Project

The Ted, Dun Laoghaire, Build to Rent

Report Title

Infrastructure Design Report

Client

Ted Living Limited

INFRASTRUCTURE

DBFL CONSULTING ENGINEERS

NOVEMBER 2021

Document Control

Job Title: The Ted, Dun Laoghaire, Built to Rent

Job Number: 190057

Report Title: Infrastructure Design Report

Report Ref: TED-DBFL-XX-XX-RP-C-0001

Author: Prinavan Chetty

Reviewed by: Nick Fenner

Date: November 2021

Distribution: DBFL Consulting Engineers
Design Team
Client

Revision	Issue Date	Description	Prepared	Reviewed	Approved
Draft	14/06/2021	Design Team Review	PCC	NJF	NJF
Draft	13/08/2021	Legal Review	PCC	NJF	NJF
Final	02/09/2021	Planning Issue	PCC	NJF	NJF
Rev A	17/11/2021	Planning Issue	MLC	NJF	NJF

DBFL Consulting Engineers

Dublin Office
Ormond House
Upper Ormond Quay
Dublin 7

Tel 01 4004000
Fax 01 4004050
Email info@dbfl.ie
Web www.dbfl.ie

Waterford Office
Suite 8b The Atrium
Maritana Gate,
Canada Street
Waterford

Tel 051 309500
Email info@dbfl.ie
Web www.dbfl.ie

Cork Office
14 South Mall
Cork

Tel 021 2024538
Email info@dbfl.ie
Web www.dbfl.ie

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 at Tedcastles, Dun Laoghaire, Co. Dublin.

1.2 Location & Topography

The proposed site is located in Dun Laoghaire, adjacent to the West Pier of Dun Laoghaire Harbour (refer to Figure 1-1). The subject site is approximately 0.31Ha and is currently occupied by an existing dwelling, and associated maintenance buildings. The subject site comprises mostly hardstanding area.

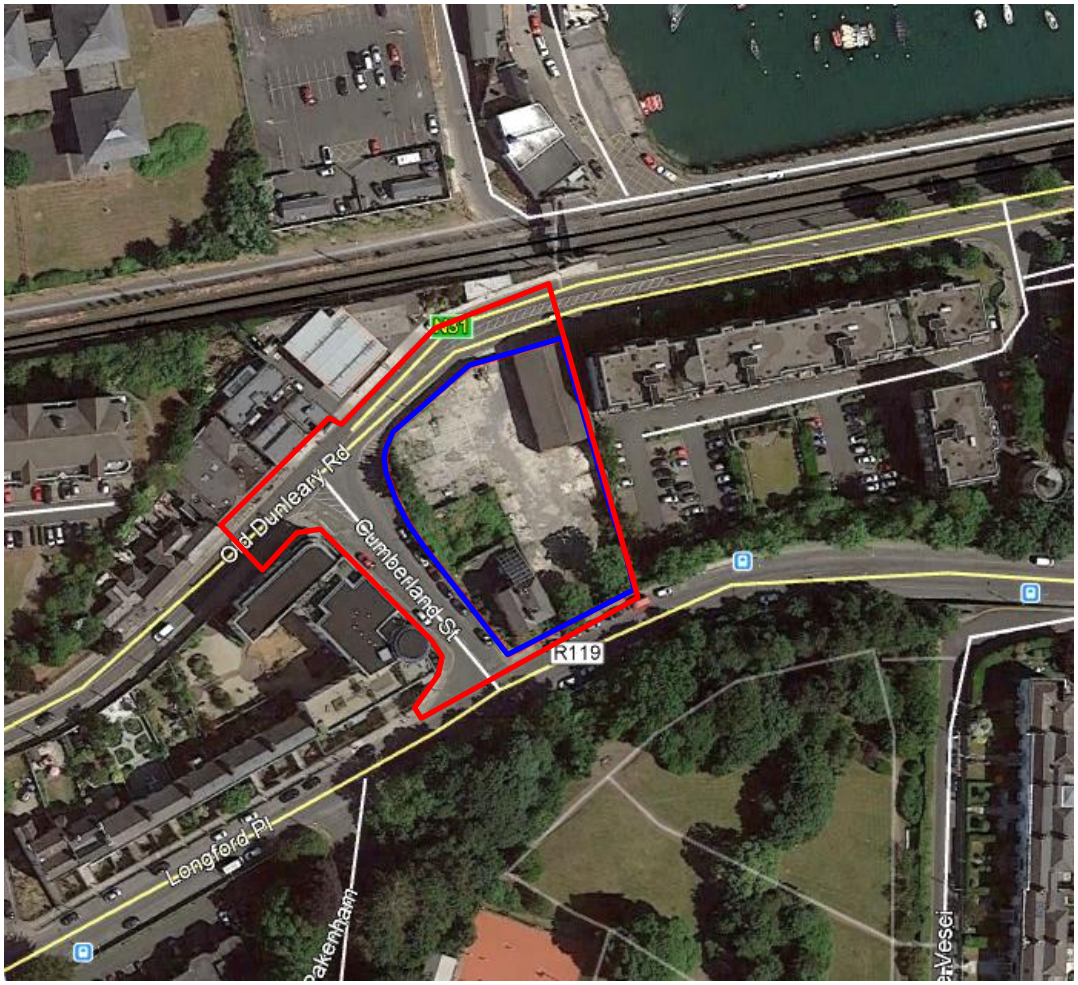
The site is bound by streets on three sides, with Old Dun Leary Road to the north, Dun Leary Hill to the south and Cumberland Street to west, with an existing residential development bounding the site to the east.

As per Dun Laoghaire Rathdown County Council's development plan, the site has been zoned NC, to protect, provide for and-or improve mixed-use neighbourhood centre facilities.

The subject site is currently terraced, with retaining structures to the north of the site with the existing dwelling at a higher level, which is accessed from the south west. A yard and shed is terraced at a lower level to the north at approximately 4.5m AOD and accessed to the north off Old Dun Leary Hill.

The subject site is relatively level, with a slight fall from south to north. There is also a steep embankment on the northern side of the site leading down to the site from Dun Leary Road.

The topographical survey has been included in appendix C.



Site Boundary Proposed development boundary

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 Concrete Surfacing to approximately 0.2m BGL on Made Ground to 0.6m-2.7m BGL. The Made Ground was followed by Cohesive deposits slightly sandy slightly gravelly CLAY and Granular deposits of slightly clayey sandy sub angular to sub sub-rounded fine to coarse GRAVEL. Both Cohesive and Granular deposits contained the occasional cobbles and boulders. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix.

The rotary core boreholes recovered medium strong to very strong grey/white coarsely crystalline Granite. The depth to rock varies from a minimum of 4.80m BGL to a maximum of 11.10m BGL.

Ground water was encountered at 4.50m BGL in BH03 at the western part of the site and at 4.70m BGL in BH04 at the northern part of the side. The borehole locations are shown in Figure 1-2.

Figure 1-2: *Site investigation trial pit and borehole locations*

1.4 Proposed Development

The proposed development at the former Ted Castles site and Dun Leary House (a proposed Protected Structure), Old Dun Leary Road, Cumberland Street and Dun Leary Hill, Dun Laoghaire will consist of:

- The provision of 146 no. apartment units (Build to Rent) and all associated ancillary facilities (including residential amenities) in a building with an overall height ranging from 6 storeys (with set backs from 4th & 5th storey) addressing Dun Leary Hill, to 5 and 8 storeys (with set back from 7th storey) addressing Old Dun Leary Road and 6-7 storeys (with set backs at 8th storey) addressing Cumberland Street. The proposal provides for private and communal open spaces in the form of balconies and terraces throughout;
- A retail unit (c.290m^2) at ground floor level addressing Old Dun Leary Road and Cumberland Street;
- The refurbishment, partial removal and adaptation of a 4 storey building on site known as “Dun Leary House” (a proposed Protected Structure) to provide co-working office suites (c.247m^2) at Levels 01,02 and 03. The works will include partial removal of original walls and floors, removal of non original extensions to Dun Leary House, repointing and repair of brickwork and granite fabric, reinstatement of timber sash windows, removal of existing roof, alterations and reinstatement of internal floor layouts, reinstatement of entrance point on Dun Leary Hill, removal of non-original level 00 and linking the existing building to the new development from

level 00 to level 03 with the construction of 3 new floors of development (with set back at roof level) above the existing building. It is proposed to repair, reinstate and improve the existing boundary treatment to Dun Leary House;

- Provision of 52 no. car parking spaces in total - 44 no. car parking spaces provided at level 00. At Cumberland Street 11 no. existing on street car parking spaces will be removed and 8 no. on street car parking spaces provided. Provision of 277 bicycle parking spaces (94 no. cycle parking spaces accommodated in bicycle stands and 183 no. long term bicycle parking spaces within a secure storage area) and 4 no. motorbike parking spaces, all at Level 00. A new vehicular entrance/cycle path (off the Old Dun Leary Road), ancillary plant areas, ESB substation and storage areas;
- Extensive hard and soft landscaping throughout, green roof, public lighting, signage, boundary treatments and public realm improvements;
- The demolition of the existing open fronted shed on site and all associated ancillary site services and site development works.

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 Dún Laoghaire-Rathdown County Council's Strategic Flood Risk Assessment (SFRA), we note that the development lands are located within Flood Zone C.

The review concluded that the proposed development site is located within Flood Zone C and has a very low risk of fluvial flooding as there are no EPA water courses in close proximity to the site as shown in Figure 2-1. There is also no risk from tidal flooding as the lowest level on the site is 4.38m AOD and the 0.1% AEP water level reaches a maximum of 3.19m AOD, providing over 1m of freeboard.

A possible source of flood risk identified was from the surcharging or blockage of the development's drainage system. This risk will be mitigated by suitable design of the drainage network, regular maintenance and inspection of the network and establishment of exceedance overland flow routes.

Flood risk from all sources have been fully assessed in a Site Specific Flood Risk Assessment (SSFRA). Please refer to DBFL report 190057-Rep-003 – SSFRA.

Figure 2-1: *Extract from EPA online mapping*

3.0 SITE ACCESS AND ROAD LAYOUT

3.1 Existing Access

The proposed development site has a single entry-point for vehicles on Old Dun Leary Road as shown on Figure 3-1. There is an existing pedestrian access on Cumberland Street at the north western side of the site, however it is overgrown and does not seem to be in use. Further pedestrian accesses to the south west giving access to the existing house are also present.

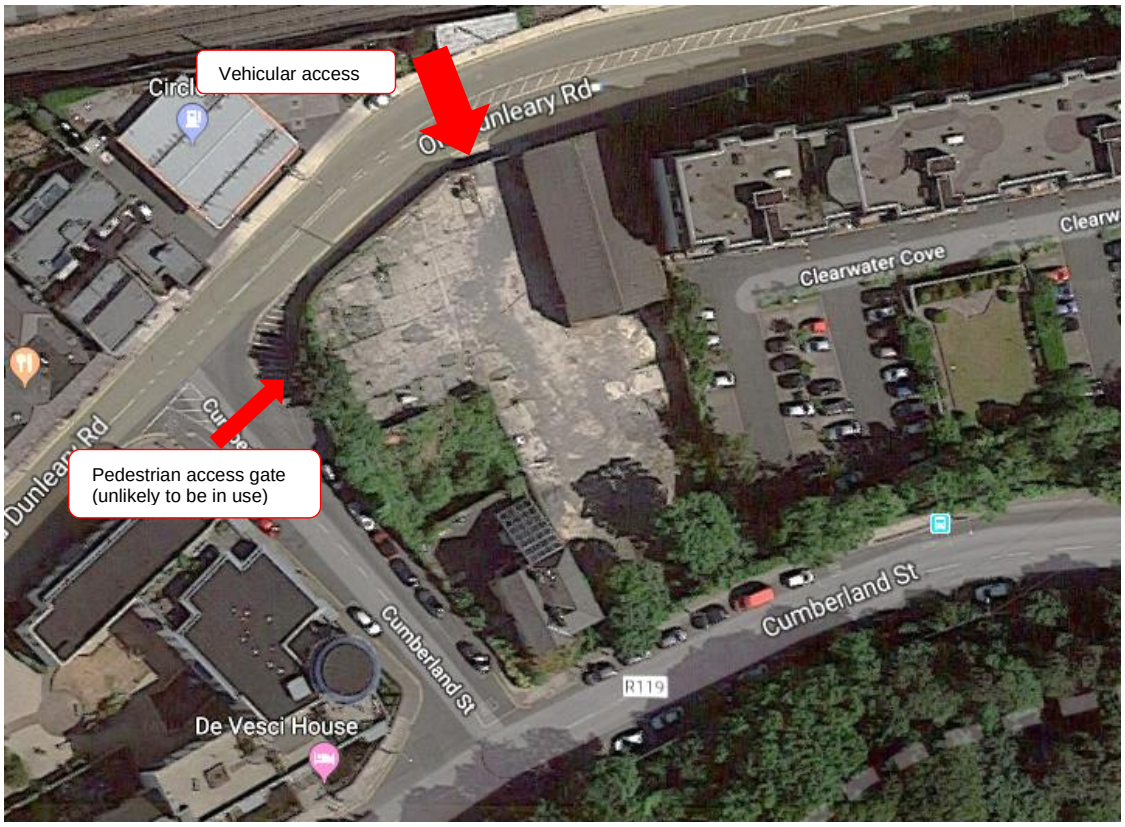


Figure 3-1: *Existing access into the site*

3.2 Proposed Access

The proposed development will have multiple accesses, shown in Figure 3-2, due to the existing topography of the surrounding street network which is 4.8m AOD on Old Dun Leary Hill and 11mm AOD on Dun Leary Hill.

