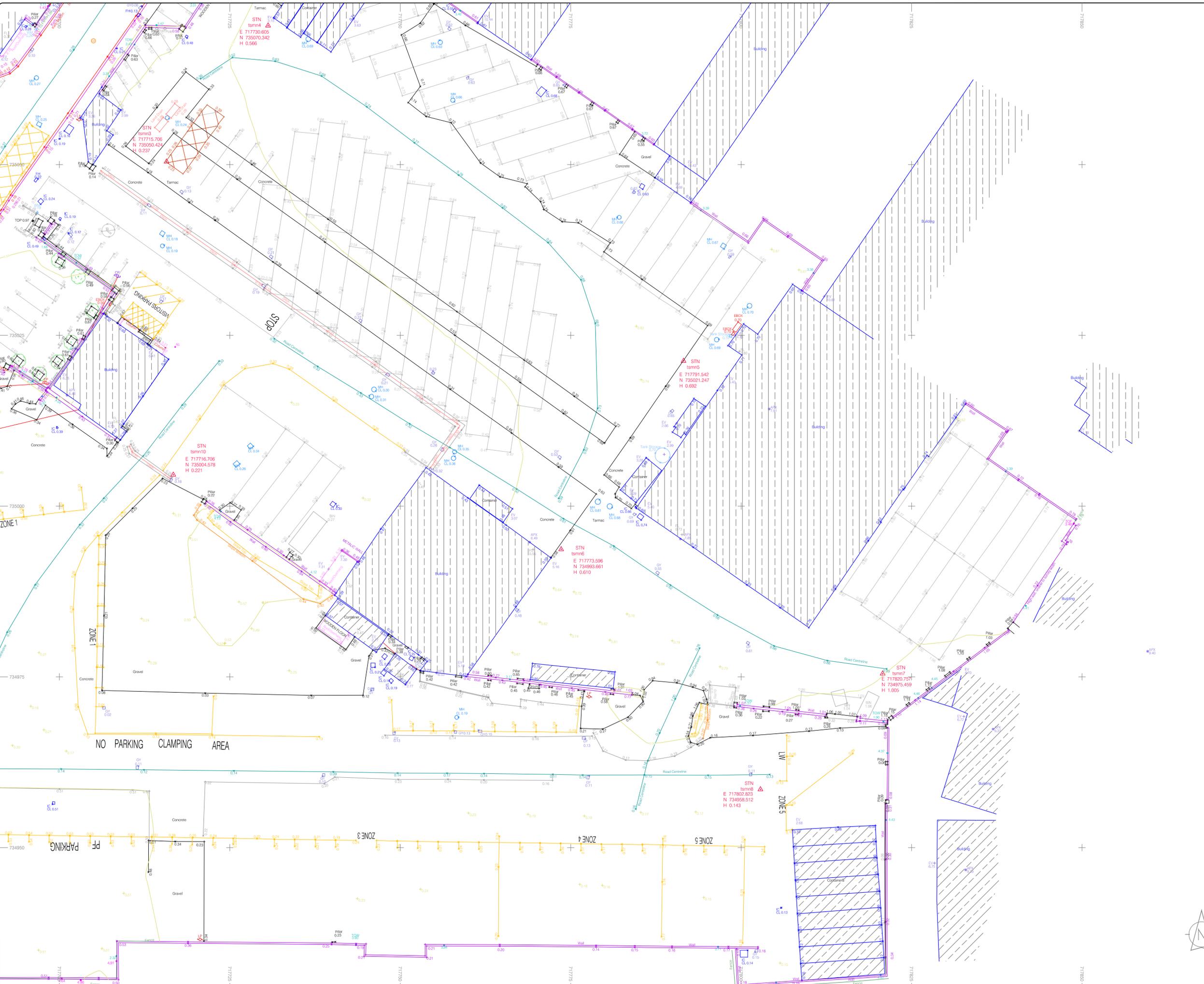
Project: Survey 3 East Road

Date: 16.02.2018 **Scale:** 1:250@A1

Description: Topographical survey

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LEGEND

Street furniture & Services

Over Head Wires (LUAS) - Pylon ESB	Street Sign	Phone Box
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Pump	Electricity Pole	Hydrant
Manhole	Telegraph pole	Fire Hydrant
Postbox	OCIS Pole	ESB Box
Water - General	CCTV Camera Pole	ESB Inspection Cover
Water Valve	Lamp Post	Trucks Covered Box
Gas Valve	Four Manhole	LUAS Technical Cabinet
Sluice Valve	Surface Walker MH	Ticket Vending Machine
Air Valve	Manholes	Water Meter Cover
Stop Cock	Air Conditioning Vents	Water Meter Inspection Cover
C/P Post	Services Inspection Cover	Monument / Toilets
Marker Post	Traffic Inspection Cover	Tank Storage
Traffic Light	Cable TV Inspection Cover	Basement, MH, Cover & Pipe
Parking Meter	Garage Inspection Cover	Dispersed Aerial Mark
Flare Aerial Mark	MU Inspection Cover	Stop for pole
Small Cart Validator	Excres Inspection Cover	PP
Unknown Valve	Rodding Eye	Washout

Natural Features

Surface Change	Water Level	Golf
Land Drain	Down Level	Fair Way
Bottom of Slope	Invert level	Green
Top of Slope	Bed Level	Tea Box
Ditch	Spotheight	Other
Water Edge / Lake / Pond	Spotheight	Survey Station
Hedge / Trees Drip Line / Vegetation	Tree Deciduous	Photo point
Tree Coniferous	Tree Deciduous	Top of Tree

Built Features

Roads & Road Markings

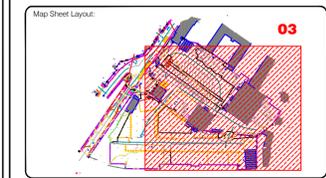
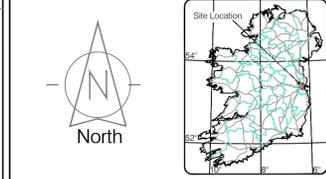
Building	Fence	Floor Level
Edge of Road	Gate	Apex Height
Kerb Bottom	Road Centreline	Eaves Height
Kerb Top	Top of Wall	Parapet Height
Bridge Abutment	Hoarding	Step Level
Bridge Deck	Property Line	Soft Elevation
Bridge Parapet	Road Bar	Step Level
Building Facade	Top of Fence	Concrete Pad
Footpath / Platform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

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Drawn by: MN	Date: February 2018	Drawn: Main Head
Checked by: PK	Date: 16.02.2018	Grid System: Irish National Grid
Revisions		
No	Date	Description
1	16.02.2018	Final 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

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Appendix C

Warning & Evacuation Plan

1-4 EAST ROAD, DUBLIN 3

Flood Warning & Evacuation Plan

Revision – (DRAFT)

December 2018

1. General Precautions and Information

- The house is located within a defended area of the tidal flood extents and in the scenario there is a breach in tidal flood defences, this plan outlines the actions required by the site users.
- The time of first inundation of the site could be fast, and with little warning due to unknown status of a breach. Although, it is likely the Local Authority will have prior warning of the increased tidal levels and have a flood warning for the area in effect.
- Ensure all residents are aware of this plan, understand it and are fully briefed on the risk assessment, and provide basic training to any children at the site.
- The residents and site users will need to be aware that during a flood event there is likely to be a failure of the utilities.
- Ensure multiple emergency flood boxes are located within each and are accessible. This should be checked and maintained as part of a bi-annual check.
- The residents should be aware of higher risk periods e.g. high spring tides, paying particular attention to weather conditions and flood warnings during these times.
- Dublin City Council operates a flood warning procedure and residents and site users are encouraged to sign up to notification systems such as MapAlerter (www.mapalerter.com/alerts/floods) and check websites such as meteoalarm (www.meteoalarm.eu) to ensure they are aware of any flood warnings in place for the area. These warnings are published on the Local Authorities website with more details of how to prepare for flooding at available through the OPW Website, ww.flooding.ie.
- A new National Flood Forecasting & Warning Service is currently being set up and is anticipated to be fully operational in 3 years (2021). All residents and site users should be made aware of the implementation of this system when operational.
- This plan should be a live document and may need to be updated in the future as a result of local policies and strategies being changed. This Flood Plan should be amended as necessary with a log kept of any changes and reasons for change. This is included in appendix 3 and should be completed following any revisions

2. Response to Flood Alert or Flood Warnings

Once a 'Flood Alert or 'Flood Warning' has been reported, the following actions will be undertaken.