3.3 Vehicular Access

The proposed vehicular access to the development will be via Old Dun Leary Road at the north eastern part of the site which allows access to the ground floor car park of the development. The access will be 6m wide and will consist of a vehicle crossover and drop kerb due to the low volume of proposed traffic and to prioritise pedestrians.

3.4 Pedestrian Access

The development can be accessed by pedestrians via various entry points. The main access to the residential elements of the development will be via Cumberland Street at a level of 8.45m AOD which leads into the development's courtyard. The commercial and café units will be accessed via Old Dun Leary Road at 5.95m AOD while a selection of own door units will be accessed from Dun Leary Hill at a level of 11.9m AOD.

3.5 Cycle Access

A dedicated cycle access has been proposed as part of the vehicular access off Old Dun Leary Road in accordance with DLRCC's Cycle parking standard. The cycle access will be 2.0m wide and will give cyclists a prioritised route to the proposed cycle store located within the car park.

3.6 Old Dun Leary Road/Cumberland Street Signalised Junction and Cumberland Street Courtesy Crossing

The subject development proposals include the upgrading of the Old Dun Leary Road/Cumberland Street junction to be signal controlled as well as the upgrading of Cumberland Street in line with the Design Manual for Road and Urban Streets (DMURS). The proposed road layout and hard landscaping areas have been tracked to demonstrate that the proposed corner radii 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 these roads (refer to DBFL Drawing TED-DBFL-RD-SP-DR-1101).

A courtesy crossing is proposed for the southern end of Cumberland Street in the form of a raised and paved crossing. This will allow pedestrians to assert a degree of priority over drivers, allowing a safer crossing point.

3.7 Proposed Parking

The parking area within the development will consist of 44 no. car parking spaces at the Level 00 with 2 no. accessible parking bays and a bike store area to accommodate 183 no. residential bikes with a further 82 no. short stay spaces available as Sheffield stands.

Provision for electric charging will be made for 4 no. spaces in accordance with Dun Laoghaire Rathdown County Council's Development Plan.

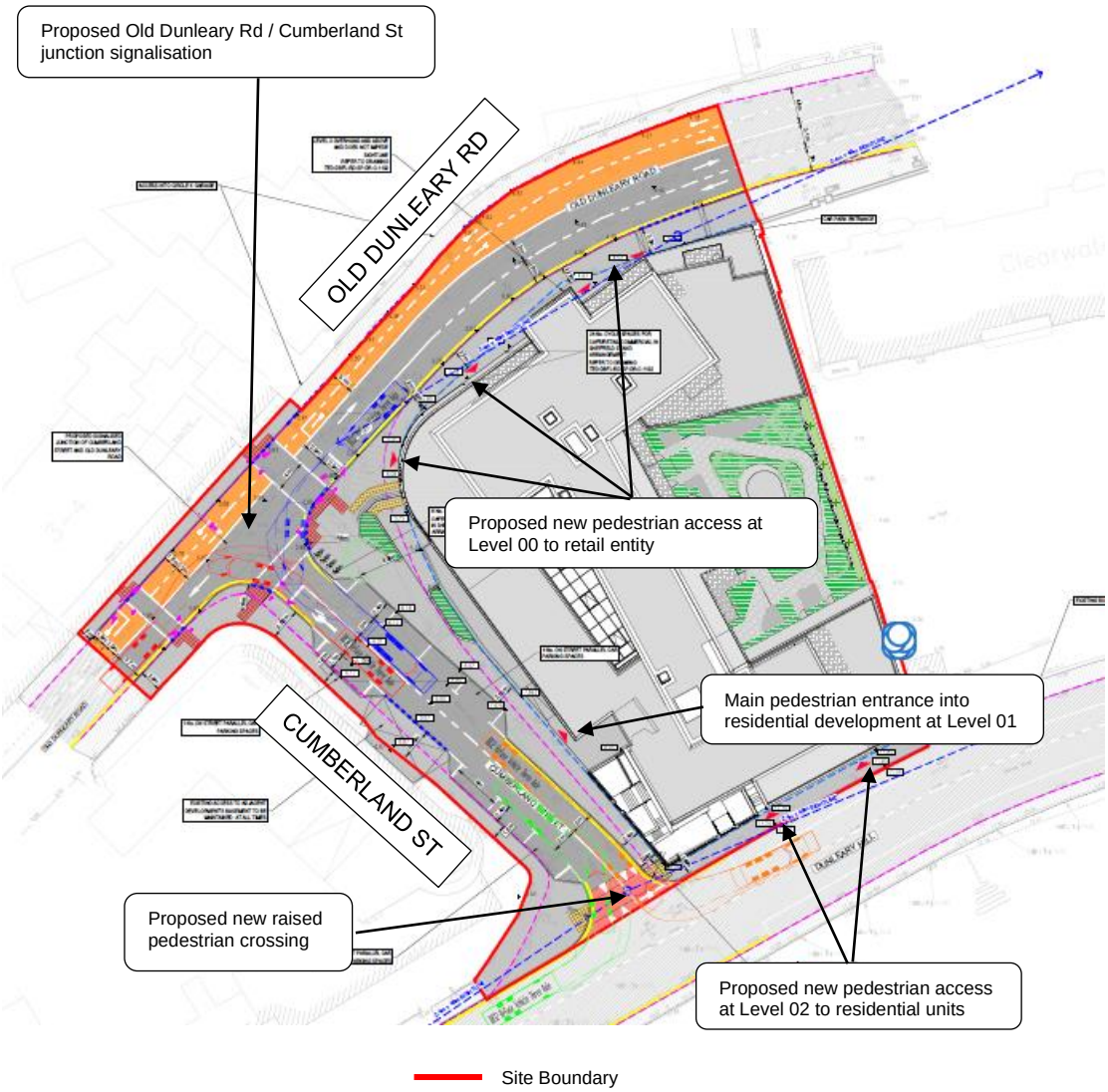


Figure 3-2: *Proposed Junction and Access for Development*

4.0 Public Realm Strategy

The development proposals include significant Public Realm improvements (shown in Figure 4-1) as mentioned under section 1.4. These works include footpath upgrades and alterations; resurfacing works; a signalised junction on Old Dun Leary Road and Cumberland Street including pedestrian crossings on all arms; provision of a seating area; landscaping; 32 no. bicycle parking spaces; and the inclusion street on car parking spaces on Cumberland Street. A layout of these proposals is shown on DBFL drawing TED-DBFL-RD-SP-DR-C-1101.

The proposed finished and materials for the works in the public realm will comply with the technical requirements of DLRCC and will be carried out by the Contractor appointed for the proposed development.

A preliminary construction traffic management plan, report no. TED-DBFL-XX-XX-C-0006, outlines the impacts of these works on affected properties and provisions to manage this.

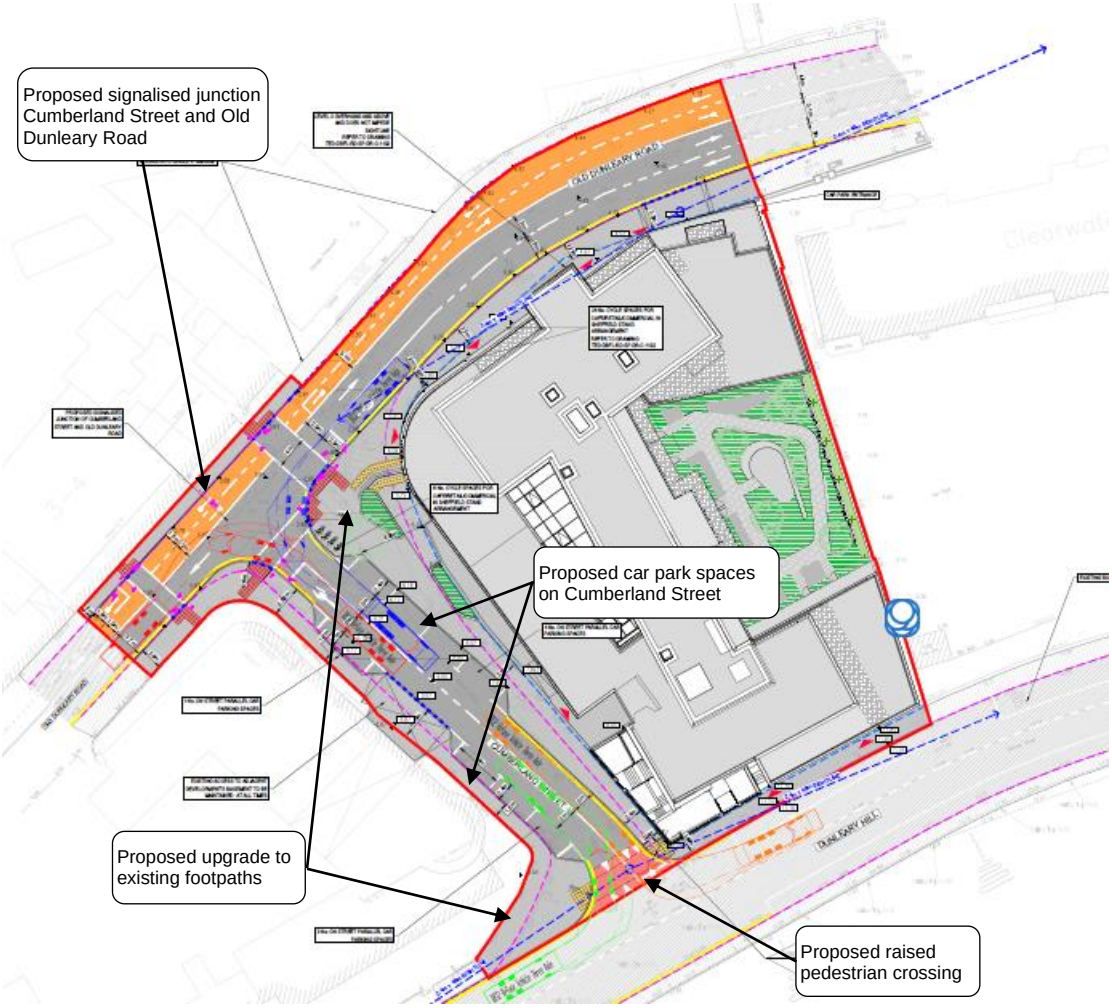


Figure 4-1: Proposed Public Realm Improvements

The proposals for the public realm and road layout have been subject to a stage 1 Quality Audit, with the Auditor's recommendations being included in the subsequent revisions. Please refer to Bruton Consulting Engineers Stage 1 Quality Audit for more information.

5.0 EXISTING SERVICES AND UTILITIES

5.1 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. In addition to this, existing information was provided by DLRCC in relation to historical surveys that have been undertaken. A summary of the existing main services is provided below, and the Irish Water records can be found in appendix D.

5.2 Surface Water Drainage

The area is served by a complex network of surface water and combined sewers which surround the site shown in Figure 5-1. As part of the adjacent 'Top Hat' site development a new 450mm surface water outfall was constructed to the north of the development on Old Dun Leary Road outfalling to the existing 900mm surface water in front of the Clearwater Cove Apartments to the east.

5.3 Foul Sewer

According to various site investigations, record drawings and discussions with DLRCC, there is an existing 1200mm diameter combined sewer on Old Dun Leary Road. This outfalls north under the railway line into a 2100mm combined sewer.

It is also known that the old Monkstown Overflow Culvert passes through the northern part of the site. From discussions with DLRCC and Irish Water it is known that the culvert originates from Longford Street, which travels down Cumberland Street towards Old Dun Leary Road where it turns within a manhole to the east and passes through the northern portion of the subject site. As part of the development, it is proposed to divert the Monkstown Overflow Sewer and the details can be found in section 7.1 of this report.

5.4 Water Supply

The site is well served by a series of watermains in Old Dun Leary Road, Cumberland Street and Dun Leary Hill as shown in Figure 5-1. The existing site looks to have two connections, one from Cumberland Street for the existing dwelling and another from Old Dun Leary Road which can be seen from the presence of water meters located on the Topographical survey.

There are existing fire hydrants along Old Dun Leary Road north eastern corner of the site and along Cumberland Street on the south western corner of the site.

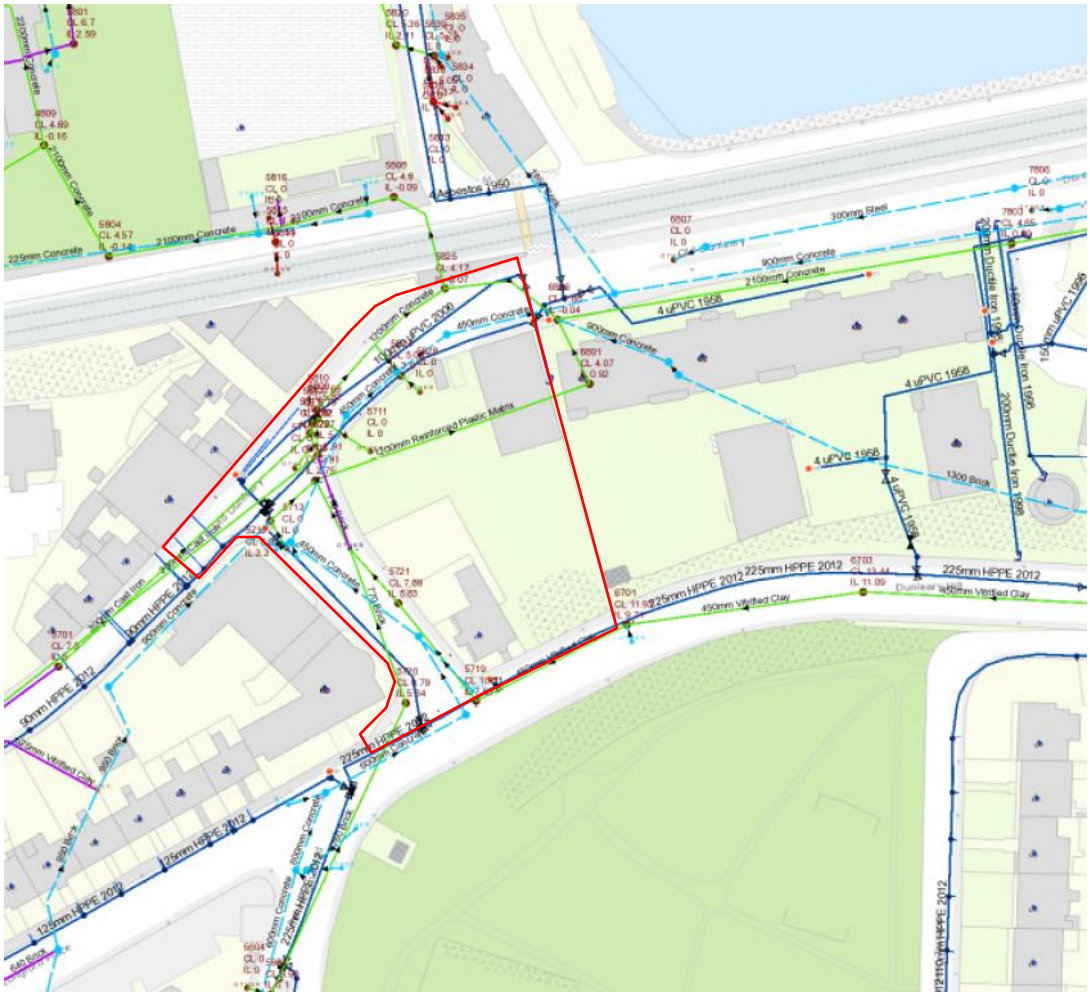


Figure 5-1: *Existing watermain and sewer records*

6.0 PROPOSED SURFACE WATER DRAINAGE

6.1 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 Dun Laoghaire Rathdown County 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).

6.2 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 of the development has progressed to the submitted design. To give a clearer understanding of each SUDS element, the different stages of the treatment train has been explained in detail in the following section. An overview of the different SUDS features incorporated within the development proposals can be seen on DBFL Drawing TED-DBFL-CS-SP-DR-C-12001 and TED-DBFL-SW-SP-DR-C-1301.

Due to the coverage of structure over the subject site, infiltration techniques will not be suitable for the development. Therefore, SUDS features at roof/terrace and podium level such as green roofs/build-up, permeable paving and rain gardens shall be implemented into the development to convey surface run-off via the drainage system to the larger attenuation tank while also providing treatment and ecological value.

Roof 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. After surface water has passed through the Green Roof, this will discharge to the surface water network below.

- 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.

Terrace Level:

- At terrace level the subject development will implement a free draining aggregate that will be placed on top of the terrace slabs allowing a reduction in flows within the drainage network.

Level 01:

- At podium level the subject development will implement a permeable paving in places and green landscaping.

  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.

- Impermeable areas have been designed to drain through green podium to ensure that any surface water runoff has an element of interception and treatment.

- 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 *Figure 6-1*). These will be specified in co-ordination with the landscape design to slow any areas of hardstanding that need to be drained and provide additional treatment and subsequent improvement of discharge quality.

Level 00:

- After rainwater has passed through the various SUDS features at the higher levels, this will drain to the below ground network. To ensure the development attenuates to greenfield run-off rates it is necessary to include an attenuation tank under the car park slab to provide the required volume for the 1% AEP event +10% Climate change

allowance. A flow control (in this instance a pump due to the shallow depth of the surface water sewer) will limit discharge to 0.6l/s.

Figure 6-1: *Examples of Urban Swales/Bio-swales – Various Sources*

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

As part of the surface water strategy, a Stage 1 Stormwater Audit has been undertaken on the development. Subsequently, drawings and documents have been updated to take account of these recommendations where agreed.

6.3 Attenuation

Attenuation volumes have been calculated based on an allowable outflow / green field runoff rate of 0.6l/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. Table 6-1 and Figure 6-2 is a summary of the site characteristics used in the selection of the pre-development soil value.

Table 6-1: Summary of Site Characteristics

Characteristic	Value	Description
Drainage Group	1 (Rarely Waterlogged within 60cm at any time)	Drainage group 1 was selected as the site is rarely waterlogged within 60cm at any time i.e. it is well drained.
Depth to impermeable layer	1 (>80cm)	Impermeable layers were encountered at depths of 4.80m BGL to 11.10m BGL during the site investigation.
Permeability group (above 'impermeable' layers or to 80cm)	Slow	The permeability group of the soil was set conservatively as "Slow" due to the clay deposits encountered during the site investigation.
Slope	2 - 8°	The fall across the site varies within the range of 2° to 8°.

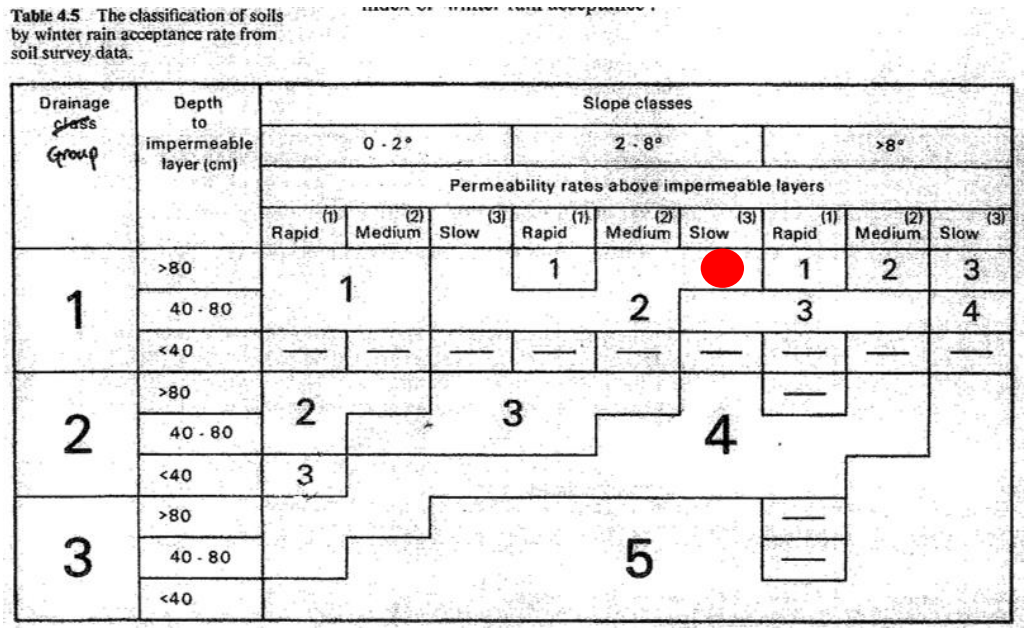


Table 4.5 The classification of soils by winter rain acceptance rate from soil survey data.

Drainage class Group	Depth to impermeable layer (cm)	Slope classes								
		0 - 2°			2 - 8°			>8°		
		Permeability rates above impermeable layers								
		Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)
1	>80	1			1			1	2	3
	40 - 80					2		3		4
	<40	—	—	—	—	—	—	—	—	—
2	>80	2		3			4	—		
	40 - 80									
	<40	3								
3	>80					5		—		
	40 - 80							—		
	<40									

Figure 6-2: *Extract of Table 4.5 for classification of SOIL type for the development*

The run-off from the new development will be treated at source using SUDS elements, shown in Figure 6-3 which include green roofs and green podiums, although the main volume will be based in a reinforced concrete tank that will be located beneath the ground floor parking, to ensure the design event of the 1% AEP plus 10% climate change is catered for.

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 5% reduction factor has been applied.
- Impermeable rooflight and private terraces, 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 Levels:

- Green areas over podium, a reduction factor of 20% 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 10% has been applied for these reasons.
- Areas draining to Green Podium filter drains and conveyance swales and/or treepits, a conservative reduction factor of 20% has been applied for these areas 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. The vegetation within these areas will provided a level of treatment and interception at the source. 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".

A reinforced concrete attenuation tank will be constructed under the ground floor slab, as the building footprint takes the majority of the site. Due to topography levels and the existing infrastructure in the vicinity of the site, the proposed attenuation tank will also need to be pumped as a gravity connection is not feasible in this location, due to the shallow nature of the 450mm diameter surface water sewer located in Old Dun Leary Road. The attenuation tank has been designed to provide the required volume for the 100-year storm event (+10% climate change) using Micro Drainage source control software. Refer to Appendix B for the summary of results for various storm-water duration. Calculations indicate that 187m^3 of storage volume for the 100-year event (+10% climate change) is needed; and the attenuation tank will be provided with a total available volume of 252m^3 to allow for 360mm of freeboard.

Surface water attenuation calculation can be found in Appendix B. A section of the attenuation tank and outfall details DBFL drawing TED-DBFL-CS-SP-DR-C-5204. A summary of the surface water runoff reduction factors is shown under Table 6-2.

Table 6-2: Summary of surface water runoff reduction factors

Description	Area (m^2)	Reduction Factor
Roof – Hardstanding (draining to gullies)	105	5%
Roof – Green	1209	5%
Terraces – Hardstanding (draining to gullies)	90	5%
Terraces – Free draining aggregate build-up	720	15%
Courtyard – Draining through SUDS features	484	20%

Figure 6-3: *Proposed Landscape showing green roof and green podium*

6.4 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: 757mm
- M5-60: 15.9mm
- Ratio r (M5-60/M5-2D): 0.27
- 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.

6.5 Climate Change

Surface water calculations for the development made use of rainfall values for the Monkstown area as provided by Met Eireann. Rainfall intensities were increased by a factor of 10% to take account of climate change, as required by the DLRCC for attenuation storage design.

6.6 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 most of the site coverage will be roof/terrace/podium area with the all of vehicle parking provided at ground level. Run-off from green areas of the roof will have a first stage of treatment by draining through green-roof medium which in turn drain to the on-line attenuation storage systems. The podium areas will drain via their build-ups to a slung system which in turn also drain via the attenuation storage system.

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

All incidental drainage from the car park is discharged via a Class 1 oil separator to the attenuation tank before eventually being discharged into to the foul sewer as per DLRCC requirements. Furthermore, the volume of surface water from the carpark is expected to be

small as it is undercroft and will have a negligible impact on the water quality. 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.

6.7 Interception of First Flush of Rainfall

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 most of the site's run-off via SUDS features e.g. green roofs and filter drains, providing interception at source. In turn resulting runoff is conveyed to attenuation storage system provide a level of further interception. Calculations in accordance with the GDSDS recommendations can be found in appendix A and indicate a minimum of 12.2m^3 of interception volume should be provided. This interception will occur within elements such as the green roof, green podium and planters.

6.8 Surface Water Pumping

As discussed under Section 6.3, the outflow from the proposed attenuation tank will need to be pumped as a gravity connection is not viable due to the shallow nature of the 450mm diameter surface water sewer located in Old Dun Leary Road. The pump shall limit the discharge to 0.6l/s as per the allowable outflow discussed under Section 6.3. The outflow will be discharged into a discharge manhole before draining under gravity via a proposed new 225mm diameter surface water line to the public sewer.

The pumps within the pump station will be installed in a duty stand-by arrangement with two stand-by pumps to allow for redundancy in the system. Maintenance and operating procedures will be provided by the Contractor to management of the property. The type of pumps proposed are submersible pumps suited for drainage applications which can be used as a stationary installation. The anticipated system curve and duty point are shown on Figure 6-4 and calculations included under Appendix G.