The Local Authority & Met Eireann are responsible for issuing severe flood warnings and residents and site users should listen to local media and watch other media to assess the developing situation.

Emergency Flood Boxes will be checked for contents. (See Appendix 2 for box contents)

3. Response to Severe Flood Warnings

Once a 'Severe Flood Warning' has been issued, the following actions should be taken.

For Residents of the development:

1. Obtain the Emergency Flood Box.
2. Assemble all residents and visitors on the podium or in dwellings which have all been raised above the flood level.
3. Avoid evacuation wherever possible, as it will be very difficult to evacuate people from the site to an area outside the floodplain using a designated safe route. Access to the evacuation route and trafficability can be lost early in the flood because of rising floodwaters. Evacuation must be organised by the emergency services in this instance.
4. Contact the emergency services.
5. Depending on the level of flood risk and its imminence the emergency services will advise the public on the quickest and safest way off the property.

IMPORTANT: DO NOT RE-ENTER THE PROPERTY UNTIL INSTRUCTED TO DO SO BY LOCAL AUTHORITY OR THE EMERGENCY SERVICES

NO ACTIONS SHOULD BE TAKEN WHICH COMPROMISE THE SAFETY OF THE PERSONS INVOLVED

APPENDIX 1: Warning System (Following Met Eireann's Weather Warning System)

1: STATUS YELLOW – Flood Alert

Flooding is possible. Be prepared - Is used from two hours to two days in advance of flooding.

Following Actions:

- Watch water levels
- Monitor local news and weather forecasts on radio, TV or internet.
- Make sure you have what you need to put your flood plan into action.
- Check flood kit is fully equipped.
- Alert your neighbours, particularly the elderly and less able.
- Reconsider travel plans.
- Ensure all residents in your dwelling are accounted for.

2: STATUS ORANGE – Flood Warning

Flooding is expected. Immediate action is required - Is used from half an hour to one day in advance of flooding.

Following Actions:

As with Flood Alert plus;

- Move valuables and other items to safety
- Prepare flood kit.
- Prepare to turn off gas, electricity and other services.
- Be prepared for evacuation.
- Protect yourself and others that need your help.

3: STATUS RED – Severe Flood Warning

Severe flooding. Danger to life - Is used when flooding poses a significant threat to life.

Following Actions:

As with Flood Warning plus;

- Stay in a safe place.
- Turn off gas, electricity and water supplies if safe to do so
- Try to keep calm, and to reassure others, especially children
- Co-operate with emergency services and local authorities
- Prepare for evacuation.
- Call 999 if you are in immediate danger.

In the Event of a Breach Scenario no warning may be provided and the first sign of flooding may be water entering the site. In this situation ensure all site users are safely gathered inside the building and contact the emergency services. Follow the actions as shown on the Severe Flood Warning.

APPENDIX 2: Emergency Flood Box Contents

1. Encapsulated procedure checklist for Flood Officer with pen
2. Torch and battery back-up for mobile phone/tablet or dynamo radio
3. A first-aid kit, including a supply of any essential medication
4. Red and white hazard tape
5. A list of useful telephone numbers
6. An up to date copy of flood warning information (Met Eireann/Dublin City Council)

Procedure list is to assist in delivery of the response plan:

Priority	Action	Complete ✓
1	<ul style="list-style-type: none"> • Account for all residents and inform about flood warning. 	
2	<ul style="list-style-type: none"> • Continue to monitor situation by watching/listening to media. 	
3	<ul style="list-style-type: none"> • Gather residents and visitors to podium level and above. 	
4	<ul style="list-style-type: none"> • Contact Emergency Services 	
<p>LEAVE THE PROPERTY FOLLOWING EMERGENCY SERVICES INSTRUCTIONS</p>		