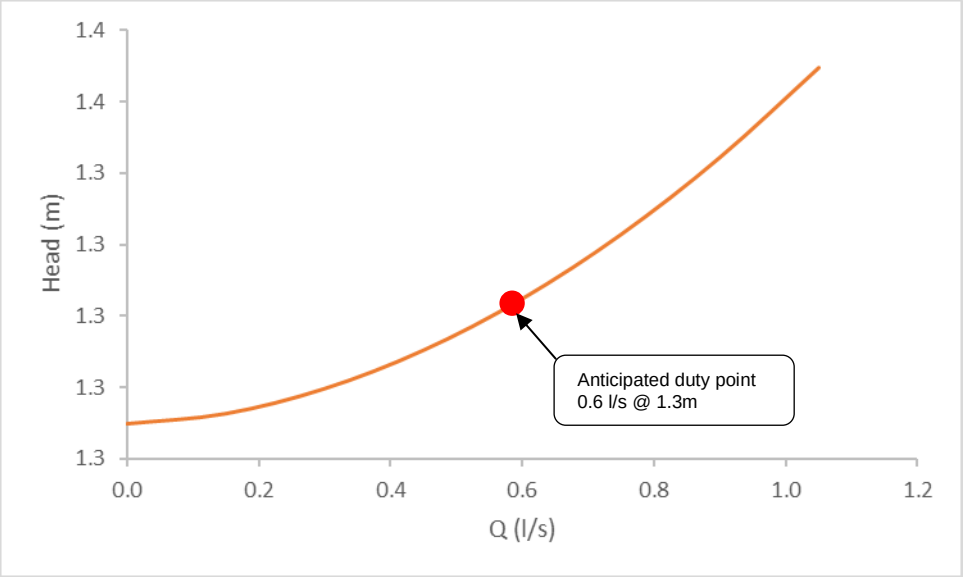


Figure 6-4: Anticipated surface water rising main system curve and duty

In the case that the external public sewer is surcharged and hence the discharge manhole is at capacity, the pump will discontinue pumping and the overflow will be contained within the car park area as the entrance level has been manipulated to allow 100mm to be stored over the car park area providing approximately 165m^3 of storage. This carpark storage excludes the volume available within the attenuation tank and internal surface water sewer network.

All doors at car park level will be fitted with water-tight seals to prevent the flooding of any facilities.

6.9 Maintenance

The proposed drainage system shall be maintained on a regular basis to reduce the risk of blockage. Operation and maintenance procedures for the proposed SUDS components shall be carried out as per the requirements set out in The SUDS Manual (refer to Table 6-3 for a summary of these procedures), while the proposed surface water manholes and sewers have been designed in accordance with GDSDS to facilitate regular maintenance.

Table 6-3: Summary of operation and maintenance activities required for key SUDS components (source: CIRIA Report C753: The SUDS Manual)

Operation and maintenance activity	SuDS component												
	Pond	Wetland	Detention basin	Infiltration basin	Soakaway	Infiltration trench	Filter drain	Modular storage	Pervious pavement	Swale/bioretention/ trees	Filter strip	Green roofs	Proprietary treatment systems
Regular maintenance													
Inspection	■	■	■	■	■	■	■	■	■	■	■	■	■
Litter and debris removal	■	■	■	■	□	■	■	□	■	■	■		□
Grass cutting	■	■	■	■	□	■	■	□	□	■	■		
Weed and invasive plant control	□	□	□	□		□	□		□		□	■	
Shrub management (including pruning)	□	□	□	□					□	□	□		
Shoreline vegetation management	■	■	□										
Aquatic vegetation management	■	■	□										
Occasional maintenance													
Sediment management[1]	■	■	■	■	■	■	■	■	■	■	■		■
Vegetation replacement	□	□	□	□						□	□	■	
Vacuum sweeping and brushing									■				
Remedial maintenance													
Structure rehabilitation /repair	□	□	□	□	□	□	□	□	□	□	□	□	
Infiltration surface reconditioning				□	□	□	□		□	□	□		

Key
■ will be required
□ may be required
Notes
1 Sediment should be collected and managed in pre-treatment systems, upstream of the main device.

7.0 PROPOSED FOUL DRAINAGE

7.1 Proposed External Foul Sewer Diversion

Correspondence with Irish Water was undertaken on the proposed diversion of the existing Monkstown Culvert. A feasibility studies report, outlining the possible diversion options, was submitted to Irish Water along with the hydraulic modelling for each option based on the East and West Pier Drainage Area Plan. The preferred option is shown in Figure 7-1 and the confirmation of feasibility issued by Irish Water is included under Appendix E.

Referring to Figure 7-1, it is proposed to construct a new manhole (*MH-A*) to replace the existing manhole on Cumberland Street (*Ex MH-1*) immediately upstream of the existing Monkstown Culvert. The construction of this manhole (*MH-A*) will make it possible to collect the existing flows from the upstream brick culvert and intercept the 300mm diameter overflow sewer at this location. The proposed sewer diversion will begin at this proposed manhole (*MH-A*) and run directly to the existing manhole on Old Dun Leary Road (*Ex MH-2*) where this will tie back into the existing network.

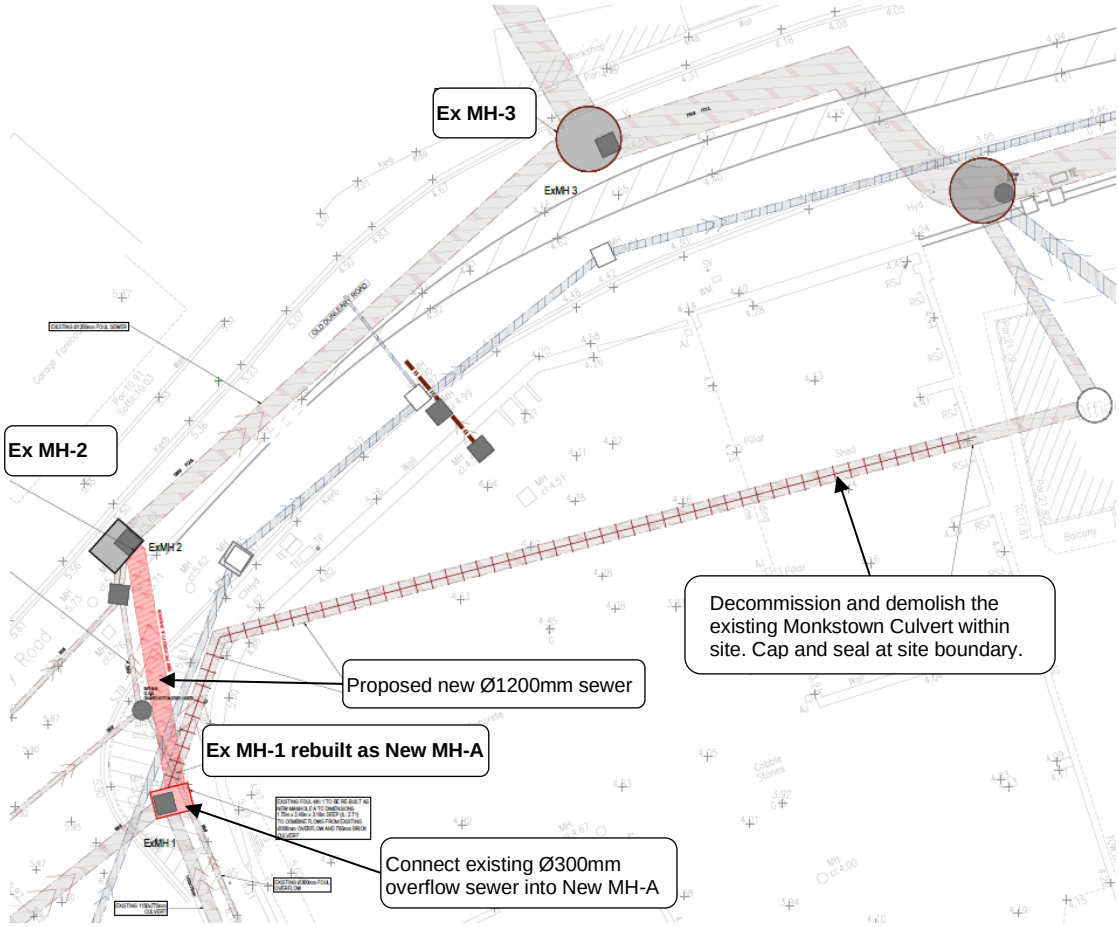


Figure 7-1: Overview of Proposed Diversion

7.2 Proposed Foul Layout

The proposed foul drainage layout for the development is largely reliant on slung drainage in the basement. As the basement extents cover most of the site, slung drainage will be located

by foul stacks which will be drained at high level under the podium slab. DBFL drawing TED-DBFL-CS-SP-DR-C-1201 shows an indicative layout of slung drainage which is designed based on a maximum 500mm service void to reach the furthest points of the basement at the required gradients.

The slung foul along with all basement level foul will ultimately drain via one outfall to the existing 1200mm diameter Irish Water foul sewer on Old Dun Leary Road to the North of the development. Irish Water has confirmed the feasibility of this connection based on a pre-connection enquiry that was submitted to Irish Water to assess the capacity available in the network. The Irish Water confirmation of feasibility has been included under Appendix E.

7.3 Design Calculations

All new main foul sewers are designed to discharge by gravity. 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: Part 2 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 7-1 and Table 7-2.

Table 7-1: *Estimated Foul Loading for residential development*

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	146	2.7 people/dwelling	394	150	59,130	0.68
					Daily Loading	**0.68**
					Growth factor	1.00
					Infiltration @ 10% (as CoP Appendix C - 2.2.4)	0.07
					Dry Weather Flow (l/s)	**0.75**
					Residential Peaking Factor (as CoP Appendix C - 2.2.5)	6.00
					Design Foul Flow (l/s)	**4.52**
					Surface Water allowance SW @ 3% (as CoP Appendix C - 2.2.10)	0.14

Design Flow (l/s)	**4.66**
***Flow rates extracted from IW CoP for Wastewater Infrastructure - Appendix D**	

Table 7-2: *Estimated Foul Loading for commercial 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)****
Retail	290	1 per 50 m^2 (staff)	6	50	290	0.003
Residential Amenities	458	1 per 20 m^2	23	50	1,145	0.013
					Daily Loading	**0.016**
					Growth factor	1.00
					Infiltration @ 10% (as CoP Appendix C - 1.2.4)	0.0016
					Dry Weather Flow (l/s)	**0.0176**
					Commercial Peaking Factor (as CoP Appendix C - 2.2.7)	4.50
					Design Foul Flow (l/s)	**0.08**
					Surface Water allowance SW_E @ 1.5 (as CoP Appendix C - 2.2.11)	0.0012
					Design Flow (l/s)	**0.0812**
***Flow rates extracted from IW CoP for Wastewater Infrastructure - Appendix D** ****For commercial premises, a working day is assumed to be over 12 hours**						

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 mixed-use comprising residential and commercial; therefore, 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).

Total Dry Weather Flow = 0.75 l/s (residential) + 0.0176 l/s (commercial) = 0**.77 l/s**

Total Foul Flow = 4.52 l/s (residential) + 0.08 l/s (commercial) = **4.60 l/s**

Total Flow = 4.66 l/s (residential) + 0.0812 l/s (commercial) = **4.74 l/s**

8.0 WATER SUPPLY AND DISTRIBUTION

8.1 Proposed Water main and Supply

As part of the development proposals the existing connection to the 100mm diameter uPVC water main on Old Dun Leary Road will be utilised. Irish Water has confirmed the feasibility of this connection, based on a pre-connection enquiry that was submitted to Irish Water to assess the capacity available in the network, subject to a valid connection agreement.

The Irish Water confirmation of feasibility has been included under Appendix E.

8.2 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.

8.3 Hydrants

As stated previously, there are existing fire hydrants along Old Dun Leary Road at the north eastern corner of the site and along Cumberland Street on the south western corner of the site. 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.

8.4 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 8-1 and Table 8-2. The total peak hour water demand for the combined commercial and residential use will be 4.59 l/s.

Table 8-1: *Estimated Water Demand for Residential Development*

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	146	2.7 persons/dwelling	394	59,130	0.68	0.86	4.28
						Peak hour water demand (l/s)	**4.28**

Table 8-2: *Estimated Water Demand for Commercial 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)**
Retail	290	1 per 50 m^2 (staff)	6	870	0.01	0.0125	0.0625
Residential Amenities	458	1 per 20 m^2	23	3,435	0.04	0.05	0.25
						Peak hour water demand (l/s)	**0.3125**
For commercial premises, a working day is assumed to be over 12 hours							

Appendix A

PERMISSIBLE OUTFLOW CALCULATIONS

PROJECT			JOB REF.
Mxed Use Development at Ted Castles, Monkstown, Co. Dublin			p190057
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Permissible Site Discharge (Impermeable Area draining to Attenuation Tank)			1
Drawing ref.	**Calculations by**	**Checked by**	**Date**
	PCC	NJF	22-Jun-21

PERMISSIBLE SURFACE WATER DISCHARGE CALCULATIONS

Site Area

What is the overall site area? **0.30** 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

How many different soil types are present on the pre-developed site? 1

Catchment	This refers to the entire site area	0.30	
Area		0.30	Hectares (ha)
Drainage Group		2	Class
Depth to Impermeable Layers		2	Class
Permeability Group above Impermeable Layers		2	Class
Slope [o]		2	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? 0.30 Hectares (ha)

Catchment 1	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Roof - Hardstanding (Draining to gullies)	105.000	0.95	99.750
Roof - Green	1140.000	0.95	1083.000
Terraces - Hardstanding (Draining to gullies)	90.000	0.95	85.500
Terraces - Free draining aggregate build up	570.000	0.90	513.000
Podium - Hardstanding (Draining to gullies)	0.000	0.95	0.000
Podium - Draining to SUDs features	1020.000	0.80	816.000

Include Public Open Space in Effective Catchment Area? No

Effective Catchment Area **2597.250** m^2

Effective Catchment Runoff Coefficient **0.89**

Long-Term Storage

Is long-term Storage provided? No

Permissible Site Discharge

What is the Standard Average Annual Rainfall (SAAR)? 757.0 mm From Met Eireann, Co-ordinates N320000, E226000

Is the overall site area less than 50 hectares? Yes

[5]$QBAR_{Rural}$ calculated for 50 ha and linearly interpolated for area of site 0.60 Litres/sec

[7]Site Discharge = **2.00** 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_{os} (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.

Appendix B

ATTENUATION CALCULATIONS

Summary of Results for 100 year Return Period (+10%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	2.799	0.199	0.0	35.7	O K
30 min Summer	2.878	0.278	0.6	50.0	O K
60 min Summer	2.973	0.373	0.6	67.1	O K
120 min Summer	3.084	0.484	0.6	87.0	O K
180 min Summer	3.153	0.553	0.6	99.6	O K
240 min Summer	3.203	0.603	0.6	108.6	O K
360 min Summer	3.270	0.670	0.6	120.5	O K
480 min Summer	3.319	0.719	0.6	129.4	O K
600 min Summer	3.356	0.756	0.6	136.1	O K
720 min Summer	3.385	0.785	0.6	141.4	O K
960 min Summer	3.429	0.829	0.6	149.2	O K
1440 min Summer	3.478	0.878	0.6	158.0	O K
2160 min Summer	3.504	0.904	0.6	162.7	O K
2880 min Summer	3.512	0.912	0.6	164.2	O K
4320 min Summer	3.502	0.902	0.6	162.4	O K
5760 min Summer	3.471	0.871	0.6	156.8	O K
7200 min Summer	3.431	0.831	0.6	149.5	O K
8640 min Summer	3.389	0.789	0.6	141.9	O K
10080 min Summer	3.346	0.746	0.6	134.3	O K
15 min Winter	2.821	0.221	0.6	39.8	O K
30 min Winter	2.911	0.311	0.6	56.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	73.311	0.0	0.0	19
30 min Summer	51.777	0.0	32.4	34
60 min Summer	34.973	0.0	50.1	64
120 min Summer	22.919	0.0	71.3	124
180 min Summer	17.646	0.0	85.1	184
240 min Summer	14.547	0.0	94.1	244
360 min Summer	10.944	0.0	97.6	362
480 min Summer	8.943	0.0	96.5	482
600 min Summer	7.638	0.0	94.9	602
720 min Summer	6.710	0.0	93.3	722
960 min Summer	5.462	0.0	90.3	962
1440 min Summer	4.076	0.0	84.5	1440
2160 min Summer	3.032	0.0	180.0	1968
2880 min Summer	2.453	0.0	172.5	2308
4320 min Summer	1.815	0.0	158.1	3072
5760 min Summer	1.465	0.0	256.1	3920
7200 min Summer	1.242	0.0	272.5	4752
8640 min Summer	1.085	0.0	286.7	5536
10080 min Summer	0.969	0.0	299.3	6360
15 min Winter	73.311	0.0	22.0	19
30 min Winter	51.777	0.0	38.5	33

Summary of Results for 100 year Return Period (+10%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	3.018	0.418	0.6	75.2	O K
120 min Winter	3.143	0.543	0.6	97.7	O K
180 min Winter	3.221	0.621	0.6	111.8	O K
240 min Winter	3.277	0.677	0.6	121.9	O K
360 min Winter	3.353	0.753	0.6	135.5	O K
480 min Winter	3.408	0.808	0.6	145.5	O K
600 min Winter	3.451	0.851	0.6	153.3	O K
720 min Winter	3.486	0.886	0.6	159.4	O K
960 min Winter	3.537	0.937	0.6	168.6	O K
1440 min Winter	3.597	0.997	0.6	179.5	O K
2160 min Winter	3.636	1.036	0.6	186.4	O K
2880 min Winter	3.641	1.041	0.6	187.4	O K
4320 min Winter	3.622	1.022	0.6	183.9	O K
5760 min Winter	3.582	0.982	0.6	176.8	O K
7200 min Winter	3.527	0.927	0.6	166.9	O K
8640 min Winter	3.466	0.866	0.6	155.9	O K
10080 min Winter	3.404	0.804	0.6	144.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	34.973	0.0	58.3	64
120 min Winter	22.919	0.0	82.0	122
180 min Winter	17.646	0.0	95.7	182
240 min Winter	14.547	0.0	99.1	240
360 min Winter	10.944	0.0	98.6	358
480 min Winter	8.943	0.0	97.2	476
600 min Winter	7.638	0.0	95.8	592
720 min Winter	6.710	0.0	94.4	708
960 min Winter	5.462	0.0	91.7	942
1440 min Winter	4.076	0.0	86.7	1398
2160 min Winter	3.032	0.0	183.2	2056
2880 min Winter	2.453	0.0	176.3	2680
4320 min Winter	1.815	0.0	163.3	3332
5760 min Winter	1.465	0.0	289.1	4264
7200 min Winter	1.242	0.0	307.5	5184
8640 min Winter	1.085	0.0	323.2	6056
10080 min Winter	0.969	0.0	321.9	6952

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	15.900	Shortest Storm (mins)	15
Ratio R	0.272	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+10

Time Area Diagram

Total Area (ha) 0.260

Time (mins) From:	To:	Area (ha)
0	4	0.260

Model Details

Storage is Online Cover Level (m) 4.400

Tank or Pond Structure

Invert Level (m) 2.600

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	180.0	1.400	180.0	2.800	0.0	4.200	0.0
0.200	180.0	1.600	0.0	3.000	0.0	4.400	0.0
0.400	180.0	1.800	0.0	3.200	0.0	4.600	0.0
0.600	180.0	2.000	0.0	3.400	0.0	4.800	0.0
0.800	180.0	2.200	0.0	3.600	0.0	5.000	0.0
1.000	180.0	2.400	0.0	3.800	0.0		
1.200	180.0	2.600	0.0	4.000	0.0		

Level Controlled Pump Outflow Control

Invert Level (m) 2.600 Cut In Height (m) 0.200 Cut Out Height (m) 0.100

Depth (m)	Outflow (l/s)	Depth (m)	Outflow (l/s)	Depth (m)	Outflow (l/s)
0.200	0.6000	2.200	0.6000	4.200	0.6000
0.400	0.6000	2.400	0.6000	4.400	0.6000
0.600	0.6000	2.600	0.6000	4.600	0.6000
0.800	0.6000	2.800	0.6000	4.800	0.6000
1.000	0.6000	3.000	0.6000	5.000	0.6000
1.200	0.6000	3.200	0.6000	5.200	0.6000
1.400	0.6000	3.400	0.6000	5.400	0.6000
1.600	0.6000	3.600	0.6000	5.600	0.6000
1.800	0.6000	3.800	0.6000	5.800	0.6000
2.000	0.6000	4.000	0.6000	6.000	0.6000

Appendix C

TOPOGRAPHICAL SURVEY

E 723450
E 723500
E 723550
E 723600
N 728850
N 728800
N 728750

Old Dunleary Road
Cumberland Street
Clearwater Cove
West Pier
Offices
Balcony
Workshop
Garage Forecourt
Canopy
Kerb
Wall
Building Line
Pillar
Shed
Concrete
Cobble Stones
Concrete Broken Ground
Gravel
Ramp
House
Path
Pedestrian Overbridge
Top of Railing:12.07
STOP
ONLY
TURN
LEFT
BUS
De Vesci Gardens
(Private Property No Access)

NOTE:

Portion of Ordnance Survey Detail Shown Grey Digitally Reproduced under Ordnance Survey Ireland Licence No. SU 0001419 © Government of Ireland.

LAND SURVEYS
22 Mellifont Avenue, Dun Laoghaire, Co. Dublin.
Ph: 2805212 Fax: 2302535 info@landsurveys.ie

Site at: Tedcastles Site, Dun Laoghaire

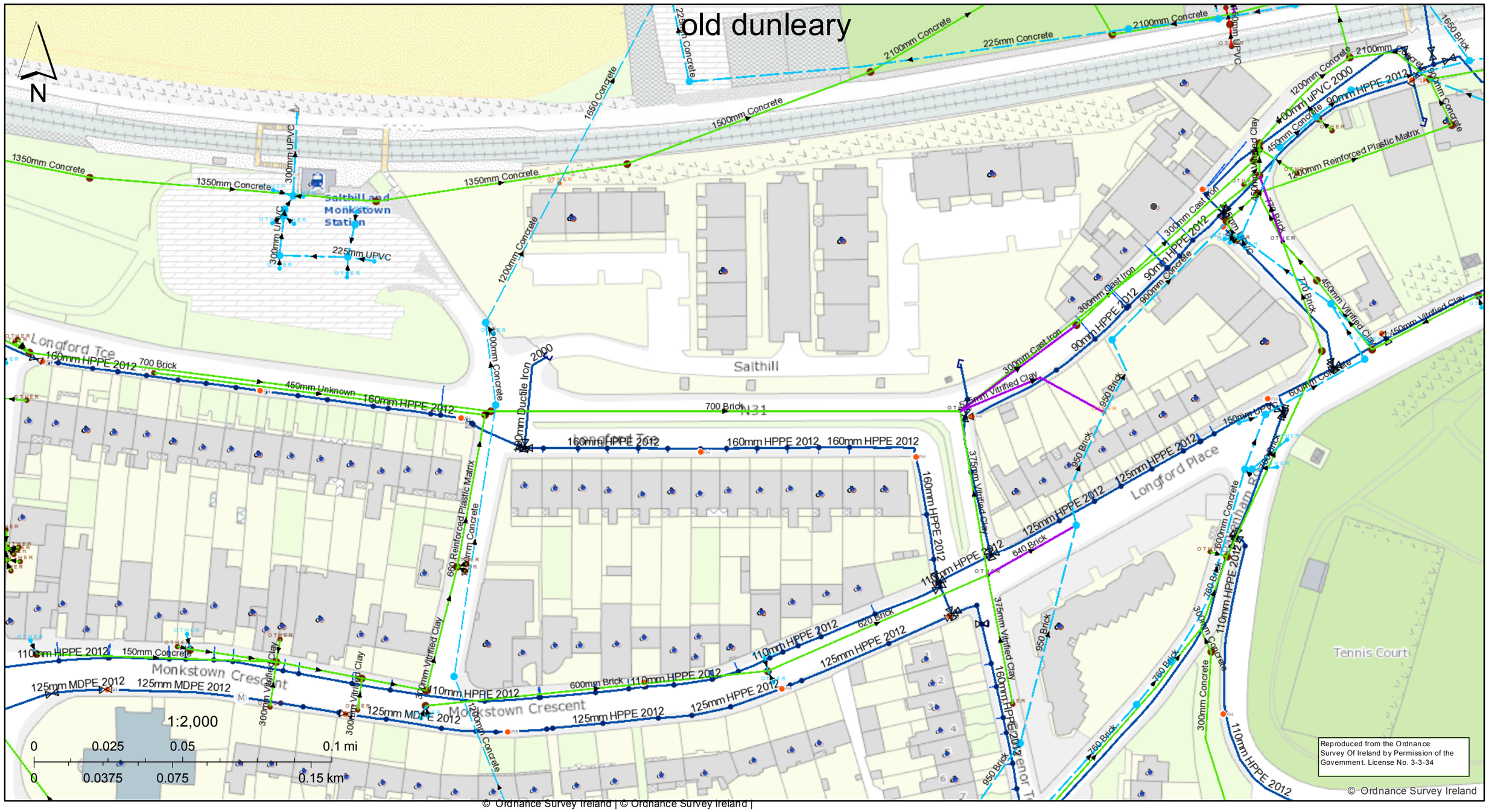
Client: Ardstone Homes

Scale: 1:250 (A1)
Contour: Spot Levels
Datum: OS Malin Head
Issued: 25.04.2019
Ref: D16157-R2D

Appendix D

IRISH WATER RECORDS

old dunleary



5/3/2019 10:31:57 AM

Legend

Stormwater Gravity Mains (Irish Water Owned)
- Surface

Stormwater Gravity Mains (Non-Irish Water Owned)
- Surface

Storm Manholes
- Cascade
- Catchpit
- Hatchbox
- Lamphole
- Standard
- Other; Unknown

Storm Inlets
- Gully
- Standard
- Other; Unknown

Storm Fittings
- Vent/Col
- Other; Unknown

Storm Discharge Points
- Outfall
- Overflow
- Soakaway
- Other; Unknown

- Storm Culverts
- Storm Clean Outs

Sewer Gravity Mains (Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Gravity Mains (Non-Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

old dunleary monkstown

5/3/2019 10:39:13 AM

Legend

Stormwater Gravity Mains (Irish Water Owned)
- Surface

Stormwater Gravity Mains (Non-Irish Water Owned)
- Surface

Storm Manholes
- Cascade
- Catchpit
- Hatchbox
- Lamphole
- Standard
- Other; Unknown

Storm Inlets
- Gully
- Standard
- Other; Unknown

Storm Fittings
- Vent/Col
- Other; Unknown

Storm Discharge Points
- Outfall
- Overflow
- Soakaway
- Other; Unknown
- Storm Culverts
- Storm Clean Outs

Sewer Gravity Mains (Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Gravity Mains (Non-Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Pressurized Mains (Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Pressurized Mains (Non-Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland. It should not be relied upon in the event of excavations or other works being carried out in the vicinity of the network. The onus is on the parties carrying out the works to ensure the exact location of the network is identified prior to mechanical works being carried out. Service pipes are not generally shown but their presence should be anticipated.

"Gas Networks Ireland (GNI), their affiliates and assigns, accept no responsibility for any information contained in this document concerning location and technical designation of the gas distribution and transmission network ("the Information"). Any representations and warranties express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation, direct, indirect, special, incidental, punitive or consequential loss including loss of profits, arising out of or in connection with the use of the Information (including maps or mapping data). NOTE: DIAL BEFORE YOU DIG Phone 1850 427 747 or e-mail dig@gasnetworks.ie – The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of the gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.ie."

Appendix E

IRISH WATER CONFIRMATION OF FEASBILITY AND DESIGN STATEMENT

Brian Morrow
48 Fitzwilliam Square
Co. Dublin

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

19 August 2021

Re: Design Submission for 225 Cumberland Street, Dun Laoghaire, Co. Dublin (the "Development")
(the "Design Submission") / Connection Reference No: CDS19003324

Dear Brian Morrow,

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 Zivanovic Byrne
Phone: 01 89 25991
Email: mzbyrne@water.ie

Yours sincerely,

Maria O'Dwyer
Connections and Developer Services

Appendix A

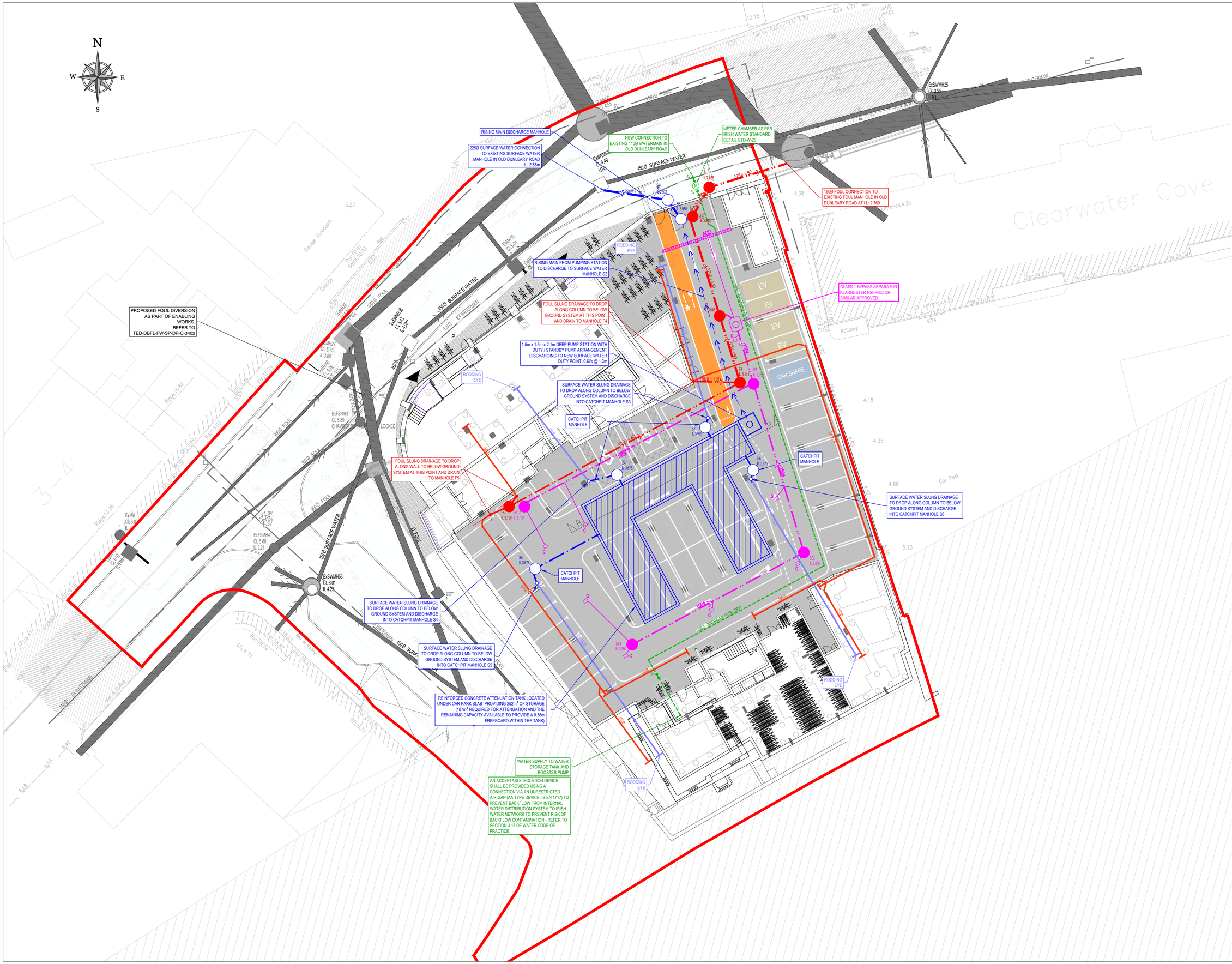
Document Title & Revision

- 190057-3001 - Rev. P01
- 190057-3031 - Rev. P01

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.



ON ORIGINAL

0 5 10 15 20 30 40 50mm

NOTES:

1. ALL DRAWINGS TO BE CHECKED BY CONTRACTOR ON SITE AND ENGINEER INFORMED OF DISCREPANCIES BEFORE WORK COMMENCES
2. ALL LEVELS ARE IN METRES AND ARE RELATED TO ORDNANCE DATUM
3. CONTRACTOR SHALL SATISFY HIMSELF AS TO THE ACCURACY OF PAVEMENT LEVELS ON SITE PRIOR TO COMMENCEMENT OF WORKS ON SITE
4. ALL NEW FOUL SEWER INFRASTRUCTURE SHALL BE LAID IN ACCORDANCE WITH IRISH WATER WASTEWATER INFRASTRUCTURE STANDARD DETAILS CONSTRUCTION REQUIREMENTS FOR SELF-LAY DEVELOPMENTS DECEMBER 2017 (REVISION 03) DOCUMENT IW-CDS-5030-01
4. ALL FOUL SEWERS TO BE uPVC TO COMPLY WITH IS EN 1401 2009/2012 UNLESS INDICATED OTHERWISE.
5. THIS DRAWING IS FOR PLANNING PURPOSES ONLY
6. MANHOLE COVER LEVELS ARE TO CONFORM WITH FINISHED ROAD AND PATH LEVELS
7. WHERE COVER TO PIPE IS LESS THAN 1200mm (ROAD/PATH/VERGE) OR 900mm (OPEN SPACE) SURROUND PIPE IN MINIMUM 150mm CONCRETE AS STD-WW- 08
8. WHERE INDICATED, ALL DISTANCES FROM DIVERTED SEWER TO ADJACENT STRUCTURES ARE TO CENTRELINE OF NEW SEWER.
9. ALL NEW MANHOLES TO BE TO STD-WW-10 UNO

LEGEND

- SITE BOUNDARY
- COURTYARD OUTLINE
- EXISTING KERB

SERVICES LEGEND

- PROPOSED FOUL SEWER
- PROPOSED SURFACE WATER SEWER
- EXISTING FOUL SEWER
- EXISTING SURFACE WATER SEWER
- PROPOSED WATERMAIN
- EXISTING WATERMAIN
- GULLY
- ACO DRAIN
- FILTER DRAIN
- ATTENUATION STORAGE
- PROPOSED FOUL WATER SLUNG DRAIN
- PROPOSED CAR PARK DRAINAGE
- PROPOSED SURFACE WATER SLUNG DRAIN
- PROPOSED SURFACE WATER RISING MAIN
- PROPOSED CARPARK DRAINAGE RISING MAIN

rev	date	description	by	chkd.
P01	10-08-21	PLANNING ISSUE	BS	PCC

client approval
- A - Approved
- B - Approved with comments
- C - Do not use

suitability: S2 - INFORMATION
issue purpose: PLANNING

DBFL Consulting Engineers
Civil, Structural & Transportation Engineering
www.dbfl.ie

DUBLIN OFFICE: Ormond House, Upper Ormond Quay, Dublin 7, D07 W704
PHONE +353 1 400 4000

CORK OFFICE: 14 South Mall, Cork, T12 CT91
PHONE +353 21 2024538

WATERFORD OFFICE: Suite 8b The Atrium, Maritana Gate, Canada Street, Waterford, X91 W028
PHONE +353 51 309 500

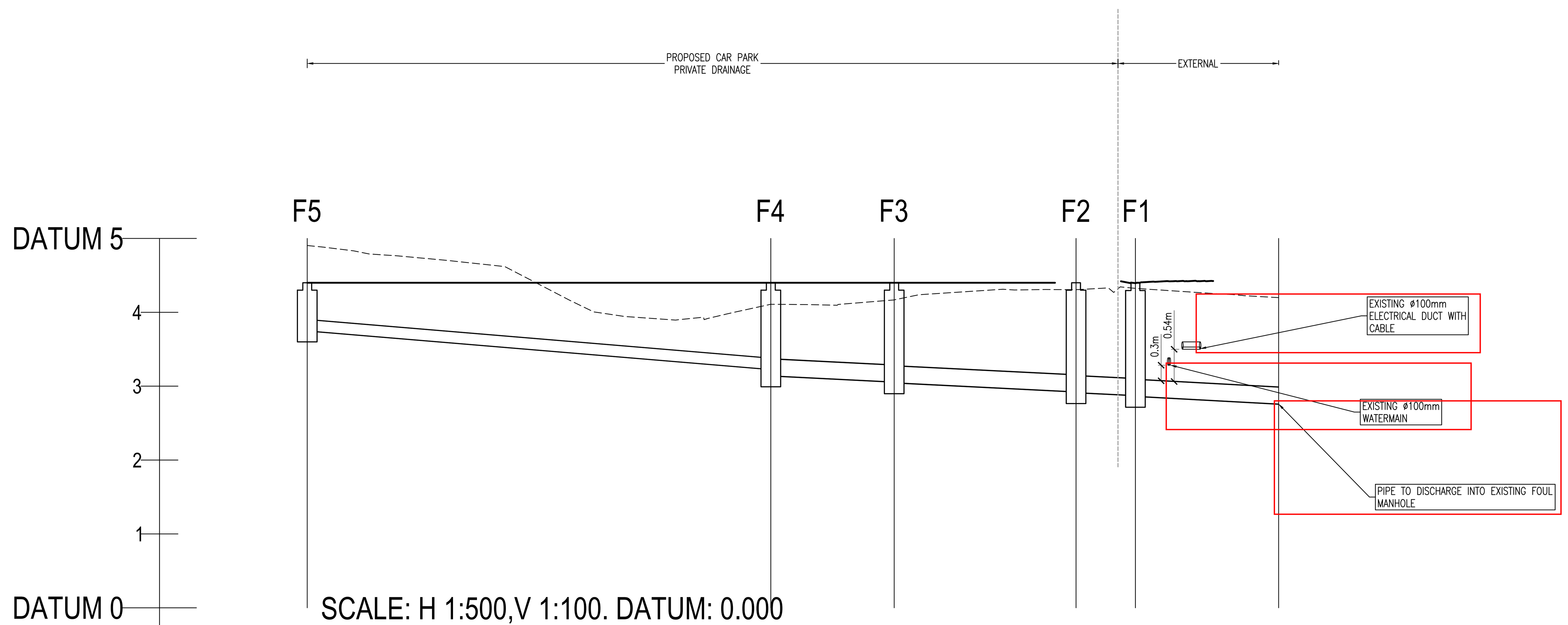
project ref.
TEDCASTLES SITE, DUN LAOGHAIRE

drawing title
SITE SERVICES LAYOUT

client
TED LIVING

designed by	author	scale	sheet size
NJF	BS	VALUE	A1

drawing no.: TED-DBFL-CS-SP-DR-C-1201
revision: P01



COVER LEVEL		4.400	4.400	4.400	4.400	4.394	
INVERT LEVEL		3.750	3.227 3.142	3.058 3.048	2.925 2.915	2.875 2.865	2.760
DEPTH (m)		0.650	1.258	1.352	1.485	1.529	
DISTANCE (m)		31.38	8.35	12.31	4.02	9.69	
PIPE SLOPE		1:60	1:99	1:100	1:100	1:92	
PIPE SIZE		150mm	225mm	225mm	225mm	225mm	

ON ORIGINAL

0 5 10 15 20 25 30 40 50mm

NOTES:

1. ALL DRAWINGS TO BE CHECKED BY CONTRACTOR ON SITE AND ENGINEER INFORMED OF DISCREPANCIES BEFORE WORK COMMENCES
2. ALL LEVELS ARE IN METRES AND ARE RELATED TO ORDNANCE DATUM
3. CONTRACTOR SHALL SATISFY HIMSELF AS TO THE ACCURACY OF PAVEMENT LEVELS ON SITE PRIOR TO COMMENCEMENT OF WORKS ON SITE
4. ALL WORKS TO BE CONSTRUCTED IN ACCORDANCE WITH THE NRA SPECIFICATION FOR ROAD WORKS UNLESS NOTED OTHERWISE
5. THIS DRAWING IS FOR PLANNING PURPOSES ONLY
6. MANHOLE COVER LEVELS ARE TO CONFORM WITH FINISHED ROAD AND PATH LEVELS
7. WHERE COVER TO PIPE IS LESS THAN 1200mm (ROAD/PATH/VERGE) OR 900mm (OPEN SPACE) SURROUND PIPE IN MINIMUM 150mm CONCRETE

KEY

- - - - - - EXISTING GROUND PROFILE
——— PROPOSED GROUND PROFILE

rev	date	description	by	chkd.
P01	10-08-21	PLANNING ISSUE	BS	PCC

client approval: A - Approved; B - Approved with comments; C - Do not use

suitability: S2 - INFORMATION
issue purpose: PLANNING

DBFL Consulting Engineers
Civil, Structural & Transportation Engineering
www.dbfl.ie

DUBLIN OFFICE: Ormond House, Upper Ormond Quay, Dublin 7. D07 W704
PHONE +353 1 400 4000

CORK OFFICE: 14 South Mall, Cork. T12 CT91
PHONE +353 21 2024538

WATERFORD OFFICE: Suite 8b The Atrium, Maritana Gate, Canada Street, Waterford. X91 W028
PHONE +353 51 309 500

project ref.
TEDCASTLES SITE, DUN LAOGHAIRE

drawing title
FOUL DRAINAGE LONGITUDINAL SECTIONS

client
TED LIVING

designed by	author	scale	sheet size
PCC	BS	AS SHOWN	A1

drawing no.: TED-DBFL-FW-SP-DR-C-3401
revision: P01

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

Mr Dan Reilly,
Director Civils & Infrastructure,
DBFL Consulting Engineers,
Ormond House,
Upper Ormond Quay,
Dublin 7,
D07 W704

18 October 2021

Dear Mr Reilly,

Re: Proposed diversion of Irish Water's 1200mm Combined Sewer at the former Ted Castles Site, Old Dun Leary Road, Dun Laoghaire, Co. Dublin/ Irish Water Diversion reference DIV19248. Subject to contract | Contract denied

In July 2020 Irish Water issued correspondence to An Bord Pleanála relating to proposals for 161 no. Build to Rent apartments and associated site works at the former Ted Castles Site, Old Dun Leary Road, Dun Laoghaire, Co. Dublin (Ref: ABP-307445-20). That correspondence outlined a major diversion of the existing Irish Water 1200mm Combined Sewer at the site is required to facilitate the proposed development and the need to establish the feasibility of same. Since that time, you have arranged detailed studies to determine the feasibility of such a diversion and provided associated information to Irish Water.

Based upon the details you have provided and as assessed by Irish Water, we wish to advise you that, subject to detailed design being agreed and valid agreements being put in place, the proposal can be facilitated.

You are advised that this correspondence does not constitute an agreement in whole or in part to build near any Irish Water infrastructure and is provided subject to the terms outlined in the associated Diversion Agreement DIV19248 being adhered to, and is strictly subject to the need for the detailed design to be agreed with Irish Water prior to the commencement of any related construction activities.

Please engage with Irish Water again in relation to this matter at such time planning permission has been granted for the proposed development.

If you have any further questions, please contact Brendan Kearney from the Diversions team on 0871016233 or email brkearney@water.ie. For further information, visit https://www.water.ie/connections/developer-services/diversion-and-build-over/.

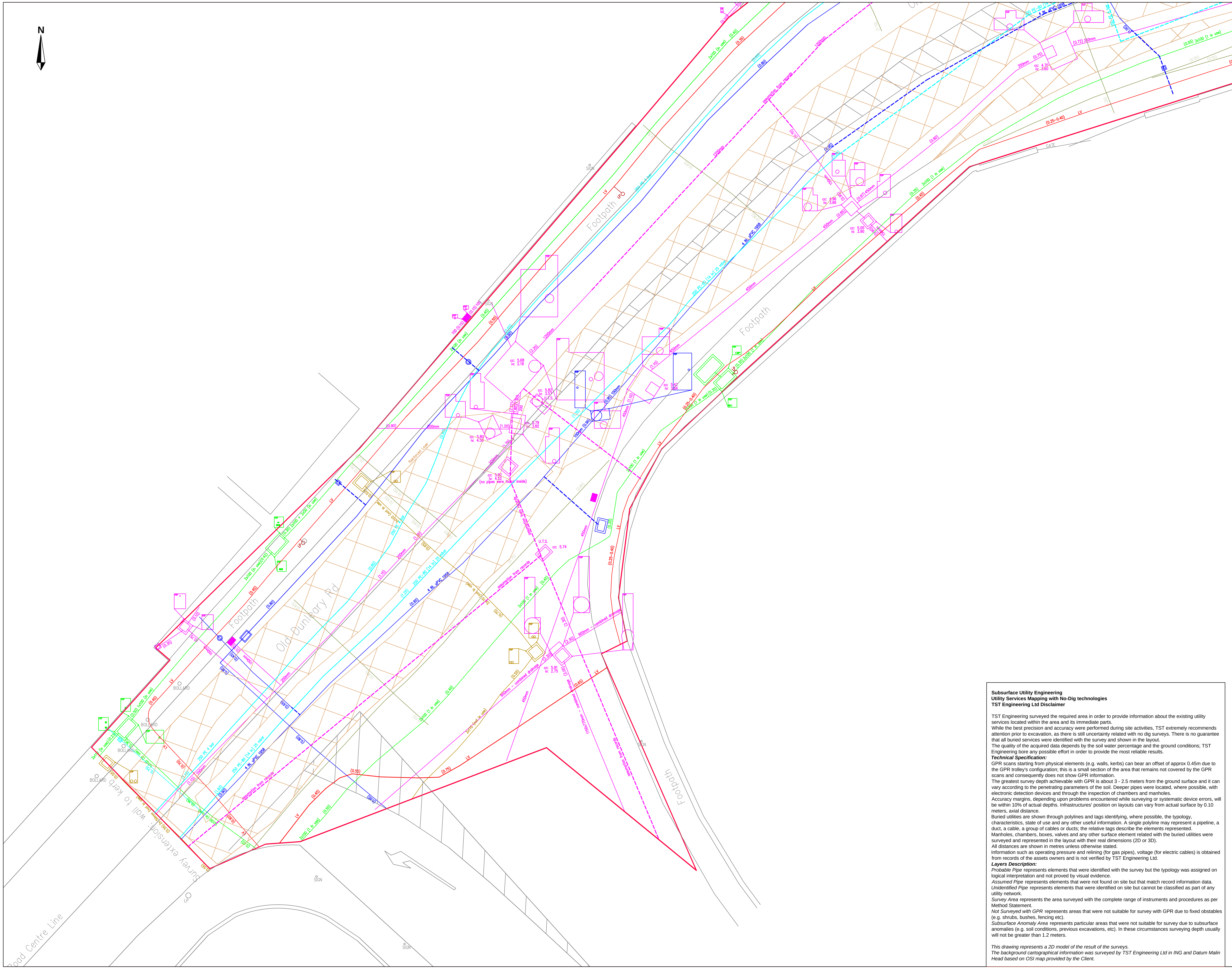
Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix F

GROUND PENETRATING RADAR SURVEY



KEYMAP

Service		Color / Line type
Drainage/Sewerage		magenta
Eircom		green
ESB		red
Gas		cyan
Unidentified Pipe/Service		olive
Water:		blue
UPC/NTL:		orange
Public Lighting:		dark red
Traffic:		ochre
Survey Area:		red
Subsurface Anomaly Area:		cross-hatched
Probable Pipe:	By layer	——— · ———
Assumed Pipe:	By layer	— — — — — — —

Description	Color	Type
No. of pipes of the same duct:	By layer	n x ∅
Cover Depht (to the top of the pipe or duct):	By layer	(0.00)
Hatched area^:	By Layer	hatched
Valve:	By Layer	V
Water Meter:	By Layer	WM
Fire Hydrant:	By Layer	FH
Pole:	By Layer	Pole/PL

Hatched Area^: It represents several cables OR a reinforced layer as protection on top of the utilities.

Manholes/Chambers:

TOP

Pipe in use
Empty pipe
Blocked pipe

Manhole's face; internal view

U.T.L.: Unable to Lift

Cover/Access Point

Internal dimension

TST Egineering LTD

Washington Court
Washington Lane
Rathfarnham
Dublin 14
Ireland
Tel. (+353) 1 4946327

Business Centre
Unit 56
2 Loughgall Road
Armagh
Northen Ireland
Tel. (+44) 2837 998544

www.tstengineering.com

CLIENT:

dlr Comhairle Contae County Council

Drainage Design Section
DUN LAOGHAIRE RATHDOWN COUNTY COUNCIL

Project: DUNLEARY HILL - GROUND INVESTIGATIONS

Description: Underground no-dig survey of existing utilities

Drawing No.: 251D-10-004-08

Scale: 1:100 (on A1)

Enclosed with: - - - -

	Date:
Surveyed by: EM-APa-JB-CP	Jun/10
Drawn by: EM-VM-MB	Jun-Jul/10
Checked by: CP	07/08/10
Approved by: CP	12/08/10

REVISIONS

No.	Date	Description
1.0	12/08/10	First Layout

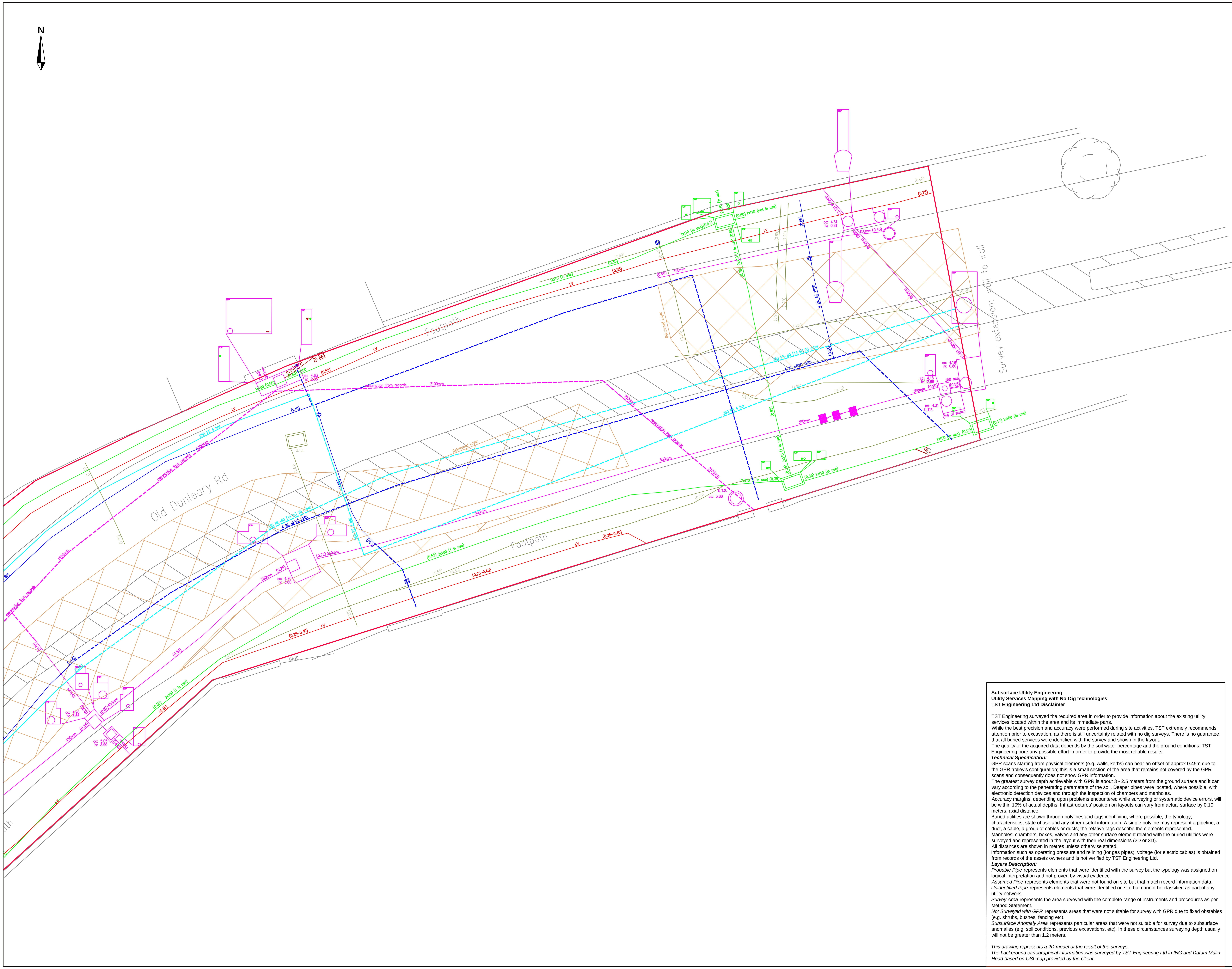
Subsurface Utility Engineering
Utility Services Mapping with No-Dig technologies
TST Engineering Ltd Disclaimer

TST Engineering surveyed the required area in order to provide information about the existing utility services located within the area and its immediate parts.
While the best precision and accuracy were performed during site activities, TST extremely recommends attention prior to excavation, as there is still uncertainty related with no dig surveys. There is no guarantee that all buried services were identified with the survey and shown in the layout.
The quality of the acquired data depends by the soil water percentage and the ground conditions; TST Engineering bore any possible effort in order to provide the most reliable results.

Technical Specification:
GPR scans starting from physical elements (e.g. walls, kerbs) can bear an offset of approx 0.45m due to the GPR trolley's configuration; this is a small section of the area that remains not covered by the GPR scans and consequently does not show GPR information.
The greatest survey depth achievable with GPR is about 3 - 2.5 meters from the ground surface and it can vary according to the penetrating parameters of the soil. Deeper pipes were located, where possible, with electronic detection devices and through the inspection of chambers and manholes.
Accuracy margins, depending upon problems encountered while surveying or systematic device errors, will be within 10% of actual depths. Infrastructures' position on layouts can vary from actual surface by 0.10 meters, axial distance.
Buried utilities are shown through polylines and tags identifying, where possible, the typology, characteristics, state of use and any other useful information. A single polyline may represent a pipeline, a duct, a cable, a group of cables or ducts; the relative tags describe the elements represented.
Manholes, chambers, boxes, valves and any other surface element related with the buried utilities were surveyed and represented in the layout with their real dimensions (2D or 3D).
All distances are shown in metres unless otherwise stated.
Information such as operating pressure and relining (for gas pipes), voltage (for electric cables) is obtained from records of the assets owners and is not verified by TST Engineering Ltd.

Layers Description:
Probable Pipe represents elements that were identified with the survey but the typology was assigned on logical interpretation and not proved by visual evidence.
Assumed Pipe represents elements that were not found on site but that match record information data.
Unidentified Pipe represents elements that were identified on site but cannot be classified as part of any utility network.
Survey Area represents the area surveyed with the complete range of instruments and procedures as per Method Statement.
Not Surveyed with GPR represents areas that were not suitable for survey with GPR due to fixed obstables (e.g. shrubs, bushes, fencing etc).
Subsurface Anomaly Area represents particular areas that were not suitable for survey due to subsurface anomalies (e.g. soil conditions, previous excavations, etc). In these circumstances surveying depth usually will not be greater than 1.2 meters.

This drawing represents a 2D model of the result of the surveys.
The background cartographical information was surveyed by TST Engineering Ltd in ING and Datum Malin Head based on OSI map provided by the Client.

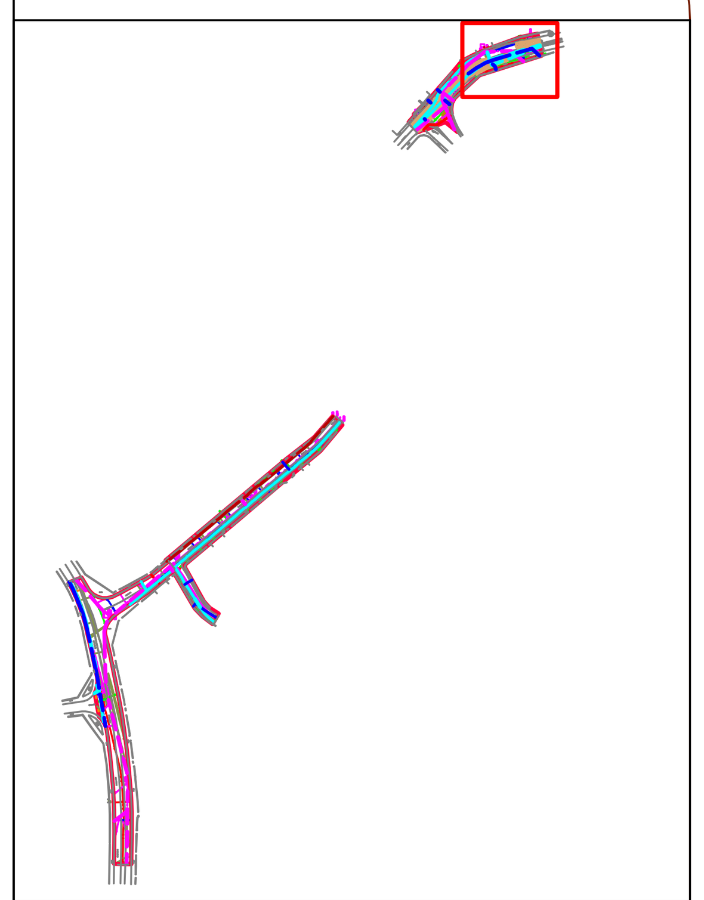


Subsurface Utility Engineering
Utility Services Mapping with No-Dig technologies
TST Engineering Ltd Disclaimer

TST Engineering surveyed the required area in order to provide information about the existing utility services located within the area and its immediate parts.
While the best precision and accuracy were performed during site activities, TST extremely recommends attention prior to excavation, as there is still uncertainty related with no dig surveys. There is no guarantee that all buried services were identified with the survey and shown in the layout.
The quality of the acquired data depends by the soil water percentage and the ground conditions; TST Engineering bore any possible effort in order to provide the most reliable results.
Technical Specification:
GPR scans starting from physical elements (e.g. walls, kerbs) can bear an offset of approx 0.45m due to the GPR trolley's configuration; this is a small section of the area that remains not covered by the GPR scans and consequently does not show GPR information.
The greatest survey depth achievable with GPR is about 3 - 2.5 meters from the ground surface and it can vary according to the penetrating parameters of the soil. Deeper pipes were located, where possible, with electronic detection devices and through the inspection of chambers and manholes.
Accuracy margins, depending upon problems encountered while surveying or systematic device errors, will be within 10% of actual depths. Infrastructures' position on layouts can vary from actual surface by 0.10 meters, axial distance.
Buried utilities are shown through polylines and tags identifying, where possible, the typology, characteristics, state of use and any other useful information. A single polyline may represent a pipeline, a duct, a cable, a group of cables or ducts; the relative tags describe the elements represented.
Manholes, chambers, boxes, valves and any other surface element related with the buried utilities were surveyed and represented in the layout with their real dimensions (2D or 3D).
All distances are shown in metres unless otherwise stated.
Information such as operating pressure and relining (for gas pipes), voltage (for electric cables) is obtained from records of the assets owners and is not verified by TST Engineering Ltd.
Layers Description:
Probable Pipe represents elements that were identified with the survey but the typology was assigned on logical interpretation and not proved by visual evidence.
Assumed Pipe represents elements that were not found on site but that match record information data.
Unidentified Pipe represents elements that were identified on site but cannot be classified as part of any utility network.
Survey Area represents the area surveyed with the complete range of instruments and procedures as per Method Statement.
Not Surveyed with GPR represents areas that were not suitable for survey with GPR due to fixed obstables (e.g. shrubs, bushes, fencing etc).
Subsurface Anomaly Area represents particular areas that were not suitable for survey due to subsurface anomalies (e.g. soil conditions, previous excavations, etc). In these circumstances surveying depth usually will not be greater than 1.2 meters.

This drawing represents a 2D model of the result of the surveys.
The background cartographical information was surveyed by TST Engineering Ltd in ING and Datum Malin Head based on OSI map provided by the Client.

KEYMAP



Service	Color / Line type
Drainage/Sewerage	
Eircom	
ESB	
Gas	
Unidentified Pipe/Service	
Water:	
UPC/NTL:	
Public Lighting:	
Traffic:	
Survey Area:	
Subsurface Anomaly Area:	
Probable Pipe:	By layer
Assumed Pipe:	By layer

Description	Color	Type
No. of pipes of the same duct:	By layer	n x ∅
Cover Depht (to the top of the pipe or duct):	By layer	(0.00)
Hatched area^:	By Layer	
Valve:	By Layer	V
Water Meter:	By Layer	WM
Fire Hydrant:	By Layer	FH
Pole:	By Layer	Pole/PL

Hatched Area^: It represents several cables OR a reinforced layer as protection on top of the utilities.

Manholes/Chambers:
TOP
Pipe in use
Empty pipe
Blocked pipe
Manhole's face; internal view
U.T.L.: Unable to Lift
Cover/Access Point
Internal dimension

TST Egineering LTD

Washington Court
Washington Lane
Rathfarnham
Dublin 14
Ireland
Tel. (+353) 1 4946327

Business Centre
Unit 56
2 Loughgall Road
Armagh
Northen Ireland
Tel. (+44) 2837 998544

www.tstengineering.com

CLIENT:
Drainage Design Section
DUN LAOGHAIRE RATHDOWN COUNTY COUNCIL

Project: DUNLEARY HILL - GROUND INVESTIGATIONS

Description: Underground no-dig survey of existing utilities

Drawing No.: 251D-10-004-09

Scale: 1:100 (on A1)

Enclosed with: - - - -

	Date:
Surveyed by: EM-APa-JB-CP	Jun/10
Drawn by: EM-VM-MB	Jun-Jul/10
Checked by: CP	07/08/10
Approved by: CP	12/08/10

REVISIONS

No.	Date	Description
1.0	12/08/10	First Layout

Appendix G

SURFACE WATER RISING MAIN CALCULATIONS

PROJECT
Mxed Use Development at Ted Castles, Monkstown, Co. Dublin

Job Ref:
190057

SUBJECT
Surface Water Rising Main Duty

Drawing Ref.	**Calculation by:**	**Checked by:**	**Date:**
190057-3002	PCC	NJF	01-Jan-2020

PIPELINE DATA

	Max	Min	Design
Suction wet well level (mAOD)	2.20	2.20	2.20
Discharge level (mAOD)	2.91	2.91	2.91
Static head (m)	0.71	0.71	0.71

NPSH Reference Plane (mAOD) 2.7

Section*	1	2	3	4	5	6
Pump Branch or Rising Main ?	Rising Main					
Diameter (mm)	96.8					
Length (m)	25.2					
Roughness (mm)	0.1					
Temperature (°C)	20	20	20	20	20	20
Duty flow velocity (m/s)	0.69	-	-	-	-	-

Minor Losses — Insert number of each type of fitting in each section

		1	2	3	4	5	6
Entry							
- Sharp edged	0.50						
- Bellmouth	0.05						
Bends							
- Sharp 90°	0.90	3					
- Sharp 45°	0.40						
- Sharp 22.5°	0.15						
- Long radius 90°	0.40						
- Long radius 45°	0.20						
- Long radius 22.5°	0.10						
Tees							
- Flow in line	0.30						
- Line to branch	1.00						
Sudden Enlargement							
- 4:5	0.15						
- 3:4	0.20						
- 1:2	0.60						
Sudden Contraction							
- 5:4	0.20						
- 4:3	0.30						
- 2:1	0.40						
Tapers							
- 4:5	0.10						
- 3:4	0.15						
Valves							
- Gate fully open	0.20	1					
- Butterfly fully open	0.15						
- Swing check	2.50	1					
Exit							
- Sharp edged	1.00						
- Bellmouth	0.20	1					
User Inputs							
Total Minor Losses		5.6	0	0	0	0	0

***Description of sections**	1	
	2	
	3	
	4	
	5	
	6	

PUMP DUTY INFORMATION

Duty Flow 0.6 l/s Nr of duty pumps 1 Pump Duty Head: 0.7 m Pump Duty Flow 0.6 l/s

PUMPED MEDIA

Pumped media: Clean Water / Sewage

FLOW / HEAD DATA

Flow (l/s)	Headloss in each section 1 (m)	2 (m)	3 (m)	4 (m)	5 (m)	6 (m)	Total Headloss (m)	Maximum Head (m)	Minimum Head (m)	Design Head (m)
0.0							0.0	0.7	0.7	0.7
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7	0.7
0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7	0.7
0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7	0.7
0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7	0.7
0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7	0.7
0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7	0.7
1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7	0.7

Please note that only headlosses on sections marked as rising main are included in calculation of the system curve
Headlosses on sections marked as pump suction or pump discharge are included in the pump curves